SOURCES OF AI INNOVATION: MORE THAN A U.S.-CHINA RIVALRY

DOI: 10.58867/XJCT9512

Many experts frame the debates around AI technology as a great power rivalry between the U.S. and China. Indeed, by most measures, the United States and China lead the world in AI innovation. Yet focusing solely on the United States and China elides global AI adoption dynamics and yields an incomplete picture about how and why countries acquire certain emerging technologies. While the U.S. and China undoubtedly matter when it comes to fostering AI innovation, cultivating AI talent, generating technology exports to emerging markets, and advancing AI global standard-setting, a diverse range of countries also exert significant influence on AI acquisition and adoption trends.

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Keywords: Artificial Intelligence, China, Capabilities and Innovation, U.S.

TPQ
Summer 2023

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This article was first published digitally on Monday, 6 June 2022.

Many experts frame the debates around AI technology as a great power rivalry between the U.S. and China.[1] Indeed, by most measures, the United States and China lead the world in AI innovation. Yet focusing solely on the United States and China elides global AI adoption dynamics and yields an incomplete picture about how and why countries acquire certain emerging technologies.[2] While the U.S. and China undoubtedly matter when it comes to fostering AI innovation, cultivating AI talent, generating technology exports to emerging markets, and advancing AI global standard-setting, a diverse range of countries also exert significant influence on AI acquisition and adoption trends.

Countries such as India, Singapore, and Israel, have vibrant AI ecosystems, including substantial investments in R&D, strong commercial applications, and conducive operating environments.[3] These countries represent not only important markets for AI technology exports but also budding centers of AI innovation. In certain respects, this makes innovative middle powers almost as crucial as the superpower competition between the United States and China.[4] To that end, analyzing and understanding middle power technology adoption trends and capabilities constitutes an important sub-topic in the broader "emerging technology-international competition" debate.

Ranking countries based on their AI capacity has become a popular point of research. These rankings usually involve compiling indexes and measurements of key AI technology components such as computer engineering talent, pre-existing scientific infrastructure, ease of investment in AI, government strategy, and commercial ecosystem.[5] These indexes all place the United States and China at the top of their country lists for possessing the most sophisticated AI-related capabilities and the most favorable investment ecosystems. Yet, due to the rapid pace of technological innovation, different countries excel in various emerging technologies, making it

1) Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (Houghton Mifflin, 2018); You Wang and Dingding Chen, "Rising Sino-U.S. Competition in Artificial Intelligence," *China Quarterly of International Strategic Studies*, Vol. 4, No. 2 (2018): p. 241-258; Satoru Mori, "U.S. Technological Competition with China: The Military, Industrial and Digital Network Dimensions," *Asia-Pacific Review*, Vol. 26, No. 1 (2019): p. 77-120.

2) H. Akın Ünver and Arhan S. Ertan, "Politics of Artificial Intelligence Adoption: Unpacking the Regime Type Debate," in *Democratic Frontiers* (Routledge, 2022): p. 83-107.

3) Michael C. Horowitz, Gregory C. Allen, Elsa B. Kania, and Paul Scharre, "Strategic Competition in an Era of Artificial Intelligence," Center for a New American Security, (2018).

4) For an extended treatment about middle powers and their evolving role, see Kleinfeld et al., "How Middle-Power Democracies Can Help Renovate Global Democracy," Carnegie Endowment for International Peace, 4 February 2021. https://carnegieendowment.org/2021/02/04/how-middle-power-democracies-can-help-renovate-global-democracy-support-pub-83809

5) See for example: Alexandra Mousavizadeh, Alexi Mostrous and Alex Clark, "The Arms Race: A Groundbreaking New Index Ranking 54 Countries," Tortoise Intelligence (3 December 2019), https://www.tortoisemedia.com/2019/12/03/global-ai-index/; Stanford University Human-Centered Artificial Intelligence (HAI) AI Index: https://aiindex.stanford.edu/ and Carnegie Endowment for International Peace AI Global Surveillance Technology: https://carnegieendowment.org/publications/interactive/aI-surveillance

difficult – if not misleading – to render a precise 'top AI nations' or 'early adopter nations' designation.

To capture the multiple facets of AI development, the Stanford Human-Centered Artificial Intelligence (HAI) AI Index uses a more disaggregated ranking format, sorting capabilities based on scientific publications, repositories, patent filings, GitHub performance, and talent recruiting and hiring.[6] For example, when countries are ranked according to growth in AI hiring, New Zealand, Hong Kong, and Ireland form the top three. On the other hand, India, the United States, and Germany lead the world regarding relative levels of AI skills penetration. As for private sector investment in AI technology, the United States sits on top – with China, the United Kingdom, and Israel falling much further behind.

These variances in measuring AI performance and capabilities reflect the rich and diverse world of AI sub-capabilities and shows how countries are trying to capitalize and form comparative advantages for different aspects of AI. Turkey's development of the Bayraktar TB2 drone and accompanying electronic warfare (EW) is a good case in point. While the United States, and to a lesser extent China, dominate military technological innovation, in recent years, other countries have stepped into the fray. Turkey's TB2 drones not only provide a cost-effective option for militaries to deploy a lethal instrument against their adversaries, but the AI platform undergirding the TB2's EW capabilities, represents a milestone innovation. As Amir Husain writes in Prism: "it has been theorized that TB2 drones over Azerbaijan were controlled from Turkey, with larger Akinci drones acting as relays. ATGMs [anti-tank guided missiles] delivered at scale, against a peer-force by attributable, long-endurance platforms controlled by pilots hundreds of miles away… never before was this concept of operations employed."[7] It would be a mistake to assume that AI innovation is relegated exclusively to the largest powers.

The diffusion of AI capabilities among middle powers presages the emergence of new global coalitions which could transcend legacy Cold War arrangements. What if, for example, the EU is joined by states such as Israel, India, Japan, and South Korea to establish a third camp of countries pursuing high-technology advantages independently from U.S. and Chinese technology firms? The European Commission, for example, has situated the EU's broader role in AI as "leading the way in the approach of developing AI on a fundamental rights framework."[8] Could European 'norm-setting' power in emerging technologies provide an alternative for

6) Stanford University Human-Centered Artificial Intelligence (HAI) AI Index. https://aiindex.stanford.edu/

7) Amir Husain, "AI is Shaping the Future of War," *PRISM*, Vol. 9, No. 3 (2021): p. 50-61.

8) Gabriela Zanfir-Fortuna, "European Commission's Strategy for AI, Explained," Future of Privacy Forum (2018). https://fpf.org/tag/european-ai-alliance/

democracies seeking to engage in technology-transfer and co-production on AI sub-components who also wish to steer clear of authoritarian practices, such as invasive biometric techniques or discriminatory profiling?[9] In particular, can the EU set the parameters for a more "humane AI" which can incorporate ethical considerations into algorithms or set legal and legislative safeguards to prevent the abuse of automation by powerful actors? Could such a bloc change the import-export dynamics of AI-related systems across the world?

Other countries may seek to go it alone and form à la carte partnerships with leading AI nations or stay fully independent in order to remain non-aligned in high-technology competition. Brazil, for example, has recently announced the creation of a network of self-contained AI labs – linked to its armed forces – which will largely rely on domestic components.[10] The same goes for Nigeria, which has established a new agency for 'Robotics and Artificial Intelligence' that seeks to render the country less dependent on foreign AI imports.[11] Slovenia and Hungary too have taken steps to reduce foreign dependence on high technology research and development by establishing national AI centers.[12]

These differing trends illustrate the fluidity of global AI technology competition and how future alignments will not necessarily be defined by two-country competition between the United States and China. Middle powers offer diverse AI capabilities and will influence how the two AI superpowers implement their AI export strategies.

Key questions loom: are middle power states interested in forming new cooperative regimes, independent from Beijing and Washington? Will the two AI superpowers accept the emergence of new coalitions of countries which are fostering AI cooperation among themselves? Will new partnerships lead to any revisions to the foundational institutions governing global digital infrastructure, such as the International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or Internet Corporation for Assigned Names and Numbers (ICANN)? More importantly, can emerging AI powers translate technological cooperation into geopolitical momentum, forming new trading regimes, long-term technology transfer partnerships, and potentially greater political and diplomatic cooperation

9) Steven Feldstein, "The Road to Digital Unfreedom: How Artificial Intelligence is Reshaping Repression," *Journal of Democracy*, Vol. 30, No. 1 (2019): p. 40-52.

10) Fernando Filgueiras, "Artificial Intelligence Policy Regimes: Comparing Politics and Policy to National Strategies for Artificial Intelligence," *Global Perspectives*, Vol. 3, No. 1 (2022): p. 32362.

11) Jake Okechukwu Effoduh, "Towards A rights-respecting artificial intelligence policy for Nigeria," Paradigm Initiative (November 2021). https://paradigmhq.org/wp-content/uploads/2021/11/Towards-A-Rights-Respecting-Artificial-Intelligence-Policy-for-Nigeria.pdf

12) Charlotte Stix, "A Survey of the European Union's Artificial Intelligence Ecosystem," ArXiv preprint arXiv:2101.02039 (2020).

in international affairs? These questions highlight the need for researchers to think beyond U.S.-China strategic competition in AI, and to consider the manifold of arrangements, innovations, and configurations that will shape AI technology.