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Technological Bifurcation in AI: Potential Convergences of China-United States Parallel Global Innovation

Alishbah Syed*

Introduction

When William. T. R. Fox considered scientific and technological capability as an appropriate benchmark for tomorrow's wealth and power back in the 1960s[1], it was no understatement. Technology today stands on a fine line between politics and economics, impacting both global power dynamics and the global supply chain. This is evident in the case of the intensifying China-United States technological rivalry, especially in artificial intelligence (AI).

While claims of technological 'decoupling' are prevalent for the China-US AI dynamic, a more intricate view would reveal a simple diverging trajectory for AI development. It is a bifurcation of the AI landscape where innovations are advancing in parallel along distinct paths.[2] The China-US AI rivalry is leading toward two separate technological ecosystems of their own advancements and capabilities. Within this study, this can be framed as the US dominates in virtual infrastructure through innovation in the AI system, while China dominates in physical infrastructure for connectivity and commercialism within framework of AI.

But a point in history is coming where these parallel developments may come quite close to one another, close enough for a convergence. Within the current power dynamics, integrated international system, and technological capabilities, China and the US owe the world an attempt to converge for the sake of a continued and secured future. By contextualizing the bifurcation based on a virtual-physical infrastructure this study examines the potential for convergence between the two competing AI rivals. In specific, how both states can converge toward one another based on a broad software-hardware synergy where their respective strengths can provide an all-round and cooperative AI development for the international world.

The US Virtual Infrastructural Approach

AI software underlines a complex framework of intelligent systems. It comprises of programming languages that guide the system, algorithms for pattern recognition and learning, and a user interface to meet with current needs and norms. This is underscored within the sphere of virtual infrastructure which supports the creation, advancement, and deployment of AI systems, complemented by integrated hardware and active research and development (R&D). All of this combines to form effective scalability, innovation and trust in AI technologies.

Since the release of ChatGPT, an international AI 'race' has begun with US at the forefront. It is not just because of the historical dominance in information technology (IT) but also a strategic virtual infrastructural approach to AI development.

This approach is evident in various US state reports. In the "*National Artificial Intelligence Research and Development Strategic Plan 2023 Update*" report, a multi-faceted approach for AI development in the US included 9 strategies that uplift software capabilities. These strategies prioritised research on AI capabilities and ethics, skills development for an effective workforce, and national and international collaboration to leverage the expertise of private sector in AI software. It showcases the US plan for a "safe, secure and trustworthy" AI system within the framework of virtual infrastructure.[3]

Similarly, the report of PCAST (President's Council of Advisors on Science and Technology) to the President of the US titled "*Supercharging Research: Harnessing Artificial Intelligence to Meet Global Challenges*" showcased the US tendency towards software development in AI. It highlights the need for developing powerful software tools for generative AI, open-source platforms to facilitate data recruitment for AI, and a secure software framework that is user-friendly for researchers,[4] all integral to virtual infrastructure.

Essentially, a strong software foundation underscores a strong virtual infrastructure. And that strong software foundation is based on innovation in the US. Silicon Valley and other technology hubs fuel software innovation while the technology giants of the US like Google, Microsoft, and Amazon have committed financial investments, user data and computing resources that produce advancements in AI. Not to mention the massive talent pool, attracting 57 per cent of the total elite AI talent

* Alishba Syed is an intern with the China Program at the Institute of Regional Studies.

in 2022 and continued in the 2023 statistics for AI talent pull.[5]

Additionally, the US lead in semiconductor and AI chips provides the 'muscles' behind expanding software capabilities. This hardware advantage is integrated into the virtual ecosystem, expanding its limitations. This is amplified by the established open-source framework and culture that fosters a collaborative and innovative environment for AI development in US. The US also leverages 'cloud platforms' online computing service providing servers, data storage, processing and software over the internet which makes powerful computing resources readily available for developing cutting-edge AI software without any physical infrastructure.[6] These interlinking 'components' direct resources and efforts towards driving advancements within the virtual infrastructure, keeping US well-paced in today's fast-advancing AI technologies.

In short, the US strategy is not about building strong AI models, but to create a resilient virtual ecosystem where strong AI models can thrive consistently and efficiently. Through this approach, the US aims to maintain its lead in the AI race.

China's Physical Infrastructural Approach

While AI seems to be all about software, its hardware is equally essential by providing effective operational grounds to advance technologies. In the particular case of physical infrastructure of AI, it provides the basic computational power, data processing and storage, and connectivity for the effective functioning and advancing of AI systems.

If the US maintains a competitive edge and major funding in virtual infrastructural development, China maintains it in physical infrastructural development. Experts at the China Conference on 4th July 2024 have stated that the competitive edge of China in AI development stems from 'infrastructure development, domestic talent pool and real-world applications of AI'.[7]

The success of China in infrastructural development in the Belt and Road Initiative (BRI), in trade connectivity and strong market foundations, extends to AI towards digital connectivity and extensive commercialisation. Here, AI is seen as the 'engine of new quality productive forces' of China. This approach is complemented and underpinned by the massive manufacturing and production capacity, and vast market outlets of China.[8] In a place where both labour and electricity is relatively cheap, such ambitions are self-explanatory. These factors ensure that AI technologies are both developed and widely accessible at domestic and international levels, driving down costs and fostering widespread adoption.

The 'New Infrastructure' initiative by China embodies a physical infrastructural approach to AI. It shifts China from its traditional connectivity and capacity-building projects, like roads and bridges, towards a new 'digitalised' connectivity and capacity-building through core technologies. The Chinese National Development and Reform Commission (NDRC) described three segments within it; information infrastructure (including 5G, data centres, AI, and cloud computing), integrated infrastructure (such as intelligent transportation and smart energy) and innovative infrastructure (covering major and industrial technologies). These three segments allow for AI training and deployment, real-world AI application and commercialisation, and progression and innovation in AI capabilities respectively. This initiative provides a robust digital infrastructure for AI development and deployment.[9] Essentially, infrastructure becomes the 'underlying structure' that supports unique circumstances of China.

The success of the approach stems from State-backing, rather than market forces, for a cohesive and comprehensive policy application. The nationwide deployments of Internet of Things (IoTs) devices feed into extensive 5G networks as high-speed data. The interconnecting data centres and massive computing infrastructure, supported by the National Integrated Computing Power Network (NICPN) for an "East Date, West Computing" initiative, processes raw data into productive data for AI training.[10] The policy of 'self-reliance and self-improvement' in AI through initiatives like "Made in China 2025" or "China Standards 2035 Plan" promotes AI development from two fronts in China. Firstly, by promoting domestic production of core technologies, leading to AI industrial growth and self-sufficiency. Secondly, by exporting production through BRI, giving access to diverse data important for effective AI training.[11]

This is coupled with China making significant strides in AI software and research through investment in programming, algorithmic research, and regulatory frameworks that support the ethical and effective application of AI. This ensures that China's AI capabilities remain competitive globally.

AI essentially becomes the core of the 'new infrastructure.' It is the foundation of many core technologies, integrated deeply with multiple civil sectors and plays a central role in many intelligent applications.[12] This infrastructure focus is embodied in 'smart cities' acting as testing grounds for AI applications in civil life.[13]

As a Chinese saying goes, "If you want to get rich, build road first," China also intends to progress in AI

development and deployment through building a digital backbone.

Coercion in Technological Innovation

Between these separate AI ecosystems of US and China, we see conflict as their advancements in AI have begun create new sore spots. While US fear the 'civil-military strategy' of China to use its advancements in AI, China is frustrated by the unilateral technological protectionism of US for its commercialisation of AI.

The US policy on AI has shifted in regards to China, going from purely focusing on national security to focusing on protecting US technological supremacy.[14]On such a basis, US utilises a "High Fence, Small Yard" strategy. US has applied (a) export controls on AI technologies like semi-conductors, (b) restricting US investments in Chinese AI companies, (c) segregating cloud users on the basis of 'know your customer' (d) and scrutinising the backgrounds of researchers to mitigate 'national security risks'. The US has also introduced the bipartisan bill, the Enhancing National Frameworks for Overseas Critical Exports Act (ENFORCE Act). This further strengthens the authority of the US government to control exports of emerging technologies like AI.[15]

China also plays a role in this dynamic. With a weak history of intellectual property (IP) protection and conflicting copyright laws, collaboration with China becomes riddled with fears technological theft. In addition, the complex regulatory management of China, which includes long bureaucratic processes, investment limits on core technologies and infrastructure restricts the free flow of ideas and talents. Lastly, the Chinese government is heavily involved in the AI development process that emphasises practical application and social order;[16] leaving not much room for fundamental research in China or international understanding of Chinese findings.

Point of Convergence; Software-Hardware Synergy

Despite their rivalry, the diverging US-China approaches mirrors the software-hardware debate in computer technology with US representing the software while China represents the hardware in a broader sense. Furthermore, it mirrors the same collaborative conclusion, albeit idealistic in the case of US-China, of interdependence.

The software-hardware synergy works on the principle that both components are essential for normal computer functioning. No optimal performance can be achieved without the other.[17] Both states have their own unique strengths which can potentially synthesise to create one comprehensive system. US and China's AI ecosystem can theoretically co-exist and progress separately, but is such a situation conducive or productive in the long run for AI technology? It is not. It is not for US, not for China or the world as a whole.

This bifurcated innovation from withholding and segregating technological progress comes at a cost. US-China is intricately interconnected. US may have a large pool of talented AI researchers for a strong R&D foundation but in 2022 statistics, 38 per cent of them working in US institutes were Chinese in origin compared to 37 per cent of US nationals.[18] China may lean towards 'self-reliance' in their AI infrastructure but their AI models are derivative of the US and require significant capital which US can amply invest. By essentially 'going their separate way', they miss the opportunity to leverage AI strengths of each other towards accelerated progress seen in a software-hardware dynamic.

Most importantly, they miss out on an open and direct communication channel to keep track of how AI is evolving and act as each other's effective check and balance. As for the rest of the world, it creates a fragmented and bipolar AI international system hard to keep track of or accountable for. As a result, 'trustworthy' deployment and consistent global regulation of AI technologies become a distant dream.

Conclusion

Through policy developments and priorities, we can generally deduce a virtual and physical infrastructural approach towards AI development for US and China respectively. Within this deduction, we can develop a narrative of convergence where their parallel innovation paths can complement one another through software-hardware synergy in a broader sense. This convergence between the two AI rivals is not an option but an imperative, having implications in the broader spectrum. Hence it is essential for a US-China AI partnership, specifically a trust-based collaboration. The ideal entry into this partnership and integration of AI systems would be small and scalable steps through collaborations on common and non-controversial grounds. Healthcare, environmental protection and clean energy sectors are potential safe zones for first contact.

The future of AI largely depends on the probability of a partnership between US and China. Just as a computer needs cutting edge software and robust hardware for optimal functioning, the strength of US and China in virtual and physical infrastructure can fuel an accelerated and inclusive development and deployment of AI technologies. The time for going on separate paths should be over and partnership should be embraced.

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