CHINA'S MILITARY–CIVIL FUSION INNOVATION ECOSYSTEM AND IMPLICATIONS FOR INDIA

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INTRODUCTION

Artificial Intelligence (AI) has emerged as a critical technology shaping the future of military power and strategic competition. Advances in machine learning, autonomous systems, and data analytics are transforming military operations by enabling faster information processing, improved situational awareness, and new forms of human–machine collaboration. The major powers increasingly view AI not simply as another technological tool but as a foundational capability capable of altering the character of warfare. Analysts have, therefore, described AI as a potential "general-purpose military technology," with implications across command and control, intelligence analysis, logistics, and weapon systems.[1]

China has set the goal of transforming the People's Liberation Army (PLA) into a "world-class military" by 2049, when the People's

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1. Jeffrey Ding and Allan Dafoe, "Engines of Power: Electricity, AI, and General-Purpose Military Transformations," version 1, preprint, *arXiv*, 2021.

Republic of China (PRC) celebrates its centenary.[2] Achieving this goal requires not only modern equipment but also the ability to integrate emerging technologies into operational concepts and organisational structures. In this process, AI is considered a major driver of military innovation and a key component in China's overall competition with technologically advanced militaries.

Military-Civil Fusion (MCF) is the key strategy through which China seeks to realise this ambition. Elevated by Xi Jinping as a national strategy in 2015, MCF aims to break down the institutional barrier between the civilian technology sector and the defence establishment. Rather than relying solely on traditional state-owned defence enterprises, the strategy seeks to mobilise universities, research institutes, and private technology firms to advance defence innovation across artificial intelligence, quantum technologies, and advanced manufacturing.[3]

Against this backdrop, the article examines how MCF has reshaped the institutional landscape through which the PLA accesses and develops AI-enabled technologies. Understanding these dynamics is important not only for assessing the trajectory of China's military modernisation, but also for analysing how this evolving innovation ecosystem may shape the regional strategic landscape. From an Indian perspective, these developments are particularly significant as they have the potential to alter the technological balance and influence patterns of military competition. Examining these trends is, therefore, important for assessing their broader implications for India's strategic planning and defence preparedness.

The article proceeds in four sections. The first section outlines China's MCF strategy as a framework for AI-driven military innovation. The second and third sections examine the roles of universities and research institutes in the PLA's AI procurement. These actors are examined in particular because they constitute the foundation of China's research and development system and serve as key institutional nodes within the MCF framework. In conclusion,

2. M. Taylor Fravel, "China's 'World-Class Military' Ambitions: Origins and Implications," *The Washington Quarterly*, vol. 43, no. 1, 2020, p. 90.
3. Richard A. Bitzinger, et al., "China's Military-Civil Fusion Strategy: Development, Procurement, and Secrecy," *Asia Policy*, vol. 16, no. 1, 2021, pp. 26–27.

the paper assesses the broader implications for India's strategic environment.

MILITARY-CIVIL FUSION AND CHINA'S AI INNOVATION SYSTEM

MCF[4] is best understood as a long-term organisational strategy for innovation, rather than a particular policy paper or initiative. Under Xi Jinping, it has progressed from earlier forms of civil-military integration to a major strategy aimed at creating an "integrated national strategic system and capabilities" that aligns economic development and military modernisation. This concept refers to the establishment of a coordinated national framework that links economic development, technical innovation, and defence modernisation, enabling the cohesive mobilisation of civilian and military resources to support national strategic goals. In the Chinese policy discourse, such integration aims to eliminate institutional fragmentation by constructing a hierarchical and systemically linked structure that connects government institutions, industry, research organisations, and the military.[5]

Structurally, China's innovation architecture can be explained through a three-tiered framework linking technological development with national strategic objectives. At the highest level, MCF provides the overarching mechanism for integrating technological innovation with both economic development and defence modernisation. Beneath this, the national innovation-driven development strategy sets national priorities for advancing science and technology. At the foundational level, universities, research institutes, and commercial technology firms form the core of the country's research and development ecosystem, generating the knowledge, capabilities, and

4. Alex Stone, "Military-Civil Fusion Terminology: A Reference Guide," China Aerospace Studies Institute, 2021, https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/CASI%20Articles/2021-03-15%20MCF%20Lexicon.pdf?ver=ERteHVCsjK2IBa6__DAldw%3D%3D. Accessed on January 17, 2026.
5. Zhang Ying, et al., "The Connotation and Construction of the Integrated National Strategies and Strategic Capabilities from the Perspective of Systems Theory," *Science & Technology Progress and Policy*, vol. 39, no. 15, 2022, pp. 11–12.

skilled personnel that sustain innovation across both civilian and military domains.[6]

The interconnected nature of this system is also reflected in the official Chinese discourse. A 2019 Xinhua News Agency report noted that Xi Jinping views technological innovation and MCF as mutually reinforcing pillars of national development. In this framework, advances in science and technology are seen as enabling the effective implementation of MCF, while closer integration between civilian and defence innovation systems accelerates the translation of technological breakthroughs into capabilities that support national development and modernisation of the PLA.[7]

The MCF strategy has been operationalised through a series of national and provincial initiatives that have placed emerging technologies at the forefront. In 2016, the State Administration of Science, Technology and Industry for National Defence issued the Opinion on Accelerating and Advancing Science and Technology Collaborative Innovation in the National Defence Science and Technology Industry, which called for the establishment of national defence laboratories and innovation centres to strengthen collaboration among military organisations, research institutes, and technology firms. The 2017 Science and Technology Military–Civil Fusion Special Projects Plan, under the 13th Five-Year Plan framework, highlighted emerging technologies, including intelligent unmanned systems, quantum communications, and brain-inspired intelligence, as priority areas for joint development. These priorities were reaffirmed in the 14th Five-Year Plan, which called for deeper military–civil collaboration across domains such as maritime systems, aerospace, cyberspace, biotechnology, and artificial intelligence.[8]

6. Audrey Fritz, "At the Nexus of Military-Civil Fusion and Technological Innovation in China," *The Diplomat*, July 14, 2021, https://thediplomat.com/2021/07/at-the-nexus-of-military-civil-fusion-and-technological-innovation-in-china/. Accessed on January 15, 2026.
7. Ibid.
8. Elsa B. Kania, "The Competitive Challenge of Military-Civil Fusion," *US-China Economic Security Commission*, 2023, pp. 4–5, https://www.uscc.gov/sites/default/files/2023-04/Elsa_Kania_Testimony.pdf. Accessed on January 17, 2026.

In this context, AI has emerged as a central focus for linking civilian technology and the PLA's modernisation objectives.[9] Beijing's 2017 New Generation Artificial Intelligence Development Plan called for the coordinated development of civilian and military AI capabilities. The plan advocated the coordinated development of civilian and defence AI applications and clearly emphasised the deployment of MCF in AI. Since its inception, the strategy has mobilised a diverse range of actors, including technology companies, universities, research institutes, and military sector groups, backed by significant government financing and legislative incentives to drive innovation. In the military domain, the plan emphasised AI's potential for applications such as command decision-making, military simulations and wargaming, and the development of advanced defence equipment.[10]

For the PLA, AI is portrayed as the primary enabling technology of a broader move toward what Chinese strategists refer to as "intelligentised warfare" *(zhinenghua zhanzheng)*. In Chinese military publications, intelligentisation (智能化) is the next stage of military modernisation, after mechanisation and informatisation (信息化). The concept highlights the incorporation of AI-powered decision systems, autonomous platforms, and data-centric command architectures into joint operations in the land, sea, air, cyber, and space domains.[11] From this vision, AI helps the PLA to accelerate operational decision cycles, increase information supremacy, and coordinate complex multi-domain operations in highly competitive contexts. In this process, MCF acts as a facilitator for the seamless transfer of technology from the civilian to the military sector.

The PLA's recent AI procurement requests offer insight into how these goals are being translated into specific capability requirements.

9 Om Ranjan "The PLA and Intelligentised Warfare," *MP-IDSA*, December 1, 2022, https://idsa.in/publisher/comments/the-pla-and-intelligentised-warfare. Accessed on January 17, 2026.

10. Graham Webster, et al., "Full Translation: China's 'New Generation Artificial Intelligence Development Plan'", *DigiChina*, August 1, 2017, https://digichina.stanford.edu/work/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/. Accessed on February 15, 2026.

11 Elsa B. Kania, "Battlefield Singularity," *CNAS*, November 28, 2017, https://www.cnas.org/publications/reports/battlefield-singularity-artificial-intelligence-military-revolution-and-chinas-future-military-power. Accessed on February 15, 2026.

Recent analysis of thousands of open-source Requests for Proposal (RFPs) issued by the PLA between 2023 and 2024 provides a clearer picture of the capabilities it is seeking to develop. These documents indicate a broad push to integrate AI across the military's C5ISRT (Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance, Reconnaissance, and Targeting). Many requests focus on AI-enabled decision-support systems designed to process large volumes of data, including open-source information, in order to accelerate strategic and tactical decision-making.[12]

Other priorities include sensor enhancement, multi-source data fusion, and advanced surveillance tools such as facial and gait recognition, digital forensics capable of recovering deleted data, and systems for generating or detecting deepfakes. Several proposals also target technologies intended to counter perceived US advantages, particularly capabilities to detect US naval assets and disrupt space-based systems. Taken together, these RFPs suggest that the PLA is not only pursuing AI to improve battlefield awareness and precision but is also rapidly experimenting with new tools, including those for cognitive and information warfare, through short development cycles and partnerships with commercial technology providers.[13]

A broader institutional framework enables the breadth of capabilities reflected in these procurement requests. Seen from this perspective, MCF functions as the overarching architectural principle underpinning China's military AI project. In the AI domain, three core objectives are visible. First, MCF aims to compress development cycles by allowing the PLA to adopt and adapt existing civilian technologies rather than funding bespoke military systems from scratch. Second, it seeks to reduce development costs, as dual-use technologies developed for large civilian markets can be supplied to the military at lower marginal cost. Third, MCF broadens the supplier base by incorporating private technology firms and civilian universities alongside traditional defence actors.

12. Emelia Probasco, et al., "China's Military AI Wish List: Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance, Reconnaissance, and Targeting (C5ISRT)," Centre for Security and Emerging Technology, 2026, pp. 1–2, https://cset.georgetown.edu/wp-content/uploads/CSET-Chinas-Military-AI-Wish-List.pdf. Accessed on January 17, 2026.
13. Ibid.

As mentioned, universities and research institutes form the core of China's defence innovation ecosystem. Therefore, the following section examines the roles and interactions of these actors and how they shape the evolving landscape of AI, with a focus on supporting the PLA's AI ambitions.

UNIVERSITIES AND PLA AI DEVELOPMENT

Universities constitute a critical component of China's MCF ecosystem. In the field of AI, universities contribute both foundational research and applied technological development. They also serve as key training grounds for specialised talent in areas such as machine learning, robotics, aerospace engineering, and data science. Beyond their traditional roles in education and basic research, universities increasingly participate directly in defence innovation programmes and procurement projects, reflecting their growing integration into China's military technology development system.[14]

A particularly important component of this network is the cluster of defence-linked universities commonly referred to as the "Seven Sons of National Defence." This group includes institutions such as Beihang University, Harbin Institute of Technology, and Northwestern Polytechnical University, which maintain deep institutional ties with China's defence industrial base.[15] Further analysis of graduate employment data further highlights the concentration of defence talent within these universities. A 2019 study by the Centre for Security and Emerging Technology (CEST) found that only about 6,000 graduates entered state-owned defence enterprises. Yet these recruits came largely from a small number of universities. Six of the Seven Sons accounted for only 16 per cent of employed graduates in the dataset, but accounted for about 72 per cent of those who joined major defence companies. This pattern

14. Alex Joske, "The China Defence Universities Tracker," Australian Strategic Policy Institute, 2019, pp. 1–2, https://www.aspi.org.au/report/china-defence-universities-tracker/. Accessed on January 17, 2026.
15. Dan Murphy, "The Seven Sons of National Defense," Rajawali Foundation Institute for Asia, 2024, pp. 1–5, https://rajawali.hks.harvard.edu/wp-content/uploads/sites/2/2024/11/240948-HKS-Occasional-Seven-Sons-FINAL-12-13.pdf. Accessed on January 18, 2026.

shows how these institutions function as key talent pipelines into China's defence sector.[16]

The procurement records further demonstrate the depth of collaboration between these universities and the PLA. Between 2023 and 2024, the Seven Sons of National Defence collectively received more than 100 AI-related defence contracts, highlighting their direct involvement in military technology development. Among them, Northwestern Polytechnical University, Beihang University, and Beijing Institute of Technology ranked among the top fifteen academic providers to the PLA in AI-related projects. Northwestern Polytechnical University emerged as the most prominent contributor within this group, receiving 33 contracts. Many of these projects are linked to AI-focussed research infrastructure, including the National Engineering Research Centre for Unmanned Aerial Vehicle Systems, which supports research on autonomous flight, swarm coordination, and human–machine teaming.[17]

Other universities within the Seven Sons network contribute complementary expertise across different technological domains. Harbin Engineering University, for example, received ten contracts and has undertaken projects such as the development of mission-reconstruction models for Unmanned Underwater Vehicle (UUV) swarms, reflecting its long-standing specialisation in undersea warfare technologies. Nanjing University of Science and Technology, a major research centre for advanced weaponry and intelligent munitions, has also participated in projects such as the development of rapid-prototyping simulation controllers for dexterous robotic systems. Together, these procurement records demonstrate that defence-linked universities are not only supplying skilled graduates but also directly contributing to the development and testing of AI-enabled systems for the PLA.[18]

16. Ryan Fedasiuk and Emily Weinstein, "Universities and the Chinese Defense Technology Workforce," Centre for Security and Emerging Technology, 2020, pp. 6–12.
17. Cole McFaul, et al., "Pulling Back the Curtain on China's Military-Civil Fusion," Centre for Security and Emerging Technology, 2025, pp.15–17, https://cset.georgetown.edu/publication/pulling-back-the-curtain-on-chinas-military-civil-fusion/.2025 Accessed on January 17, 2026.
18. Ibid., p. 17.

RESEARCH INSTITUTES AND AI INNOVATION FOR THE PLA

Research institutes comprise another important component of China's academic-defence innovation ecosystem. Among these, the network of institutes connected with the Chinese Academy of Sciences (CAS) is particularly significant. CAS has over 100 research institutes across the country and has long been involved in China's strategic scientific and technological programmes, including those focussed on artificial intelligence, robotics, and advanced sensing systems.[19] Contract evidence shows that these institutes have become key partners in the PLA's AI development. According to PLA procurement data, CAS and its affiliated institutes acquired more than 90 AI-related contracts between 2023 and 2024, totalling approximately US$ 20 million.[20]

Several institutes have made significant contributions to military-relevant technologies. The Shenyang Institute of Automation has a long record of expertise in robotics and unmanned systems, having worked on projects such as autonomous underwater vehicles and swarm coordination. The institute specialises in computer vision, pattern recognition, and intelligent control systems, which support applications such as target recognition, sensor fusion, and AI-powered decision-support tools. Meanwhile, the Changchun Institute of Optics, Fine Mechanics, and Physics (CIOMP) develops innovative optical technologies for missile guidance, high-resolution imaging, surveillance systems, and space situational awareness.[21] Notably, numerous CAS institutes involved in these initiatives, including the Shenyang Institute of Automation and CIOMP, have been placed on the US Entity List, reflecting foreign concerns that nominally civilian research operations are closely related to China's military modernisation efforts.[22]

Taken together, the evidence demonstrates that universities and research institutes form a critical component of China's military

19. CAS, "Talent Education: Chinese Academy of Sciences", https://www.cas.cn/rcjy/. Accessed on October 12, 2025.
20. McFaul, et al., n. 17, p. 15.
21. Ibid.
22. US Department of Commerce, Bureau of Industry and Security, "Revisions to the Entity List," January 6, 2025, https://www.federalregister.gov/documents/2025/01/06/2024-31468/revisions-to-the-entity-list. Accessed on January 17, 2026.

innovation ecosystem. Rather than functioning solely as sources of talent or basic research, these institutions increasingly participate directly in defence technology development through collaborative laboratories, joint research programmes, and procurement contracts with the PLA. Their integration into MCF allows advances in AI and related technologies to move more rapidly from academic laboratories to operational military applications. In this sense, universities and research institutes operate not as peripheral actors but as core nodes in a distributed innovation network supporting the technological modernisation of the PLA.

CONCLUSION: IMPLICATIONS FOR INDIA

This article examines how China's MCF strategy has reshaped the institutional ecosystem supporting the PLA's development of artificial intelligence. The analysis shows that China's military AI development increasingly operates through a distributed innovation ecosystem that connects research institutions with defence modernisation efforts. The article shows that universities and research institutes play an important role in supporting the PLA's broader effort to integrate AI into its operational capabilities. This ecosystem provides several advantages for China's defence innovation system. By leveraging civilian technological advances and a large domestic technology market, MCF enables the PLA to access a broad talent pool, reduce development costs, and experiment with emerging AI capabilities through relatively rapid development cycles.

For India, these developments carry important strategic implications. AI-enabled capabilities emerging from China's civil–military ecosystem, particularly in areas such as autonomous systems, intelligent surveillance, and data-driven decision support, may influence the evolving character of military competition. Although democratic systems are unlikely to replicate a highly centralised MCF model like China's, stronger collaboration among the armed forces, universities, and research institutions remains essential. Expanding the role of academic and research institutions in foundational and applied research could help develop niche and asymmetric technological capabilities.

At the same time, India's response should not focus solely on developing AI-enabled systems but also on anticipating potential counter-measures. As advances in human–machine interaction and AI-assisted decision-support tools shorten operational decision cycles, often described as compression of the observe–orient–decide–act loop, military effectiveness will increasingly depend on the ability to operate in contested and information-denied environments. Given the network-dependent nature of AI-enabled warfare, India must focus not only on adopting advanced technologies but also on ensuring that military operations remain effective when digital networks and information systems are disrupted or degraded.