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AI Markets and Competition in India

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Abstract

Artificial Intelligence (AI) technologies are becoming integral to businesses and public markets alike, enabling innovation and efficiency and creating avenues for economic growth. The emphasis in public discourse has been on the technological advances enabled by AI and the risks and benefits associated with them. It is equally important that discussions on market implications of firm behavior active in AI are also understood. This report explores the evolving market dynamics in India and the critical challenges faced by policymakers and regulators in creating a competitive and innovative AI ecosystem. The report also examines the AI technology stack, highlighting its distinct layers and their implications for industrial organization and market competition. Key themes include the role of major cloud providers in shaping the AI ecosystem, the complexities of open-source models, the expanding network of partnerships between global technology companies, AI startups, and domestic IT incumbents, and the creation of new dependencies. Drawing on global best practices, the report emphasizes the need for a nuanced mix of competition and industrial policies, including a Digital Public Infrastructure paradigm, to foster a competitive, inclusive, and innovative AI ecosystem in India. It also highlights India's push for technological sovereignty through initiatives like the IndiaAI Mission and investments in indigenous AI models and supercomputing capabilities. The recommendations proposed in the report include promoting interoperability, enhancing access to computing resources, strengthening data-governance frameworks while facilitating access to high-quality open datasets, and leveraging public-private partnerships to support emerging AI startups.

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List of Abbreviations

ACM	Authority for Consumers and Markets
AI	Artificial Intelligence
AICOA	American Innovation and Choice Online Act
AMD	Advanced Micro Devices
API	Application Programming Interface
AWS	Amazon Web Services
BFSI	Banking, Financial Services and Insurance
CAC	Cyberspace Administration of China
CAGR	Compound Annual Growth Rate
CAS	Complex Adaptive System
CCI	Competition Commission of India
CDCL	Committee on Digital Competition Law
CMA	Competition and Markets Authority
COE	Centre of Excellence
CPU	Central Processing Unit
DCA	Digital Competition Act
DEPA	Data Empowerment and Protection Architecture
DIA	Digital India Act
DMA	Digital Markets Act
DOJ	Department of Justice
DPI	Digital Public Infrastructure
DSA	Digital Services Act
EAC-PM	Economic Advisory Council to the Prime Minister
EC	European Commission
FCA	Financial Conduct Authority
FM	Foundation models
FTC	Federal Trade Commission
GCP	Google Cloud Platform
GenAI	Generative artificial intelligence
GPAI	Global Partnership on Artificial Intelligence
GPAIM	General-Purpose AI Model
GPU	Graphic Processing Units

GVA	Gross Value Added
IaaS	Infrastructure-as-a-Service
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
IoT	Internet-of-Things
IPR	Intellectual Property Rights
IT	Information Technology
LAM	Large Action Model
LLaMA	Large Language Model Meta AI
LLM	Large Language Model
LLMOps	LLM Operations
LM	Language Model
MeitY	Ministry of Electronics and Information Technology
MENA	Middle East and North Africa
MSME	Micro, Small and Medium Enterprises
NBFC	Non-Banking Financial Companies
NDGFP	National Data Governance Framework Policy
NLP	Natural Language Processing
OCC	Open Cloud Compute
OSI	Open Source Initiative
OSL	Open-source licence
PPP	Public-Private Partnerships
PSB	Public Sector Bank
SGE	Search Generative Experience
SLM	Small Language Model
SME	Small and Medium Enterprises
SMS	Strategic Market Status
SSDE	Systematically Significant Digital Enterprises
TPU	Tensor Processing Unit
ULCA	Unified Language Contribution API
VC	Venture Capital

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CHAPTER 1

INTRODUCTION

The transformative power of Artificial Intelligence (AI) is reshaping the contours of modern economies, fueling innovation, enhancing productivity, and redefining competitive dynamics across industries. AI's rapid advancement marks not just a technological shift but also profound economic and social changes. Its applications span healthcare, finance, manufacturing, and education, while also creating complex market structures and raising potential competition concerns.

Generative AI (GenAI) has also developed at an exponential rate. To reach 100 million users, the telephone took 75 years, the mobile phone took 16 years, the web took seven years, Facebook took four years, and Instagram took three years.[1] Meanwhile, ChatGPT took just two months. These metrics underscore how AI technologies are being rapidly adopted, disrupting *status quo*, and highlight the importance of getting competition right from the very beginning.

The AI industry has a complex ecosystem that involves hardware providers, cloud computing hyperscalers, foundational AI model developers, and application platforms. Despite the diversity of players, market power is often concentrated in certain layers, where incumbent dominant tech firms may leverage their financial resources, vast data pools, and technical expertise to maintain competitive advantages.

The global development of AI adds further complexity, as leading firms operate across borders and form strategic partnerships reminiscent of "reverse killer acquisitions" from the period of Big Tech dominance during the platformisation of the web. Incumbent firms continue to consolidate power by acquiring or partnering with emerging AI technologies, similar to strategies adopted during the rise of the internet. While open-source alternatives could contest the concentration of market power, the industry lacks a clear definition of what constitutes "open source". Some AI models are accessible for public use; however, they lack true openness due to the non-disclosure of training data, model weights, code, and model architecture. Exploring open source as an alternative to proprietary AI models also requires building safeguards against the misuse of these models, particularly in downstream applications. While the entry of new competitors like Anthropic and Perplexity show that dominance is not inevitable, the conduct of incumbents must be carefully monitored to ensure that innovation is not stifled.[2]

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1 Leigh, A. (2024). *Competition and Artificial Intelligence: An Australian policy perspective.* IZA Policy Paper No. 209. https://docs.iza.org/pp209.pdf

2 Concurrences. (2023). *Gen AI & Market Power: What role for antitrust regulators?* CEPR Competition Policy RPN Webinar. https://www.concurrences.com/en/events/upcoming-events/cepr-competition-policy-rpn-gen-ai-market-power-what-role-for-antitrust

India's AI market holds tremendous potential. By 2025, its value is projected to reach USD 7.8 billion, driven largely by the growing semiconductor industry.[3] Key sectors, including industrials, automotive, healthcare,[4] retail, and consumer goods, are anticipated to account for 60% of AI's Gross Value Added (GVA) in India's GDP. Currently in India, AI is finding significant applications in banking, financial services and insurance (BFSI) and agri-tech.[5] In 2023, both AI and GenAI adoption was highest in North America, followed closely by developing markets such as India, Latin America, and the Middle East and North Africa (MENA) region. India was the global leader in AI skill penetration in 2023 and has a USD 9.85 billion AI-ready market.[6]

Between 2019 and 2024, AI startups in India grew by 38.46% annually, and investments surged from USD 254 million in 2019 to USD 830 million in 2022. By August 2024, cumulative AI investments reached USD 2.25 billion, representing 4.19% of global funding in GenAI. Around 37.55% of AI startups in India during the 2020-2024 period were categorized as industry-agnostic, focusing on applications like text, image, and speech generation, with chatbots being prominent. The video-generation segment attracted the most funding during the same period.[7]

The Indian government has also initiated efforts to develop sovereign AI models tailored to the country's unique needs, leveraging India's rich linguistic diversity and extensive datasets to create AI models designed specifically for Indian contexts.[8] Projects like Bhashini, an AI-driven language-translation system, are aimed at facilitating the development of AI tools in local languages. In tandem with this, several Indian startups like Gnaani, Reverie, and Devanagari are making strides in offering AI services in various Indian languages. Meanwhile, the Supreme Court of India is using the AI-driven translation tool Samantar to make rulings more accessible in vernacular languages.[9]

AI market trends reflect an economic transition toward a post-industrial phase, where knowledge creation and rapid innovation are levers of economic growth. This shift requires a corresponding understanding of "post-industrial organization" economics, as regulators confront issues like data monopolies, algorithmic bias, and the potential for anti-competitive behaviour. Traditional antitrust tools are being put to the test.

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[3] Invest India. (2023, March 28). *Artificial intelligence – Powering India's growth story.* https://www.investindia.gov.in/team-india-blogs/artificial-intelligence-powering-indias-growth-story

[4] Porecha, M. (2020, December 22). Qure's AI bet goes from TB to Covid. *The Ken*. https://the-ken.com/story/qures-ai-bet-goes-from-tb-to-covid/

[5] Invest India. (2023, March 28). *Artificial intelligence – Powering India's growth story.* https://www.investindia.gov.in/team-india-blogs/artificial-intelligence-powering-indias-growth-story

[6] Maslej, N., Fattorini, L., Perrault, R., Parli, V., Reuel, A., Brynjolfsson, E., Etchemendy, J., Ligett, K., Lyons, T., Manyika, J., Niebles, J. C., Shoham, Y., Wald, R., & Clark, J. (2024). *The AI Index 2024 annual report*. Institute for Human-Centered AI, Stanford University. https://aiindex.stanford.edu/wp-content/uploads/2024/05/HAI_AI-Index-Report-2024.pdf

[7] Data from Tracxn.

[8] ANI. (2024, September 17). *Will have sovereign AI models designed, built in India: Union Minister Rajiv Chandrasekhar.* https://www.aninews.in/news/business/will-have-sovereign-ai-models-designed-built-in-india-union-minister-rajiv-chandrasekhar20240311175136/

[9] Elias, J. (2023, January 30). *AI for all: How India is carving its own path in the global AI race.* OECD.AI Policy Observatory. https://oecd.ai/en/wonk/india

India's regulatory approach to AI has been evolving since its 2018 National Strategy for AI, AIforAll,[10] to keep pace with the growth of technology. In May 2022, the Ministry of Electronics and Information Technology (MeitY) introduced the draft National Data Governance Framework Policy (NDGFP),[11] aimed at addressing the governance issues related to data that is critical for AI development. India is also the lead chair for Global Partnership on Artificial Intelligence (GPAI) for 2023-24 and hosted the GPAI Summit in 2023,[12] reflecting its commitment to AI governance. The 2023 GPAI Ministerial Declaration was formally adopted at this summit. The declaration focuses on advancing AI through multi-stakeholder initiatives and acknowledges the importance of international collaboration and governance for promoting safe and innovative AI systems.[13] In January 2024, the Economic Advisory Council to the Prime Minister (EAC-PM) suggested a Complex Adaptive System (CAS) framework for regulating AI, which acknowledges the dynamic and unpredictable nature of AI technologies.[14] In March 2024, the Committee on Digital Competition Law (CDCL), established by the Ministry of Corporate Affairs, released a draft report[15] proposing the Digital Competition Act (DCA). This *ex-ante* legislation aims to regulate large digital firms and address emerging competition issues in the digital space. Given that digital markets are dynamic, the Committee recommended that the list of Core Digital Services, which would be subject to the proposed *ex-ante* law, be included as a Schedule to the Draft Digital Competition Bill. This would give the Central Government the flexibility to occasionally add new digital services.

MeitY has also issued a series of advisories under the Information Technology Act, 2000 and the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021. On March 15, 2024,[16] MeitY revised its advisory issued on March 1, 2024,[17] lifting the mandate for prior approval, instead advising that unreliable AI models be appropriately labelled for Indian users. It also retracted the obligation for platforms to submit action

[10] NITI Aayog. (June 2018). *National strategy for artificial intelligence: AI for all.* https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

[11] Ministry of Electronics and Information Technology. (May 2022). *National Data Governance Framework Policy (Draft).* https://www.meity.gov.in/writereaddata/files/National-Data-Governance-Framework-Policy.pdf

[12] IndiaAI. (2024, June 24). *Global IndiaAI Summit – Global IndiaAI summit 2024 to be held in New Delhi on July 3-4.* https://indiaai.gov.in/article/global-indiaai-summit-2024-to-be-held-in-new-delhi-on-july-3-4

[13] Global Partnership on Artificial Intelligence (GPAI). (2023). *GPAI Ministerial Declaration.* https://gpai.ai/2023-GPAI-Ministerial-Declaration.pdf

[14] Sanyal, S., Sharma, P., & Dudani, C. (2024). *A complex adaptive system framework to regulate artificial intelligence* (Working paper no. 26). Economic Advisory Council to the Prime Minister (EAC-PM). https://eacpm.gov.in/wp-content/uploads/2024/01/EACPM_AI_WP-1.pdf

[15] Ministry of Corporate Affairs. (February 2024). *Report of the Committee on Digital Competition Law.* https://www.mca.gov.in/bin/dms/getdocument?mds=gzGtvSkE3zIVhAuBe2pbow%253D%253D&type=open

[16] Ministry of Electronics and Information Technology. (2024, March 15). *Due diligence by intermediaries/platforms under the Information Technology Act, 2000 and the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021.* https://www.meity.gov.in/writereaddata/files/Advisory%2015March%202024.pdf

[16] Ministry of Electronics and Information Technology. (2023, December 26). *Due diligence by intermediaries and grievance reporting mechanism, under the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021.* https://www.meity.gov.in/writereaddata/files/Eradicated_Advisory_26Dec2023.pdf

[16] Ministry of Electronics and Information Technology. (2024, September 3). *Due diligence by intermediaries under the Information Technology Act, 2000 and the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021.* https://www.meity.gov.in/writereaddata/files/Merged%20for%20MeitY%20website3.pdf

[17] As per the advisory issued on March 1, 2024, intermediaries and platforms using GenAI models and Large Language Model (LLM) software or algorithms are required to obtain government approval before deployment.

reports. In continuation of the advisories published on December 26, 2023,[18] and March 15, 2024, another advisory was released on September 3, 2024[19]. MeitY in its December 2023 advisory, issued a warning to social media platforms that failing to remove or delete deepfake content may result in these platforms potentially losing safe-harbour protections. In the latest advisory, MeitY directed the platforms to delete fake content "promptly within ten hours of receiving such complaint".[20] In addition, MeitY published a presentation outlining the general framework of the proposed Digital India Act (DIA), which is supposedly the successor to the Information Technology Act, 2000.[21] The DIA seeks to govern a wide range of digital businesses, such as e-commerce companies, social media websites, and AI – based platforms.[22]

Against the backdrop of these developments, this study aims to provide a competition analysis of the AI market in India, drawing on a wide range of sources and perspectives. It seeks to illuminate the key trends and forces shaping the AI industry, identify the main competitive challenges, and offer insights into the potential paths forward. By examining both the technological and market structures of AI as well as the strategic behaviours of leading firms, this study contributes to a deeper understanding of the competitive landscape in AI and the implications of current trajectories and policy decisions for future innovation and economic development. The study thus seeks to build knowledge for informed competition policy decisions, ensuring that the benefits of AI are widely shared.

It is important to examine if AI, that promises to be disruptive, will dislodge incumbent tech companies or will the ecosystems, governed by the dominant incumbent platforms, be replicated and other actors of the AI stack simply integrate into their business models? Will the AI ecosystem have a future in which incumbent tech firms monopolize essential inputs (e.g., cloud infrastructure, foundation models (FMs), and large datasets) and exercise market power on complementor firms in the market for AI-based products and services? This study attempts to address some of these questions by analyzing secondary literature and conducting stakeholder consultations of various actors in the Indian AI market stack.

[18] Ministry of Electronics and Information Technology. (2023, December 26). *Due diligence by intermediaries and grievance reporting mechanism, under the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021*. https://www.meity.gov.in/writereaddata/files/Eradicated_Advisory_26Dec2023.pdf

[19] Ministry of Electronics and Information Technology. (2024, September 3). *Due diligence by intermediaries under the Information Technology Act, 2000 and the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021*. https://www.meity.gov.in/writereaddata/files/Merged%20for%20MeitY%20website3.pdf

[20] Ministry of Electronics and Information Technology. (2024, September 3). *Due diligence by intermediaries under the Information Technology Act, 2000 and the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021*. https://www.meity.gov.in/writereaddata/files/Merged%20for%20MeitY%20website3.pdf

[21] Ministry of Electronics and Information Technology. (2023, March 9). *Proposed Digital India Act, 2023.* https://www.meity.gov.in/writereaddata/files/DIA_Presentation%2009.03.2023%20Final.pdf

[22] Ministry of Corporate Affairs. (February 2024). *Report of the Committee on Digital Competition Law.* https://www.mca.gov.in/bin/dms/getdocument?mds=gzGtvSkE3zIVhAuBe2pbow%253D%253D&type=open

The study is structured as follows: Chapter 2 provides an overview of the AI stack, delineating the different layers that characterize its operational framework. It provides a deep dive into India’s GenAI startup ecosystem, covering trends in investments, startups, unicorns, emerging application segments, and Big Tech investments. The chapter also examines the intricate partnerships and non-controlling investments between major AI firms and infrastructure actors. Chapter 3 addresses competition issues, examining data ownership consolidation in GenAI and challenges faced by AI startups. The chapter also examines how incumbent firms leverage their existing platforms to consolidate power and cement their dominance in the market. The chapter further scrutinizes the concept of “openness” in AI, questioning the extent to which proprietary models are accessible and the implications of such access on competition. Chapter 4 summarizes the stakeholder consultations on Indian market dynamics, exploring AI market dependencies and partnerships. Finally, Chapter 5 summarizes key findings relevant for regulators, startups, competition authorities, and businesses in India.

CHAPTER 2

INDUSTRY TRENDS

Understanding the rapid advancements in GenAI and their implications for competition and governance necessitates a structured analysis of the market. In this chapter, we aim to do this by first demystifying the AI stack, which can help categorize emerging AI innovations within the layers and enable the assessment of technical and economic dependencies across the stack. Such dependencies, when seen in the context of the market structure within each layer, can provide an overview of how AI markets can reinforce the dominance of incumbent players, particularly in infrastructural layers like cloud and hardware, where these players have established strong control.

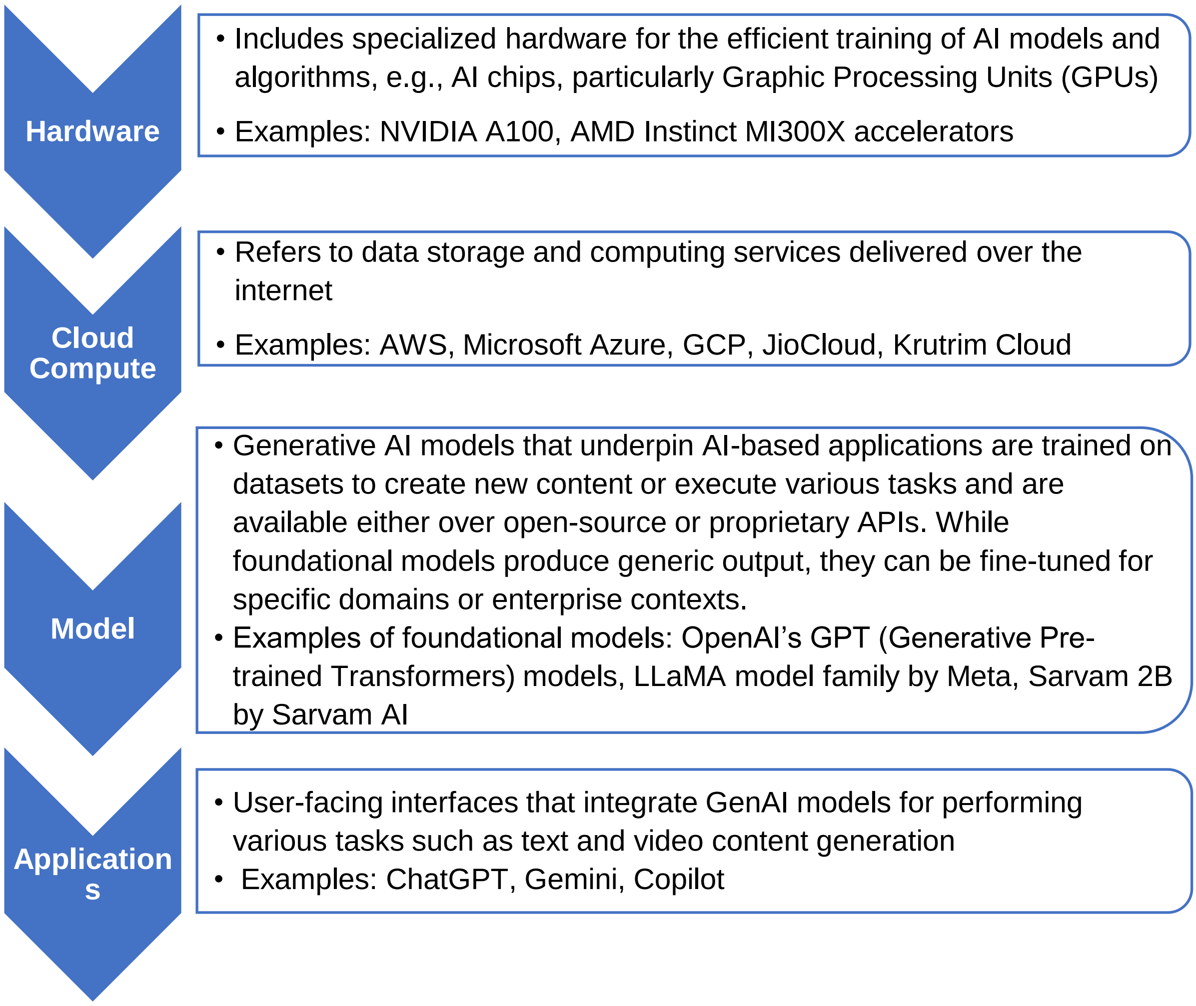
We then provide a comprehensive picture of the trends shaping the Indian AI market, including the growth of startups, investments, popular product categories, and top investors. We then document the industrial policy response aimed at creating a more open infrastructure, ensuring meaningful competition, and reducing dependencies along the AI supply chain. These initiatives aim to leverage India's linguistic diversity to support data curation and the development of models and applications to serve local needs.

The following section maps out the investments, acquisitions, and strategic partnerships between entrenched players and nascent startups in downstream markets, which are shaping cooperation and competition in the Indian and global AI markets. An overview of such partnerships within and beyond the market, including with the government, academia, and civil society, is crucial to understand the ecosystem-wide reach of those players who predominantly control critical inputs of infrastructure and major distribution avenues for AI. Such ecosystem capture has implications for consumer choice, competition, and innovation, not just within the AI market but also for enterprise users of AI operating in various domains. However, even amid concentration risks, India is witnessing the proliferation of AI startups in unique niches, particularly in the Indic LLM and application layers.

1. Overview of the AI Technology Stack

There is a broad consensus in the literature that there are four main components of the AI stack—hardware, cloud compute, models, and applications—with some conceptions of the stack including additional layers or sub-layers. Figure 1 provides an overview of the AI technology stack, with examples for each layer.

Figure 1: The Layers of the AI Technology Stack, with Examples



a. The market structure of AI stack layers

Hardware

The market structure for AI hardware is oligopolistic, with the dominance of a few global players, which limits competition and often leads to supply constraints. In GPUs, particularly, NVIDIA has near monopoly and increased its market share from 84% in Q1 2023 to 88% in Q1 2024,[23] seizing a significant market share of AMD and the entirety of Intel. Faced with increasing costs of delivering AI services due to supply constraints in the GPU market, hyperscalers are attempting to build AI chips in house. For instance, Amazon introduced its custom chips, AWS Trainium and AWS Inferentia, to optimise the training costs of models and accelerate the deployment of GenAI applications.[24] Similarly, Microsoft introduced its own chips, Azure Maia 100 designed to optimise AI tasks and Azure Cobalt 100 CPU for handling

[23] Batt, S. (2024, June 7). *NVIDIA takes 88% of the GPU market share, crushing Intel's grasp into nothingness.* https://www.xda-developers.com/nvidia-88-gpu-market-share/

[24] Goldstein, P. (2023, October 7). *Why purpose-built artificial intelligence chips may be key to your generative AI strategy.* AWS Insights. https://aws.amazon.com/blogs/aws-insights/why-purpose-built-artificial-intelligence-chips-may-be-key-to-your-generative-ai-strategy/

general computing workload.[25] Google's Tensor Processing Unit (TPU) chips power many of its AI workloads, including the training and running of its Gemini chatbot, and are also used in model training by Apple and Anthropic and offered through partner platforms like Hugging Face.[26,27] This trend highlights how major cloud providers are seeking to reduce their reliance on external GPU suppliers and integrating backwards, gaining greater control over their AI infrastructure and costs.

Cloud compute

The cloud computing market is similarly heavily concentrated. Globally, in the Infrastructure-as-a-Service (IaaS) model, hyperscalers have captured a market share of around 69%, while in India, the market share of the top three hyperscalers amounted to 87% in 2023.[28] In recent years, domestic cloud service providers that offer AI cloud have emerged in India. However, shared characteristics with other digital markets, such as economies of scale, network effects, and vertical integration, along with various technical and financial barriers, such as interoperability constraints, software licensing restrictions, tying and bundling, cloud credits, and committed spending discounts, entrench the dominance of first movers, which are generally the large, global tech companies.[29]

Models

Due to the significant capital investments required for developing foundational models, widely used models have been pioneered by Big Tech, particularly Google, Microsoft, and Meta, and a handful of global startups (e.g., OpenAI, Anthropic, Inflection AI, Stability AI, Midjourney, and Mistral AI). It is estimated that startups in the model layer accounted for around 77% of global funding in Generative AI, with the bulk of the investments secured by OpenAI, Anthropic and Inflection.[30] Of the 398 foundational models tracked by the Stanford CRFM's Ecosystem Graphs, around 63.56% of them are open-source models, 21.35% of them are closed-source and 14.82% of them have limited access. However, enterprise usage in US is dominated by closed-source models, commanding around 81% market share vis-à-vis 19% market share of open-source models.[31] In India, a survey of generative AI Indian startups has revealed preference for a hybrid architecture consisting of a mix of open and closed-source models (43%), followed by open-source models (35%) which for some, enable better

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[25] Siegel, J. (2023, November 15). With a systems approach to chips, Microsoft aims to tailor everything 'from silicon to service' to meet AI demand. *Microsoft News*. https://news.microsoft.com/source/features/ai/in-house-chips-silicon-to-service-to-meet-ai-demand/

[26] Tarasov, K. (2024, August 23). How Google makes custom chips used to train Apple AI models and its own chatbot, Gemini. *CNBC Tech*. from https://www.cnbc.com/2024/08/23/how-google-makes-custom-cloud-chips-that-power-apple-ai-and-gemini.html

[27] David, E. (2024, September 23). Chip race: Microsoft, Meta, Google, and Nvidia battle it out for AI chip supremacy. *The Verge*. https://www.theverge.com/2024/2/1/24058186/ai-chips-meta-microsoft-google-nvidia/archives/2

[28] See the International Data Corporation website: https://www.idc.com/

[29] See Malik, P., Das, B., & Jagadeesh, H.T. (2024). *A competition analysis of the Indian cloud computing market*. ICRIER. https://icrier.org/pdf/Indian_CloudComputing_market.pdf

[30] Nasscom Insights. (2024, October 16). *India's generative AI startup landscape 2024.* https://community.nasscom.in/communities/nasscom-insights/indias-generative-ai-startup-landscape-2024

[31] Tully, T., Redfern, J., Xiao, D., & Sonnet, C. (2024, November 20). *2024: The state of generative AI in the enterprise.* Menlo Ventures. https://menlovc.com/2024-the-state-of-generative-ai-in-the-enterprise/

customisation of applications with the least preferred category being closed-source (22%).[32] The ownership structure is distributed among a vast number of companies and not-for-profits; however, Google, Amazon, Microsoft and Meta together account for around 28.64% of all the models built.[33] Among startups, OpenAI while accounting for around 5.52% of the models tracked, has enterprise market share in the US amounting to around 34%, closely followed by Anthropic at 24%.[34]

In India, this layer has resulted in the growth of AI startups developing LLMs trained on vernacular languages, often built on top of models from Meta, OpenAI, and other international providers. Around 80% of Indian LLMs are estimated to be built atop existing foundational models.[35] Besides Sarvam AI's Hindi LLM, Tamil LLaMA, Telugu LLaMA, and OdiaGenAI are some local-language LLMs being built atop Meta's LLaMA 2.[36] Similarly, BharatGPT, with support for over 12 Indian and 120 foreign languages,[37] was developed by CoRover and built on OpenAI's GPT-4 architecture.[38]

However, recent months have seen a major shift as Indian startups begin to build their own foundational models rather than relying solely on foreign-developed architectures. An example is the open-source Sarvam 2B model, which belongs to the class of Small Language Models (SLMs) and is trained on four trillion tokens of data and tailored for 10 Indian languages.[39] Other notable examples include Krutrim's multimodal foundational models[40] and Tech Mahindra's Project Indus, which currently focuses on Hindi and its dialects.[41] Models fine-tuned for specific domains are also emerging, such as Kissan AI's Dhenu 1.0 model, which is built on Sarvam AI's OpenHathi model, is tailored for the Indian agricultural sector and can take instructions in Hindi and English.[42] This trend raises hopes that these small language Indic models will reduce dependencies on global Big Tech companies and provide contestability in the model layer of the AI market.

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32 Nasscom Insights. (2024, October 16). *India's generative AI startup landscape 2024.* https://community.nasscom.in/communities/nasscom-insights/indias-generative-ai-startup-landscape-2024

33 The shares have been computed by filtering the 'organisation' column containing these company names in https://crfm.stanford.edu/ecosystem-graphs/index.html?mode=table

34 Tully, T., Redfern, J., Xiao, D., & Sonnet, C. (2024, November 20). *2024: The state of generative AI in the enterprise.* Menlo Ventures. https://menlovc.com/2024-the-state-of-generative-ai-in-the-enterprise/

35 https://nasscom.in/knowledge-center/publications/indias-generative-ai-startup-landscape-2024-0#dwn-report

36 AIM. (2023, December 20). *Top 8 Vernacular Language Models Based on Llama 2.* https://analyticsindiamag.com/developers-corner/top-8-vernacular-language-models-based-on-llama-2/

37 AIM. (2023, April 14). 9 *groundbreaking GPT-based models developed in India.* https://analyticsindiamag.com/ai-mysteries/9-groundbreaking-gpt-based-models-developed-in-india/

38 Ali, S.N. (2024, June 16). *BharatGPT: The next generation AI language model.* https://dev.to/nashetking/bharatgpt-the-next-generation-ai-language-model-296c#:~:text=BharatGPT%20is%20built%20upon%20the,and%20generate%20human%2Dlike%20text

39 AIM. (2024, September 16). *Sarvam AI launches India's first open source foundational model in 10 Indic languages.* https://analyticsindiamag.com/ai-breakthroughs/sarvam-ai-launches-indias-first-open-source-foundational-model-in-10-indic-languages/

40 See the official website of Krutrim: https://www.olakrutrim.com/

41 See the official website of the Indus Project: https://www.projectindus.in/en/

42 AIM. (2023, December 25). *How Pratik Desai is sowing AI seeds in India.* https://analyticsindiamag.com/intellectual-ai-discussions/how-pratik-desai-is-sowing-ai-seeds-in-india/

Applications

This layer consists of companies that build interfaces for end users to interact with GenAI and has the highest scope for product differentiation, as companies can tailor AI applications to specific industries and business needs. The presence of Indian startups is concentrated in this layer across a variety of verticals such as coding, gaming, customer service, and designing. Between the first half of 2023 and that of 2024, the number of generative AI application startups in India is estimated to have risen by around 3.2 times, with the most popular use case (around 55% startups) being Gen-AI enabled assistants for employee services, customer support, etc.

Some ideations of the stack also place two additional layers—'model development and fine-tuning'[43] between the model and application layer and 'service provider'[44] atop the application layer.

Model development and fine-tuning

The companies in this layer provide various tools and software or have built platforms that aid in various steps in the lifecycle of LLM operations (LLMOps)[45]; from model preparation to final enterprise AI deployment. This includes processes such as data curation, model fine-tuning, model integration/deployment, and inferencing and monitoring. For instance, Datalogy AI offers tools for automated data curation for training of AI models;[46] MindsDB provides an automated fine-tuning platform,[47] and Portkey provides a unified gateway for connecting to multiple foundational AI model providers.[48] Indian startups like Xylem are emerging as key players in this niche, thus contributing to global LLMOps innovation.[49]

GenAI service providers

These are IT consulting companies that work with enterprises on various digital transformation projects, including cloud migration and the adoption of other frontier technologies such as Internet-of-Things (IoT) and blockchain. These companies manage the entire lifecycle of GenAI projects, from proof of concept to development and deployment of customized applications for enterprises for various use cases. Although there are several domestic companies in this space, a bulk of the projects are being led by a handful of companies; as of June 2024, TCS was estimated to be working on 270 use cases, Infosys on 225, and L&T Mindtree on 140.[50]

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[43] Inc42 Datalabs. (2023). *India's generative AI startup.* https://inc42.com/reports/indias-generative-ai-startup-landscape-report-2023/

[44] Nasscom Insights. (2024, July 29). *Cloud and generative AI: A synergistic future.* https://community.nasscom.in/communities/nasscom-insights/cloud-and-generative-ai-synergistic-future

[45] Golden, C. (2024, January 8). *A guide to LLMOps: Large Language Model Operations.* Comet. https://www.comet.com/site/blog/a-guide-to-llmops-large-language-model-operations/

[46] Wiggers, K. (2024, February 22). *DatologyAI is building tech to automatically curate AI training datasets.* TechCrunch. https://techcrunch.com/2024/02/22/datologyai-is-building-tech-to-automatically-curate-ai-training-data-sets/?guccounter=1

[47] See the official website of MindsDB: https://docs.mindsdb.com/use-cases/automated_finetuning/overview

[48] See the official website of Portkey Docs: https://docs.portkey.ai/docs/product/ai-gateway

[49] Tensoic, the creator of Kannada LLaMA, used Xylem's platform for its efficient inference stack.

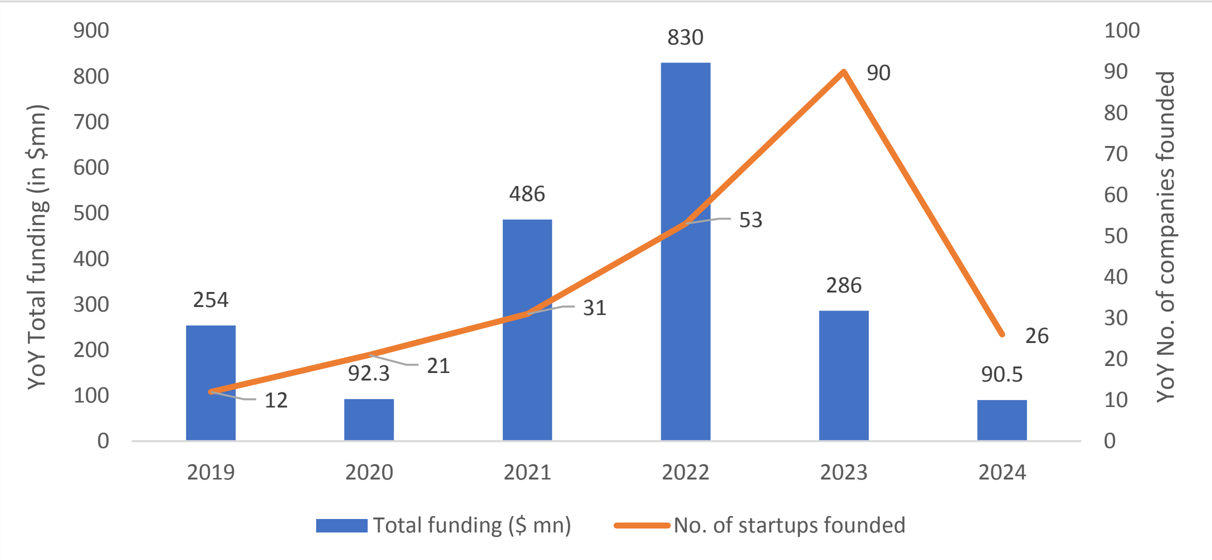
[50] NASSCOM Insights. (2024). *Generative AI tracker: Tech industry activity*. https://nasscom.in/knowledge-center/publications/generative-ai-tracker-tech-industry-activity#

2. Indian AI Startup Trends

By the end of 2023, India emerged as a significant player in the global AI startup ecosystem, ranking seventh in both private AI investments, amounting to USD 9.85 billion, and the number of newly funded AI companies, at 45.[51] The adoption rate of AI globally is 55%, higher than the adoption rate of GenAI (33%) in 2023. North America remains the leader in AI adoption (61%) and GenAI adoption (40%), followed closely by developing markets (including India, Latin America, and the Middle East and North Africa (MENA) region), with AI adoption at 49% and GenAI adoption at 33%. India also leads in AI skill penetration, surpassing global giants like the US and Germany, with a penetration rate of 2.8.[52] Globally, in 2023, every surveyed region reported higher AI adoption rates than in 2022.

The GenAI startup landscape in India has witnessed tremendous growth in the past few years. The annual investment in GenAI increased from USD 254 mn in 2019 to USD 830 mn in 2022, reflecting a Compound Annual Growth Rate (CAGR) of 48.39%. The cumulative investment in India GenAI startups as of August 2024 is estimated to be USD 2.25 bn, accounting for approximately 4.19% of global funding in GenAI. The total number of companies in the country is estimated to be 287, contributing to around 10.39% of companies founded globally. The number of startups founded in India each year grew on average by 38.46% for the 2019-24 period (see Figure 2). Krutrim is the only startup during this period to have reached unicorn status, compared to 43 worldwide.

Figure 2: Trend in Startup Founding and Investment, 2019-24



Source: Tracxn

[51] Maslej, N., Fattorini, L., Perrault, R., Parli, V., Reuel, A., Brynjolfsson, E., Etchemendy, J., Ligett, K., Lyons, T., Manyika, J., Niebles, J. C., Shoham, Y., Wald, R., & Clark, J. (2024). *The AI Index 2024 Annual Report*. AI Index Steering Committee, Institute for Human-Centered AI, Stanford University. https://aiindex.stanford.edu/wp-content/uploads/2024/05/HAI_AI-Index-Report-2024.pdf

[52] Ibid

In addition to investments, acquisitions are a way for larger companies to gain direct control of startup products that complement their own products. There have been three notable acquisitions of companies with GenAI offerings in India (see Table 1). Jio, through its acquisition of Haptik, an AI-based conversational platform, aimed to leverage the latter's AI capabilities across various devices and touchpoints in the consumer's journey. Haptik's conversational AI expertise enabled Jio to improve response times to user queries and open a new channel for lead generation and acquisition of customers for JioFiber and 5G.[53] Additionally the acquisition was an opportunity for Jio to enter the market for GenAI-based personal assistants across industries, such as retail, fintech, and healthcare.[54] Another example is Adobe's acquisition of Rephrase.ai to expand the company's generative video capabilities.[55]

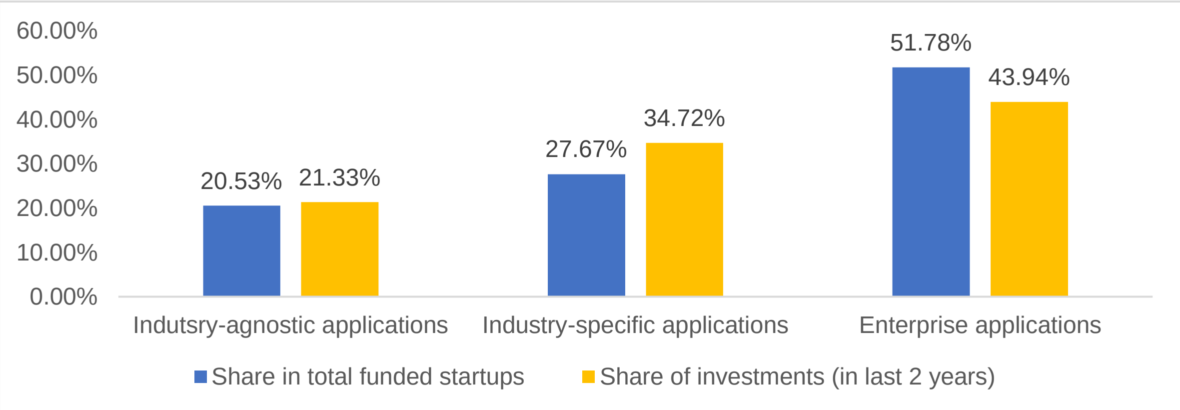
Table 1: AI Startup Acquisitions in India

Startup	Description	Acquirer
Haptik	AI-based conversational management solutions for businesses	Jio USD 101 mn (87% stake)
Rephrase.ai	AI-based video-creation platform	Adobe
TensorTour	Computer vision and machine learning technologies provider	Typeface

Source: Tracxn

Around 112 GenAI companies in India, representing 39% of the total, have received funding until September, 2024. The enterprise application category has the highest share of funded companies and also received the majority share of investments (Figure 3).

Figure 3: GenAI Funding by Categories



Source: Tracxn

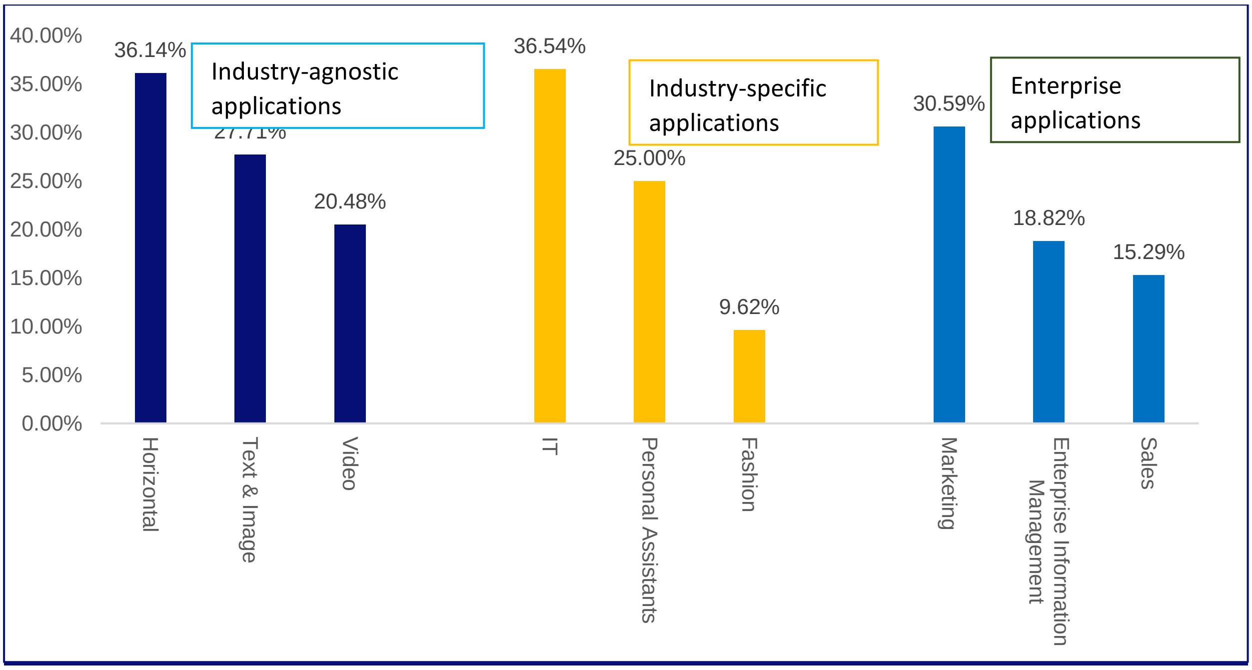
[53] See the official website of Haptik in the Resources section at https://www.haptik.ai/resources/case-study/jio-digital-life#:~:text=How%20Haptik%20Offered%20a%20Solution,queries%2C%20thereby%20enhancing%20customer%20experience.
[54] See the official website of Haptik: https://www.haptik.ai/platform/generative-ai-faq-assistant
[55] Mint. (2023, November 23). Adobe enters into Indian generative AI space by taking over Rephrase.ai. All you need to know about the deal. https://www.livemint.com/companies/news/adobe-enters-into-indian-generative-ai-space-by-taking-over-rephrase-ai-all-you-need-to-know-about-the-deal-11700706574825.html

Among the 221 startups founded in India in the 2020-24 period, around 83 (37.55%) are in the industry-agnostic category. A majority of these are startups with horizontal offerings (i.e., text, image, and speech-generation chatbots; Figure 3) that, in the past two years, received the highest investments, amounting to USD 21.1 mn, which constitutes around 65.52% of overall investments in the industry-agnostic category. However, this investment was concentrated in four out of 30 startups in the horizontal chatbot sub-category. The video-generation sub-category has the highest share of funded startups—at seven out of 17 (41.17%)—with a total of USD 5.29 mn or 16.53% of funding in the industry-agnostic category.[56]

In the industry-specific application category, 53 (23.98%) startups were founded in the 2020-24 period. While most of these catered to the IT industry, the highest share of funding—at three out of four (75%)—was for startups that offered applications specific to the finance sector. In terms of value of investments received, the sub-category of GenAI-based personal-assistant tools in shopping and travel account for the highest share, at around 54%.

In the enterprise application category, 85 (38.46%) startups were founded in the 2020-24 period. A majority of these offered marketing-based applications and received majority share of investments (48.29%) over the past two years. The highest share of funded startups—at seven out of 13 startups (approximately 54%)—were in the sales sub-category.

Figure 4: Top Three Sub-Categories of Each Application Segment by Share of Startups (2020-24)



Source: Tracxn

[56] Calculated from Tracxn data

Investors play a crucial role in shaping the Indian GenAI ecosystem, contributing not only capital but also mentorship and global exposure to emerging startups. Some of the top investors in GenAI in India based on the number of funding rounds in which they participated are presented in Table 2.

Table 2: Snapshot of Top Investors (by No. of Funding Rounds) in the GenAI Market in India

Investor	No. of Rounds	Portfolio Companies	Total Funding Amount Raised in Participating Rounds ($mn)
Accel	12	6	33
Entrepreneur First	11	8	5.42
100XVC	10	9	1.64
LetsVenture	9	9	7.04
Y Combinator	9	6	24

Source: Tracxn

India's AI startup ecosystem is rapidly evolving, with significant growth in investments. However, challenges remain in scaling to unicorn status and securing broader funding for a more diverse range of startups.

3. Emerging Partnerships of Big Tech across the AI Stack

Dominant players in markets of the AI value chain have formed various strategic partnerships among themselves and with other players in the AI stack to leverage synergies and expand their portfolio of offerings. Table 3 provides an overview of Big Tech partnerships across the AI stack in India and worldwide. As evident from Table 3, hyperscalers have leveraged their advantageous position to build a presence in the other AI layers *via* partnerships as well as their own in-house products, thus becoming vertically integrated across the stack.

Table 3: Illustration of Big Tech Partnerships across the AI Stack in India and Worldwide

	Own Product	Global Partnerships	Indian Partnerships
Chips	NVIDIA A100, NVIDIA GeForce RTX SUPER GPUs, etc. Microsoft Azure Maia 100 AWS Trainium, AWS Inferentia	NVIDIA & AWS (Strategic) Microsoft & AMD	NVIDIA & Yotta (for building NVIDIA GPU, powered Shakti Cloud)[57] NVIDIA & Reliance (for development of AI cloud infrastructure, local LLMs, and applications) NVIDIA & Tata (for building AI cloud)

[57] Yotta has also named NVIDIA's 'Elite Partner', enabling quicker access to high-end GPUs. See Bordoloi, P. (2024, September 27). 'Being an Elite NVIDIA Partner, we have access to high end GPUs'. *AIM*. https://analyticsindiamag.com/ai-insights-analysis/how-yotta-landed-over-16000-nvidia-h100-gpus/

Cloud Platforms	Google Cloud Platform Microsoft Azure Amazon Web Services (AWS)	Google & IBM Microsoft & Oracle	Microsoft & Reliance Jio (for the co-development of customized, affordable cloud-based solutions particularly targeted towards Small and Medium Enterprises (SMEs) and startups) AWS, Google, & Bharti Airtel (for co-development and deployment of cloud and GenAI solutions)
Models	Google – MedLM, Imagen, Codey, Chirp AWS – Amazon Titan	Amazon and Google partnership with Anthropic Google partnership with Mistral AI Microsoft partnership with OpenAI and Inflection AI	Microsoft & Sarvam AI (to make Indic voice LLMs available on Azure) Google Cloud and CoRover partnership in the development of BharatGPT
Model Development, Fine-tuning & Monitoring	Google Vertex AI Studio Amazon SageMaker JumpStart	WhyLabs & AWS (Strategic) LangChain[58] & Microsoft (Strategic) Google & Labelbox	Portkey.ai has received investments from AWS and OpenAI
Applications	Microsoft GenAI applications such as Designer and Copilot Google's Gemini	AWS Generative AI Accelerator selected 21 GenAI application startups	Google for Startups Accelerator programme: Partnerships with 20 Indian GenAI application startups Amazon's ML Elevate programme: 35 GenAI startups and 105+ overall AI startups
GenAI consulting services	AWS Generative AI Innovation Center[59]	Microsoft & Genpact, Accenture Google Cloud & Capgemini partnership (to set up a global Google Cloud GenAI Center of Excellence (CoE)	Google & Infosys (to set up a GenAI lab) Google & TCS (in the TCS GenAI offering) Deloitte India & AWS (Strategic partnership to develop GenAI apps for Indian enterprises) Microsoft & Tech Mahindra (to enable GenAI-powered enterprise search)

Sources: Company press releases and other media reports

[58] LangChain is an LLM fine-tuning platform. It is also part of Microsoft for Startups Pegasus Program.

[59] AWS Generative AI Innovation Center is an in-house team of Amazon GenAI experts that directly work with enterprises to identify appropriate use cases, select the right foundational models, and build and scale end-user applications.

Partnerships of chipmakers with Indian players

NVIDIA is collaborating with Indian data centre startups such as Yotta for the launch of their own AI cloud. The NVIDIA-Yotta deal for the launch of Yotta's Shakti Cloud, powered by over 16,000 NVIDIA H100 Tensor Core GPUs, was worth USD 500 million and is expected to reach over USD 1 billion by the end of 2025 as the company plans to double its GPU inventory by 2025.[60] NVIDIA has also tied up with Indian giants in the telecom, cloud infrastructure, and tech consulting markets. For instance, it announced a collaboration with Reliance in September 2023 to provide access to its NVIDIA GH200 Grace Hopper Superchip and NVIDIA DGX Cloud for developing AI-cloud infrastructure, local LLMs, and GenAI applications.[61] It forged another partnership in September 2023 with Tata Communications to build an AI cloud powered by NVIDIA GH200 Grace Hopper for driving the AI transformation of Tata Group companies across verticals (e.g., manufacturing, consumer products). This partnership also focuses on the upskilling of 600,000 TCS workforce involved in driving AI adoption of its enterprise customers.[62] Its ecosystem of partners in India also includes technology service providers such as Infosys, Wipro, and L&T Tech, which provide tailored GenAI solutions to businesses across various industries.[63] The NVIDIA-Infosys alliance, for instance, integrates Infosys's AI service Topaz with NVIDIA's hardware and AI enterprise suite[64] to drive efficiency across business functions such as inventory management, customer relationship management, and fraud detection and verticals such as manufacturing, media and entertainment, and retail.[65]

Investments and partnerships of hyperscalers in Indian AI

The investments and partnerships by hyperscalers in the Indian AI market play a pivotal role in shaping the competitive landscape of the sector. Economic literature has highlighted that direct investments provide the highest degree of control over technological development and market positioning,[66] while partnerships allow for shared expertise and resources by creating strategic dependencies. Accelerators, on the other hand, represent softer forms of influence, offering support while allowing startups greater autonomy.[67] In India, hyperscalers like AWS, Google, and Microsoft are leveraging these mechanisms to strengthen their foothold,

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60 IndianWeb2. (2024, March 19). *Everything about NVIDIA – Yotta deal – India's biggest AI deal ever.* https://www.indianweb2.com/2024/03/everything-about-nvidia-yotta-deal-as.html

61 NVIDIA Newsroom. (2023, September 8). Reliance and NVIDIA partner to advance AI in India, for India. https://nvidianews.nvidia.com/news/reliance-and-nvidia-partner-to-advance-ai-in-india-for-india

62 NVIDIA Newsroom. (2023, September 8). Tata partners with NVIDIA to build large-scale AI infrastructure. https://nvidianews.nvidia.com/news/tata-partners-with-nvidia-to-build-large-scale-ai-infrastructure

63 Benzinga India Staff. (2024, June 6). *Top Indian companies that have partnered with U.S. Giant Nvidia.* https://in.benzinga.com/content/39201786/top-indian-companies-that-have-partnered-with-u-s-giant-nvidia

64 A cloud-native software platform offering pre-trained models, frameworks and tools for streamlining development and deployment of generative AI applications. See NVIDIA AI Enterprise. https://www.nvidia.com/en-in/data-center/products/ai-enterprise/

65 Infosys Limited. (2023). *Infosys-NVIDIA: AI-driven operational excellence for next-generation businesses*. https://www.infosys.com/services/applied-ai/documents/next-generation-business.pdf

66 Williamson, O. E. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law & Economics, 22*(2), 233-261.

67 Cohen, S., Fehder, D., Hochberg, Y., & Murray, F. (2019). The design of startup accelerators. *Research Policy*, *48*(7), 1781-1797.

fostering innovation, and steering the development of AI through targeted investments, strategic collaborations, and support for AI startups.

Investments and acquisitions

Big Tech players are engaged in direct investments and acquisitions across various layers of the AI value chain, particularly targeting high-potential startups. These investments not only provide capital but also shape the innovation trajectories of these startups by aligning them with the strategic priorities of larger players. Additionally, such moves can create ripple effects across the ecosystem, influencing the flow of talent, resources, and research, potentially leading to both consolidation and growth in certain sectors. Table 4 provides details of Big Tech investments and acquisitions involving Indian startups, and Table 5 outlines similar activities on a global scale.

Table 4: Big Tech Investments and Acquisitions of Indian Startups

Google		
	Investments	
Company	**Description**	**Amount Invested**
ProjectX	AI-enabled cloud-based operating system	USD 204.0K
Onward Assist	AI-powered platform for cancer diagnostics	
MetaShop	Cloud and AI-based platform for 3D content creation	USD 100.0K (Grant-prize money)
	Acquisitions	
Halli Labs	Provider of AI development and machine learning solutions	
Microsoft		
	Investments	
DTU Leap	Provider of AI development and machine learning solutions	USD 500.0K
Saarthi	Provider of conversational AI for customer support	$12 million[68]
LEGOAI	AI-powered analytics platform	$150,000 (Grant from Microsoft for Startups)[69]
Scibler	AI powered one touch meeting scheduling	

Source: Tracxn

[68] JSA Law. (2021, November 26). *Microsoft Corporation invests in Salesken.* https://www.jsalaw.com/deals-matter/microsoft-corporation-invests-in-salesken/

[69] See the website of LEGOAI: https://www.crunchbase.com/organization/legoai

Table 5: Select Big Tech Investments of Global Startups

Company	Description	Amount Invested
Nvidia		
Company	**Description**	**Amount Invested**
Perplexity AI Model & Application Layer	AI-powered knowledge-discovery platform	Three funding rounds (total amount raised: USD 387 mn)
Mistral AI Model Layer	Developer of GenAI models	One funding round (total amount raised: USD 503 mn)
CoreWeave Cloud Layer	GPU-accelerated cloud-computing IaaS company	One funding round (total amount raised: USD 221 mn)
Microsoft		
Mistral AI Model layer	Developer of GenAI models	USD 16.3 million
Open AI Model layer	Developer of GenAI models	USD 10 bn (in Jan'23) USD 1 bn (co-investor in Jul'19)
Datalogy AI Model development and fine-tuning layer	Automated data-curation platform for GenAI models	One funding round (total amount raised: USD 46 mn)
Inflection AI Model layer	AI-based personal-assistant provider	Acquired for USD 650mn

Source: Tracxn

Partnerships on model development

Partnerships have been established for building diverse LLMs. In February this year, Microsoft and Sarvam AI announced a partnership to make Indic voice LLMs available on Azure. The collaboration involves Microsoft supporting the startup with access to its cloud and AI infrastructure—including Azure OpenAI Service and Azure Machine Learning—to train, host, and scale its LLMs, while also conducting research on ways to better support Indian languages in Microsoft's GenAI frontier language models as well as for deploying them at scale.[70] Meta is also working with Sarvam AI in the development of LLMs in vernacular languages. Sarvam AI's open-source Hindi language model, OpenHathi-Hi-0.1, was built atop Meta AI's LLaMA 2-7B model.[71,72] Another development that is likely to have far-reaching impacts on the Indian AI startup ecosystem is the MoU between Meta and the IndiaAI mission, which would focus on building datasets in Indian languages to enable translation and LLMs by leveraging Meta's AI research models such as LLaMA, Massively Multilingual Speech, and the No Language Left Behind project.[73] The BharatGPT model, which supports more than 14 Indian languages, is developed by CoRover.ai in partnership with Google Cloud. The latter supported CoRover

[70] Microsoft. (2024, February 8). Indian startup Sarvam AI collaborates with Microsoft to bring its Indic voice large language model (LLM) to Azure. https://news.microsoft.com/en-in/indian-startup-sarvam-ai-collaborates-with-microsoft-to-bring-its-indic-voice-large-language-model-llm-to-azure/

[71] The Hindu Bureau. (2023, December 15). Indian AI startup Sarvam AI open–sources first Hindi AI model. https://www.thehindu.com/sci-tech/technology/indian-ai-startup-sarvam-ai-open-sources-first-hindi-ai-model/article67641090.ece

[72] The Economic Times. (2024, March 1). Meta working with Sarvam AI to build vernacular LLMs. https://cio.economictimes.indiatimes.com/news/artificial-intelligence/meta-working-with-sarvam-ai-to-build-vernacular-llms/108124592

[73] Meta. (2023, July 27). Forging partnerships to advance AI technologies in India. https://about.fb.com/news/2023/07/meta-and-india-ai-to-foster-advancements-in-ai-technologies-in-india/

with cloud credits and provided non-equity financing of USD 500,000 to scale up the project. The model is hosted in Google Cloud Platform (GCP), and CoRover's AI conversational platform also integrates Google's model development and fine-tuning platform Vertex AI.[74]

Partnership with technology service providers

The importance of hyperscalers in the cloud computing market and their significant presence in adjacent digital markets provides them with a significant advantage in partnerships. Their large pre-existing ecosystem of partners reinforces network effects in downstream GenAI markets. This is particularly relevant for the capture of the high-end segment of enterprise customers that have a long historical working relationship with a few large IT service providers, such as Infosys, Wipro, and TCS, who in turn have long-standing strategic partnerships with hyperscalers. Many of the GenAI partnership announcements in recent months between hyperscalers and IT service providers are expanding on existing partnerships. While these IT service providers partner with over 50 technology companies on average across various domains, they have a disproportionate focus on a handful of "top-tier" strategic partners, which are generally hyperscalers and other large global cloud providers (e.g., AWS, Microsoft, Google Cloud, Oracle, SAP, and Salesforce).[75] These priority partners are assigned dedicated customized business units for solutioning, delivery, sales, and marketing to drive the adoption of their offerings, including their GenAI models and applications.

Big Tech players are also forging strategic partnerships with several leading Indian technology service providers for the co-development of tailored GenAI applications at an enterprise scale, most prominently through the establishment of Centres of Excellence (CoE) and AI labs. Some of these are illustrated in Table 6.

[74] See the official website of CoRover.ai: https://corover.ai/bharatgpt/

[75] Jain, N. & Sharma, D. (2023). *Generative AI Startup Landscape in India – A 2023 Snapshot*. NASSCOM. https://nasscom.in/product/41#:~:text=Strategic%20Partnerships%20in%20the%20cloud,the%20%24300%2D%24350%20b

Table 6: Big Tech Partnerships with Technology Service Providers on GenAI

Google	
Google-Infosys	Establishment of a global GenAI Lab for the development of industry-specific solutions as part of the Infosys Topaz suite of offerings. The partnership also involves training around 20,000 professionals in Google Cloud's AI services such as Vertex AI and Duet AI. The joint capabilities are being leveraged for delivering projects for enterprises across verticals such as consumer goods and telecommunications to improve the planning of marketing spend, product supply, and customer experience, among others.[76]
Google-TCS	TCS and Google Cloud announced a partnership in 2023 for TCS's GenAI offerings, which integrate Google Cloud's GenAI tools Vertex AI, Generative AI Application Builder, and Model Garden with TCS's own solutions. TCS also plans to train around 40,000 of its professionals on Google Cloud GenAI skills.[77]
AWS	
AWS-Deloitte	Deloitte India unveiled a strategic partnership with AWS for the co-development of GenAI applications across various sectors such as financial services, pharmaceuticals, automotive, and consumer products by leveraging AWS's Amazon Bedrock and other GenAI technologies. The use cases being explored include semantic text exploration, content creation, image recognition, and code generation.[78]
AWS-Persistent	Persistent Systems announced multi-year strategic collaboration agreements with AWS for GenAI adoption across various industry verticals, leveraging services such as Amazon CodeWhisperer for optimizing software development tasks. Over 16,000 engineers have been trained to use these services.[79]
Microsoft	
Microsoft-Tech Mahindra	Tech Mahindra partnered with Microsoft in 2023 for its GenAI-powered Enterprise Knowledge Search offering, which integrates Microsoft Azure OpenAI Service, Azure Cognitive Search, and Azure Language for efficient structuring, search, and use of enterprise data.[80] It expanded the collaboration in 2024 to set up a dedicated Copilot practice.[81]
Microsoft-Wipro	Wipro collaborated with Microsoft for the launch of a suite of GenAI-powered solutions for the financial services sector, including Wipro GenAI Investor Intelligence, Wipro GenAI Investor Onboarding, and Wipro GenAI Loan Origination.[82]

Source: Compiled from press releases

[76] Infosys Press Release. (2023, October 18). *Infosys and Google Cloud expand alliance to help enterprises transform into AI – first organizations.* https://www.infosys.com/newsroom/press-releases/2023/global-generative-ai-labs-gcp.html

[77] TCS Press Release. (2023, May 22). *TCS announces generative AI partnership with Google Cloud and new offering for enterprise customers.* https://www.tcs.com/who-we-are/newsroom/press-release/tcs-announces-generative-ai-partnership-with-google-cloud

[78] Deloitte Press Release. (2023, September 19). *Deloitte and AWS join forces to enable Indian customers address real world challenges using generative AI.* https://www2.deloitte.com/in/en/pages/about-deloitte/solutions/Deloitte-and-AWS-join-forces-to-enable-Indian-customers-address-real-world-challenges-using-generative-AI.html

[79] Persistent. (2023, June 7). *Persistent expands relationship with AWS to adopt Amazon CodeWhisperer.* https://www.persistent.com/wp-content/uploads/2023/06/Press-Release_Persistent-Expands-Relationship-with-AWS-to-Adopt-Amazon-CodeWhisperer.pdf

[80] Tech Mahindra Press Release. (2023, June 30). *Tech Mahindra integrates Microsoft Azure OpenAI to boost enterprise knowledge search.* https://www.techmahindra.com/insights/press-releases/tech-mahindra-integrates-microsoft-azure-openai-boost-enterprise-knowledge/

[81] Tech Mahindra Press Release. (2024, July 9). *Tech Mahindra collaborates with Microsoft to modernize workplace experiences with generative AI.* https://www.techmahindra.com/insights/press-releases/tech-mahindra-collaborates-microsoft-modernize-workplace-experiences/

[82] Wipro. (2024, May 6). *Wipro collaborates with Microsoft to launch a suite of generative AI–powered virtual assistants for financial services*. https://www.wipro.com/newsroom/press-releases/2024/wipro-collaborates-with-microsoft-to-launch-a-suite-of-generative-ai-powered-virtual-assistants-for-financial-services/

Partnerships with government and academia

Another emerging dimension of partnerships is with the public sector and academia. For instance, in June 2024, AWS announced a USD 50 million investment in its AWS Worldwide Public Sector Generative AI Impact Initiative to accelerate GenAI adoption in public-sector organizations through programme components such as cloud credits, technical support, and access to its Generative AI Innovation Center expertise.

In 2023, Google Cloud partnered with Bhashini, an initiative within MeitY, to launch the Center of Excellence on Generative AI and Language Inclusivity. This collaboration focuses on the development of citizen services in Indic languages and the training of around one million professionals in GenAI.[83] Additionally, in 2024, it expanded on this collaboration through a partnership with the MeitY Startup Hub, under which 10,000 selected startups will be provided cloud credits of up to USD 350,000 and technical training.[84] Hyperscalers are also closely engaging with state governments in skills training.[85,86] There have also been notable collaborations with academia. Microsoft in collaboration with AI4Bharat, based in IIT Madras, launched Jugalbandi, a multilingual GenAI-powered chatbot that is integrated with WhatsApp and is designed to provide personalized assistance and information about government programmes and related queries, especially to people in rural and remote areas.[87] These academic partnerships support cutting-edge AI research and foster the development of locally relevant AI solutions that can be widely adopted across India's public sector and businesses.

Accelerator programmes

At the application layer, such partnerships are most notably in the form of GenAI startup accelerator programmes. These programmes offer startups with support in growing and scaling their businesses through funding, mentorship, and networking opportunities. For instance, in 2024, Google's AI First Accelerator programme selected 20 Indian startups across domains such as healthcare, gaming, and cybersecurity to receive equity-free support through components such as cloud credits, state-of-the-art AI tools, exclusive access to technical bootcamps and mentorship from Google teams, and business support pertaining to company and product strategy from Google network of industry experts.[88] Similarly, AWS's

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[83] Gupta, S. (2023, October 19). Google for India 2023: Partnering India's success in a new digital paradigm. *Google India Blog*. https://blog.google/intl/en-in/partnering-indias-success-in-a-new-digital-paradigm/#:~:text=To%20accelerate%20the%20development%20of,Excellence%20on%20Generative%20AI%20and

[84] Singh, P. (2024, July 18). *Google partners with MeitY Startup Hub to train 10,000 startups in AI.* TechGig. https://content.techgig.com/technology/google-partners-with-meity-startup-hub-to-train-10000-startups-in-ai/articleshow/111830263.cms

[85] Elets News Network. (2024, September 6). Telangana takes major leap in AI with 21 MoUs signed at Global AI Summit. https://egov.eletsonline.com/2024/09/telangana-takes-major-leap-in-ai-with-21-mous-signed-at-global-ai-summit/

[86] The Economic Times. (2024, February 9). Google, Maharashtra government to collaborate for AI-led development. https://economictimes.indiatimes.com/tech/technology/google-maharashtra-government-to-collaborate-for-ai-led-development/articleshow/107535075.cms?from=mdr

[87] Das, M.R. (2023, May 24). India's AI Push: Microsoft launches 'Jugalbandi', AI-based multilingual chatbot for rural India. *FirstPost*. https://www.firstpost.com/india/microsoft-launches-jugalbandi-ai-based-chatbot-for-farmers-and-rural-india-12641952.html

[88] Farish, C.V. (2024, July 18). Introducing the 2024 class of Google for startups accelerator: AI First. *Google India Blog*. https://blog.google/intl/en-in/introducing-the-2024-class-of-google-for-startups-accelerator-ai-first/

2023 GenAI edition of the ML Elevate programme provided a cohort of 35 Indian GenAI application startups with AWS credits of up to USD 200,000, access to AI models, tools, and other curated resources, an opportunity to pitch to a network of venture capital (VCs), and to scale up support of their applications on Amazon SageMaker JumpStart.[89] In June 2024, AWS also announced a commitment of USD 230 million to support GenAI startups across the world.[90]

Implications of partnerships

While the discourse on partnerships and investments in the GenAI space has raised significant concerns regarding anti-competitive issues (which will be discussed in Chapter 3), some commentators have pointed out that such investments have enabled rival startups to emerge, supported by technical and financial resources of competing Big Tech players, even as the latter continue to develop in-house AI products that compete with these startups.[91] They point to the emergence of Anthropic, financed by Google and Amazon as a strong competitor to Microsoft-backed OpenAI. Anthropic's Claude is a competitor to ChatGPT, and the models powering it, such as Claude 2, have been found to have an edge in document-ingestion capacity and specific tasks such as writing and coding.[92] Emerging trends suggest that similar dynamics are shaping the Indian AI landscape. For instance, Sarvam AI is largely backed with technical and business support from Microsoft while its rival CoRover has a close technical partnership with GCP in the development of Indic models.

It has also been argued that such backing from large incumbents play a crucial role in crowding in other forms of investments, such as from VCs, which support scale-up. On the other hand, restricting such partnerships could prevent new entrants from accessing similar investment opportunities, thereby stifling innovation and competition in the market.[93] Others have also pointed to how strategic partnerships can unlock larger macro-efficiencies and quality improvements at the deployment level through the integration of startup AI models into adjacent digital services of the tech conglomerate.[94] These considerations need to be weighed against the anti-competitive effects of partnerships.

At the same time, regulators of enterprise user markets such as financial services in India and abroad are pointing to the risks emerging from close collaboration and partnership of large financial firms with Big Tech. For instance, the Financial Conduct Authority (FCA) noted that

[89] AWS ML Elevate. (2023). *AWS announces 35 generative AI startups selected for ML Elevate 2023.* https://www.mlelevate.com/mlelevate2023cohort

[90] Amazon Press Centre. (2024, June 13). *AWS announces $230 million commitment for Generative AI startups.* https://press.aboutamazon.com/2024/6/aws-announces-230-million-commitment-for-generative-ai-startups

[91] Perault, M. (2024, August 26). *The deals that will hamper competition in AI markets.* Promarket. https://www.promarket.org/2024/08/26/the-deals-that-will-hamper-competition-in-ai-markets/

[92] Rajaraman, S. (2023, November 21). Open AI faces competitive pressure from Anthropic. *Forbes*. https://www.forbes.com/sites/sunilrajaraman/2023/11/21/openai-faces-competitive-pressure-from-anthropic/

[93] Perault, M. (2024, August 26). *The deals that will hamper competition in AI markets.* Promarket. https://www.promarket.org/2024/08/26/the-deals-that-will-hamper-competition-in-ai-markets/

[94] Abecasis, P., & Michiel, F.D. (2024). Generative AI Partnerships: Separating good from bad. *CPI Antitrust Chronicle*, July 2024. https://copenhageneconomics.com/wp-content/uploads/2024/07/2-GENERATIVE-AI-PARTNERSHIPS-SEPARATING-GOOD-FROM-BAD-Paulo-Abecasis-Federico-Di-MiChiel.pdf

such partnerships have made the integration of big data analytics, cloud services, and AI services of Big Tech a critical component of the operations of financial services' firms. However, the concentration risk arising from a lack of readily available substitutes could limit the latter's bargaining power over the terms of the partnerships and affect competition and innovation in the larger financial services market due to discriminatory terms applied to favoured partners when compared to regular customers.[95] Similar concerns are likely to emerge in India as Big Tech collaborations with Public Sector Banks (PSBs), private-sector banks, and Non-Banking Financial Companies (NBFCs) proliferate in payments and other segments.[96]

Public investments in GenAI in India

India has taken steps in advancing GenAI through public investments at both the central and sub-national levels. The following initiatives highlight some of the key efforts driving this development.

The IndiaAI mission

The national-level AI mission is designed to provide public investments across the entire AI technology stack through key programme components such as IndiaAI Datasets Platform (for democratized access to non-personal data), IndiaAI Compute Capacity (for creating compute capacity at scale), IndiaAI Innovation Centre (for the development and deployment of indigenous foundational models), and IndiaAI Application Development Initiative (for developing, scaling, and promoting AI applications in critical sectors).[97] It is estimated that around 50% of the mission funds (INR 5,000 crore of a total INR 10,372 crore) has been earmarked for the creation of computing infrastructure through the provisioning of at least 10,000 GPUs. Instead of direct procurement to build a publicly owned and operated infrastructure, these funds will be used to subsidize up to 50% of compute costs for startups, while enabling the latter to choose from a variety of GPUs in the market that meet their requirements.[98] This will allow startups to select GPUs that align with their specific computational needs, promoting efficiency in AI development. However, data collection on the utilization of the created capacity also needs to be in place to address the possibilities of sub-optimal usage.[99]

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95 Financial Conduct Authority. (2024). *Feedback Statement FS24/1: Potential competition impacts from the data asymmetry between Big Tech firms and firms in financial services.* https://www.fca.org.uk/publication/feedback/fs24-1.pdf

96 Reserve Bank of India. (2024). *Report on Currency and Finance 2023-24: India's digital revolution*. https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/RCF29072024D5F1960668724737AD152F783DB63F10.PDF

97 Press Information Bureau. (2024, March 7). *Cabinet approves ambitious IndiaAI Mission to strengthen the AI innovation ecosystem.* https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2012355

98 Grover, J. (2024, July 5). *Viability gap funding for startups to procure GPUs.* FE Tech Bytes. https://www.financialexpress.com/life/technology-viability-gap-funding-for-startups-to-procure-gpus-3543992/

99 Mohanty, A. (2024, May 17). *Compute for India: A measured approach.* Carnegie India. https://carnegieendowment.org/posts/2024/05/compute-for-india-a-measured-approach?lang=en

Bhashini: National Language Translation Mission

To enable the reach of digital services across the country in regional languages, the government set up Bhashini, an AI-led language translation platform,[100] with the goal of contributing to the collection and curation of digital data in Indic languages and addressing the language barriers that restrict access to AI services for non-English speakers in India. As of 2023, Bhashini had spent USD 6-7 million in data collection.[101] Domestic GenAI startups are already leveraging Bhashini's capabilities. For instance, CoRover integrated Bhashini in its AI chatbot AskDISHA (built for e-ticketing and other services for Indian Railways), enabling the company to expand the chatbot's capabilities to Gujarati and possibly expanding to10 other languages.[102] Similarly, KissanAI, a startup building AI-powered virtual assistants for the agriculture sector, leveraged Bhashini's open-source translation model IndicTrans. KogoAI is another startup that is collaborating with Bhashini to provide a platform for the development of multilingual AI agents powered by Large Action Models (LAMs)[103] by leveraging SLMs, whose domain-specificity and agility enables faster handling of smaller tasks.[104] The Bhashini project also aims to provide training and benchmarking datasets along with a model repository as digital public goods accessible via a standard API, i.e., Unified Language Contribution API (ULCA). In addition to this, an ecosystem of applications and tools from industry and academia can be developed.[105]

Telangana AI Mission

The Telangana AI Mission is building a holistic ecosystem that involves government agencies, industry, and academia for the development of AI use cases across domains such as e-governance, healthcare, mobility, and agriculture. The mission has an explicit intent to favour AI innovations being pursued by Micro, Small and Medium Enterprises (MSMEs) and startups for the purposes of government procurement.[106] The mission, in collaboration with Centre for Development of Advanced Computing (C-DAC) and IIT Hyderabad and the support of around INR 10 crores, has enabled 142 startups under the Revv Up accelerator programme to access affordable AI supercomputing infrastructure, initially at no cost for one year, followed by highly subsidized rates (i.e., one-third of the rates charged by private cloud infrastructure providers).[107] As part of its focus on GenAI, the state is also investing in building

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100 Ministry of Electronics & IT. (2022, August 26). *Digital India BHASHINI – India's AI-led language translation platform.* https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/aug/doc202282696201.pdf

101 Das, S. (2023, December 9). Mint AI Summit: How India's taking GenAI to the hinterlands with its language database program. *Mint*. https://www.livemint.com/ai/mint-ai-summit-how-india-s-taking-genai-to-the-hinterlands-with-its-language-database-program-11702120254309.html

102 Bordoloi, P. (2023, September 14). Bhashini will truly democratise AI in India. *AIM.* https://analyticsindiamag.com/innovation-in-ai/bhashini-will-truly-democratise-ai-in-india/

103 LAMs can execute complex tasks by decomposing them into smaller sub-actions.

104 Bordoloi, P. (2024, May 21). KOGO AI is collaborating with Bhashini to build AI agents in Indic languages. *AIM*. https://analyticsindiamag.com/ai-breakthroughs/kogo-ai-has-partnered-with-bhashini-to-build-multilingual-ai-agents-in-indic-languages/

105 See official page of Bhashini Sanchalak–National Language Translation Mission: https://bhashini.gov.in/sanchalak

106 See official website of Telangana AI Mission (T-AIM): https://ai.telangana.gov.in/

107 CDAC. (2023, April 12). Telangana AI mission enables start-ups to access AI computing resources. https://www.cdac.in/index.aspx?id=pk_itn_spot1323

local datasets through incentive programmes for students and other stakeholders. It is also working towards the standardization of domain-specific datasets to ensure interoperability and the exchange of such data across platforms via the Telangana Data Exchange (TGDex) platform, along with channelizing efforts in other key areas such as establishment of advisory councils and research collaboration networks for driving state-specific model development and application deployment.[108]

The partnerships across the AI value chain in India generally involve a combination of data sharing, compute, or distribution agreements. While they can have pro-competitive effects in terms of infusing critical technical inputs, financial capital, and expertise in startups, they also create conditions for anti-competitive conduct.[109] This necessitates a closer look by competition authorities at the contractual terms and conditions of such partnerships, which determine the ability and incentives of larger firms to influence not just the trajectory of the smaller partner firm but also the overall effects on the market. The next chapter will delve deeper into the implications of partnerships and other strategic behaviour for competition dynamics in AI.

[108] Government of Telangana. (2024). *AI-powered Telangana: Strategy document & implementation roadmap.* https://it.telangana.gov.in/wp-content/uploads/2024/09/AI-Powered-Telangana-Strategy-Document-and-Implementation-Roadmap.pdf

[109] Abecasis, P., & Michiel, F. D. (2024). Generative AI partnerships: Separating good from bad. *CPI Antitrust Chronicle,* July 2024. https://copenhageneconomics.com/wp-content/uploads/2024/07/2-GENERATIVE-AI-PARTNERSHIPS-SEPARATING-GOOD-FROM-BAD-Paulo-Abecasis-Federico-Di-MiChiel.pdf

CHAPTER 3

COMPETITION ISSUES

Disruptive technologies often promise to dislodge entrenched incumbents. In this context, it is important to examine how the AI market will shape up. Will the new technology be integrated into existing business models of Big Tech incumbents and mirror the ecosystems that have been created on various digital platforms, or will the market structure, which is still emerging, be diverse and competitive?

Ecosystems have emerged as an acceptable way to describe the economic activity that develops around Big Tech firms as they leverage critical input—the most important of which is data—to orchestrate the creation and provision of products and services and to dictate the terms of engagement to their ecosystem partners, who are dependent on the platform. Are AI platforms that bring together datasets, language models, cloud infrastructure, computing power, and applications emerging into a new ecosystem? Will the future of the AI ecosystem be marked by incumbent tech firms monopolizing essential inputs and exercising market power on complementor firms for AI-based products and services? Will leveraging existing positions of dominance, including in search and operating systems, enable incumbent firms to capture new markets and technologies? Additionally, will signing partnerships with smaller challengers neutralize the competitive threat? This chapter explores some of these questions by using a secondary literature survey. Since most incumbent firms are global, international dialogues on market trends may provide an indication of the emerging competition issues.

Over the past several decades, a handful of private actors have accrued power and resources in the digital ecosystem. Big Tech firms also seem to enjoy advantages in the AI market stemming from characteristics shared with other digital markets such as economies of scale and scope, network effects, accumulation and control over data (some of which is now proprietary), and user behaviour such as willingness to accept defaults and barriers to switching. Compounded with anti-competitive conduct such as tying and bundling and self-preferencing, complemented by mergers and acquisitions and opaque partnerships with innovative firms, the AI market may become concentrated with high barriers to entry and expansion. Firms are also using open-source systems to entrench themselves in the market.[110] AI is a related market for many of these firms, thereby presenting a risk to competition and thus to long-term innovation.[111]

This chapter attempts to explore how compute, data, and control of core AI infrastructure for both development and deployment are likely to shape the future innovation trajectory of AI markets. It should be noted that, since market dynamics are still playing out, secondary

[110] Widder, D. G., West, S., & Whittaker, M. (2023). Open (for business): Big tech, concentrated power, and the political economy of open AI. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4543807

[111] OECD – EU Online Workshop. *What does our past experience with big tech platforms tell us about competition issues in AI?* https://web-archive.oecd.org/temp/sections/economy/reform/regulation-ai/Slides%20Keynote.pdf

literature merely serves to point out trends; the actual impact on market competition is not clear at the time of writing this report.

1. Barriers to Entry

Barriers to entry in the AI stack span multiple layers, with major industry players wielding substantial control over infrastructure and critical resources. This control enables them to not only direct AI development but also create dependencies that reinforce their market power. Some of these barriers to entry are described below.

Limited Access to Resources

The primary bottlenecks and barriers to entry in AI can be categorized in terms of key inputs: data, computational power, and the availability of skilled personnel. These barriers are evident in both the creation and implementation of AI models.

Data

Language models (LMs) excel with diverse data from both proprietary and public sources. These datasets can be either closed, such as DeepMind's MassiveText, or open, such as the Amazon MASSIVE dataset.[112] Barriers associated with data include factors such as dataset size, diversity, freshness, and exclusivity, which influence model outcomes. While large datasets have historically been advantageous to train AI models,[113] recent advances in AI—such as the Retrieval-Enhanced Transformer technique and use of synthetic data[114]—are enabling smaller datasets to compete effectively. These advances also highlight the efficiency of AI models over large volumes of data.[115]

Data freshness is also a challenge. Pre-trained models often lack the latest information, which affects the quality of the output. Few companies, such as Google, Microsoft, and OpenAI, consistently provide real-time data. Fine-tuning by using high-quality datasets provides models such as Koala a distinct performance edge.[116]

The privileged data access available to Big Tech players incentivizes foundational model (FM) producers to partner with them, reinforcing vertical integration[117] and further raising entry barriers. Moreover, certain datasets are highly valuable due to their scarcity and their

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112 Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

113 Google's FLAN model, trained on 1.87 trillion words, exemplifies this trend, alongside OpenAI's GPT-2 (1.5 billion parameters), GPT-3 (175 billion parameters), and the even larger GPT-4 (undisclosed).

114 For more such examples, see Schrepel, T., & Pentland, A. (2023). Competition between AI foundation models: Dynamics and policy recommendations. *MIT Connection Science Working Paper.* https://laweconcenter.org/wp-content/uploads/2023/09/SSRN-id4493900.pdf

115 Knight, W. (2023, April 17). OpenAI's CEO says the age of giant AI models is already over. *Wired.* https://www.wired.com/story/openai-ceo-sam-altman-the-age-of-giant-ai-models-is-already-over/

116 Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

117 Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

specialized nature. Firms can also bolster their data advantage through acquisitions and exclusive licensing agreements with niche firms.[118]

Access to unique datasets enhance firms' ability to offer tailored insights. Google, for example, restricts access to YouTube's video transcripts and comments, giving it an edge in understanding user behaviour, trends, and interactions.[119] Large firms that refuse to share essential data could potentially be breaching competition law.[120] Although many models rely on public datasets, proprietary data use is on the rise, challenging smaller firms with limited access[121] and raising legal issues over public data utilization.[122] Additionally, models trained on copyrighted material may have a "first mover advantage".[123]

Concerns about unauthorized dataset use have sparked intellectual property rights (IPR) lawsuits, such as those involving the New York Times, OpenAI, and Microsoft.[124] Content creators have also raised concerns about IPR issues leading to legal scrutiny, particularly in the US and UK. Data scraping[125] also poses anticompetitive risks in Europe. For instance, in the *Google Search (Shopping)* case, rival firms alleged that Google was scraping their content without their permission and using this data for its own search services.[126] To address IPR concerns, some firms offer opt-out options or licensing agreements, such as OpenAI's partnership with Axel Springer.[127] Competition authorities are also scrutinizing these practices, as exemplified by France's EUR 250 million fine on Google for unauthorized data usage in early 2024.[128]

Computational Power

Developing and deploying ML models requires substantial computational resources, such as graphic cards and specialized hardware, including systems equipped with multiple Central Processing Units (CPUs) and GPUs. Training these models can take months. Parallel computing

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118 AI Now Institute. (2024, March 12) *Joint submission to the European Commission's consultation on competition and generative AI.* https://ainowinstitute.org/wp-content/uploads/2024/03/EU_GenAI_CivilSociety.pdf

119 Schrepel, T., & Pentland, A. (2023). Competition between AI foundation models: Dynamics and policy recommendations. *MIT Connection Science Working Paper.* https://laweconcenter.org/wp-content/uploads/2023/09/SSRN-id4493900.pdf

120 Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

121 Autorité de la concurrence. (2024, March 20; November 2023). *Competition and generative artificial intelligence.* https://www.concorrencia.pt/sites/default/files/documentos/Issues%20Paper%20-%20Competition%20and%20Generative%20Artificial%20Intelligence.pdf

122 OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18.* https://doi.org/10.1787/e7e88884-en.

123 AI Now Institute. (2024, March 12). *Joint submission to the European Commission's consultation on competition and generative AI.* https://ainowinstitute.org/wp-content/uploads/2024/03/EU_GenAI_CivilSociety.pdf

124 The details about these lawsuits are provided in the Section 6 of this chapter.

125 "Data scraping" means extracting information from sources like the web.

126 Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

127 Carugati, C. (2024). The generative AI challenges for competition authorities. *Intereconomics, 59*(1), 14-21. https://intapi.sciendo.com/pdf/10.2478/ie-2024-0005

128 Autorité de la concurrence. (2024, March 20). *Related rights: The Autorité fines Google €250 million for non-compliance with some of its commitments made in June 2022.* https://www.autoritedelaconcurrence.fr/en/press-release/related-rights-autorite-fines-google-eu250-million-non-compliance-some-its

techniques can significantly expedite the process. For instance, Meta's Llama and Open AI's GPT-3 were trained in 21 days and approximately one month, respectively.[129]

The market for computational resources remains concentrated, with NVIDIA dominating in the GPU space and Intel in CPUs. As of writing, competition authorities in France,[130] Europe,[131] and the US[132] are investigating NVIDIA's business practices, while entrants like Advanced Micro Devices (AMD) and Intel are challenging its position. Leading tech firms, including Meta, Amazon, and Alphabet, have developed proprietary chips to boost AI workloads, and major cloud providers such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud are offering cloud services to firms in GenAI markets.[133] Google, Microsoft,[134] Meta, and NVIDIA have also invested heavily in supercomputing technologies.[135] NVIDIA's dominance raises concerns about India's own AI readiness, with local startups potentially lacking computing power. The dominance of NVIDIA further spurred AWS, Azure, and new players like Yotta and NeevCloud to enter India-made cloud networks, mirroring global trends. [136]

The oligopolistic cloud market has attracted scrutiny from competition regulators in the UK, US, France, Japan, and other nations.[137] Key concerns include high switching costs, restrictive licensing, and limited interoperability,[138] which make it challenging for developers to switch between platforms like Azure and Google Cloud.[139] The barriers to switching across ecosystems are notably higher than those between individual applications.[140] Overall, the main competition issues in the cloud layer pertain to financial lock-in practices such as committed spending discounts, cloud credits, and (until its recent phase-out) egress fees, as well as technical lock-in strategies such as limited interoperability and tying and bundling.[141]

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129 Autoridade da Concorrencia. (November 2023). *Competition and generative artificial intelligence.* https://www.concorrencia.pt/sites/default/files/documentos/Issues%20Paper%20-%20Competition%20and%20Generative%20Artificial%20Intelligence.pdf

130 Competition Policy International. (2024, July 1). *French antitrust regulator to charge Nvidia over alleged anti-competitive practices.* https://www.pymnts.com/cpi-posts/french-antitrust-regulator-to-charge-nvidia-over-alleged-anti-competitive-practices/

131 Reuters. (2023, October 01). EU examines Nvidia-dominated AI chip market's alleged abuses, Bloomberg reports. https://www.reuters.com/technology/eu-starts-early-stage-probe-into-nvidia-dominated-ai-chip-market-abuses-2023-09-29/

132 David, E. (2024, June 06). FTC and DOJ reportedly opening antitrust investigations into Microsoft, OpenAI, and Nvidia. *The Verge.* https://www.theverge.com/2024/6/6/24172868/ftc-doj-antitrust-openai-microsoft-nvidia-investigations

133 Carugati, C. (2024). The generative AI challenges for competition authorities. *Intereconomics, 59*(1), 14-21. https://intapi.sciendo.com/pdf/10.2478/ie-2024-0005

134 Microsoft partnered with OpenAI in 2019 by investing USD 1 billion in developing its supercomputer, which has 285,000 CPUs and 10,000 GPUs, on its Microsoft Azure cloud service.

135 Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

136 Abhirami, G. (2024, April 17). Nvidia's AI chips are about to flood the Indian market. But who needs them? *The Ken.* https://the-ken.com/story/nvidias-ai-chips-are-about-to-flood-the-indian-market-but-who-needs-them/

137 See, for the US, Federal Trade Commission. (2023, March 22). *An inquiry into cloud computing business practices: The Federal Trade Commission is seeking public comments*. https://www.ftc.gov/policy/advocacy-research/tech-atftc/2023/03/inquiry-cloud-computing-business-practices-federal-trade-commission-seeking-public-comments. The press release mentions the links to the other investigations.

138 Panettieri, J. (2022, December 05). Big Tech antitrust investigations: Amazon, Apple, Google, Meta/ Facebook and Microsoft updates. *Channel E2E.* https://www.channele2e.com/news/big-tech-antitrust-regulatory-breakup-updates

139 Carugati, C. (2024). The generative AI challenges for competition authorities. *Intereconomics, 59*(1), 14-21. https://intapi.sciendo.com/pdf/10.2478/ie-2024-0005

140 OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18.* https://doi.org/10.1787/e7e88884-en

141 Malik, P., Das, B., & Jagadeesh, H.T. (2024). A competition analysis of the Indian cloud computing market. *ICRIER Prosus Centre for Internet and Digital Economy. https://icrier.org/pdf/Indian_CloudComputing_market.pdf*

Talent

Developing GenAI models requires extensive experimentation and optimization, demanding a skilled workforce well-versed in machine learning, NLP, and related areas. However, sourcing and retaining such talent remains challenging.[142] A 2021 survey found that organizations struggle to fill AI roles and often resort to recruiting from established market leaders, which reinforces the dominance of financially stronger firms.[143] Yet, some experts argue that talent mobility mitigates this barrier,[144] as professionals from leading firms frequently establish their own AI startups. Examples include Mistral AI, co-founded by former Meta and DeepMind employees,[145] and Anthropic, founded by ex-OpenAI scientists.[146]

Cloud computing further requires specialized skills, often necessitating formal training or certifications for each hyperscaler. For firms looking to add or switch cloud providers, this translates into retraining costs or hiring expenses. Additionally, labour shortages in the tech sector intensify these challenges. Developers trained by IT consulting firms on proprietary GenAI services may be hesitant to transition to competitors, given their existing contractual commitments and specialized training.[147]

Cost of Training AI Models

Training and deploying AI models incurs substantial costs, while models that optimize data use and training time can offer cost savings.[148] The training of LLMs remains particularly costly due to intensive computing requirements.[149] For instance, GPT-3's training expenses exceeded USD 4.6 million,[150] while estimates for GPT-4 and Google's Gemini Ultra model indicate significantly higher costs.[151] Some companies, including EleutherAI[152] and Microsoft

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142 Autoridade da Concorrencia. (November 2023). *Competition and generative artificial intelligence.* https://www.concorrencia.pt/sites/default/files/documentos/Issues%20Paper%20-%20Competition%20and%20Generative%20Artificial%20Intelligence.pdf

143 Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

144 OECD – EU Online Workshop. *What does our past experience with big tech platforms tell us about competition issues in AI?* https://web-archive.oecd.org/temp/sections/economy/reform/regulation-ai/Slides%20Keynote.pdf

145 Ortiz, S. (2024, February 28). *What to know about Mistral AI: The company behind the latest GPT-4 rival.* https://www.zdnet.com/article/what-to-know-about-mistral-ai-the-company-behind-the-latest-gpt-4-rival/

146 Holden, D. (2024, October 05). Anthropic's sibling founders on leaving OpenAI to start a $15B startup. https://observer.com/2024/05/anthropics-sibling-founders-on-leaving-openai-to-start-a-15b-startup/#:~:text=The%20Bloomberg%20Tech%20Summit%20yesterday,now%20valued%20at%20%2415%20billion.

147 Ofcom. (2023, October 5). *Cloud services market study, final report.* https://www.ofcom.org.uk/__data/assets/pdf_file/0027/269127/Cloud-services-market-study-final-report.pdf

148 Autoridade da Concorrencia. (November 2023). *Competition and generative artificial intelligence.* https://www.concorrencia.pt/sites/default/files/documentos/Issues%20Paper%20-%20Competition%20and%20Generative%20Artificial%20Intelligence.pdf

149 Vanian, J., & Leswing, K. (2023, April 17). ChatGPT and generative AI are booming, but the costs can be extraordinary. *CNBC.* https://www.cnbc.com/2023/03/13/chatgpt-and-generative-ai-are-booming-but-at-a-very-expensive-price.html

150 Meyer, D. (2024, April 4). The cost of training AI could soon become too much to bear. *Fortune.* https://fortune.com/2024/04/04/ai-training-costs-how-much-is-too-much-openai-gpt-anthropic-microsoft/

151 GPT-4 likely exceeded USD 100 million while Gemini Ultra had an even higher cost of USD 191 million. See Visual Capitalist. (2024, May 22). *The training costs of AI models over time.* https://www.voronoiapp.com/technology/The-Training-Costs-of-AI-Models-Over-Time-1334

152 EleutherAI spent USD 4 lakhs on fine-tuning pre-trained models using the GPT-3 dataset. See Schrepel, T., & Pentland, A. (2023). Competition between AI foundation models: Dynamics and policy recommendations. *MIT Connection Science Working Paper.* https://laweconcenter.org/wp-content/uploads/2023/09/SSRN-id4493900.pdf

Azure,[153] have invested substantial resources in fine-tuning and supercomputing infrastructure. Training also incurs additional costs for the human validation of AI output, which is often outsourced to reduce expenses. Such practices can disadvantage smaller firms and also raise ethical concerns regarding labour conditions.[154,155]

Since the early 2010s, the computing power needed to train advanced AI models has roughly followed an accelerated version of Moore's Law,[156] doubling approximately every six months.[157] Training costs have tripled each year, driven in part by the semiconductor industry's concentration and supply-chain issues.[158] Efforts to reduce these high training costs are underway, with NVIDIA claiming that its GPUs can cut training costs from USD 10 million to USD 400,000.[159] Smaller models tailored for specific use cases present a shift from traditional scaling laws,[160] potentially enhancing speed, privacy, and data protection, although they raise concerns about exclusivity in certain applications.[161,162]

Entrenched Market Power

The US Federal Trade Commission (FTC) has raised concerns that Big Tech's substantial investments in AI could further entrench their market dominance. Major players like Microsoft, NVIDIA, Amazon, and Meta are making significant investments in AI,[163] with exclusive contracts often favouring these companies. Microsoft's initial USD 1 billion investment in OpenAI designated Azure as OpenAI's exclusive cloud provider,[164] while Hugging Face has partnered with AWS as its preferred cloud provider.[165] This "quasi-merger"

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153 Microsoft's Azure invested USD 1.2 billion in a supercomputer for training OpenAI's models. See Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

154 Hao, K., & Hernandez, A.P. (2022, April 20). *How the AI industry profits from catastrophe.* MIT Technology Review. https://www.technologyreview.com/2022/04/20/1050392/ai-industry-appen-scale-data-labels/

155 Dzieza, J. (2023, June 20). AI is a lot of work. *The Verge.* https://www.theverge.com/features/23764584/ai-artificial-intelligence-data-notation-labor-scale-surge-remotasks-openai-chatbots

156 In 1965, Gordon Moore, co-founder of Intel and Fairchild Semiconductor, predicted that the number of transistors on a microchip would double yearly, cutting manufacturing costs per component in half. He later revised this to doubling every two years. This is popularly referred to as Moore's Law.

157 Meyer, D. (2024, April 4). The cost of training AI could soon become too much to bear. *Fortune.* https://fortune.com/2024/04/04/ai-training-costs-how-much-is-too-much-openai-gpt-anthropic-microsoft/

158 Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

159 According to NVIDIA's estimates, it would cost businesses USD 10 million to train a single LLM. Jensen Huang, CEO of NVIDIA, went on to say that the power that firms would receive from investing that USD 10 million in a GPU cluster would be sufficient to teach 44 LLMs at the same cost. See B. U. (2023, May 29). NVIDIA announces $9.6M drop in cost when using its GPUs for AI LLM training. *Tech Times*. https://www.techtimes.com/articles/292051/20230529/nvidia-announces-9-6m-drop-in-cost-when-using-its-gpus-for-ai-llm-training.htm

160 According to the "scaling laws" principle, an AI foundation model's performance is determined by its size (which is determined by the number of parameters or "weights" of the model) and the pre-training dataset.

161 Kowalski, K., Volpin, C., & Zombori, Z. (2024). Competition in generative AI and virtual worlds. *Competition Policy Brief No. 3/2024.* https://competition-policy.ec.europa.eu/document/download/c86d461f-062e-4dde-a662-15228d6ca385_en

162 *Fine-tuning LLMs: Overview, methods and best practices.* https://www.turing.com/resources/finetuning-large-language-models

163 Microsoft owns a 49% stake in OpenAI, and Anthropic has raised over USD 7 billion from investors, with Amazon responsible for more than half of the funding, at USD 4 billion. For more information, see OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18*. https://doi.org/10.1787/e7e88884-en.

164 Concurrences Antitrust Publications & Events. (May 2024). *Artificial intelligence and antitrust.* https://www.concurrences.com/en/review/numeros/no-2-2024/on-topic/artificial-intelligence-and-antitrust

165 Boudier, J., Schmid, P., & Simon, J. (2023, February 21). *Hugging Face and AWS partner to make AI more accessible.* https://huggingface.co/blog/aws-partnership#:~:text=Through%20the%20strategic%20partnership%2C%20Hugging,and%20deploy%20models%20on%20AWS.

approach[166] to securing influence in the AI sector has attracted scrutiny from antitrust authorities in the UK and EU.

Big Tech also games the separation of privacy and competition policy to reinforce their market control. For example, Google's Privacy Sandbox aims to shift away from third-party cookies for targeted advertising, raising complaints from publishers who argue that it undermines their revenue while consolidating Google's dominance.[167] This mirrors broader trends from previous decades, where regulatory delays enabled tech giants to cement their positions.

Data-Driven Learning and Network Effects

Network effects, which drive demand-side economies, enhance AI models through valuable training data. Firms like Alphabet and Meta capitalize on these effects, strengthening user experience and maintaining a competitive edge. Competition authorities recognize the risk of quasi-monopolies, where data-driven companies leverage AI and network effects.[168]

Generative models improve with user interaction, creating data that strengthens their quality and attractiveness, thus reinforcing network effects.[169] OpenAI, for example, collects data from ChatGPT interactions to improve the model.[170] This cycle—where an expanding user base boosts product quality, attracting more users—creates a strong first-mover advantage, posing entry barriers for new firms that lack an established user network.[171]

Big Tech firms are increasingly prioritizing first-party data collection over third-party tracking, using network effects to maximize in-platform data value.[172] Additionally, linking models with upstream and downstream services reduces users' search costs and increases complementarity, although it can make competition more challenging for new entrants.[173] Integrating plugins[174] also strengthens network effects, creating new opportunities for developers.[175]

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166 Sawers, P. (2024, May 24). Big Tech companies are plowing money into AI startups, which could help them dodge antitrust concerns. *TechCrunch*. https://techcrunch.com/2024/05/24/big-tech-companies-are-plowing-money-into-ai-startups-which-could-help-them-dodge-antitrust-concerns/

167 Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power*. AI Now Institute. https://ainowinstitute.org/2023-landscape.

168 Carugati, C. (2023). Antitrust issues raised by answer engines. *Bruegel Working Paper No. 07/2023*. https://www.econstor.eu/bitstream/10419/274213/1/1853919209.pdf

169 Carugati, C. (2024). The generative AI challenges for competition authorities. *Intereconomics, 59*(1), 14-21. https://intapi.sciendo.com/pdf/10.2478/ie-2024-0005

170 Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

171 OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18*. https://doi.org/10.1787/e7e88884-en.

172 Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power*. AI Now Institute. https://ainowinstitute.org/2023-landscape.

173 Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

174 Plugins are software components that can be used to expand the features of GenAI models. It may be developed by third parties and are akin to applications for an operating system. For instance, in a plugin, the user can upload a PDF file and ask the AI about its contents, which can be used, for example, to summarize chapters.

175 Autoridade da Concorrencia. (November 2023). *Competition and generative artificial intelligence.* https://www.concorrencia.pt/sites/default/files/documentos/Issues%20Paper%20-%20Competition%20and%20Generative%20Artificial%20Intelligence.pdf

2. Possible Antitrust Challenges in the AI Market

Major players, equipped with scale and vertical integration, are dominating AI ecosystem, often by leveraging anti-competitive practices such as tying and bundling, exclusive agreements, and self-preferencing to reinforce their positions. These tech giants are using their strong market positions to expand into emerging markets and technologies while also partnering with smaller competitors to reduce competitive pressures.

Interplay of Leveraging and Vertical Integration in the AI Market

Similar to practices in the digital economy, foundational models in the AI market gain value through integration with services such as software, search engines, and cloud platforms.[176] Dominant firms use their influence in these markets to promote their own AI solutions, which can limit market access for competitors and reduce consumer choice. Vertical integration further strengthens these strategies, allowing leading firms to control multiple levels of the AI value chain.[177]

This consolidation of power might restrict competition and innovation,[178] particularly in AI, where foundational models require substantial resources and distribution networks. As demand for AI services grows, some FM providers have begun investing in their own hardware[179] or partnering with Big Tech,[180] which may further entrench their vertical relationships and complicate market entry for new competitors.

Tying and Bundling

The practice of linking GenAI to core products accelerates adoption but risks stifling competition by effectively locking out competitors.[181] Major tech firms, such as Google and Microsoft, embed their FMs into widely used platforms. For example, Google has integrated AI-powered applications into Google Search, Google Chrome, and Google Workplace, and Microsoft has integrated AI-powered Copilot applications into its search engine, browser, software, and operating system. These practices may limit the ability of rivals to enter the market, hindering the growth of competing models.[182]

Firms leading in upstream markets, such as cloud computing, strengthen their downstream influence by bundling proprietary AI models with cloud subscriptions, making it harder for

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[176] Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

[177] Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

[178] Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power.* AI Now Institute. https://ainowinstitute.org/2023-landscape

[179] For fine-tuning PaLM (Google's LLM trained on Google's own chips), computational power is drawn from Google Cloud.

[180] Microsoft's investment in OpenAI gave Microsoft the right to be the exclusive provider of cloud services for OpenAI.

[181] Autoridade da Concorrencia. (November 2023). *Competition and generative artificial intelligence.* https://www.concorrencia.pt/sites/default/files/documentos/Issues%20Paper%20-%20Competition%20and%20Generative%20Artificial%20Intelligence.pdf

[182] Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

third-party models to compete.[183] Additionally, model marketplaces and the "platformization" of GenAI reinforces these barriers. Major cloud providers, including Microsoft Azure AI, Amazon Bedrock, Google Cloud, and NVIDIA, offer combined access to computational power and AI models on single platforms. This setup not only encourages customer dependency but also cements these providers as central players in the AI landscape, creating barriers for smaller firms without access to such resources.[184] These dynamics reflect broader trends in platform markets, where large incumbents benefit from distributional advantages, while new entrants struggle to reach customers and grow.

Self-Preferencing

The concentration of power within the AI value chain has led to rising concerns about barriers to entry, prompting calls for regulation to ensure interoperability.[185] For instance, Google's AI-powered Search Generative Experience (SGE) within Google Search is positioned prominently, potentially limiting the visibility of third-party chatbots.[186] Similarly, Microsoft may provide preferential placement to its AI tools in search results, raising concerns about self-preferencing.[187] In the evolving AI landscape, OpenAI's app store for custom ChatGPT versions[188] could drive competition but may also allow dominant players to exert power over developers and clients,[189] risking similar anti-competitive outcomes.

Regulatory steps are underway globally to address such issues. In the US, legislative proposals such as the American Innovation and Choice Online Act (AICOA)[190] and the Open App Markets Act (2021)[191] aim to address these concerns. The AICOA seeks to prevent tech platforms from using non-public data to promote their products or limit competitor visibility, while the Open App Markets Act aims to prevent firms from restricting app downloads and payment systems.[192] However, progress on these bills has been slow.

[183] Wesonga, S. (2024, April 115). *Unleash the power of Microsoft Copilot for security: Introducing the Copilot for security hub.* https://techcommunity.microsoft.com/t5/microsoft-security-copilot-blog/unleash-the-power-of-microsoft-copilot-for-security-introducing/ba-p/4109184

[184] AI Now Institute. (2024, March 12). *Joint submission to the European Commission's consultation on competition and generative AI.* https://ainowinstitute.org/wp-content/uploads/2024/03/EU_GenAI_CivilSociety.pdf

[185] OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18*. https://doi.org/10.1787/e7e88884-en.

[186] Carugati, C. (2024). The generative AI challenges for competition authorities. *Intereconomics, 59*(1), 14-21. https://intapi.sciendo.com/pdf/10.2478/ie-2024-0005

[187] Carugati, C. (2023). Antitrust issues raised by answer engines. *Bruegel Working Paper No. 07/2023*. https://www.econstor.eu/bitstream/10419/274213/1/1853919209.pdf

[188] Varanasi, L. (2024, January 11). OpenAI's app store is here. It has chatbots for everything from negotiating a job offer to looking up a pet question. https://www.businessinsider.com/openai-gpt-store-apps-details-2024-

[189] Narechania, T. N., & Sitaraman, G. (2024). An antimonopoly approach to governing artificial intelligence. *Vanderbilt Law Research Paper (24-8)*. https://cdn.vanderbilt.edu/vu-URL/wp-content/uploads/sites/412/2023/10/06212048/Narechania-Sitaraman-Antimonopoly-AI-2023.10.6.pdf.pdf

[190] American Innovation and Choice Online Act, https://www.congress.gov/bill/117th-congress/senate-bill/2992/text

[191] Open App Markets Act, https://www.congress.gov/bill/117th-congress/senate-bill/2710/text#:~:text=A%20BILL-,To%20promote%20competition%20and%20reduce%20gatekeeper%20power%20in%20the%20app,Short%20title.

[192] Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power*. AI Now Institute. https://ainowinstitute.org/2023-landscape.

Copying or Unfair Trade Practices

Vertical integration also raises concerns about dominant cloud providers copying and innovations from downstream developers and integrating these into their own services. This discourages entrepreneurs and investors, who may avoid new ventures fearing that their ideas will be copied or acquired early. These concerns also apply to applications built on foundational models, creating a "kill zone" that stifles innovation.[193]

In *Elasticsearch v. Amazon*, Amazon's cloud division launched a competing product based on Elasticsearch's code, causing customer confusion. Similarly, AWS copied the open-source database MongoDB, effectively locking users into AWS infrastructure and making it difficult to switch cloud providers. Such practices harm startup value and deter investments in new technologies.[194]

Collusion

The 2023 Draft Merger Guidelines[195] recognize AI and algorithms as factors that may enhance markets' susceptibility to collusion by enabling firms to closely track competitors' prices. This aligns with the FTC's warning about shared pricing algorithms potentially violating antitrust laws if used for price coordination.[196] Collusion can be explicit, where firms use the same algorithm to align pricing, or implicit, where algorithms autonomously converge on non-competitive pricing patterns. LMs, if trained on confidential data, could facilitate explicit collusion by detecting deviations and reinforcing pricing agreements,[197] as seen in historical cases with poster sellers in the UK and US.[198]

AI can further foster "tacit collusion", where firms align prices without overt agreements, especially when using identical algorithms from a common provider. This implicit coordination arises as AI-driven algorithms make data more accessible, influencing firms to take less aggressive pricing actions, knowing that competitors' algorithms will quickly counteract these actions. These systems can stabilize prices, discouraging competitive moves and creating challenges in detection and liability under existing competition laws.[199] Moreover, price-fixing via AI-driven software has led to lawsuits, with firms being accused of

[193] Narechania, T. N., & Sitaraman, G. (2024). An antimonopoly approach to governing artificial intelligence. *Vanderbilt Law Research Paper (24-8)*. https://cdn.vanderbilt.edu/vu-URL/wp-content/uploads/sites/412/2023/10/06212048/Narechania-Sitaraman-Antimonopoly-AI-2023.10.6.pdf.pdf

[194] US Federal Trade Commission. (2023, June 21). https://downloads.regulations.gov/FTC-2023-0028-0073/attachment_2.pdf

[195] US Draft Merger Guidelines. https://www.ftc.gov/system/files/ftc_gov/pdf/p859910draftmergerguidelines2023.pdf

[196] Lent, K.H., & Schwartz, K. (2023). Antitrust implications of AI technology remain key focus of US regulators. *New York Law Journal.* https://www.skadden.com/-/media/files/publications/2023/11/antitrust_implications_of_ai_technology_remain_key_focus_of_us_regulators.pdf?rev=b326e11a93e04e5e9bb7ebdda1fd85d7&hash=1E708357C8C64E525EEB3871C9E0E4FD

[197] Carugati, C. (2023). Competition in generative artificial intelligence foundation models. *Bruegel Working Paper No. 14/2023*. https://www.econstor.eu/bitstream/10419/274220/1/1853932469.pdf

[198] OECD. (2021). Competition and AI. In *OECD business and finance outlook 2021: AI in business and finance*. OECD Publishing. https://doi.org/10.1787/ba682899-en.

[199] OECD. (2021). Competition and AI. In *OECD business and finance outlook 2021: AI in business and finance*. OECD Publishing. https://doi.org/10.1787/ba682899-en.

using AI to adjust prices unfairly in real time.[200] The UK Competition and Markets Authority (CMA) notes that AI is particularly likely to foster collusion in markets that are already prone to such practices, such as those with homogenous firms and products.[201]

Pricing Strategies

Digital companies may use below-cost pricing to rapidly attract users and build network effects, potentially sidelining competitors. For example, OpenAI's ChatGPT and other foundation model providers, like Anthropic's Claude, DeepMind's Sparrow, and Google's Bard, offer free chatbot access, reflecting a strategy to scale user bases and gain influence. While this approach can accelerate market power, it may pose anticompetitive risks,[202] echoing past challenges to antitrust authorities in platform-driven markets.

AI may reshape pricing strategies, enabling personalized pricing by analyzing consumer data to set prices based on individual characteristics and predicted willingness to pay. Although such personalization can enhance market accessibility, it also raises concerns about "black-box" algorithms. Dominant firms might use AI to impose selective or exploitative pricing, potentially leading to exclusionary practices or abuse of market power.[203]

3. Open-Source AI models and Competition

The term "open-source" originates from a long-standing practice wherein software code is freely accessible for examination, modification, and expansion[204] under specific copyright licences, known as open-source licences (OSL). These licences permit the software or data to be freely used, studied, modified, and shared.[205] This open-source ideology has been extended to AI;[206] open-source AI generally refers to models and components—such as documentation and software code—that are accessible under OSLs.[207]

The distinction between "open" and "closed" AI models does not follow a binary categorization, but spans a spectrum of openness from fully open to fully closed.[208] Thus, it can include anything from making training and evaluation datasets publicly accessible, to releasing model architecture or hyperparameters, to making model weights publicly

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200 Crowell & Moring LLP. (2024, January 10). *Antitrust: Artificial intelligence moves into the realm of antitrust litigation*. https://www.crowell.com/en/insights/publications/artificial-intelligence-moves-into-the-realm-of-antitrust-litigation

201 OECD. (2021). Competition and AI. In *OECD business and finance outlook 2021: AI in business and finance*. OECD Publishing. https://doi.org/10.1787/ba682899-en

202 Vipra, J., & Korinek, A. (2023). Market concentration implications of foundation models: The invisible hand of ChatGPT. *Center on Regulation and Markets Working Paper No. 9.* https://www.brookings.edu/series/center-on-regulation-and-markets-working-papers/

203 OECD. (2021). Competition and AI. In *OECD business and finance outlook 2021: AI in business and finance*. OECD Publishing. https://doi.org/10.1787/ba682899-en.

204 The Guardian. (2023, December 05). *Meta and IBM launch 'AI Alliance' to promote open-source AI development.* https://www.theguardian.com/technology/2023/dec/05/open-source-ai-meta-ibm

205 Open Source Initiative. (n.d.). *The Open Source Definition*. https://opensource.org/osd

206 Widder, D. G., West, S., & Whittaker, M. (2023). Open (for business): Big tech, concentrated power, and the political economy of open AI. http://dx.doi.org/10.2139/ssrn.4543807

207 Kluwer Copyright Blog. (2024, April 15). Open Source AI – definition and selected legal challenges. https://copyrightblog.kluweriplaw.com/2024/04/15/open-source-ai-definition-and-selected-legal-challenges/

208 Kluwer Copyright Blog. (2024, April 15). Open Source AI – definition and selected legal challenges. https://copyrightblog.kluweriplaw.com/2024/04/15/open-source-ai-definition-and-selected-legal-challenges/

available, to providing documentation like model cards or data sheets. However, the term "open" is commonly used by AI companies to imply greater transparency than is actually provided—a practice known as "open washing".[209]

While the exact definition of open-source AI remains a topic of considerable debate, the EU AI Act has taken a stance that affords a degree of definitional precision.[210] Article 2 of the Act exempts free and open-source licensed AI systems from certain regulatory provisions, except for those deemed "Prohibited" or "High-Risk AI" or those engaging directly with users ("Individual-User-Facing AI").[211] The Act also delineates a broader exception for General-Purpose AI Models (GPAIMs)[212] released under free and open-source licences. This exception permits access, usage, modification, and distribution of the model, provided critical parameters—including weights, model architecture, and usage information—are publicly disclosed;[213,214] monetized[215] GPAIMs or those posing systemic risks[216] are not exempt.

In October 2024, the Open Source Initiative (OSI) also released a definition of open-source AI, stating that "an open-source AI system can be used for any purpose without the need to secure permission, and researchers should be able to study how the system works and inspect its components. It should also be possible to modify the system for any purpose—including to change its output—and to share it with others to use, with or without modifications, for any purpose."[217] The definition also attempts to define a level of transparency for a model's weights, source code, and training data.[218] The organization is formulating a mechanism for enforcement that will identify models that claim to be open source but fail to comply with its established criteria; it also intends to publish a list of AI models that conform to their newly defined standards.[219]

In practice, open-source AI takes various forms: some systems provide full access to datasets and model architecture, while others restrict availability to an API or a licence for specific use, including commercialization.[220] For instance, Meta's Llama 2 can be downloaded, modified, and used without cost but cannot be used for training other language models and requires a specialized licence for its deployment in large -scale applications.[221] In contrast, EleutherAI's

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209 Gent, E. (2024, March 25). *The tech industry can't agree on what open-source AI means. That's a problem.* MIT Technology Review. https://www.technologyreview.com/2024/03/25/1090111/tech-industry-open-source-ai-definition-problem/

210 Keller, P. (2023, December 14). *A Frankenstein-like approach: open source in the AI act*. Open Future. https://openfuture.eu/blog/a-frankenstein-like-approach-open-source-in-the-ai-act/

211 EU AI Act. Article 2 (12). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024R1689#d1e1975-1-1

212 Defined under EU AI Act. Article 3 (63). https://artificialintelligenceact.eu/article/3/

213 EU AI Act. Article 53. https://artificialintelligenceact.eu/article/53/

214 EU AI Act. Recital 102. https://artificialintelligenceact.eu/recital/102/

215 EU AI Act. Recital 103. https://artificialintelligenceact.eu/recital/103/

216 EU AI Act. Recital 104. https://artificialintelligenceact.eu/recital/104/

217 Open Source Initiative. (n.d.-a). *The Open Source AI Definition – 1.0*. https://opensource.org/ai/open-source-ai-definition

218 Williams, R., & O'Donnell, J. (2024, August 22). *We finally have a definition for open-source AI*. MIT Technology Review. https://www.technologyreview.com/2024/08/22/1097224/we-finally-have-a-definition-for-open-source-ai/

219 Williams, R., & O'Donnell, J. (2024, August 22). *We finally have a definition for open-source AI*. MIT Technology Review. https://www.technologyreview.com/2024/08/22/1097224/we-finally-have-a-definition-for-open-source-ai/

220 Open Source Initiative. (n.d.-a). *Endorser organizations*. https://opensource.org/ai/endorsements

221 Digital Republic. (2024, September 13). *India should think about 'open source AI'.* https://digitalrepublic.substack.com/p/india-should-think-about-open-source-8fd

GPT Neo operates under standard open-source licences that are considered to be more openly accessible.[222]

Since the release of GPT-2, there has been a noticeable shift towards closed models, particularly in LLMs,[223] driven by the need for stricter safeguards to address the heightened risks associated with their use.[224] Companies like OpenAI have stopped disclosing essential model details—except for specifying the use of its Reinforcement Learning from Human Feedback approach, as seen with GPT-4—citing competition and safety concerns.[225] This departure from the open-source ethos can restrict independent innovation and has implications for the AI community. With large companies like Google, DeepMind, and OpenAI moving towards closed models, independent developers might be left with outdated models, thus hindering advancements.[226]

Tensions between open-source ideals and the realities of competitive, profit-driven motivations raises questions about the future of open-source AI and its dependencies on entrenched players. It is crucial to recognize that not all assertions of openness guarantee complete transparency. For instance, sharing model weights without training data or source code enable others to run, integrate, and adapt the model, but it limits reproducibility or in-depth analysis. There is limited evidence on the adoption of open-source versus closed AI models;[227] however, it is clear that advanced closed models are currently outperforming open models.[228] The current "open" labelling of systems that provide only an API rather than full model access can create a misleading impression of transparency[229] and serve to boost the revenues of Big Tech companies, thus solidifying their market entrenchment. While there are valid reasons to consider the potential downstream risks associated with the broad accessibility of such systems, the substantial computational demands of these systems suggest that dependencies between these projects and entrenched players will likely endure.[230]

Notably, the dominance of large companies poses significant risks to the advancement of open-source technologies, such as resource constraints, intellectual property management, and ecosystem dominance.[231] While a variety of resources, including models, APIs, and

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222 Knight, W. (2023, August 24). The myth of 'open source' AI. *Wired.* https://www.wired.com/story/the-myth-of-open-source-ai/

223 The authors analyzed trends by the original method of release across prominent base GenAI systems. This does not include fine-tuned or updated systems such as models that undergo reinforcement learning with human feedback.

224 Solaiman, I. *The gradient of generative AI release: Methods and considerations.* https://arxiv.org/pdf/2302.04844

225 Heaven, W.D. (2023, May 12). *The open-source AI boom is built on Big Tech's handouts. How long will it last?* MIT Technology Review. https://www.technologyreview.com/2023/05/12/1072950/open-source-ai-google-openai-eleuther-meta/

226 Heaven, W.D. (2023, May 12). *The open-source AI boom is built on Big Tech's handouts. How long will it last?* MIT Technology Review. https://www.technologyreview.com/2023/05/12/1072950/open-source-ai-google-openai-eleuther-meta/

227 The leader board compares over 100 models and is a "crowdsourced open platform for LLM evaluations that has collected over 1,000,000 human pairwise comparisons to rank LLMs." It ranks models with proprietary licences above those with "open" licences. For details, see https://huggingface.co/spaces/lmsys/chatbot-arena-leaderboard

228 AI Now Institute. (2024, March 12). *Joint submission to the European Commission's consultation on competition and generative AI.* https://ainowinstitute.org/wp-content/uploads/2024/03/EU_GenAI_CivilSociety.pdf

229 Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power.* AI Now Institute. https://ainowinstitute.org/2023-landscape.

230 Heaven, W.D. (2023, May 12). *The open-source AI boom is built on Big Tech's handouts. How long will it last?* MIT Technology Review. https://www.technologyreview.com/2023/05/12/1072950/open-source-ai-google-openai-eleuther-meta/

231 AI Now Institute. (2024, March 12). *Joint submission to the European Commission's consultation on competition and generative AI.* https://ainowinstitute.org/wp-content/uploads/2024/03/EU_GenAI_CivilSociety.pdf

structured and unstructured data (such as data warehouses and data lakes), may be available under open-source licences, developers who rely on these resources might nevertheless have to rely on major cloud operators to attain scale. However, the resources that are to build AI from scratch and to deploy large AI systems at scale remain "closed"—available only to those with significant (almost always corporate) resources.[232]

Firms often struggle to merge open-source approaches with sustainable business models. Big Tech firms leverage open source as a strategy to proliferate their model. Meanwhile, they seek to monetize their open models by developing products that are built on foundational models.[233] Moreover, major tech firms often use open-source projects to solidify and expand their centralized control in various ways. Examples include IBM's USD 1 billion investment in Linux (open-source OS) to challenge Microsoft's dominance, and Google's significant investment in Android OS to establish supremacy over Apple in mobile OS.[234]

While open-source AI models can promote innovation, competition, and transparency,[235] there are associated risks, including malicious uses like deepfakes or disinformation.[236] Transparency and reproducibility challenges also arise from extensive datasets, which can complicate model integrity verification.[237] For instance, image-generation models like Stable Diffusion, which scrape the internet for training data, face copyright and ethical issues,[238] indicating a need for public datasets or partnerships with those who have the IP rights to such data to ensure responsible model development. Therefore, a balanced regulatory approach is crucial—one that supports both open- and closed-source models to foster innovation while addressing potential risks in the rapidly evolving AI landscape.

Indic LLMs

Open-source AI has emerged as a significant focus within the Indian AI space, particularly in the development of AI models in Indic languages. Various projects and startups are working towards creating language models that can understand and process instructions in multiple Indian languages. Tech Mahindra's Project Indus and BharatGPT are both initiatives that aim to build Indic language LLMs from the ground up, with the intention to open source their models once they are fully operational.[239]

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232 Narechania, T. N., & Sitaraman, G. (2024). An antimonopoly approach to governing artificial intelligence. *Vanderbilt Law Research Paper (24-8).* https://cdn.vanderbilt.edu/vu-URL/wp-content/uploads/sites/412/2023/10/06212048/Narechania-Sitaraman-Antimonopoly-AI-2023.10.6.pdf.pdf

233 Schrepel, T. (2024, April 15). *Thomas Wolf: Open-source AI scaling laws* [Audio podcast]. https://podcasters.spotify.com/pod/show/scalingtheory/episodes/3--Thomas-Wolf-Open-Source-AI-Scaling-Laws-e2ici54/a-ab5s05s

234 Widder, D. G., West, S. & Whittaker, M. (2023). Open (for business): Big tech, concentrated power, and the political economy of open AI. http://dx.doi.org/10.2139/ssrn.4543807

235 Kapoor, S., Bommasani, R., Klyman, K., Longpre, S., Ramaswami, A., Cihon, P., ... & Narayanan, A. (2024). On the societal impact of open foundation models. arXiv. https://crfm.stanford.edu/open-fms/paper.pdf

236 Seger, E., Dreksler, N., Moulange, R., Dardaman, E., Schuett, J., Wei, K., … & Gupta, A. (2023). Open-sourcing highly capable foundation models: An evaluation of risks, benefits, and alternative methods for pursuing open-source objectives. *LawAI Working Paper No. 2-2023*. http://dx.doi.org/10.2139/ssrn.4596436

237 Tante. (2024, March 12). *Magic market words.* https://tante.cc/2024/03/12/magic-market-words/

238 Heikkila, M. (2022, September 16). *This artist is dominating AI generated art and he's not happy about it.* MIT Technology Review. https://www.technologyreview.com/2022/09/16/1059598/this-artist-is-dominating-ai-generated-art-and-hes-not-happy-about-it/

239 Pandey, M. (2024, April 12). *A bunch of 20 year old programmers are driving India's open source AI.* https://analyticsindiamag.com/ai-origins-evolution/a-bunch-of-20-year-old-programmers-are-driving-indias-open-source-ai/

In addition to these larger initiatives, several startups are contributing to the creation of models for specific use cases in Indic languages. Sarvam 2B, India's first open-source foundational model, can process instructions in ten Indic languages, including Hindi, Tamil, Telugu, and Bengali. Sarvam 2B is classified as a Small Language Model (SLM) and is designed to facilitate tasks such as translation, summarization, and understanding colloquial expressions.[240] Another example is Navarasa 2.0, a multilingual variant of Google's Gemma model, which includes generative capabilities that encompass 15 Indian languages in addition to English.[241]

The landscape of open-source AI and Indic language LLMs in India is rapidly evolving, driven by collaborative efforts from both the private sector and government initiatives.[242] Proponents of open-source initiatives in Indic languages argue that they can pave the way for a future where technology is more inclusive and accessible to speakers of diverse Indian languages.[243]

DPI Approach to AI

The AI ecosystem being largely controlled by major corporations risks fostering a profit-driven "AI monoculture" that stifles diversity and innovation.[244] The Digital Public Infrastructure (DPI) approach promotes a more inclusive, public-focused AI framework to counter Big Tech's dominance. While open-source AI has driven innovation, it alone cannot tackle corporate monopolies. India's AI mission is, thus, focused on building sovereign AI models tailored to the country's unique needs, including its diverse languages and vast datasets.[245] India is also seeking to establish AI compute infrastructure[246] and a customized AI foundational model intended for use by Indian companies, entrepreneurs, academia, and researchers.[247]

Integrating AI within DPI could reduce dependencies on dominant players, though the scale and investment power of incumbents cannot be ignored. Public-private partnerships may enable dominant corporations to engage in this space, raising potential conflicts of interest and unequal power dynamics. Policymakers and regulatory bodies should establish transparent guidelines to ensure fair competition and protect public interest in AI development and deployment.

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240 Bordoloi, P. (2024, August 13). *Sarvam AI launches India's first open source foundational model in 10 Indic languages.* https://analyticsindiamag.com/ai-breakthroughs/sarvam-ai-launches-indias-first-open-source-foundational-model-in-10-indic-languages/

241 Pakalapati, S.S. (2024, August 23). *Unlocking the potential of Indic languages: The rise of Indic LLMs.* https://medium.com/aimonks/unlocking-the-potential-of-indic-languages-the-rise-of-indic-llms-1426463c01e4

242 Explained in Chapter 2.

243 Pakalapati, S.S. (2024, August 23). *Unlocking the potential of Indic languages: The rise of Indic LLMs.* https://medium.com/aimonks/unlocking-the-potential-of-indic-languages-the-rise-of-indic-llms-1426463c01e4

244 Widder, D. G., West, S., & Whittaker, M. (2023). Open (for business): Big tech, concentrated power, and the political economy of open AI. http://dx.doi.org/10.2139/ssrn.4543807

245 HT News Desk. (2024, March 11). *We will have AI models designed and built in India: Rajeev Chandrasekhar.* https://www.hindustantimes.com/technology/we-will-have-ai-models-designed-and-built-in-india-rajeev-chandrasekhar-101710151920398.html

246 ANI. (2024, March 11). *Will have sovereign AI models designed, built in India: Union Minister Rajeev Chandrasekhar.* https://www.aninews.in/news/business/will-have-sovereign-ai-models-designed-built-in-india-union-minister-rajiv-chandrasekhar20240311175136/

247 TOI Tech Desk. (2024, May 22). *India to develop its own foundational model for AI: Report.* https://timesofindia.indiatimes.com/technology/tech-news/india-to-develop-its-own-foundational-model-for-ai-report/articleshow/110332386.cms

The Open Cloud Compute (OCC)[248] project exemplifies efforts to democratize access by creating a distributed, interoperable network of smaller cloud providers. Initially focused on integrating independent providers into a single network via a set of standard interfaces, it now helps enhance the discoverability and utilize the services of smaller domestic providers.[249] LLMs require intensive computing power and are unsuitable for training in a distributed network; meanwhile, inferencing and fine-tuning on smaller datasets can potentially use compute capacity from micro data centres located closer to end users, thus reducing costs and latency.[250]

By linking and combining underutilized storage and computing capacity, OCC could improve market competition by shifting some AI workloads away from the primary providers (largely hyperscalers), thus opening the market for new entrants and providing greater choice to the growing customer base. The potential of government departments as a demand-side stakeholder in the OCC whose cloud use cases can partially be shifted to the network is also being explored. At a later stage, the project would focus on the seamless integration and interoperability of services across providers in the network through a set of comprehensive APIs and realizing the potential of better resiliency and security of a distributed network by enabling trust through a system of verifiable credentials. By solving issues of discoverability, interoperability, and trust, the OCC could become a crucial DPI for AI transactions**,** offering low-cost solutions through a network of accredited cloud service providers, data service providers, compliance providers, and cloud service users.[251]

Further, nurturing data marketplaces has the potential to enhance contestability in AI innovation. Consent-based data-exchange systems such as account aggregators are already facilitating the exchange of user-approved sharing of data among financial institutions. The Data Empowerment and Protection Architecture (DEPA) framework can be expanded to unlock user data that is locked in siloes across the platforms of multiple service providers or in various domains in order to enable free and fair access to data for domestic AI startups.[252]

4. Mergers & Acquisitions and Partnerships

While partnerships and non-controlling investments between major AI firms and infrastructure actors have potentially sidestepped formal merger reviews, they remain particularly important as firms seek to gain a competitive edge in the rapidly evolving AI landscape.

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248 People plus ai. *Open cloud compute is a DPI for AI.* https://peopleplus.ai/occ

249 Palchaudhuri. S., Lall, T., Bhojwani, T., & Varma, P. *Creating open, innovative compute markets: The DPI way.* https://docs.google.com/document/d/1ZZd3d8CDu4qcZlrr_b3WW9QGVO-IPl2Ztph_8iQKlkc/edit

250 Malik, P., Das, B., & Jagadeesh, H.T. (2024). A competition analysis of the Indian cloud computing market. *ICRIER Prosus Centre for Internet and Digital Economy.* https://icrier.org/pdf/Indian_CloudComputing_market.pdf

251 Malik, P., Das, B., & Jagadeesh, H.T. (2024). A competition analysis of the Indian cloud computing market. *ICRIER Prosus Centre for Internet and Digital Economy.* https://icrier.org/pdf/Indian_CloudComputing_market.pdf

252 Reddy, B., Pai, N., Panicker, R., Sahu, S., & Krishna, S. (June 2024). A pathway to AI governance. *Takshashila Discussion Document No. 2024-10*. The Takshashila Institution.

Mergers & Acquisitions

Big Tech firms enter mergers and acquisitions to consolidate data advantages and bolster market dominance. Notable cases include Google's 2008 acquisition of DoubleClick, which enhanced its ad-targeting capabilities, and Facebook's 2013 acquisition of Onavo, which reportedly influenced its later decision of acquiring WhatsApp.[253] These acquisitions, despite their obvious anticompetitive implications, were allowed to proceed without any remedies.

With the rise in such data-driven mergers, regulators in the US and EU are seeking more robust tools to address such mergers more effectively. The FTC and Department of Justice (DOJ) have proposed new merger guidelines that would presume acquisitions by dominant platforms to be anticompetitive, thus shifting the burden of proof to these platforms.[254] Similarly, the European Commission (EC) has revised its merger review guidelines,[255] reducing the burden of proof to assess merger deals for potential anticompetitive effects in digital markets.

Nevertheless, there is a risk that current merger control could have gaps, especially concerning filing thresholds, as nascent tech firms often fall below turnover thresholds.[256] Authorities must adapt their tools and strategies of merger control to the unique challenges presented by the AI industry to prevent anticompetitive practices and promote innovation.

Partnerships

In GenAI, partnerships can mirror the competitive effects of outright acquisitions and raise similar concerns. These partnerships might include investments, service contracts for data or computing resources, or even mass hiring from rival firms to replicate transactional impacts.[257] For example, Microsoft stepped down from OpenAI's board to mitigate regulatory scrutiny surrounding their partnership. The Competition Commission of India (CCI) and other competition authorities are especially wary of the impact of common ownership on strategic decisions and data-sharing, thus requiring remedies such as limiting shared directors to ensure business independence.[258]

Competition regulators are closely watching partnerships such as those between Microsoft and OpenAI. Microsoft's partnership with Mistral AI is also being closely monitored by UK CMA despite its potential shareholding of less than 1%. Though minority stakes typically

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[253] Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power*. AI Now Institute. https://ainowinstitute.org/2023-landscape

[254] Kak, A., & West, S. M. (2023). *AI now 2023 landscape: Confronting tech power*. AI Now Institute. https://ainowinstitute.org/2023-landscape

[255] European Commission. (February 2021). *Guidance on the application of the referral mechanism set out in Article 22 of the Merger Regulation to certain categories of cases.* 2021/C 113/01. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC0331(01)

[256] OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18*. https://doi.org/10.1787/e7e88884-en

[257] OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18*. https://doi.org/10.1787/e7e88884-en

[258] Roy, A., & Kapoor, S. *Navigating AI–related combinations in India: Key insights and takeaways*. Sarvada.

bypass notification if deemed purely investment-oriented, the strategic intent behind AI alliances often subjects them to scrutiny.[259] It is also likely that future competition from startups will be fuelled by the investments made in AI models by Big Tech firms. For instance, Google's and Amazon's backing of Anthropic not only fuel competition with ChatGPT but also improve product offerings across the board.[260]

Another industry trend is the practice of "acqui-hires", i.e., the acquisition of companies for their talent. For instance, the co-founders of Adept were hired by Amazon, Google hired founders from Character, and Microsoft integrated top talent from Inflection.ai.[261] Such hires enhance internal expertise and drive rivalry, prompting regulators in Austria, Germany, the UK, and the US to review such acquisitions.[262] The US FTC now requires companies to disclose partnership details to assess competitive impacts.[263]

Partnerships should be examined carefully for potential competitive risks. A framework based on "ability, incentive, and effects" can identify concerns, although GenAI's evolving landscape may demand extra scrutiny. As per the framework, firstly, it is important to assess whether the partnership affects a partner's ability to influence market outcomes, such as through control over partner decisions or through existing market power. Secondly, understanding how the partnership changes incentives is critical, particularly if it could lead to anticompetitive behaviour.[264] Finally, the overall impact on competition and consumers must be evaluated.[265] Even if partnerships do not immediately trigger antitrust actions, regulators gain insights through market studies to track exclusivity or restrictive terms around critical resources like chips, cloud services, and APIs.[266]

Model developers frequently collaborate with major cloud providers, exchanging model access for computing resources. While these partnerships can promote competition, exclusive arrangements—such as Microsoft's exclusive hosting of OpenAI models on Azure, with integrations across Office 365 and other services—raise potential competition issues.[267] These partnerships vary in exclusivity. OpenAI, for instance, exclusively uses Microsoft Azure

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259 Roy, A., & Kapoor, S. *Navigating AI–related combinations in India: Key insights and takeaways*. Sarvada.

260 Perault, M. (2024, August 26). *The deals that will hamper competition in AI markets.* Promarket. https://www.promarket.org/2024/08/26/the-deals-that-will-hamper-competition-in-ai-markets/

261 Perault, M. (2024, August 26). *The deals that will hamper competition in AI markets.* Promarket. https://www.promarket.org/2024/08/26/the-deals-that-will-hamper-competition-in-ai-markets/

262 AI Now Institute. (2024, March 12). *Joint submission to the European Commission's consultation on competition and generative AI.* https://ainowinstitute.org/wp-content/uploads/2024/03/EU_GenAI_CivilSociety.pdf

263 Michaels, D. (2024, June 06). FTC opens antitrust probe of Microsoft AI deal. *The Mint*. https://www.livemint.com/companies/ftc-opens-antitrust-probe-of-microsoft-ai-deal-11717648732778.html

264 Exclusive partnerships may diminish incentives for firms to compete directly, as seen in Microsoft's decision to discontinue its Cortana virtual assistant in favour of the OpenAI-powered Copilot. See: Thun, M.V., & Hanley, D.A. (2024). *Stopping big tech from becoming big AI: A roadmap for using competition policy keep artificial intelligence open for all*. Open Markets Institute. https://static1.squarespace.com/static/5e449c8c3ef68d752f3e70dc/t/67100da0fb1ffa695a7ad75b/1729105313006/Stopping+Big+Tech+from+Becoming+Big+AI.pdf

265 Abecasis, P., & Michiel, F. D. (2024). Generative AI partnerships: Separating good from bad. *CPI Antitrust Chronicle.* https://copenhageneconomics.com/wp-content/uploads/2024/07/2-GENERATIVE-AI-PARTNERSHIPS-SEPARATING-GOOD-FROM-BAD-Paulo-Abecasis-Federico-Di-MiChiel.pdf

266 Perault, M. (2024, August 26). *The deals that will hamper competition in AI markets.* Promarket. https://www.promarket.org/2024/08/26/the-deals-that-will-hamper-competition-in-ai-markets/

267 OECD. (2024). Artificial intelligence, data and competition. *OECD Artificial Intelligence Papers No. 18*. https://doi.org/10.1787/e7e88884-en

as its cloud provider, while Anthropic and Cohere's arrangements with Amazon and Google lack such restrictions. In some cases, firms may gain privileged but not exclusive access; for example, Amazon engineers and AWS customers receive prioritized access to Anthropic's models.[268]

5. International Regulatory Investigations

The complexity and rapid growth of AI technologies, especially foundation models, have raised concerns about their potential to disrupt market competition, challenge consumer protection, and concentrate power in the hands of a few dominant players. Jurisdictions around the world are adopting various regulatory approaches to address these risks.

United Kingdom (UK)

The UK CMA is scrutinising AI FMs for potential competition and consumer risks. In May 2023, the CMA launched an initial review[269] of FMs and published its findings in an Initial Report[270] in September 2023, followed by an Update Paper[271] and Technical Update Report[272] in April 2024. The CMA identified an "interconnected web" of over 90 partnerships and strategic investments among major firms such as Google, Apple, Microsoft, Meta, Amazon, and NVIDIA, highlighting three main risks: control of critical inputs; market power exploitation; and partnerships that may further entrench market power. The Update Paper proposed principles to mitigate these risks.[273] The Technical Report refined these principles, emphasizing access to inputs, diversity in business models, consumer choice, fair conduct, transparency, and accountability.[274]

The CMA has also scrutinized specific AI-related partnerships using its merger control powers. In December 2023, it began reviewing Microsoft's partnership with OpenAI.[275] The Microsoft and Mistral AI partnership in May 2024 did not qualify for investigation under the UK merger control regime because it did not give Microsoft the ability to influence Mistral's commercial policy.[276] Moreover, UK CMA has cleared Microsoft's hiring majority of Inflection AI's staff for

[268] Thun, M.V., & Hanley, D.A. (2024). *Stopping big tech from becoming big AI: A roadmap for using competition policy keep artificial intelligence open for all.* Open Markets Institute. https://static1.squarespace.com/static/5e449c8c3ef68d752f3e70dc/t/67100da0fb1ffa695a7ad75b/1729105313006/Stopping+Big+Tech+from+Becoming+Big+AI.pdf

[269] CMA. (2023, May 04). *AI foundation models: Initial review.* https://assets.publishing.service.gov.uk/media/64528e622f62220013a6a491/AI_Foundation_Models_-_Initial_review_.pdf

[270] CMA. (2023, September 18). *AI foundation models: Initial report.* https://www.gov.uk/government/publications/ai-foundation-models-initial-report

[271] CMA. (2024, April 24). *AI foundation models: Update paper.* https://www.gov.uk/government/publications/ai-foundation-models-update-paper

[272] CMA. (2024, April 16). *AI foundation models: Technical update paper.* https://assets.publishing.service.gov.uk/media/661e5a4c7469198185bd3d62/AI_Foundation_Models_technical_update_report.pdf

[273] CMA. (2024, April 24). *AI foundation models: Update paper.* https://www.gov.uk/government/publications/ai-foundation-models-update-paper

[274] CMA. (2024, April 16). *AI foundation models: Technical update paper.* https://assets.publishing.service.gov.uk/media/661e5a4c7469198185bd3d62/AI_Foundation_Models_technical_update_report.pdf

[275] CMA. (2023, December 08). *Microsoft / Open AI partnership merger inquiry.* http://www.gov.uk/cma-cases/microsoft-slash-openai-partnership-merger-inquiry

[276] CMA. (2024, May 21). *Microsoft / Mistral AI partnership merger inquiry.* https://www.gov.uk/cma-cases/microsoft-slash-mistral-ai-partnership-merger-inquiry

its new AI division, determining that it poses no significant risk of reducing competition through horizontal unilateral effects.[277] Other merger investigations include the USD 4 billion collaboration between Amazon and Anthropic, which has the potential to create anticompetitive threats in the UK market.[278] Additionally, as part of a broader market investigation into cloud services launched in October 2023, the CMA is evaluating AI's impact on competition within the cloud sector.[279]

The UK's Digital Markets, Competition & Consumers Act, 2024 authorizes the designation of firms active in AI development and deployment as having Strategic Market Status (SMS).[280] Once designated as SMS, the CMA can, if needed, enforce conduct standards on firms to prevent self-preferencing, improve data access, ensure compatibility, provide users with greater choice, and promote transparency in algorithms.[281]

European Union

In March 2024, the European Parliament enacted the AI Act, marking one of the first regulatory efforts to address the challenges posed by rapidly evolving AI technologies. Following this, the EC stepped up its investigation of incumbent firms with AI exposure, including Google, Facebook, and TikTok, requesting information on their mitigation strategies for the risks posed by GenAI.[282] The Commission also issued guidelines under the Digital Services Act (DSA)[283] recommending that very large online platforms and search engines adopt measures such as labelling AI-generated content and updating their terms of service to manage election-related risks[284] effectively. The Commission also amended its merger referral guidelines[285] to simplify the review of mergers impacting digital markets' competitiveness.

Microsoft continues to attract scrutiny in the EC, especially around its investment in OpenAI in January 2024.[286] While the EU Merger Regulation review found no formal acquisition or operational control, exclusivity clauses raised concerns about potential impacts on

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277 CMA. (2024, September 04). *Microsoft / Inflection inquiry.* https://www.gov.uk/cma-cases/microsoft-slash-inflection-ai-inquiry

278 CMA. (2024, August 08). *Amazon / Anthropic partnership merger inquiry.* https://www.gov.uk/cma-cases/amazon-slash-anthropic-partnership-merger-inquiry

279 CMA. (2024, September 19). *Cloud services market investigation.* https://www.gov.uk/cma-cases/cloud-services-market-investigation

280 This status will only apply to firms designated by the CMA, following an evidence-based investigation and public consultation, as having Strategic Market Status (SMS) in relation to one or more digital activities. The CMA expects to start three to four SMS investigations within the first year of the new regime coming into force.

281 CMA. (2024, January 11). *CMA sets out approach to new digital markets regime* [Press release]. https://www.gov.uk/government/news/cma-sets-out-approach-to-new-digital-markets-regime

282 European Commission. (2024, March 14). *Commission sends request for information on generative AI risks to 6 very large online platforms and 2 very large online search engines under the Digital Services Act.* https://digital-strategy.ec.europa.eu/en/news/commission-sends-requests-information-generative-ai-risks-6-very-large-online-platforms-and-2-very

283 European Commission. (2024, March 26). *Commission publishes guidelines under the DSA for the mitigation of systemic risks online for elections.* https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1707

284 These risks can include the spread of misinformation, the manipulation of public opinion through targeted political advertising, and the amplification of harmful content that undermines trust in democratic institutions. To mitigate these risks, measures such as promoting accurate electoral information, enhancing media literacy, and adapting platform algorithms to limit the virality of harmful content are recommended.

285 European Commission. *Simplification of merger control procedures.* https://competition-policy.ec.europa.eu/mergers/publications/simplification-merger-control-procedures_en

286 Mckay, C. (2024, January 09). *EU investigates Microsoft's OpenAI investment for potential merger regulation implications.* https://www.maginative.com/article/eu-investigates-microsofts-openai-investment-for-potential-merger-regulation-implications/

competition. In May 2024, the Commission escalated its enforcement, legally requesting Microsoft to provide internal data related to GenAI risks on Bing.[287] This request focuses on potential DSA breaches, such as the failure to address risks like AI-generated 'hallucinations', the proliferation of deepfakes, and election-related service[288] manipulation. This aligns with the EU's broader efforts to address AI risks.

France

In February 2024, France's Autorité de la Concurrence launched a public consultation to examine the influence of major digital companies within the AI value chain, focusing on market-power concentration and investments in GenAI firms.[289] The Autorité's findings from the consultation were published on 28 June 2024.[290] It highlighted that Alphabet and Microsoft operate across the entire AI value chain, while Amazon, Apple, Meta, and NVIDIA are participating only in certain layers. The Autorité highlighted that Alphabet's and Microsoft's advantage from vertical integration allowed them to scale, leverage network effects, and benefit from preferential access to key AI inputs. High barriers to entry—including specialized hardware, cloud computing, data access, skilled labour, and capital—further reinforce the dominance of established players.

To address these concerns, the Autorité proposed enhancing the effectiveness of the current regulatory framework without altering existing legislation, designating key players as gatekeepers under the Digital Markets Act (DMA), and monitoring the AI Act's impact on competition. It also recommended fostering innovation by ensuring better access to computing resources, balancing data access with fair remuneration for data rights holders, and ensuring transparency around investments in AI, particularly minority investments.

In March 2024, Google was fined EUR 250 million for "content scraping" French news websites without permission to train its GenAI chatbot, Gemini; this followed a previous USD 500 million penalty in 2021 over related negotiation failures with press publishers.[291] Additionally, the Autorité opened an investigation into NVIDIA's practices in July 2024.[292] As the leading manufacturer of GPUs and other software (including Compute Unified Device Architecture (CUDA) chip programming), NVIDIA's potential anticompetitive conduct may

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[287] European Commission Press Release. (2024, May 17). *Commission compels Microsoft to provide information under the Digital Services Act on generative AI risks on Bing.* https://digital-strategy.ec.europa.eu/en/news/commission-compels-microsoft-provide-information-under-digital-services-act-generative-ai-risks

[288] Services offered by designated digital platforms. See services here: European Commission. *Supervision of the designated very large online platforms and search engines under DSA.* https://digital-strategy.ec.europa.eu/en/policies/list-designated-vlops-and-vloses

[289] Autorité de la concurrence. (2024, February 08). *Generative artificial intelligence: The Autorité starts inquiries ex officio and launches a public consultation open until Friday, 22 March.* https://www.autoritedelaconcurrence.fr/en/press-release/generative-artificial-intelligence-autorite-starts-inquiries-ex-officio-and-launches

[290] Autorité de la concurrence. (2024, June 28). *Generative artificial intelligence: The Autorité issues its opinion on the competitive functioning of the sector.* https://www.autoritedelaconcurrence.fr/en/press-release/generative-artificial-intelligence-autorite-issues-its-opinion-competitive

[291] European Commission. (2024, March 22). *France fines Google for unauthorised use of media content – CJEU Case C-382/21P: PCT priority and community designs applications.* https://intellectual-property-helpdesk.ec.europa.eu/news-events/news/france-fines-google-unauthorised-use-media-content-cjeu-case-c-38221p-pct-priority-and-community-2024-03-22_en

[292] Reuters. (2024, July 15). French competition authority confirms investigation into Nvidia. https://www.reuters.com/technology/french-competition-authority-confirms-investigation-into-nvidia-2024-07-15/

have significant implications for market dynamics in the broader AI sector. NVIDIA has been previously scrutinized for anticompetitive conduct in the graphics card sector.[293,294]

United States

In October 2023, then US President Joe Biden signed an executive order to establish standards for AI safety, security, and innovation, emphasizing the risks that AI poses to market competition and highlighting the government's commitment to address dominance concerns among major firms.[295] In December 2023, the FTC and the DOJ introduced revised Merger Guidelines,[296] which "lower the threshold market concentration level at which the agencies would presume a merger to be illegal and include a new presumption that a merger resulting in the merged firm having a market share greater than 30% would be illegal if it also resulted in a relatively modest increase in market concentration."[297] The guidelines underscore a proactive stance to prevent mergers that could weaken competition, incorporating feedback on the unique challenges in digital markets.

In January 2024, the FTC issued orders to five major firms to disclose details about their investments and partnerships with GenAI companies and major cloud service providers.[298] This investigation focuses on understanding the specifics of these investments, including strategic motivations and their practical implications, such as new product releases and governance rights. The investigation targets three multibillion-dollar deals: Microsoft and OpenAI, Amazon and Anthropic, and Google and Anthropic. The FTC also extended its scrutiny to Microsoft's agreement with Inflection AI, evaluating potential anti-competitive structuring that may bypass merger disclosure requirements. To streamline investigations, the FTC and DOJ have also divided their focus areas,[299] with the DOJ examining NVIDIA's role in AI semiconductor markets and the FTC investigating Microsoft and OpenAI's conduct.

China

China has opted for a piecemeal approach to AI regulation. First, in March 2022, China's national data and cybersecurity regulator, Cyberspace Administration of China (CAC), introduced the Internet Information Service Algorithmic Recommendation Management

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293 Autorité de la concurrence. (2023, September 27). *The general rapporteur of the Autorité de la concurrence indicates that an unannounced inspection was carried out in the graphics cards sector.* https://www.autoritedelaconcurrence.fr/en/press-release/general-rapporteur-autorite-de-la-concurrence-indicates-unannounced-inspection-was

294 Cherney, M.A. (2023, September 29). Nvidia's French offices raided in cloud computing competition inquiry, Wall Street Journal reports. *Reuters.* https://www.reuters.com/technology/nvidias-french-offices-raided-cloud-computing-competition-inquiry-wsj-2023-09-28/

295 The White House. (2023, October 30). *Executive order on the safe, secure, and trustworthy development and use of artificial intelligence.* 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/#:~:text=The%20Federal%20Government%20will%20seek,inequities%2C%20threatening%20human%20rights%2C%20and

296 U.S. Department of Justice and the Federal Trade Commission. (2023, December 18). *Merger guidelines.* https://www.justice.gov/d9/2023-12/2023%20Merger%20Guidelines.pdf

297 Paul, Weiss, Rifkind, Wharton & Garrison LLP. (2023, December 20). *DOJ and FTC issue final 2023 merger guidelines.* https://www.paulweiss.com/practices/litigation/antitrust/publications/doj-and-ftc-issue-final-2023-merger-guidelines?id=49570

298 Federal Trade Commission. (2024, January 25). *FTC launches inquiry into generative AI investments and partnerships.* http://www.ftc.gov/news-events/news/press-releases/2024/01/ftc-launches-inquiry-generative-ai-investments-partnerships

299 Godoy, J. (2024, June 07). *US sets stage for antitrust probes into Microsoft, OpenAI and NVIDIA.* https://www.reuters.com/technology/us-regulators-open-antitrust-inquiries-microsoft-openai-nvidia-nyt-reports-2024-06-06/

Provisions,[300] which require companies using algorithms in services that could shape public opinion to file key algorithmic details with the CAC within 10 days of launch.

Second, to address concerns of AI-generated misinformation and hallucinations, including deepfake risks, China implemented the Internet Service Deep Synthesis Management Provisions[301] in January 2023. These provisions prohibit illegal content creation and require maintaining compliance and risk-management systems.

Lastly, it published the 'Interim Measures for the Management of Generative Artificial Intelligence Services' in July 2023.[302] These measures are applicable to the Chinese public and mandate content screening, data privacy, intellectual property protection, and anti-discrimination safeguards in training and creating LLMs.

Brazil

From 2019 to 2021, Brazil introduced various AI regulatory proposals aimed at balancing and reducing harm from AI while maintaining the momentum of technological innovation.[303,304,305] However, none of these bills were passed in Congress. In May 2023, a new bill, 2338/2023, was introduced to replace the earlier proposals.[306] This bill is inspired by the EU's AI Act and adopts a risk-based regulatory approach that prioritizes human rights. The bill prohibits excessively risky AI systems and grants key rights to individuals, including prior information on AI interactions, explanations of AI outputs, the right to contest impactful AI decisions, human oversight, and protections against discrimination and privacy breaches.

Non-compliance penalties can reach up to BRL 50 million or 2% of an entity's turnover, with possible suspensions or bans for serious violations. The bill also mandates transparency and bias mitigation, especially in high-risk AI systems, and requires public impact assessments detailing system purposes, risk controls, and stakeholder engagement. Entities would bear strict liability for any damages caused by these systems.

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300 Office of the Central Cyberspace Affairs Commission. (2022). "互联网信息服务算法推荐管理规定 [Recommended management regulations for Internet information service algorithms]." http://www.cac.gov.cn/2022-01/04/c_1642894606364259.htm]

301 Gov.cn. (2022). "国家互联网信息办公室
中华人民共和国工业和信息化部 中华人民共和国公安部 令 第12号 [National Internet Information Office
Ministry of Industry and Information Technology of the People's Republic of China
Ministry of Public Security of the People's Republic of China
order No. 12]." https://www.gov.cn/zhengce/zhengceku/2022-12/12/content_5731431.htm

302 Office of the Central Cyberspace Affairs Commission. (2023). "国家互联网信息办公室关于《生成式人工智能服务管理办法（征求意见稿）》公开征求意见的通知 [Notice of the National Internet Information Office on 《 Generating Artificial Intelligence Service Management Measures (Consultation Draft) 》 Public Consultation]." http://www.cac.gov.cn/2023-04/11/c_1682854275475410.htm

303 Senador Styvenson Valentim. (2019). *Senado federal projeto de lei N° 5051, de 2019*. https://legis.senado.leg.br/sdleg-getter/documento?dm=8009064&ts=1692813888884&disposition=inline&_gl=1*1kmg5k0*_ga*MTAxMjI1NzIyMC4xNjg5MTAzNjQ0*_ga_CW3ZH25XMK*MTY5Mjg2NzI4Ny4xMC4xLjE2OTI4Njg5NzMuMC4wLjA.

304 Chamber of Deputies. (n.d.). *Establishes foundations, principles, and guidelines for artificial intelligence development and application in Brazil and establishes other provisions.* https://www.derechosdigitales.org/wp-content/uploads/Brazil-Bill-Law-of-No-21-of-2020-EN.pdf

305 Senador Veneziano Vital do Rêgo (MDB/PB). (2021). *Senado federal projeto de lei N° 872, de 2021*. https://legis.senado.leg.br/sdleg-getter/documento?dm=8940096&ts=1692813921369&disposition=inline&_gl=1*redj4s*_ga*MTAxMjI1NzIyMC4xNjg5MTAzNjQ0*_ga_CW3ZH25XMK*MTY5Mjg2NzI4Ny4xMC4xLjE2OTI4Njg4OTEuMC4wLjA.

306 Clairk. (n.d.). *Brazil: Bill on the use of Artificial Intelligence [2338/2023].* https://clairk.digitalpolicyalert.org/documents/brazil-bill-on-the-use-of-artificial-intelligence-2338-2023-original-language/raw

Argentina

In 2023, several draft laws addressing AI regulation were introduced in Argentina's National Congress. The first draft law, 2505-D-2023, aims to establish ethical frameworks, protect human rights, ensure transparency, promote accountability, and support innovation. Another draft law, 1472-D-2022, proposes amendments to the existing Law on Science, Technology, and Innovation to incorporate ethical AI principles, such as diversity, inclusion, peace, and justice. Draft law 3161-D-2023 suggests the creation of a Federal Council of Artificial Intelligence as an advisory body composed of public officials to advance AI research, ethics, and public awareness.[307] In June 2024, Bill 3003-D-2024[308] was introduced to establish a legal framework for responsible AI use, drawing from the US and EU examples. It mandates transparency, robustness, fairness, traceability, privacy, security, reliability, and international collaboration for entities involved in AI within Argentina.

Canada

In June 2022, Canada introduced the Artificial Intelligence and Data Act as part of Bill C-27, the Digital Charter Implementation Act, 2022.[309] This draft law focuses on establishing a risk-based regulatory framework for "high-impact" AI systems, requiring entities to assess their potential to cause harm or yield biased results. Entities will be required to develop mitigation plans to address or reduce these risks, publicly disclose the deployment of high-impact systems, and maintain ongoing monitoring. To enforce compliance, the Minister of Innovation, Science, and Industry would be empowered to conduct audits and impose penalties for violations.[310]

South Korea

Currently, there is no specific legislative framework for AI regulation in South Korea, but several bills have been introduced in the National Assembly since 2022. The most significant bill, the Act on Promotion of AI Industry and Framework for Establishing Trustworthy AI,[311] seeks to unify existing fragmented AI legislation. This bill aims to promote AI development while protecting users, focusing on obligations such as mandatory notifications to users and standards for trustworthiness and safety. It categorizes AI that impacts human life and safety as "high-risk AI", with specific reliability measures. If enacted, the AI Act will become the

[307] Cisneros, N. (2024, August 17). Mapping artificial intelligence regulation in Latin America. *Tech Policy Press*. https://www.techpolicy.press/mapping-artificial-intelligence-regulation-in-latin-america/

[308] Senado & Honorable Cámara de Diputados. (2021). Régimen juridico aplicable para el uso responsable de la inteligencia artificial en la república Argentina. In Ptoyecto de ley [Legal]. https://www4.hcdn.gob.ar/dependencias/dsecretaria/Periodo2024/PDF2024/TP2024/3003-D-2024.pdf

[309] *Government Bill (House of Commons) C-27 (44-1) - First reading - Digital Charter Implementation Act, 2022 - Parliament of Canada*. (n.d.). https://www.parl.ca/DocumentViewer/en/44-1/bill/C-27/first-reading

[310] *Canada's Artificial Intelligence and Data Act (AIDA) 2024: A Comprehensive Guide - Cox & Palmer.* (2024, April 12). Cox & Palmer. https://coxandpalmerlaw.com/publication/aida-2024/

[311] 대한민국국회 [National Assembly]. (2023). 국회 과방위 법안2소위, 「메타버스법」 및 「인공지능법」 등 의결 [Parliamentary Overfire Act 2, Metabus Act and Artificial Intelligence Act]." https://www.assembly.go.kr/portal/bbs/B0000051/view.do?nttId=2095056&menuNo=600101&sdate=&edate=&pageUnit=10&pageIndex=1

primary regulation for AI in South Korea, mandating strict notification and certification requirements to create a secure AI ecosystem. [312]

Mexico

In February 2024, a Mexican Senator proposed the Federal Law Regulating Artificial Intelligence,[313,314] inspired by the EU's regulatory approach. This bill provides structured guidelines for AI development, deployment, and use in Mexico. It categorizes AI systems by risk level and sets out responsibilities for AI providers and users. Key provisions include mandatory labelling of AI-generated content for intellectual property registration and a requirement for developers to obtain consent from rights holders when using data. The bill has an extraterritorial component, applying to AI providers outside Mexico whose services are available in Mexico or whose data originates in the country.

Indonesia

In December 2023, Indonesia introduced its AI ethical guidelines through two initiatives. The first, Circular Letter No. 9 of 2023 on AI Ethical Guidelines, released by the Ministry of Communication and Informatics, provides ethical guidance for industry players utilizing AI. Responsibilities outlined include avoiding sole reliance on AI for decisions impacting human welfare, preventing racism, and minimizing harm. The guidelines highlight six ethical principles: inclusivity, humanity, credibility, accountability, privacy preservation, and overall accountability.[315] The second initiative came from the Financial Services Authority, which issued guidelines for responsible AI use in the fintech sector, requiring adherence to principles such as fairness, accountability, transparency, robustness, and security.[316]

Intellectual Property Rights Infringement by AI

Beyond concerns related to competition, several high-profile cases have emerged in the US and UK regarding the infringement of intellectual property rights by AI companies. Key themes emerging from these cases include widespread allegations of copyright infringement, where AI companies are accused of using copyrighted content—such as images, text, and sound recordings—without permission to train their models. Another common accusation is content scraping, where digital material is allegedly collected from various sources without proper authorization. The following is a non-exhaustive list of illustrative cases.

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312 의안정보시스템 [Bill Information]. (2022). "인공지능산업 육성 및 신뢰 확보에 관한 법률안(윤두현의원 등 12인) [Legislation on fostering and securing trust in the artificial field industry (12 members, Yundu County Council)]." https://likms.assembly.go.kr/bill/billDetail.do?billId=PRC_H2X2J1V2M0Q1B0F9V2P9Q1E2D9T1Z2

313 Monreal, R. (2024). Iniciativa con proyecto de decreto por el que se expide ley federal que regula la inteligencia artificial. In *Iniciativa con provecto de decreto.* https://ricardomonrealavila.com/wp-content/uploads/2024/02/Inic_Morena_inteligencia_artificial.pdf

314 Pascu, M. (2024, August 18). *A closer look: Mexico's proposed artificial intelligence bill*. INQ Consulting. https://www.inq.consulting/post/a-closer-look-mexico-s-proposed-artificial-intelligence-bill

315 Saffa, A. (2023, December 18). *Indonesia's roadmap for responsible AI*. OpenGov Asia. https://opengovasia.com/2023/12/18/indonesias-roadmap-for-responsible-ai/#:~:text=As%20for%20the%20six%20AI%20ethics%2C%20according%20to,regulated%20AI%20usage%20will%20result%20in%20organised%20outputs

316 International Trade Administration. (2024, March 15). *Indonesia Artificial Intelligence.* https://www.trade.gov/market-intelligence/indonesia-artificial-intelligence

Andersen v. Stability AI Ltd.
Visual artists Andersen, McKernan, and Ortiz sued Stability AI, Midjourney, and DeviantArt in the US district court for allegedly using billions of images scraped from the internet without permission to train their AI models.
Getty Images v. Stability AI
Getty Images sued Stability AI in both the US (Delaware District Court) and the UK High Court. Getty alleged that Stability AI used over 12 million Getty photos to train its Stable Diffusion model without permission.
Universal Music Publishing Group, Concord Music Group, ABKCO v. Anthropic
Music publishers sued Anthropic in the US federal court for allegedly using copyrighted song lyrics to train its AI models.
New York Times v. OpenAI
The New York Times sued Microsoft and OpenAI in the US court for copyright infringement, alleging that their AI tools reproduce near-verbatim excerpts of its articles. Additionally, the Times asserted that ChatGPT falsely attributed information to the newspaper, known as AI "hallucinations".
Nicholas Basbanes and Nicholas Gage v. Microsoft and OpenAI
Authors Basbanes and Gage sued OpenAI and Microsoft in the US district court, alleging that their copyrighted works were used without permission to train AI models.
Main Sequence, Ltd. v. Dudesy, LLC
The estate of George Carlin sued Dudesy in the US district court over an AI-generated comedy special that allegedly used Carlin's material without consent.
Raw Story Media, Inc. and AlterNet Media, Inc. v. OpenAI
The two news organizations sued OpenAI in the US district court for using their articles to train ChatGPT.
Brian Keene, Abdi Nazemian, and Stewart O'Nan v. NVIDIA
Authors Keene, Nazemian, and O'Nan brought a class action against NVIDIA in the US district court for using their books to train the NeMo AI platform. The authors alleged that their works were part of a dataset of about 196,640 books that helped train NeMo to simulate ordinary written language.
Lawsuit by Eight Newspapers (The New York Daily News, Chicago Tribune, Denver Post, Mercury News, Orange County Register and St. Paul Pioneer-Press, and Tribune Publishing's Orlando Sentinel, and South Florida Sun Sentinel) Against OpenAI
Eight US newspapers sued OpenAI and Microsoft in the US federal court for allegedly using their articles to train AI without permission.
Paul Lehrman and Linnea Sage v. Lovo Inc.
Voice actors Lehrman and Sage sued Lovo for USD 5 million in the US federal court, alleging fraud and false advertising and violating their publicity rights. They claimed that Lovo used their voices without permission for AI technology and is selling AI versions of their voices after misleading them into providing voice samples.
Sony Music, Universal Music Group, Atlantic Records, Warner Bros, and Capitol Records v. Suno and Udio
Major record labels sued Suno and Udio in the US for copyright infringement by scraping and using copyrighted sound recordings for AI training.
Center for Investigative Reporting (CIR) v. OpenAI and Microsoft
CIR alleged that OpenAI and Microsoft used its content without permission for AI training and filed a suit for copyright infringement in the US district court.
Asian News International (ANI) v. OpenAI
ANI, an Indian news agency, sued OpenAI in the Delhi High Court, alleging that the latter used its copyrighted news content to train its models without authorization.

This chapter has brought forth the international understanding of emerging AI markets and the emergence of a "post-industrial" phase and "post-industrial organisation" economics requiring a deeper understanding of these markets and the uncovering of their micro-foundations. The micro-foundations may be country and context specific. For instance, the competitive landscape of the Indian AI market is shaped by dominant firms leveraging control over data, compute resources, and strategic partnerships alongside a thriving Indian AI startup sector that is providing innovative AI solutions to meet indigenous demand. These dynamics present both opportunities for innovation and risks of dependencies that may warrant regulatory monitoring. However, understanding these issues requires more than just secondary market analysis; it demands insights from those who are directly involved—ranging from startups to established industry players and regulators. The next chapter will present findings from stakeholder consultations, offering a diverse set of perspectives on the challenges and opportunities in the Indian AI market and the role of competition and industrial policy in fostering a fair and dynamic AI ecosystem.

CHAPTER 4

VOICES FROM THE ECOSYSTEM: STAKEHOLDER PERSPECTIVES

The current study adopts a comprehensive approach, combining secondary data analysis, policy examination, and in-depth stakeholder consultations to analyze the development of AI markets along the AI stack and the emerging market structure in India. As part of this study, we engaged with key players from across the AI ecosystem, including government representatives, industry leaders, and academic experts. The consultations spanned various layers of the AI stack, each offering a unique perspective on the market dynamics shaping the sector.

To conduct consultations, we held one-on-one interviews with stakeholders in the AI stack, including developers of Indian LLMs, government representatives, cloud and hardware providers, companies operating in fine-tuning layer, developers of SLMs, and application-layer and tech-service providers.

The discussions with Indian developers of LLMs shed light on the challenges in developing and scaling AI solutions that are specific to the needs of India. Further, the contributions from tech-service providers enriched our understanding, particularly regarding the commercialization and scaling of AI-driven services. The consultations with academicians provided an academic lens through which to examine the broader trends and challenges in AI markets. These insights helped frame the issues of data access, partnerships and collaborations, LLMs, open-source models, compute infrastructure, innovation, and market structure in the context of India's AI market.

Key areas of discussions included issues regarding AI infrastructure, competitive dynamics between incumbent players and startups, the critical role of data in AI development, and the impact of policy on market structure and innovation. Specific attention was given to understanding the challenges faced by Indian AI startups, such as barriers to entry, the importance of interoperability, and the implications of data ownership.

Rather than a questionnaire format, discussions with stakeholders followed an indicative list of issues falling under the following broad topics.

AI Market Dynamics

- Perception regarding the competitive landscape of the Indian AI market, particularly with the emergence of domestic AI startups in various layers of the AI stack
- Availability of computing power and cloud infrastructure at competitive prices to AI startups in India

- Complementarity of incumbent technology companies in the model/infrastructure layer with India's strength in the application layer

Partnerships and Collaborations

- From a long-term perspective, how could collaborations between AI developers and infrastructure providers influence market dynamics?

Infrastructure

- Do infrastructure and resource disparities influence the competitive dynamics between large AI firms and smaller entities in India?

Open-Source AI Ecosystems

- The role of open AI ecosystems in fostering innovation and competition within the Indian AI market alongside legal concerns around data privacy, intellectual property, and compliance

Industrial Policy

- What kind of innovation is being pursued by government-supported initiatives, and do they complement industry-led initiatives, especially for the startups?

In this chapter, we have captured a wide range of perspectives from stakeholders to undertake a comprehensive analysis of India's AI market. The insights presented in this chapter, along with established research from academia and industry, can help us draw policy and regulatory recommendations that will support an innovative and competitive AI ecosystem.

1. Insights from Stakeholder Consultations

AI Adoption and Awareness Challenges

AI adoption in India is in its early stages, reinforced by reluctance among businesses due to a limited understanding and awareness of its benefits and the need for clearer evidence of tangible returns. While global markets, particularly in the US, exhibit mature adoption trends fuelled by innovation and investment, Indian companies lag in both development and integration. Many clients outside major tech hubs hold unrealistic expectations of AI, further complicating adoption. Indian enterprises, particularly MSMEs and mid-market businesses, are often cautious due to the perceived complexity of AI and unclear return on investment, preferring affordable, quick-to-deploy solutions to minimize risk. The risk-averse nature of Indian IT companies, which focus more on services than on product innovation, further hampers progress. Significant education efforts are required to address misconceptions, such as viewing AI as a panacea, and to highlight its transformative potential through targeted awareness initiatives.

Linguistic Relevance and Indic Language Models

Bridging the digital divide in India necessitates accessible and affordable language technologies that address the country's linguistic diversity. However, a scarcity of resources for training AI models in Indic languages, particularly vernacular ones, hampers the development of solutions tailored to India's unique linguistic and cultural needs. Challenges such as diverse dialects, inadequate datasets, and the dominance of translation-based models reliant on English limit the effectiveness of AI applications for regional languages.

Translation services also generally focus on a few widely spoken languages, neglecting many others and restricting their use in technology. Thus, public-sector initiatives such as Bhashini are significant as they create open datasets in Indic languages, aim to broaden the scope of language applications, and improve translation quality, which otherwise lacks ownership and accuracy.

Tailored AI solutions, such as AI's generative models for farmers and voice bots for BFSI, highlight the potential of Indic-centric models to meet sectoral needs. However, most open-source models, trained primarily on western data, do not accurately capture the nuances of Indian languages and cultural contexts. Developing native Indic language models with robust datasets is crucial for enhancing inclusivity and driving innovation across key sectors such as agriculture, healthcare, and financial services.

Data: Availability and Accessibility

Data challenges, particularly in Indic languages, emerged as a central theme in most consultations. Stakeholders pointed to the lack of high-quality, domain-specific datasets as a major impediment to AI innovation in India. Dependence on datasets and models that are predominantly "California-centric" engenders a bias that favours English and prominent Indian languages, consequently marginalizing numerous regional languages. The lack of diverse datasets impairs the robustness of AI solutions, while inadequate labelling, formatting, and integration exacerbates the problem. Many Indian startups face disadvantages compared to global players due to limited access to interoperable systems and secure data-sharing frameworks. Privacy concerns and regulatory constraints further limit the availability of datasets in sensitive industries. Proprietary data has become a critical asset for effective AI model development, with many companies preferring models trained on their internal data and hosted on premises, i.e., within their own secure environments, particularly for sensitive applications like finance. The absence of localized infrastructure and the high costs of secure data hosting add to the barriers, underscoring the urgent need for investments in secure, sovereign AI infrastructure and better data-governance frameworks.

Data Flows and Interoperability

Data flows within the AI ecosystem not only facilitate development but also raise critical questions about data ownership, privacy, and the broader implications of data sharing. The stakeholder consultations highlighted concerns about whether data used by the application layer to fine-tune AI models flows back to the foundational LLMs owned by global tech companies. This issue highlights the asymmetry in data control between smaller firms and LLM providers, potentially undermining data sovereignty and the competitive positioning of startups.

While some stakeholders assert that the data used for fine-tuning remains proprietary to firms that are developing AI applications, others indicated that transparency around this process is often lacking. In many cases, businesses lack clarity on how their data is stored, accessed, or utilized by LLM providers, raising fears that proprietary or sensitive data might inadvertently contribute to improving foundational models.

To address these concerns, stakeholders advocated for clear contractual agreements and robust governance mechanisms to ensure that data ownership and usage rights are respected. Regulatory measures could include transparency mandates requiring LLM providers to disclose the datasets used for training and fine-tuning. Furthermore, nurturing healthy data markets through transparency and accessibility can mitigate competitive imbalances and improve trust in data ecosystems.

Additionally, there were calls for localized LLMs that could be fine-tuned within a controlled environment, ensuring that data remains within the enterprise or region. Enhanced interoperability standards, combined with regulatory oversight, are essential to strike a balance between leveraging global LLM capabilities and protecting the proprietary data of Indian companies. Moreover, creating dynamic data marketplaces was recommended to alleviate some of these issues. Such marketplaces could incentivize data providers by fairly attributing value to their contributions. This would require establishing transparent mechanisms to evaluate data quality, uniqueness, and relevance while promoting equitable access to high-quality data resources.

Infrastructure and Compute challenges

Access to affordable and scalable compute infrastructure remains a significant barrier for startups and mid-sized firms in India, especially in sectors like fintech and healthcare. High GPU costs, supply constraints, and limited access to data centres and computing power in tier-2 cities exacerbate the issue. On-premises deployments, which are often necessary for sensitive applications, require substantial investments, adding to the burden of smaller players.

The reliance of the AI ecosystem on hyperscalers adds to cost pressures and dependency concerns. Their aggressive pricing strategies and ecosystem lock-in makes it difficult for smaller players to switch providers. Although hyperscalers offer benefits such as cloud credits, concerns about the sustainability of such measures and their broader impact on the ecosystem persist. Hyperscalers also dominate AI model hosting and enterprise adoption due to their existing infrastructure, strategic partnerships with leading model providers, customer familiarity, and significant financial resources, which further challenge smaller competitors. Startups also face challenges in government procurement due to high qualification thresholds, which often exclude smaller players from lucrative opportunities.

Edge computing is emerging as a viable alternative, enabling reduced latency and enhanced data security through on-device AI agents, especially for applications in defence and healthcare. With edge AI systems powered by SLMs revolutionizing real-time decision-making closer to the source of data generation, India's AI industrial policy could focus on creating high-quality datasets that are accessible for developing SLMs. Such efforts would help ensure that localized models address India-specific challenges.

Addressing infrastructural challenges requires substantial investments in local infrastructure, subsidies for GPU access, and the development of decentralized solutions to support innovation across the AI ecosystem. These measures would not only level the playing field for smaller players but also create a more robust and inclusive AI ecosystem in India. However, it is also crucial to ensure that these public strategies do not disproportionately benefit entrenched players. Beyond market developments, it will be vital to monitor the beneficiaries of these initiatives, assess the value of these approaches, and evaluate the innovation trajectories encouraged by such policies.

Partnerships and Collaborative Ecosystem

Stakeholder consultations highlighted the critical role of partnerships in driving AI innovation and fostering a collaborative ecosystem in India. Generally, partnerships in AI follow a hybrid organizational model, distinct from traditional mergers or contracts between independent market players, and have become a defining feature of the industry. Startups, hyperscalers, system integrators, academia, and the government were identified as key collaborators, each contributing unique value to the AI ecosystem. Partnerships with hyperscalers provide startups with access to cloud infrastructure, GPU resources, and marketing support. For example, several startups rely on partnerships with cloud providers for scalable solutions, while some collaborate with major chip manufacturers to enhance AI capabilities. Collaboration between startups and system integrators enables early-stage firms to reach enterprise clients, while academic institutions like Indian Institute of Science (IISc) and Indian Institute of Technology (IITs) contribute foundational research that bridge the gap between research and commercialization.

Globally, incumbent technology platforms are increasingly becoming co-investors (along with venture capitals (VCs) and institutional investors) to acquire minority stake in several generative AI startups in the model and application layers. However, in India, investments by Big Tech are still largely in the form of one-time grants and accelerator programmes that involve providing credits for cloud services and entrepreneurial support for scale-up. Domestic cloud service providers, on the other hand, are largely focusing on the provision of specialized AI cloud infrastructure and platform services to support model developers and end users rather than building AI models themselves. Several independent LLM providers in India have entered compute and distribution partnerships with hyperscalers that support model development and deployment.

Market Dynamics and Competition

Big Tech's access to vast data resources and advanced infrastructure underpins concerns about their dominance in the Indian AI landscape and emphasizes the need for a more competitive ecosystem. Investment disparities between Indian startups and their Silicon Valley counterparts often push Indian firms to incorporate abroad for better access to funding. Indian startups also face hurdles such as data gaps for Indic languages, limited access to affordable computing resources, and high infrastructure costs, which impact their competitiveness. While strategic partnerships can provide startups with essential resources, they can skew market dynamics through exclusive agreements and increased dependencies, especially for compute and distribution, potentially folding smaller firms in the business models of the incumbent technology firms.

Will the future of the AI ecosystem be marked by incumbent tech firms monopolizing essential inputs data sets, language models, cloud infrastructure, and computing, resulting in them exercising market power on complementor firms for AI-based products and services? Will signing partnerships with smaller challengers neutralize the competitive threat? At this stage, as the market is still fluid and emerging, the answers to these questions remain unclear.

Many AI startups we interviewed were of the view that these collaborations were not accompanied with any exclusivity arrangements, and the firms did not lose their agency. One of the unknowns, however, was the data flow dynamics; although some of these interfaces were secure by design, most application developers using the LLMs of hyperscalers, especially through application programming interface (APIs), were not sure if the data feedback loops from fine-tuning were inadvertently benefitting the model developers. However, the hyperscalers did not participate in the stakeholder consultation, so this finding could not be validated.

The reliance on open-source foundation models controlled by a few major players raises concerns about vendor lock-in and the ecosystem's sustainability. SLMs are emerging as cost-effective alternatives to LLMs, offering localized solutions tailored to India's unique needs.

Platforms promoting decentralized AI distribution through app stores and AI marketplaces provide opportunities for MSMEs and individual developers to democratize access to AI capabilities, but the reliance on hyperscalers for infrastructure continues to challenges domestic AI solution providers. Building a more competitive ecosystem requires investments in localized infrastructure, equitable access to resources, and targeted incentives for India-focused AI models.

Policy Insights

The absence of a clear national strategy for AI development in India, tailored to the country's unique needs, has raised concerns among stakeholders. Current policy efforts appear to be influenced by global trends rather than addressing local priorities. There is need for a comprehensive AI policy that provides clarity on data usage, privacy, and ethical considerations and for developing responsible AI principles that are purpose-driven, explainable, inclusive, and privacy-conscious.

DPI has been recognized as a critical enabler for AI development, particularly for Indic languages. High-quality datasets are essential for training effective AI models, with Bhashini emerging as a potential marketplace for aggregating and sharing data and resources. DPI initiatives can lower entry barriers for AI innovation by offering essential resources, improving data access and sharing under privacy guidelines, and addressing India-specific needs. However, concerns persist about potential favouritism towards certain providers, data security risks, and the need to balance government support without excessive control, which could hinder innovation or create unfair competitive advantages.

Stakeholders emphasized the importance of data-sharing frameworks to address privacy concerns, encourage the creation of community datasets free from personally identifiable information, and support privacy-preserving AI techniques. Increased transparency from Big Tech regarding data practices and enhanced awareness among AI developers about data access policies are also deemed essential for the development of a responsible AI ecosystem.

Sovereign AI—solutions that enable businesses and governments to retain control over their data within national jurisdictions—was also highlighted as a priority. This concept aligns with the need for data privacy and protection in sensitive sectors, reducing the reliance on foreign technology and promoting strategic autonomy. However, implementing sovereign AI has challenges, including potential government overreach, the necessity for accessible datasets for local companies, and substantial investment requirements for infrastructure and talent development. Collaboration among government, industry, and research institutions is essential to establish regulatory frameworks that balance security with a competitive AI environment.

A more inclusive approach to AI policymaking is necessary, with diverse stakeholder representation to ensure that practical, sectoral, and academic perspectives are considered.

Policymaking consultations should be broad based and should include Indian developers, cloud providers, and academics. Fostering collaboration between academia, industry, and government to drive innovation and knowledge sharing in the AI space is considered to be essential. This could involve promoting data-sharing agreements, undertaking joint research projects, and facilitating partnerships between large system integrators and AI startups. The Indian system integrators can serve as an important distribution channel for indigenous AI solutions and foster a mutually beneficial partnership.

India's industrial policy for AI has increasingly prioritized infrastructure development and data platforms to advance socioeconomic goals. Recent years have seen a shift towards using industrial policy tools to reduce dependencies along the AI supply chain and create more open infrastructure. Under the banner of sovereign AI, the government is boosting chip manufacturing and cloud compute capacity, while DPIs are being leveraged to support AI applications for socioeconomic development. This developmental approach views the state not only as an actor addressing market failures but also as a driver of economic transformation and global leadership in AI.[317]

Several initiatives, including collaborative efforts between various stakeholders, have sought to promote data democratization by creating and open-sourcing large datasets for, *inter alia*, Indic languages. These initiative empower start-ups, researchers, and the wider AI community to develop and improve AI models and applications for India. These initiatives also seek to enhance dataset accessibility and can help develop locally relevant AI solutions. Further investments in open-source AI models and efforts to digitize and improve data interoperability are essential to democratize AI access. Additionally, large-scale upskilling programs are necessary to prepare the workforce for AI-driven changes and ensure India's competitiveness on the global stage. Government initiatives like IndiaAI and GPU subsidies have been well received, but stakeholders stressed the need for targeted investments and long-term strategies to foster a robust and equitable AI ecosystem in the country.

The consultations provided valuable insights into the evolving dynamics of India's AI ecosystem. While challenges related to data, infrastructure, and market dominance persist, stakeholders are optimistic about India's potential as a hub for AI application development. By addressing these challenges through strategic policies, public-private partnerships (PPPs), and investments in infrastructure and talent, India can build a robust and inclusive AI ecosystem that benefits all stakeholders.

[317] Kak, A., & West, S. M. (2023). *2023 landscape: Confronting tech power*. AI Now Institute. https://ainowinstitute.org/2023-landscape

CHAPTER 5

IN LIEU OF A CONCLUSION

This study has attempted to provide a comprehensive assessment of the evolving AI market in India and the emerging competition challenges that policymakers and regulators globally are confronting. The AI technology stack, characterised by diverse market structures at different layers, creates possibilities of different industrial organizations. Therefore, an effective competition policy must first comprehend these emerging market structures to gain clarity about evolving business models and new interdependencies. For instance, open-source models are creating opportunities for developers to create localized AI solutions, thus facilitating the decentralization of technology. However, it is crucial to examine the underlying market power dynamics that are embedded within large-scale AI ecosystems. While open-source GenAI models offer significant advantages for enhancing competition, competition policies must adopt a nuanced approach that avoids assuming that these models are inherently pro-competitive. The growing complexity of economic systems reinforces the need to modernize competition frameworks to address the unique challenges presented by AI.[318]

As it has already become evident that the hardware, cloud computing, and foundational model layers are exhibiting consolidation due to substantial capital investments, scale economies, and network effects, downstream markets for sector-specific models and applications have enabled the growth of competitive startups. Indian AI startups in particular have focused on addressing the country's linguistic diversity through multilingual LLMs as well as SLMs optimized for specific domains and input modes such as voice, thus reflecting evolving innovation priorities.

Global digital platforms play a pivotal role as providers of critical inputs and enablers of mass distribution, shaping competition, innovation, and consumer choice in GenAI markets. Policymakers must be vigilant about potential challenges, including tying, bundling, self-preferencing, unfair trade and pricing practices, and other anti-competitive conduct that may potentially stem from their legacy advantages in Web 2.0 markets. Key issues such as burgeoning investments, partnerships, copyright concerns, and AI safety have already drawn regulatory attention in jurisdictions like the US, UK, EU, and Brazil. Indian decision-makers must monitor these developments, craft context-appropriate policies, and align with global AI governance principles to address shared risks and ensure fair competition.

[318] Dahmen, H., & Coyle, D. (2024). Open source generative AI from a competition policy perspective. In A. Abbott & T. Schrepel (Eds.), *Artificial intelligence and competition policy* (pp. 3–16). Concurrences. https://www.concurrences.com/en/all-books/artificial-intelligence-and-competition-policy

Some of the key takeaways and policy lessons from this study are as follows:

The Indian AI models' market is likely to remain fragmented over the short term, with a potential of greater consolidation over the longer term.

The analyses of recent market trends point to the Indian and global model markets fragmenting into specialized segments powering applications in particular industry verticals (e.g., BFSI, healthcare) or horizontal enterprise use cases (e.g., human resources, customer service). Several Indian startups building models suited to local contexts are therefore increasingly positioning themselves as complements rather than substitutes to many global vertically integrated model providers. This complementary positioning aligns with the incentives provided by global tech giants, many of whom operate in upstream cloud services markets, to support these emerging segments.

However, global tech firms are also releasing sector-specific models. For instance, while Google Cloud has released a family of medically fine-tuned models called MedLM for the healthcare industry[319], AWS and Microsoft Azure have for long been developing a suite of AI capabilities tailored for the manufacturing and retail sectors, respectively.[320] In the current evolving landscape of the AI ecosystem, supply-side diversity is expected to persist in the short term. As the pace of innovation plateaus over time, there will be potential for consolidation even within specialized segments of the model market. In such a scenario, vertically integrated tech giants, with their strong distribution networks and access to high-end enterprise-user segment from their existing services, may emerge as dominant players, capturing a significant share of the value in these markets.

There is also the possibility of rise of platform ecosystems or marketplaces centered around the model layer of the stack, which is likely to favour the vertically-integrated cloud providers and dominant foundational model providers.[321] Similar to how network effects in the cloud led hyperscaler marketplaces to become key distribution channels for independent software vendors (ISVs) offering SaaS solutions, these dynamics are likely to focus developer attention on marketplaces hosted by prominent FM providers and cloud incumbents, linking them to a large user base. This trend is already evident. For instance, the popularity of ChatGPT spawned developer interest in building their own custom GPT models and applications whose distribution is now being facilitated by OpenAI through the GPT store.[322] Similarly, the competitive edge of the AWS Marketplace is being expanded through the provision of third-party AI applications as well as the launch of the Amazon Bedrock Marketplace which features over hundred foundational models from a plethora of companies.[323]

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[319] Matias, Y. & Gupta, A. (2023, December 14). MedLM: Generative AI fine-tuned for the healthcare industry. *Google Cloud.* https://cloud.google.com/blog/topics/healthcare-life-sciences/introducing-medlm-for-the-healthcare-industry

[320] Luitse, D. (2024). Platform power in AI: The evolution of cloud infrastructures in the political economy of artificial intelligence. *Internet Policy Review, 13*(2). https://doi.org/10.14763/2024.2.1768

[321] Niefer, M. J., & Hoag, A. D. (2024). Artificial intelligence, uncertainty, and merger review. In A. Abbott & T. Schrepel (Eds.), *Artificial intelligence and competition policy* (pp. 83–104). Concurrences. https://www.concurrences.com/en/all-books/artificial-intelligence-and-competition-policy

[322] OpenAI. (2024). *Introducing the GPT Store.* https://openai.com/index/introducing-the-gpt-store/

[323] Amazon Bedrock Marketplace. https://aws.amazon.com/bedrock/marketplace/

Asymmetry of data access and limited data transparency in data markets must be addressed to foster efficient and equitable outcomes.

Competition authorities need to take a closer look at how data markets are evolving, given their criticality in the AI value chain. One key concern, which was highlighted in Chapter 3, is the asymmetry in data access. While large digital platforms accrue first-party data benefits due to their significant presence in other digital markets, they also have the resources, business networks, and favourable bargaining power to negotiate agreements with providers of high-quality proprietary data. On the other hand, smaller firms are less favourably positioned to enter such data partnerships and are disproportionately reliant on web-scraped data, of which only a minuscule share is of high quality and which is growing at a slower pace.[324] This disparity creates multiple entry barriers for new players. To address these challenges, regulators could examine contracts between data providers and AI firms to check for the type of data being shared and the terms of such trade. Such oversight could help mitigate risks of exclusionary practices and promote more equitable access to data resources.

Another key concern pertains to the increasing opacity of AI firms in the disclosure of their training datasets. The risks arising from this are twofold. First, developers of downstream applications may struggle to identify and mitigate biases or hallucinations in their applications, potentially affecting consumer protection. Second, such lack of transparency prevents the development of efficient data markets by exacerbating information asymmetry between content creators and AI firms. Content producers, unaware of whether or how their data is being used for AI training, are now increasingly restricting access to web content that was previously freely available to consumers. This trend may also discourage the creation and sharing of high-quality data. Furthermore, opacity can hinder price-discovery mechanisms, potentially leading to the valuation of data and inefficiency in its use.[325] To address these concerns, Indian regulators could explore measures to encourage fair data-sharing practices, support innovation, and promote efficient data market functioning.

As AI systems increasingly rely on vast amounts of data, robust data-governance frameworks become essential to balance privacy concerns with the need for high-quality datasets. In India, evolving laws like the Digital Personal Data Protection Act must align with AI's demands while safeguarding individual rights. Establishing clear protocols for data collection, sharing, and usage can create an ecosystem where privacy and innovation coexist.[326]

Effective data governance is inseparable from AI governance. Policies ensuring transparency and accountability in data usage—such as creating metadata, traceability, and validation mechanisms—can build confidence in AI models' outputs. These frameworks are critical for

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324 Hunt, S., Jian, W., Mawar, A., & Tablante, B. (2023). *You are what you eat: A guide to healthy eating*. Keystone.ai. https://cdn.prod.website-files.com/66cc68fc984f55062a489fe2/66fd5a1985d19eeeaea7d440_you-are-what-you-eat.pdf

325 Hunt, S., Jian, W., Mawar, A., & Tablante, B. (2023). *You are what you eat: A guide to healthy eating*. Keystone.ai. https://cdn.prod.website-files.com/66cc68fc984f55062a489fe2/66fd5a1985d19eeeaea7d440_you-are-what-you-eat.pdf

326 OECD. (2023). *AI, data governance and privacy: Key considerations*. OECD Publishing. https://www.oecd.org/en/publications/ai-data-governance-and-privacy_2476b1a4-en.html

India's push towards sovereign AI infrastructure, enabling data to serve as a strategic asset rather than a liability.[327]

Data openness plays a vital role in stimulating competition in the AI sector by lowering barriers to entry and reducing uncertainty regarding access to data. Access to diverse and high-quality data is pivotal for AI innovation. While open-source datasets provide a foundation, advancing AI capabilities will require access to specific proprietary datasets. This aligns with global data-governance practices prioritizing interoperability, privacy, and the availability of government data. Without addressing challenges such as data fragmentation and lack of interoperability, the potential of AI will remain underutilized.[328]

The interplay between data quality and AI system performance underscores the need for a comprehensive data strategy. Targeted investments in infrastructure and the creation of public data repositories can bridge existing gaps. Additionally, fostering collaboration between government, academia, and industry will help establish benchmarks for data quality. Moreover, unlocking the full potential of a centralised data platform such as the one envisioned under the IndiaAI Mission, necessitates creating adequate incentives, co-developing data standards and interoperability guidelines as well as guardrails for private sector participation in the exchange and use of proprietary datasets.[329] Such efforts will pave the way for AI-driven innovation across sectors.

Regulation of vendor lock-in strategies and policy support for the DPI paradigm can be twin avenues for effective intervention to promote competition in the cloud computing layer.

The significant presence of major global cloud providers in the AI ecosystem is reinforced by their financial and other investments in startups, making AI another avenue through which they can influence the market. Access to advanced foundational models developed by these platforms is increasingly contingent on customers' annual spending commitments, which may create dependencies and limit opportunities for smaller players.[330]

It will be critical to monitor services that offer access to GenAI models in the cloud as well as the growing role of cloud credits in facilitating AI adoption. Leading cloud infrastructure providers, who oversee the integration of hardware and software, are offering compute as a bundled service to meet the rising demand for AI-driven solutions. While vertical integration and hardware-software specialization generate efficiency gains, they also contribute to increased switching costs. Unlike traditional general-purpose chips, in-house chips are co-

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[327] Dataversity. (n.d.). *Data governance and AI governance: Where do they intersect?* https://www.dataversity.net/data-governance-and-ai-governance-where-do-they-intersect/

[328] EY. (2024). *Enabling AI development in India through data access.* https://www.ey.com/content/dam/ey-unified-site/ey-com/en-in/insights/ai/images/ey-enabling-ai-development-in-india-through-data-access.pdf

[329] EY. (2024). *Enabling AI development in India through data access.* https://www.ey.com/content/dam/ey-unified-site/ey-com/en-in/insights/ai/images/ey-enabling-ai-development-in-india-through-data-access.pdf

[330] Moneycontrol. (2024). *Indian IT cos struggle with Gen AI rollout delays amid rising compute, cloud cost*. https://www.moneycontrol.com/technology/indian-it-cos-struggle-with-gen-ai-rollout-delays-amid-rising-compute-cloud-cost-article-12757271.html

designed with software to optimize performance for specific applications. This hardware-software alignment enhances performance but creates additional barriers when switching providers.

Additionally, these providers play a critical role in partnerships with AI startups such as OpenAI and Anthropic, enabling access to the computing power that are essential for developing AI systems. However, this reliance creates potential bottlenecks, as migrating from one provider to another often requires redesigning products due to the lack of standardization across cloud environments. Some cloud providers have attempted to reduce switching costs, such as by eliminating data-transfer fees for migrations, but these measures address only a fraction of the total cost.[331]

One form of intervention in this layer could involve addressing vendor lock-in strategies, drawing on regulatory frameworks and recommendations from other jurisdictions as well as introducing new antitrust tools to allow for these concerns to be addressed quicker. For instance, France's Autorité de la Concurrence has suggested distinguishing between short-term free trials and longer term business support programs when regulating cloud credits. Similarly, the Netherlands' Authority for Consumers and Markets (ACM) has proposed incorporating specific interoperability requirements, such as open APIs and seamless interconnection of third-party services, into the European Commission's Data Act, alongside provisions for data portability.

In addition to regulating vendor lock-in practices, policy incentives to scale up the DPI approach to cloud computing could create new opportunities for competition. This could involve developing an interconnected grid of independent micro-data centres, which would provide a decentralized alternative for hosting AI workloads. Such an approach could introduce contestability at the margins and offer smaller players an opportunity to participate in the AI value chain without heavy reliance on dominant providers.

Together, these measures could mitigate the risks associated with market concentration in the cloud computing layer, fostering a more competitive and diverse ecosystem to support AI innovation and development.

Monitoring investments and partnerships in the AI ecosystem for risks from exclusive or privileged contractual terms.

The evolving AI ecosystem is characterized by an expanding network of partnerships between global technology companies, AI startups, and domestic IT incumbents. As discussed in Chapter 2, large platforms, particularly in developed markets, are increasingly co-investing with venture capitalists and institutional investors to acquire minority stakes in GenAI

[331] Gernone, F., & Teece, D. J. (2024). Competing in the age of AI: Firm capabilities and antitrust considerations. In A. Abbott & T. Schrepel (Eds.), *Artificial intelligence and competition policy* (pp. 65–82). Concurrences. https://www.concurrences.com/en/all-books/artificial-intelligence-and-competition-policy

startups operating in the model and application layers. In India, investment trends are more nascent, with funding primarily provided through one-time grants, accelerator programs, cloud infrastructure credits, and entrepreneurial support for scale-up.

Additionally, many independent LLM providers collaborate with multiple hyperscalers for compute and distribution partnerships to support model development and deployment. These partnerships often unlock essential complementarities, enabling startups to access the computational resources required to develop AI systems. However, these arrangements can create dependencies, leaving smaller players vulnerable to the terms dictated by dominant providers. Multi-homing strategies—where AI startups support their products across multiple cloud platforms—can reduce dependency risks but are often expensive due to a lack of standardization and increased cloud-consumption costs.

Policymakers and competition authorities must weigh the benefits of these partnerships against the potential risks of vertical integration and dependencies. The financial capital, technical resources, and talent development enabled by such collaborations are vital for the growth and success of startups in the AI ecosystem. These partnerships also offer large platforms with an efficient way to leverage innovations from downstream markets, often avoiding the organizational and financial costs associated with mergers, acquisitions, or extensive in-house R&D.

However, controlling investments, acquisitions, exclusive dealing, or privileged access to inputs from certain partnerships can potentially have adverse effects on competition. Such agreements could potentially lead to market foreclosure or other anti-competitive practices. A careful and detailed examination of contractual terms is therefore essential to assess whether such alliances create incentives or opportunities for harmful market behaviour and to evaluate their actual impact on competition and overall market outcomes.

Concentration in the AI market can pose systemic risks in critical sectors of the economy.

There are also emerging concerns on the impact of concentration in AI markets on critical sectors such as financial services. Key issues include the asymmetry of bargaining power in partnerships, as well as financial stability risks stemming from disruptions to systems operated by large technology platforms. For instance, an AWS outage in December 2021 reportedly caused losses of around USD 160 million to US financial services companies.[332] Similarly, a recent Microsoft Windows outage caused by a CrowdStrike update is estimated to have caused losses of around USD 5.4 billion to US Fortune 500 companies[333] and affected around 10 banks and NBFCs in India.[334]

[332] Sverdlik, Y. (2017). *AWS outage that broke the internet caused by mistyped command*. Data Center Knowledge. https://www.datacenterknowledge.com/outages/aws-outage-that-broke-the-internet-caused-by-mistyped-command

[333] Livemint. (2024). *Microsoft outage, CrowdStrike update to cost US Fortune 500 firms $5.4 billion, report says*. https://www.livemint.com/technology/tech-news/microsoft-outage-crowdstrike-update-to-cost-us-fortune-500-firms-5-4-billion-report-says-11721903289977.html

[334] Livemint. (2024). *Microsoft outage: How Indian financial sector averted global Windows glitch, RBI explains*. https://www.livemint.com/economy/microsoft-outage-how-indian-financial-sector-averted-global-windows-glitch-rbi-explains-11721393159126.html

As AI tools integrate further into critical sectors, it would become critical for regulators to assess and mitigate associated risks. Besides addressing the potential for single points of technical failure and ensuring operational resilience, areas warranting closer scrutiny include the potential for partnerships to encourage heightened financial risk-taking or to expose financial institutions to reputational risks. The risks could arise from algorithmic biases or other issues within the AI systems of global tech platforms on which the sector is increasingly dependent.[335]

Industrial policy focused on reducing dependencies in critical AI infrastructure and supporting nascent domestic entrants can promote meaningful competition.

As there are opportunity costs of public investments in AI, it is essential to ensure that government-supported initiatives are tailored to benefit new entrants so as to promote market diversity and enhance consumer choice. Policy impetus such as Telangana AI Mission's preferential procurement of innovations from MSMEs and startups and IndiaAI Mission's relaxation of annual turnover and certain technical requirements from companies eligible to bid under its compute capacity component are steps in the right direction.[336] Other policy nudges could include incentives for startups developing applications to use local compute or AI models[337] or for startups that differentiate themselves in terms of sustainability and other goals that align with national policy priorities. By tailoring support to foster the growth of domestic entrants, industrial policy can play a key role in building a resilient and competitive AI ecosystem in India. For instance, one of the cornerstones of IndiaAI Mission is IndiaAI Datasets Platform—a unified platform that provides Indian startups and researchers with streamlined access to high-quality, non-personal datasets. This data infrastructure aims to catalyze AI research and development by facilitating easy data discoverability, accessibility, and usability, which is essential for training and deploying AI models.

Policymakers need to monitor market developments and ensure global harmonization of regulations.

The Indian AI market is still at a nascent stage in terms of adoption but is evolving at a rapid pace on the supply side, marked by release of new models, applications, and partnerships. Therefore, it is essential for policymakers and regulators to closely monitor market developments. Capturing the realities of the AI market necessitates not just a case-by-case analysis of individual transactions but also a holistic look at how a series of such transactions are shaping the competition landscape. This is important because, while individual investments or partnerships may not meet the thresholds for anti-competitive scrutiny, their

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335 Bank for International Settlements. (2024). *The intersection of AI, data governance, and privacy: Insights for financial stability*. https://www.bis.org/fsi/publ/insights44.pdf

336 The Indian Express. (2024). *To accommodate start-ups, MeitY relaxes AI compute procurement norms*. https://indianexpress.com/article/business/to-accommodate-start-ups-meity-relaxes-ai-compute-procurement-norms-9610674/

337 A requirement for sourcing components for cloud services locally has already been introduced in the IndiaAI Mission programme.

cumulative effects could reshape competition.[338] The proposed Digital Competition Bill—which includes the framework for *ex-ante* regulation, where core platforms operate as systemically significant digital enterprises (SSDE)—could provide a proactive mechanism to address potential anti-competitive practices.

Many of the challenges concerning competition, governance, and AI regulation are universal in nature. While India's regulatory framework must cater to its specific market dynamics, aligning with broader international principles is crucial to avoid regulatory arbitrage and ensure coherence with global efforts to address shared AI-related concerns. However, these challenges are likely to reshape traditional assumptions and practices that have long guided market regulations. Addressing these emerging issues will require more than competition policy alone. Societies will need to determine the acceptable thresholds of market power that they are willing to tolerate, along with understanding the long-term implications for markets and society.

Push for sovereign AI to promote competition, complementing competition policy with industrial policy.

A blend of public and private investment are frequently required for policies aimed at promoting innovation, technology adoption, infrastructure development, decarbonization, and economic security.

In this context, India's push for sovereign AI represents a transformative step towards technological self-reliance and global leadership. Initiatives like IndiaAI Mission, investments in AI supercomputers, GPUs, and indigenous LLMs have the potential for creating a robust AI ecosystem tailored to India's diverse needs. The scale of computation required to manage tasks is a limiting factor in the AI industry, and it is here that sovereign nations need to concentrate their efforts and resources, in addition to creating non-discriminatory open access to anonymised high-quality datasets, if they desire to shape competitive markets.

These efforts attempt to address key challenges such as supply-chain dependencies and data accessibility while fostering innovation, empowering startups, and transforming critical sectors like healthcare and agriculture. Building infrastructure, developing AI-governance policies, and implementing appropriate regulatory frameworks are crucial for fuelling a competitive and innovative AI ecosystem. A good start but a lot more needs to be done. The direction that India will take in shaping AI markets be it through regulation or overt industrial policy or a combination of both will, as in other countries, be a political economy response. There is no correct answer.

[338] Maggiolino, M., & Zoboli, L. (2024). Preserving competition in generative AI: Addressing the merger conundrum. In A. Abbott & T. Schrepel (Eds.), *Artificial intelligence and competition policy* (pp. 65–82). Concurrences. https://www.concurrences.com/en/all-books/artificial-intelligence-and-competition-policy

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