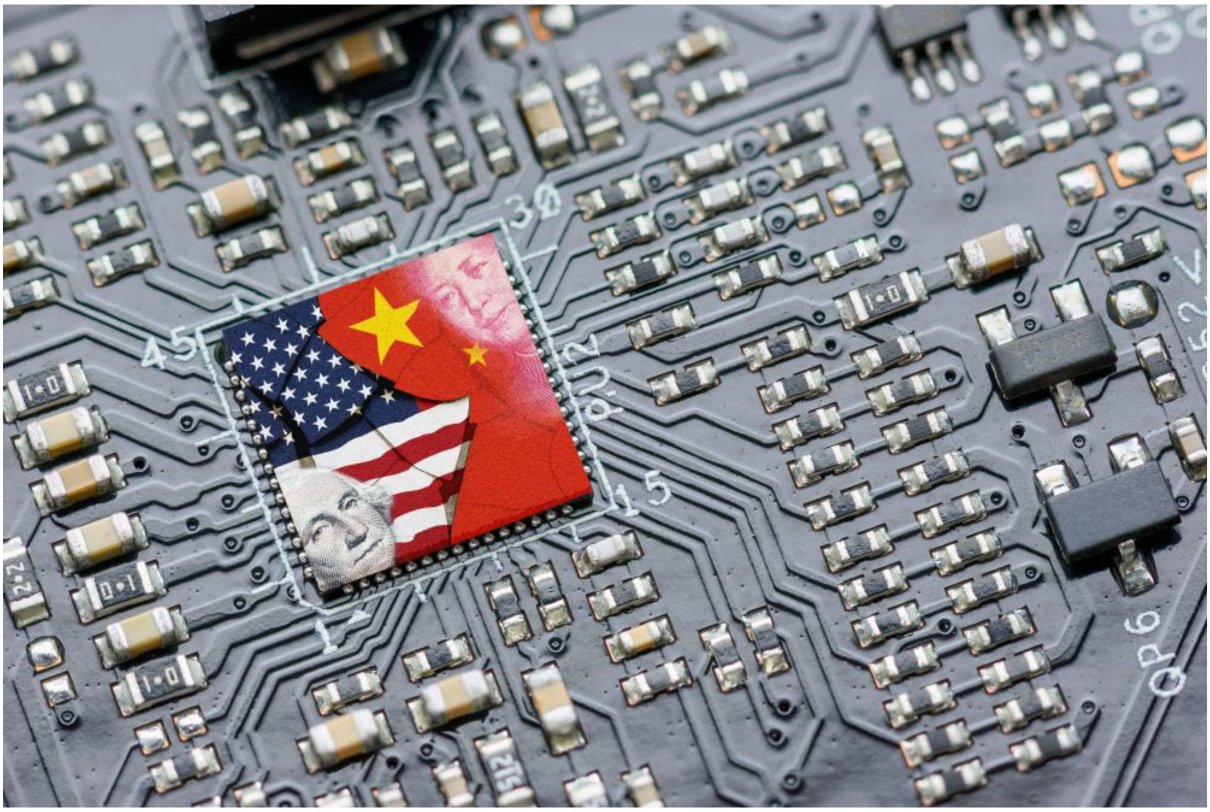
Publication: Asia Global Online
Date: 22 December 2022

Headline: Counting the Costs of US-China Technology Decoupling

Counting the Costs of US-China Technology Decoupling

Roland Bouffanais with Sun Sun Lim

The global implications of the US-China competition over technology including advanced semiconductors would be better understood if policymakers, diplomats and other players in the unfolding quarrel used big-data analytics and artificial intelligence to study the complexities and convolutions of the decoupling dispute, write Roland Bouffanais of the University of Ottawa and Sun Sun Lim of Singapore Management University.



Much like the breathless World Cup final between Argentina and France with its dramatic twists and turns, the US-China technology decoupling saga has had its fair share of convolutions. But where the football analogy ends is that the latter cannot be resolved by penalty kicks but will likely be an interminable affair with ramifications extending far beyond two countries. Fortuitously, charting the full range of consequences of this multifaceted geopolitical controversy is now possible with an emerging research approach known as computational diplomacy.

To grasp fully the value of such accounting, we need only highlight some notable developments in this still unfolding dispute involving the two superpowers. The first salvo was fired by the US when it banned Huawei's technology, followed by its promulgation of the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act in August 2022. Through the law, the US is effectively blocking exports of some chip manufacturing equipment and limiting sales of certain semiconductors to China. US companies that manufacture products in China are now unable to import chips for that purpose and must relocate their production. Meanwhile, China is seeking to develop its own chip design and fabrication capacity to circumvent these barriers.

Publication: Asia Global Online
Date: 22 December 2022

Headline: Counting the Costs of US-China Technology Decoupling

In the past week alone, three notable developments have occurred to deepen this rift between China and the US. First, the administration of US President Joe Biden extended its “entity list” to include another 36 Chinese companies. To sell specific technologies to circumscribed enterprises, American firms must first obtain hard-to-secure government permission. One immediate consequence was UK-based chip designer Arm being prohibited from selling its most advanced designs to Chinese firms such as tech giant Alibaba due to US and UK controls.

Second, on December 15, China filed a complaint with the World Trade Organization (WTO) accusing the US of abusing its export controls on semiconductors and other related technology effectively to maintain “its leadership in science, technology, engineering and manufacturing sectors”. It added that American actions undermined “the stability of the global industrial supply chains”. The US strenuously denied these charges, justifying their measures by citing national security interests. (This came days after Washington rejected a WTO ruling against the US in challenges brought by China, Norway, Switzerland and Turkey to tariffs levied by the then administration of president Donald Trump in March 2018 on steel and aluminum imports on national security grounds.)

Third, US curbs extend not only to chips but also to critical chip manufacturing equipment. The US confirmed talks with Japan and the Netherlands about restricting such exports to China. Companies such as Japan's Tokyo Electron Ltd and Dutch lithography specialist ASML both produce the equipment needed to make highly advanced chips. They have been under pressure to limit supplies to China (ASML stopped sending its most sophisticated machines to China in 2019) and would be directly affected if their two countries choose to comply with US controls.

Caught in the crossfire: Lithography by ASML of the Netherlands (left) and TSMC semiconductor fabrication in Taiwan (Credit: ASML, TSMC)

As these recent developments clearly illuminate, US-China decoupling involves more than the two protagonists. Instead, there are distinct implications for many affected economies, industries and companies. Taiwan is a critical player. Viewed by China as its sovereign territory, Taiwan’s status as global leader in semiconductor manufacturing is undisputed, a critical reason for why the US is intent on extending its protection to and guarantee of defense of the island – the vaunted “Silicon Shield” – in the event of an attack or invasion by mainland Chinese forces. Nearly all of the most advanced microprocessors worldwide are currently manufactured by a single company – Taiwan Semiconductor Manufacturing Company (TSMC) – with production solely domestic.

Publication: Asia Global Online
Date: 22 December 2022

Headline: Counting the Costs of US-China Technology Decoupling

With semiconductor chips now indispensable in all kinds of hardware linked by the Internet of Things, from mobile phones to smart cars, collaborative robots and military equipment, the timely supply of chips is a commercial and security issue of global proportions. More dramatically, the lack of access to the newest nano-scale chips will constitute a major impediment for the development of new strategic technologies in artificial intelligence (AI) and robotics all over the world, including in China and the US.

By dint of its size, the semiconductor industry is far from straightforward and features many other companies scattered across diverse sectors with specializations in integrated circuit (IC) chip design, wafer fabrication and backend equipment manufacturing. The implications of the CHIPS and Science Act for this long tail of companies will play out in different ways with knock-on effects for yet other industry sectors.

In its efforts to curb China’s access to this technology, the US government is essentially cutting its nose to spite its face. This action will hurt its own tech giants such as AMD and NVidia. Its hawkish approach of pushing ahead with unilateral controls and pressuring its allies to fall in line may also undermine the latter’s support in the long run. Even if the US can enjoy some near-term gains by hobbling China’s manufacturing sector, China could retaliate by seizing Taiwan by force, thus controlling such key entities as TSMC, though that would be predicated on the assumption that a mainland invasion would be able to secure and preserve the relevant facilities.

Great power competitors in a complex diplomatic game: Chinese leader Xi Jinping and US President Joe Biden on the sidelines of the G20 summit in Bali, Indonesia, November 14 (Credit: Adam Schultz/The White House)

Considering the scale and complexity of the issue, how can states such as the US weigh with greater accuracy the gravity and consequences of their actions so that they can avoid the inevitable fallout of a possibly brutal zero-sum game? Given how intertwined the US and Chinese economies are, the global nature of the manufacturing supply chain, and the deep interconnectedness of today’s technology sector, the impact of the CHIPS and Science Act may not turn out as planned.

Publication: Asia Global Online
Date: 22 December 2022

Headline: Counting the Costs of US-China Technology Decoupling

The nascent field of computational diplomacy could offer a helpful perspective. Grounded in complexity theory and computational social science, it provides an operational toolkit for analyzing, modelling, and simulating geopolitical incidents. It entails mining data generated by diplomatic negotiations such as official correspondence, formal agreements, meeting transcripts, media reports and online campaigns. By trawling and making sense of large data sets, computational diplomacy throws up possible scenarios and simulates different courses of action for all contingencies considered. It leverages recent advances in data science, deep learning, and massive computations of highly complex systems to facilitate the quantitative forecasting of intricate international relations including the fraught US-China technology decoupling.

By calculating the costs of different courses of action for any given scenario, and by identifying the key actors of interest – states, companies, individuals, non-governmental organizations, and other players – the full range of diplomatic moves could be robustly assessed just as AlphaGo, the computer program developed by Google's DeepMind Technologies, did when it mastered the challenging board game Go.

Experiments of computational diplomacy are already ongoing in institutions such as the University of Geneva and ETH Zürich, which together established the interdisciplinary Lab for Science in Diplomacy (SiDLab) in collaboration with the independent Geneva Science and Diplomacy Anticipator (GESDA), a foundation focused on combining the anticipative power of science with diplomacy. Other natural hubs could emerge to conduct similar interdisciplinary research that marry insights from complexity science with political science and international relations. Critical nodes in the international diplomatic circuit come to mind including New York which hosts the United Nations, the Hague with the International Court of Justice (ICJ) and the International Criminal Court (ICC), or Singapore where the secretariat of the Asia Pacific Economic Cooperation (APEC) forum is located. These cities already have thriving ecosystems of universities, research institutes and think tanks that could embark on interdisciplinary research in computational diplomacy.

While computational diplomacy is still a nascent field, the "proof of concept" for such an approach was demonstrated by scientists at Meta (parent company of Facebook) with their recent success with Cicero, the first AI agent to attain human-level performance in Diplomacy, a strategic board game released in 1959. Players must strike a fine balance between cooperation and competition with others to vanquish opponents. Cicero deployed natural language negotiation and tactical coordination skills that characterize diplomatic engagement. It made use of human-AI interactions and then outperformed human participants, ranking among the top 10 percent of those who played more than one game.

Sceptics may argue that international relations are no board game. But as with many other complex systems, it would be helpful and most likely highly revealing to consider the prospects for computational methods in deriving deeper insights into intricate dependencies. The CHIPS and Science Act may trigger collateral damage and unanticipated consequences with an uncertain timeline. But the computing power supplied by these ubiquitous chips – along with analytical frameworks offered by computational diplomacy – could help us avoid these pitfalls.

Further reading:

Bouffanais, Roland; and Lim, Sun Sun. (15 September 2022) "Computational diplomacy – the science of an art?", The Interpreter, Lowy Institute, Sydney, NSW, Australia.

Publication: Asia Global Online
Date: 22 December 2022

Headline: Counting the Costs of US-China Technology Decoupling

Inkster, Nigel. (December 2020) The Great Decoupling: China, American and the Struggle for Technological Supremacy, Hurst Publishers, London, UK.

Meta Fundamental AI Research Diplomacy Team (FAIR) (Bakhtin, Anton; Brown, Noam; Dinan, Emily; Farina; Gabriele; Flaherty, Colin; Fried, Daniel; et al. (November 22, 2022) “Human-level play in the game of Diplomacy by combining language models with strategic reasoning”, Science, vol. 378, issue 6624, pp 1067-74, Washington, DC, USA.

Miller, Chris. (October 4, 2022) Chip War: The Fight for the World’s Most Critical Technology, Scribner, Simon & Schuster, New York, NY, USA.

Wernli, Didier; Chopard, Bastien; and Levrat, Nicolas. (August 2021) “When Computational Power Meets Diplomacy: Training a New Generation of Scientists in Diplomacy and Diplomats in Science”, Bulletin – VSH-AEU, vol. 27, no. 2, p 4, Vereinigung der Schweizerischen Hochschuldozierende/Association Suisses des Enseignant-e-s d'Université, Geneva, Switzerland.

Author:

Roland Bouffanais

University of Ottawa

Roland Bouffanais is associate professor at the University of Ottawa. His research focuses on the interdisciplinary intersections of complexity, network science, control theory, machine learning, and multi-agent systems. He has published over 100 peer-reviewed papers in top scientific journals and conference proceedings. He authored Design and Control of Swarm Dynamics (Springer, 2016). He received his PhD in computational science from École polytechnique fédérale de Lausanne (EPFL) in Switzerland, for which he was awarded the ERCOFTAC (European Research Community On Flow, Turbulence and Combustion) Da Vinci Award Silver Medal in 2007 and the IBM Research Prize in Computational Sciences the following year.

Sun Sun Lim

Singapore Management University

Sun Sun Lim is vice president, partnerships and engagement, at the Singapore Management University, where she is concurrently professor of communication and technology at its College of Integrative Studies. She authored Transcendent Parenting – Raising Children in the Digital Age (Oxford University Press, 2020) and co-edited The Oxford Handbook of Mobile Communication and Society (Oxford University Press, 2020). She serves on the boards of the Social Science Research Council, the Singapore Environment Council, the Media Literacy Council, and eleven international journals. She was named to the inaugural Singapore 100 Women in Tech list in 2020 and is fellow of the International Communication Association. From 2018-20, she served as a nominated member of the Parliament of Singapore, where she advocated for more responsible use of artificial intelligence, transparency in data sharing, greater digital inclusion, and enacting digital rights for children.