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Comparative Analysis of Defence R&D Budgets: Dominance of China and Aspirations of India in Military Modernisation for 2023-24

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ABSTRACT

This research paper provides a comprehensive and critical analysis of the research and development (R&D) budgets allocated by China and India for defence modernisation during the fiscal years 2023 - 24. Drawing on official government reports, international think tank publications, and scholarly analyses, the study employs a mixed-methods analytical research methodology, combining quantitative data on budget allocations with qualitative assessments of geopolitical implications, technological advancements, and policy frameworks. Key findings reveal a stark disparity: Estimated defence R&D spending of China reached approximately $44.4 billion (15% of its SIPRI-estimated $296 billion military expenditure), while allocation of India to the Defence Research and Development Organisation (DRDO) stood at $2.8 billion (about 3.35% of its $83.6 billion total military spend). This gap underscores aggressive push of China toward indigenous technological superiority in areas like hypersonics, cyber warfare, and artificial intelligence (AI), contrasted with more incremental approach of India focused on self-reliance under the Atmanirbhar Bharat initiative. The analysis examines how these budgetary patterns influence military capabilities, regional power dynamics, and global security, highlighting opportunities for India to enhance R&D efficiency through public-private partnerships and increased funding. Limitations include the opacity of official figures of China, which necessitate relying on estimates from sources like SIPRI and the U.S. Department of Defence. Future outlook suggests that without substantial increases, R&D investments of India may struggle to counterbalance advancements of China, potentially exacerbating asymmetries in the Indo-Pacific region.

Keywords: Budget; China; Geopolitics; India; Modernisation; R & D

INTRODUCTION

Over the past two decades, both India and China have significantly ramped up defence spending to modernise their militaries amid evolving geopolitical tensions. According to estimates, overall military spending of China increased by 6.0% to $296 billion in 2023, while India's increased by 4.2% to $83.6 billion[1]. These figures, however, mask the critical role of R&D allocations in driving technological innovation and long-term military superiority. R&D was mostly funded through the DRDO, which received ₹23,264 crore ($2.8 billion) of 2023 - 24 defence budget of India, which came to ₹5.94 lakh crore (about $72.6 billion at the time)[2]. In contrast, official defence budget of China was announced at RMB 1.55 trillion (about $224.79 billion), but independent estimates, accounting for off-budget items like R&D and procurement, place total military spending at $296 billion, with R&D comprising an estimated 15% or $44.4 billion[3].

This study aims to compare these R&D budgets, focusing on their implications for modernising defence in 2023 - 24. The analysis is structured around six themes: historical context, budget overviews, allocation trends, impacts on modernisation; technological innovations, and geopolitical ramifications. By integrating quantitative data with qualitative insights, the paper reveals how higher R&D investments of China enable disruptive technologies, while India's constrained funding limits indigenous development, potentially widening the capability gap. It is vital for policymakers to understand these patterns, as declining R&D allocations could reshape global military power equations; however, predicting exact disruptions remains speculative due to variables such as international alliances and economic constraints.

Background of China and India in Defence Modernisation

China's military doctrine has evolved from a purely defensive posture to one emphasising "active defence" with offensive elements, as formalised in its 2015 Defence White Paper and reinforced in subsequent reforms. This shift, driven by concerns over U.S. rebalancing in the Asia-Pacific and territorial conflicts in the East and South China Seas, as well as backup plans of Taiwan, has prioritised R&D in asymmetric warfare domains. In 2023 - 2024, military modernisation of China focused on integrating AI, quantum computing, and hypersonic weapons, backed by the Military-Civil Fusion (MCF) approach, which conflates defence with civilian research and development. This approach allows China to leverage commercial innovations for military gains, but it raises concerns about intellectual property theft and dual-use technology proliferation, as noted in U.S. intelligence reports[4].

Defence modernisation of India is shaped by multifaceted threats, including border disputes with China and Pakistan, sub conventional warfare as well as Indian Ocean Region (IOR) marine security[5]. The 2020 Galwan clash underscored the need for advanced technologies in high-altitude warfare, prompting increased R&D focus on drones, cyber defences, and precision munitions under the Atmanirbhar Bharat scheme. However, R&D allocation of India remains modest at 5-6% of the defence budget, compared to global averages of 10-15% in leading powers[6]. This underinvestment perpetuates reliance on imports (over 60% of equipment), hindering self-sufficiency and exposing vulnerabilities to supply chain disruptions[7].

Significance of Research and Development Budget Comparison

Comparing R&D budgets reveals disparities in technological trajectories and geostrategic ambitions. R&D investments of China, estimated at 1.7-2.3% of GDP overall (with a significant defence share), enable breakthroughs in hypersonics and space warfare, providing strategic advantages[8]. GERD (Gross Expenditure on R&D) of India hovers at 0.65% of GDP, with defence R&D at just 0.05-0.07%, limiting innovation velocity[9]. This differential could tilt regional balances, as R&D spillovers enhance economic competitiveness. While budgets signal intent, their effectiveness depends on execution; Centralised MCF of China contrasts with fragmented ecosystem of India, plagued by bureaucratic delays.

METHODOLOGY

This study adopts an analytical research methodology, blending quantitative and qualitative approaches to dissect R&D budget comparisons. Quantitative analysis involves descriptive statistics and trend comparisons of budget data from 2023-24, sourced from official documents and international databases. For instance, regression models could correlate R&D spending with modernisation outcomes; given data limitations, the focus is on comparative ratios (e.g., R&D as a percentage of the total defence budget). Qualitative analysis employs thematic coding of policy documents, expert interviews (secondary), and case studies to evaluate impacts. Data collection prioritises primary sources: Union Budget 2023 - 24 of India, DRDO reports, and China's National People's Congress budget announcements[10]. Secondary sources include SIPRI, U.S. DoD reports, and think tanks like RAND and IDSA for estimates, addressing opacity of China.

Limitations: Budgets of China exclude off-book R&D (e.g., via state-owned enterprises), inflating underestimations by 30-50%[11]. Data of India is transparent but underreports private sector contributions. The framework tests hypotheses on budget impacts using variables like R&D intensity and capability metrics, ensuring robustness through triangulation.

Data Collection Sources

Primary data: Ministry of Defence (MoD) of India budget reports and DRDO annual statements[12]; Ministry of Finance and Defence White Papers of China[13]. Secondary: SIPRI Military Expenditure Database, EDA reports, and academic journals[8]. While official figures provide baselines, estimates from Western sources may carry biases, necessitating cross-verification.

Analytical Framework

The framework analyses budgets across dimensions: absolute vs. relative allocations, priority sectors, and efficiency metrics. For example, China's R&D and GDP ratio (2.3%) vs. India's (0.65%) highlights investment gaps. Qualitative inferences are drawn from threat perceptions and policy alignments, critiquing how resource constraints force trade-offs-e.g., pension burdens of India (28% of budget) vs. procurement focus of China.

HISTORICAL CONTEXT OF DEFENCE MODERNISATION IN CHINA AND INDIA

The historical trajectory of defence modernisation of China was profoundly influenced by the 1991 Gulf War, which exposed the vulnerabilities of traditional warfare against advanced U.S.-led coalitions employing precision strikes and informatized systems. This "Desert Storm education" prompted the People's Liberation Army (PLA) to pivot toward a Revolution in Military Affairs (RMA), emphasising high-tech capabilities, network-centric warfare, and informatisation—integrating information technology into military operations[14]. Initiated in the late 1990s under Deng Xiaoping's reforms and accelerated by Jiang Zemin

and Xi Jinping, this involved massive R&D investments, with military spending surging from $21 billion in 1991 to over $234 billion by 2019[15]. By 2023-24, these efforts culminated in breakthroughs like the DF-17 hypersonic missile, a medium-range system with a glide vehicle capable of speeds exceeding Mach 5 and a range of 1,800 - 2,500 km designed to evade missile defences and target U.S. assets in the Indo-Pacific[16]. Central to this acceleration is MCF strategy of China, formalised in 2015 under Xi, it removes obstacles to civilian research, commercial sectors, and military applications, enabling rapid innovation in AI, quantum computing, and hypersonics by leveraging private tech giants like Huawei[17].

In contrast, defence modernisation of India gained momentum after the 1999 Kargil War, which highlighted deficiencies in high-altitude warfare, intelligence, and equipment, leading to the establishment of key reforms like the Kargil Review Committee and a renewed focus on indigenous development through the Defence Research and Development Organisation (DRDO)[18]. Post-Kargil initiatives included the 2001 recommendations by Group of Ministers for integrated defence structures and boosted DRDO funding, though progress has been uneven due to chronic shortfalls—R&D often comprising only 5-6% of the defence budget—and bureaucratic delays. Initiatives under the 2020-launched Atmanirbhar Bharat (Self-Reliant India) initiative, have aimed at reducing import dependence, which stood at 65% historically but dropped to about 4% by mid-2025, with defence exports growing 34-fold in the last decade and full ammunition self-reliance targeted by year-end[19]. Projects like the Tejas fighter and Agni missiles exemplify indigenous strides, yet funding constraints have perpetuated reliance on foreign suppliers for advanced systems.

Modernisation of both nations responds to mutual threats, including border disputes along the LAC, where superior R&D ecosystem of China—bolstered by the MCF—facilitates faster innovation cycles and technological leaps, potentially shifting regional power balances. India's import dependence, while declining, exposes vulnerabilities to supply chain disruptions and escalates costs, meaning it requires sustained investment to counter asymmetric advantages of China. This disparity highlights how historical shocks like the Gulf and Kargil Wars have shaped divergent paths: China's proactive, integrated approach versus reactive, resource-limited indigenisation of India. As of 2025, these dynamics continue to influence Indo-Pacific security, with China maintaining a lead in disruptive technologies.

OVERVIEW OF RESEARCH AND DEVELOPMENT BUDGETS IN CHINA AND INDIA

In the fiscal year 2023 - 24, defence research and development (R&D) efforts of China were deeply integrated into its Military-Civil Fusion (MCF) strategy, which leverages civilian innovations for military applications, blurring the lines between the commercial and defence sectors. With some financing opacity, this strategy has allowed China to explore dual-use technologies like artificial intelligence (AI), quantum computing, and hypersonic systems. According to SIPRI estimates, total military expenditure of China in 2023 reached $296 billion, a 6.0% increase from the previous year. While official figures from China's National People's Congress attached the defence budget at approximately RMB 1.55 trillion (about $225 billion), independent analyses, including those from the U.S. Department of Defence, suggest that actual spending, including off-budget R&D, could be 30-40% higher[20]. R&D allocations are particularly elusive, often embedded in broader science and technology budgets, but methodology of SIPRI attributes around 14-15% of adjusted military spending to additional R&D with military applications, equating to an estimated $44.4 billion[3]. This funding surge supports advancements in areas like cyber warfare and space capabilities, reflecting ambition of China to achieve technological superiority along the Indo-Pacific frontiers and in disputed areas like the South China Sea.

Table 1: Comparative Analysis of Military Expenditure and R&D Allocation: China vs. India (2023)

Country	Total Military Spend (2023, USD Bn)	Est. R&D Allocation (USD Bn)	R&D % of Military Spend
China	296	44.4	15%
India	83.6	2.8	3.35%

Source- Taken from CSIS China Power[20]

In contrast, R&D budget of India for modernising defence is more transparent, but it is constrained by economic priorities. The DRDO, the primary agency for indigenous military technology, received an allocation of ₹23,264 crore (approximately $2.8 billion) in the 2023-24 Union Budget, marking a 9% increase from the prior year[2]. This funding emphasizes upgrades to existing platforms, including the Tejas light combat aircraft, Agni-series missiles, and anti-submarine warfare systems, aligning with the Atmanirbhar Bharat (Self-Reliant India) initiative to reduce import dependency, which historically accounted for over 60% of equipment. Total military expenditure of India for 2023 was estimated at $83.6 billion by SIPRI, with R&D comprising just 3.35% of this amount[21]. Transparency in budgeting process of India allows for public scrutiny through parliamentary reviews, but the allocation remains limited relative to GDP (about 0.07% for defence R&D), hampered by competing demands like pensions (28% of the defence budget) and revenue expenditures. The Table 1 summarises the key comparative metrics given above.

R&D surge of China - driven by MCF and consistent 6-7% annual growth in military spending - contrasts sharply with relative stagnation of India, where allocations have hovered around 5 - 6% of the defence budget amid

fiscal constraints[11]. This disparity risks accelerating India's technological obsolescence, particularly in emerging fields like hypersonics and AI, where China has already deployed systems like the DF-17 missile. While focus of India on cost-effective upgrades fosters self-reliance, the funding gap could undermine deterrence against asymmetric threats, especially along the LAC. Policymakers must address this imbalance to prevent widening strategic vulnerabilities in the Indo-Pacific region, potentially through enhanced public-private partnerships and international collaborations to boost R&D efficiency.

COMPARISON OF BUDGET ALLOCATION TRENDS IN CHINA AND INDIA

Defence research and development budget of China trends demonstrate robust, consistent growth, averaging 6 - 7% annually over the past decade, aligning with its broader military modernisation under the Military - Civil Fusion (MCF) strategy. In 2023, total military expenditure reached $296.44 billion, a 1.53% increase from 2022, with estimates suggesting R&D allocations embedded in off-budget items pushing effective spending to around $471 billion by 2024[22]. This surge funds cutting-edge domains like artificial intelligence (AI), hypersonic weapons, and quantum technologies, with R&D intensity reaching 2.6% of GDP in 2023, approaching OECD levels[11]. For instance, investments in hypersonics, such as the DF-17 missile, reflect prioritised procurement and innovation, comprising about 40% of the budget. In contrast, India's trends show incremental progress, with the DRDO receiving $2.8 billion (₹23,264 crore) in 2023 - 24, a 9% increase from the previous year[2]. Total military spending rose to $83.57 billion in 2023, up 4.5% from 2022, but R&D remains modest at 3-4% of the defence budget[21]. Pensions consume 28% of allocations, squeezing capital outlays for modernisation, while revenue expenditures dominate. Deep analysis reveals this disparity amplifies lead of China in emerging technologies, enabling asymmetric advantages in cyber and space warfare. Focus of India on cost-effective indigenisation, such as through Atmanirbhar Bharat, promotes self-reliance but lags in scale, risking widening gaps amid border tensions. By 2024 - 25, defence budget of India grew to ₹6.21 lakh crore, yet R&D growth remained below 10%, underscoring the need for reallocation to match momentum of China.

IMPACT OF BUDGET ALLOCATION ON DEFENCE MODERNISATION EFFORTS

Higher budget allocations directly correlate with accelerated defence modernisation, as evidenced by China's substantial R&D investments that yield operational superiority. In 2023 - 24, China's estimated $44 - 47 billion in defence R&D (part of $296 - 471 billion in total spending) has propelled advancements in the cyber, space, and hypersonic domains, enhancing the PLA's integrated warfare capabilities[4]. For example, MCF-driven funding has operationalised systems like quantum-secured communications and AI-enabled drones, providing edges in disputed regions including the Indo-Pacific and South China Sea. Efforts of India, while notable, progress more slowly due to constrained allocations. The ₹23,264 crore budget of DRDO in 2023-24 supported projects like the Agni-V intercontinental ballistic missile and Tejas upgrades, contributing to indigenous capabilities and a 34-fold export growth over the decade[23]. However, with total spending at $83.57 billion, inefficiencies - such as project delays (e.g., over 50% of DRDO initiatives face extensions) and high pension burdens - undermine potential, limiting innovation velocity. Allocation inefficiencies of India, including bureaucratic hurdles and underutilised private sector involvement (only 25% R&D earmarked for industry in 2024-25), necessitate reforms like streamlined procurement and increased academia ties[24]. Without these, the funding gap risks perpetuating vulnerabilities against rapid advancements of China, potentially affecting deterrence along the Line of Actual Control. Enhanced budgets could translate to faster capability gains, signalling stronger pre-emptive postures regionally.

TECHNOLOGICAL INNOVATIONS AND CAPABILITIES DEVELOPED THROUGH RESEARCH AND DEVELOPMENT

Substantial defence R&D investments of China have driven groundbreaking innovations, particularly hypersonic weapons and quantum sensors, which significantly enhance its offensive and defensive capabilities. In 2023-24, advancements in hypersonic missile technologies, such as the DF-17 and DF-27 systems, have matured over the past two decades, enabling speeds exceeding Mach 5 and manoeuvrability to evade U.S. missile defences[25]. Quantum sensors, integrated into military applications for precise navigation and detection, position China as a leader alongside the U.S., with potential impacts on submarine warfare and ISR (intelligence, surveillance, reconnaissance)[26]. These developments, fuelled by Military-Civil Fusion, act as force multipliers, allowing asymmetric advantages in regional conflicts like the Indo-Pacific. Innovations of India, while impressive, are constrained by scale and funding. The BrahMos supersonic cruise missile, jointly developed with Russia, saw extended-range variants (up to 800 km) ordered for the Navy in 2024, demonstrating enhanced strike capabilities[27]. Sonar technologies of DRDO and underwater communication systems have advanced anti-submarine warfare for submarines. However, production remains limited compared to output of China. Critical analysis reveals budget disparities - $44.4 billion of China vs. $2.8 billion of India - allow China to outpace India in disruptive force multipliers like AI and quantum tech[28]. India mitigates this through collaborations, such as with

Israel for radar and UAVs, fostering hybrid innovations, but sustained investment is essential to close the gap.

CHALLENGES AND OPPORTUNITIES IN RESEARCH AND DEVELOPMENT BUDGET ALLOCATION

Challenges in allocating the defence R&D budget for 2023-24 highlight systemic issues for both China and India. Rapid growth of China - a 7.2% increase to $231 billion in 2024- faces bureaucratic inefficiencies and external pressures, including U.S. sanctions on tech transfers, complicating indigenous innovation amid internal economic strains[29]. India's static budget ($72.6 billion in 2023-24) persists despite threats from China, with high pension costs (28%) and delays in projects eroding capital for R&D, exacerbating talent shortages and low private investment[30]. These constraints risk widening the capability gap, as R&D intensity of India (0.07% of GDP) lags 2.6% of China[31]. Opportunities abound, however. India's Atmanirbhar Bharat initiative earmarks 25% of R&D for startups and promotes academia-industry ties, boosting indigenisation and exports[24]. MCF strategy of China integrates civilian tech for military gains, surging R&D in energy and defence. Both can leverage global partnerships—India with QUAD for tech sharing and China via Belt and Road. A critical view emphasizes policy harmonisation: streamlining India's procurement and enhancing transparency of China could optimize allocations, turning challenges into strategic advantages amid Indo-Pacific tensions.

GEOPOLITICAL IMPLICATIONS OF BUDGET DISPARITIES IN DEFENCE MODERNISATION

In the Indo-Pacific region, where superior investments of China allow for coercive measures in disputed areas like Ladakh and the South China Sea (SCS), differences in defence R&D budgets between China and India greatly increase tensions. In 2024-25, military spending of China reached an estimated $471 billion, over three times India's $72.6 billion, allowing advancements in hypersonics, AI, and cyber capabilities that bolster grey-zone tactics, such as border incursions in Ladakh since 2020 and militarisation in the SCS[32]. This asymmetry pressures India to respond, exacerbating security dilemmas and potential flashpoints along the LAC. For India, these gaps necessitate strengthened alliances like the QUAD with Australia, Japan, and the US, which facilitate technology sharing and joint exercises to counterbalance dominance of China[33]. Critical analysis indicates that budget disparities could ignite arms races, as incremental 4.7% budget hike of India in 2024-25 falls short of matching 7.2% growth of China, potentially altering global equilibria by shifting power dynamics in Asia and prompting broader coalitions[34]. Without addressing this, India risks strategic encirclement, while advancements of China could embolden assertiveness, influencing U.S. Indo-Pacific strategies and global trade routes.

POLICY RECOMMENDATIONS FOR ENHANCING RESEARCH AND DEVELOPMENT BUDGETS IN INDIA

To bridge the widening gap with China, India should increase its defence R&D allocations to at least 10% of its total military budget, up from the current 1% - 3%, prioritising its defence R&D allocations to at least 10% of its total military budget, up from the current 1% - 3%, prioritising emerging technologies like AI and cybersecurity amid rising digital threats[35]. The Union Budget 2025 allocated ₹1,900 crore for cybersecurity, including AI Centres of Excellence and CERT - In expansion, but experts advocate for dedicated R&D institutes and higher grants to foster innovation. Fostering public-private partnerships (PPPs) is crucial, leveraging initiatives like Atmanirbhar Bharat to integrate startups and industry, with tax incentives and ethical AI governance to accelerate development in defence applications. Prioritising AI and cyber domains align with strategic imperatives, such as the 2022 list of 75 AI defence projects, which focus on data processing and unmanned systems to counter advancements of China[35]. These recommendations must harmonise with national security goals, including talent development and data access, to ensure self-reliance. Without reforms, 2% GDP defence expenditure of India in FY25 - 26 risks perpetuating vulnerabilities, but targeted increases could enhance deterrence and global competitiveness[36].

CONCLUSION AND FUTURE OUTLOOK

The comparative analysis of defence R&D budgets for 2023-24 reveals a significant disparity between China and India, with profound implications for military modernisation and regional stability in the Indo-Pacific. China's estimated $44.4 billion R&D allocation, constituting 15% of its $296 billion military expenditure, underscores its aggressive pursuit of technological superiority through the Military-Civil Fusion (MCF) strategy. This investment fuels advancements in hypersonics, AI, and quantum technologies, positioning China as a dominant force in asymmetric warfare and reshaping power dynamics. In contrast, $2.8 billion R&D budget of India, a mere 3.35% of its $83.6 billion military spend, reflects a constrained approach despite the Atmanirbhar Bharat initiative's focus on self-reliance. While India has made steps in indigenous systems like the Tejas and BrahMos, the funding gap limits its ability to match rapid innovation of China, risking strategic vulnerabilities along the Line of Actual Control (LAC) and beyond.

China's robust R&D ecosystem, driven by consistent 6-7% annual budget increases and MCF integration, enables breakthroughs that enhance its global influence, particularly

in contested regions like the South China Sea. The deployment of systems like the DF-17 hypersonic missile illustrates how R&D translates into operational advantages, amplifying coercive capabilities of China. India, however, faces systemic challenges, including bureaucratic inefficiencies and a high pension burden (28% of its defence budget), which divert resources from modernisation. Despite a 34-fold increase in defence exports and progress in ammunition self-reliance, R&D intensity (0.07% of GDP) of India lags far behind China's (2.6%), hampering innovation velocity. This disparity underscores the need for India to reallocate resources, reorganise procurement, and foster public-private partnerships to bolster indigenous capabilities and counterbalance technological edge of China.

Geopolitically, the R&D budget disparity exacerbates tensions and fuels an arms race in the Indo-Pacific. China's advancements enable grey-zone tactics, such as border incursions in Ladakh, challenging deterrence posture of India. India's response, including alliances like the QUAD, offers opportunities for technology sharing but cannot fully offset the gap without increased R&D investment. Projections indicate military spending of China could reach $471 billion by 2024, potentially surpassing 1,000 nuclear warheads by 2030, while budget of India, rising to $125.2 billion by 2030, struggles to keep pace. This asymmetry could embolden assertiveness of China, influencing global trade routes and U.S. Indo-Pacific strategies. India's demographic dividend and growing defence industry provide a foundation for progress, but without reforms, its strategic ambitions may remain constrained, impacting its global standing.

Looking ahead, India must prioritise increasing R&D allocations to at least 10% of its defence budget, focusing on AI, cybersecurity, and unmanned systems to align with strategic imperatives. Policies like Atmanirbhar Bharat and enhanced QUAD collaboration offer pathways to mitigate the gap, but success hinges on overcoming bureaucratic hurdles and integrating private sector innovation. China's lead, while formidable, faces challenges like U.S. sanctions and economic strains, suggesting potential vulnerabilities. For India, sustained investment and global partnerships could foster a balanced regional order, reducing the risk of encirclement. Failure to act risks entrenching China's dominance, potentially destabilising the Indo-Pacific. By leveraging its strengths and addressing inefficiencies, India can enhance its deterrence and global competitiveness, contributing to a stable and multipolar global security landscape.

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