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US-China Geotechnology Race and the Lessons for India: Importance of Indigenous Technologies in Enhancing Indian Defence Capabilities*

Abstract

The current US-China stand-off underlines a major shift in the arena of geopolitical rivalry to technological competition. Unlike India, China and the US understand the importance of Science and Technology as drivers of growth and ultimately, geopolitical power. China aims to become the most globally advanced Science & Technology nation by 2050. Since Technology is the real foundation of power, this is triggering a US backlash. It has deployed its own multi-domain economic-technological (Eco-Tech) and geopolitical Playbook to counter China's rise and stem technology flows to China. The Eco-Tech Playbook closes loopholes for technology acquisitions by China and addresses supply chain dependency on China, which has led to genuine concerns over "decoupling". The "trade war" is therefore a Technology War. The Geopolitical Playbook covers many fields, but at its core, it too is aimed at maintaining U.S. global technological superiority, which is fully reflected in the US National Security and Defense Strategies. The National Defense Authorisation Act (NDAA) is a detailed handbook for maintaining U.S. global superiority in frontier technology areas. Counter-measures to stem technology flows to China like FIRRMA have been taken under the NDAA. Under these circumstances, there can be no G2 for the foreseeable future, which China has begun to realise.

Keywords: *US-China, trade war, geotechnology, defence, military, S&T, R&D, technology war, Eco-Tech, geopolitics*

Technology as the Foundation of Power

The current US-China stand-off indicates a major shift of geopolitical rivalry to the arena of technological competition. Unlike India, China and the US recognise that the source of ultimate power is scientific and technological capability. Geopolitical power rests on economic foundations, and these are in their turn a function of the technological maturity the country has achieved (Porter 1990). Robert Solow won the Nobel Prize for his work proving that technology was the "dominant engine of growth"[1]. The US is the living proof of the axiom that technological supremacy combined with an enabling ecosystem, is the basis of economic and geopolitical power.

Meanwhile, command over disruptive technologies promises to unlock wealth on a scale never realised before, with a 2013 McKinsey study estimating it at an annual US$33 *trillion*

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* This paper was presented at the 11th All India Conference on China Studies at Christ University, Bengaluru, held on 15-17 November 2018.

[1]Robert M. Solow Prize Lecture, Lecture to the memory of Alfred Nobel, December 8, 1987 http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1987/solow-lecture.html. He showed that technology accounted for 87.5% of growth in US output per capita between 1909-49 with only 12.5% accounted for by capital "Technical Change and the Aggregate Production Function", https://faculty.georgetown.edu/mh5/class/econ489/Solow-Growth-Accounting.pdf

by 2025. These technologies include the Internet of Things & precision manufacturing, Data Analytics, Brain Mapping / Artificial Intelligence/ Robots/ Cyborgs/ Autonomous Systems replacing blue- and white-collar workers, 3D printing, Nanotechnology, Fusion Energy, Genomics, with more still to come. But since this wealth accrual will go to countries with existing robust innovation ecosystems, advanced manufacturing and investible capital, it will further deepen the divide between the Technology "Haves" and "Technology Have-Nots". The Brave New World will be an Elysium for some and a Dystopia for others (and as I said earlier) "two different planets on a single mother Earth".

The United States and China have therefore devoted enormous resources to mastering futuristic technologies as the essential key to continued / eventual ascendancy. China knows it can challenge the United States only if it matches its technological and economic power. Echoing Solow, China lays heavy emphasis on "Science and Technology *as the primary productive force"*. Perhaps it is no coincidence that the *Made in China* document contains the same milestone as the McKinsey report – 2025. China wants to ensure that it too reaps the techno-wealth bonanza.

China's science & technology aspirations are also simultaneously firmly tied to its military strategy & geopolitical goals. Science and Technology (S&T) in China serve the Party and the PLA[2]. President Xi Jinping at the 19th National Congress of the CPC on October 18, 2017, said that "technology is the *core combat capability*". Hence the US can hardly ignore China's S&T aspirations and allow itself to be displaced at the top of the technological or for that matter any pecking order. President Trump has consequently deployed a comprehensive Playbook to counter China's technological rise. If this stand-off continues, there can be no G2 for the foreseeable future, which China has begun to gear up for. The geopolitical race is thus better termed the Geo-technological race and the so-called trade war - a Technology War. The power that pulls ahead will come out on top.

China's S&T Playbook

China's Industrial Policy is attuned to attaining self-reliance in advanced technologies. China's Playbook to catch up in S&T rests on two pillars -endogenous and indigenous, which overlap somewhat. It is the exogenous thrust of China's S&T strategy which has provoked the US counter-attack. A brief digression into China's S&T strategy would clarify matters.

The Endogenous Pillar

China launched an aggressive pursuit of high-tech industrial growth following adoption of the State Council Guidelines for the Medium- & Long-Term Science & Technology Plan 2006-2020 (MLP for short). China had earlier laid sound foundations in primary and secondary education (Goldman et al 2008) and followed it up by encouraging higher education and R&D. In 1986, Deng Xiao Ping blessed a proposal by eminent scientists to invest in advanced technologies, followed up by new S&T programs and a multi-pronged

[2] Tai Ming Cheung: "S&T strategies and plans are closely tied and subordinate to the country's national-level military strategy, the Military Strategic Guidelines (MSG)".

effort through Programmes such as 211 and 985 to promote research, attract academic talent back to China, create world-class Universities and commercialise R&D by academic institutions.

The educational initiatives soon yielded positive results: by 2015, R&D performed by the higher education sector out of total national R & D expenditure stood at 7 percent, compared to the US at 15 percent and India at 4 percent (NSB 2018). Several Chinese cities and Hong Kong, Macau and Taiwan scored higher than the average US score for mathematics and science (NSB 2018). Chinese and Indian students reportedly account for a large percentage of students taking science and related postgraduate courses in US institutes, underlining a growing weakness in US higher education. Seven Chinese Universities featured in the top 100 in the widely trusted Quacquarelli Symonds World University Rankings (India, 0), and Shanghai topped the PISA test scores in math and science, while participating Indian States trailed second last. Meanwhile, firms like Lenovo, Huawei, Haier, Hunan Heamam System Co., and many other enterprises were amongst many of the early spinoffs of the Chinese Academy of Sciences and other Universities.

China also launched a robust Industrial Policy which focused on R&D intensification. Under the Strategic Emerging Industries Plan (2010), US$1.5 trillion was pledged for R&D in seven next-generation sectors, boosting the economy in the wake of the 2008 financial crisis. The plan to favor indigenously innovated products in government procurement in November 2009, generated strong opposition from the US, EU and allied countries, which viewed it as a violation of free market principles (Purushottam 2010). The AI 2030 plan, the 13th FYP, the Internet Plus Plan, and many others underlined the Chinese State's determination to ensure that China would leapfrog to the ranks of the world's most technologically advanced manufacturing countries.

In May 2015, the Made in China 2025 program and its associated policies in the "Major Technical Roadmap" Green Book, aimed at making China a superpower in technology - was launched. Its aim was to create world-class industries and win dominant domestic and global market shares in several high-tech sectors. The domestic and specially the *global* market share targets set alarm bells ringing in the United States and other western countries. In fact, Made in China 2025 was one of the key triggers for the Trump Administration's alarm and subsequent action to counter China's technological rise, and is also reportedly one of the central programs targeted for roll-back by the US in the "trade" talks. For example the US Chamber of Commerce urged that "MIC 2025 and related policies be at the top of the economic agenda in future bilateral discussions with China" (US Chamber of Commerce 2017). If only our chambers of commerce were this alert!

The Exogenous Pillar - Fair is Foul and Foul Is Fair

The second, exogenous pillar of China's Playbook, which focused on extracting technological secrets from other countries by any means available, drew exceptional western ire. This Playbook could be roughly summed up as the APE, FDI + Forced TOT, CMI and ODI strategies (called IDAR in US congressional reports).

Interestingly, some of the tactics underlying this coordinated whole-of-government approach to extracting technology from the West were first described in the seminal work "Unrestricted Warfare" (although the "Principle" of Asymmetry monopolised all subsequent discussion) (Phillip 2018) (Liang and Wang 1999). The authors presciently anticipated the battlegrounds of the future, which "would be everywhere", characterised by the erasure of boundaries between military and non-military means of waging wars and their corresponding theatres. The latter would extend to trade, finance, ecological war, etc. This would necessitate the employ of another principle – "multidimensional coordination". But what is far more interesting - is that it is America which has taken a leaf out of this Playbook by waging multidimensional war, in the sense that its actions encompass trade, investment restrictions, punitive actions and geopolitics, necessitating multidimensional coordination to counter China's rise in the modern, omnipresent battlefield.

China's Technology Heist: APE, FDI + FORCED TOT, CMI, ODI

APE

The self-explanatory acronym APE stands for ACQUIRE, PRODUCTIONISE, EXPORT, the first step in assimilating and exploiting foreign technologies. "Acquire" stands for copying, espionage, stealing and reverse engineering. The MLP contains a clear exhortation to "Enhance the Absorption, Assimilation, and Re-Innovation of Imported Technologies." This is further embedded in national S&T directives, market access conditions imposed on foreign investors, and policies enjoining Chinese firms to acquire foreign technologies through overseas direct investment (ODI).

<u>Cyber-espionage with Chinese characteristics</u>

While a full detailing of Chinese cyberattacks on US targets could fill a tome on its own, an attempt has been made to outline the main characteristics, on which there is general agreement.

1. Chinese commercial and military cyber espionage against the U.S. has been going on for years[3] (Purushottam 2010).

2. Advanced U.S. technologies in practically any sector including military technologies and especially those identified as priorities in China's Industrial and S&T plans are the primary targets of Chinese cyber-theft.[4]

[3] US investigations on "Foreign Economic Collection and Industrial Espionage" dated back to 1997. In 2010, a US Chamber of Commerce report alleged that China was deploying a "blueprint for technology theft on a scale the world has never seen before" (*apcoworldwide.com/content/PDFs/Chinas_Drive_for_Indigenous_Innovation.pdf*.
Contemporary experts assert that "Chinese espionage against the United States has reached unprecedented levels, greater than anything seen in the Cold War."[3] This is despite a 2015 commitment made by President Xi Jinping to President Obama to abjure cyber espionage and theft. The 2018 report on "Foreign Economic Espionage in Cyberspace" described the threat in detail and warned that "If this threat is not addressed, it could erode America's long-term competitive economic advantage".

[4] As per the Annual Report to Congress on Foreign Economic Collection and Industrial Espionage—2005, August 2006, Office of the National Counterintelligence Executive, "collectors targeted the entire range of items on the Militarily Critical Technology List (MCTL) in FY 2005."

3. The Chinese State is behind these attacks, whether conducted directly or through proxies, making APE an official policy.

4. Apart from Chinese entities, China recruits U.S. *intelligence* officials and citizens to extract information on sensitive defence technologies, like the B2 stealth bomber, anti-submarine warfare and missile technologies.

(It would not be surprising if Chinese entities had hacked into Indian government networks and extracted information on commercially useful information).

Individual cases of cyber-theft are far too many to record, but the most prominent would be the theft of technologies from SolarWorld, Micron's advanced memory chip designs, energy companies, Dow, Dupont and other U.S. companies dealing in specialty chemicals, and F-35 and F 22 designs and technologies. Adding salt to the wound, China paraded Chinese clones of these products - JA Solar and Trina, Jinhua, the J 35 and J 22. Perhaps the most bizarre was the case of Micron, which reportedly produces 25% of the world's supply of advanced memory chips. The Chinese first made an offer to acquire the company. When this was rejected, they set up a rival Chinese company, stole the technology, and then sued Micron! The U.S. is now retaliating by bringing an indictment against the perpetrators.

Civil Military Integration (CMI)

The China Technology Heist Playbook is supplemented by China's Civil & Military Integration (CMI) strategy, given formal shape in the MLP. On its own, CMI seeks to avoid the USSR's mistake in firewalling its advanced military technologies from the civilian sector. The exhortation in the reworked 16-character policy[5] - "Let the civil support the military", indicates China's determination not to go the Soviet way, ensuring that a strong economy will form the basis of its strong military. CMI further encourages the osmosis of technologies developed in the civilian economy to the military, the "spin-on" effect described by Prof. Tai Ming Cheung, a synergy that the US is now trying hard to replicate. Thus "China's 2017 AI Development Plan, which aims to make China the world's primary AI innovation centre", calls for extensive implementation of civil-military integration and leveraging the private sector to leverage "advances in AI …for national defense". This will lead to an era of "intelligentized" warfare, an evolution from "informatized" warfare, which will transform future battlegrounds.[6]

Several sectors and companies have benefited from this cross-fertilisation of technologies. Many private Chinese companies are being encouraged to either start military production or supply State companies with indigenous defence products, buoyed by billions of dollars of venture capital and other investment funds (Feng 2018). In India, the State views the private sector with such suspicion that defence and electronics reforms have still not had a commensurate impact on the ground. Our biggest asset

[5] An excellent analysis of CMI is contained in Prof. Tai Ming Cheung's seminal book on Chinese defence innovation, *Fortifying China*.
[6] These two sentences have been almost verbatim taken/adapted from "Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power", November 2017, by Elsa B. Kania.

against China - our private sector – is being frittered away, while in China, private enterprise is being encouraged to become an essential partner in China's military-industry complex. Defence enterprises have entered into collaborative ventures with academic and R & D institutions. The Chinese also wish to emulate the successful integration of civil and military technologies by the US and Japan, according to Professor Tai Ming Cheung, and "If China succeeds, its dual-use economy would become a formidable global strategic competitor."[7]

The end result will be not only to synergise civil and military capabilities, but to "embed Military Capabilities in Civilian Capabilities"[8] *This is important because CMI performs a vital function – it provides a channel for diversion of restricted dual-use technologies obtained for the civilian sector from advanced countries to the defence industry.* China has deployed technology theft through CMI effectively in the aerospace sector, as it needs aerospace / jet engine technologies. The Cox Committee Report detailed the diversion of high-tech U.S. machine tools ostensibly purchased for China's commercial airliner project to a military complex. China also diverted Pratt & Whitney Co. helicopter engines obtained for civilian purposes to its military helicopters. The Chinese Air Force reportedly refitted Boeing 737s into military platforms in 2007, and so on.

FDI and the Forced Transfer of Technology (ToT)

China's FDI policy is part of its Industrial Policy (Nicolas 2008), in pursuit of which China has circumvented WTO obligations by imposing stringent performance requirements on FDI. Foreign investors are obliged to form joint ventures as minority or 50:50 equity shareholders, with control in the hands of the Chinese partner, followed up by mandatory technology transfers. As in the case of commercial espionage, maximum pressure for technology transfer has been applied in the priority high-tech sectors identified in China's Industrial Policy. Additionally, China periodically amends FDI regulations and reclassifies sectors in encouraged, restricted and prohibited categories, calibrating FDI policy to keep pace with progress towards indigenous technological maturity (Nicolas 2012).

Thus, FDI rules 'encouraged manufacturing of complete automobiles" until 2010, "permitted" it from 2011-2014, and "restricted" it in 2015 as domestic auto sector capabilities improved' (USTR 2018). Similarly, requirements for new electric vehicle (NEV) TOT in China were graduated to include "complete mastering" of NEV technology. European and Japanese companies shared high-speed train technologies hoping it would give them market entry, but Chinese companies reverse engineered and deployed the trains domestically. China aggressively imposed conditionalities on commercial aircraft and components imports, mandating high-technology transfers to its domestic civil aviation programs and fostering the development of an indigenous high-tech aerospace industry. China's strategy of leveraging enormous purchases of commercial aircraft to grow domestic industry via offsets must be emulated by India, by forming a buyers' consortium composed of Air India and private airlines.

[7] Notes given in Prof Tai Ming Cheung's lecture in 2010 on the China defence Innovation Economy, UCSD.

[8] The National Medium- and Long-Term Program for Science and Technology Development (2006-2020): Para 7. Perfect Mechanisms for Combining Military and Civilian Production and Embedding Military Capabilities in Civilian Capabilities.

In contrast, India stopped imposing any performance requirements on FDI, even as it sharply reduced tariffs under ITA1 and regional FTAs. The result was a surge in electronics and telecom imports and little investment in manufacturing capacity, which Dr Smitha Francis ascribes to the overly "liberal FDI policy regime that has been in place since 1991 (Francis 2016)". Common sense dictates that lowering tariffs disincentivises FDI, except in low value-added operations as Dr Francis has pointed out. India's auto sector may be one of the very few manufacturing sectors still receiving FDI as high import tariffs incentivise tariff-jumping FDI, lowering other perceived investment risks associated with a soft currency and market shallowness.

So perhaps it is not surprising that China figures higher at No. 3 than India (at No. 7) in the 2017 OECD Foreign Investment Restrictiveness Index.

Overseas Direct Investment by China (ODI)

Finally, as China became wealthier, the ODI or "Going Out" strategy came into play. Technology acquisitions in the United States, Europe and other advanced economies elbowed aside resources acquisitions in Latin America & Africa. The objective of ODI was the same as for the other tools in China's Economic Playbook – acquire advanced technologies through takeovers. Acquisitions accounted for 92.4 percent of ODI between 2010-2016, greenfield investments only 7.6 percent (USTR 2018). The encouraged categories were provided State including diplomatic support and funding.

China's ODI was US$196.1 billion in 2016 (USTR 2018). Senate Majority Whip John Cornyn (R-Texas) was reported to have said that China had "weaponized" its investments in America to vacuum up U.S. industrial capabilities from American companies" (Bennett and Bender 2018), like Paslin (and Kuka in Germany) with advanced robotics technologies, Robbins with advanced underground construction technologies, ATop Tech technologies for automated manufacturing of versatile chips, and many more Silicon Valley tech companies (USTR 2018). Another area of focus was aircraft technologies, with acquisitions of Epic Aircraft, Continental Motors, Cirrus, etc, where ODI complemented the Forced TOT through FDI policy from aerospace majors like Boeing, Airbus-EADS, Honeywell, Embraer, Safran, GE etc. China also tried to acquire Motor Sich, the Ukrainian engine company, but a court halted the takeover. This would have given an enormous boost to China's aircraft development capabilities if it had succeeded. The current situation is not clear.

Again, an entire tome can be devoted to this, but China's technology acquisitions policy through ODI is several years old (Purushottam 2011). Another very real concern is Europe, where China has targeted the weaker economies for a strong ODI push. Countries receiving Chinese largesse are predictably siding with China on key issues in the EU. This is something I predicted in "China Woos Europe" in 2011.

Results

The results of China's S & T strategy/ Industrial Policy through which the APE, FDI + forced TOT, CMI and ODI playbooks were deployed - have been fulsome. China has overtaken the

entire EU and is behind only the United States in global R &D expenditure. The US share fell from 37 percent to 26 percent of the world total, while China's rose to 21 percent. China's R &D intensity increased from 1.4 percent in 2005 to 2.1 percent, compared to 2.7 percent for the US, while India's fell from 0.85 percent in 2011 to 0.63 percent in 2015.

Derived from US S&E 2018 indicators: US$ billion, 2015

Countries	R&D Expenditure	Share of world total		R&D Intensity	
Whole World	1918	100%			
US	497	26%	2000 37%	2.7%	
China	409	21%		2.1%	2005 1.4%
India	50	2.6%		0.63%	2011 0.85%

On the back of this success, China has set itself several ambitious goals: to become the leading S & T power by 2050, the "world's primary AI innovation centre" by 2030, master quantum technology, explore dark matter, build hypersonic weapons, and secure dominant domestic and global market shares in the top high-tech industries. President Xi has lauded the "successful launch of the Tiangong-2 space lab, the commissioning of the deep-sea manned submersible Jiaolong and of the five-hundred-meter aperture spherical telescope (FAST) Tianyan, the launch of the dark matter probe satellite Wukong and the quantum science satellite Mozi, and the test flight of the airliner C919". China has landed a rocket on the far side of the moon, a global first.

But most importantly, China's Knowledge and Technology Intensive industries (KTI) account for 35 percent of China's GDP, as opposed to 38 percent of the US (NSB 2018). As the US S&E report underlines, countries with a higher KTI share in their GDP do better in "economic growth and competitiveness." China has generated huge domestic value addition, unquantifiable multipliers and a boost to the domestic innovation ecosystem through its techno-nationalist policies and shown that S&T are potent multipliers and a productive economic force. No wonder its economy is over 5 times the size of India, when it was just over double India's size in 2001 when I wrote "Can India Overtake China". China's economy is now No. 2 in the world, with a GDP of around US$ 12 trillion, as opposed to America's US$ 19 trillion and India's relatively paltry US$ 2.5 trillion[9]. The gradient gives me vertigo.

This is what can be achieved by emphasising S&T in growth and ensuring that value is captured in the country, not frittered away in imports and procurements abroad.

The China Threat

From 1991-2014, there was a dramatic accretion to Chinese power while the US was busy expending its resources in the catastrophic Global War on Terror (GWOT) in West Asia and in Containment of Russia, literally fighting the last war. It gave time to China to catch up in multiple domains of comprehensive national power. Meanwhile the US was also beset by the 2008 crisis, the opioid epidemic, and falling educational standards. The US National

[9] https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=US

Defense Strategy (NDS 2017) ruefully acknowledged that “America has no preordained right to victory on the battlefield”. It went on to say “Today, we are emerging from a period of strategic atrophy, aware that our competitive military advantage has been eroding”.

The US Response – the Geopolitical Playbook

But China’s success and hubris led it to make the strategic mistake of threatening its neighbours and confronting the US in the South China Sea, thus prematurely precipitating an inflexion point. The need for a response became a pressing national security priority and received bipartisan support in the US.

The U.S. deployed its own multi-domain Playbook spanning economic and geopolitical tools to check China’s rise. The two reinforced and complemented each other. The NDAA stated “Congress declares that long-term strategic competition with China is a principal priority for the United States that requires the integration of multiple elements of national power, including diplomatic, economic, intelligence, law enforcement, and military elements, to protect and strengthen national security”.

At the military, geopolitical level, the US formalised its geographical pivot to the Asia-Pacific, making India one of the lynchpins in its strategy. Vice President Pence sounded the bugle on this recently in a speech at the Hudson Institute. Current US defence strategies implicitly recognised China as a peer military competitor which needs “Offsetting”, a big change from the days when the PLA, as the weaker party, had focused only on “trump cards” and “asymmetric responses”. This shift was reflected in the National Defence and Security Strategies. Thus, the NDS stated: “Inter-state strategic competition, not terrorism, is now the primary concern for U.S. national security” and China was the first country to be named as such. The proposed withdrawal from the INF Treaty and erection of the Cyber Command were equally in response to the perceived threat from China.

The inter-relatedness of the geopolitical and eco-tech strategies was also underlined by the multiple references to maintaining technological superiority in U.S. National Security documents. The National Security Strategy (NSS) mentioned technology at least 20 times, the summary US National Defense Strategy (NDS) at least 21 times. The NSS prioritised keeping America’s technological edge in critical areas and contained a chapter on “Leading in Research, Technology, Invention, and Innovation”, stating “The United States must preserve our lead in research and technology and protect our economy from competitors who unfairly acquire our intellectual property.”

It was also significant that many economic and technological counter-measures were sanctioned under a defence act - the NDAA 2019, again underlining that the main battleground was technology. Indeed, the NDAA 2019 could be read as by far the most comprehensive handbook for the technology war with China. It contained multiple provisions on the need to stay ahead of all peer and even potential peer competitors. It enjoined on the US Secretary of Defense to develop a Science and Technology Strategy, prepare regular reports on the Comparative Capabilities of Adversaries In Key Technology

Areas in Hypersonics, Artificial intelligence, Quantum information science, Directed energy weapons, and other emerging technical areas, etc. The Secretary of Defense also had to submit a report to Congress examining the health of the defence electronics industrial base and develop a plan for limiting foreign access to technology in the interest of national security. The NDAA enjoined on the President to commission a report containing a whole-of-government strategy to counter China's multiple activities to undermine US capabilities and wrest technology through unfair means. The NDAA also prohibited use or procurement of telecommunications and Video Surveillance Services or Equipment from China. All in all, the NDAA contained 75 references to China.

Finally, apart from the NDS, NSS and 3rd Offset, even the move to abrogate the INF treaty had a China dimension.

The US Eco-Tech Playbook

The Eco-Tech Playbook complemented and supported the geopolitical Playbook and included the most forceful actions yet to counter China's technological ascent. The Playbook included multiple investigations into China's technology acquisitions strategies including the comprehensive Section 301 Report on China's S&T strategy, assessments of weaknesses in the Manufacturing and Defense Industrial Base and Supply Chain Resiliency, the so-called trade war which is actually a technology war, the enactment of FIRRMA under the National Defense Authorisation Act 2019 (NDAA) tightening CFIUS provisions and checking Chinese ODI, the indictments to curb espionage and technology theft, the ban on Chinese ICT companies etc.

The defense industrial base report was forthright about the threat China poses in multiple areas to the US and contained 196 references to China[10]! It included assessing the damage wrought mainly by China's economic policies on the U.S. defence industrial base, leadership in futuristic technologies and battlefield readiness. It analysed specific sectors with security implications in which China had either gained ground or eliminated U.S. capabilities (machine tools, solar cells for military use, flat-panel aircraft displays, advanced biomaterials, ceramics, and composites, printed circuit boards and semiconductors, dual-use production lines essential for U.S. weapons systems). The report also emphasised supply chain vulnerabilities in view of China's increasing domination of global upstream and downstream "manufacturing supply chains" in areas critical to U.S. national security. These included munitions and missiles, the rare earths market where China had already flexed its muscles to deny availability, and others.

Its public recommendations included (there is a classified Action Plan unavailable for analysis) formulating "*an industrial policy* in support of national security efforts, as outlined in the National Defense Strategy", and diversifying from dependence on

[10] Assessing & Strengthening Manufacturing & Defense Industrial Base & Supply Chain Resiliency, Report to President Donald J. Trump by the Interagency Task Force in Fulfillment of Executive Order 13806, September 2018, https://media.defense.gov/2018/Oct/05/2002048904/-1/-1/1/ASSESSING-AND-STRENGTHENING-THE-MANUFACTURING-AND%20DEFENSE-INDUSTRIAL-BASE-AND-SUPPLY-CHAIN-RESILIENCY.PDF

unreliable countries for sources of supply. [11] This is a breath-taking departure from the neoliberal prescriptions usually advocated by the American Right.

A report submitted to the US China Economic and Security Review Commission on supply chain vulnerabilities from China, also recommended a national strategy for promoting supply chain transparency, including of procurements linked to China (USCESRC 2018).

All these point to "decoupling", which would include disentangling the supply chains of the two economies, a risky strategy with immense potential for global economic disruption if mishandled, given the complex cross-border interrelationships spanning most industrial sectors.

Is it a Trade or Technology War?

The so called US-China Trade War has riveted the world's attention, perhaps because of its repercussions for global supply chains. But what has been missed is that this is a technology war, and the underlying issue is all about retaining global primacy in technology. One cannot therefore see the Trade War in isolation, but as a sub-set of the geo-technological and geopolitical struggle for supremacy. Our view is that trade is being used as a lever to pry open the relatively closed Chinese market and put an end to the unfair transfer of American technologies via the means described above. There may also be a larger classified strategy aimed at decoupling the two economies[12] (Segal 2019). India will soon have to pick sides, and that would be a foregone conclusion if the lethargy in the face of Chinese cyberattacks, existing and potential, weren't so worrisome. Consider the following:

1. Firstly, the size of the threat on the trade front to the U.S. appears to be exaggerated. The US initiated tariff increases on the grounds that China had accumulated large goods trade surpluses due to unfair means, around US$375.6 billion in 2017. But according to China, its goods trade surplus with the US is US$275.8 billion, not $375.6 billion. China argues that since its foreign trade is characterized by large-scale reprocessing, exports on a value-added basis are considerably lower (44 percent) than those calculated on a conventional basis[13] (SCIO 2018). Even Chinese official sources have confirmed that *China relies for 95% of some high-end components on other countries.* No less than the Vice-Minister of Industry and Information Technology, Xin Guobin, has said "China is still at the lower end of the global industrial chain."[14] The US Science & Engineering Indicators 2018 report too indicates that China's high-technology exports due to their high import content are lower in value-added than in conventional terms. In fact, exports calculated on a value-added basis are higher than exports calculated on a

[11] *Ibid.*

[12] Prof. Tai Ming Cheung lecture in India, July 2018.

[13] For 2016, China's goods surplus with the US was US$250.7 billion if calculated on a conventional basis, but the value-added calculation reduced the deficit to US$139.4 billion, a 44.4% decrease.

[14] China still at lower end of global industrial chain
http://news.sina.com.cn/c/2018-07-15/doc-ihfkffak0526628.shtml

conventional basis for all the countries shown in figure 6E of that report, including the U.S., *except for China, where it is lower*! *This may explain the extraordinary dip in China's global trade surplus for a sub-set of high-tech products - from "$120 billion on a conventional basis in 2011 to $1 billion on a value-added basis* (Figure 6-F)".

2. Secondly, the tariffs directed specifically on US$50 bn worth Chinese goods in June 2018[15] were triggered by the Section 301 report on China released in late March 2018, which outlined its objectives as follows: "the United States is taking action to confront China over its state-led, market-distorting forced technology transfers, intellectual property practices, and cyber intrusions of U.S. commercial networks". Even the detailed Section 301 Report dealt mainly with technology issues, not trade deficits (USTR 2018).
3. Thirdly, during trade talks American negotiators made it explicit that market opening was not just about lowering Chinese tariffs, but about China agreeing to meet U.S. concerns on forced TOT, technology theft, overseas acquisitions and curbing support for high-technology industries. It was reported that rolling back Made in China 2025 was one of the key U.S. demands, which would entail tremendous loss of face for the Chinese leadership.
4. Fourthly, the U.S. levied measures (see below) *under its National Defence Authorisation Act* 2019 to contain these Chinese practices, *adding a defence/ security dimension to the current confrontation.*

FIRRMA

The frenetic pace of China's takeover of America's prime technology assets triggered a bipartisan move to strengthen and update the powers of the Committee on Foreign Investment in the United States (CFIUS). In August 2018, President Trump signed the Foreign Investment Risk Review Modernization Act (FIRRMA)[16]. Under Title XVII of the National Defense Authorization Act 2019 (NDAA), FIRRMA enabled CFIUS to apply *national security* considerations in reviewing and checking foreign investments, *giving the technology competition with China a clear geopolitical dimension*. It also demanded very detailed biennial reports on Chinese investment in the US. The NDAA moreover expanded the definition of "critical technology" to include "emerging and foundational technologies.

[15] The January and February tariffs on washing machines, solar equipment, steel and aluminium were global, although they included Chinese imports.

[16] Amidst earlier deals blocked by US Presidential order were the purchase of Lattice Semiconductor (2017), the sale of the U.S. subsidiary of a German semiconductor company Aixtron to China (2016), the reversal of Mamco's acquisition by China, an airplane parts manufacturer (1990). Other blocked purchases included those of Xcerra, maker of equipment to test computer chips and circuit boards. But it was anybody's guess as to how many valuable technologies had already been acquired by China through overseas acquisitions.

Recent figures show that there has been a steep fall in Chinese ODI in the US in 2018, which is now "projected to fall from $29.4 billion in 2017 to $4.0 billion", due to the trade war and FIIRMA (Schott and Lu 2018).

Export controls

Title XVII of the NDAA 2019 also tightened export controls and mandated reviews of defense technologies critical to the United States "maintaining superior military capabilities, especially with respect to *potential peer* and *near peer* military or economic competitors", and to preserving "the qualitative military superiority of the United States, strengthening the United States defense industrial base, and US leadership in the science, technology, engineering, and manufacturing sectors, including foundational technology essential to innovation".

To this end, the President was enjoined to "*maintain the leadership of the United States in science, engineering, technology research and development, manufacturing, and foundational technology that is essential to innovation;* protect United States technological advances by prohibiting unauthorized technology transfers to foreign persons in the United States or outside the United States, particularly with respect to countries that may pose a significant threat to the national security of the United States; strengthen the United States industrial base, both with respect to current and future defense requirements;" etc. Strengthened controls would additionally help American firms to reject demands for forced technology transfers through FDI in China (Chorzempa 2018).

Epilogue

China has been moving up the value chain in manufacturing, but with hiccups. The efforts and resources it has deployed in acquiring technologies abroad including through espionage and strong-arming foreign companies in China, seem to indicate its indigenous abilities are still not at par with those of advanced countries. Its lack of progress in semiconductor fabrication was exposed during the crisis that erupted when the U.S. threatened to bar trade with ZTE. The Chinese jetliner C919 still relies on foreign technologies and engines. It lags advanced countries in high-tech manufacturing.

But China is making progress in many frontier areas –in thrust vector engine technology, Artificial Intelligence, unmanned vehicles, supercomputers, quantum and hypersonics technologies, and many others identified in its S & T Plans. It is also investing heavily in areas where it lags. China dominates the Medium Hi-Tech Industrial sector and has achieved enormous growth by capturing maximum value addition in advanced manufacturing within its borders. It is constantly adapting strategy to keep pace with changed requirements. For example, its focus on civil-military integration has led to an increase in private sector participation in defence production.

Meanwhile the US-China Technology War to slow China's advance, appears to be having an impact, with a UBS analysis projecting that several companies are considering moving

out of China, with the exodus predating the Technology War but presumably gaining momentum going forward. Similarly, Chinese investment in the US has fallen massively this year, from US$29.4 billion to US$4.0 billion in 2017 (Schott and Lu 2018). Decoupling is a possibility and would dislocate supply chains and impact economic growth in other countries. At the same time decoupling opens up opportunities for countries like India in realigning supply chains.

Conclusion

The pressure on China's economy has increased the threat to the Indian manufacturing sector manifold, as, shunned from other markets, Chinese companies are going all out to secure Indian orders by any means available (including launching a political charm offensive). India must wake up to the enormity of both the threat and the opportunity.

But for that it seriously needs to get its act together. The importance of S & T is decreasing rapidly in India. Its R&D intensity has decreased even as China's has shot up, and there has been a 14% decline in India's high-tech manufacturing sector. There is no synergistic thinking in India on how to advance economic or scientific strength as part of a holistic national security strategy. Vested interests and import lobbies thwart implementation of recently introduced policies aimed at restoring some of the damage wrought by decades-old policies hobbling high-tech manufacturing and the development of a dynamic innovation ecosystem in India. Not a single prominent leader has echoed Peter Navarro's eminently correct statement "Economic Security is National Security", which was followed up by bipartisan collaboration to face the China threat.

And yet, despite the lack of vision, India has produced world-class manufacturing companies. Our telecommunications companies for example are as good as the Chinese and have beaten them in international competitions. But venal officials are withholding hundreds of crores of Rupees of dues to Indian companies and fixing tenders to favour multinationals including Huawei. This should ring alarm bells but we don't hear anything about it in national discourse.

India needs to understand the centrality of technology in national power and reorient its national discourse and economic/ technology/ national security policies accordingly. A radical systemic overhaul is required so that its sclerotic bureaucracy gears up to support indigenous Industrial and Technological capabilities.

India can follow up some of the positive measures already taken with overhauling the antiquated 19th century Central and State Government procurement system, placing honest officials in charge and genuinely committing to domestic procurement, which would generate huge multipliers. The private sector must be encouraged and made a full partner in high-tech projects, and a civil military integration strategy must be followed in developing an aerospace and other high-tech industries in India. The State must also step up and devote more funding for R & D. It can follow the China example by investing in a couple of science mega-projects in partnership with private industry. Two key areas (among many) would be defence production and Industry 4.0 technologies (which require pairing software including very soon – AI - and hardware). Only the State can put up the

funding for projects which do not yield immediate returns, and China is only following the eminent US example of State support for high-tech innovation projects.

It is high time we got our act together to face the 21st century. We cannot remain satisfied with the services dominant model which creates/ retains minimum value in India, while the bulk of profits flow abroad, contributing to persistent current account deficits, a secular decline in the Indian rupee's value, weak employment and skilling opportunities and rising inequity.

For the sake of India's security and the well-being of the Indian peoples, and to ensure India plays a role commensurate with its potential, we need to rapidly modernise and reform outdated policies and procedures thwarting progress and realise India's potential to the full. Otherwise India's potential will remain just that, potential.

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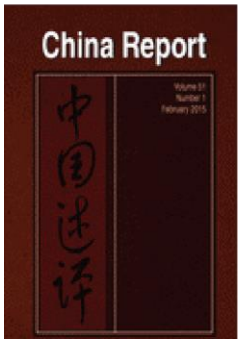

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