Economics of Artificial Intelligence

The Implications of the AI Explosion for Productivity Growth and Monetary Policy

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Chair Powell's January 2024 Press Conference

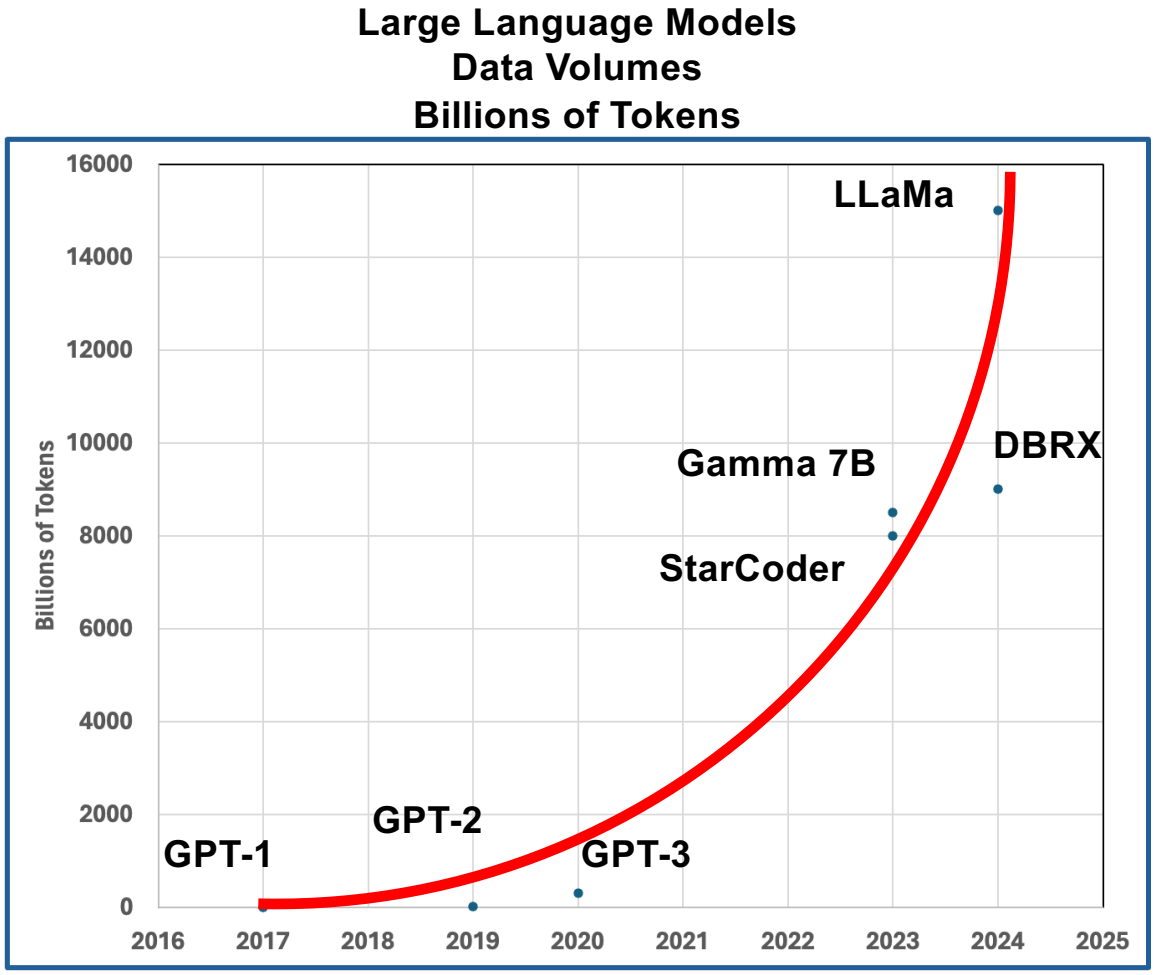
- Question:
  - *Do you see [recent] productivity [growth] as sort of just temporary because of the factors—the labor and supply chain factors you were talking about—or*
  - *Do you think that productivity growth will, will fade over time?*
- Answer:
  - *So, this is a really interesting question.*
  - *Is there—is there a case—will it be the case that we come out of this more productive on a sustained basis?*
  - *And I don't know. I don't know.*
  - *What would it take?*

Source: Federal Reserve Board, Press Conference Transcript, January 31, 2024.

Artificial Intelligence Technology and Sectors

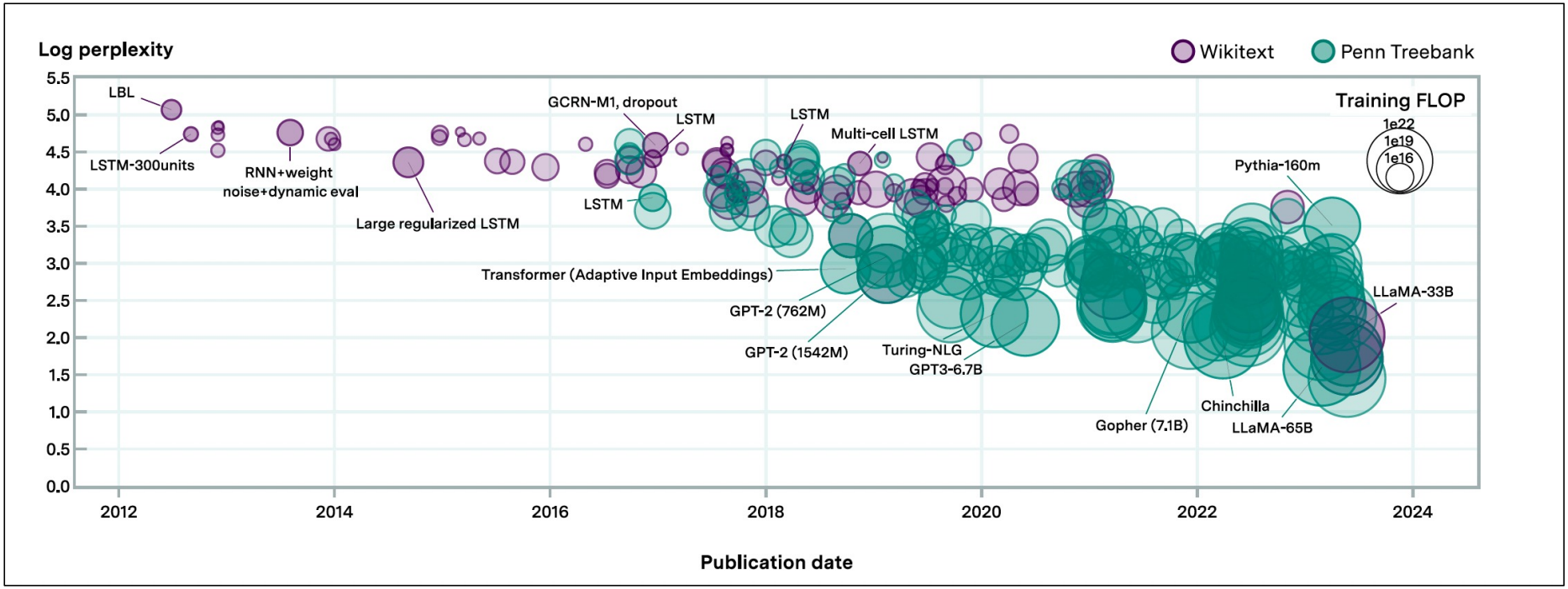
	Generative Pre-Trained Models	Other Large Language Models	Classical AI Models
Technology Sector			
Very Large Business and Government Organizations			
All Other Organizations			

Data Volumes Have Exploded



Supply Side

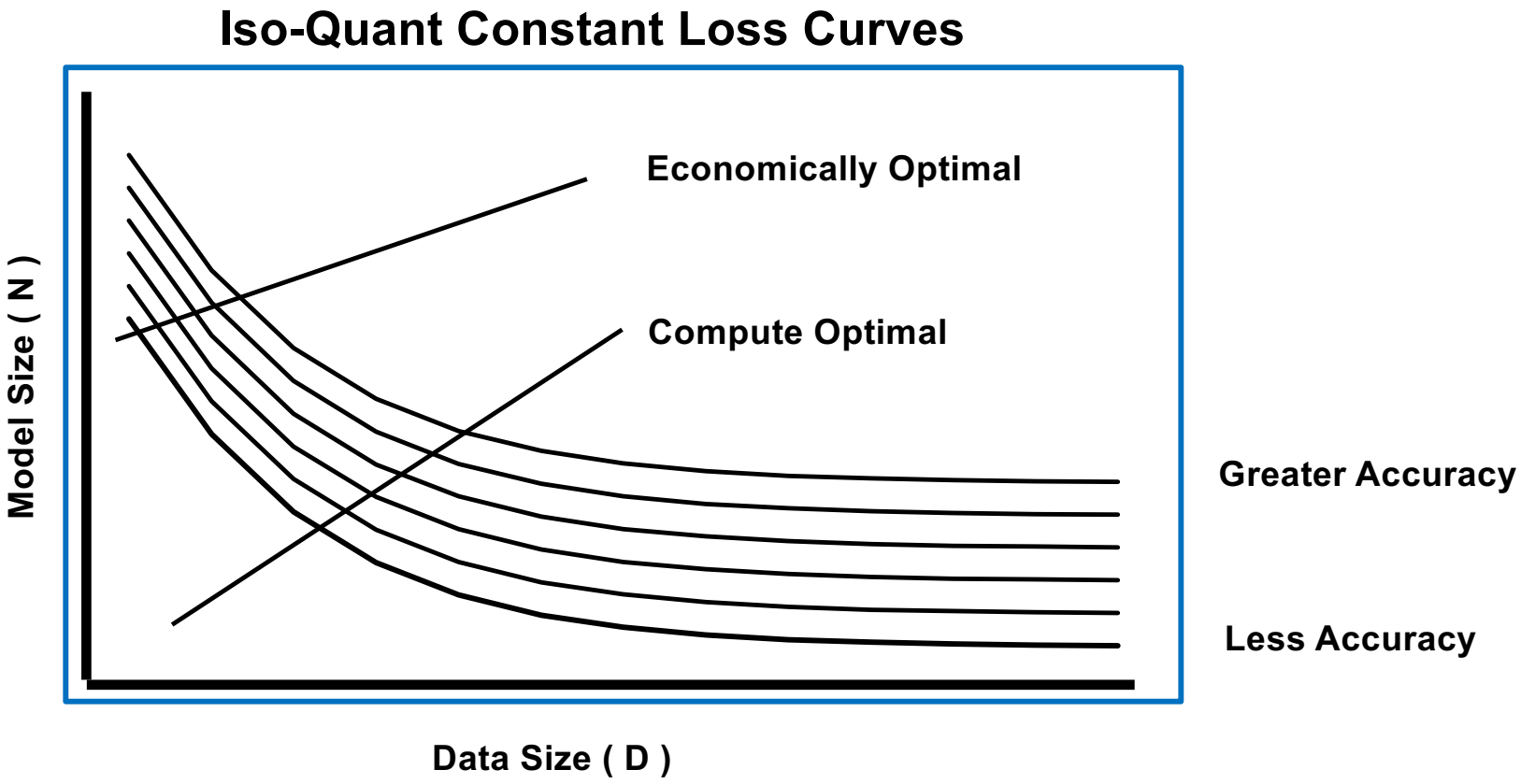
231 Language Models Span Eight Orders Of Compute Magnitude



Common crawl data are available for free but growing very slowly. To maintain or improve accuracy, less data means more compute or vice versa. There is a hyperbolic relationship – isoquants - between data and model size for constant accuracy.

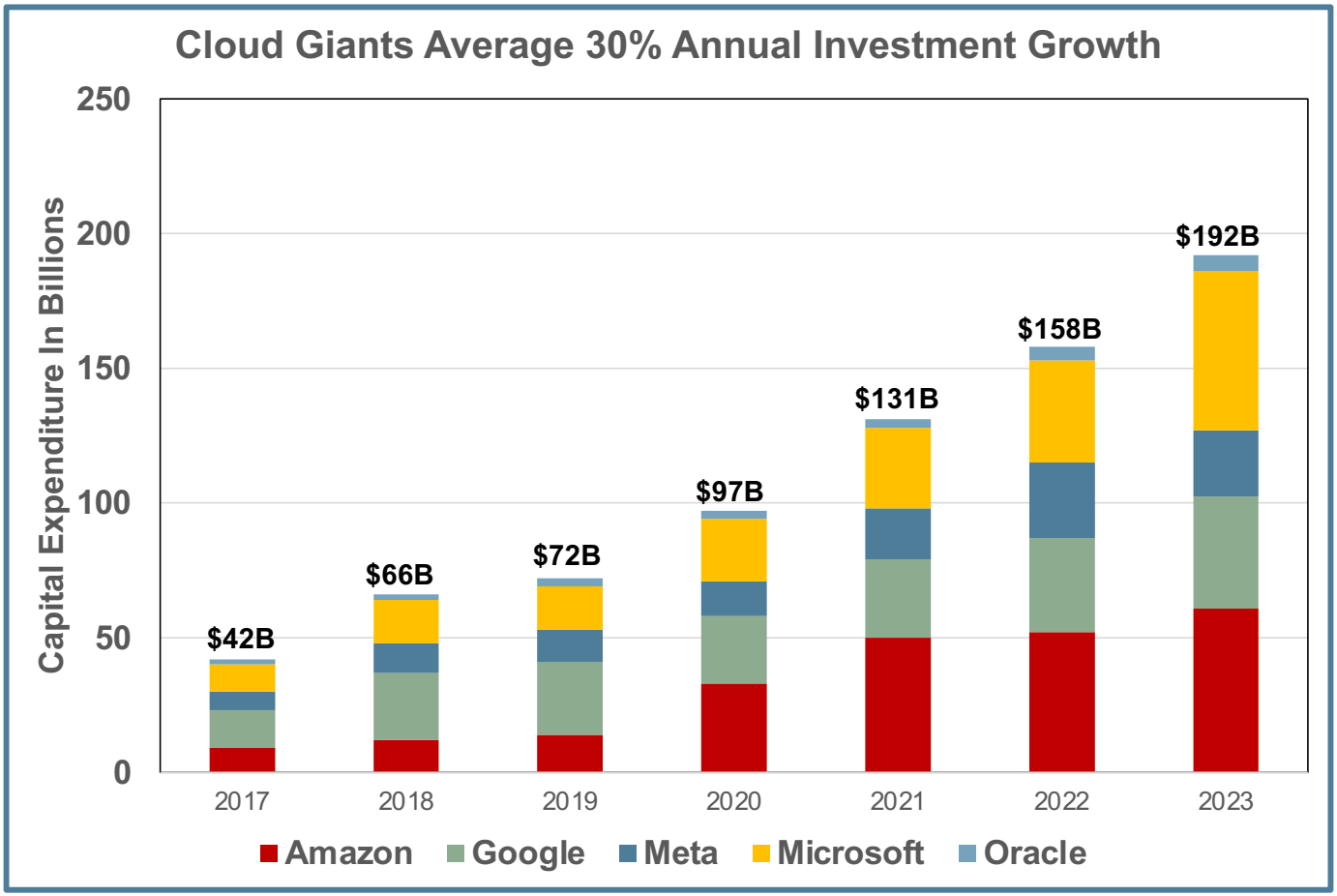
Ho, A., Besiroglu T., Erdil, E., Owen, D., Rahman, R., Guo, Z.C., Atkinson, D., Thompson, N., and Sevilla, J. (2024); *Algorithmic Progress in Language Models*; (FutureTech MIT CSAIL) arXiv:2403.05812v1.

Growth of Computing Resources for LLMs



Anna M. Pastwa, Dan Zhao, Martin Fleming, Brian C. Goehring, Kate Soule, and Neil Thompson (2024); *Accounting for Data Costs in the Economically-Optimal Scaling of Large Language Models;* ; (FutureTech MIT CSAIL) OpenReview.net

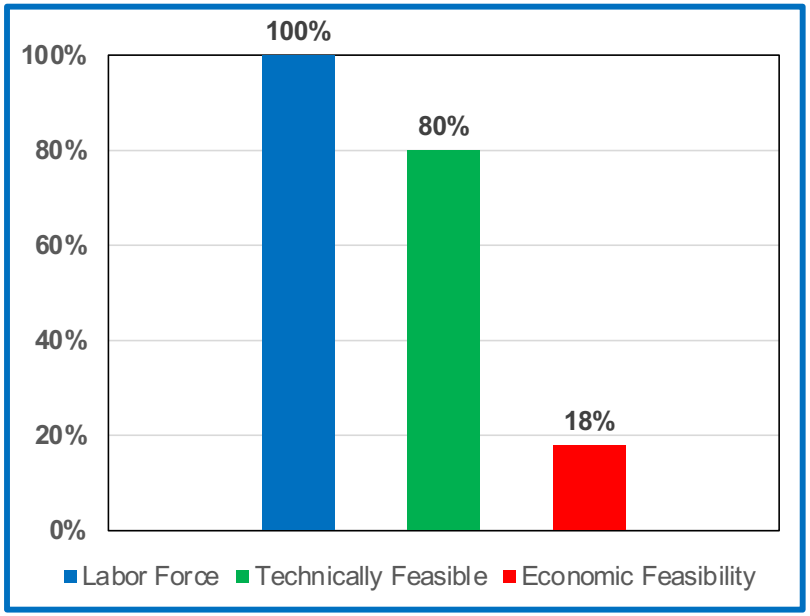
Cloud Computing Providers Increase Datacenter Investment



https://www.costar.com/article/1971975198/cloud-computing-firms-increase-data-center-investment-for-artificial-intelligence

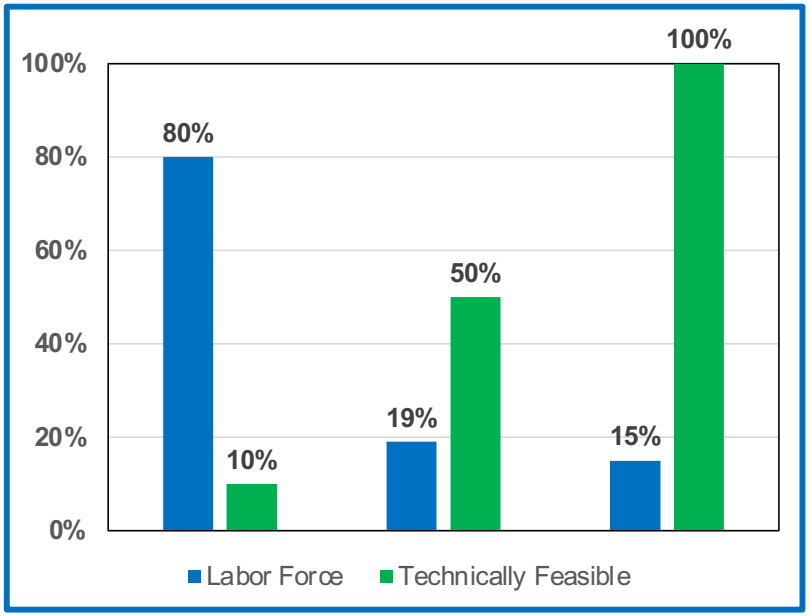
Technical Feasibility Versus Economic Feasibility

Computer Vision Task Automation



Svanberg, M. S., W. Li, M. Fleming, B. C. Goehring, and N. C. Thompson (2023). *Will It be Cost-Effective to Automate Human Tasks with AI? Evidence from Computer Vision;* (MIT FutureTech CSAIL, Working Paper).

Large Language Models Task Automation



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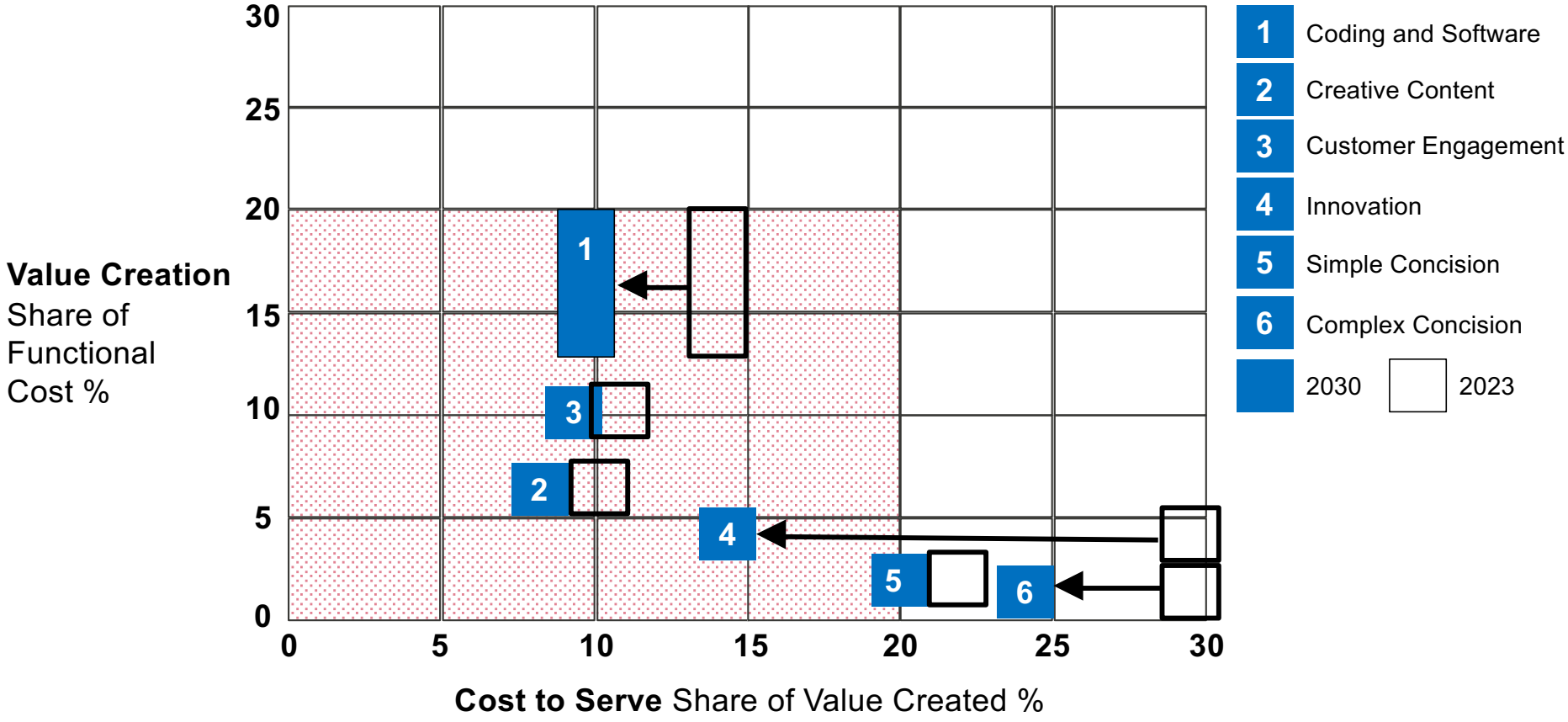
Demand Side

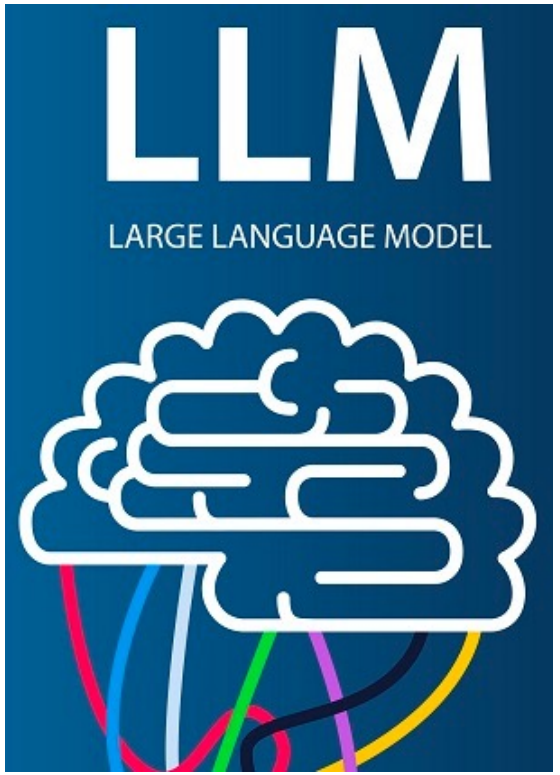
Only Five of Six Archetypes Will Be Economically Viable and Widely Adopted By 2030



Burkacky, O., Pototzky, K., Patel, M., Tang, D., Vrijen, R., andZhu W. (2024); *Generative AI: The Next S-curve for the Semiconductor Industry?*; McKinsey & Company, 29 March

Outlook for AI Economics

- Data Hungry LLMs
  - *Training data increased 3 orders of magnitude (OOM)*
  - *Data for high-quality LLMs is increasingly expensive and could be exhausted within 2 yrs*
- Compute Demand
  - *Growth improves accuracy and offset data limits*
  - *LLMs have expanded 8 OOM*
  - *Compute requirements could in by 2 OOM by 2030*
  - *Algorithm improvement has been faster than Moore's Law*
  - *Algorithm progress could meet 20% of compute need*
- Sector Deployment and Absorption
  - *Datacenter investment growth continues strong with implications for capital, energy, and water markets*
  - *AI technology sector is the early winner, but the economics of foundations models are unknown and at risk*
  - *Firms who are users and workers have seen limited benefit*



"What Will It Take?"

Five Criteria for Assessing Monetary Policy, AI, and Productivity

1. AI models accuracy, quality, and certainty

2. AI diffusion and adoption beyond the technology sector and very large enterprise

3. AI-as-a-service, business model transformation, and market development

4. Workers' willingness to develop new skills and adopt new ways of working
   - *Productivity Effects versus Displacement Effects*

5. Effectiveness of industrial policy, competition policy and privacy


BREAK
THROUGH
A GROWTH
REVOLUTION
MARTIN FLEMING

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