DEFENSE AND AEROSPACE PROGRAM

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ZEITENWENDE MEETS ATMANIRBHAR

Co-Creating the Future of Indo-German Defense

CSDR
COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

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ABOUT THIS REPORT

This report analyzes the transformative potential of the Indo-German defense partnership, which currently stands at a "strategic inflection point" driven by Germany's Zeitenwende and India's Atmanirbhar Bharat initiative. It argues that while high-profile government contracts for platforms like submarines are essential, the sustainable future of this alliance lies in integrating Germany's advanced Mittelstand technology with India's scalable, cost-efficient manufacturing base.

The report identifies deep complementarities among naval systems, land warfare, and emerging technologies (AI and drones), while offering candid solutions to historical barriers such as restrictive export controls and trust deficits. Moving beyond a buyer-seller relationship, the report proposes a phased roadmap (2025–2035) to operationalize a "bilateral innovation ecosystem". It outlines actionable steps—including a joint innovation fund and shared IP frameworks—to foster co-creation between MSMEs and startups, ultimately enhancing the strategic autonomy of both nations

ABOUT CSDR'S DEFENSE AND AEROSPACE PROGRAM

Our Defense and Aerospace Industry Program conducts research, policy analysis and business consulting. We actively collaborate with government entities to present various policy options for achieving defense manufacturing, indigenization, and export goals. In partnership with the Indian Armed Forces, we provide critical insights into the implications of emerging technologies and their impact on warfare and security scenarios through battlespace trend analysis and forecasts. Additionally, our program conducts research to formulate procurement strategies and warfighting doctrines that align with these new technologies and weapon systems.

ABOUT COUNCIL FOR STRATEGIC AND DEFENSE RESEARCH

Founded in January 2020 by Lt. Gen. D.S. Hooda (Retd.) and Dr. Happymon Jacob, CSDR is an innovative think tank and consultancy specializing in foreign policy, geopolitical risk, connectivity, and critical areas of defense and aerospace. With a focus on the Indian subcontinent, Eurasia, and the Indo-Pacific, CSDR is committed to generating strategic insights that drive meaningful change. Read more at www.csdronline.com

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LIST OF ABBREVIATIONS

- AI: Artificial Intelligence
- AIPS: Air Independent Propulsion System
- B2B: Business-to-Business
- BDI: Bundesverband der Deutschen Industrie (Federation of German Industries)
- BDSV: Bundesverband der Deutschen Sicherheits- und Verteidigungsindustrie e.V.
- BEL: Bharat Electronics Ltd
- BMVg: Bundesministerium der Verteidigung (Federal Ministry of Defence, Germany)
- C2: Command and Control
- CDS: Chief of Defence Staff
- CIH: Cyber Innovation Hub
- CVRDE: Combat Vehicles Research and Development Establishment
- DDP: Department of Defence Production
- DIC: Defence Investor Cell
- DIN: Deutsches Institut für Normung (German Institute for Standardization)
- DIU: Defense Innovation Unit
- DPSU: Defence Public Sector Undertaking
- DRDO: Defence Research and Development Organisation
- DTSG: Defence Technology Sub-Group
- EDF: European Defence Fund
- EUDEX: Euro Defense Expo
- FCAS: Future Combat Air System
- FDI: Foreign Direct Investment
- FRCV: Future Ready Combat Vehicles
- G2G: Government-to-Government
- GA: German Accelerator
- GoI: Government of India
- HAL: Hindustan Aeronautics Ltd.
- HDC: High Defence Committee
- HDW: Howaldtswerke-Deutsche Werft
- IC: Indigenous Content
- iDEX: Innovations for Defence Excellence
- IGC: Intergovernmental Consultation
- IIT: Indian Institutes of Technology
- IOP: Indian Offset Partner
- IP: Intellectual Property
- ISRO: Indian Space Research Organisation
- JV: Joint Venture
- KMW: Krauss-Maffei Wegmann
- L&T: Larsen & Toubro
- LiDAR: Light Detection and Ranging
- MBT: Main Battle Tank
- MCSG: Military Cooperation Sub-Group
- MDL: Mazagon Dock Limited
- MDS: Mazagon Dock Shipbuilders
- MGCS: Main Ground Combat System
- MMRCA: Medium Multi-Role Combat Aircraft
- MoD: Ministry of Defence
- MSME: Micro, Small and Medium Enterprises
- MTCR: Missile Technology Control Regime
- MTU: Motoren-und Turbinen Union
- NATO: North Atlantic Treaty Organization
- OAS: Obstacle Avoidance Systems
- OEM: Original Equipment Manufacturer

- OPT: Optional Practical Training
- PASSEX: Passage Exercise
- PLA(N): People's Liberation Army Navy
- PSU: Public Sector Undertaking
- SIDM: Society of Indian Defence Manufacturers
- SIPRI: Stockholm International Peace Research Institute
- SP: Strategic Partnership
- SPRIND: Bundesagentur für Sprunginnovationen (Federal Agency for Disruptive Innovation)
- STANAG: Standardization Agreement
- TASL: Tata Advanced Systems Ltd
- TDF: Technology Development Fund
- TKMS: Thyssenkrupp Marine Systems
- UAV: Unmanned Aerial Vehicle
- UUV: Unmanned Undersea Vehicle

Executive Summary

Indo-German defense cooperation stands at a decisive turning point. Germany's Zeitenwende—launched after Russia's 2022 invasion of Ukraine—has increased defense spending targets to 3.5 % of GDP by 2029 under Chancellor Friedrich Merz. At the same time, Berlin's October 2024 Focus on India policy paper elevates New Delhi as a priority Indo-Pacific partner, calling for joint production, reliable armaments collaboration, and coordinated responses to regional instability.

This vision aligns with India's Atmanirbhar Bharat initiative. India has sharply reduced its reliance on Russian arms, with imports falling from 76% (2009–2013) to 36% (2019–2023), according to SIPRI. Consequently, the urgency to diversify into high-technology partnerships, particularly those that support co-production, has never been greater. Historical collaborations—such as the HF-24 Marut fighter, Shaktiman truck, Dornier 228 aircraft, and Shishumar-class submarines—demonstrated strong potential for co-development and technology transfer, despite bureaucratic and political challenges.

Today, industrial complementarities are compelling. Germany's Mittelstand leads in precision subsystems, sensors, and advanced platforms; India's network of over 10,000 defense MSMEs, combined with cost-efficient manufacturing and deep IT expertise, enables scalable, innovative production. Recent flagship agreements underscore this synergy: the 2024 TKMS-Mazagon Dock $6.02 billion submarine project with air-independent propulsion; the Rheinmetall-Reliance munitions venture, and Hensoldt-Bharat Electronics' electronic warfare systems.

Geopolitical convergence can accelerate momentum. German naval deployments in the Indo-Pacific, Luftwaffe participation in Exercise Tarang Shakti 2024, and the 2023 agreement on classified information exchange signal deepening trust and interoperability. Yet significant barriers remain—Germany's restrictive export controls, India's complex procurement processes, intellectual property concerns, and legacy trust deficits from past scandals.

Government-to-government contracts can deliver major platforms, but are slow and risk-averse. Sustained progress demands a pivot toward MSMEs and startups, where agile innovation in AI, drones, quantum technologies, and dual-use systems can thrive. A bilateral innovation ecosystem—anchored by joint accelerators, shared IP frameworks, MSME corridors, and a dedicated defense innovation fund—will bridge regulatory, financial, and cultural gaps.

This report proposes a phased roadmap from 2025 to 2035: concluding a Comprehensive Defence Partnership Agreement in 2025, operationalizing a joint innovation fund by 2026, delivering the first co-produced platform by 2029, and achieving integrated supply chains, joint exports, and leadership in emerging technologies by 2035. If realized, an Indo-German defence partnership could enhance strategic autonomy and industrial competitiveness for both countries.

Introduction: A Strategic Inflection Point for Indo-German Defense Cooperation

A quarter century after India and Germany upgraded their relations to a 'strategic partnership,' trade, investments, people-to-people ties, and industrial and development cooperation have all emerged as strong pillars of their bilateral relationship. In contrast, Indo-German defense ties have remained largely constrained by a variety of factors: strategic divergence, Germany's restrictive export controls, India's challenging procurement process, misalignments in defense-industrial standards or requirements, political sensitivities and hesitancy, and so on. India's close strategic ties with Russia continue to be a sore point: most recently, India's (albeit limited) participation in ZAPAD 2025, a military exercise hosted by Moscow, was widely seen as tone-deaf by the German strategic community and with alarm by some segments.

However, a range of major and recent shifts in their respective geopolitical environments and domestic policy landscapes has created an arguably greater-than-ever logic and a strong imperative for both New Delhi and Berlin to reimagine their bilateral defense partnership.

While India sustained relatively high levels of growth in the last three decades, it has also witnessed a stark deterioration in the country's geopolitical and security environment in more recent years, marked by a protracted military standoff with China in the years after the 2020 Galwan Valley clash and two rounds of major military escalations with Pakistan in 2019 and 2025. These events have also been accompanied by closer military cooperation between China and Pakistan, which in turn has led to sharp fears in the Indian strategic community over a 'China-Pakistan' nexus against India and a consequent 'two-front security dilemma.'

As a result, the need to modernize the Indian armed forces, and more specifically, to build a technologically intensive defense industrial base that can meet the requirements of the Indian military, has never been greater.

> "Russia's 2022 invasion of Ukraine shocked the country's political and security establishment and revived the long-dormant threat of another European war. Top German military officials have since publicly warned that Russia could become capable of attacking NATO by 2029 (caveated on the outcome in Ukraine). Consequently, a dramatic shift in Germany's foreign policy and security orientation has closely followed, often referred to as the Zeitenwende (a turning point), accompanied by a massive increase in the country's defence budget.

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Prime Minister Narendra Modi greets German Chancellor Olaf Scholz prior to a meeting at Hyderabad House in New Delhi on October 25, 2024. | Photo Credit: Shiv Kumar Pushpakar, The Hindu

For both India and Germany, core geopolitical and national security challenges have been further compounded by rocky, unpredictable ties with an isolationist, revisionist Trump administration in Washington.

Over the last few months, the US has imposed 50% tariffs on India (among the highest on any country), ostensibly as a punitive measure for India's purchase of Russian oil, and publicly reinvigorated its diplomatic relationship with Islamabad in the immediate aftermath of a short conflict between India and Pakistan. Subsequently, bilateral trust has arguably plummeted to its lowest level in decades, and for New Delhi, the prospect of Washington as a key defence and strategic partner has become uncomfortably uncertain (at least, for the rest of Trump's term).

Similarly, strategic trust between Berlin and Washington has eroded to levels unseen in the last eight decades of the transatlantic alliance, due to Trump's moves to downgrade support for Ukraine dramatically, and the President's public threats to support US withdrawal from NATO unless European nations stop being "free riders". As a result, in February, German Chancellor Merz called for "achieving independence from the USA." His comments were unprecedented, marked a "watershed moment," and captured a sense of Washington's unreliability, a view now shared across the German strategic community. More recently, the US National Security Strategy paper has turned the Trump administration's erstwhile hostility towards Europe into official policy, calling on European nations to take "primary responsibility" for their own defense. Notably, the document was released on 4 December, just days after Russian President Putin warned that his country was "ready" for a war with Europe.

Geopolitical challenges for both India and Germany are further complicated by China's rise, its willingness to weaponize and disrupt supply chains such as those of rare earths (critical inputs in defense production),

increasing assertiveness in the Indo-Pacific region, Beijing's 'no-limits' partnership with Moscow, and Trump's willingness to downsize strategic competition with China in favor of a bilateral trade deal.

The geopolitical shifts have also eroded key cultural and political barriers to a robust, advanced bilateral defence partnership between India and Germany, and have provided the two nations with an opportunity to take decisive action. In the aftermath of WWII, the German state was essentially pacifist, but today, polls consistently indicate a shift underway due to Moscow's invasion and Washington's perceived unreliability – a 69% majority in Germany favors the radical increase in its defense budget.

This assumes significance because Germany's pacifist political culture has historically played a role in deterring bilateral defense cooperation. For example, France is subject to similar (external) rules and regulations (export controls) as a member of both NATO and the EU, but has far greater defense industrial ties with India than Germany, largely due to political will and a distinct strategic culture. In the last decade, as Russia's share of Indian defense imports dropped to 36 percent (from over 72%), France's share increased by almost 400 percent (between 2013 and 2022).[1] France now accounts for over 30 percent of Indian defence imports, in stark contrast to Germany, which accounts for just 4-5 percent.

Relatedly, the aforementioned dramatic decline of Russian defence imports points to a major shift within the Indian strategic community, which historically viewed the Soviet Union more favorably than the West. In recent decades, sentiments towards the West have witnessed a transformative and positive evolution, for a range of reasons: India's relations with Western countries have rapidly grown, Russia's power and stature have relatively declined, and China and Russia have declared a 'no-limits' partnership.

Amid these domestic shifts and in a dynamic, uncertain international context, both New Delhi and Berlin have recognized the need to forge a closer defense partnership as major powers that remain invested in a rules-based international order. In 2024, Berlin released its Focus on India Paper, which stated, "the German Government will therefore expand its arms cooperation with India, continue to improve the reliability and

predictability of arms export control procedures, and promote and support cooperation between German and Indian arms companies."[2] The German Ambassador to India has declared that a "clear political will" in Berlin exists to boost defense ties. Meanwhile, as recently as September this year, Indian EAM Jaishankar argued for greater security cooperation between India and Germany and expressed "appreciation" for "more expeditious clearances" and the relaxation of export controls.

The shared imperative is already evident in more frequent high-level bilateral defense engagements and military exercises, and, most recently, in a multi-billion-dollar deal between German conglomerate Thyssenkrupp Marine Systems (TKMS) and Indian PSU Mazagon Dock Shipbuilders (MDS), supported by their respective governments. The agreement marks a milestone, as the greatest potential to radically upgrade the Indo-German strategic partnership lies in mutually beneficial, sustained defense industrial collaborations between India and Germany.

In this context, this report examines the logic, drivers, opportunities, and challenges of the Indo-German defense partnership and offers a roadmap to deepen defense industrial collaboration over the next decade.

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The Need and Logic of Defense Industrial Collaboration

India's defence modernization is underpinned by a mammoth effort to transform the country from the world's largest arms importer in recent history into an Atmanirbhar (self-reliant) arms producer and even a major exporter of defence equipment.

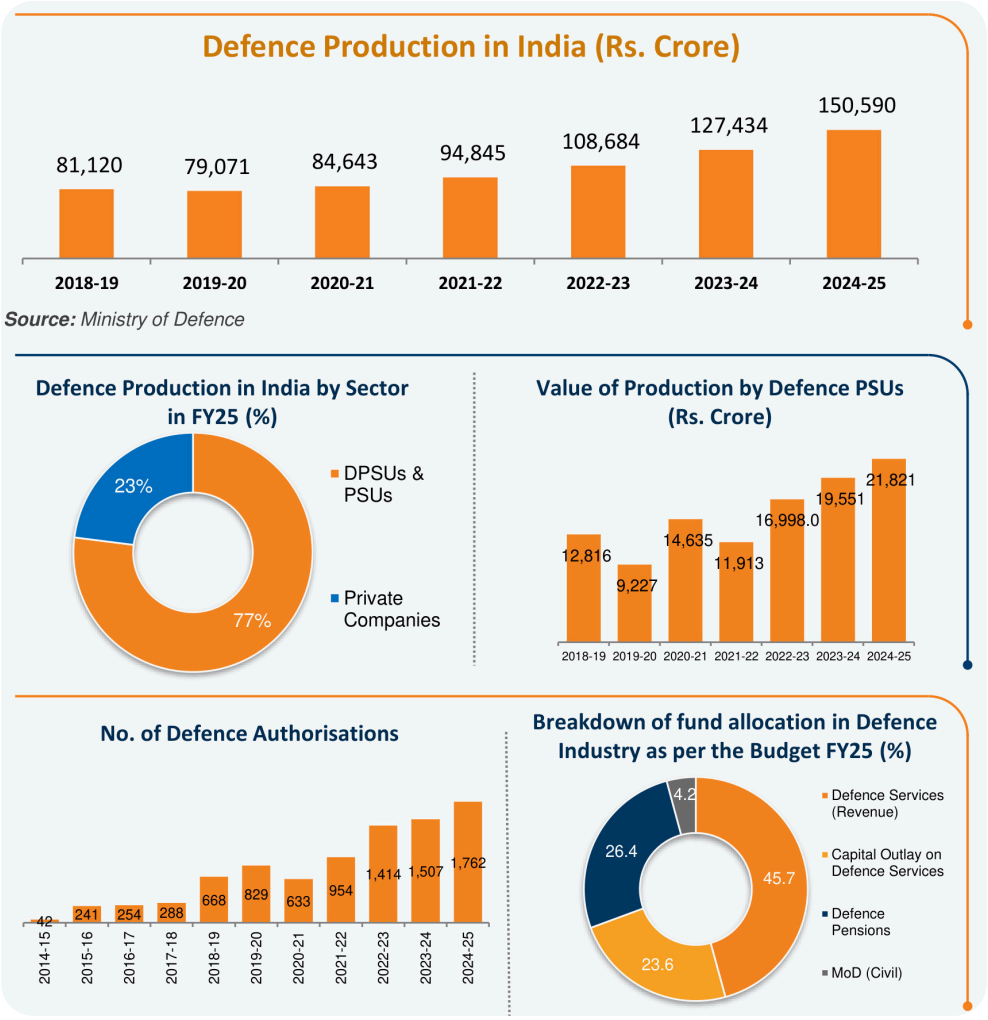
Towards this end, the GoI has introduced major reforms since 2014 under the 'Make in India' and 'Atmanirbhar Bharat Abhiyan' (self-reliant India mission) initiatives. These reforms have touched virtually every aspect of the Indian defense economy, from defense industrial regulations to acquisition processes and budgetary provisions.

At the institutional level, it has created the post of Chief of Defence Staff and the Department of Military Affairs under the CDS, which inter alia is tasked with promoting the use of indigenous equipment by all three services. 41 Ordinance Factories in India have been converted into seven distinct DPSUs, and two Defense Industrial Corridors have been established in the states of Uttar Pradesh and Tamil Nadu.

An integral part of acquisition reforms is the mandate for significantly higher indigenous content (IC)— in parts, components, raw materials, and software—in various domestic industry-friendly procurement categories.

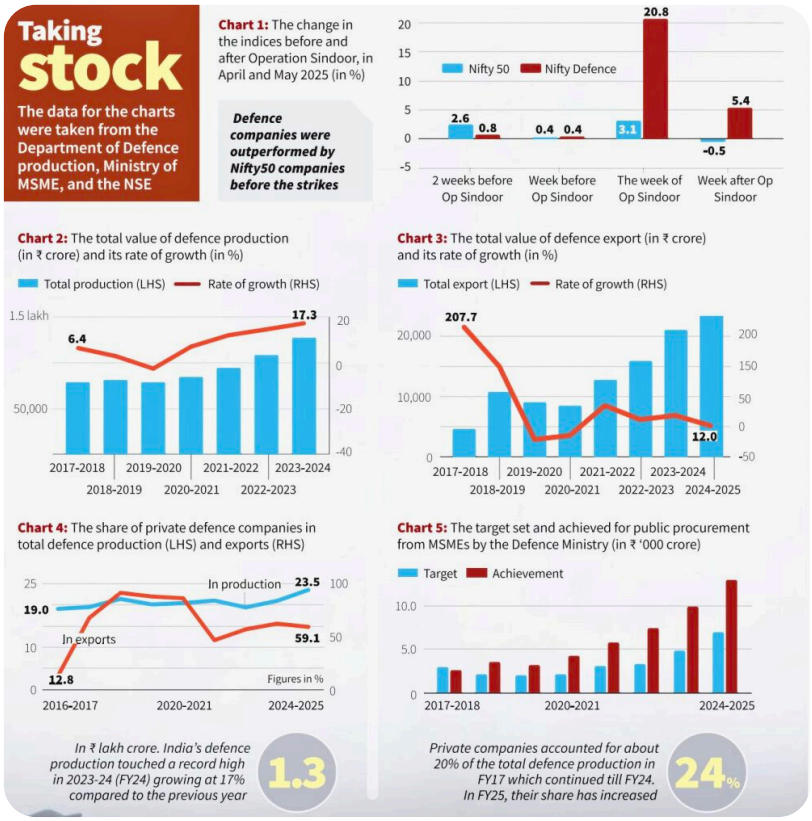
The GoI has also placed heavy focus on Ease of Business: it has streamlined the industrial licensing process; liberalized the defense foreign direct investment regime – FDI cap under the automatic route has been increased 26 percent to 74 percent; created an SOP to formalise the process of defence export authorisation; allowed the private sector to use government-run facilities to test their equipment; opened a single-window agency (the Defence Investor Cell) to address investors' queries; and so on.

This transformation in the domestic policy landscape has already delivered results. In the last decade, India's domestic defence production has witnessed a dramatic rise of more than 300%, reaching $17.2 billion, and India's defence exports have grown more than thirtyfold, reaching $2.8 billion in the last FY. The trajectory of the defense industrial base thus far makes the GoI's ambitious targets – $34.7 billion in defense production and $5.8 billion in defense exports by 2029 – realistic and achievable, thereby allowing India to emerge as a key player in the global defense ecosystem.[3]



Source: *Ministry of Defence*

Source: India Brand Equity Foundation



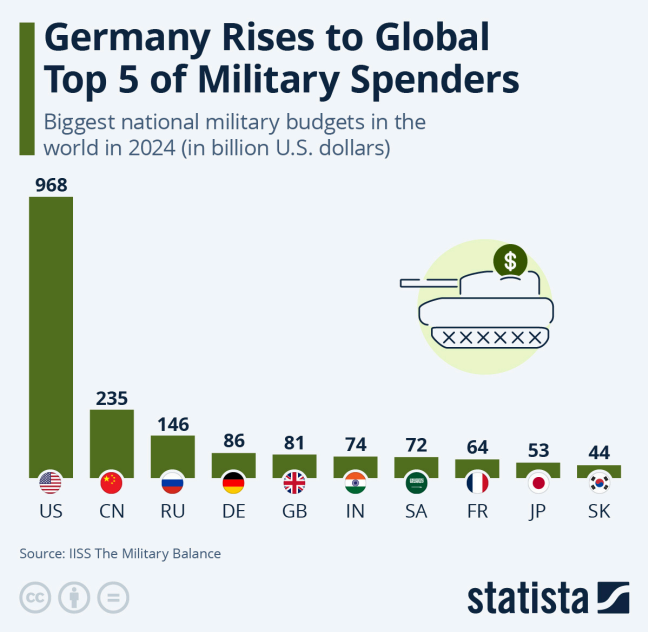
Source: Civils Daily

Meanwhile, Germany's defense industrial base could be undergoing an even more dramatic transformation. As a result of the Zeitenwende, Germany spent $88 billion on defence, becoming the world's fourth-largest military spender. This marked the first time Berlin actually met NATO's 2% of GDP spending target, set in 2014. In June 2025, the German government announced plans to spend over $750 billion to meet NATO's new spending target (set this year) of 3.5 % of GDP. The announcement was made months after Berlin moved to exempt the defense budget from the country's constitutional fiscal restraints. The objective is clear: to transform the Bundeswehr into "the strongest conventional army in Europe," in the words of German Chancellor Friedrich Merz.

In this context, there is a clear set of strategic arguments supporting deeper, broader defense industrial collaborations between India and Germany. To begin with, access to (advanced) technology will remain a critical bottleneck in the Indian defense sector for the foreseeable future. A recent FAST report estimated that Indian defence firms currently have an R&D intensity of 1.2%, compared to 3.4% among global defence firms, despite the GoI's efforts over the last decade. With Germany's advanced industrial base, it can thus emerge as a critical source of technology and expertise.

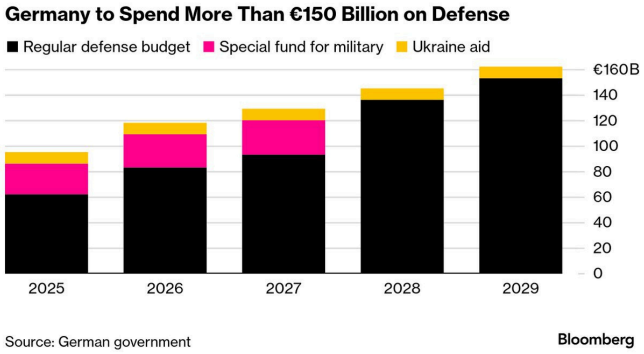
For Germany, the dramatic rise in defense spending will undoubtedly and significantly enhance the already advanced capabilities of the German defense sector. However, it is also likely that the sheer volume of capital infusion cannot be adequately absorbed by domestic players alone and will create an incentive to invest in JVs abroad. This is especially the case since demand for defense equipment is expected to skyrocket. German lawmakers have already passed a law to increase the number of German soldiers to 260,000 by 2035, a nearly 50 percent boost, and top security officials have drafted plans to enlist and train as many as 460,000 personnel eventually.

At the same time, reports of poor operational readiness of the Bundeswehr highlight challenges such as a lack of helmets, 30-year-old radio equipment, etc., suggesting that a substantial portion of Germany's challenges will center on the cost-efficacy and scale of production. The country already faces a massive skilled labor shortage, and the Confederation of German Employers' Associations has claimed that the German economy cannot cope with large numbers of young people enlisted in the army, as it would delay vital careers. Therefore, India can offer Germany a cost-competitive, skilled, and scalable production base for German defense firms to offshore supply chains.



This assumes great significance, as analysts have pointed out that years of restricted defense budgets in Germany make it unlikely that domestic industry can meet targets in the near term and that it will need to import a large amount of equipment. Consequently, Germany has an incentive to support Indian defense production through purchase orders for low-tech gear, to begin with, and even to target co-production through technology transfers, in order to diversify partners and reduce its own dependencies on the US and even on China (which is an ally of its primary adversary, Russia). In the process, it will also chip away at India's defence import dependency on Russia, and more importantly, bolster the strategic partnership between the two.

While radical at present, ultimate success in this endeavor would look like a bilateral innovation ecosystem that links major defence companies, MSMEs, and startups in India and Germany, resulting in steady advances in defence and dual-use capabilities to the mutual economic and strategic benefit of both nations. This will involve sustained high-level political commitment, the formation of deep industrial linkages, the removal of regulatory barriers, and many other complex actions. However, the stakes are high. An Indo-German partnership can strengthen the democratic world's response to authoritarian and revisionist challenges and help stabilize a rules-based international order in the Indo-Pacific and beyond.



Historical Precedents: Industrial Successes Amidst Governmental Hurdles

What Has Worked?

The history of Indo-German defense industrial cooperation dates back to the 1950s and has witnessed sporadic examples of co-production and technology transfer. India's first indigenous fighter aircraft, the HF-24 Marut, was built with the help of German designer Dr. Kurt Tank, who was enlisted by Prime Minister Nehru in 1955 to lead development at Hindustan Aeronautics Ltd. (HAL). He was supported by a team of up to 80 German engineers who helped develop the twin-engine fighter-bomber. It made its maiden flight in 1961, achieved 70% indigenization by the mid-1970s, and served until the 1990s.[4]

The Marut's successful development helped establish German technological expertise in the Indian defense sector early on, and over the subsequent years, many German defense firms supplied critical know-how to India.

HAL HF-24 Marut ("Spirit of the Tempest") was developed and manufactured by Hindustan Aeronautics Limited (HAL) during the 1960s and early 70s. The Marut was designed by the German aeronautical engineer Kurt Tank. The aircraft was the first Indian-developed jet fighter. Source: HF-24, Marut Repository: San Diego Air and Space Museum Archive

In the early 1980s, the German manufacturer, Kraus Maffei, helped India with initial design assistance for the Arjun Main Battle Tank MBT, in its capacity as a consultant to the Combat Vehicles Research and Development Establishment (CVRDE). Even in the latest variant of Arjun today, several components are of German origin, such as the Renk RK 304-I transmission system, the MTU MB838 1,400cc diesel engine that powers the Arjun, and the Bosch gun control system.

Over the years, Germany has emerged as the fifth-largest exporter of arms and defence equipment to India, and since 1999, Germany has exported parts to the Indian Navy for the construction of ships and submarines and provided the Indian military with technologies related to fire control systems as well as sonar and other forms of navigation. In 2016, the German defence manufacturer ThyssenKrupp Marine Systems (TKMS)

signed a US$38.4 million contract to modernise two Type 209/1500 diesel-electric attack submarines for the Indian Navy.

The 2016 contract between Thyssenkrupp Marine Systems (TKMS) and the Indian Navy involved integrating submarine-launched Harpoon Block II anti-ship missiles (UGM-84L encapsulated variant) on two Shishumar-class (Type 209/1500) submarines: INS Shalki (S46) (Bottom left) and INS Shankul (S47) (Above left). This upgrade enabled these submarines to fire Harpoons from their 533mm torpedo tubes, extending their operational life by about 10 years.
Sources: Above left X @WBWhiskeyBravo Below left X @indiannavy

Indian defense PSUs or private firms have secured German technology through agreements and licenses. For instance, Shaktiman, a 3-tonne military truck, was produced under a licensing agreement with Maschinenfabrik Augsburg-Nürnberg AG (MAN), facilitated by the German Foreign Office. Its production began in 1959 at the Vehicle Factory in Jabalpur, and within five years, it reached nearly 70% indigenous content. The Dornier 228 aircraft was similarly a result of technology transfer between Dornier GmbH and HAL in 1983. HAL began production in 1985 and delivered over 150 military Do-228s to its customers.[5] More recently, Hensoldt (in which the German government has a 25% stake) helped Bharat Electronics Ltd (BEL) to localize electronic warfare sensors, and in 2024, BEL secured a contract to supply 14 state-of-the-art EW sensor suites to L&T for the Indian Navy.[6].

All the aforementioned examples point to capabilities unlocked by successful technology transfer and absorption, but perhaps the most prominent instance of Indo-German defense industrial collaboration to date remains the 1981 agreement for six Shishumar-class (Type 1500) submarines. India procured two such submarines from Germany, while four were assembled at Mazagon Dock Limited (MDL) with help and kits from Howaldtswerke-Deutsche Werft (HDW). In the process, critical submarine-building expertise was transferred to MDL, which helped turn the PSU into the country's foremost manufacturer of naval platforms. [7]

The history of collaborations has helped foster strategic trust and vital linkages that can be (and have already been) leveraged for future growth. It's no coincidence that one of India's most expensive defense deals today involves MDL and TKMS, who recently announced a partnership to develop submarines with an Air Independent Propulsion System (AIPS) under the Project 75I of the Indian Navy. While details are contingent

on final negotiations, TKMS will transfer core technology to MDL as a Joint Venture (JV) under the MoD's Strategic Partnership (SP) model.

Similarly, at Aero India 2025, Hensoldt signed new MoUs (with Samtel and Raphe) to co-develop avionics and radar, which further underscores this strategic partnership in defense tech.[8] More importantly, in November at the Dubai Airshow 2025, HAL and Hensoldt agreed to jointly manufacture Obstacle Avoidance Systems (OAS) for military helicopters, which will involve transferring Hensoldt's highly valued LiDAR OAS technology.

> A recent example of a joint venture with clear strategic implications is the tie-up between Germany's Diehl and Reliance Defence, focused on the 155mm Vulcano, a highly advanced artillery shell with laser and GPS guidance. As part of the agreement signed in June 2025, Diehl will provide core technology and systems-level expertise, while Reliance will serve as the prime contractor and manufacture shells domestically.

Another recent example of a joint venture with clear strategic implications is the tie-up between Germany's Diehl and Reliance Defence, focused on the 155mm Vulcano, a highly advanced artillery shell with laser and GPS guidance. As part of the agreement signed in June 2025, Diehl will provide core technology and systems-level expertise, while Reliance will serve as the prime contractor and manufacture shells domestically. Estimates suggest that the deal could generate annual revenues of approximately US$1.1 billion over the long term, but more importantly, it will significantly bolster India's strategic efforts to emerge as a global hub of 155mm artillery and simultaneously provide cost-competitive precision-guided munitions to Germany and Europe for future defence preparedness (both the EU and NATO have spent billions solely on purchase of 155 mm artillery shells for Ukraine in recent years). In other words, it is an illustrative example of mutually beneficial defence industrial collaboration.

Strategic Dialogue and Military Engagement

Over the last two decades, New Delhi and Germany have also built institutional frameworks to enable closer defence ties. In 2006, the Indian and German Defence ministries signed an agreement to deepen security and defence cooperation, which could include the exchange of military personnel, increased technology transfer, and greater collaboration in joint defence projects. In February 2019, both sides signed the "Arrangement on Implementation of the Agreement of 2006 concerning Bilateral Defence Cooperation". During Prime Minister Modi's visit to Germany in May 2022, the Defence Technology Sub-Group was revived to help diversify India's defence system and technology acquisitions.

A key outcome of the 2006 agreement was the establishment of the High Defence Committee (HDC), which is co-chaired by the Indian and German defense secretaries and meets annually. The HDC, which approves bilateral programs and dozens of projects per year, has met 12 times and, importantly, in November 2025, discussed priority areas for co-development and co-production of defence equipment.[9] Notably, the aforementioned agreement between HAL and Hensoldt for the production of LiDAR OAS systems came a day after the HDC met.

India and Germany have also held 18 meetings of the Military Cooperation Sub-Group (MCSG) – another important dialogue mechanism, which, inter alia, helps coordinate joint military exercises. In recent years, shared geopolitical challenges, particularly Chinese assertiveness in the Indo-Pacific, have led to an uptick in security cooperation and joint exercises between India and Germany. In 2024, as part of Germany's Indo-Pacific naval deployments, frigate Baden-Württemberg and support ship Frankfurt am Main are scheduled to make port calls in India. The same year, the German Air Force participated for the first time in an aerial exercise on Indian soil, Tarang Shakti 2024, during which it deployed Eurofighter Typhoons and other aircraft.

Indian Air Chief Marshal V.R. Chaudhari with German Lt. Gen. Ingo Gerhartz, General Stephane Mille, Chief of Staff of the French Air and Chief of Staff of the Air and Space Force (Spain) Francisco Braco Carbó during the multilateral air combat exercise Ex Tarang Shakti. Source: ANI

Germany plans to participate in the next edition of Tarang, and both countries' navies also plan to participate in Milan 2026. More importantly, New Delhi and Berlin have affirmed their intent to sign an MoU for mutual military logistics support. Apart from fostering interoperability, joint exercises and the MoU will also help both sides develop a deeper understanding of each other's defense systems and requirements.

Gaps and Hurdles

- **Export controls and policy hurdles**

A key historical impediment to Indo-German defense cooperation has been Germany's restrictive arms export framework. German laws such as the War Weapons Control Act (Kriegswaffenkontrollgesetz, 1961), the Political Principles on Exports of War Weapons and Military Equipment (1982), and the Foreign Trade and Payments Act strictly regulated the export of military hardware, dual-use technologies, and critical components.

Under these frameworks, exports to countries outside NATO, particularly to designated "areas of tension," were subject to stringent scrutiny, political oversight, and additional conditions on end-use and human rights compliance. As a result, Indian security forces have sometimes faced obstacles in the procurement of even relatively basic German equipment, such as Heckler & Koch submachine guns for police and paramilitary

units.[10] More prominently, India's indigenous light tank project (Zorawar) originally planned to use German engine maker Motoren-und Turbinen Union's (MTU) diesel engines, but was forced to pivot after Berlin failed to ease restrictions (despite high-level appeals), and delivery was delayed by over a year.[11]

In some instances, even after approvals were granted, conditions attached to licenses, such as restrictions on deployment, limitations on technology transfer, or mandatory end-use reporting, constrained operational flexibility and slowed project execution. Given that these hurdles created uncertainty about the viability of long-term cooperation, Indian military planners and defence manufacturers have often had to hedge against potential supply disruptions or redesign projects to rely on alternative suppliers.

In recent years, German officials have openly acknowledged the need to develop a "reliable Berlin supply policy," and although Germany has recently eased restrictions[12] and designated India as a preferred partner for select naval and dual-use exports,[13] a perception of German unreliability among Indian defence stakeholders continues to be an unfortunate legacy of the export controls regime.

- **Procurement process, technology-transfer requirements, industrial standards, and business climate**

Meanwhile, India's notoriously slow and complex defense procurement has been an equally significant challenge. It is characterized by long, tender cycles and a series of approvals that, by the time bureaucratic processes are completed, have even led to changes in defense requirements (due to technological advancement). While the GoI has announced a series of acquisition reforms to address the same, many are yet to be fully implemented in letter and spirit. Furthermore, India's strong and (often conditional) emphasis on technology transfer is not always easy for German OEMs (or any foreign OEMs) to meet (due to market competition or governmental regulations or both).

In the 2010s, for example, the Eurofighter Typhoon (built by a European consortium which included Germany) lost out on India's MMRCA fighter competition, partly because its bid could not fully meet India's technology-transfer and price expectations. Similarly, bids by German companies have stalled when India required proprietary source codes or design information to qualify for the Make in India initiative. Even the high-profile Project-75I submarine tender dragged on for over a decade, and several Western OEMs dropped out, in large part, due to such concerns. In fact, TKMS had first obtained bid approval from the GoI to build the submarines in 2020 but withdrew it the next year due to reservations about the "high indigenous content proportion and nearly unlimited liability on the foreign technology partner." Although TKMS has recently returned to the table, the "glacial

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pace" of the process has led to wasted time and resources.[14]

German OEMs have traditionally guarded their intellectual property and advanced know-how closely, not just to retain a market advantage but also because of a trust deficit.[15] From Germany's perspective, India's diversification of suppliers (Russia, France, Israel, the US, etc.) raises core concerns about IP leakage or lack of exclusivity, even as hardly any such examples exist in the history of Indian defence production, particularly for PSUs (which have executed many joint defense projects with a range of countries).

More broadly, German policy until recently was focused on the export of equipment rather than co-production—a stance now under reconsideration.[16] Additionally, India's recent indigenization efforts mandate a progressive ban on certain defense imports in favor of local equipment, creating uncertainty about the long-term returns for German companies seeking to license technologies to Indian counterparts.

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Relatedly, German industrial standards—primarily DIN (Deutsches Institut für Normung, or the German Institute for Standardization)—are among the most stringent in the world. Although they are meant to be a rigorous technical barrier, the standards can also act as hurdles to defense industrial collaborations. For example, material specifications for submarine steel can be notoriously difficult to replicate without proprietary German machinery or technology transfer. Furthermore, a substantial portion of India's legacy defense production is based on Soviet/Russian standards (GOST), which can be fundamentally different from Western European (DIN/EN) standards, and therefore, to transition a production line to German specifications can require a total overhaul of quality control systems, etc. Consequently, the certification process for Indian sub-components to meet German military-grade standards can be lengthy and expensive, thereby delaying co-production timelines.

Finally, cases of corruption and trust deficit have also damaged and deterred defense industrial ties. The most infamous example remains the HDW submarine scandal (1987) – allegations of kickbacks in the 1980s deal led India to blacklist the German submarine company for years.[17] They were finally resolved much later (with no convictions), but not before they derailed Indian plans to buy more submarines from Germany. In 2012, Rheinmetall was blacklisted over a bribery case related to air defense guns, which cut it off from the Indian market for nearly 10 years.[18] Such episodes have sparked wariness about India's governance system and a perception of an unfavorable business climate, leaving the German defense industry overly cautious and hesitant to explore deals in India.

An Overview of India and Germany's Defense Industries and the Potential for Collaboration

India's Defense Industrial Landscape

The state sector has traditionally dominated the Indian defense industrial base, which includes 16 DPSUs, such as HAL and MDL, as well as the Defence Research and Development Organisation (DRDO), a sprawling network of over 50 laboratories responsible for developing indigenous technology. These entities have been the primary recipients of government contracts and have developed major platforms, such as the Tejas Light Combat Aircraft and the Arjun Main Battle Tank.

Alongside these, a wave of large private-sector players has entered the defence sector. Conglomerates like Larsen & Toubro (L&T), which specializes in naval platforms, artillery systems, missile launchers, and advanced electronics, and Tata Advanced Systems Ltd (TASL), which partners globally on aircraft, UAVs, and security solutions, have become key defense integrators. The Kalyani Group's Bharat Forge, historically a heavyweight in metallurgy, now produces indigenous artillery guns, armoured vehicle components, and other land systems with a focus on indigenization. Other conglomerates involved include Adani Defence & Aerospace, which has rapidly expanded since 2015 (invested in small arms, UAVs, radars, and ammunition production infrastructure), and Reliance Defence, which has projects in ammunition, explosives, and aerospace.[19]

Year	Old Defence PSUs	New Defence PSUs	Other PSUs/JVs	Private Companies	Total Production
2016-2017	0.48 bn	0.18 bn	0.06 bn	0.17 bn	0.88 bn
2017-2018	0.52 bn	0.17 bn	0.06 bn	0.18 bn	0.93 bn
2018-2019	0.54 bn	0.15 bn	0.07 bn	0.21 bn	0.97 bn
2019-2020	0.57 bn	0.15 bn	0.08 bn	0.19 bn	0.94 bn
2020-2021	0.53 bn	0.17 bn	0.08 bn	0.21 bn	1.01 bn
2021-2022	0.67 bn	0.14 bn	0.09 bn	0.23 bn	1.09 bn
2022-2023	0.76 bn	0.20 bn	0.09 bn	0.25 bn	1.30 bn
2023-2024	0.89 bn	0.23 bn	0.08 bn	0.32 bn	1.52 bn
2024-2025	0.36 bn	0.10 bn	0.05 bn	0.16 bn	0.67 bn

Summation of annual sales turnover as reported by Indian defense companies/PSUs

Indian defense ecosytem has also developed strategic niches in areas such as unmanned aerial vehicles (UAVs), which is exemplified by startups like IdeaForge (a domestic leader in small drones for the military), missile technology – with DRDO's ballistic and cruise missile programs and Bharat Dynamics Ltd mass-production of guided weapons,[20] space systems – via ISRO and companies like Paras Defence (which

makes optical systems and electronics for satellites and missiles),[21] and considerable software-centric capabilities (particularly in AI and cyber domains). Private firms like IdeaForge and Raphe Mphibr (drone manufacturers) have made headway in autonomous systems, while traditional players have focused on integrating AI-enabled command and control into defense platforms.

Concurrently, in recent years, India has witnessed a surge in MSME and start-up participation in the defense sector. Over 10,000 Indian MSMEs (as of 2022) and over 650 startups (as of 2025), are involved in defense production,[22] supported by flagship initiatives: such as the Innovations for Defence Excellence (iDEX) program, which provides grants and mentorship to small firms that qualify in sub-programs such as Defence India Start Up Challenges and SPRINT for Naval Technology; the Technology Development Fund (TDF), which grants funds and allows joint ownership of IP between government and its partners; SIDBI Cash Defence, which provides financial assistance to MSMEs through purchase orders; and others. They have successfully developed dozens of new defense products and prototypes, with a focus on niche technologies that can be absorbed by the Indian Armed Forces.[23], [24]

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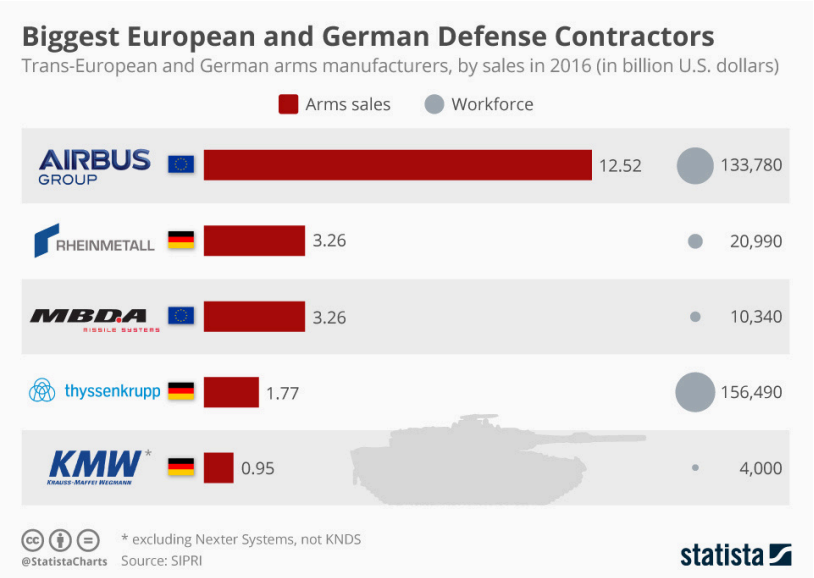
In summary, India now fields a broad defence industrial base – from heavy engineering of ships and land systems to advanced electronics - as well as a network of MSMEs and startups focused on new tech solutions, which is increasingly capable of partnering with foreign OEMs. The government's indigenization push,[25] liberalization of FDIs in the defence sector, and other initiatives, such as two new Defence Industrial Corridors, have further incentivized joint ventures and technology transfer. Taken together, India has already emerged as an attractive co-production and (niche) R&D partner and is on a trajectory to further consolidate this position in the near future.

Germany's Defense Industrial Base

A cadre of advanced-technology firms with deep engineering expertise anchors Germany's defense industry. Leading German OEMs include Rheinmetall AG, ThyssenKrupp Marine Systems (TKMS), Hensoldt AG, Airbus Defence & Space, and others.[26] These companies incorporate Germany's core strengths in land systems, naval platforms, sensors, and aerospace. For instance, Rheinmetall (Germany's largest defence contractor) produces a wide portfolio of armored vehicles (such as the KF51 Panther next-generation tank

and Lynx IFV), combat vehicle cannons, artillery, and air defence systems (such as the Skyranger mobile air defence gun), as well as munitions and electronic subsystems. Krauss-Maffei Wegmann (now part of the Franco-German KNDS) is likewise famed for its Leopard main battle tanks and artillery systems. In the maritime domain, TKMS (a division of ThyssenKrupp) is a global leader in conventional submarine design and construction – its Type 212/214 diesel-electric submarines and naval production expertise are renowned.



German shipbuilders, such as Lürssen, also excel in the design and construction of frigates, corvettes, and advanced warships. Hensoldt, in turn, exemplifies Germany's prowess in defence electronics – it develops cutting-edge radars, optronics, avionics, and electronic warfare sensors for air, land, and sea (The German government bought a 25% state stake in Hensoldt largely to preserve these strategic sensor technologies).[27] In aerospace, Airbus Defence & Space (the pan-European firm with major German presence) leads production of military transport aircraft, satellites, and Eurofighter Typhoon fighters; Germany's MTU Aero Engines is a key player in propulsion for combat jets and UAVs. Diehl Defence, another German stalwart, specializes in missile and air-defence systems – notably the IRIS-T series of air-to-air and surface-to-air missiles (which saw high demand after proving their effectiveness in Ukraine). Germany is also home to MBDA Deutschland (the German division of Europe's missile consortium, which develops missiles such as Meteor and contributes to the MEADS air-defense program) and small-arms makers like Heckler & Koch.

The backbone of German defence giants is formed by the Mittelstand – small and medium-sized enterprises (SMEs).[28] German defense SMEs are often niche, high-tech manufacturers that provide vital, specialized components and subcomponents to system integrators.[29] Historically, defense innovation in Germany has been driven by close ties between defense majors, private SMEs, state-funded research institutes such as the Fraunhofer Institutes, and the Bundeswehr's technical centers.[30] German universities play a smaller but vital role (due to legal/societal limits on military research), particularly the Bundeswehr Universities in Munich and Hamburg.

Notably, Berlin has, in recent years, sought to energize defense innovation by adopting startup models from abroad. The Bundeswehr established a Cyber Innovation Hub (CIH) in 2017 as a "military digital innovation

unit" modeled on U.S. and Israeli tech hubs.[31]

The CIH pilots digital solutions from start-ups for the armed forces in an agile manner (similar to the U.S. Defense Innovation Unit model). Furthermore, Germany's federal agency for disruptive innovation (SPRIND), which has until now focused on civilian technology, is planning a dedicated defense technology offshoot—a "military SPRIND"—to incubate high-risk, high-reward defense innovations.[32] This reflects a new policy push by Berlin to emulate DARPA-like approaches and explicitly support dual-use start-ups for national security.

Germany's defense R&D has long emphasized dual-use innovation and is increasingly focused on emerging technologies. Key areas include digitalization and software-centric defense systems, which integrate AI tools and other advanced software into sensor fusion, command and control networks, and autonomous platforms.

Feature	India	Germany
Market Size (2025 est.)	USD 30.5 billion	EUR 52 billion (USD 56.3 billion)
Key Public Sector Players	HAL, BEL, DRDO, MDL, BDL	N/A (Largely privatized)
Key Private Sector Players	L&T, Tata Advanced Systems, Bharat Forge, Adani Defence	Rheinmetall, ThyssenKrupp Marine Systems (TKMS), Hensoldt
SME/MSME Role	14,000+ MSMEs forming a critical Tier II/III supply chain.	The Mittelstand forms the specialized, innovative backbone of the industry.
Startup Ecosystem Focus	Drones, AI, ISR, Simulation, Cyber	AI Software, Unmanned Ground/Air Systems, Dual-Use Tech
Core Technological Strengths	Cost-effective scale, Software & AI, Missile systems, Naval shipbuilding	High-end sensors, Platforms (Submarines, Armor), Ammunition, Precision engineering
Key Government Initiatives	Atmanirbhar Bharat, iDEX, Defence Production & Export Promotion Policy	Zeitenwende Special Fund, Bundeswehr Cyber Innovation Hub (CIHBw)

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The German defence sector also has deep supply chain interlinkages with its European counterparts, and the government's new National Security Strategy (2024) advocates for a double-down on European co-production. This is underscored by Franco-German projects such as the Main Ground Combat System (MGCS) – a next-generation tank program launched in 2025 – and the Future Combat Air System (FCAS) – a 6th-generation fighter and drone system. Both projects involve German firms at the forefront of robotics, stealth, and AI-enabled combat systems. Germany also excels in cyber defense and encryption tech (e.g., companies like Secunet in secure communications) and has developed nascent capabilities in quantum communications.

In summary, Germany's defence industrial base is mature and highly advanced technologically, making it a formidable partner.

Need for a New Zeitgeist: Complementarities and Potential Areas of Cooperation

India and Germany's defense industries are markedly complementary in meaningful ways and offer rich avenues for collaborations, even as their historical development trajectories have diverged. India's core strengths – a large pool of skilled engineers, cost-efficient production, an advanced IT base, and indigenous innovation – can unlock synergies when meshed with Germany's advanced defense technological capabilities. The political commitment to co-development and co-production on both sides, coupled with Germany's recent relaxation of export controls for India, therefore creates a number of opportunities.[33]

In the naval domain, the TKMS and MDL partnership, which has now entered exclusive negotiations, can be expected to significantly advance Indian production capabilities and potentially enable future exports of German-origin submarines built in India.[34] Collaborations in surface naval can also be mutually beneficial – India's private shipbuilders (L&T, for example) and German firms like Lürssen could co-develop frigates or auxiliary ships that combine Indian steel fabrication and modular construction with German design and automation systems. Underwater autonomous systems are another niche: Germany's advances in unmanned undersea vehicles (e.g., SeaCat, Seehund UUVs from Atlas Elektronik) complement India's need for autonomous mine-countermeasures and surveillance drones in littoral waters. Joint R&D in sonar and underwater robotics would enhance anti-submarine capabilities for both sides (which assumes much significance in the context of the Chinese PLA(N)'s plans to deploy large numbers of submarines across the Indo-Pacific).

On land, there is scope for co-development of armoured fighting vehicles and artillery. India's Army is seeking next-generation "Future Ready Combat Vehicles" (tanks and infantry fighting vehicles) and advanced artillery – areas where German technology is world-class. For example, Rheinmetall's KF51 Panther concept tank or Krauss-Maffei's Leopard 2 represent potential partners for India's FRCV project. Indian conglomerates such as L&T or the Kalyani Group are well placed to team up with Rheinmetall/KMW to design a new MBT tailored to Indian requirements, with joint intellectual property.

Artillery and air-defence systems are another natural fit. Indian firms (such as Bharat Forge (Kalyani)) have domestic 155mm howitzer designs and production capacity, which, if paired with German ballistic expertise (long-range gun barrels, RDM propellant tech), can improve artillery technology and enable scalable production for the needs of both the Indian and German militaries, as well as exports to third countries. In

fact, German and Indian firms have already kick-started this process. In addition to the aforementioned Reliance-Diehl deal to locally manufacture advanced Vulcano 155mm shells, Rheinmetall and Reliance Defence have announced a strategic partnership for ammunition production, through which Reliance will supply propellants to Rheinmetall, and production figures could go up to 200,000 artillery shells annually.[35] [36]

In UAVs, India's vibrant drone startups paired with German technology providers could yield world-class systems, as indicated by Hensoldt's MoUs with Indian firms Samtel Avionics and Raphe mPhibr to localize the production of sensors and payloads for surveillance drones.[37]

Beyond hardware, joint R&D in cutting-edge tech can serve as a foundational pillar for future-oriented, agile defense industrial collaborations. New Delhi and Berlin have already agreed to deepen their collaboration in emerging technologies, such as AI and quantum computing, which could lead to partnerships between Indian IT firms or DRDO labs and German research institutes or companies to develop AI-driven defense applications, quantum-communication technologies, and so on.[38]

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Enabling Bottom-up Cooperation: Joint Innovation Through MSMEs and Start-Ups

While government-to-government (G2G) contracts can deliver major platforms like submarines or tanks, they are inherently protracted, bogged down by bureaucratic hurdles, political cycles, and complex technology-transfer negotiations. While they are critical for landmark projects and acquisitions, it's equally imperative to sustain momentum in the overall defence relationship by emphasizing B2B collaborations, particularly through MSMEs and supply chain cooperation.

German Mittelstand firms, traditionally oriented toward EU markets, can be incentivized to engage India's dynamic defense MSMEs and startups. In disruptive technologies such as AI, drones, quantum systems, and cybersecurity, the MSMEs on both sides are a vanguard of innovation and promise nimble partnerships. Enhanced Indo-German collaboration of this kind can generate a steady pipeline of dual-use solutions, complement OEM-level efforts, and ensure the partnership remains vibrant and lays the foundation for future depth.

Both nations recognize MSMEs and start-ups as engines of defense innovation, but their policy tools differ (as outlined in previous sections). India's approach centers on competitive innovation challenges and

incubation (iDEX's open calls, prototype funding, and military-user feedback loops) to attract new players into the defense sector. Germany, with a strong industrial base, is now augmenting its traditional procurement and R&D system with innovation agencies/units to tap non-traditional vendors. For example, Germany has plans for an Innovationsagentur BMVg (innovation agency under the defense ministry), as evidenced by proposals to allow SPRIND to fund defense projects and by the MoD's new "Round Table for medium-sized defense companies," launched in 2023.[39]

Additionally, at the European level, programs such as the European Defence Fund (EDF) actively incentivize SME participation in multinational defense R&D, aligning with Germany's priority of including its SMEs in collaborative projects. Both countries also stress dual-use innovation – India's iDEX recently inked an MoU to extend its model to civilian sectors under the ASPIRE program for ed-tech,[40] and Germany's innovation agendas (national and EU) similarly emphasize technologies that straddle civil and military use (e.g., AI, cyber, space). In summary, the Indian and German defense ecosystems differ in maturity and structure, but both are increasingly innovation-led and MSME-driven, setting the stage for potential synergies.

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Barriers to Cross-Border MSME Collaboration & Creating a Bilateral MSME/Start-up Innovation Channel

There are, however, significant challenges in forging cross-border defense collaborations between Indian and German MSMEs. Germany's stringent export controls, differential standards, certifications, and procurement processes all complicate partnerships, as Indian startups find German defense systems opaque, and German Mittelstand firms face similar hurdles in India. Limited access to foreign opportunities and networks, exacerbated by language and cultural barriers, restricts MSMEs' ability to connect with partners or military end-users. Security and intellectual property concerns also impede collaboration; uncertainty over co-developed IP rights and weak redressal mechanisms in India deter firms from sharing sensitive technologies.

Additionally, MSMEs struggle to finance joint projects due to limited capital, hindering their ability to navigate long payment cycles without government grants or venture capital backing. Addressing these interconnected barriers is essential to realizing the full potential of Indo-German MSME defense cooperation.

Given the complementarities and challenges outlined above, a structured Indo-German innovation channel for defense MSMEs and start-ups could lay the groundwork for a future defense industry relationship. This would serve as a dedicated pipeline to connect innovators, fund joint projects, and fast-track dual-use

technologies to both militaries. Inter alia, many frameworks can be considered to initiate and enable this process:

- **MSME Incubation Corridors**

Both sides should establish “innovation corridors” that link their defense incubators and hubs. For instance, the India-Israel innovation corridor (DRISHTI), housed at the Center of Excellence in Hyderabad, hosts Israeli start-ups and provides them with mentorship, local market access, and customer matchmaking. [41] It is a good model to replicate.

An Indo-German corridor could similarly rotate cohorts of German start-ups through Indian defense incubators (and vice versa) for 3–6-month immersion programs. This would provide German MSMEs with a soft landing in India, offer exposure to user needs, help conduct field trials, and establish connections with integrators.

Defence industry clusters in Bavaria or Bangalore, for instance, could partner to run a joint accelerator and offer office space, fabrication labs, and mentors from both countries’ militaries and industries. Notably, Bengaluru-based Dynamatic Technologies supplies the rear fuselage for the D328eco, while Sasmos Het Technologies and Hyderabad-based Cyient handle wiring and cabin systems, demonstrating that some Indo-German defense supply chains are already in place and can be scaled up and diversified.[42]

- **Bilateral Defence Innovation Accelerators**

The two sides could launch a joint accelerator or challenge program. This can co-sponsor innovation challenges targeting shared capability gaps (e.g., drone swarms, AI for surveillance, EW). The Defence Investor Cell (DIC), a dedicated single-window interface established under the Department of Defence Production (DDP), Ministry of Defence in India, and the Federal Ministry of Defence (BMVg) could launch a “INDO-GER Defense Innovation Unit” to issue joint problem statements for MSMEs from both sides. This competitive approach would energize new entrants and ensure solutions meet both Indian and German requirements, potentially qualifying for procurement in both markets. These efforts could be overseen by the India-Germany Defence Technology Sub-Group (DTSG), under the India-Germany High Defence Committee (HDC).[43]

Leveraging Successful Templates: There is also a need to draw on best practices from other contexts. For instance, Israel’s defense innovation ecosystem thrives on close military-startup linkages and dual-use development – lessons that can be applied in Indo-German programs. The U.S. DIU’s partnerships demonstrate the importance of bridging gaps between two cultures (military and start-up) through embedded teams and fast contracting.[44] Notably, DIU’s approach to onboarding “non-traditional companies” and providing them with military problem statements has accelerated the adoption of commercial technology for defense. Indo-German initiatives can emulate this by actively scouting civilian tech SMEs (e.g., automotive or Industrie 4.0 firms in Germany; aerospace start-ups in India) and repurposing their innovations for defense needs.

- **Tri-sector Involvement - Clusters, Academia, and Industry Bodies**

A robust innovation channel should involve more than just governments and companies. Industrial clusters and trade associations can be utilized to identify high-potential MSMEs and facilitate business-to-business (B2B) linkages. While there have been early industrial delegation exchanges in 2024 between the Bundesverband der Deutschen Sicherheits- und Verteidigungsindustrie e.V. (BDSV) and the Society of Indian Defence Manufacturers (SIDM), a more dedicated and consistent forum for engagement is needed. Limited and inconsistent reciprocal participation in large defense expos such as the Euro Defense Expo (EUDEX) in Germany and DefExpo and AeroIndia in India leaves much to be desired.

Even more importantly, academic institutions should be tapped to provide research expertise and talent. The two governments have proposed an Indo-German Innovation and Incubation Exchange for academic institutions,[45] which could pair universities (e.g., IITs and German technical universities) to run joint hackathons, student exchanges, and R&D projects in emerging technologies (AI, quantum, materials, etc.). The Optional Practical Training (OPT) program between India and the US, which allows Indian students (and other international students on an F-1 student visa) to study at a university and then work for a company in a field related to their major, could be seen as a useful model that targets both skilled mobility and defense innovation in the India-Germany relationship.

Export promotion councils and even industrial chambers, such as India's SIDM and Germany's BDI and BDSV, can also contribute by co-organizing innovation showcases and investor roadshows in both countries, helping MSMEs navigate foreign market entry (in either country). Notably, Germany's startup accelerator program has begun targeting India – the German Accelerator (GA) was praised for helping German start-ups address the Indian market, and plans are underway to establish GA's presence in India, with a corresponding program to support Indian start-ups in Germany.[46] This reciprocal approach (a startup "bridge" in each direction) will greatly assist MSMEs in overcoming entry barriers, and the defense innovation channel can piggyback on such infrastructure (e.g., dedicating a track for defense tech start-ups within these accelerators).

In summary, creating a dedicated bilateral innovation channel – through linked incubators, joint accelerators/challenges, and network support – would systematically lower barriers to MSME and start-up collaborations between India and Germany. It would institutionalize the currently ad hoc interactions and ensure a steady flow of co-developed and dual-use solutions that benefit both defense ecosystems.

Financial and Regulatory Enablers

Even the best innovation programs will falter without the right financing and regulatory support. Several enabling measures are crucial to sustain MSME/start-up cooperation in defense:

- **Mobilizing Risk Capital and Co-Funding**

Access to funding is a perennial challenge for defense start-ups. New Delhi and Berlin could consider a joint venture fund or co-investment scheme targeting dual-use defense tech. The EU has pioneered such models – in 2024, the European Investment Fund launched a €175 million Defence Equity Facility to back venture funds investing in innovative dual-use defense companies.[47] A similar Indo-German Defense Innovation Fund, with contributions from the public and private sectors, could provide seed capital for MSME

collaborations (e.g., matching funds for any Indo-German start-up project selected under bilateral innovation challenges).

Additionally, cost-sharing in R&D could be institutionalized: for example, if an Indian and a German SME form a consortium to develop a new drone, both governments could explore mechanisms to co-fund the project (each financing the work of their national MSME, possibly with a common pot for shared expenses). This can substantially reduce risk for small firms and signal political commitment. It also leverages the fact that dual-use startups can tap civilian venture capital by highlighting commercial market potential.
In essence, blended finance – combining government grants, defense offsets (see below), and venture investment – should be used to fuel the joint innovation pipeline.

- **Emphasizing Dual-Use Technology Development**

A focus on dual-use (civil-military) applications can amplify funding options and ease regulatory friction. Germany has made dual-use a priority in its innovation policy (e.g., SPRIND projects and EU programs explicitly seek civilian spin-offs of defense tech).[48] Dual-use projects are often eligible for broader research grants or for export to friendly markets, provided they comply with dual-use controls (in both cases, India and Germany are parties to the Wassenaar and MTCR regimes).

A focus on areas such as AI, cybersecurity, space, and autonomous systems – which have obvious civilian markets –can benefit Indo-German ventures from both defense and civilian innovation frameworks. For instance, the India-Israel DRISHTI program deliberately targets dual-use domains (such as AI, drones, and robotics) to ensure solutions have wide applicability. Similarly, Indo-German start-up teams could jointly work on, for example, a climate-resistant battery or a secure communications system that serves both military needs and commercial power grids or telecom, which can then make them eligible for EU green tech funds or Indian digital mission funds alongside defense-oriented financial support.

In summary, a partnership focused on dual-use innovation is a strategic lever that both widens the resource pool and enhances the economic viability of MSMEs of both India and Germany.

- **Shared IP and Technology Transfer Frameworks**

A clear, pre-negotiated framework for intellectual property rights and tech transfer can go a long way to support joint projects. Uncertainty over ownership of a co-developed technology is a key deterrent to collaborations. To address this, India and Germany could establish template agreements. Broadly, these can stipulate that any IP developed under a bilateral program is jointly owned and that both governments have mutual license rights for defense use. A bilateral framework can also cover equitable benefit-sharing (ensuring a small firm feels secure that a larger foreign partner won't appropriate its innovation) and clarify how export licenses for jointly developed technology will be handled.

Both countries recently signed an agreement to protect classified information [49], a prerequisite for sharing sensitive technical data. The next step is to agree on knowledge and IP sharing. Moreover, harmonization of standards for co-developed equipment (so that a prototype meets both Indian and German military specs) can be pursued through joint working groups. These measures ensure that MSMEs on both sides can collaborate without legal quagmires and with confidence that successful innovations can be scaled in both markets (and elsewhere as well).

- **Leveraging Defense Offsets for MSME Collaboration**

Defense procurement offsets – in which a buyer country requires the seller to reinvest a portion of the contract value – can be a powerful tool for channelling investment into MSME-led innovation. India's offset policy already encourages foreign OEMs to partner with local firms (often MSMEs) as Indian Offset Partners (IOPs), and to transfer technology or set up local production to discharge offset obligations.[50] Future Indo-German defense deals (for example, if India procures submarines or artillery from German companies) could explicitly tie a portion of offsets to joint R&D projects with MSMEs.

For instance, a German OEM could satisfy offset requirements by funding the development of a critical subsystem by an Indo-German start-up, or by establishing an innovation center in India that incubates MSME solutions integrated into the main platform. Other countries offer instructive ideas: South Korea grants foreign vendors additional offset credit (e.g., a 5x multiplier) for any tech transfer that benefits Korean SMEs.[51] India and Germany could similarly incentivize offsets toward MSME innovation by offering multipliers or fast-track offset credits for investments in qualified start-up projects or venture funds for SMEs. Such policies ensure that big-ticket contracts directly nurture smaller players and new technologies, rather than simply fulfilling offsets through traditional licensed production. In summary, smart offsets can serve as venture capital substitutes, funnelling global defense dollars into local innovation ecosystems.

- **Streamlining Licensing and Export Controls**

Simplifying the bureaucratic processes around international collaboration is essential. Germany's stance on expedited exports to India has evolved and now treats India on par with its close (non-NATO) partners, such as Australia and Japan.[52] Building on this, the two governments could establish a fast-track export license regime for bilateral R&D and prototyping activities, effectively providing a blanket pre-approval for certain categories of dual-use technology sharing between trusted entities.

They might also negotiate a reciprocal defense trade memorandum that outlines simplified trial procedures, the temporary import/export of prototype units, and the evaluation of each other's MSME products. It can also simplify industrial licensing processes for defense start-ups (many of which work on dual-use products that blur civil-military lines), helping them engage foreign partners without running afoul of legacy regulations.

In theory, establishing a one-stop "Indo-German Defense Tech Single Window" for approvals could significantly reduce delays. This office could handle clearance for collaborations, ensure compliance with both nations' laws, and provide guidance to MSMEs on export classification of their innovations. By making the legal/regulatory maze navigable, such frameworks will encourage many more small companies to seek joint ventures with their counterparts.

In summary, financial and regulatory enablers serve as the scaffolding that supports innovation-led cooperation among MSMEs and start-ups. Adequate funding (through joint risk capital and offsets), clarity on IP and tech sharing, and a lighter bureaucratic touch (especially for dual-use tech) will create a fertile environment.

Conclusion: Operationalising Cooperation

There are three substantive conclusions about the state and potential of Indo-German defense cooperation. First, the structural conditions for a transformative partnership now exist in ways they have not previously. Second, the primary impediments to realizing this potential are institutional and political rather than technical or economic. Third, the window for capitalizing on current alignment may be narrower than commonly assumed, requiring decisions and institutional investments in the immediate term that will determine whether this partnership fulfils its promise or follows the pattern of earlier missed opportunities.

Historical record demonstrates that Indo-German defense cooperation has succeeded when industrial logic has aligned with political will, and floundered when either element was absent. What distinguishes the current moment is that both the industrial logic and political conditions have shifted fundamentally. Germany's Zeitenwende represents not merely increased defense spending but a strategic reorientation toward viewing the defense industry as systemically important and reconsidering export restrictions that previously constrained partnerships beyond NATO. India's diversification from Russian dependence is driven by strategic necessity rather than preference, creating genuine receptivity to technology partnerships that previous generations of Indian defense planners would have approached more cautiously.

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However, both nations continue to approach defense cooperation primarily through the lens of government-to-government procurement of major platforms. Large platform programs serve important functions in signaling political commitment and transferring industrial capabilities, but they are inherently slow, vulnerable to political shifts, and insufficient for capitalizing on rapidly evolving technologies where innovation cycles are measured in years rather than decades. The strategic error both nations risk is treating major platform deals as the substance of cooperation rather than as one component of a broader ecosystem.

The pathway forward must simultaneously address such assumptions and create new ones. Therefore, while Government-to-government contracts for major platforms remain essential as lighthouse projects that demonstrate political commitment and generate industrial learning, the real dynamism must come from extensive and innovative bilateral collaborations in the MSME and startup ecosystems. To support this channel, new bilateral financial and regulatory enablers must be conceived. Template agreements on intellectual property rights, pre-negotiated to ensure joint ownership and clear commercialization pathways, would eliminate the case-by-case negotiations that currently paralyze many collaborations. Fast-tracking export licensing procedures for bilateral R&D projects would effectively provide blanket preapprovals for

technology sharing between vetted entities, reducing bureaucratic friction while maintaining necessary security safeguards. Defense offsets from major procurement contracts should be strategically directed toward MSME-led innovation rather than merely fulfilling obligations through traditional licensed production, with multipliers or accelerated credit for investments in qualified startup ventures.

Success will also require sustained political will that transcends electoral cycles and bureaucratic inertia. The Inter-Governmental Consultations must elevate defense cooperation to standing agenda status with measurable deliverables and accountability mechanisms. Along these lines, Military-to-military exchanges should expand beyond ceremonial visits to substantive training partnerships, officer rotations through each other's staff colleges, and joint doctrinal development in emerging warfare domains.

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Additionally, both governments must also actively counter sceptics: Germany must reassure domestic audiences that India's Russia relationship, rooted in decades of dependence for platforms and spare parts, does not preclude a genuine strategic partnership with the West, while India must carefully balance its relationship with Russia, especially till the end of the war in Ukraine. Both sides must also realize that the strategic imperative for increased defense cooperation extends beyond bilateral industrial benefits to broader geopolitical stakes.

Considering the challenges and opportunities outlined in this report, we propose the following roadmap for the next decade.

Recommendations

Immediate-Term Actions (2025–2026)

- Institutionalize defense cooperation as a permanent agenda item at every Indo-German Intergovernmental Consultation (IGC) to accelerate strategic alignment and resolve bottlenecks in real time.
- Expand the bilateral officer exchange programme from 8 to 20 personnel annually: 10 Indian Army officers (Major to Lieutenant Colonel) should complete a 6-month staff course at the Führungsakademie der Bundeswehr in Hamburg, focusing on urban operations and AI-enabled command systems; reciprocally, 10 German officers (Hauptmann to Oberstleutnant) should train for the same duration at the Army War College in Mhow. Funding should be drawn from existing allocations.
- Convene the Export Control Working Group quarterly, alternating between New Delhi and Berlin, to publish a concise, single-page “Green List” of pre-approved defense and dual-use items for India, thereby minimizing case-by-case reviews and reducing approval timelines.

- Establish a $50 million Seed Innovation Fund through reallocation of existing resources: $30 million from Germany's SPRIND agency (no new Bundestag appropriation required) and $20 million from India's Technology Development Fund (TDF), already authorized under the 2025–26 budget. The fund should launch a single joint innovation challenge targeting three high-priority dual-use technology gaps, for instance, lightweight drone jamming systems, secure high-altitude communication radios, and cold-weather battery packs. Selected Indo-German MSME teams could receive these funds to develop prototypes within a 9-month timeline.

Medium-Term Initiatives (2027–2029)

- Scale the Seed Innovation Fund to a $100 million rolling commitment, sustained through the same SPRIND and TDF channels without additional fiscal burden. Establish dedicated liaison desks within iDEX premises in New Delhi and the Cyber Innovation Hub (CIH) in Berlin to coordinate an annual joint innovation challenge, selecting five mixed consortia (minimum three Indian MSMEs and two German Mittelstand firms) for co-development of dual-use technologies.
- Introduce a 3× multiplier on defense offset discharge for German OEMs that directly invest in R&D with Indian MSMEs, applicable to ongoing P-75I offsets and Rheinmetall contracts, incentivizing technology transfer and local innovation.
- Institutionalize regular military engagements: conduct an annual naval Passage Exercise (PASSEX) in the Arabian Sea and a biennial air interoperability exercise alternating between Jodhpur (India) and Neuburg (Germany), involving Eurofighter Typhoon and Tejas aircraft to enhance tactical coordination.

Long-Term Objectives (2030–2035)

- Sign a Reciprocal Defence Procurement Memorandum to enable fast-track tender procedures for all bilateral contracts valued below €100 million, reducing procurement cycles and administrative overhead.
- Establish a Joint Export Catalogue for co-produced munitions and sensor systems, with pre-cleared German export licenses for items of "Indo-German origin," targeting sales to ASEAN and African partners (e.g., Vietnam, Kenya) supported by shared training and maintenance packages.
- Integrate supply chains such that Indian MSMEs supply 10% by value of components for Germany's next Leopard 2 upgrade programme, while German firms source cabling, electronics, and subsystems from India's Uttar Pradesh and Tamil Nadu Defence Industrial Corridors, enhancing resilience and cost efficiency.
- Secure leadership in one niche technology domain, either AI-driven command and control (C2) systems or quantum-secure communications, with a joint submission of a NATO Standardization Agreement (STANAG) proposal by 2035 to establish global technical standards.
- Transition the bilateral innovation ecosystem to full self-sustainability, funded through private venture capital, reinvested defense offset obligations, and commercial dual-use applications, eliminating the need for direct government contributions beyond initial seed support.

Potential Indo-German Defense Industry Collaborations

The following table draws on India's Technological Perspective and Capability Roadmap (TPCR) 2025, which outlines the Armed Forces' priority requirements for the next 15 years. It matches these capability domains with corresponding technologies and platforms offered by the German defense industry. The objective is to identify areas where German competencies align with India's future needs, and to assess the scope for export, co-production, or technology transfer.

No Alignment ***Relative alignment*** ***Clear Alignment***

Army

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
ARMOURED FIGHTING VEHICLES SYSTEMS	Active Protection for Tanks (APS), Future MBT (FRCV), Light Tank (High mobility), Engine, Night sights	Rheinmetall StrikeShield APS – 360° hard-kill system, Leopard 2A7+/KF51 Panther next-gen tank, No off-the-shelf light tank; subsystems (MTU engine, Lance turret), MTU 883 series engine, Hensoldt night vision sights	APS and Night Sights are available, the rest is compatible but export/tot is ambiguous	Defensive tech, exportable. Co-produce possible/not possible via TOT
REMOTELY PILOTED AIRCRAFT AND SYSTEMS	Stealth RPAs (HALE), UAV-Launched Precision Missiles	No operational stealth UAV	Low – only experimental R&D in Germany	Collaboration unlikely, India already buying Spike through Israel
WEAPONS AND SYSTEMS	Man-portable C-IED robot, 81mm Automated Mortar Carrier	Telerob telemax EOD robot, Rheinmetall/KMW mortar integration solutions	High – German EOD robots match weight & capability	Exportable; could be locally produced with ToT
MISSILES AND SYSTEMS	Air-to-Air Missile for Helos, Tank-fired ATGM	Diehl IRIS-T missile (with HOBS IR seeker), EuroSpike Spike-ER on external launcher	High – IRIS-T meets range & agility; needs heli integration, via external mount	Export likely; Diehl could integrate on Dhruv/LCH (India uses Mistral already)
SUPPORT AND SMALL ARMS	9×19mm Machine Pistol	Heckler & Koch MP5/UMP9 SMGs (NSG already uses MP5)	Very High – world-standard SMGs, reliable and accurate	Direct purchase or licensed production possible

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
AMMUNITION	125mm APFSDS, 30mm Prox-Fuzed Ammo, ER 155mm Artillery Shell, Flares & Chaff, Trajectory-Correcting Fuze, 23mm Prox-Fuzed Ammo	Rheinmetall DM63 tech, Oerlikon AHEAD airburst 30×173mm, Diehl VULCANO 155mm GPS-guided projectile, Rheinmetall and DM countermeasure flares/chaff, Diehl/Rheinmetall fuze R&D, No German prox-fuzed ammo	Medium – can achieve requirements	Tech transfer of penetrator design possible (already under dev by DRDO), can upgrade IFVs to 30×173, Joint Reliance-Diehl production underway in India, flares exportable, fuze unlikely
SUPPORT AND SMALL ARMS	9×19mm Machine Pistol	Heckler & Koch MP5/UMP9 SMGs (NSG already uses MP5)	Very High – world-standard SMGs, reliable and accurate	Direct purchase or licensed production possible
SENSORS	Thermal Sights for Small Arms, Gen-3 Image Intensifier Sights, Advanced Theodolite, Helmet-Mounted NVG, Indigenous IR Seeker & Accelerometer dev	Hensoldt NSV & IRV thermal weapon sights, Photonis/Hensoldt Gen3 tubes, Zeiss/Leica digital aiming theodolites, Hensoldt MUM or Gen3 bi-ocular NVGs, Diehl dual-band seeker tech; Northrop LITEF high-G IMU (German branch)	Very High – matches performance; Germany can supply tubes	Exportable; some units in use with Indian forces already, Possibly under joint ventures
COMBAT ENGINEERING	Man-Portable Mine-Laying Systems, Autonomous Mine-Laying UGV, Explosive Minefield Breaching, Drone-Based Mine Dispensing, Mechanized Mine Breaching (plow/roller), Vehicle Mine Scattering (AT mines), Standoff Buried Object Detection	AP mines banned by Germany, Fraunhofer FHR GPR research, experimental UWB radars	N/A	No, violates Ottawa Treaty for AP mines

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
COMBAT ENGINEERING	Explosive Minefield Breaching (MICLIC), CBRN Decontamination System, Laser Ordnance Disposal (stand-off), Comprehensive C-IED gear sets, Flexible Anti-ballistic Material, LiDAR Drone Survey System	Rheinmetall line charge systems, Kärcher TEP90 mobile decon system, Rheinmetall 5-10kW laser demonstrators for EOD, Rohde & Schwarz jammers, Vallon detectors, Telerob robots, Teijin aramid fabric, DSM Dyneema composite (via DE), RIEGL LiDAR + Quantum-Systems Vector UAV	Germany has the required technologies	Exportable; could be integrated
EW AND COMMUNICATIONS	Integrated EW System (ground mobile), S-band Satcom Handheld/Manpack, Software Defined Radios (60k units), High-Capacity Radio Relay (1–2 Gbps)	Hensoldt/R&S “Hüter” EW suite, Rohde & Schwarz tech	High – German EW covers required bands & functions	Exportable, and G2G deal possible
SIMULATORS	New-Gen Missile Simulators	Rheinmetall full-mission simulators (software-based)	Very High – German expertise in virtual training	Exportable; can customize to Indian ATGM/air-to-air systems
SPECIALISED VEHICLES	Amphibious Armoured Dozer, Tracked Light Dozer (Heli-transportable)	No in-service model	Medium – German engineering can create one (has bridging & amphibious heritage)	Would be a bespoke development; moderate timeline
CAMOUFLAGE & CONCEALMENT	Adaptive Vehicle Stealth (thermal signature cloaking)	Early R&D in Germany (Fraunhofer, etc) on adaptive camo	Medium/Low – not field-ready anywhere yet	Joint R&D opportunity; long-term payoff; requires significant investment
	Bridge Stealth (multispectral coating/net)	Saab Barracuda camouflage nets (German service use)	High – passive camo can reduce bridge signature	Exportable easily; active measures are possible but passive suffice

Navy

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
SHIPS/CRAFT	Aircraft Carrier (design & build), EMALS Catapult	No German carrier experience (only subsystems possible)	Low – Germany cannot be lead integrator for carrier	Might contribute in minor ways (steel, some subsystems)
	Next-Gen Destroyers/Frigates / Corvettes, Mine Countermeasure Vessels (MCMV), Unmanned MCM suite (ASVs, AUVs, ROVs)	TKMS MEKO-A family designs (5k–7k ton frigates), Lürssen, Abeking & Rasmussen minehunter designs and ARCIMS	Very High – German designs meet multi-role specs	G2G co-production possible; German yard can TOT to Indian yard, (e.g. GRSE-Lürssen MoU exists), SeaFox already in Indian service
SUBMARINE SYSTEMS	Off-Board Sub Vehicles (tube-launched UUV), HE Autonomous Underwater Vehicle	Atlas “Modular UUV” concept (e.g. SeaFox variant for ISR)	Medium – tech pieces exist, integration needed	Could be developed in parallel with new subs; likely offered in P75I package as optional
	Diesel-Alternator/Rectifier for sub, Li-Ion Battery for Sub, UUV Payload Sensors (ESM, EO, sonar), Fuel Cell AIP (>250kW)	MTU submarine diesel-gen sets, TKMS/Saft Li-Ion battery, Hensoldt mini-ESM, Atlas compact sonar for UUV, Siemens/BMW PEM fuel cell AIP	Very High – exactly meets P75I needs	Offered in P75I, exportable
WEAPONS AND SYSTEMS	Torpedo (324mm, 25+km), Modular ESM Receivers, Indigenous Integrated Mast (ELINT/COMINT), Drone-based ELINT, T/R Modules for Phased Array EW, Gas Turbines (40MW), Main Diesel Engines (>100 units)	533mm SeaHake, Hensoldt Kalaetron modular ESM, Mast, SIGINT, GaN T/R modules	Very High	Germany would supply, could deliver prototype, it is also keen to involve private industry for DRDO project

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
WEAPONS AND SYSTEMS	Gas Turbines (40MW), Restraining Gear (catapult), Arresting Gear, Nuclear Propulsion, Semi-closed Gas Turbine AIP, MagnetoHydrodynamic Propulsion	None indigenous	None	—
MISSLIES AND SYSTEMS	Shore-based Anti-Ship Missile (>250km), Helium Floatation Bottles (missile), TLT Cable (submarine missile interfacing)	Diehl/Saab RBS-15 Mk4, (HUBER+SUHNER)	Germany open to supply via Diehl	Reports India prefers German RBS-15 for new coastal batteries
AMMUNITION	Standoff Guided Bomb (naval air), 76mm+ Guided Ammo, ER 127mm Ammo, Active Offboard Decoy (RF) for ASM	No German specific bomb, Vulcano127mm	Medium – reliant on third-party solution	Reliance-Diehl JV covers 127mm shells, high effort
SENSORS	Sonobuoys (DIFAR/DICASS), Advanced Sonar Transducers, Low-freq Bow Sonar, Thin-line Towed Array, IR Search & Track, (IRST) for ships, Long-range EO sensors (helicopters/UAV)	Germany doesn't make sonobuoys, Atlas Elektronik, low-freq bow array, ACTAS, Hensoldt IRST concept, ARGOS-II HD gimbal	High – can design to fit current requirements	Joint R&D likely
EW AND COMMUNICATIONS	Submarine Comm System (integrated), Laser Comm System (ship-shore), 10kW HF Broadcast System, Multi-function Antenna (V/UHF/L-band), AI Emitter Identification, Tethered UAV for EW, Secure Fleet Communication (FFCN)	Rohde & Schwarz integrated comm suite (Panther systems), Tesat-Spacecom laser terminal, Rohde & Schwarz SK4100 HF transmitter, NAVICS multi-band comm suite, Hensoldt Kalaetron AI-based ESM, Atlas Elektronik prototype, Rohde & Schwarz integrated comm network	Very High – Germany uses integrated comm management	Would come with German sub, or can supply as upgrade to current subs

Air Force

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
COMMS SYSTEMS	IAF Strategic Communication Network with Indian Security Protocol, Zero Trust Network Access (ZTNA) Model, Unidirectional Security Gateway, Mobile SATCOM & TROPO Terminal (MSTT)	Rohde & Schwarzsecure military communications,cybersecurity firms (e.g. Secunet, T-Systems), INFODAS SDoT data diodes, ND Satcom mobile SATCOM hubs; Rohde & Schwarz Tropo scatter radio	High – German industry provides robust secure networking meeting military specs.	Proven export of comms systems (e.g. to other NATO allies). Joint development or tech transfer feasible under bilateral IT/cyber cooperation.
ELECTRONIC WARFARE	ASOJ (Airborne Stand-Off Jammer), Airborne GPS Jammer	*No dedicated German platform.*	NA	NA
	Ground Based Multipurpose Jammer, RWJ for DARIN-III Jaguar (Radar Warner Jammer)	Rohde & Schwarz "Guardsman" family ground EW systems, Hensoldt "Kalaetron Attack" digital ELINT/jamming suite for fighters	Medium – German ground jammers exist for comms and radar, developing advanced airborne jammer pods for Eurofighter	Germany has exported ground EW to NATO partners. Co-development to extend range possible with tech transfer under government approval.
	UAV-based SIGINT/ELINT System – Drone-mounted signals intelligence payload	HENSOLDT Kalaetron Integral (SIGINT Pod)	High: This offering covers the same spectrum and functionality the IAF desires.	As a domestically developed German system, export is relatively straightforward pending government approval.
AI/ ML/ BIG DATA	AI/ML/Big Data Applications	Fraunhofer Institute, IBM Germany, etc., offer AI solutions for defense (predictive maintenance, ISR analytics).	High – Domain-agnostic, Germany's advanced software industry can meet AI/ML requirements.	Software collaboration likely under industrial MoUs.

Category	Domain & Requirement	German Capability/Offering	Compatibility	Notes on Export/Co-production
UNMANNED AERIAL SYSTEMS/ COUNTER SYSTEM	Unmanned Aerial Systems (UAS) & Counter-UAS	Airbus (Germany) leading EurodroneMALE UAV development; Hensoldt “Xpeller” counter-drone solution for C-UAS.	High – Eurodrone will meet MALE specs (30k+ ft, >24h endurance) when ready; German C-UAS tech is field-proven.	Eurodrone program includes German participation
SATELLITE BASED APPLICATIONS	Satellite Based Applications (incl. small sats, SSA)	OHB System AG and Airbus build small satellites (SAR, EO) and SSA sensors for EU.	High – German industry highly capable in satellite buses, EO payloads, SAR (TerraSAR-X heritage) etc.	Germany has co-launched satellites with partners. Willing to provide bus or payload tech under commercial contracts;
METEOROLOGY	Meteorology Systems (Advanced weather tech)	Jenoptik and Vaisala GmbH supply upper-air sounding systems; DWD (German Weather Service) uses advanced radars and models.	High – German firms can offer weather radars, models matching IAF’s needs for accurate met data.	Weather instruments are non-sensitive.
DEW	Directed Energy Weapons (DEW)	Rheinmetall High-Energy Laserdemonstrators (20–100 kW) proven to neutralize drones and mortars.	Medium – German lasers meet power needs, but not yet an operational fielded system (tech readiness nearing production).	Germany is open to joint laser weapon development (e.g. with MBDA).

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