

Dual-Use Technology: Bridging the Gap Between Civil and Military Technology

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Introduction

Dual-use technology refers to items, goods, software, or technology that can be used for both civilian and military purposes. Technology is considered ‘Dual Use’ when it has been researched and developed, and its applications can be found both in commercial and Military purposes.¹ As indicated in Figure 1, the dual-use technology transition is a two-way process. Many of today’s technologies, such as computer-aided design, soldering, process control, drones, artificial intelligence, and machine learning, are considered dual use.²



Figure 1: Dual-Use Tech Transition

Source: *MDPI*³

Traditionally, the flow of technology infusion has traversed from the armed forces to the civil domain across the globe. One of the major systems which has become a trademark example of this transfer of technology is the advent of global positioning system.⁴

The hegemony of the military technology over commercial sector continued till the Cold War era, rather several critical commercial technologies that are seen and utilised today originated as military technology in a dedicated military research lab. However, as the industrialisation picked up, the Research and Development (R&D) investments by the commercial entities started gathering steam.

The shift in the technological dominance from the military to civil sector is primarily attributed to three major factors—the end of Cold War; the subsequent establishment of the start-up culture in the information age; and the rise of the internet and technology giants such as Apple, Alphabet, Microsoft, fuelled by globalisation.⁵

Global Paradigm on Dual-Use Technology Infusion

- **Defence Innovation Unit (DIU)—United States (US)**

Taking cognisance of the shift in the R&D spending and how the commercial sector was moving ahead of the military in technology domain, the DIU as a specialised component of the US Department of Defence was established in the year 2015 in the Silicon Valley. The DIU serves as a critical bridge between the military and innovative technology sectors.⁶ It was established to accelerate the adoption of commercial technologies for national security purposes and focuses on identifying, evaluating, and rapidly prototyping cutting-edge solutions that can enhance military capabilities. Operating with streamlined acquisition processes, the unit works directly with start-ups, small businesses, and non-traditional defence contractors to bring emerging technologies into military applications. The three core components of the DIU are indicated in Figure 2.

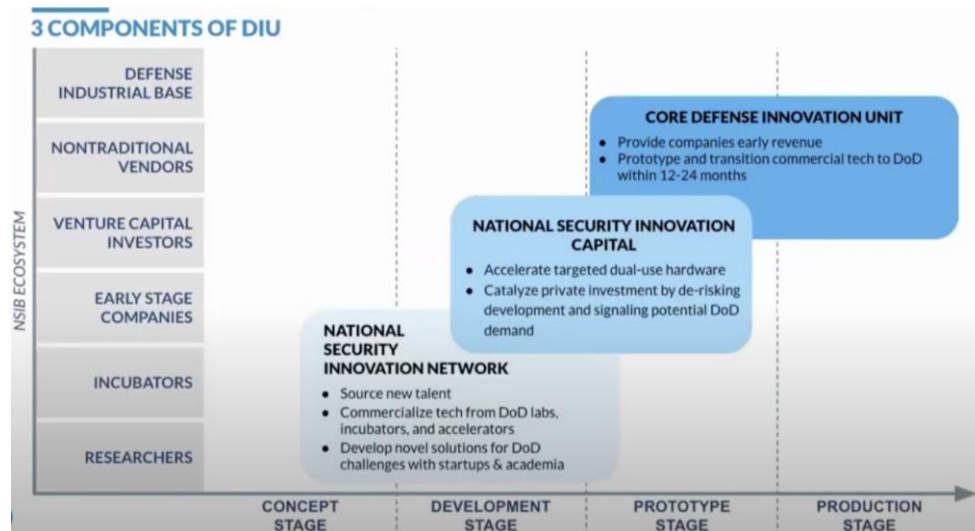


Figure 2: Components of DIU

Source: CCC⁷

Within the DIU, the National Security Innovation Network (NSIN) is a program office that runs a NSIN Emerge Accelerator, which seeks to establish partnerships with universities to create new dual-use ventures that can serve both government and commercial markets.⁸

- **Israel**

To capitalise on the potential of dual-use technology, Israel runs INNOFENSE innovation program. As part of the program, a list of multi-pronged defence challenges is published with the aim of attracting commercial start-ups to field their commercial technology for defence purposes and test the technologies feasibility for defence use cases.⁹ INNOFENSE is a unique acceleration program designed to bridge the world of tech created for civilian and military use.

- **Russia**

Russia too has embraced open innovation strategy for its defence sector. In 2011, the Russian government increased the share of R&D as part of its gross domestic product in science, technology, and innovation to 2.5-03 percent. As a strategic measure, the Russian government places great emphasis on creating links between various innovation players. The Russian government corporation ROSTEC, which is a Russian state-owned defence conglomerate headquartered in Moscow, has a role of development and export of high-tech military and civilian industrial products. The corporation consists of about 700 organisations, which include well-known international brands such as Avtovaz and Kamaz Kalashniko.¹⁰

Dual Tech Infusion: National Initiatives

According to the data from the Department of Science and Technology (DST) for the year 2020-21, private industry expenditure on R&D accounted for 36.4 per cent of the national R&D efforts, as shown in Figure 3. This data signals an increasing involvement of private enterprises in advancing technological research at the national level. Recognising this, the Union Cabinet launched the Research, Development, and Innovation scheme with a corpus of INR one lakh Cr¹¹ and is being steered by the DST.

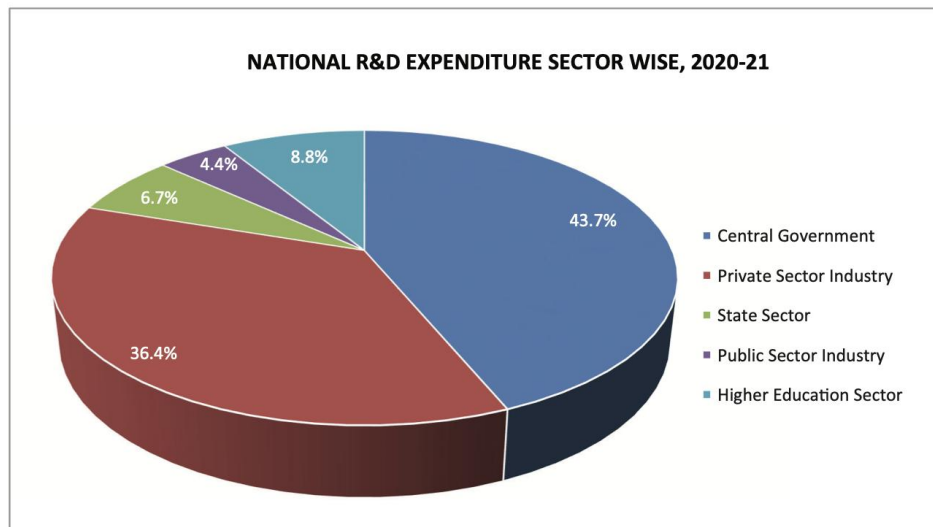


Figure 3: National R&D expenditure for 2020-21

Source: DST, Government of India¹²

The government has introduced targeted innovation programs, such as the Innovation for Defence Excellence (iDEX) scheme, aimed at start-ups and micro, small, and medium-sized enterprises, as well as the Technology Development Fund. Complementing these initiatives are the 'Make I' and 'Make II' schemes, which seek to further enhance the capacity and capabilities of the private sector to contribute meaningfully to defence technology development.¹³ The various schemes under the iDEX framework are given in Figure 4.

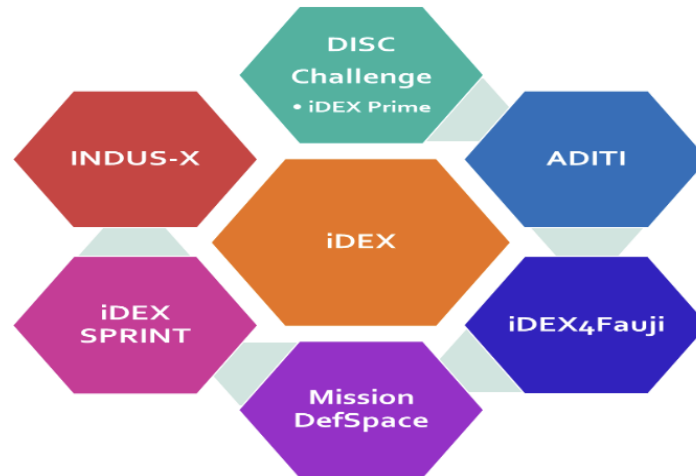


Figure 4: Schemes under iDEX

Source: Indian Journal of Public Administration¹⁴

Why Dual-Use Demands a Strategic Outlook?

The commercial and defence markets are vastly different¹⁵. Recognising this differential, the Massachusetts Institute of Technology (MIT) has developed the 'Dual-use Readiness Levels' framework, as shown in Figure 5. The framework acts as a guide to help start-up teams understand the language of both civil and military sector.¹⁶ The firms must assess themselves on 5 levels, which include technology readiness, commercial funding, commercial customer readiness, mission funding, and the mission customer readiness level, to find the suitability of

their technology and product to meet the requirements of both the sectors.

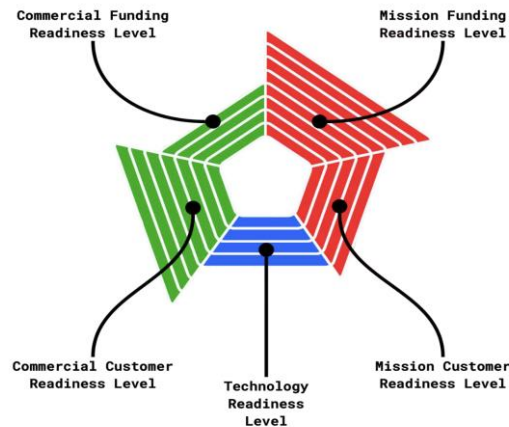


Figure 5: Dual-Use Readiness Pillars

Source: MIT¹⁷

The Era of Electric Tech Stack Fuelling Dual-Use Possibilities

The Electric Tech Stack thesis proposed by Noah Smith argues how the electric tech stack, consisting of batteries, electric motors, power electronics, and chips, are indicative of both military capability and manufacturing dominance of a nation. The traditional industries required separate supply chains, making of cars different from making aircraft or electronics. However, today, the electric platforms share core components—companies such as Xiaomi and BYD demonstrated how they moved from one sector to another in a quick timeframe, with Xiaomi, a mobile making company, entering the Electric Vehicle (EV) sector and BYD starting as a battery maker moving and scaling across in the EV sector. The control over Electric Tech Stack has enabled this quick transition.¹⁸ The Venn diagram shown in Figure 6 highlights how China has mastered the supply chain convergence of the electric tech stack, enabling them to make military drones as quickly as the EVs and mobile phones.

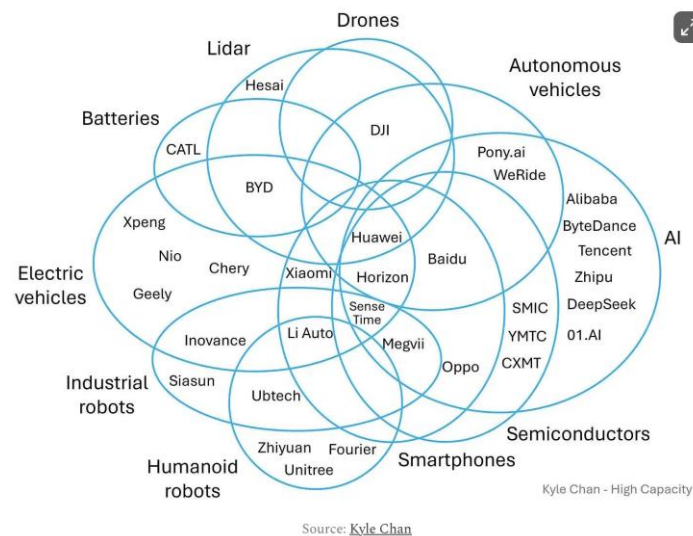


Figure 6: China's Electric Stack Companies

Source: Kyle Chan

The Way Forward

The technological landscape is evolving in a short span of time and the lifecycle of technology has reduced. Further, minor innovative tweaks to already available technology may lead to a decisive advantage to armed forces against an adversary. Therefore, quickly identifying a technology available with the commercial sector, modifying it to the needs, and quick adoption will keep the armed forces in good stead. Some of the proposals towards embracing the dual-use technology are listed below:

- **Raising Indian electric stack companies and adopting postponement strategy.** A focused governmental strategy should be implemented to systematically identify and incubate Indian electric stack companies specialising in batteries, electric motors, power electronics, semiconductor chips, and artificial intelligence. These sectors represent crucial technology domains with significant dual-use potential. In the context of future conflicts, such capabilities are anticipated to play a pivotal role in fulfilling both national security imperatives and economic prosperity objectives. Therefore, nurturing these industries aligns with broader policy goals aimed at enhancing technological self-reliance and strategic advantage. In addition, the postponement strategy (supply chain management method) that delays the customisation or differentiation of a product until last possible instance may be utilised to keep the civil and military use supply chains common and tweak the production line during conflicts to provide resilience.
- **Intellectual Property (IP) showcase event for patent to product.** With increasing focus on R&D in the country, IP has become ever more crucial. Several patents are being applied for and being awarded to university-level researchers. However, they face issue in conversion to a prototype product. Several such patents have dual-use applications, such as fields related to materials, batteries, etc. Therefore, organising IP showcase events can lead to collaboration between the innovator and angel investor, orchestrated by the multi-ministerial government initiative. At this level, defence use cases can be deliberated through the iDEX framework. This will ensure that such technology do not face inadvertent delays in deployment in the armed forces.
- **Open dedicated dual-use incubation centres.** The DST and iDEX should look for collaboration opportunities and identify firms providing technology, which can be deployed readily both by the military and the civil markets with minimum tweaks. Necessary mentoring provided to the firms towards diversifying their portfolio to address both commercial and defence needs will go long way in ensuring the sustainability of the ventures. This mentoring in line with dual-use readiness framework proposed by MIT during incubation, whether being done by DST or Ministry of Defence or any other agency, is crucial to bridge the gap between commercial tech and the defence tech.¹⁹

Conclusion

The dual-use technology and open innovation model provides the Indian defence ecosystem with an opportunity to get ahead in the technology curve with respect to other advanced countries. Chinese realised this during their initial growth years which led to its spiral development through military-civil fusion strategy adopted towards harnessing the commercial sector capability for People Liberation Army's capability development. To make this possible in Indian context, there is a need for a national policy that rewards and motivates private industry and academic institutions to focus on developing critical technologies, supporting the goal of self-reliance and long-term resilience in prolonged conflicts.²⁰

Endnotes

- ¹ “Exporting Dual-Use Items—Trade and Economic Security”, *Trade EC*, 08 Sep 2025, accessed 28 Nov 2025, https://policy.trade.ec.europa.eu/help-exporters-and-importers/exporting-dual-use-items_en
- ² “Dual-Use Technology Applications in Defense Tech”, NSTXL, 16 Apr 2025, accessed 26 Sep 2025, <https://nstxl.org/dual-use-technology-applications-in-defense-tech/>
- ³ “Conversion of Dual-Use Technology: A Differential Game Analysis under the Civil-Military Integration”, *Symmetry*, 2020, accessed 20 Nov 2025, <https://doi.org/10.3390/sym12111861>
- ⁴ Scott Pace et al., “The Global Positioning System: Assessing National Policies”, *RAND Corporation*, 1995, accessed 05 Nov 2025, <https://doi.org/10.7249/MR614>
- ⁵ Nir Reuven and Eitan Shamir, “The Shift in Technological Dominance and the Adaption of Open Innovation by the Defence Sector”, *Defense & Security Analysis* 41, no. 3 (2025): 392–415, accessed 20 Nov 2025, <https://doi.org/10.1080/14751798.2025.2484920>.
- ⁶ Christopher Kirchoff, Raj M Shah, *Unit X: How the Pentagon and Silicon Valley Are Transforming the Future of War*, [Scribner: 2024].
- ⁷ Scott Summer, “How to work with US DoD’s Defense Innovation Unit (DIU)”, CCC, accessed 22 Nov 2025, <https://www.ccc.ca/en/videos/how-to-work-with-u-s-dods-defense-innovation-unit-diu/>
- ⁸ “National Security Innovation Network: Emerge Accelerator”, *National Security Innovation Network*, accessed 19 Sep 2025, <https://www.nsin.us/emerge/>
- ⁹ Jennifer L Schenker, “The Rise Of Dual-Use Technologies”, *The Innovator*, accessed 20 Nov 2025, <https://Theinnovator.News/the-Rise-of-Dual-Use-Technologies/>
- ¹⁰ “About Rostec”, *Rostec*, accessed 29 Sep 2025, <https://rostec.ru/en/about/>
- ¹¹ “Cabinet Approves Research Development and Innovation (RDI) Scheme to Scale up Research, Development and Innovation in Strategic and Sunrise Domains”, *Press Information Bureau*, accessed 10 Sep 2025, <https://www.pib.gov.in/www.pib.gov.in/Pressreleaseshare.aspx?PRID=2141130>
- ¹² “National Science & Technology Management Information System”, *Department of Science & Technology*, GOI, accessed 20 Nov 2025, <https://dst.gov.in/scientific-programmes/scientific-engineering-research/national-science-technology-management-information-system-nstmis>
- ¹³ “DAP 2030”, *Ministry of Defence*, GOI, accessed 27 Sep 2025, <https://www.mod.gov.in/dod/sites/default/files/DAP2030new.pdf>
- ¹⁴ SN Ahmed, “Empowering Defence Start-Ups: An Analysis of India’s iDEX Initiative”, *Indian Journal of Public Administration*, 2025, accessed 25 Sep 2025, <https://doi.org/10.1177/00195561251367636>
- ¹⁵ “Dual-Use Is a Strategy, Not a Category (Nor a Trap)”, *War on the Rocks*, 02 Jan 2025, accessed 28 Nov 2025, <https://warontherocks.com/2025/01/dual-use-is-a-strategy-not-a-category-nor-a-trap/>
- ¹⁶ “Dual-Use Readiness Model”, *Massachusetts Institute of Technology*, accessed 24 Sep 2025, <https://dualuse.mit.edu/#commercialfundingreadinesslevelcfl>
- ¹⁷ Ibid.
- ¹⁸ Noah Smith, “Why Every Country Needs to Master the Electric Tech Stack”, 09 Dec 2024, accessed 20 Sep 2025, <https://www.noahpinion.blog/p/why-every-country-needs-to-master>
- ¹⁹ “Scaling Nontraditional Defense Innovation”, *Defense Innovation Board*, accessed 25 Sep 2025, <https://innovation.defense.gov/Portals/63/DIB%20Scaling%20Nontraditional%20Defense%20Innovation%20250113%20PUBLISHED.pdf>
- ²⁰ Amy J Nelson, “Innovation and Its Discontents: National Models of Military Innovation and Its Discontents: National Models of Military Innovation and the Dual-Use Conundrum Innovation and the Dual-Use Conundrum”, *Center for International and Security Studies at Maryland (CISSM)*, Jul 2020, accessed 20 Oct 2025, https://cissm.umd.edu/sites/default/files/2020-07/EmergingTechInnovation_063020.pdf

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Article uploaded: 02-12-2025

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