CENTRE FOR SECURITY STUDIES | **ISSUE BRIEF**

OCTOBER 2022

Tracking American Critical Technology Transfer and Allied Concerns

Arshdeep Singh Dutt

Edited By: Divyashree Jha

About the author

Arshdeep Singh Dutt is an undergraduate student at the Jindal School of International Affairs and a Research Intern at the Centre for Security Studies, JSIA.

About the Centre for Security Studies

The Centre for Security Studies (CSS) was established in 2020 as the Jindal School of International Affairs' first student-run research centre under the aegis of Prof Dr Pankaj K Jha. Researchers at CSS – through in-depth analysis briefs and events, reports, policy briefs and print publications – explore both regional and thematic topics in the broader field of international security studies. The concept of international security has been expanded to reflect not merely the study of state security, but also include topics like ethnic, sectarian and religious conflict; civil wars and state failure; cyber and space warfare; resource related security issues; the proliferation of weapons of mass destruction; defence economics and also the role of ethics or morality in the formulation of security policies. The complexity of these matters is what the Centre for Security Studies attempts to unfold. Please refer to www.cssjsia.com for further details, and follow the Centre's social media platforms for critical news and research updates:


www.linkedin.com/company/jindal-centre-for-security-studies/


www.instagram.com/css_jsia/


https://twitter.com/Css_Jsia

Get in touch with us through email: css@jgu.edu.in

Important disclaimer

IB2210008

INTRODUCTION

In the 22 years of the 21st century, the world stands as a witness to the process of a changing world order. The United States of America today is faced by China – a consequence of sheer ignorance by the US during the cold war period on China's practices and malpractices regarding technology transfer, and the fact that present law infrastructure is not up to date with current realities. This issue of technology transfer is ever more relevant than in the past and will remain relevant as its role increases in the coming future. Artificial Intelligence, Quantum Computing, Biogenetics, Nanotechnology, etc., are some dual-use technologies that nations are competing to achieve superiority in, and are willing to resort to measures licit or illicit to obtain a competitive advantage. Putting this narrative in perspective of the current geopolitical realities – the Russia-Ukraine crisis has encouraged nations to heighten their investment in developing and protecting critical technologies.

This paper aims to detail technology transfer and its accompanying features, the meaning of critical technology in America, American foreign policy on technological transfer, and, currently, America's greatest concern concerning critical technology transfer – China and its role in obtaining foreign technologies.

DEFINING TECHNOLOGY AND UNDERSTANDING TECHNOLOGY TRANSFER

Technology, since the beginning of civilisation, has accompanied human progress throughout the ages. Now, it is regarded as one of the defining factors in enabling a nation to pursue its national interest, and in maintaining superiority over other allied and non-allied actors. Technology is a

keyword in our world, yet it is also one of the most confusing.[1] It is usually defined in terms of an end product or the form of know-how of an end product it can be best defined in conjunction with science. John Granger in his work *Technology and International Relations* understands science as a "body of verifiable knowledge and an associated conceptual framework that attempts to structure the observable features to the material world and to predict the outcome of observations and experiments yet to be conducted"[2] and technology as "action-oriented, concerned with doing things, solving practical problems, the creation of goods and services that are marketable in the commercial sense or the sense that they fill the perceived needs of nations as a whole"[3].

This means that while the science on one hand is guided by academic ambition and exploration, technology is more of a practical response to existing problems and opportunities in the world. Understanding the symbiotic relationship between science and technology, governments invest in both academics and research, as well as industry and innovation. In case one of the two mentioned factors is neglected, technological progress is also hampered. Taking the case of Latin American countries, in the case of academia, they traditionally did not focus on vocational subjects and therefore lagged behind their counterparts globally, until the recent decades.[4]

Technology in the field of international relations made its entry prominent in the 20th century. The two world wars boosted the link between international affairs, and science and technology. This was further consolidated by the nuclear powers and the politics of deterrence.[5] It again obtained the spotlight because of the US-China trade war in 2018 and the following issues surrounding Taiwan and the world semiconductor industry today – to name a few.

---

[1] Jon Agar (2020) What is technology? Annals of Science, 77:3, 377-382, DOI: 10.1080/00033790.2019.1672788

[2] Granger, John V. Technology and International relations. San Francisco, W.H. Freeman and Company, 1979. Pg. 9. https://archive.org/details/technologyintern0000gran_h9n3/page/8/mode/2up

[3] Ibid Pg. 10.

[4] Galhardi, Regina. Modernization in vocational education and training in the Latin American and the Caribbean Region, 2001. https://www.ilo.org/skills/pubs/WCMS_104019/lang--en/index.html

[5] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986.

Following this entry, two seemingly paradoxical views on technology came about on its role in world politics. The first view places technology as a facilitator for increased cooperation and interdependence among nations, whereas the second view places technology as a facilitator for greater power politics among nations. While both perspectives hold credibility to a given extent, it is important to note that in this case, interdependence and cooperation, and on the other hand, power politics – are part of the same coin. This can largely be determined by the technological gap as well as the economic gap between the concerned parties.

Those nations with higher gaps are bound to be exploited by technologically advanced nations. One can see the case of the relation of the North to the South wherein the North exploits the South's cheap labour, all the while allowing for minimal development in the given region[6] – such is what happens with MNCs particularly[7]. Whereas on the flip side, west-west trading is based more on even grounds and they are, therefore, able to reap the fruits of the free market and the accompanying competition. Chances of cooperation in this kind of interdependence are more as the concerned parties are on a similar footing in technology and economy wise.

HOW DOES TECHNOLOGY TRANSFER TAKE PLACE?

The process of technology transfer is a "complex process that includes not only the ongoing creation, transmission, and reception of technical artefacts as end products but also the creation, transmission, and reception of "disembodied" technical concepts and designs or the productive

[6] Hickel, Jason., The Divide: A Brief Guide to Global Inequality and its Solutions, Part One, Chapter 1.

[7] Aisbett, Emma. Harrison, Ann E. Levine, David I. and Silver, Jed., Do MNCs Exploit Foreign Workers? 2019. https://www.brookings.edu/wp-content/uploads/2019/12/Aisbett-et-al._Brookings-draft-2019.11.26_Harrison.pdf

know-how required to create technical artefacts. When the parties involved are sovereign nation-states, the process becomes even more sensitive and complex."[8]

To make the process of technology transfer more digestible, Melvin Kranzberg understands technology as knowledge and then goes on to introduce a typology of technology transfer wherein he divides technology transfer into three categories; material transfer, design transfer, and capacity transfer.[9]

Material transfer refers to the type of technology transfer wherein one country exports the finished product to the importing country. These types of transfers do not involve the transfer of any kind of knowledge. The importing country is incapable of reproducing the transferred technology. Design transfers are wherein technology is transferred mainly through the design elements – books, blueprints, formulas, etc. The recipient country, in this case, begins to produce the goods domestically that it earlier imported through material transfer, however, it still lacks the expertise to make any kind of advancements, and therefore is dependent on the exporting nation. Capacity transfer primarily involves transferring technical knowledge and technical expertise. This not only allows the recipient nation to domestically produce the goods but also improves them to sustain innovation and self-reliance.

Technology transfer also depends on the receptivity of the recipient country. Take the case of Japan and the Soviet Union and their import of tractors as a part of the modernisation of their agriculture[10]: -

In 1924, only about 1000 tractors were operating in the Soviet Union. A decade later that number rose to 200,000, while the Soviet Union was producing the tractors indigenously as well. In 1924 it only produced 17 tractors, by 1934 it produced 100,000 – this is an example of design transfer,

[8] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986. Pg. 25
[9] Ibid Pg. 32
[10] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986. Pg. 35-37

and here also, in a study of western technology and Soviet development, Anthony C. Sutton traced various types of Soviet models to western origin[11]. This means that they scaled up production however they did not innovate.

In the case of Japan, there were almost no tractors in the 1940s however by 1955 there were 89,000, by 1960, 517,000, and over 2,500,000 by 1965. The Japanese first started importing small-sized tractors in order to, just like the Russians, transfer design. However, not many tractors were in use. This was due to the fact that the tractor was not suited to Japan's farms. And so, the Japanese studied and adapted these tractors to meet their needs – which reflects capacity transfer.

HOW DID TECHNOLOGIES BECOME "CRITICAL" IN AMERICA?

There are many terms, used interchangeably, that are used to describe technologies that hold importance in terms of their consequence towards a nation's economy, and national security – such as sensitive technology, high technology, critical technology, advanced technology, etc. – with a certain nuance to each of them. For this paper, we will be focusing on the term 'critical' as it has been consistently produced in many United States Government (USG) laws and acts. The following is a brief overview of the evolution of critical technology.

The term "critical" in critical technology has its origin in military planning wherein the term critical was used in conjunction with "strategic" in planning for interruption of the supply of important materials such as copper or aluminium during wartime.

[11] Sutton, A.C. Western Technology and Soviet Economic Development, 1917-1930. Stanford, California: Hoover Institution, 1968: https://archive.org/details/Sutton--Western-Technology-1917 1930/page/n6/mode/1up?view=theater

With war looming ahead, the Strategic and Critical Material Act of 1939, posited that since the US did not have certain critical materials, and therefore it should aim to not be too dependent on any particular nation as it would be a costly dependence during times of national crisis. Then in 1952, the Paley commission recommended stockpiling 74 critical materials on the national stockpiling list. Furthermore, in 1972, the National Materials Policy Commission used the term "critical" when reporting on the "federal stockpile of strategic and critical materials". By the 1970s, this interpretation has entered the English language. The Webster's Third New International Dictionary describes critical as "essential for conduct of war but available in short supply, as in critical materials".[12]

Over the next decade, in 1984, the department of defence released a Militarily Critical Technology list that identified technologies crucial to defence systems. Following that year, the amendments to the export administration control act, the congress authorised the pentagon to control certain critical technologies. In 1987, the department of commerce produced a document to find ways to reduce barriers to critical technologies, which came to be called the commercial critical technology list. This added an economic dimension to critical technology. In 1989 the Pentagon's first annual critical technology plan talked about the use of several dual-use technologies. By the 1990s, many reports on critical technology have been released, and they included contributions to the economy, the environment, the quality of life, energy security, and so on. [13]

[12] Bimber, Bruce A. and Steven W. Popper, What is a Critical Technology? Santa Monica, CA: RAND Corporation, 1994. https://www.rand.org/pubs/drafts/DRU605.html.
[13] Ibid Pg. 5-8

US FOREIGN POLICY REGARDING CRITICAL TECHNOLOGY TRANSFER

When it comes to American foreign policy regarding technology transfer, it can be divided into three sections largely; the North-South, the West-West, and the East-West. As Henry R. Nau puts it, "International technology transfer serves multiple objectives in U.S. foreign policy. It has important consequences for the East-West military balance and deterrence, for North-North economic relations and industrial competitiveness, and for North-South development cooperation and humanitarian goals".[14] While the each of the three dimensions involve the use of critical technology one way or another, the focus will primarily be on the East-West relations as it is the most relevant, given the security concerns.

The United States, post-world war two, in the 1950s and 1960s, emerged as a technological superpower. Major advances were made in technology at a pace that would render the previous one obsolete before its useful life expired. Technology was viewed as just another product in the production process to be sold off for relatively short-term goals, in contrast to the view that it is the resource that builds capacity. [15] The former view was further exemplified by the fact that other industrialised nations were nowhere near the American standard of technological development.

During this period, it was also relatively easy for the US to restrain technology transfer to the USSR and its Comecon allies (Council for Mutual Economic Assistance). Critical technologies of military significance like those of aerospace, electronics, and nuclear applications were centered in the US and there wasn't any conflict between the US and USSR over trade controls, given the minimal quantity of trade at the time.[16]

---

[14] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986. Pg. 61

[15] Bucy, J. Fred. "On Strategic Technology Transfer to the Soviet Union." *International Security* 1, no. 4 (1977): 25–43. https://doi.org/10.2307/2538620.

[16] Ibid Pg. 27

The economic relations between both the USSR and the US soon began taking off due to President Nixon's *Détente* policy, which was subsequently carried on by his successor President Gerald Ford. To give an idea, the volume of trade between the two power was 50 million USD in the 1950s, and during 1960-68 trade was below 110 million USD per year – with the exception of 1964 when trade was 164 million USD. Trade started quickly rising from 1969 with a turnover of 177 million and it grew to 462 million USD in 1972 and 1500 million USD in 1973[17]. Naturally, technological cooperation also increased – the US export of machinery to the USSR in 1971 was worth 239 million USD worth of plant and equipment and 465 million USD worth in 1972.[18] However, critical technology was still closely monitored.

In the late 1970s and from the early 1980s, with President Ronald Reagan at the helm – the ongoing US foreign policy towards the USSR turned hard-line again. This is due to the fact that the technological gap between the Soviets and Americans was closing rapidly, in weapons and power projection. The policies introduced by the Reagan administration were an important turning point as they revived the defence and space technology development, and tightened the existing technology flows over to the USSR. Reagan also tried to put in stricter measures with the Ottawa Summit in 1981 to tighten COCOM controls – which did not come to fruition.

The period from 1990-2010 was characterised by absolute American hegemony as the Soviet Union collapsed, and no state actor was left to challenge the US. Therefore, the US began extending its influence and maintaining control over technology transfer, the Wassenaar Arrangement came to the fore in 1996. US foreign policy was now geared towards expanding its commercial interests across the world. Security and transfer of critical technology were not much of a prevalent issue. The 9/11 attack in 2001 called for the US to focus its attention on non-state actors and therefore the US also made sure that critical technologies are not trafficked to such

[17] Levine, Herbert S. "An American View of Economic Relations with the USSR." *The Annals of the American Academy of Political and Social Science* 414 (1974): 1–17. http://www.jstor.org/stable/1041188.
[18] Ibid Pg. 3

actors. Around the late 2000s, China's meteoric rise also made it into the limelight and by implication – its relations with the US.

From the early 2010s till the present, China emerges as a rival to the US which forced the US to revisit its policy relating to China. During his tenure, President Trump viewed Chinese trade and investment practises as exploitative and harmful to US national security, and consequently, started a trade war with China in 2018 with the FIRRMA *(Foreign Investment Risk Review Modernization Act)* upon the existing ITAR (International Traffic in Arms Regulation) and EAR (Export Administration Regulations). Currently, the US is attempting to enforce stricter measures on various exports to the Chinese, the latest development being the ban on advanced American semiconductor chips to China.[19]

MULTILATERAL EXPORT REGIMES

Scholars have long advocated for cooperation in the field of technology exports for several reasons[20] and to that end, there are a number of Multilateral Export Control Regimes that the US has either led earlier or leads today.[21]

The Coordinating Committee on Multilateral Export Controls (COCOM) was founded in 1950– a non-treaty organisation of NATO, also known as the economic arm of NATO, comprising 17 members including Japan. Within COCOM, items were generally divided into three lists –

[19] Fima, Zev., "U.S. export restrictions of powerful chips to China hurt now, but prove bullish long term". CNBC. November 21, 2022. https://www.cnbc.com/2022/11/21/us-export-restrictions-of-powerful-chips-to-china-hurt-now-but-should-prove-bullish-long-term.html

[20] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986 Pg. 151

[21] U.S. Department of Commerce, Bureau of Industry and Security. "Multilateral Export Control Regimes". https://www.bis.doc.gov/index.php/policy-guidance/multilateral-export-control-regimes

International Munitions List (IML), the International Atomic Energy List (IAEL), and the International (industrial) List (IL) on dual-use technology[22]. Technologies under these lists were considered strategic and would aid the Soviet military in one way or another and therefore were completely banned from the reach of the USSR and its allies.

Following the disbandment of the COCOM in 1994, as the cold war's export regime needed a change, the international community soon followed up with the Wassenaar Arrangement on Export Control for Conventional Arms and Dual-use Technologies established in 1996. The main difference with this is that the Wassenaar agreement is that it is inclusive of the Warsaw Pact nations and the non-existence of the veto power of any individual nation over an organisational decision, unlike COCOM.[23]

There is the Nuclear Suppliers Group, initially known as the London Club, that was informally founded in 1974 in response to India's operation Smiling Buddha[24] and attempts by some nations to obtain nuclear arms.[25] Consisting of a group of nuclear supplier countries, the main aim of this group is to prevent nuclear proliferation by seeking to control the exports of materials and equipment used for manufacturing nuclear arsenals.[26]

---

[22] Cupitt, Richard T., and Suzette R. Grillot. "COCOM Is Dead, Long Live COCOM: Persistence and Change in Multilateral Security Institutions." *British Journal of Political Science* 27, no. 3 (1997): 361–89. http://www.jstor.org/stable/194122.

[23] U.S. Department of State, Archive. "Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies". https://1997-2001.state.gov/global/arms/np/mtcr/000322_wassenaar.html

[24] Burr, William. The Making of the nuclear Suppliers Group, 1974-76. Wilson Center. https://www.wilsoncenter.org/publication/the-making-the-nuclear-suppliers-group-1974-1976

[25] Strulak, Tadeuz. "The Nuclear Suppliers Group", *The Nonproliferation Review/Fall* 1993. https://www.nonproliferation.org/wp-content/uploads/npr/strula11.pdf

[26] Nuclear Suppliers Group website, "About the NSG". https://www.nuclearsuppliersgroup.org/en/about-nsg

The Australia Group was established in 1985 in response to the use of chemical weapons in the Iran-Iraq war – of which some materials were obtained through legitimate trading channels. Violating the 1925 Geneva Protocol, in 1984, individual countries went on to put export control on items that could be used for making chemical weapons. As these controls lacked uniformity, and that attempts had been made to circumvent this. This led Australia to propose a meeting regarding the same in Brussels in 1985. Today, the Australia Group has put agents and materials related to biological and dual-use agents/materials as well.[27]

The Missile Technology Control Regime (MTCR) was established in 1987 by the G7 nations and it aims to control the exports of goods and technology that could contribute to the delivery systems of weapons of mass destruction (WMDs) in order to prevent the proliferation of the same.[28]

Lastly, there is also the US-led Proliferation Security Initiative (PSI). This initiative was launched in May 2003 to put a stop to the trafficking of WMDs, their delivery systems, and related materials from both state and non-state actors. The PSI stemmed from the US National Strategy to combat weapons of mass destruction which was issued in December 2002.[29]

It is important to note that none of the above multilateral export control regimes are legally binding to any nation, however exporting critical technology, or strategic good in general invites international backlash and criticism. Take the case of Japan's Toshiba-Kongsberg Incident wherein in 1981, the Toshiba Machine Company and Kongsberg Vaapenfabrik started exporting advanced machinery and equipment to the USSR – which was a violation of the regulations in

[27] Australia's Department of Foreign Affairs and Trade (*DFAT*) website "The Australia Group" https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/index.html

[28] Missile Technology Control Website, "Frequently asked questions (FAQs)". https://mtcr.info/frequently-asked-questions-faqs/

[29] Bureau of International security and non-proliferation, U.S. Department of State. "About the Proliferation Security Initiative". March 2019. https://www.state.gov/about-the-proliferation-security-initiative/

COCOM. This export of technology later translated into soviet submarines which became quieter and therefore, more difficult to track.[30]

While multilateral mechanisms are important and necessary for coordinated export control, however, this is not always the case, such deliberations can lead to stalling efforts, given the different geopolitical dispositions of each nation. If we look at the example of Huawei, the telecommunications equipment manufacturer based out of China[31]. We can see that after the US added it to the entity list in the EAR, other nations soon followed suit.

CHINA AND TECHNOLOGY TRANSFER: A BACKGROUND

With regards to technology transfer, those nations who are unable to require certain technology resort to clandestine practises and manipulative economic policies. Nazak Nikakhar, who formerly worked in the US department of commerce remarked on China's actions as "predatory economic practices" and also emphasised how China has been blatantly violating the 2015 bilateral commitment where it vowed not to steal and misappropriate US intellectual property [32]. In order to understand how China ended up where it has today, one needs to dive into Sino-US relations during the cold war, particularly after 1979, when China opened up its market to the world and

[30] King's College London, "The Toshiba-Kongsberg case", News Centre. https://www.kcl.ac.uk/news/the-toshiba-kongsberg-case

[31] "Explainer: The U.S. export rule that hammered Huawei teed to hit Russia", January 2022. Reuters. https://www.reuters.com/business/us-export-rule-that-hammered-huawei-teed-up-hit-russia-2022-01-24/

[32] Nikakhtar, Nazak. Testimony Before the United States-China Economic and Security Review Commission. March 19, 2021. https://www.uscc.gov/sites/default/files/2021-03/Nazak_Nikakhtar_Testimony.pdf Pg. 1 and Pg. 6 of the attached statement

President Jimmy Carter granted China full diplomatic recognition while acknowledging China's One-China principle.[33]

Denis Fred Simon writes in his work *The Technology Issue in Sino-US Relations (1986)*[34] about how

> *"Those inside and outside of the U.S. government who remain unconvinced of the long-term intentions of China question whether the United States should be more forthcoming with the Chinese. Specifically, should a sudden souring of Sino-U.S. relations occur, it would be extremely difficult, if not impossible, to turn off rapidly the technology valve that has been opened so wide since 1980"*

According to a congress report on China's economic rise[35], the two factors that enabled the same were large-scale capital investment and rapid productivity growth. Foreign investments have been an integral part of the latter and play a major role in facilitating technology transfer.

In addition to improving and readjusting its economy, China also modified its technology acquisition strategy. The following were the four main errors in obtaining technology earlier identified by the Chinese in their magazine *Hongqi*: (a) reliance on the imports of complete plant and equipment; (b) general duplication of imports; (c) tendency of importing items without having

[33] U.S.-China Relations 1949-2022, Council on Foreign Relations. https://www.cfr.org/timeline/us-china-relations

[34] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986 Pg. 241-242

[35] Congressional Research Service., "China's Economic Rise: History, Trends, Challenges, and Implications for the United States". June 25, 2019. https://sgp.fas.org/crs/row/RL33534.pdf

adequate knowledge of how they function and their maintenance; and (d) failure to sufficiently analyse imported technology to understand and diffuse it to other sectors[36]

In this case, material transfer was taking place which meant no real technology transfer was taking place. Therefore, the Chinese changed their strategy by stressing the need to import and cultivate "intangible" forms of technology - which essentially is a capacity transfer: (a) advanced management methods; (b) new skills and scientific rules of operation; (c) new design principles; (d) new and sophisticated materials; and (e) select advanced equipment and components[37]

There were several signs of issues with the Chinese that were prevalent earlier, however, the US ignored them despite their possible consequences – which it is facing now. An obvious instance of this can be the civil industry, military industry, and R&D overlap in China which may facilitate unwanted technology transfers, making the export of dual-use technology very risky, and this poses even more of a risk as China is unwilling to accept end-use controls on the use of imported items[38]

[36] China Report., "Red Flag". Foreign Broadcast information service. 16 December 1982. https://www.bannedthought.net/China/Magazines/Hongqi-Revisionist/1982/RF1982-24-JPRS-English.pdf

[37] McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986 Pg. 46

[38] Simon, D. F. "Technology for China: Too Much Too Fast?" Technology Review (October 1984b)

TECHNOLOGY TRANSFER WITH CHINA TODAY

There are a number of ploys that the Chinese have put into action to acquire foreign technology either legally or illegally.[39] These are mainly in the form of: -

1. **Buying Foreign technology** – This includes importing weapons systems or their components, mainly to create the foundation for developing indigenous capabilities.
2. **Administrative Requirements in China** – To conduct business in China, companies are required to disclose their intellectual property which means a transfer of foreign knowledge to Chinese authorities.
3. **Investing in Overseas firms -** China encourages investment in firms that are specialising in the research and manufacture of several critical and advanced technologies.
4. **Utilising Human Resources** – China, in exchange for a significant benefit, attracts experts from western nations like the US to do research and share knowledge. China also sponsors research and academic collaborations to get access to important research.
5. **Stealing technology** – Either through cyber warfare[40] or espionage[41]

[39] Tenyotkin, Rose. Herlevi, April. Kaufman, Alison and Miller, Anthony., Economic Statecraft: How China Legally Accessess Foreign Technologies to Build Military Capabilities. Center for Naval Analysis, June 2020. https://www.cna.org/reports/2020/08/DRM-2020-U-027240-1Rev.pdf

[40] "Significant Cyber Incidents"., Center for Strategic & International Studies. https://www.csis.org/programs/strategic-technologies-program/significant-cyber-incidents

[41] Giglio, Mike., "China's Spies are on the Offensive: China's spies are waging an intensifying espionage offensive against the United States. Does America have what it takes to stop them?". The Atlantic. August 26, 2019. https://www.theatlantic.com/politics/archive/2019/08/inside-us-china-espionage-war/595747/

6. **Circumventing US export laws** – By using shell companies, or third-party entities, China is exploiting loopholes in American laws. Furthermore, laws themselves are not enforced properly.[42]

All of the above Chinese practises and malpractices can be found documented under the update on section 301 investigative report on "China's Acts Policies and practises related to technology transfer, intellectual property and innovation" November 2018.[43]

An example of the transfer of critical technology is related to the hypersonic missile program of the PRC. It was reported that China obtained access to US-made software and technology in hypersonic weapon research as a Chinese firm sold it despite US export controls being active – which aided the Chinese military in making advances in military weaponry and filling some domestic gaps in domestic technology.[44]

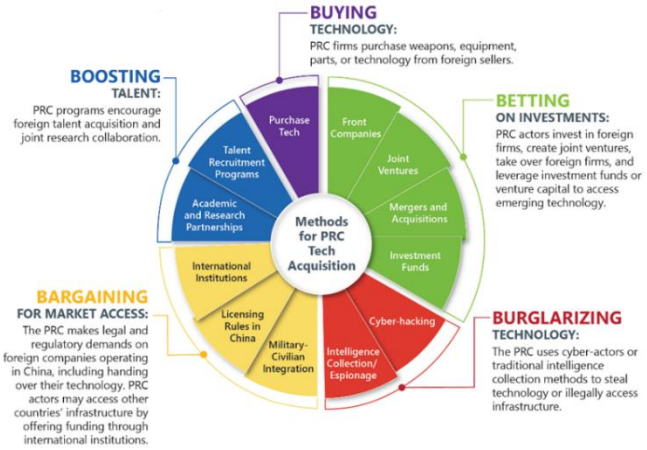

Figure 1:The 5Bs Model on how China Accesses Foreign technology –

https://www.cna.org/our-media/newsletters/intersections

[42] Nikakhtar, Nazak. Testimony Before the United States-China Economic and Security Review Commission. March 19, 2021. https://www.uscc.gov/sites/default/files/2021-03/Nazak_Nikakhtar_Testimony.pdf

[43] https://ustr.gov/sites/default/files/enforcement/301Investigations/301%20Report%20Update.pdf

[44] https://www.washingtonpost.com/national-security/2022/10/17/china-hypersonic-missiles-american-technology/

CONCLUSION

To put China's position into perspective, China exports to America, 80% of its critical minerals[45], 20-23% of its semiconductor chips[46], 60% of its consumer electronics including telecommunications equipment[47], 75% of its lithium-ion battery cells[48], and many pharmaceuticals and medical supplies.[49] Taiwan exports 92% of its advanced semiconductor chips to the US.[50]

Furthermore, when it comes to transitioning to greener energy, it is seen that China dominates the new energy supply chains which are inclusive of both extraction and processing of the materials. China has immense influence and control over the global supply chains, and its share is usually more than reported.[51] See Figure 2 for reference.

[45] U.S. Department of Commerce., "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." https://www.commerce.gov/sites/default/files/2020-01/Critical_Minerals_Strategy_Final.pdf

[46] https://www.semiconductors.org/wp-content/uploads/2021/05/BCG-x-SIA-Strengthening-the-Global-Semiconductor-Value-Chain-April-2021_1.pdf

[47] Ibid Pg. 28

[48] Thompson, Gavin., "Batteries with Chinese Characteristics: China's control of raw materials supply chains risks leaving others standing". Wood Mackenzie. February 10, 2021. https://www.woodmac.com/news/opinion/batteries-with-chinese-characteristics/

[49] Huang, Yanzhong., "U.S. Dependence on Pharmaceutical Products From China". Council on Foreign Relations. August 14, 2019. https://www.cfr.org/blog/us-dependence-pharmaceutical-products-china

[50] U.S. Department of Commerce., "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." https://www.commerce.gov/sites/default/files/2020-01/Critical_Minerals_Strategy_Final.pdfPg. 5

[51] Fannon, Frank., "A Roadmap for Winning the Energy Transition". Krach Institute for Tech Diplomacy at Purdue. June 9, 2022. https://techdiplomacy.org/reports-case-studies/a-roadmap-for-winning-the-energy-transition/ Pg. 9

Therefore, decoupling from China will not be an easy job. Unlike the Soviet Union-US dynamic wherein both the powers are rather detached from each other along with their allies, China and the US are interlinked to each other, and the allies, in this case, are not properly delineated as well. Taking the case of Israel, one of the most technologically advanced nations in the world wherein China has taken the opportunity to invest and innovate[52]

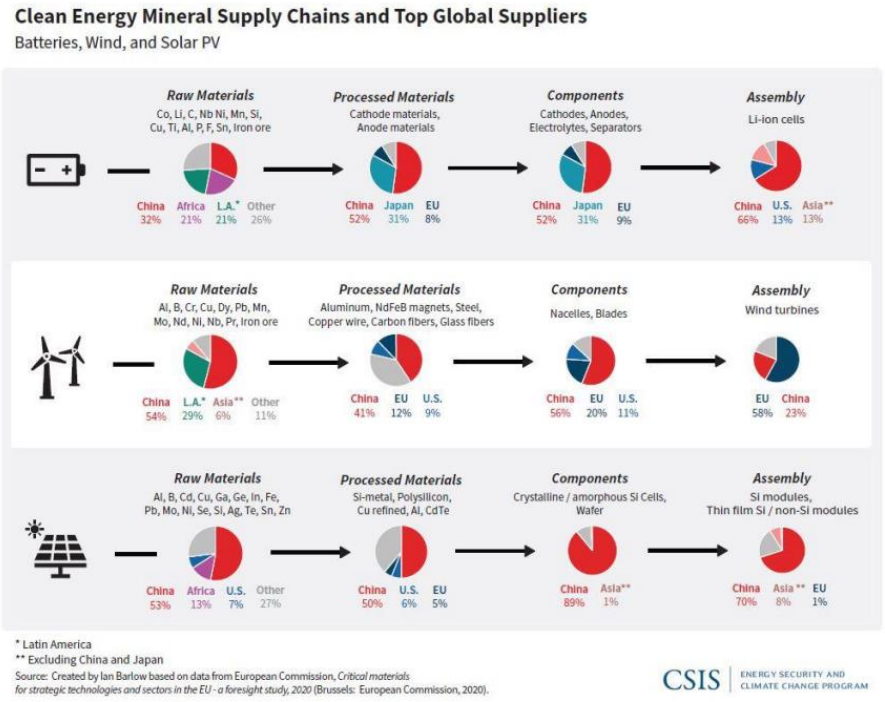

Figure 2: Shares of the global clean energy mineral supply chains controlled by China (Red)
https://www.csis.org/analysis/geopolitics-critical-minerals-supply-chains

[52] Schanzer, Jonathan. Efron, Shira. Martjin, Rasser and Hickson, Alice., "Aligning U.S.-Israeli Cooperation on technology Issues and China". Center for New American Security. March 9, 2022. https://www.cnas.org/publications/reports/aligning-u-s-israeli-cooperation-on-technology-issues-and-china

It is imperative for the US to act to align its objective with allied nations for better cooperation, just like how the US has imposed limitations on the export of semiconductors[53], the new export control regulation adopted by the EU[54], amendment to the Investment Canada Act[55] and action is taken to divest three critical minerals companies by the Canadian government.[56]

Given that this decoupling has already started occurring, it is only a matter of time before decoupling happens, though it will take a decade or so[57], the Chinese will need to act swiftly within this decade to make use of its dominance over world supply chains, whereas the US will need to act swiftly to minimise its enormous losses if in case both the powers clash intensely.

[53] Nikakhtar, Nazak. Testimony Before the United States-China Economic and Security Review Commission. March 19, 2021. https://www.uscc.gov/sites/default/files/2021-03/Nazak_Nikakhtar_Testimony.pdf

[54] REGULATION (EU) 2021/821 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. May 20, 2021 https://eur-lex.europa.eu/eli/reg/2021/821

[55] Government of Canada. "An Overview if the investment Canada Act (FAQs)" Frequently asked questions. https://ised-isde.canada.ca/site/investment-canada-act/en/frequently-asked-questions

[56] Government of Canada. "Government of Canada orders the divestiture of investments by foreign companies in Canadian critical minerals companies". November 2, 2022. https://www.canada.ca/en/innovation-science-economic-development/news/2022/10/government-of-canada-orders-the-divestiture-of-investments-by-foreign-companies-in-canadian-critical-mineral-companies.html

[57] Nikakhtar, Nazak. Testimony Before the United States-China Economic and Security Review Commission. March 19, 2021. https://www.uscc.gov/sites/default/files/2021-03/Nazak_Nikakhtar_Testimony.pdf Pg. 11

BIBLIOGRAPHY

- "Explainer: The U.S. export rule that hammered Huawei teed to hit Russia", January 2022. Reuters. https://www.reuters.com/business/us-export-rule-that-hammered-huawei-teed-up-hit-russia-2022-01-24/
- "Significant Cyber Incidents"., Center for Strategic & International Studies. https://www.csis.org/programs/strategic-technologies-program/significant-cyber-incidents
- Aisbett, Emma. Harrison, Ann E. Levine, David I. and Silver, Jed., Do MNCs Exploit Foreign Workers? 2019. https://www.brookings.edu/wp-content/uploads/2019/12/Aisbett-et-al._Brookings-draft-2019.11.26_Harrison.pdf
- Australia's Department of Foreign Affairs and Trade (*DFAT*) website "The Australia Group" https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/index.html
- Bimber, Bruce A. and Steven W. Popper, What is a Critical Technology? Santa Monica, CA: RAND Corporation, 1994. https://www.rand.org/pubs/drafts/DRU605.html.
- Bucy, J. Fred. "On Strategic Technology Transfer to the Soviet Union." *International Security* 1, no. 4 (1977): 25–43. https://doi.org/10.2307/2538620.
- Bureau of International security and non-proliferation, U.S. Department of State. "About the Proliferation Security Initiative". March 2019. https://www.state.gov/about-the-proliferation-security-initiative/
- Burr, William. The Making of the nuclear Suppliers Group, 1974-76. Wilson Center. https://www.wilsoncenter.org/publication/the-making-the-nuclear-suppliers-group-1974-1976
- Cadell, Cate and Nakashima, Ellen., American technology boosts China's hypersonic missile program. The Washington Post. October 17, 2022. https://www.washingtonpost.com/national-security/2022/10/17/china-hypersonic-missiles-american-technology/
- China Report., "Red Flag". Foreign Broadcast information service. 16 December 1982. https://www.bannedthought.net/China/Magazines/Hongqi-Revisionist/1982/RF1982-24-JPRS-English.pdf
- Congressional Research Service., "China's Economic Rise: History, Trends, Challenges, and Implications for the United States". June 25, 2019. https://sgp.fas.org/crs/row/RL33534.pdf
- Cupitt, Richard T., and Suzette R. Grillot. "COCOM Is Dead, Long Live COCOM: Persistence and Change in Multilateral Security Institutions." *British Journal of Political Science* 27, no. 3 (1997): 361–89. http://www.jstor.org/stable/194122.

- Fannon, Frank., "A Roadmap for Winning the Energy Transition". Krach Institute for Tech Diplomacy at Purdue. June 9, 2022. https://techdiplomacy.org/reports-case-studies/a-roadmap-for-winning-the-energy-transition/
- Fima, Zev., "U.S. export restrictions of powerful chips to China hurt now, but prove bullish long term". CNBC. November 21, 2022. https://www.cnbc.com/2022/11/21/us-export-restrictions-of-powerful-chips-to-china-hurt-now-but-should-prove-bullish-long-term.html
- Galhardi, Regina. Modernization in vocational education and training in the Latin American and the Caribbean Region, 2001. https://www.ilo.org/skills/pubs/WCMS_104019/lang--en/index.html
- Giglio, Mike., "China's Spies are on the Offensive: China's spies are waging an intensifying espionage offensive against the United States. Does America have what it takes to stop them?". The Atlantic. August 26, 2019. https://www.theatlantic.com/politics/archive/2019/08/inside-us-china-espionage-war/595747/
- Government of Canada. "An Overview if the investment Canada Act (FAQs)" Frequently asked questions. https://ised-isde.canada.ca/site/investment-canada-act/en/frequently-asked-questions
- Government of Canada. "Government of Canada orders the divestiture of investments by foreign companies in Canadian critical minerals companies". November 2, 2022. https://www.canada.ca/en/innovation-science-economic-development/news/2022/10/government-of-canada-orders-the-divestiture-of-investments-by-foreign-companies-in-canadian-critical-mineral-companies.html
- Granger, John V. Technology and International relations. San Francisco, W.H. Freeman and Company, 1979. https://archive.org/details/technologyintern0000gran_h9n3/page/8/mode/2up
- Hickel, Jason., The Divide: A Brief Guide to Global Inequality and its Solutions. Windmill Books, London. 2018
- Huang, Yanzhong., "U.S. Dependence on Pharmaceutical Products From China". Council on Foreign Relations. August 14, 2019. https://www.cfr.org/blog/us-dependence-pharmaceutical-products-china
- Jon Agar (2020) What is technology? Annals of Science, 77:3, 377 382, DOI: 10.1080/00033790.2019.1672788
- King's College London, "The Toshiba-Kongsberg case", News Centre. https://www.kcl.ac.uk/news/the-toshiba-kongsberg-case
- Levine, Herbert S. "An American View of Economic Relations with the USSR." *The Annals of the American Academy of Political and Social Science* 414 (1974): 1–17. http://www.jstor.org/stable/1041188.

- McIntyre, John R. and Papp, Daniel S., The Political Economy of International Technology Transfer. Westport, Connecticut: Quorum Books, 1986.
- Missile Technology Control Website, "Frequently asked questions (FAQs)". https://mtcr.info/frequently-asked-questions-faqs/
- Nakano, Jane., "The Geopolitics of Critical Minerals Supply Chains". Center for Strategic & International Studies. March 11, 2021. https://www.csis.org/analysis/geopolitics-critical-minerals-supply-chains
- Nikakhtar, Nazak. Testimony Before the United States-China Economic and Security Review Commission. March 19, 2021. https://www.uscc.gov/sites/default/files/2021-03/Nazak_Nikakhtar_Testimony.pdf
- Nuclear Suppliers Group website, "About the NSG". https://www.nuclearsuppliersgroup.org/en/about-nsg
- Office of the United States Representative Executive Office of the President., UPDATE CONCERNING CHINA'S ACTS, POLICIES AND PRACTICES RELATED TO TECHNOLOGY TRANSFER, INTELLECTUAL PROPERTY, AND INNOVATION., November 20, 2018. https://ustr.gov/sites/default/files/enforcement/301Investigations/301%20Report%20Update.pdf
- REGULATION (EU) 2021/821 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. May 20, 2021 https://eur-lex.europa.eu/eli/reg/2021/821
- Schanzer, Jonathan. Efron, Shira. Martjin, Rasser and Hickson, Alice., "Aligning U.S.-Israeli Cooperation on technology Issues and China". Center for New American Security. March 9, 2022. https://www.cnas.org/publications/reports/aligning-u-s-israeli-cooperation-on-technology-issues-and-china
- Simon, D. F. "Technology for China: Too Much Too Fast?" Technology Review (October 1984b)
- Strulak, Tadeuz. "The Nuclear Suppliers Group", *The Nonproliferation Review/Fall* 1993. https://www.nonproliferation.org/wp-content/uploads/npr/strula11.pdf
- Sutton, A.C. Western Technology and Soviet Economic Development, 1917-1930. Stanford, California: Hoover Institution, 1968. https://archive.org/details/Sutton--Western-Technology-1917 1930/page/n6/mode/1up?view=theater
- Swanson, Anya., "Biden Administration Clamps down on China's Access to Chip technology" The New York Times. October 7, 2022. https://www.nytimes.com/2022/10/07/business/economy/biden-chip-technology.html

- Tenyotkin, Rose. Herlevi, April. Kaufman, Alison and Miller, Anthony., Economic Statecraft: How China Legally Accessess Foreign Technologies to Build Military Capabilities. Center for Naval Analysis, June 2020. https://www.cna.org/reports/2020/08/DRM-2020-U-027240-1Rev.pdf
- Thompson, Gavin., "Batteries with Chinese Characteristics: China's control of raw materials supply chains risks leaving others standing". Wood Mackenzie. February 10, 2021. https://www.woodmac.com/news/opinion/batteries-with-chinese-characteristics/
- U.S. Department of Commerce, Bureau of Industry and Security. "Multilateral Export Control Regimes". https://www.bis.doc.gov/index.php/policy-guidance/multilateral-export-control-regimes
- U.S. Department of Commerce., "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." https://www.commerce.gov/sites/default/files/2020-01/Critical_Minerals_Strategy_Final.pdf
- U.S. Department of State, Archive. "Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies". https://1997-2001.state.gov/global/arms/np/mtcr/000322_wassenaar.html
- U.S.-China Relations 1949-2022, Council on Foreign Relations. https://www.cfr.org/timeline/us-china-relations
- Varas, Antoio. Vardharajan, Raj. Goodrich, Jimmy and Yinug, Falan., "Strengthening The Global Semiconductor Supply China in an Uncertain Era". Semiconductor Industry Association. April, 2021. https://www.semiconductors.org/wp-content/uploads/2021/05/BCG-x-SIA-Strengthening-the-Global-Semiconductor-Value-Chain-April-2021_1.pdf