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INDIA'S NORMATIVE ASPIRATIONS OF CIVIL-MILITARY FUSION KNOWLEDGE ABSORPTION BY PRIVATE SECTOR THE KEY

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Introduction

When the Cyberspace Administration of China(CAC) requested user data from DiDi, a Chinese car-rental company, the latter was initially reticent. Then, upon insistence by the regulatory authorities, it reluctantly complied by providing hardcopy printouts of the data, thus denying digital data analysis of its customers. However, DiDi's defiance didn't last long. It was eventually forced to delist from the New York Stock Exchange and was fined 1.2 Bn Euros by the CAC in July 2022.[1] In another Apple-FBI standoff, the manufacturer has refused access to the iPhone used by a terrorist in the San Bernardino shooting. It was eventually unlocked by a small Australian hacking firm Azimuth Security in 2016, ending a momentous standoff between the US government and the tech titan Apple[2]. The DiDi-CAC and Apple-FBI faceoffs suggest that it is problematic for the civil industry to cooperate with governments in China or elsewhere for national security and, by extension, 'Military-Civil Fusion' (MCF). A US equivalent of the concept, Civil-Military Integration (CMI), has also yielded mixed results posing fundamental doctrinal concerns for battlefield logistics post-9/11. In comparison, India's experiment with *Atmanirbhar Bharat* is relatively nascent. In September 2022, Hon'ble Raksha Mantri's call for 'Civil-Military Fusion' (CMF) and the Indian Army's allusions to *Samanjasya Se Shakti* were encouraging but normative.

Essentially, the fourth industrial revolution is redefining the character and nature of warfare and smudging the borders of liminal technologies. Moreover, its propensity to cause economic disruption and desolation to the civil population fundamentally challenges the International Humanitarian Laws (IHL) on armed conflict. In response to this new normal, countries must learn to absorb technological know-how rapidly and widely from commercial sources. Incidentally, the private sector is better structured to grab fleeting opportunities and absorb galloping technologies at a pace probably faster than Moores's law.

Against this backdrop, the paper seeks, firstly to declutter the alphabet soup of oft-quoted adages like CMF, CMI, and MCF. Next, it describes the various phases of knowledge absorption necessary for CMF and identifies the current gaps in the Indian defence R&D sector. Essentially the paper argues that the intensity and speed of absorbing knowledge from abroad by India's private sector are indeed strewn with challenges but will be critical for realising the full potential of CMF.

Alphabet Soup of MCF, CMI, and CMF

The relationship between military and civilian technology is as old as human civilisation. For example, the Walls of Jericho in the West Bank were built around 8000 BCE. Its massive stone walls with intermediate watchtowers are clear signs of early human endeavour to harness civil technology for military purposes.[3] Ever since, warfare has constantly evolved to gain an edge over the enemy. However, it is difficult to say if commercial technology drove military modernisation or *vice-versa*. Incidentally, face recognition, microwave, GPS, the internet, and virtual reality are some military research that transformed the commercial world profoundly.[4] By the way, the reverse is also true. All defence forces are now being forced to adapt their doctrines and equipment with commercial-off-the-shelf (COTS) products, such as wearable computing, the Internet of Things (IoT), 3D printing, drones, and 5G.

In addition to valour and military tactics, there are perhaps less spectacular but significant forces behind the scenes of visible warfare. I call these Organisations, Innovations, and Logistics, or the OIL of warfare. MCF, CMI, or CMF essentially enhance the quality of this OIL for creating asymmetry on the battlefield. For example, PLA's Strategic Support Force (SSF) organisation (O), formed in 2015, seeks to "overcome the superior with the inferior" through the application of asymmetric commercially available technologies for information countermeasures against critical nodes in space, cyberspace, and the electromagnetic domains.[5] Similarly, the Byraktar drone is an asymmetric innovation (I) that has altered the trajectory of wars in Kurdistan, Syria, Nagorno-Karabak, Tigray, and Ukraine.[6] Asymmetry in logistics (L) is clearly altering the Chinese force posture on the Line of Actual Control (LAC). To win localised conflicts, the PLA's Western Theatre Command (WTC) plans to build 20 new border airports by 2025, upgrade the G219, G331 and G318 national highways, and complete the Siachun-Tibet (Chengdu-Lhasa) railway link.[7] Thus, one could argue that CMF is the elixir for creating asymmetric OIL for winning wars. In another time, this would have been known as Revolution in Military Affairs (RMA). Be that as it may, the leitmotif of the alphabet soup of MCF, CMI, or CMF is two folds. Firstly, to harness the potential of commercial R&D and, secondly, to cut government spending by integrating defence specifications into commercial goods and services. In a larger sense, these acronyms are not just about dual-use technology but the effective military use of civilian facilities and talent. It could mean using highways as emergency airstrips, civilian transport for military logistics, commercial technologies to create new systems, upgrading the capabilities of the older weapons and sensors, or attracting civilian talent and venture capital to aid military programmes.[8] Civil-military relations for unified central leadership and organisation have been kept out of this paper's scope or ambit.

Chinese Military-Civil Fusion. China's 2006−2020 Medium- and Long-Term Defence Science and Technology Development Plan (MLDP) draws inspiration from the experiences of Japan, South Korea, and the Soviet Union. Between the 1950s and 1990s, Japanese and Korean firms signed know-how contracts with the West, allowing access to manufacturing, knowledge, and blueprints. In addition, it provided them with knowledge of reverse engineering and critical skills for catching up. The Soviet Union simultaneously engaged in indigenous development and extensive industrial espionage.[9] Notably, the Chinese MLPD stresses these paradigms of absorbing foreign technology to leapfrog the present gap with the western world. It is incidentally distinct from building innovation capacities, which rely on an indigenous R&D system.

Although China has implemented a slew of policies and plans, like the MLPD, its badly needed *fusion* of MCF still remains aspirational. It is because the Chinese defence sector is heavily dominated by sclerotic state-owned enterprises (SOEs) and cannot respond to the dynamic commercial technology. Despite years of reforms, the participation of Chinese private companies in defence projects, barring probably logistics, has been frustrating. As a strategy, MCF is miles away from STEM driven US defence ecosystem. Whilst the Chinese Communist Party (CCP) does not need a law to compel private companies to turn over their technologies, unfortunately, coercion has proven to be an unsustainable method. The recent DiDi-CAC face off is a vindication of such intimidations. Thus, the repackaging and relabeling of Chinese CMI into its current avatar of MCF seeks to remedy this problem by shedding and moderating the old draconian ways.[10] However, MCF's in China is a hostage of its deep systemic problems of knowledge absorption from the commercial sector.

The U.S. Civil-Military Integration*.* Since World War II, the US' Offset Strategies (OS) have defined its defence posture*.* 1OS had sought to create nuclear deterrence against the Soviets, which the Soviets neutralised by achieving nuclear parity and conventional dominance against NATO in the 70s. The post-Cold War 2OS strategy was about achieving conventional superiority through network-centric warfare, which the Chinese Anti-Access Area Denial (A2/AD) managed to counter.[11] In response, Pentagon's Third Offset Strategy (3OS) pursues next-generation technologies and concepts to ensure conventional deterrence. 3OS aims to answer Russian and Chinese parity by deploying asymmetric Artificial Intelligence (AI), lethal autonomous weapons, hypersonic weapons, directed energy weapons, biotechnology, and quantum technology. All these technologies can be injected into the sensor, C4I, logistics and support grids.[12] In effect, the current version of the US CMI seeks to leverage military advantage over adversaries whilst simultaneously harnessing the common potentials of technologies, processes, labour, equipment, material, and facilities. The US private sector, fortunately, has robust defence R&D capable of learning, absorbing and galloping alongside the commercial sector. From 3OS, it also becomes evident that today's CMI necessitates rapid absorption of cutting-edge commercial technologies.

India's Civil-Military Fusion. During the formative years after independence, State Public Sector Units (PSUs) and Council of Scientific and Industrial Research (CSIR) laboratories took the lead in space, nuclear energy and defence sectors. However, in the 1980s, self-reliance petered off unsuccessfully due to decreased support for PSUs and their inability to upgrade technologies. Even the liberalisation of Indian industries in the 1990s did not bring new technological knowledge into India. The private sector in India showed little interest in R&D and was content with collaborating with foreign Original Equipment Manufacturers (OEMs) on the latter's terms. India thus wholly missed out on the Third Industrial Revolution, characterised by semiconductors, mass manufacturing, electronics, white goods, etc. Years of enticing foreign defence majors to set up shops in India also came to nought. As a result, India has emerged as the largest defence importer in the bargain, causing a big drain on taxpayers' money and strategic dependence on foreign countries. Hon'ble Raksha Mantri's call for 'Civil-Military Fusion' (CMF) in September 2022 is meant to correct this.[13] However, India's experiment with *Atmanirbhar Bharat* and CMF @75 is relatively normative and will need real-time knowledge absorption by the Indian private sector from high-tech foreign firms. In this context, The National Security Advisors of India and the US launched the initiative on Critical and Emerging Technologies (iCET) on 01 February 2023, which promises to foster an open, accessible, secure technology ecosystem. iCET is the fruition of intent expressed at the Biden-Modi meeting in May 2022 to further and elevate the US-India strategic partnership and defence industrial cooperation. This opens opportunities to envelop cutting-edge commercial technologies in the defence sector more seamlessly, such as Desktop as a Service (DaaS), robotics, AI, semiconductors, jet engines, SpaceX Starlink communication systems, and autonomous weapons, to name a few.

Knowledge Absorption

India's ability to value, assimilate, and apply new knowledge will be critical to realising the true potential of CMF. It is a deliberate process and cannot be sustained by ad hocism and rhetoric. Many scholars like Shaker A. Zahra and Gerard George have demonstrated how Absorptive Capacity (ACAP) is critical for providing strategic flexibility and freedom to adapt and evolve in a dynamic and high-velocity environment like the defence industry. They argue that ACAP exists in two dimensions. While *potential ACAP* comprises knowledge acquisition and assimilation, *realised ACAP* is concerned with knowledge transformation and exploitation.[14] In the following sections, this paper posits that ACAP has received disproportionately less attention in India, and India's private sector has the requisite flexibility and agility to adopt CMF to make a truly self-reliant India.

Acquisition through Vicarious Learning and Grafting

Organisations do not begin their lives on a tabula rasa. R&D organisations are initially created on cognitive knowledge. After that, institutions of R&D add experimental knowledge through systematic processes and accidental discoveries. We have witnessed this kind of knowledge growth in India's premier defence research organisation, the Defence Research and Development Organisation (DRDO). Adapting to the impending threats and potential technologies, DRDO's experimental journey has resulted in outstanding achievements. India's strategic missiles, nuclear submarines, fighter aircraft, main battle tanks, and personal weapons are its illustrious products, to name a few. However, the Indian Armed Forces are still resorting to foreign acquisitions to tide over the immediate capability gaps. The high production costs and prolonged timelines of DRDO can be attributed to technology denial, foreign monopoly and the political economy of the global defence industry. Under these circumstances, George P. Huber proposes two additional acquisition methods: *vicarious learning* and *grafting.* Indian defence R&D could adopt these to bridge the production and time cost. Both domains of knowledge acquisition support CMF.

Vicarious Learning. Vicarious Learning is a strategy of second-hand learning of niche technologies by borrowing or through corporate intelligence. Automobile and computer manufacturers routinely indulge in corporate intelligence by examining their competitors' products. Such information is acquired from consultants, professional meetings, trade shows, publications, vendors and suppliers and networks of professionals in less competitive environments. However, defence industries typically resort to mimicry in a highly secretive environment encumbered by prohibitive sanctions. China has wildly succeeded in this technique. Some Chinese clones remarkably resemble the Lockheed Martin F-35 Joint Strike Fighter and Northrop Grumman X-47B unmanned combat air vehicle (UCAV). Several technologies used in these designs were mainly acquired through vigorous Chinese cyber spying campaigns[15]. India's vision of *Atmanirbhar Bharat* and CMF will need to incorporate these ACAP methods in an institutional and organised manner. However, Vijay Mahajan, Subhash Sharma, and Richard A. Bettis have argued that organisational imitation is often haphazard and fraught.[16] Based on empirical research, Bourgeois and Eisenhardt have concluded that mimicry is not always efficacious in stiffly competitive and fast-changing environments.[17] Instead, organisations can improve their expertise by grafting new members from outside who possess transformational knowledge.

Grafting. Grafting is more likely to succeed in acquiring complex information or knowledge and is a faster acquisition method. Ostensibly, China has long been recruiting western researchers and planting its own scientists in the US national security research facilities. Between 1987 and 2021, at least 162 scientists joined the Chinese defence R&D projects after receiving scientific training at Los Alamos.[18] Private sector companies are most suitable for such learning methods as government, or public sector R&D organisations cannot undertake grafting due to organisational pride and reticence.

Coincidentally, DRDO has created five new Young Scientists Laboratories (DYSLs). These were expected to draw talented youth and prevent brain drain to western MNCs. DYLSs envisage integrating new technological horizons in defence R&D, such as Artificial Intelligence, Quantum

Technologies, Cognitive Technologies, Asymmetric Technologies and Smart materials. In addition, DRDO has also introduced Research Fellowships for young scientists/Engineers to undertake cutting-edge research. Further, the Defence Industry Academia Centre of Excellence (DIA-CoE) provides financial support to ten IITs/Universities to undertake science and technology projects and create special test facilities. DRDO has also commenced Cyber and Artificial Intelligence (AI) and Machine Learning (ML). So far, more than 1000 professionals have been trained in these domains.[19] These are bold and decisive steps initiated by DRDO but fall short of grafting. For this, DYSLs will need to absorb the corporate work ethics, culture, and human resource practices of MNC's. A highly paid, stiffly competitive, project-based, time-sensitive, and hire-fire environment of MNCs is essential in DYSLs to achieve the desired transformation for CMF. However, youth seeking job security will be a liability in an intensely competitive environment.

Assimilation to Escape the Learning Trap

It is natural for any organisation to favour familiar technologies over the unfamiliar, prefer the mature over the nascent, and search for solutions from the existing ones. Defence labs worldwide are no exception. For example, some components of new torpedoes, like the battery or the servo, may change the functional parameters of the weapon. Typically such critical components are imported after extensive in-house developmental trials fail. But the rest of the numerous components are borrowed from existing technologies. Such pathological entanglement with old technologies is called a *learning trap.*[20] Similar trends can be seen in most weapon systems, especially in developing countries. Development of a novel (unfamiliar), emerging (leading edge), and pioneer (no antecedents) technology is problematic as external knowledge is often contextual and prevents outsiders from understanding or replicating. Such endeavours need corporate entrepreneurship, capable of understanding opportunities and breaking the learning trap. Large private firms worldwide have demonstrated the capacity and incentive to create RMA through CMF. A case in point is the private Turkish drone maker Baykar by the Byraktar family in Turkey. The nexus between technological breakthroughs and large private firms are founded on the ability to combine private wealth creation with social benefits.[21] Unfortunately, such market-driven capitalist motivations cannot be expected from government-led R&D facilities.

Transformation for Integrating Multiple Specialities

Transformation is the ability of an organisation to create and integrate knowledge from different sources and speciality areas. This is especially the case in the defence sector where knowledge from the private sector or multiple labs need to be integrated. The clustering of 52 DRDO labs into seven technology clusters has been a step in the right direction. For example, it has ensured that technology integration within the aeronautical sector (Aero) happens seamlessly. Similarly, we have the Missile and Strategic Systems (MSS), Armament and Combat Engineering (ACE), Electronic and Communication Systems (ACE), Micro Electronic Devices, Computational Systems & Cyber Systems (MED & CoS), Naval Systems and Materials (NS& M), and Life Science (LS).[22] However, despite these foundational changes in DRDO, it will not be easy to keep pace with the dynamism of technological innovations.

he recent takeover of Xilinx by AMD is an example of how technology is integrated into a company to enhance ACAP and lead the world. AMD is a Santa Clara-based tech giant that drives innovation in high-performance computing, graphics and visualisation technologies. Integration of Xilinx into AMD now offers it the leadership in Field Programmable Gate Arrays (FPGA), adaptive SoCs, AI engines and software expertise with an approximately $135 billion market opportunity.[23] Ironically, such investments are opportunistic and cannot be made by PSUs and DRDO labs. Hence, large private sector enterprises will always have an edge and must be included in *Atmanirbhar Bharat*.

Exploitation

Exploitation reflects a firm's ability to harvest and incorporate knowledge into operations.[24] Using patent citation data to track knowledge transfer between firms, Almeida has shed startling new light on foreign direct investment (FDI). He shows how FDI in semiconductor industries is used to access technical knowledge in overseas countries.[25] But this is easier said than done. It is well-documented that China's weak IP regime has discouraged foreign technology transfer to domestic firms. As a result, though foreign firms may increase overall innovation, it does not essentially translate to the capability-building of indigenous entities. So, even if FDI in China continues to grow, they do not enhance the innovation abilities of Chinese enterprises. Instead, they are used for building plants, importing technology, and managerial expertise. In recent years, Chinese firms are increasingly in-licensing patents, which, when absorbed, have improved their indigenous technological capabilities. But the same is not the case with the absorption of foreign technologies. This is attributable to China's prohibitive Technology Import Export Regulation (TIER).[26] The Chinese experience shows that despite an authoritarian government, technology absorption is difficult due to IPR issues, type of FDI, and domestic regulations. So, the Indian MoD has to revisit the Foreign Trade (Development & Regulation) Act of 1992, India's Export-Import (EXIM) Policy, the IPR regulations, and the nature of FDIs to enable the meaningful realisation of CMF.

Conclusion

MCF, CMI, or CMF are essentially similar adages used for enhancing the quality of organisations, innovations, and logistics (OIL) on the battlefield. Firstly, to harness the potential of commercial R&D and, secondly, to cut government spending by integrating defence specifications into commercial goods and services.

This paper argues that today's CMF necessitates rapid knowledge absorption of cutting-edge foreign technologies by the Indian private sector. The private sector is better structured to grab fleeting opportunities and absorb galloping technologies at a pace probably faster than Moores's law. Such knowledge can be obtained through industrial intelligence and grafting. Large private firms have the incentive to create private wealth. Even if companies were to absorb high-end technology from abroad, their productionisation would need a review of various regulatory roadblocks.

Essentially, India's experiment with *Atmanirbhar Bharat* and CMF is relatively normative and will need real-time knowledge absorption by the

Indian private sector from high-tech foreign firms. The recent India-US iCET tech collaboration has afforded the Indian private sector a golden opportunity to invest in defence R&D.

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Endnotes

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