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Message from the Chief Patron



It gives me immense pleasure to present Mirpur Papers, Volume 32, Issue 38, May 2026 the flagship academic journal of the Defence Services Command and Staff College (DSCSC), Bangladesh. This publication continues to serve as an intellectual platform for the exchange of ideas, professional discourse, and scholarly reflection within the DSCSC community as well as the wider academic and professional sphere.

Mirpur Papers contribute significantly in critical thinking and continuous learning by encouraging intellectual curiosity, fostering analytical rigor, and promoting informed debate on issues of national and international significance. This issue presents articles and research works that reflect the depth of thought, professionalism, and academic commitment of our officers, faculty members, and contributors. The subjects explored herein encompass contemporary security challenges, leadership, defence management, operational concepts, emerging technologies, and strategic affairs. Such scholarly contributions enrich professional military education and support the development of future leaders capable of addressing complex and multidimensional challenges.

I commend the Editorial Board for their dedication and professionalism in producing this publication. I also extend my sincere appreciation to all contributors whose efforts have enriched this issue with valuable insights and perspectives.

I wish Mirpur Papers continued success in its mission in promoting intellectual growth and professional excellence.

Major General Chowdhury Mohammad Azizul Haque Hazary, OSP (BAR), SGP, ndc, afwc, psc, M Phil
Commandant
Defence Services Command and Staff College

Editor's Note

Keeping its legacy high, the 38th issue of Mirpur Papers, a scholarly publication of the Defence Services Command and Staff College, is presented to its readership. This publication continues to serve as a deliberate space for reflection, analysis and informed debate for the military academia. It provides a platform where rigorous thinking meets professional experience, ensuring that the intellectual output of DSCSC is recorded, preserved and recognised. For our course participants, it remains an archive of ideas to revisit; for our faculty and alumnus, serving as a channel to extend lessons beyond the traditional learning space.

This issue brings together a diverse range of topics of contemporary relevance to national and regional security. The first paper revisits the Bangladesh Armed Forces' deterrence posture amid regional power asymmetry and drawing on the experience of small states such as Singapore and Vietnam, proposes a pragmatic deterrence strategy blending conventional and asymmetric approaches, including enhanced cyber capability and intelligence-led deterrence. The second one highlights the Navy's surveillance posture in the Bay of Bengal and proposes a phased, AI-based surveillance network anchored by data fusion centres to deliver real-time maritime domain awareness. The third article analyses the Army's logistics structure in the context of asymmetric warfare. The next paper addresses the escalating threat of pre-programmed drones to the Navy and proposes an integrated counter-drone strategy built around a 4P framework of perception, prevention, protection and preparation to ensure resilience against evolving drone threats. The fifth article examines the effect of adaptive thinking on the decision-making capability of junior leaders and proposes integrating a structured adaptive-thinking training framework, modelled on practices such as the US Army's 'Think Like a Commander' programme, into existing training modalities to prepare them for future operations. The sixth article evaluates the physical, organisational and psychological work environment of the Air Force's Rectification and Inspection (R&I) Flights, establishing its significant bearing on technicians' job performance and aircraft maintenance outcomes, and recommends measures for improvement. The seventh article assesses the state of soft skills among junior officers of Bangladesh Army and recommends structured objectives, synchronised training models and the integration of e-learning to strengthen professional competence. Finally, the last paper, contributed by an international course participant, examines the viability of 'Atmanirbharta', or self-reliance, for India's defence in the prevailing geo-political scenario, concluding that the path is essential though constrained by the limited absorption capacity of defence public sector undertakings, and calls for stronger defence research and development with greater private sector participation.

We extend our compliments to our community of readers, writers, editors and well-wishers for their continued support in enabling this publication to grow as a trusted intellectual platform.

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Rethinking Deterrence: A Pragmatic Approach for Bangladesh Armed Forces (BDAF) in Emerging Security Parlance

Lieutenant Colonel Mir Kamrul Hasan, BSP, afwc, psc, G, Arty

"Even the finest sword plunged into salt water will eventually rust."

— Sun Tzu

Abstract

This paper evaluates the effectiveness of BDAF's current deterrence approach in the face of emerging security threats and regional power asymmetry. Given limited resources and conventional capability, small states like Bangladesh (BD) faces challenges in deterring militarily superior adversaries. The study highlights the challenges of (BDAF's) traditional deterrence posture constrained by conventional military capability, limited indigenous production, and lack of cyber and hybrid warfare readiness. Drawing insights from small states like Taiwan, Singapore, and Vietnam, it proposes a deterrence strategy combining operational, conceptual, and moral power tailored to BDAF. These include indoctrination of aggressive fighting strategy, enhancing cyber capabilities, maximizing demographic dividends, deterrence through intelligence etc. This paper adopts mixed method methodology and applies non-probability purposive sampling technique. For collecting the primary data, semi-structured interview was conducted with senior military officers of BDAF and academics of International Relations. It was revealed through the research that integration of conventional and asymmetric approaches can help BD build credible, sustainable deterrence when substantiated by pragmatic modernization of its Armed Forces. The study concludes with a set of practical recommendations to reshape BDAF's doctrine and capabilities for a more resilient and adaptive deterrence posture. The findings are useful for any small state's deterrence approach.

Introduction

Deterrence is a strategic approach that discourages potential adversaries by clarifying that the costs of aggression would be greater than any potential gains (Keinonen, 2024). Despite evolution, the deterrence theory still holds relevance in the face of changing geo-political landscape and exponential technological advancement. In an era of evolving security challenges, small, and economically constrained states like Bangladesh (BD) must rethink its deterrence posture beyond a conventional militarybuildup alone. The emergence of hybrid warfare, cyber threats, and regional instability also warrants a realistic and pragmatic approach to deterrence which is tailored to our geopolitical realities.

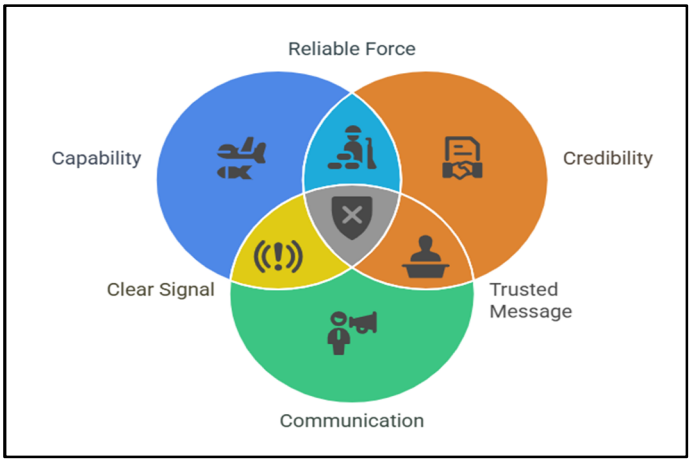
BD's unique geopolitical positioning and regional power asymmetry profoundly complicates its security landscape. Like any other developing country, economic constraints limit BDAF's ability to project traditional deterrence despite its modernization efforts (Azam, 2018). To effectively counter potential threats, Bangladesh must adopt an alternative strategy that seamlessly integrates its existing conventional capabilities with innovative, non-traditional approaches.

Against this backdrop, this paper first evaluates the effectiveness of BD's current deterrence framework against the evolving threat landscape. It then analyzes the pragmatic approaches of other small states in projecting deterrence while operating within comparable socio-economic, political, and military contexts. Finally, the paper proposes a feasible deterrence model incorporating operational and conceptual components to offer pragmatic, cost-effective options for enhancing the deterrence posture of BDAF.

Understanding Deterrence

Deterrence theory originated during the Cold War, when the world experienced a nuclear race between the United States (USA) and the then USSR, where Mutually Assured Destruction (MAD) became its foundation (Snyder, 1961). The idea was that the threat of devastating retaliation would prevent conflict. The US Department of Defense defines deterrence as "the prevention of action by the existence of a credible threat of unacceptable counteraction and/or the belief that the cost of action outweighs the perceived benefits" (Mauroni, 2019). For deterrence to be effective, it requires three essential elements: credibility, capability, and communication ensuring that the adversary believes in, fears, and clearly perceives the potential consequences (Snyder, 1961).

Figure 1: The Synergy of Deterrence Elements



Source: Author's Construct

BD's Emerging Security Threat Parlance

a. **Regional Security Dynamics**. The power struggle between India and China, coupled with India's historical conflict with Pakistan has led to increased militarization in the region. BD, being strategically positioned between these powers, faces indirect but significant security implications (Rahman M., 2020). The very recent air battle following the 'Pehelgum Standoff' is yet another testament to this. This tension between these two countries often impacts regional trade, affects military alliances, and creates security risks that have spillover effects on other neighboring countries. In recent years, Sino-Indian relations have also seen a downturn which has been manifested through conflicts such as the Doklam standoff in 2017 and the clashes in Ladakh in 2020. China's Belt and Road Initiative (BRI) and India's 'Act East Policy' also place BD in a strategic dilemma, where aligning too closely with either power could lead to military or economic consequence (Zaman, 2025).

b. **Security Concern with Neighboring India**. The relationship between Bangladesh (BD) and neighboring India is marked by complex security dynamics that involve border disputes and growing economic interdependence (Jamil, 2021). Furthermore, the Teesta River dispute remains unresolved despite repeated diplomatic maneuver. Moreover, following the political turnover in August 2024, BD-India relations have gone through a challenging phase marked by diplomatic standoffs, disinformation and misinformation campaign, religious sensitization, and tensions (Mostofa, 2024). Indian military exercises near the Siliguri Corridor in 2025 also indicate a growing deterioration in the regional security environment (Sinha, 2025). Besides, a total of 1,222 people were forcibly pushed into Bangladesh in May 2025 alone, which raises security concern along the border (Kamal, 2025).

c. **Security Conundrum concerning Myanmar**. BD-Myanmar-India-China equation presents a unique security dilemma for BD. Myanmar, an important strategic partner for both China and India, is a source of border security concern to BD. As Myanmar military and the Arakan Army fight for dominance in Rakhine state, it raises the level of tension along Bangladesh's southeastern border. China's military and economic engagement in Myanmar makes it difficult for BD to exert diplomatic pressure on Naypyidaw. India's 'Act East Policy' has strengthened its ties with Myanmar which technically reduces BD's sphere of influence. The Arakan Army (AA) now controls large parts of Myanmar's Rakhine State, which directly concerns BD (Hossain,

2025). It is alarming to note that 1,50,000 new FDMNs have infiltrated BD within last one and half year as recorded by UNHCR (Daily Prothom Alo, 2025). Therefore, BD is at the risk of transnational crime coupled with humanitarian crisis with the new wave of FDMN.

d. **Domestic Non-state Actors**. BD remains one of the most densely populated countries in the world. Although the population is relatively homogeneous, various contentious issues in the Chittagong Hill Tracts (CHT) have long been utilized and exploited by external actors to destabilize the internal security situation. Hence, CHT has been one of the principal security concerns for BD as well as for BDAF since independence. Additionally, Emergence of Kuki Chin National Front (KNF) in recent years has given new momentum to the separatist attitude in this area (Figure 2).

Figure 2: Map of Planned Kuki Homeland

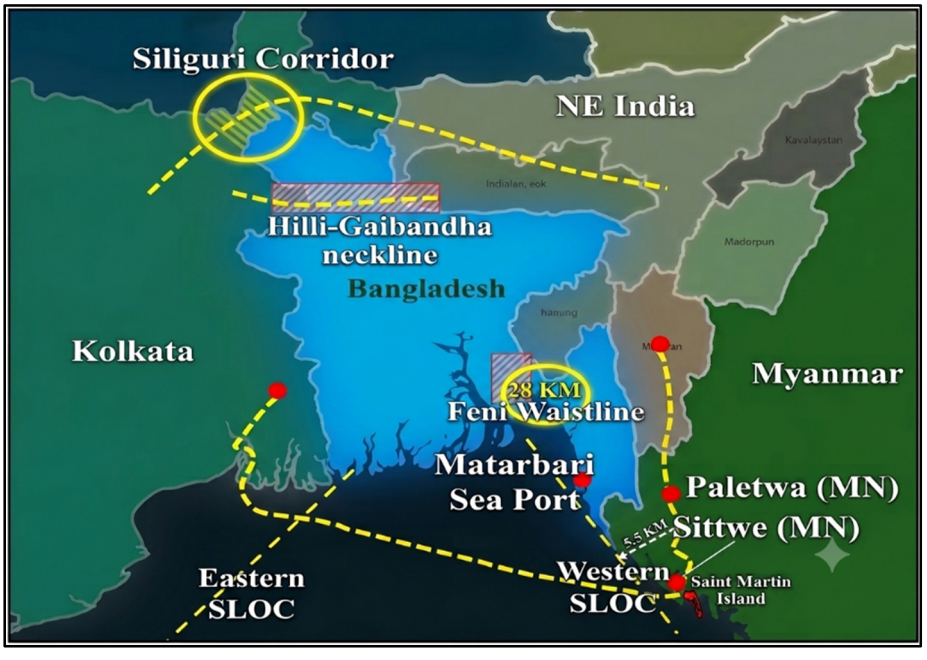


Source: (IAS, 2025)

e. **Sectoral Geographical Vulnerability**. BD's security concern stems largely from its geography. While the narrow Siliguri corridor offers tactical opportunity, Hilli-Gaibandha neckline poses serious strategic vulnerability. Lack of geographic depth of Feni waistline and its proximity to Chattogram port, the main economic gateway of the country adds further complexity (Bashar, 2024). Lack of geographic depth renders any location within the

country easily reachable by modern stand-off weapons systems. Besides, both of Bangladesh's Sea Lines of Communication (SLOC) are vulnerable to sabotage (Figure 2.3). The Saint Martin Island located within 5.5 KM from neighboring Myanmar has always been subjected to genuine geographical vulnerability (Islam, 2014). Therefore, the sectoral threat variation leads to building sector wise deterrence approach from land, maritime, and air perspective.

Figure 3: BD's Threat Outlook from Geo-vulnerabilities



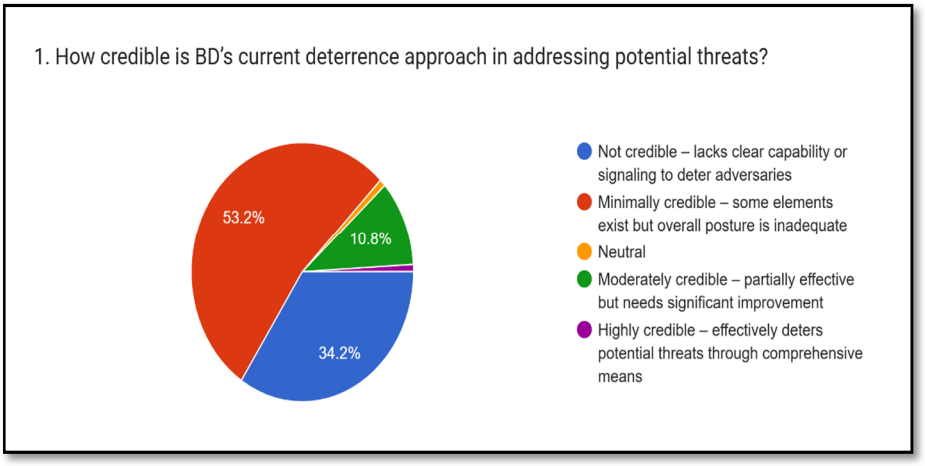
Source: Author's Construct

Evaluation of Current Deterrence Approach

a. **Current Deterrence Framework**. The 'Draft Defence Policy 2018'- of BD outlines deterrence as one of the three core pillars of national security strategy beside diplomacy and defeating hostile designs. It also underscores that BDAF should be organized, equipped, continuously upgraded and maintained at a level which provides minimum credible deterrence (AFD, 2018). Current deterrence posture primarily relies on military capability and diplomacy both at national and military level. However, the deterrence posture is not articulated in a way that adversaries perceive it as serious. A survey conducted to assess perceptions of its effectiveness revealed mixed opinions.

The survey found that 53% respondents believed the current deterrence approach to be minimally credible where some elements of deterrence exist, but overall posture remains inadequate to create effective deterrence (Figure 4). The survey result clearly indicates that there is genuine concern regarding the credibility of deterrence. An assessment of five deterrence parameters discussed subsequently also provides insight into the efficacy of deterrence.

Figure 4: Survey Result on Assessment of Current Deterrence



Source: Author's Construct

b. **Conventional Military Capability**. According to the Global Firepower Index, BD ranks 35th globally, while regional powers such as India and Pakistan remain significantly ahead and Myanmar remains close in overall ranking. This suggests that BD's ability to generate deterrence through conventional military strength alone is limited. Moreover, military modernization is a continuous and resource-intensive process that is largely dependent on a country's economic capacity. Therefore, pursuing deterrence solely through conventional force expansion may not be a pragmatic option. Instead, greater emphasis should be placed on asymmetric approaches, selective modernization, indigenous defense production, joint force integration, and other cost-effective measures.

c. **Strategic Alliances and Military Diplomacy**. BD's strategic outlook is shaped by its non-alignment approach which promotes maintaining balanced relations with both regional and international powers. However, this cautious approach has often limited its diplomatic effectiveness, except for a few occasional strategic advantage (Zaman, 2025). Although BD maintains

defense cooperation with countries like China, Turkey, and the USA exists, these engagements have not translated into long-term, interoperable, or strategically binding defense alliances. Moreover, BD is yet to leverage multilateral platforms like BIMSTEC or Indian Ocean Rim Association (IORA) as a tool for strengthening its deterrence posturing.

d. **Defense Budget and Logistic Sustainability**. BD's defense expenditure has remained relatively modest, averaging around 1.3% of GDP in recent years, which is lower than that of regional countries such as India, Pakistan, and Myanmar (Stockholm International Peace Research Institute, 2025). Moreover, a substantial portion of the defense budget is allocated to recurring expenditures, leaving limited resources for capital acquisition and modernization. This may constrain the pace of capability enhancement and affect the long-term sustainability of military preparedness and deterrence.

e. **Indigenous Defense Production Capability**. Indigenous defense capability is a key pillar of sustainable deterrence, yet BD remains largely dependent on foreign procurement**.** While there have been attempts to enhance the indigenous capability, very little has been achieved so far. In contrast, other countries in the region have made significant strides in indigenous defense production who produce a range of advanced systems, and a variety of sophisticated weapons (Bureau, 2025). BD's reliance on imports for military equipment and armament limits its strategic autonomy and deterrence effectiveness (Rahman, 2025). In a prolonged high-intensity conflict, foreign supply lines can be easily disrupted by sea blockades, international sanctions, or a supplier's own political calculations which may cripple BDAF's operational capability.

f. **Cyber and Hybrid Warfare (HBW) Readiness**. Modern threat landscape is increasingly shaped by cyber intrusions, disinformation campaigns, and non-kinetic operations. Unfortunately, BDAF's preparedness in this domain is embryonic. The lack of offensive and defensive cyber readiness limits BD's ability to deter hybrid threats, especially those that fall below the threshold of conventional war (Alim, 2025). A survey analysis (Table 1) empirically confirms the limitations across all five parameters, with each parameter scoring below 2.2 on a 5-point scale. Strategic alliances and military diplomacy and conventional capability scored the highest, yet their low averages show the limitations of conventional asymmetry and non-alignment. Genuine concerns are further reflected in the low scores for logistical sustainability and indigenous production. Crucially, cyber and

hybrid warfare readiness scored the lowest (Mean = 1.67), with a high positive skewness indicating a heavy concentration of responses at the bottom of the scale. This data demonstrates that the current posture lacks credible deterrence, reinforcing the need for an asymmetric defense framework.

Table 1: Descriptive Analysis on Deterrence Parameter

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Conventional military capability	200	1	5	2.08	1.041	.666	.172	-.391	.342
Strategic alliances and military diplomacy	200	1	5	2.11	1.126	.816	.172	-.040	.342
Defence budget & logistic sustainability	200	1	5	1.99	1.068	.760	.172	-.217	.342
Indigenous defense production capability	200	1	5	1.80	.965	.976	.172	.160	.342
Cyber and Hybrid Warfare (HBW) readiness	200	1	5	1.67	.886	1.094	.172	.344	.342
Valid N (listwise)	200								

Source: Author's Construct from SPSS Analysis

Deterrence Strategies of Small States and Lessons for BD

Small states face significant challenges in projecting credible deterrence. The reasons include military inferiority, economic fragility, dependence on external alliances, and vulnerability to hybrid threats. Small states, unlike major powers, usually do not have the economic capacity to sustain large standing military or invest in sophisticated weaponry. Consequently, they prefer to depend more on asymmetric approaches including cyber capabilities, missile defense systems, and guerrilla tactics (Wivel, 2014). Besides, the lack of nuclear weapons in most small states further constrains their deterrence potential as they cannot credibly threaten existential damage to adversaries. However, there are a few small states that maintain a credible deterrent posture despite these inevitable constraints. It is now imperative to explore how these small states have adapted their strategies to maintain credible deterrence.

a. **Taiwan**

Deterrence Concept Centering Asymmetric Warfare and Denial. Taiwan's approach to deterrence is not centered on direct, large-scale confrontation, but on strategies that take advantage of China's operational vulnerabilities (Ross, 2002).

Missile Defense and Precision Strikes. Taiwan has deployed Sky Bow III and Hsiung Feng III missiles, capable of targeting Chinese naval vessels before they can reach Taiwan's shores. The Sky Bow III missile system is intended to intercept incoming ballistic missiles, making pre-emptive missile strikes difficult for its potential adversaries (Ross, 2002).

Naval Warfare: Anti-Access and Coastal Defense. Rather than relying on large warships, Taiwanese navy emphasizes fast attack missile boats which are harder to locate and neutralize. Sea mines deployed along key invasion routes adds another layer of defense against potential amphibious landings (Reuters, 2026).

Air Defense and Interception. Taiwan has upgraded its fighter fleet to the F-16V standard, significantly improving radar, electronic warfare, and beyond-visual-range engagement capabilities. These aircraft are integrated with a layered air defense network comprising Patriot PAC-2/PAC-3 systems and indigenous Sky Bow missile systems, designed to counter aircraft, cruise missiles, and ballistic missile threats (Air Force Command Headquarters, 2026).

Cyber Warfare and Digital Deterrence. Taiwan has established itself a strong player in cyber defense which regularly counters cyberattacks and disinformation campaigns designed to weaken Taiwan's resolve. Besides, Taiwan has strengthened cooperation with the U.S. and Japan to establish a cyber warfare unit capable of offensive operations against adversarial digital infrastructure.

Strategic Alliances and Diplomatic Deterrence. Although Taiwan has no formal military alliances, it maintains strong security partnerships with the USA, Japan, and other regional actors. Moreover, the U.S. Indo-Pacific Command conducts freedom of navigation exercises in the Taiwan Strait, serving as a visible signal of deterrence to China (Sisson, 2022).

b. **Singapore**

Singapore's Deterrence Strategy. Singapore's deterrence posture is built around its Total Defence Strategy that integrates five core pillars: military, civil, economic, social, and psychological defense (Matthews, 2019). This comprehensive framework serves as a deterrent by demonstrating its capacity to withstand and respond to wide range of security challenges.

Indigenous Defense Industry and Self-Reliance. Singapore's strategic autonomy and operational readiness have been strengthened by its capacity to design, manufacture, and deploy its own military equipment. The Defense Science and

Technology Agency (DSTA) and ST Engineering play key role in advancing the country's indigenous defense industry. They produce key military equipment such as the Bionix armored vehicle, Terrex infantry carrier vehicle, and SAR-21 assault rifle (Matthews, 2019).

Strategic Partnerships and US Military Cooperation. The US-Singapore Defense Cooperation Agreement (2015) has promoted close military collaboration between these two countries. It includes U.S. aircraft maintenance, intelligence-sharing, and joint military exercises. The Changi Naval Base, which can accommodate U.S. aircraft carriers and warships, serves as a critical logistics hub. This arrangement makes any military action against Singapore likely to draw U.S. involvement.

Psychological Deterrence and Strategic Messaging. Singapore places strong emphasis on psychological deterrence by shaping both domestic and external perceptions of its military credibility. Despite its limited strategic depth, Singapore's defense policy consistently conveys that it is not an easy target. To reinforce this message, Singapore actively participates in high-profile military exercises to showcase its advanced capabilities and technological sophistication.

c. **Vietnam**

Vietnam's Deterrence Strategy. Given its smaller size and military inferiority compared to China, Vietnam has adopted a hybrid deterrence model. This model combines conventional, asymmetric, and unconventional strategies along with a strong psychological component (Grossman, 2021).

Asymmetric and Guerrilla Warfare Doctrine. Vietnam's deterrence approach is firmly grounded in asymmetric and guerilla warfare concepts which is shaped during the Vietnam War (1955-1975). This approach primarily focuses on the Peoples's War Doctrine. It emphasizes the mobilization of civilian population and the conduct of decentralized resistance through guerilla operations (Buffaloe, 2006).

Cyber Warfare and Hybrid Deterrence. Vietnam has incorporated cyber deterrence into its national security doctrine in response to China's expanding use of cyber domain. Unit 47 is a key component of this effort which is a specialized cyber force tasked with countering disinformation campaigns, cyber espionage, and other digital threats targeting national security (Pham, 2017).

Coastal and Naval Deterrence. Facing Chinese naval expansion, Vietnam has prioritized a strong coastal defense strategy. Despite having a weaker navy, Vietnam deploys coastal missile batteries, fast-attack craft, and anti-ship missile systems to

deter potential aggression. The Kh-35 Uran and BrahMos missile systems provide Vietnam with the ability to impose significant costs on superior naval forces (Pham, 2017).

Preemptive Deterrence and Uncertainty. Vietnam maintains strategic ambiguity regarding its red lines and thresholds for escalation. This uncertainty makes it difficult for an adversary to anticipate Vietnam's response. Thus, Vietnam deters potential aggression through unpredictability (Schofield, 2017).

Table 1: Comparative Assessment of Deterrence Approach

Country	Key Deterrence Tools	Strategic Posture	Relevance to BD
Taiwan	Precision guided missiles, layered air defence, cyber units, fast missile boats, and sea mines.	Porcupine Strategy, focused on denial and survival.	Shows how asymmetric strategies can deter superior conventional forces; applicable for coastal and cyber defence models in BD.
Singapore	Total defence integration, conscription, indigenous production, cyber defence, strategic ambiguity.	Comprehensive deterrence posture combining hard and soft power.	Useful for whole-of-nation defence, integrating civilians into deterrence, provides insight on how BD could build morale, resilience, and reserve systems.
Vietnam	Guerrilla warfare legacy, fast-attack craft, coastal missile systems hybrid and cyber units.	Hybrid Defence Strategy with layered coastal and guerrilla elements.	Terrain-focused asymmetric defence, guerrilla resilience and digital warfare directly applicable for BD's riverine and coastal areas.

Source: Author's Construct

Key Findings and Lessons for BD

a. **Doctrinal Development**. An essential component that is common to all successful small-state deterrence models is the presence of a clear, assertive doctrine. BDAF must stop relying on passive defense postures and embrace offensive-defense doctrine combining conventional, cyber, and hybrid elements.

b. **Asymmetric Capabilities**. Some small countries like Vietnam and Taiwan have shown how weak forces with technological disadvantage can achieve high denial cost through asymmetry. Similarly, BD must concentrate on developing drone technology, man-portable air defense systems, light anti-tank weapons, and coastal missiles specially along maritime and eastern border.

c. **Whole-of-Nation Defense**. Vietnam and Singapore offer excellent examples of how civilian involvement in national defense contributes significantly to strengthening deterrence. BD needs to integrate its large youth population and demographic dividend either in the form of a National Reserve Force or through conscription.

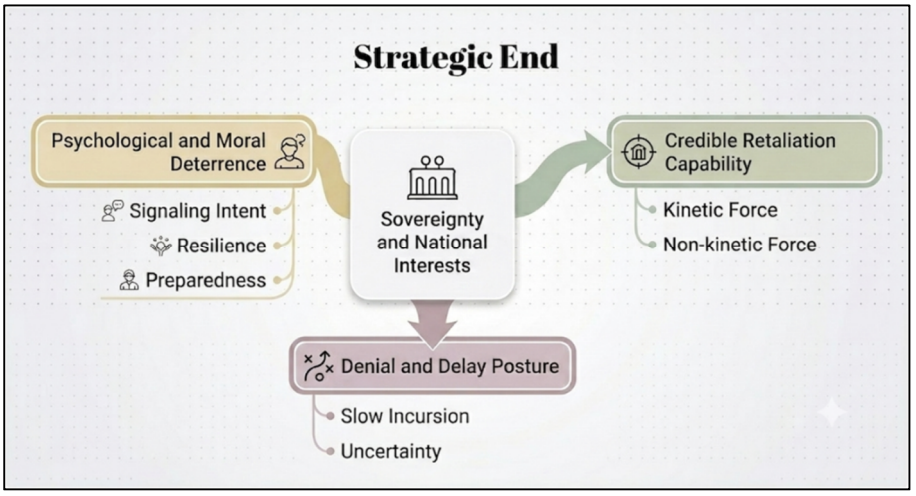
d. **Cyber and Hybrid Preparedness**. The realm of cyber and hybrid warfare has become key areas of deterrence in recent times. BD should also formulate and promulgate a joint doctrine for cyber warfare to establish deterrence through clarity, policy alignment, and international signaling.

e. **Strategic Alliances**. Small states can increase their deterrence capacity by forming strategic alliances. BD needs to develop defense diplomacy with important allies such as China, Turkey, and ASEAN member states to achieve deterrence by association. Greater engagement in multilateral military exercises and regional dialogues will improve strategic signalling, strengthen international partnerships and expand its deterrence umbrella.

Proposed Deterrence Strategy for BDAF

The deterrence strategy proposed subsequently follows Arthur F. Lykke's strategic logic of aligning Ends, Ways, and Means. The desired strategic end is to dissuade, deny, and deter hostile actions across both kinetic and non-kinetic spectrum. This desired end can be achieved by three mutually reinforcing capabilities: a Credible Retaliation Capability, Denial and Delay Posture, Psychological and Moral Deterrence (Figure 5). The proposed model combines largely two broad approaches: Operational approach and conceptual approach.

Figure 5: Proposed Deterrence Strategy Framework



Source: Author's Construct

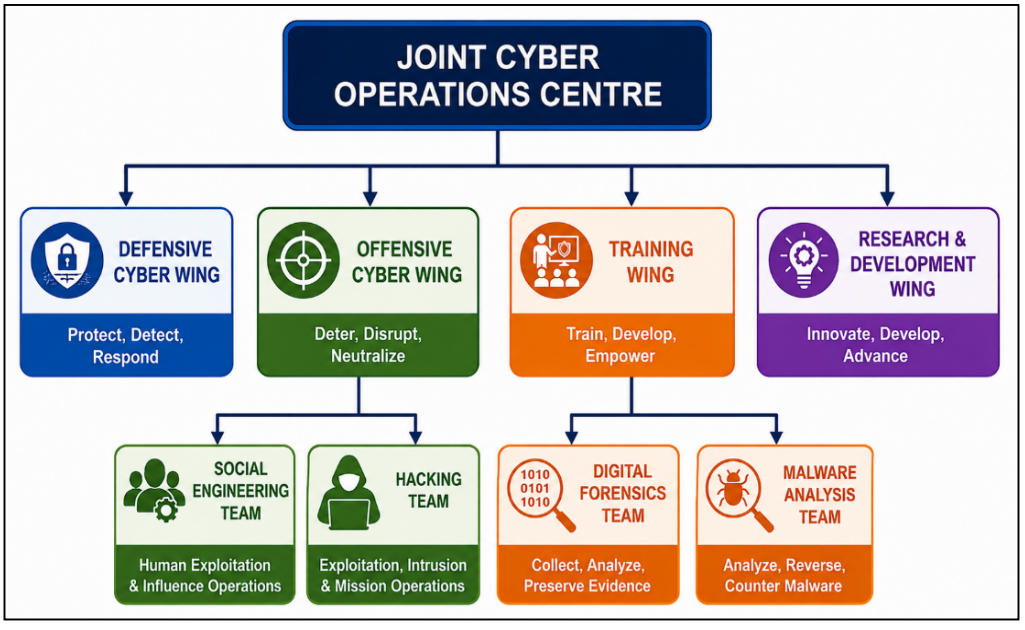
a. **Operational Approaches for Creating Deterrence**

Indoctrinating Aggressive Fighting Strategy. A key component of the proposed strategy is to instill an aggressive fighting mindset through doctrine, training and practices across all domains of BDAF. The existing posture of fighting a defensive battle will only delay defeat, victory will be farfetched. Therefore, a proactive 'Offensive-Defense' model should be adopted shifting away from a traditional reactive posture (Rahman, 2025). However, this fighting strategy must be adequately supported by capability enhancement.

Offensive Cyber Capability. The current state of BDAF's cyber operations remains humble, though some initiatives have been undertaken by National Telecommunication and Monitoring Cell (Quiyum,2025). Besides, BD Army established Army Cyber Group in 2021 to manage both defensive and offensive cyber operations. However, several challenges persist including absence of a joint coordination framework, fragmented efforts across different organizations, and lack of a dedicated cyber operations doctrine for BDAF. To address these issues, AFD can consider establishing a Joint Cyber Operations Centre as proposed subsequently (Figure 6). It may consist of four functional wings: Defensive Cyber Wing, Offensive Cyber Wing, Training Wing, and Research & Development Wing. The Defensive Cyber Wing would be responsible for protecting military networks, critical information infrastructure, and communication systems against cyber intrusions. The Offensive Cyber Wing would develop active cyber capabilities and offensive cyber

operations to create credible deterrence in cyberspace. The Training Wing would focus on developing skilled cyber operators through specialized training, digital forensics, and malware analysis, while the Research and Development Wing would drive innovation, indigenous tool development, and adaptation to emerging cyber threats.

Figure 6: Proposed Organogram of 'Joint Cyber Operations Centre'



Source: Author's Construct

Integrated Unmanned Aerial System. Recent armed conflicts such as Israel-Iran war, India-Pakistan standoff, Nagorno-Karabakh war and Ukraine-Russia war demonstrated the game-changing role of drones and Unmanned Aerial Systems (UAS) in modern battles. Following the trend of modern warfare, BDAF should also prioritize UCAVs, loitering munitions, and surveillance drones. Air Force can lead on strategic and tactical UAV operations while Navy should integrate UAVs for coastal defence and ISR. BDAF should develop a joint Unmanned System Strategy to synchronize the fragmented effort including the prospect of its low-cost indigenous production. Coproduction and technology transfer of UAS could provide more pragmatic pathway towards gradual self-reliance.

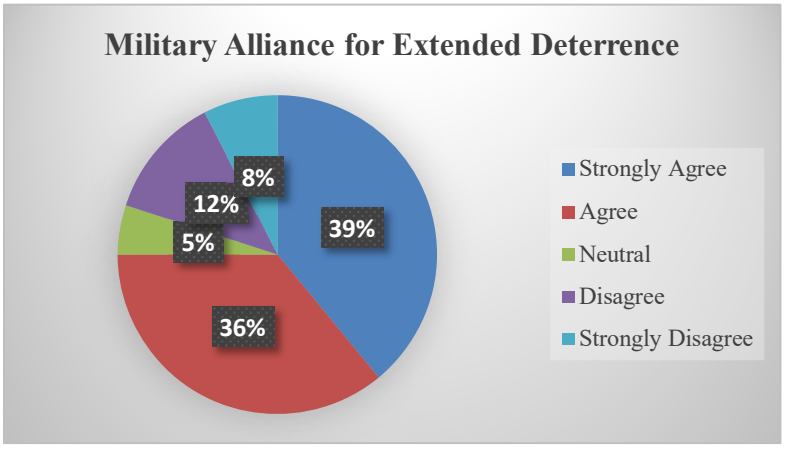
Long-range Strike Capability. Acquisition of advanced medium-range SAM and surface-to-surface missile systems would extend operational reach, increase reaction time, and enhance protection of critical military and civilian infrastructure. Introduction of short and medium-range SAM and tactical missiles like Nasr 2 as

operational fire platforms would significantly strengthen the deterrence posture of BDAF (Shirazi, 2025).

Sectoral Force Structure. The principal guiding factor for force restructuring should be to create a smaller and more agile combat group with the ability to quickly group and regroup, integrate and disintegrate while maintaining a small logistical footprint (Mahfuz, 2025). In this regard, the South-eastern Sector could adopt the Operational Battalion Group (OBnG) concept, which can be more effective for conducting operations in hilly and jungle terrain, supported by all the complementary elements required for battalion-level operations. On the other hand, Western Sector can be converted into a Corps where there will be number of Modular Brigade Groups/ Battle Groups operating directly under Corps Commander. It will provide flexibility to the Corps Commander to adopt an aggressive operational posture. In addition, the deployment of a brigade group at Feni, and the establishment of a joint operating base on St. Martin island will enhance the deterring posture. However, an offensive force structure alone will hardly create any credible deterrence unless it is publicized and propagated through doctrinal promulgation and open academic discourse on national and international platforms and institutions.

Military Alliance for Extended Deterrence. The Rohingya crisis stands as a stark reminder of BD's difficulty in securing reliable support when it was most urgently needed. In this regard, survey findings indicate that over 63% of respondents view the formation of a military alliance with a major power or block as a viable means of achieving extended deterrence (Figure 7). However, an alliance entails both reciprocal benefits and inherent costs (Zaman, 2025). Furthermore, the recent Iran–Israel conflict has raised question about the reliability of alliance based security guarantees as the USA was unable to fully protect its ally from Iranian missiles and drone attacks in the Middle East. Therefore, Ministry of Foreign Affairs in coordination with Defense Ministry and AFD may conduct an in-depth study in consultation with security and international relation experts to evaluate the effectiveness, risks, and overall suitability of pursuing military alliances from BD's strategic perspective.

Figure 7: Military Alliance for Extended Deterrence



Source: Author's Construct based on Survey

Modern Air Platform and Integrated Air Defense. A country without a strong air force is at the mercy of any aggressor (Khan, 2025). Therefore, acquisition of a limited number of highly capable MRCA can generate strong psychological deterrent effect against any aggressive action by potential adversaries. Besides, an integrated air defense system is essential for creating a deterrent armed force.

Enhancing Indigenous defense Production Capability. Establishing a robust defense industry would send a clear message to adversaries that BD can sustain its military power independently while ensuring long-term strategic security. It can start with the critical items like artillery and small arms ammunition and progressively venture for indigenous production of rocket or missile. However, the opportunity of exporting the military goods to be explored to encourage private investment by establishing military export processing zone (Rahman, 2025).

b. **Conceptual Approaches for Creating Deterrence**

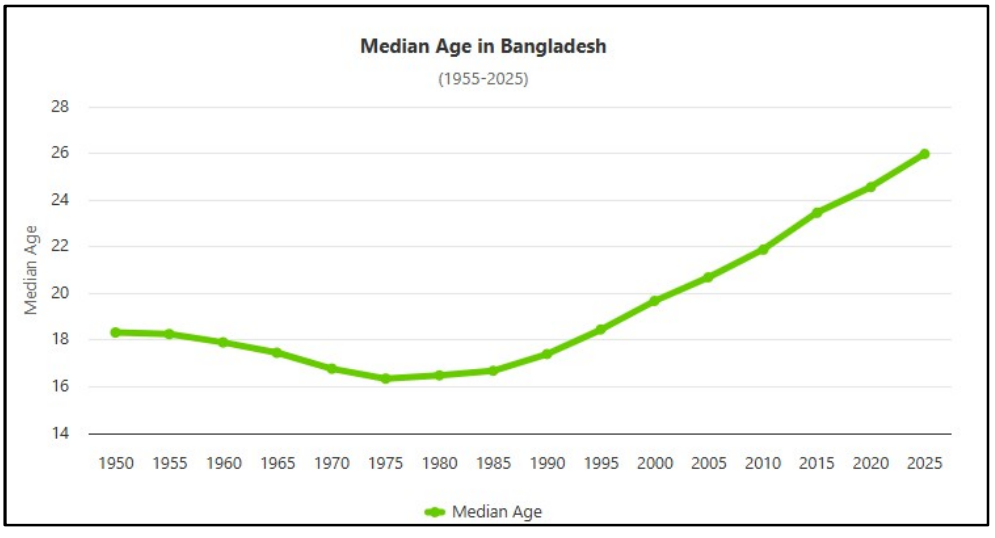
Doctrinal Concept Upgradation and Propagation. Deterrence is shaped not only by military capabilities but also by how those capabilities are perceived and interpreted by potential adversaries. A well-articulated doctrine serves as a strategic signal of a nation's intent, resolve, and preferred mode of warfare. It influences an adversary's decision-making calculus even before a conflict begins. For BDAF, doctrinal modernization is essential to maintain a credible defense posture as it can create a deterring perception once promulgated effectively. An upgraded 'Offensive Defense' doctrine that incorporates aggressive, asymmetric, and rapid maneuver warfare strategies is likely to send a strong message to potential adversaries. The shift

towards the 'Offensive defense' doctrine can be widely propagated through exercises, case studies, and seminars at institutions like DSCSC, NDC, and other international academic and training institutions.

Strategic Messaging and Communication. Strategic communication, complemented by genuine political will, is the foundation of credible deterrence. A clear articulation of red lines, military intent, and national resolve can deter adversaries without a shot being fired. A well-calibrated show of force through strategic messaging, military diplomacy, and visible demonstrations of capability can prevent conflicts by instilling uncertainty and fear in potential opponents. The BDAF should showcase their military might to the world by conducting regular joint exercises with like-minded or allied nations and periodically disclosing significant military capabilities and achievements through the media (Shameem, 2025).

Utilizing Demographic Dividend. The main demographic dividend of BD is that 65% of its population is between the ages of 15 to 65 and the median age in just 26 (Figure 9). We can harness this demographic dividend like Vietnam in our favor to make the BDAF a massive deterrent force. This can be done by creating a National Reserve Force or Conscription Policy. However, providing military training to large amount of people comes with a security concern. Therefore, compulsory BNCC enrolment for students can be an expedient way of utilizing the huge demographic dividend.

Figure 9: Demographic Dividend-Median Age of BD Population



Source: Bangladesh Bureau of Statistics, 2025

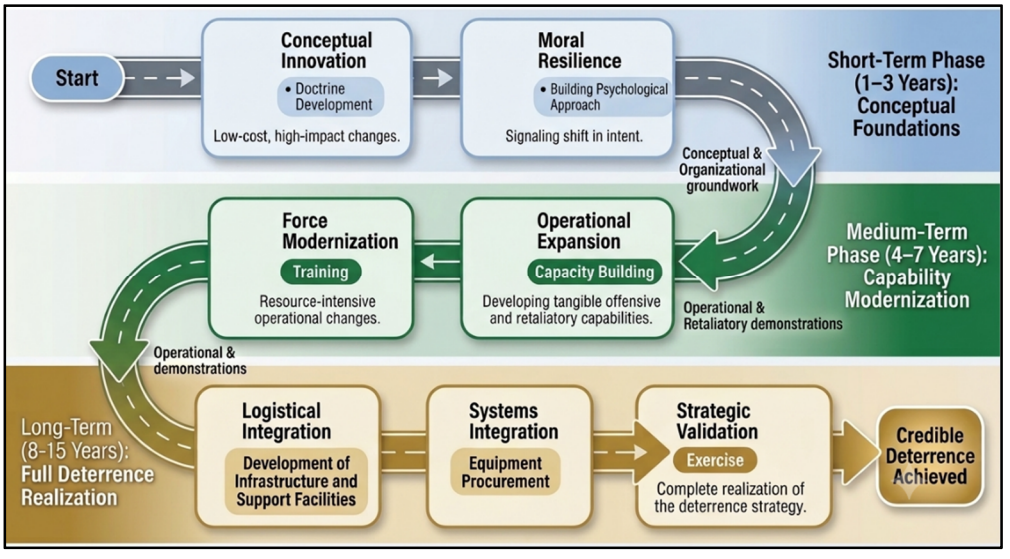
Psychological Deterrence through Resilient Force. A force characterized by firm moral principles, deep patriotism, and a relentless sense of commitment can create a psychological edge that technology cannot match. Building resilience among the members of the BDAF by incorporating value-based training programmes, appropriate ideological education, and cultivating a warrior spirit will help turn the BDAF into a deterrent force.

Fostering Intellectual Agility and Aggressive Leadership. Leadership that integrates intellectual adaptability with physical endurance serves as an important force multiplier for deterrence. This can be ensured by institutionalizing thematic courses that combine an offensive mindset, cognitive flexibility, and the promotion of risk taking. This approach should start from the early stage of a military career at the military academy and be sequentially integrated into subsequent courses. Additionally, creating a culture of learning swhere professional debates are credited, not undermined will foster intellectual agility.

Road Map towards Implementation

This roadmap is designed to move the BDAF from a denial and delay posture to one with credible deterrence capability, combining conceptual innovation, moral resilience, and force modernization. The overall workflow towards achieving the proposed strategy is as below:

Figure 10: Deterrence Strategy Implementation Roadmap



Source: Author's Construct

This plan is divided into short-term (1–3 years), medium-term (4–7 years), and long-term (8-15 years) phases (Figure 10). The short-term phase is concerned with low-cost, high-impact conceptual and organizational changes to signal a shift in strategic intent and lay the institutional groundwork for more significant transformations. The second phase expands on the short-term through resource-intensive operational changes that demonstrate tangible offensive and retaliatory capabilities. The final phase aims at the complete realization of the deterrence strategy.

Conclusion

BD's evolving security landscape is characterized by a complex interplay of conventional threats, border instability, and new forms of hybrid threats. Incidents like cross-border provocations, airspace violations, and maritime dominance by neighboring countries in recent years signal a changing threat paradigm. While BDAF strives to modernize its inventory, it suffers from limitations in several key deterrence parameters. These include the absence of a cohesive doctrine, limited long-range strike and offensive cyber capabilities, fragmented force posture, and underdeveloped indigenous defense production. This gap between ambition and capability results in a deterrence posture that struggles to influence adversarial intent or behavior in a meaningful way.

The limitations of BD's deterrence posture are comparable to small states across the globe. Small states often find it difficult to maintain credible deterrence using conventional means. This challenge is negotiated by embracing non-traditional approaches to deterrence, including asymmetric tactics, layered denial strategies, psychological operations, and hybrid warfare readiness. Small states seek to create uncertainty, impose high costs, and strengthen societal resilience to deter aggression. The emphasis shifts from sheer firepower to flexibility, strategic communication, doctrinal clarity, and proactive defensive measures. These insights offer valuable lessons for BD to develop a deterrence model tailored to its own realities.

Considering the inadequacies of existing deterrence approach and comparing the deterrence model of other small states, a pragmatic deterrence strategy tailored to BD's unique threat environment has been suggested. Operationally, this strategy focuses on adopting an aggressive fighting posture, enhancing cyber capability, electronic warfare, and unmanned capabilities, restructuring force deployments based on geographic threats, and strengthening defense diplomacy. Conceptually, it calls for clear strategic communication, upgrading and promulgation of doctrines, development of intellectually agile leadership, and fostering a morally resilient force. Overall, the proposed strategy offers the BDAF a credible and balanced approach to deter superior

adversaries while enhancing internal readiness and resilience. In view of the findings and proposed strategy, the following recommendations have been suggested:

(1) AFD may formulate a '**Armed Forces Deterrence Strategy'** in line with the strategy proposed in this research integrating operational, conceptual, and hybrid approaches.

(2) AFD may merge the cyber organizations of all three services into a **'Joint Cyber Operations Centre'** as suggested in this research within 3–5 years.

(3) **Mil Export Processing Zone (MEPZ)** may be established under MoD within 5-6 years to facilitate production, quality assurance, and export of armament system.

(4) MoD may initiate a pilot project to assess the feasibility of introducing **National Reserve Force** or **Conscription** model to utilize the demo dividend as deterrence.

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Biography



Lieutenant Colonel Mir Kamrul Hasan, BSP, afwc, psc, G, Arty was commissioned in the Corps of Artillery in December 2002 with 47 BMA Long Course. He held various appointments in several artillery regiments. Besides, he has served as GSO- III (Operations) at HQ 24 Artillery Brigade in Chittagong Hill Tracts, GSO-II at Military Operations Directorate in GS Branch of AHQ, and Directing Staff in DSCSC, Mirpur. He has commanded 9 Field Regiment under Operation 'Purbo Pracheer' and 41 Medium Regiment. As a peacekeeper, he participated as an Observer in Western Sahara and Staff Officer in Mali. He is a graduate of DSCSC, Mirpur and Armed Forces Command and Staff College, Saudi Arabia. He has four masters to his credentials. He also obtained PGD in International Relations from University of Dhaka. Presently, he is working as Directing Staff at DSCSC.

Emphasizing the Need for Enhancing Maritime Surveillance in the Bay of Bengal with an AI-Based Surveillance Network

Commander Mohammad Pranjol Islam, (G), psc, BN

Abstract

The Bay of Bengal (BoB), spanning approximately two million square kilometres, is a critical maritime domain through which 90% of Bangladesh's international trade transits. The Bangladesh Navy (BN), which is maintaining good order at sea, currently relies on surface ships, Maritime Patrol Aircrafts, UAVs, satellite imagery, and Open-Source Intelligence for conducting surveillance in the BoB. However, this posture remains critically insufficient against the scale of the operational environment. Transnational threats including Illegal, Unreported and Unregulated (IUU) fishing, drug and arms smuggling, human trafficking, and illegal maritime migrations continue to exploit the existing surveillance gaps. Through Key Information Interviews (KII), Focal Group Discussions (FGD), and structured surveys of serving BN officers, five critical capability gaps were identified. Survey findings indicate that these deficiencies may directly contribute to rising maritime crime and reduced Blue Economy activities in the BoB. To address these gaps, the paper proposes a phased AI-based surveillance network comprising three interconnected Data Fusion Centres located in the Dhaka, Chittagong, and Khulna regions. The Data Fusion Centres may analyse the data collected from various sensors, employ Large Language Model (LLM) analytics, and propose an indigenously developed Generative AI system to deliver real-time Maritime Domain Awareness across the BoB to human operators. If implemented, this could significantly enhance BN's operational effectiveness and allow safeguarding of Bangladesh's maritime sovereignty.

Introduction

The Bay of Bengal is a vast area of about 2 million square kilometres surrounded by the littoral states like India, Bangladesh, Myanmar, Sri Lanka and the northern parts of the Malay Peninsula (A. Verlaan, 2023). It needs constant surveillance to ensure that trade flows without any hindrance and that the economic activities of the littorals continue to progress undisturbed (Baruah, 2018). The Bay of Bengal landscape i.e., security environment is undergoing significant changes marked by great power rivalry, regional geopolitical competition, and increased non-kinetic hostilities (Naumann, 2022). Thereby, it is assessed that the littoral states of Bay of Bengal need to monitor all the activities in the Bay of Bengal, which would help address any issues that threaten good order at sea in this vast maritime area.

Monitoring the Exclusive Economic Zone (EEZ) is a mammoth task requiring magnanimous resources (Lean, 2023). Furthermore, various other challenges of benign nature are also being used to project power in this region. The littorals of the Bay of Bengal (BoB) face numerous security challenges (Chatterjee, 2014) including Illegal, Unreported and Unregulated (IUU) fishing, arms and drug smuggling, human trafficking, seaborne pollution, and acts of armed robbery. These are some of the major transnational security threats against good order at sea in the BoB (Khasru & Noor, 2019). Many of these threats may range from inshore water to the deep ocean. Besides, some of these threats are caused by state actions such as the Rohingya influx and drug trafficking through maritime routes in the BoB (Khasru & Noor, 2019).

Presently, Bangladesh Navy (BN) is maintaining good order at sea and surveillance through ships, aircraft and presence missions. However, due to the vastness of the BoB, military monitoring of the BoB is at times insufficient (Ahmed, 2023). As military monitoring is insufficient in the BoB, it is prudent for BN to take a holistic approach by embracing the essence of technology-driven smart power. Therefore, a comprehensive AI-based surveillance system may be developed to ensure good order at sea within the EEZ of the Bay of Bengal. A few plausible options has also been explored to develop the surveillance capability of BN through an effective AI-based surveillance network system.

This paper employed a mixed method research design combining qualitative and quantitative data collection methods. Primary data were collected through Key Information Interviews (KIIs) with twelve senior BN officers, two Focal Group Discussions (FGDs) comprising eighteen officers across senior and mid-levels, and a structured Survey administered on eighty-five serving BN officers using Likert-scale questions. Survey responses were analysed using descriptive statistics, while KII and FGD data were systematically referenced.

Present State of Surveillance by BN in Monitoring the Activities in the BoB

The Bay of Bengal is the lifeline of Bangladesh as 90% of trade flows through the two International Shipping Lanes (ISLs) to Chittagong and Mongla (Baruah, 2018). Therefore, apart from various threats, daily maritime activities also need to be monitored to prevent accidents or *Force Majeure* events to prevent the loss of life and the maritime image of Bangladesh. The present state of surveillance and monitoring is severely limited to time and the presence of various platforms and equipment (A. Verlaan, 2023). Therefore, various maritime activities need to be monitored to assess

where more focus needs to be given regarding maritime surveillance. The maritime activities are highlighted below:

a. **Fishing Activities**. Fishing is a primary daily activity in the Bay of Bengal, supporting the livelihoods of numerous coastal communities. It is a vital economic activity which contributes greatly to the national economy and needs protection and monitoring by the Navy and the Coast Guard. BN generally in coordination with the Ministry of Fisheries and Bangladesh Coast Guard regularly monitor fishing vessels and activities at sea.

b. **Shipping and Trade**. The Bay of Bengal is an essential route for international shipping, connecting ports in South and Southeast Asia. Daily maritime activities include the movement of cargo ships, container vessels, and oil tankers transporting goods and resources between various ports, such as Dhaka, Narayanganj, Khulna, Mongla, Barishal, and Chittagong. Furthermore, vessels remain at roadsteads and anchorage just outside port entrances which need protection and security. BN; along with the Coast Guard, the Port Authorities of Chittagong, Mongla and Payra, monitor plying of these vessels near the coast and in the inland transit. Ships plying beyond the territorial waters are monitored by BN ships and crafts.

c. **Coastal and Inland Transportation**. Local ferries, coasters, launches and small boats provide transportation services for both passengers and goods between coastal areas and islands. These vessels are crucial for connecting remote communities to the mainland and facilitating trade and travel within the region. These activities are monitored by the BCG and BN in coordination with Riverine Police. Presently BCG and BN are coordinating various operations to curb illegal plying of unfit vessels, overcrowded ferries and launches and overloaded cargo boats.

d. **Offshore and Underwater Projects**. Bangladesh has two Floating Storage and Regasification Units (FSRU) at Maheshkhali which need to be monitored for physical security (Faruquee, Restructuring Operational Activities of BN, 2023). This includes daily operations involving oil rigs, supply vessels, and other support services related to the extraction and transportation of oil and gas resources. Furthermore, the submarine cable and other maritime projects run through Cox's Bazar and Barisal which need security and protection. These activities are extensively monitored by BN and BCG ships through physical presence.

e. **Accidents and Pollution at Sea**. Due to the monsoon climate and rough seas in the BoB, different types of accidents occur from minor to major criticality. Accidents mostly occur before and during cyclones. Furthermore, due to large traffic density near the ports, a lot of pollution takes place which is severely detrimental to the living resources in the BoB. Most of the accidents occur under the jurisdiction of the Port Authorities. However, they are monitored, addressed and responded first by the BCG and BN.

f. **Weather Warning Activities**. The BoB and its coasts frequently face severe cyclones from August to January. Furthermore, the monsoon climate also entails severe torrential rain and rough seas from March to August. Therefore, all through the year the sea remain turbulent and cause *Force Majeure* incidents in the BoB. Therefore, the Navy need to play a vital role in providing weather warnings alongside the Port Authorities and the Coast Guard.

Existing Surveillance Capability of BN to Monitor the BoB

Various Key Informant Interviews (KIIs) and Focal Group Discussions (FGDs) were carried out when and wherever mid-level naval officers (FGD-1, 2023) and senior level naval officers agreed upon (Shiraji, 2024) and the researcher came to know that the present state of surveillance needs to be enhanced by many folds to have a proper 'Recognized Maritime Picture' (RMP) of the BoB. Studying and analyzing the present state and capability of BN allowed new means and ways to enhance the capability of BN to monitor maritime activities in the BoB. Upon the collection of primary data from KIIs and FGDs, it was deduced that BN uses the following means of monitoring the BoB:

a. **Surface Ships in Various Zones**. BN deploys ships in adherence to its constabulary roles designated by the government. Ships are excellent platforms which provide real-time information and intelligence on maritime activities in their Area of Responsibility (AOR). Presently, ships are allocated to various patrol zones, and they are deployed 24/7 to monitor the maritime activities and address emergencies. Furthermore, BCG also complements BN in monitoring and addressing maritime activities and events in the BoB (Shiraji, 2024).

b. **Satellite Data and Imagery**. Satellite imagery from different sources are used by BN to monitor weather updates as well as the positions of

ships at anchor in the roadsteads and at the anchorage of the ports (Jamal, 2023). However, often they only help determine the anchorage positions and record the positions of ships at a particular time. Both BN and BCG are actively monitoring satellite data to gather information on ships at BoB.

c. **MPA and UAV Patrol Zones**. The Maritime Patrol Aircraft (MPA) and the Unmanned Aerial Vehicles (UAVs) are some of the best methods to monitor real-time activities at sea at great distances. BN possesses a squadron of MPAs which are extensively used to carry out surveillance and patrol missions in the BoB. Additionally, rotary wing UAVs are also introduced in BN to monitor maritime activities. The MPAs have separate patrol zones which are regularly monitored by the Naval Aviation Group and all emergencies or issues are reported to BN area operations room. The BCG depends on BN to collect MPA and UAV data on the maritime activities in the BoB (Shiraji, 2024).

d. **Vessel Traffic Monitoring Systems (VTMS)**. The Port Authorities mainly use VTMS and aid BN in monitoring the vessels at anchorage in real time. They can provide real-time video imagery both during the day and at night but are only limited to port entrances and anchorages. At present both Chittagong Port Authority and Mongla Port Authority possess VTMS. Data and information from these port authorities are disseminated to BN and BCG to address issues in the BoB.

e. **AIS Monitoring (White and Dark Shipping)**. AIS monitoring by ships, C2 facilities and MPAs can provide shipping data and can help in collecting white shipping data monitoring as well as dark shipping activities. However, AIS data can be easily manipulated and may lead to false analysis of information (Jahid, 2022). It needs in-depth analysis and support from all maritime organisations to deduce AIS data falsifications and analyse the situations.

f. **Open-Source Intelligence (OSINT)**. Open-source intelligence provides data which can be easily obtained and analysed to monitor shipping and trade activities. However, the source of data can be easily manipulated and it would take a long time for human operators to correctly analyse the data obtained. Furthermore, there are also limited scopes to clearly verify the authenticity of open-source data (Nazrul, 2023).

From the above analysis, it was evident that the BN uses the above presence-based means of surveillance and requires extensive human operator involvement to analyse the data from surveillance systems. It is envisaged that newer and more practical surveillance methods need to be undertaken by the BN to monitor the BoB. However, to attain these newer methods of surveillance the BN needs to address various challenges regarding number of ships, technology, expenditure, training etc.

Existing Challenges Faced by BN in Monitoring the BoB

Various Key Informat interviews (KIIs) and Focus Group Discussions (FGDs) were carried out among naval officers of different ranks and levels of seniority. Upon the collection of primary data from KIIs and FGDs, following challenges faced by BN were identified:

a. **Limited BN Platforms at Sea vs. the Area of the BoB**. Presently BN platforms are divided into two naval commands, namely West Zone and East Zone. Ships are deployed as per deployment zones to monitor activities and carry out surveillance missions within the EEZ (Ahmed, 2023). Even with a considerable number of ships in BN and BCG inventory, it is quite limited to fully monitor the area of the BoB. Furthermore, inclement weather reduces the seakeeping capability of smaller craft, thereby limiting the duration of surveillance operations across various deployment zones.

b. **Requirement of Higher Number of Surveillance Sensors**. The BN needs a higher number of surveillance sensors to effectively monitor maritime activities at sea. It is physically quite challenging to monitor the entire BoB with the existing surveillance systems, even by a much superior navy. Furthermore, sensors are planned for acquisition in phase-wise terms through official procurement processes. Therefore, to monitor the vast area of BoB it would take a higher number of sensors, as well as time which is likely not feasible for small navies.

c. **Training of Crew in Heterogeneous Surveillance Systems**. BN has a variety of surveillance sensors fitted in various ships. The crew in BN are rotated within different ships as their career progresses. Therefore, a crew member trained in a particular system or sensor may not get adequate time to master his abilities as well as professionalism for a longer duration. Each user and maintainer might need to master multiple systems and pieces of equipment. This practice and individual career path compel personnel to undergo heterogeneous training which ultimately reduces their proficiency.

d. **Integrated C4I Facilities with Real-Time Surveillance Equipment**. As BN has a lot of surveillance sensors, all data received from platforms, radar stations, equipment and sensors need to be analysed by human operators and monitored for a prolonged duration (A. Verlaan, 2023). Modern navies use sophisticated AI models to address this time duration dilemma. The USA uses a symbiotic ecosystem of AI platforms like Palantir and Project Maven, RAPTOR (Rapid Tactical Operations Reconnaissance, Lockheed Generative AI for Search and Rescue (SAR), and various other commercial AI models along with their surveillance equipment to monitor maritime areas (Lockheed, 2025). This integration for the BN and BCG is a mammoth task and would require substantial time and acquisition plan (Ahmed, 2023).

e. **Long Response Time and Situation Analysis by Human Operators**. Due to the limited number of ships and the heterogenous training of operators, the reaction and response time for achieving situation awareness and conducting analysis by human operators is relatively high. Although the human decision-making process is still the most important factor, it is constrained by the lengthy process of data collection, interpretation and analysis. Modern navies have been actively pursuing new AI-based models to reduce the response time and aid the human operators in making quick and accurate decisions. China uses Space based AI satellites, large language model (LLM) agents like generative AI 'Transparent Ocean Guardians' as well as **AI-enabled** acoustic **systems integrated** with acoustic equipment to **reduce** the **extended** response time **associated with** human analysts (Zhang, 2026). However, no such AI-based surveillance capability exists in the BN or BCG which significantly increases the response time of human analysts.

Possible Impacts of Highlighted Challenges

On analysis of the deduced challenges, the following impacts are likely to take place if the challenges faced by BN are not mitigated:

a. **Rise in Crime Related Activities**. Any lack of surveillance and monitoring capability may give rise to an increase in criminal and offensive activities through the BoB. Perpetrators are adapting and using unique and newer methods for drugs and human trafficking, arms smuggling, pollution and petty robbery (FGD-2, 2023; Ahmed, 2023). Therefore, newer methods of surveillance are required to keep pace with the nature of criminal activities in

the BoB. A survey was conducted amongst mid-level and senior officers of the BN to assess these impacts and around **64.7%** of the respondents '**Strongly Agree**' and **25.9%** '**Agree'** that crime-related activities have increased due to lack of surveillance in the BoB.

b. **Reduced Economic Activities**. Any rise in criminal activity as well as reduced surveillance capability may affect various economic activities at sea. There might be a reduction in fishing activities, transportation, deep-sea survey operations as well as energy generation activities (FGD-2, 2023). Any reduction of economic activities in the BoB is likely to directly impact the growth of the Blue Economy of Bangladesh, which will also have a severe detrimental effect on the maritime strategy of Bangladesh (Shidore, 2023). In the Survey around **57.6%** of the respondents '**Strongly Agreed**' and **28.7%** '**Agreed**' with the assessment of reduction of economic activities in the Bob if challenges are not addressed.

c. **Reduced Trade and Shipping Activities in the BoB**. An increase in criminal activities, and reduction of economic activities may also lead to a reduction in trade and shipping activities in the BoB (Ahmed, 2023). Trade routes may be compromised by various man-made or natural disasters. Shipping organisations and trade companies may reduce shipping traffic, which may have a detrimental effect on the Blue Economy of the country (Naumann, 2022). Around **62.4%** of the respondents in the Survey '**Strongly Agreed**' and **23.5%** 'Agreed', that trade and shipping activities would decline if criminal activities increased, thereby adversely affecting economic activity.

Analysis of Challenges and Their Impacts

From the survey results it was clear that the challenges faced by the BN will be more crucial in the future due to the changing nature and dynamics of the maritime security situation. The impacts of the challenges pose an even greater threat to the BN as the impacts directly affect the economy of the country. Therefore, it is evident through the analysis that newer methods of surveillance system need to be incorporated in the BN to enhance its surveillance capability and contribute to the Blue Economy of Bangladesh. One such approach can be to invest in AI-based surveillance system which can fill up the gap faced by BN in the BoB.

Proposed AI-based Methods for Surveillance in the BoB by the BN

The analysis of the present state of surveillance in the BoB, the challenges and their impacts, emphasises the need for a new AI-based surveillance method in the BoB. The AI technologies which are highlighted include Machine Leaning (ML), Predictive Analytics, Anomaly Detections, Sensor Fusion, Decision Support Algorithm and Generative AI. The AI model suggestions will entail full human decision authority to never replace the human judgement while making decisions to address various situations at sea. The considerations from the interviews, analyses of AI based applications, discussions and research paved the way to suggest following ways to incorporate an AI-based surveillance system for BN:

a. **Sensor Integration with Mobile and Stationary Surveillance Platforms**. Ships, Coastal Radars, UAVs and MPAs provide excellent radar data which are used to generate a Recognized Maritime Picture (RMP). The data generated by these stationary and mobile platforms can be compiled and connected to a simple AI server for detailed analysis of the maritime environment as well as decision-making (Jamal, 2023; Ahmed, 2023). Furthermore, an AI model may be incorporated within various platforms with a network-centric connection through a data link with a shore-based AI-server station to generate RMP/MDA in the future.

b. **Building Data Fusion Centers to Collate Surveillance Data**. A shore-based Data Fusion Centre may be enacted with AI servers to collect data from all mobile and stationary platforms through a Data Link or any suitable receiver. Data compilation through a shore-based station with simple AI algorithms is easily affordable and implementable (Ahmed, 2023). A Data Fusion Centre will provide effective RMP/MDA through radar pictures, AIS feed, GPS, Vessel Traffic Monitoring Systems, and Satellite images. It will also ensure encrypted traffic data using satellites (Faruquee, Restructuring Operational Activities of BN, 2023). This method can be implemented on an intermediate basis.

c. **Data Analysis of Open-Source Intelligence (OSINT)**. Vast amounts of data are available on open source due to the advent of technology. Data analysis from open source takes a huge amount of time by human operators. Using LLM-based AI models to analyse these data may significantly reduce the time for effective data analysis. Furthermore, machine learning algorithms along with human interface have tremendously paved the way for faster

decision making and better authentication. Hence, LLM based AI models utilizing machine learning with human operators in the loop may help in authenticating vast amount of open-source data for effective decision making.

d. **Integration of an Indigenous Generative AI**. The advent of Generative AI provides detailed, in-depth and accurate information that is used in effective decision-making and accurate predictions. Many countries are opting towards Generative AI models, which allow for a more human centric interaction between AI and human operators and provides logical solutions to complicated problems. Integration of machine learning keeping human operators in the loop may allow more authentic deductions from data in the open source (Zhang, 2026). This type of AI-based surveillance method may be incorporated after the data fusion centres are enacted. There are many local developers working on machine learning, LLM models and developing AI models who can be tasked with developing an indigenous AI system to develop AI based indigenous capability.

Though there are many benefits of using AI, it is also associated with cybersecurity risks. An AI-based network introduces cybersecurity vulnerabilities which require proactive mitigation. OSINT and AIS are susceptible to spoofing and manipulation which may deceive the decision makers and human operators. The Data Fusion Centres can remain at a high risk for spoofing and hacking by adversaries. AI systems also carry false alarm risks which require mandatory human operator verification and authentication. Therefore, BN will need to institutionalise a Human in the Loop (HOOTL) policy across all AI based decision-making situations.

Possible Benefits of Using AI-Based Surveillance Methods by BN

The possible benefits of using an AI-based system to monitor the BoB are highlighted below:

a. **Developing Human Operator's Efficiency**. It is expected that the incorporation of AI-based models will help the operators to solely depend on data from sensors. If the BN can acquire AI based models and integrates with available equipment, then the human operators will likely benefit tremendously as they will become more conversant to identifying emergency events and situations and reacting appropriately with correct decisions.

b. **Reduction in Reaction Time of BN Platforms**. The incorporation of AI is likely to significantly reduce the decision-making process as well as

situation analysis of any threat-oriented situation. Human operators would generally require a much longer time to identify threat-oriented scenarios as well as analysis of a situation. Predictive algorithms can assist in identifying threats as well as provide probable solutions to human operators by analysing the data from surveillance equipment and platforms. Utilising AI can significantly reduce the reaction time of platforms to react to emergency issues in the maritime domain.

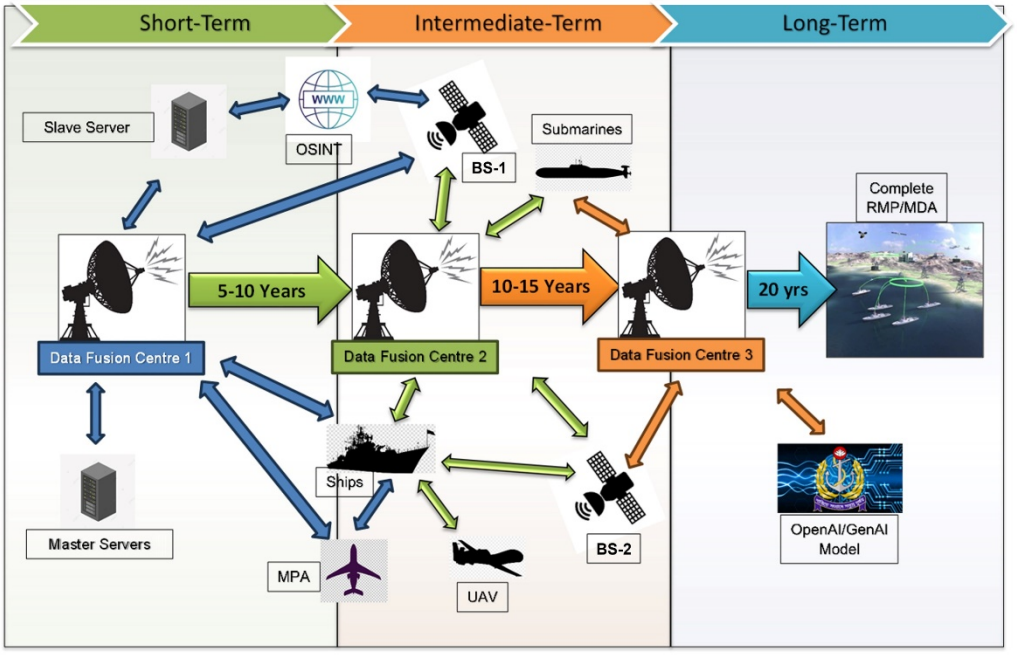
c. **Deployment of Lesser Number of Ships**. Once an AI-based surveillance system is incorporated, analyzed information will be readily available to human operators. Human operators will be able to visualise a broader picture with the assistance of the AI system. Presence-based missions will be less required as AI will be able to generate the whole picture along with suggested precautionary actions. Therefore, it is envisaged that fewer ships will be required to address situations.

d. **Generating a Complete RMP/MDA in the BoB**. A sensor-based connected AI system will provide a complete picture to the human operators. Human operators will be able to analyse data from all sources. They will be able to see the complete RMP required for a total maritime picture in the maritime domain. Maritime security and good order would be ensured at sea and there would be a rise in economic activities for Bangladesh.

Term-wise Roadmap to an AI-based Surveillance Network

From the survey results it was clear that incorporating an AI-based surveillance system would benefit the BN in enhancing its surveillance capability. Thus, a term-wise roadmap to integrate an AI-based surveillance system for BN is proposed below:

Figure 1: Roadmap for incorporating an AI-based Surveillance network in BN



Source: Author's Concept

a. **Short-Term Actions (2026 – 2030).** The first Data Fusion Centre can be introduced in Dhaka within next five to ten years. The Data Fusion Centre will be connected to the existing Bangladesh Satellite-1 with MPA, drones, sensors and surface ships at sea. Initial Machine Learning (ML) algorithms for detecting AIS anomaly, and OSINT analysis may be incorporated.

b. **Intermediate-Term Actions (2031 – 2041).** The second Data Fusion Centre may be introduced at Chittagong within the next ten to fifteen years given that the second satellite is launched by 2030. It should be connected to the first satellite and the first Data Fusion Centre. The second Data Fusion Centre may have sensor fusion and predictive analytical algorithms fused with other surveillance platforms like drones and submarines.

c. **Long-Term Actions (2041 onwards).** The third Data Fusion Centre may be constructed at Khulna/Mongla within next fifteen to twenty years and should be connected to the first and second Data Fusion Centres. Once all the Data Fusion Centres get inter-connected, the naval decision makers, with the help of an Open/Gen AI algorithm, will be able to comprehend and compile

all information to receive a complete Maritime Domain Awareness and Relative Maritime Picture at the Bay of Bengal.

Conclusions and Recommendations

Bangladesh Navy is the prime organisation which protects the territorial integrity of Bangladesh in the maritime arena. With the advent of technology, hybrid threats, international laws and regulations, BN needs to perform a variety of multi-dimensional tasks to safeguard national integrity at sea. The professionalism of the personnel and the monitoring capability will determine how best it will be able to perform its mandated duties. To keep up with the fast-changing environment, BN needs to enhance its surveillance and monitoring capability. Initially, the research highlighted the general maritime activities in the BoB which need monitoring by the BN. Activities like fishing in the BoB, shipping and trade activities, tourism and coastal transportation, offshore and underwater projects, accidents and pollution at sea and weather warning activities are pertinent activities which need supervision and monitoring by the Navy.

Considering the existing capabilities of the BN, it is pertinent that the BN needs to enhance its maritime surveillance capability to monitor the vast area of the BoB. However, various challenges prevail to enhance the surveillance capability of the BN. Some of the challenges are: limited number of ships in consideration of the vast area of BoB, the acquisition of more sensors, training of crew in heterogeneous sensors, lack of integrated C4I facilities, and the human factor in analysing threat-oriented situations at sea. It was found through FGDs, KIIs and surveys that if the surveillance system is enhanced then BN can effectively counter the challenges highlighted in the research.

A few methods were highlighted in the research like sensor integration of mobile and stationary platforms with an AI server. Building of data fusion centres in both East Zone and West Zone to collect, collate and analyse data from sensors, satellites and open-source websites. In the long term, in about 15 to 20 years, a Generative AI algorithm model can be indigenously developed. This type of AI model integration will significantly help naval commanders in decision-making and generating threat scenarios before a threat-based situation can occur.

The methods proposed would bear various benefits for the BN. Benefits like expenditure on sophisticated and expensive sensors would be reduced, and the time between detection, response and reaction would be significantly reduced. Fewer number of ships will be needed for deployment as threat analysis would allow operators on the ground to understand situations without a direct presence in the area.

Fewer ships deployed will automatically mean that fewer personnel are deployed. Hence, there would be a drastic reduction in fatigue among the personnel on the ships. A complete RMP would be generated and commanders can get the complete picture of activities at sea. Maritime security and good order would be ensured at sea paving way to rise in economic activities for Bangladesh.

Thus, the researcher recommended the following actions:

a. **Funding of an indigenous AI-model project**. NHQ may form a committee to fund a project by 2026 to develop an indigenous Open AI/Generative AI algorithm model. The project may be funded for a long-term project till 2040 for integration in Data Fusion Centers.

b. **Conversion of the existing IFF Center into a Data Fusion Center**. A committee may be formed to check the feasibility of converting the existing IFF Data Centre into a Data Fusion Centre to incorporate AI servers and provide necessary data to Area Ops Rooms. This can be undertaken on an immediate basis by 2026.

c. **Sensor Integration with AI server at Data Fusion Center**. Initiative may be taken to integrate the sensors of the surface, subsurface and aviation platforms along with coastal radar stations with AI servers to establish connection with Data Fusion Centre. This can be done in an intermediate-term notice by at least 2030.

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Biography



Commander Mohammad Pranjol Islam, (G), psc, BN, joined the Bangladesh Navy on 04 July 2007. He was commissioned in the Executive branch on 01 June 2009. He participated in 52nd BN JSC from Bangladesh Naval Academy (BNA) and was selected for the Chief of Naval Staff Trophy for attaining the 1st position. He participated in UN mission onboard BNS SANGRAM in Lebanon as part of UNIFIL in 2021. He is a proud graduate of DSCSC, Mirpur, Dhaka and later completed his 2nd staff course from Defence Services Staff College, Wellington, India in 2024. He commanded the Patrol Craft BNS SURMA. Presently, he is appointed as Naval Directing Staff at DSCSC, Mirpur, Dhaka.

Unlocking Warfare Potential: Analysing the Bangladesh Army's Logistics in Asymmetric Warfare

Major Abdullah Al Mamun Faysal, psc, ASC

"You will not find it difficult to prove that battles, campaigns, and even wars have been won or lost primarily because of logistics".

- General Dwight D. Eisenhower

Abstract

This write-up analyses the logistics structure of the Bangladesh Army (BA) in the context of Asymmetric Warfare (AW), identifying its imperative needs and weaknesses and proposing recommendations. The paper emphasises the important role that logistics plays in determining the success of operations, particularly in the dynamic and often complex environments found within AW scenarios. The write-up effectively reveals weaknesses and vulnerabilities in the system, such as reliance on a linear supply chain, dependency on foreign procurement, and deficient integration of technology; additionally, it highlights communication deficiencies, capability strain, and the budgetary limitations. The traditional logistics model constrains BA's readiness and adaptability in AW. The recommendations emphasise the necessity of diversifying supply lines through multimodal transport, enhance domestic production capabilities, developing advanced communication and autonomous delivery technologies, improving doctrinal agility, and strategically stocking supplies. Together, these initiatives aim to transform logistics from merely enabling operations to being a central component of operational effectiveness. The study also supports the idea that systematically and innovatively addressing these constraints will lead to significant improvements in logistics performance, thereby enhancing the BA's operational capability against asymmetric threats.

Introduction

Asymmetric Warfare (AW) is a type of combat in which the parties have entirely unique goals, means, or methods of fighting. Most scholars agree that there is a significant power difference between the warring parties in asymmetric conflicts (Mello, 2014). In the event of an attack by a materially superior foe, the BA would be forced to take an AW approach, avoiding head-to-head conventional engagements in favour of using geography, dispersion, and local support to impose costs and offset the attacker's advantages. In such a war, the emphasis would be on mobility, decentralised

operations by small units and on targeted strikes limited in time and space, with fighting power maintained by rapid dispersal, concealment and deception.

On the other hand, military logistics is the art and science of planning and carrying out the movement and maintenance of military forces. No strategic, operational, or tactical plan can attain victory unless supported by a sound logistics system. During the World War II, Field Marshal Slim turned defeat into victory in the Burma campaign by developing an elaborate logistics arrangement. In contrast, General Mutaguchi's Japanese forces suffered a severe setback due to their failure to understand the impact of this seemingly unexciting yet essential aspect (Islam A. M., 2011). In the arena of AW, the Vietnam War is a classic example. A number of studies highlight the similarly critical role of logistics in modern day conflicts such as the Gulf War and the Russia-Ukraine War. Thus, General Eisenhower emphasised logistics by saying, "It is logistics that controls all campaigns and limits many."

However, the logistics of AW are substantially different from those of traditional warfare, and several challenges must be addressed. Thus, the logistics system for AW requires a radically new approach (Janos, 2014). Against this backdrop, the paper first evaluates the requirements of a logistics system in AW. After that, the existing logistics system of BA and those of selected contemporary regional armies are analysed. Thereafter, the paper also identifies the limitations of the existing logistics system to support AW. Finally, the paper proposes a few plausible measures to enhance the logistics function in AW.

Requirements of the Logistics System in AW

After a thorough content analysis and interview of key informants, the author has identified the requirements of a logistics system in AW for it to function effectively. The details are discussed in the subsequent paragraphs:

a. **Agility and Flexibility**. During AW, logistics support must be agile and flexible to allow forces to react to unusual threats or a disruption in supply lines. AW requires adjustable logistics systems, which differ from conventional rigid supply systems. Such approaches enable rapid responses even when units are disconnected from central depots (Janos, 2014). Soviet partisans used pre-positioned caches that were set up, captured equipment, and new ways of getting supplies, such as airdrops and homemade piers, to continue fighting against a technologically superior enemy during the World War II.

b. **Decentralised and Network-Based Supply**. In operational environments characterised by AW, decentralised and networked systems of supply are crucial because the enemy can disrupt standard hierarchical supply structures. These systems allow autonomous means to acquire resources in a variety of ways by replacing linear supply chains with interconnected nodes. Hence, critical infrastructure becomes more difficult to target. This system allows rapid replenishment at locations with heavy fighting but with high operational security via distributed storage.

c. **Mobility and Survivability**. In contemporary theatres of combat, asymmetric logistics focuses on mobility and survivability to counter evolving threats (Rahman L. G., 2025). To ensure effective logistics, the right equipment and material must be made available for the end user at the right time in the right place and at the right quality. General Mark A. Milley emphasised the importance of logistics units staying on the move or hiding instead of having static bases.

d. **Technological Integration**. Given that conventional logistics can be exploited by a technologically superior enemy, AW logistics should harness technology to enhance coordination and efficiency. Real-time surveillance technologies such as Unmanned Aerial Vehicles (UAVs), as well as Internet of Things (IoT) sensors, can allow systems to monitor alternative supply routes, which makes convoys a lot safer in high conflict areas. These technologies can also assist in forecasting resource consumption and logistics requirements in advance.

e. **Civilian Integration and Outsourcing**. Civilian integration and outsourcing in AW logistics are particularly important because they enhance flexibility, optimise resource utilisation, and help forces contend with a stronger adversary. In such a battle scenario, with the enemy succeeding in maintaining control of the territory or the air, there is normally a need for decentralised outsourced supply networks to cope with the difficulties (Spenard, 2004-05). For instance, inferior forces may be able to tap locally procured civilian vehicles and readily available equipment to maintain their lines of communication without exhausting military rounds.

f. **Storage and Prepositioning**. AW necessitates storage and pre-positioning due to its unpredictable nature. In an asymmetrical conflict, supply lines are often disrupted, so it is crucial to cache weapons, supplies and equipment in different locations ahead of the conflict where they are needed.

g. **Training and Capacity Building**. Training and capacity building form an important part of the logistics of asymmetric conflicts, ensuring that logistics personnel are capable of operating under unforeseen and exceptional conditions. AW is fundamentally different from conventional warfare because it requires specialised skills, such as procuring resources through irregular means, maintaining logistics under disrupted conditions, and adapting local civilian resources for military purposes.

Existing Logistics System of the BA and Contemporary Regional Armies

Analysis of Logistics Factors

a. **Logistics Planning**. Scheduling logistics can be more or less complex depending on the size of the operation. It demands foresight, vigilance for trouble, and a balancing act of a few key factors.

b. **Force Composition**. The composition of the force has a large impact on logistics. Standard systems may keep up with the demands of regular troops, but adding paramilitary or reservist forces places new and different demands on the system without breaking the system**.**

c. **Logistics Environment**. The logistics environment, which in this context includes geography, climate, population, obstacles, and resource bases, is also critical. At the policy level, it must maximise the nation's assets. If resources are scarce, it is important to stay tight on concentration and economy of force.

d. **Priority and Allocation**. Setting priorities and allocating goods and services are other important things to do. In order to accomplish that and to prevent it from breaking down due to overrated priorities or those which are misused, the commanders must establish priority according to theater-level orders.

e. **Critical Items**. It is essential to locate and keep track of key items, which are supplies that are required to operate but are difficult to acquire. Leaders will develop methods for watching and fighting this stuff in a manner that keeps operations flowing smoothly**.**

Analysis of Conceptual Framework of Logistics System

a. **Riverine Geography**. Bangladesh's riverine geography has determined her logistical approach. Waterways are effective supply lines, even if air, roads, or rail communication means are not possible.

b. **Civil Resources**. The draft defence policy allows formations to utilise civilian assets up to 20%. Commanders adjust this level based on the size of the force in an area besides ensuring that civilians' needs are addressed.

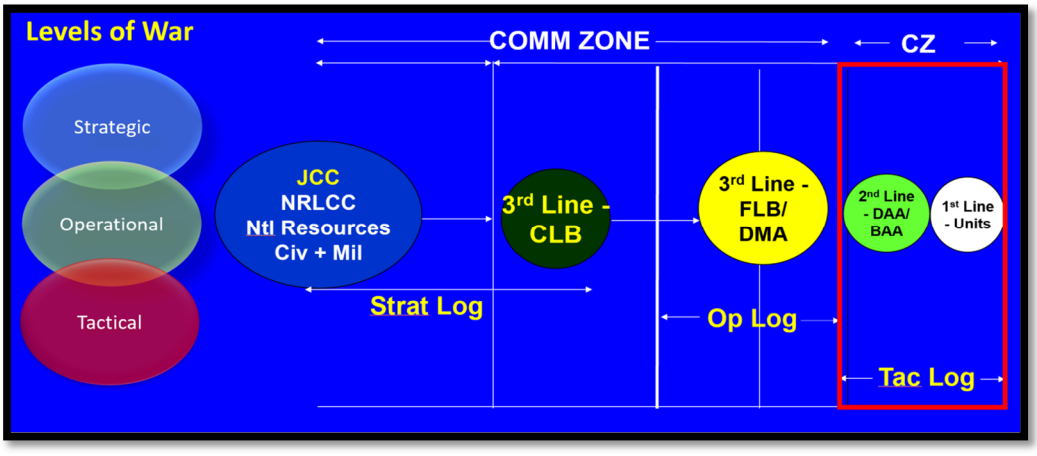
c. **Decentralised Logistics**. Logistics from multiple decentralised sources are extremely important. For example, pre-positioning combat supplies in preferred forward areas while using local labour, porters, and indigenous transportation enhances the battlefield's self-reliance.

d. **Geographic Challenges**. Geographical issues like natural barriers, limited infrastructure, and enemy air threats, make it difficult to transport large quantities of goods. Rather than concentrating everything in one place, logistics bases, themselves as a composition of separate nodes, move out to the hinterlands in increments to ensure that they can survive.

Analysis of Logistics Chain

a. **Combat and Communication Zone**. A successful logistics chain ensures that people and equipment move freely from procurement points to the soldiers at the front. This structure divides operational theaters into two: Combat Zones (CZ), where the troops are engaged in direct fights and Communication Zones (Comm Z), which run back from the central bases to the furthest edges of the field units.

Figure 1: Combat and Communication Zone



Source: Author's self-construct.

b. **Different Logistics Bases**. Central logistics bases prioritise controlled items, but they may also carry uncontrolled items when necessary. In Bangladesh, the deployment of Forward Logistics Bases (FLB) or Division Maintenance Areas (DMA) is necessary due to the terrain's division, the unreliability of communication lines, and the scarcity of air power.

c. **Administrative Areas**. Brigade and Division Administrative Areas (BAA & DAA) maintain stockpiles of combat supplies within their respective areas of responsibility. Forward BAAs (established by brigades) provide tailored combat service support to meet the immediate requirements of tactical forces.

Logistics of Contemporary Regional Armies

a. **Indian Army**. Within the Indian Army, the logistics of AW emphasise technological integration and adaptability. Logistics support relies on multimodal transportation and the inclusion of AI to assist with predictive maintenance and enhance operational efficiency.

b. **Pakistan Army**. The Pakistan Army's logistics plan for AW concentrates on decentralised, self-reliant and elastic administration of resources. A crucial aspect of this plan is ensuring that headquarters, posts and forward locations can run on their own for 7-10 days.

c. **Sri Lanka Army**. The Sri Lanka Army has reorganised its logistics system to cater for the requirements in AW, wherein mobility, flexibility, and the ability to face unconventional threats have been given more priority. To effectively combat these non-traditional foes, the army has implemented lightweight systems and established decentralised, redundant supply sources.

d. **Nepal Army**. The logistics plan of the Nepal Army for AW focuses on mobility, delegation, and solutions that work best in certain terrains to meet the dynamics of conflict, especially in the mountains. Logistics units rely on small, mobile supply hubs near dispersed operational teams.

Limitations of the Existing Logistics System to Support in AW

The author has reviewed multiple documents to identify the limitations of the existing logistics system to support AW. Extrinsic aspects are initially identified through interviews and FGDs, which are later verified by surveys. The limitations are discussed in subsequent paragraphs:

a. **Conventional and Linear Supply Chain**. Under AW situations when the Bangladesh Army will operate, the logistics system utilised by the Army might face difficulties based on the conventional and linear supply chain system (Asgar, 2025). These systems can be fragile and resistant to adaptation in the face of undirected threats and rapidly shifting battle lines.

b. **Procurement Based on Foreign Trade**. The BA's logistics procurement model has much to do with trading with other countries. The Army procures significant combat materials—modern weapons, most military vehicles, and specialised equipment from friendly countries. 90% of military hardware and equipment are being imported (Asgar, 2025).

c. **Inadequate Technological Integration**. The BA's logistics in AW are poor due to a lack of technological integration. Advances in modern software systems, GPS, and automated inventory management like Supply and Transport Management Software (STMS) and Ordnance Management Software have been applied, though they are yet to be fully integrated in all logistical endeavours.

d. **Lack of Effective Communication Means**. The BA's logistics are significantly constrained by an inefficient communication system; the logistics units are still not completely equipped with modern communication equipment designed to facilitate the smooth operation of logistics (Patwary, 2025).

e. **Deficiency of Capabilities**. Serious deficiencies in equipment capability handicapped the logistics of BA. Logistics units usually do not have enough of the right kind of equipment to perform effectively. There have been reports of perennial shortages of essentials, such as specialised weapons/guns, special and sophisticated ammunition, transportation vehicles, spare parts, and advanced communications technologies.

f. **Absence of Due Importance**. In BA, logistics often receives less attention than other areas such as tactics and strategy. Logisticians are professionals who are in great demand during wartime but often sink resentfully into obscurity during peacetime. Logistics is not merely a "rib" or subordinate component of strategy; it frequently is the decisive factor in the success or failure of military operations (Kinsey, 2023). This absence of importance results in poor performance.

Measures to Enhance the Logistics Function in AW

The author reviewed multiple documents to identify the measures to enhance the logistics function in AW. Extrinsic factors were first identified through interviews and FGDs, which led to identify the following measures to enhance the logistics function:

a. **Diversification of Supply Means and Routes**. Diversifying methods, routes and sources of supplies enhances logistics resilience during AW. The BA can strategically use the existing rail infrastructure along with a comprehensive network of river arteries to maintain supply lines when direct land routes are obstructed (Patwary, 2025).

b. **Developing Local Production**. Supply lines that lack access to outside sources can render military operations unsustainable in AW. This means logistics would have to be able to manufacture goods (Rahman L. G., 2025). The plan of the BA should be to produce all munitions they fire by developing a Defence Industrial Zone (DIZ). It is feasible by gradual localisation through co-production and technology transfer agreements while building research and development capacity.

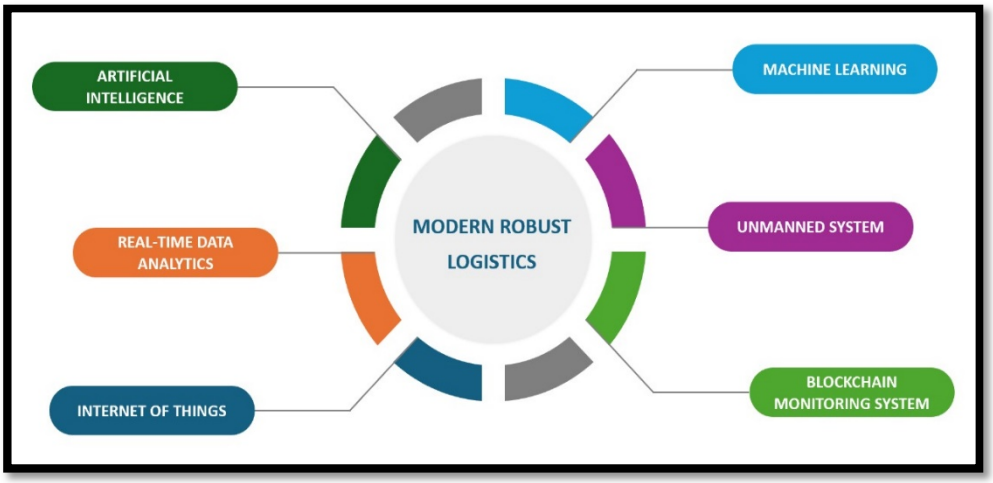
c. **Modern Communication Means**. Logistics units will struggle during emergencies, as they do not have access to sophisticated communication devices. To solve this problem, logistics units must now deploy modern communication tools like satellite phones, secure digital radios, encrypted messaging devices, and personal internet terminals that are being used today.

d. **Prioritising Logistics in Military Planning**. Martin van Creveld contends in his scholarly work on the subject, 'Supplying War', that both logistics and strategy are of equal importance. He argues that logistics, rather than strategy, determines war success, as a viable strategy without adequate logistical support, cannot deliver victory.

e. **Technological Enhancement**. Modern logistics technology connects military supply lines to adaptable and resilient networks, enabling them to tackle the distinct challenges posed by AW. This is because military planners can use sophisticated digital tools like artificial intelligence (AI), machine learning, and real-time data analytics to estimate demand, determine the best supply routes, and rapidly respond to problems arising from enemy strikes (Khan B. G., 2025). Technological enhancement to be implemented in a phased and selective manner. The BA can adopt the lower-risk digital

platforms now, while advanced systems should wait until data quality, cyber protection, and institutional maturity improve.

Figure 2: Technological Enhancement as a Measure



Source: Author's self-construct

f. **Autonomous Delivery System and Cyber Resilient Logistics**. Future war fighting requires the transformation of military supply chains to incorporate autonomous delivery systems and cyber-resilient logistics (Khan M. G., 2025). In logistics operations, combat forces achieve operational-scale effects by allowing rapid resupply at locations where traditional logistics are subject to ambush or disruption using autonomous drones, a terrestrial robotic force, or AI-controlled convoys. Autonomous delivery is feasible in a limited tactical form, while cyber-resilient logistics already has a moderate baseline but needs stronger AI-driven, logistics-specific development.

g. **Doctrinal Adaptation for AW**. Doctrinal accommodation for AW calls on a comprehensive review of conventional military concepts to address unconventional threats. This evolution in BA necessitates the use of adaptive, tech-savvy strategies that favour a networked command system, rapid logistical assistance, and agile operation planning.

h. **Prepositioning of Supplies**. In an asymmetric brand of warfare, stockpiling supplies in contested areas is one of the primary ways to prevent a stronger adversary from disrupting one's own logistics, ensuring that operations can continue unabated even if supply lines are disrupted.

Conclusion

Logistics in AW is crucial, often determining whether such forces can continue to operate against a numerically and technologically superior enemy. If their logistics is efficient, they are able to remain mobile, to reconstitute their forces rapidly, and to adapt to disrupted or closed-down conventional supply systems, which often result from territorial losses or adverse battlefield conditions.

The paper describes the basic requirements of logistics systems in AW and how they differ from logistics in conventional operations. The evidence, consisting of surveys, interviews, and FGDs, suggests that agility and maneuverability are keys to making quick adjustments in the face of unexpected challenges. Decentralised/networked supply systems strengthen resilience and continue aid in all disrupted contexts. Mobility and survivability are key to the protection of logistics and to the effectiveness of operations. Thereafter, it provides a detailed look at the logistics system of the BA in the context of contemporary regional forces.

Furthermore, the paper analyses the shortfalls of the existing BA logistics in supporting AW. According to the analysis, the bottleneck is the traditional, linear supply chain, which is not sufficiently agile to support decentralised and dynamic operations. Major challenges include resource shortages, excessive reliance on imports, poor technology absorption, and ineffective communication capabilities.

Finally, it explores steps to enhance the logistics capabilities of BA in AW. Key concepts include expanding distribution networks through multimodal transport systems to enhance their resilience to disruptions. The focus is on increasing local production capabilities and reducing reliance on imports, supported by recommendations for establishing additional ordnance factories and military industrial estates.

Recommendations

Based on the findings of the research, the following recommendations are made:

a. The BA may direct all stakeholders to diversify the logistics movement by integrating rail and air transport networks with road networks, including unmanned artificial intelligence (AI)-enabled delivery systems. This initiative should be implemented at the earliest opportunity.

b. The BA may initiate local military manufacturing by establishing new ordnance factories and defence industrial zones for the production of munitions and other identified critical spare parts. The implementation may

follow a timeline. Short-term (up to 2 years) focuses on pilot production at BOF and DIZ phase-1 starts to enable 3-5 munitions types. Medium-term (3-5 years) scales at 5-10 munitions types and 30% spare parts indigenisation. Long-term (5-10 years) achieves strategic self-sufficiency.

c. Army Headquarters (AHQ), General Staff (GS) Branch, Signal Directorate may supply modern and secured digital communications means that includes satellite phones, encrypted radios to enhance cooperation in disrupted environments for logistics units. It may be expected to start by 2027.

d. AHQ, GS Branch, Information and Technology Directorate may integrate automated inventory management and advanced digital platforms, such as AI-enabled logistics analytics and blockchain technology along with strong cyber protection to improve effectiveness and resilience. Pilot projects may begin by December 2026.

e. AHQ, GS Branch, Military Training Directorate, in coordination with Headquarters Army Training and Doctrine Command, may revise and update Army Logistics Doctrine (ATP 006) on AW. Situation-based training plans may be structured from December 2026.

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Biography



Major Abdullah Al Mamun Faysal, psc, ASC was commissioned from Bangladesh Military Academy (BMA) with 69 BMA Long Course in the Army Service Corps on 24 December 2013. He has diverse experience of serving in various units. He served in 36 Supply and Transport Battalion and 40 Supply and Transport Battalion in different regimental appointments. He commanded Station Supply Depot, Rangamati and Savar. As instructor, he served in Army Service Corps Center and School and Bangladesh Military Academy. He has also served as adjutant in Bangladesh Transport Company-5 in MINUSMA (Mali). Currently he is serving as Deputy Assistant Director of Supply and Transport (DADST), Supply and Transport Directorate, Army Headquarters.

Countering Pre-Programmed Drone Threats in Bangladesh Navy: Exploring Options, Challenges and Ways Forward

Lieutenant Commander Ariful Islam, (L), psc, BN

Abstract

The rapid evolution of drone technology, particularly pre-programmed drones has heightened security risks to military forces globally, including Bangladesh Navy (BN). Unlike operator-controlled drones, pre-programmed drones pose unique challenges due to their ability to operate without real-time human input. The study focuses on exploring viable options for how BN's counter-drone capability remains resilient amid such evolving pre-programmed drone threats. The study conducts a gap analysis of BN's existing counter-drone initiatives compared to global best practices, through consultations with senior BN officers involved in policy making and procurement. The study identified critical gaps, including the lack of a comprehensive threat evaluation mechanism, absence of preventive measures and long-term system acquisition plan, inadequate policy & regulation, and limitations in skill development. The findings emphasise the need for an integrated counter-drone strategy that combines both preventive and reactive measures. To address these gaps, the study proposes a dynamic counter-drone methodology and a plausible strategy centring on 4P framework (Perception, Prevention, Protection and Preparation). The study also suggests future research on integrating BN's counter-drone capabilities with the national air defence network and evaluating the feasibility of developing indigenous counter-drone technologies.

Introduction

Drone threat to military domain has evolved exponentially in recent years, posing a wide range of critical challenges. Drones, initially deployed for reconnaissance and surveillance, are now increasingly used for precision strikes, electronic warfare, and intelligence gathering (Kang et al., 2020). Rapid technological advancements in drone domain have led to the emergence of pre-programmed drones. Unlike operator-controlled drones that rely on consistent commands from ground station, pre-programmed drones can operate without an operator. Usage of cutting edge technologies such as AI and machine learning, pre-programmed drones can navigate and engage targets independently (Watkins et al., 2020). This paradigm shift in technology increases the pre-programmed drone threats significantly.

Compared to traditional drones, pre-programmed drones poise heightened risks in terms of lethality, flexibility and accessibility. Recognising the vulnerability of these evolving threats, BN is pursuing to adopt counter-drone systems. However, considering the rapid advancements in drone technology, BN's counter-drone capability development process must address the full spectrum of drone threats, including the pre-programmed ones. Furthermore, this development initiative must be sufficiently robust to keep pace with the evolving technologies and align with global best practices.

Against backdrop, this paper endeavours to evaluate drone technology trends and the unique characteristics of pre-programmed drones that pose risks to BN. Therefore, the study conducts a gap analysis of BN's approach to developing counter-drone capability comparing it with global best practices to identify existing gaps. Consequently, a plausible approach towards a resilient counter-drone capability is proposed for BN to address these gaps.

Threats Posed by Drones

Drones have become accessible, affordable, and highly adaptable. They provide relatively low cost, low risk involved means of conducting air operation ranging from surveillance to lethal attack (AFD, 2020). According to their size, weight and capability, drones can be classified into three broad categories: Class I, II and III (as per NATO). Among these, Class I drones are particularly challenging to detect and intercept using conventional air defence systems due to their small size, low radar cross-section, and ability to fly at low altitudes (Kang et al., 2020). Hence, they pose a constant and asymmetric threats to critical assets, equally applicable to BN installations and assets (DNO, 2025).

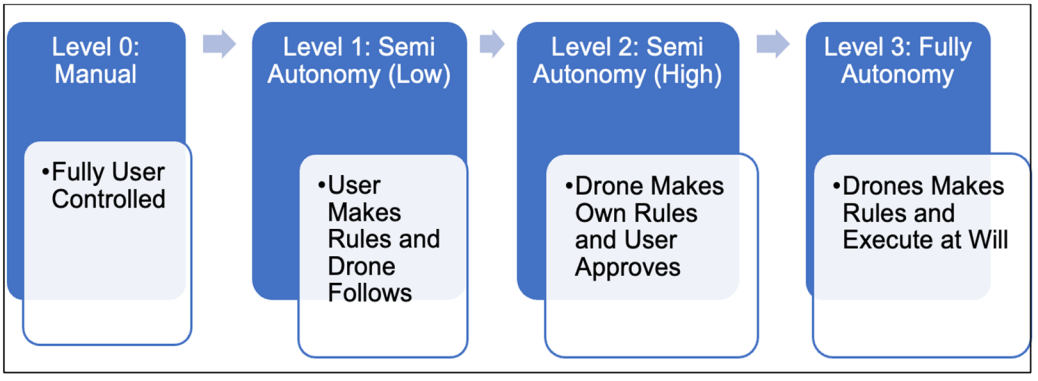
Heightened Risks from Pre-programmed Drones

Based on the command and control method, drones can be further classified as operator-controlled drones and pre-programmed drones (Ball et al, 2021). Pre-programmed drones, including both automated and autonomous variants, present a significant escalation in risk. Unlike operator-controlled drones, pre-programmed drones can execute missions without real-time human input (Watkins et al, 2020). Pre-programmed drones, such as the Harpy (Israel) and ASN-301 (China) can loiter for up to six hours, autonomously seeking out targets and attacking without keeping a human in the loop. Such independence from human control makes them immune to conventional jamming and Radio Frequency (RF) countermeasures.

Spectrum of Pre-programmed Drones' Autonomy

Capability of pre-programmed drones depends largely on its level of autonomy. This understanding is also important to design a suitable counter solution. According to Watkins et al. (2020), drones' autonomy continuum is of four levels, as portrayed in Figure 1.

Figure 1: Levels of Drone Autonomy



Source: Author's construct analysing content from Watkins et al. (2020)

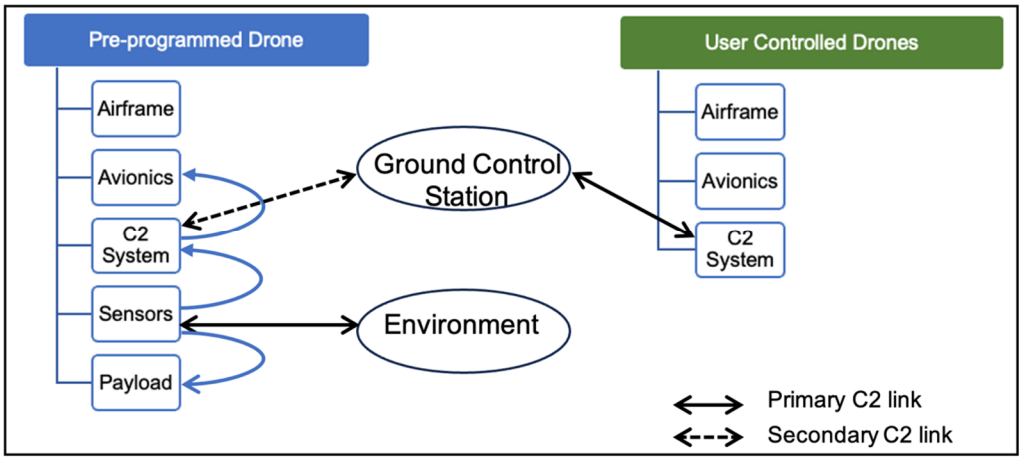
Drones' Emergent Behaviour: Evolving Drone Threats

A crucial relationship exists between the level of autonomy and the adaptation capability, which is known as emergent behaviour (Ball et al, 2011). Such capability is not attained by any individual process, rather, it is the result of interactions of multiple processes. Moreover, when AI and machine learning are embedded in the drones, they become autonomous. Such drones can adjust their actions in real time based on sensor input and AI algorithms (Kang et al., 2020). For example, in Ukraine, commercial drones equipped with AI-based navigation have been observed rerouting themselves around EW zones (JPACC, 2023).

Unique Risk Characteristics

The system architecture of pre-programmed drones itself poses unique risk characteristics. Pre-programmed drones possess all the major components of user-controlled drones and more as demonstrated in Figure 2.

Figure 2: System Architecture of User-Controlled and Pre-programmed Drone



Source: Author's construct analysing content from Watkins et al. (2020)

Pre-programmed drones are uniquely dangerous because they are independent, adaptive and difficult to detect. Their ability to operate autonomously, in swarms and with emergent behaviours makes them a far more complex and persistent threat. A comparative risk matrix analysing controlled and pre-programmed drones is summarised in Table 1. Moreover, the evolving nature of such drone threats affects the overall efficacy of counter-drone measures. The only solution, in this context, is to adapt countermeasures to evolving threat.

Table 1: Comparative risk Matrix: Controlled vs Pre-programmed Drones

Feature	Controlled Drones	Pre-programmed Drones
Command & Control	Remote operator	Autonomous/ Automated (no live operator)
Vulnerability to Jamming	High	Low/None (especially autonomous)
Swarm Capability	Limited	Advanced, coordinated
Detection difficulty	Moderate	High (low RCS, minimal emissions)
Mission Adaptability	Limited	High (AI ML-driven)
Risk Level	**Moderate**	**Severe**

Source: Author's construct excerpting data from content analysis

Evaluation of Pre-programmed Drone Threats to BN

It is essential to evaluate the dynamics of the threat posed by pre-programmed drones in BN's operational environment. Swarm attacks, evasion of detection, autonomous targeting, GPS-absent operations and EW are perceived threats to BN emanating from pre-programmed drones. Due to drones' affordability and availability, even non-state actors can now acquire and deploy them. Like any other threat, drone threats require the conventional concept of detection followed by neutralisation (Cdre Naim, 2025). A critical analysis of BN's capabilities against drones is therefore imperative to understand the extent of the threat posed by these pre-programmed drones.

a. **Limitations in Detection Capability**. Though drones are aerial threat, BN ships' conventional RADARs are not capable to detect drones. Moreover, when ships remain at harbour, RADARs are not usually operated which eliminate any possibility of detection. During exercises, it has been observed that when target drones are deployed for test firing, these are not detected by RADARs unless heavily modified with reflectors. Therefore, at present, drones can remain undetected by ships both in harbour and underway which is a serious concern (DNO, 2025).

b. **Ineffectiveness of Neutralisation Capability**. Since C2 system of pre-programmed drones does not require RF input, onboard EW system is not competent to detect them, let alone neutralisation (DNW&EE, 2025). Moreover, onboard guns or guided munition is also unsuitable to neutralise these drones (Cdre Naim, 2025). This ineffectiveness of BN platforms increases the risks posed by such types of drones.

Need for Resilient Counter-drone Capability

A stand-alone system, be it even the most sophisticated one, will not be adequate to deal with the drone threats since drone technology is evolving (ACNS (M), 2025). Furthermore, the increasing autonomy of pre-programmed drones challenges the effectiveness of reactive systems in the long run (JPACC, 2023). Therefore, an integrated approach combining both preventive and reactive measures is necessary to counter pre-programmed drone threats, which would also address other types of drones, including operator-controlled drones. Such an approach is also followed by modern military forces, as found in the US DoD Strategy for Countering Unmanned Systems and the UK Counter- Unmanned Aircraft Strategy. These necessitate a critical analysis of BN's ongoing counter-drone capability enhancement initiative in mitigating evolving drone threats.

Analysis of Global Best Practices for Countering Pre-programmed Drones

a. **UK Counter-Drone Strategy (2019)**. The UK's counter-drone strategy, published in 2019 by the UK Home Department, focuses on reducing the risk of illegal use of drones. It involves building a comprehensive risk picture through continuous threat evaluation, incorporating input from law enforcement, intelligence agencies, international partners, and drone manufacturers. The strategy includes preventive and reactive measures, with an emphasis on modular, scalable technology solutions that can evolve as pre-programmed drone technology advances. It also ensures effective operational response through training, awareness, and simulated exercises, while fostering collaboration among stakeholders to deter drone misuse.

b. **USA Counter-Drone Strategy (2024)**. The USA's counter-drone strategy, published in 2024 by the Department of Defence, aims to reduce vulnerabilities and achieve resilience against evolving drone threats. It focuses on raising awareness, supporting threat assessment through Joint Intelligence, Surveillance, and Reconnaissance (JISR), and taking pre-emptive actions to disrupt threat networks. The strategy promotes the development of integrated, modular, and scalable counter-drone solutions. Additionally, it ensures that future force structures are designed to adapt to the evolving nature of pre-programmed drones, with an emphasis on interoperability and joint exercises to maintain readiness.

Evaluation of BN's Counter-drone Capacity Enhancement Initiative

Acknowledging the growing risks posed by pre-programmed drones, BN has taken steps to enhance its counter-drone capability. One such initiative is the pursuit of acquiring a counter-drone system (DNW&EE, 2025). However, evaluation of global best practices reveals that acquiring a system alone cannot ensure resilient counter-drone capability for future evolving threats. Therefore, a comparative analysis has been conducted to assess whether BN's initiative aligns with global best practices. This analysis will also help identify existing gaps in achieving a resilient counter-drone capability.

a. **Threat Evaluation Mechanism**. For a resilient counter-drone capability, a consistent threat evaluation mechanism is crucial. According to BN experts, BN's threat evaluation mechanism has scopes for expansion. Furthermore, limited scope of intelligence sharing among organisations, may hinder effective threat evaluation. From the analysis, it is evident that a co-

ordination mechanism with all relevant agencies and policy makers is necessary for an effective threat evaluation system.

b. **System Acquisition and Integration Practices**. Global best practices dictate that counter-drone system should have open architectures with modular components. This approach ensures that today's investments remain relevant against tomorrow's threats (Cdre Iqbal, 2025). Nevertheless, recognising the benefits of scalable and modular configurations, BN is considering such designs in its ongoing procurement efforts, including the acquisition of counter-drone systems (DNW&EE, 2025). Modern navies avoid standalone systems procurement and ensure that each procurement fits into a long-term plan (Cdre Iqbal, 2025). However, BN's acquisition is often based on immediate operational needs and available budgets rather than long-term planning (ACNS (M), 2025). This leads to systems that may meet specific needs but lack overall capability enhancement.

c. **Skill Development**. Training and exercises are given due importance to enhance overall operational efficiency in both UK and USA strategies. These trainings and exercises are continuous and often conducted jointly or in coordination with other stakeholders. However, BN typically receives specific training from vendors when a new system is being procured. This training is often limited to basic operations rather than providing a deep technical understanding (DNW&EE, 2025). Although the pre-programmed drone threat has raised concerns, specific training with structured syllabi on drone and counter-drone operations is still not introduced (SO(T), 2025).

d. **Policy and Regulation**. Both strategies rely on formulation of doctrine, policy and regulations. Regulations (e.g. act, law) are developed based on threat evaluations to prevent (deter, disrupt, avoid) drone threats, including pre-programmed ones. Doctrine and policy delegate the appropriate level of authority (who will do what), ensuring preparedness against threats. However, in case of BN, formulation of doctrine and regulations are rarely emphasised during induction of new systems. Although there is a draft joint doctrine for UAV operations, a doctrine specifically for countering drones has yet to be developed.

Identifying Gaps in BN's Initiative

From the above discussions, it is evident that BN's initiative has gaps when compared to global best practices. Such gaps are likely to persist since global best practices involve technological prowess that are first invented and comes in hand to their militaries (ACNS (M), 2025). These gaps may hinder the overall process of developing resilient counter-drone capability for the militaries of developing countries like Bangladesh (ACNS (M), 2025). However, through a gap analysis BN's approach can be scrutinised to identify the sectors where BN has scope to improvement. In this context, BN's ongoing initiatives have been assessed against a set of questions as illustrated in Table 2.

Table 2: Gaps in BN's Approach for Achieving Resilient Counter-drone Capability

Requirements to Achieve Resilient Capability	Questions to Measure BN's Initiative	Findings
Threat evaluation mechanism	Does BN have a consistent threat evaluation mechanism?	No
	Is BN co-ordinating with stakeholders for threat evaluation?	Limited
Policy and Regulation	Does BN have effective data-sharing mechanism?	No
	Does BN have regulatory framework?	No
Acquisition and Integration plan	Is BN acquiring modular and scalable solution?	Yes
	Does BN follow long-term acquisition plan?	No
System Configuration	Is BN collaborating with others for co-production?	No
	Does BN ensure interoperability and standardisation?	Limited
Skill Development	Does BN provide sufficient training and awareness programs?	Limited
	Are there clear delegation of authority and operational procedures?	No

Source: Author's construct

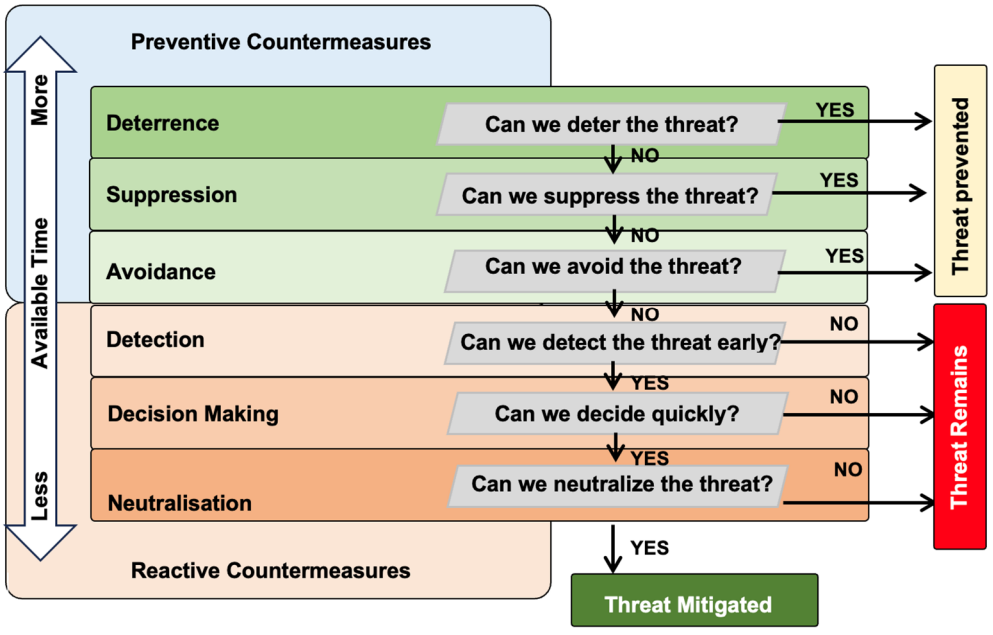
From the gap analysis it has been observed that, BN's initiative is focused on adopting only reactive countermeasures. Certain efforts are ongoing, such as coordination amongst stakeholders for threat evaluation, acquiring systems maintaining interoperability & standardisation, and basic training from vendor. However, there are definite gaps in threat evaluation mechanism, preventive countermeasures, long term acquisition plan and formulation of policy. These are key requirements to achieve a

resilient capability in mitigating evolving pre-programmed drone threats, which can be addressed through an integrated counter-drone strategy combining both preventive and reactive measures.

Feasible Counter Drone Solution for BN

The pre-programmed drone has elevated the risk level at new height. Due to the uniqueness, there is no 'one-size-fits-all' solution to neutralise these threats. However, systems designed to counter evolving pre-programmed drones are generally also effective against controlled drones. A pragmatic counter-drone methodology is, therefore, proposed in Figure 3. This construct combines reactive and preventive countermeasures and shows the correspondent actions against time available. While preventive countermeasures largely depend on comprehensive planning and involvement of different agencies, the reactive countermeasures are more of selection of feasible systems (e.g. hardware, software and architecture). Preventive countermeasures have the advantage, if successfully applied, a potential threat will not even occur (JAPCC, 2023). However, if the miscreants could successfully evade the preventive measures and make the threat airborne, the reactive countermeasures will come into action (JAPCC, 2023).

Figure 3: Proposed Counter-drone Methodology for BN



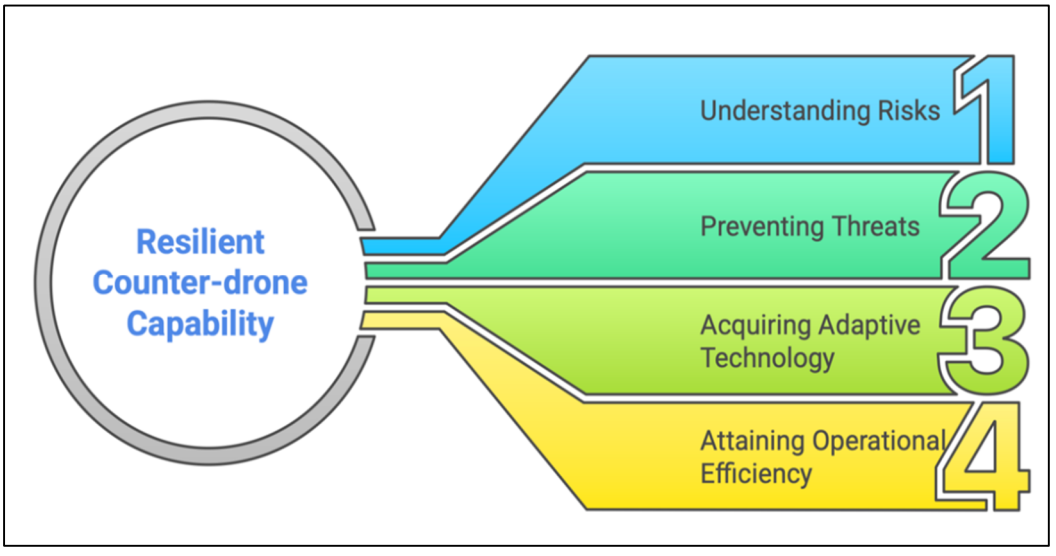
Source: Author's construct

Resilient Counter-drone Strategy for BN: Ways Ahead

The goal of achieving resilience in countering evolving pre-programmed drone threats, it is evident that BN needs a comprehensive approach. Such approach may be implemented through a pragmatic strategy. This strategy includes plausible ways to effectively utilise and develop the means available to achieve goal.

Defining Objectives (Ends). The objectives as depicted in Figure 4 are to understand the risks facing now and into the future, to prevent (deter, disrupt and avoid) drone to be threat, to acquire adaptive technological solution for keeping pace with evolving threat, and to attain operational efficiency in responding to evolving threat.

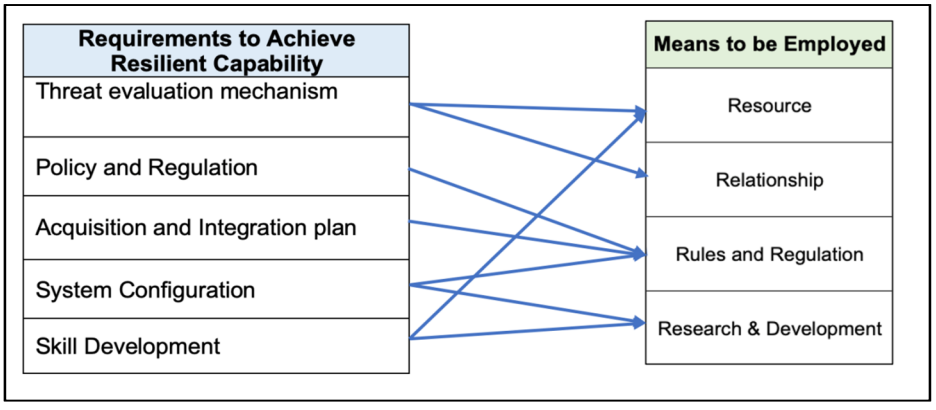
Figure 4: Defining objectives to achieve goal



Source: Author's construct

Identifying the Enablers (Means). From the gap analysis, the requirements for resilient counter-drone capability can be linked with means by which these requirements may be met, as shown in Figure 5.

Figure 5: Identifying means from requirements

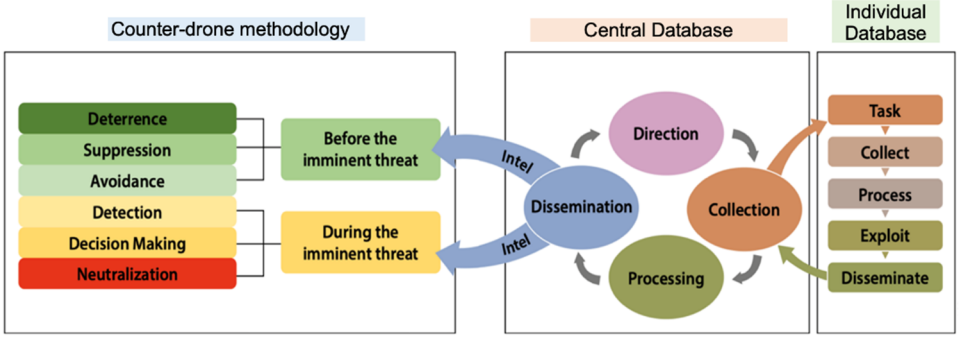


Source: Author's construct

Getting Ahead of the Threat (Ways).

a. **Perception-Developing a Systematic Threat Evaluation Mechanism.** First step to prepare for countering drone (irrespective of type) is to identify how likely a threat is to occur, how it is likely to emerge, and from where it might originate. Hence, a mechanism may be developed as illustrated in Figure 6 to provide probabilities if a threat exists and how it could evolve, so appropriate countermeasures can be developed accordingly. A joint approach may be taken integrating all services ISR efforts. The resources to be tasked to collect data on potential adversary's inventory, capabilities and anticipated performance, as well as their possible evolution in the future. Upon processing, these data may be archived in a secured database and shared amongst the stakeholders. This intel may be therefore utilised as appropriate according to the countermeasures.

Figure 6: Concept for a systematic threat evaluation mechanism



Source: Author's construct

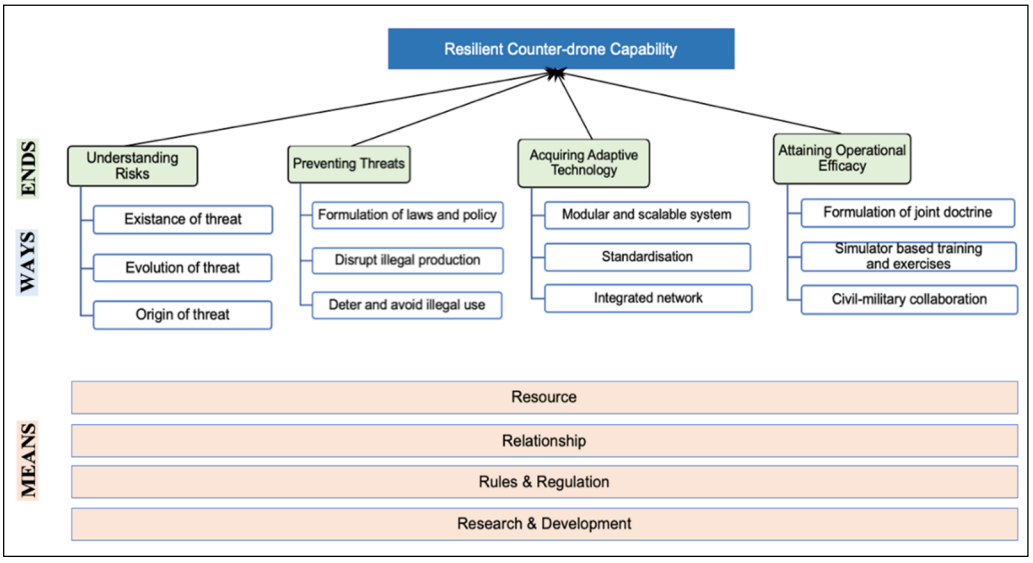
b. **Prevention - Developing a Robust Prevention System**. An effective co-ordination mechanism may be developed with AFD, the law enforcement agencies and policymakers to establish an effective prevention system. Therefore, any anticipated threat from organised miscreants using drones illegally can be identified and addressed promptly. Again, based on the evolving threat, required laws and policies can be adopted to reduce the illegal production of drones. If these policies and laws are made stronger and capable to deal with contemporary threat, the prevention mechanism will be more effective.

c. **Protection - Developing Adaptive Defence Network**. All the platform and bases of BN may be equipped with counter drone system. Such mass acquisition needs to be planned through a road map. However, to ensure interoperability the system may be standardised. Moreover, greater emphasis may be placed on research and development initiatives. Since counter-drone systems will be required by all services, a joint approach may be taken. A dedicated project to build indigenous capability for countering drones may be taken under AFD. Counter-drone systems deployed around BN bases and platforms should be interconnected to enable real-time data sharing and monitoring.

d. **Preparation - Developing Operational Efficiency**. The crews may be given comprehensive training to respond to the threat promptly. Along with the system integration training, the drone and counter-drone operation, its uniqueness and evolving nature may be taught in the basic and specialisation courses. Dedicated simulator and digital training aids may also be incorporated to effectively provide training for both operators and maintainers. A joint doctrine needs to be formulated to ensure a common concept of operation. Such a doctrine should define command responsibilities, operational procedures and stakeholder coordination mechanisms. Advanced training and exercises may therefore be organised based on the doctrine. Furthermore, a pertinent ROE are necessary to govern the employment of hard-kill effectors by specifying threat identification criteria, engagement authority and conditions for use during peacetime, crises and wartime. To ensure robust maintenance support, subject matter experts from civil organisations may be engaged. Civil-military collaboration with industries and universities may also be adopted to achieve in-house capability.

The goal of achieving resilience in counter-drone capability may be achieved by utilising the resource, relationship, rules, regulation and R&D to develop perception, prevention, protection and preparation for the evolving pre-programmed drone threats, as illustrated in Figure 7.

Figure 7: Proposed resilient counter-drone strategy for BN



Source: Author's construct

Suggestive Implementation Roadmap

Implementing the proposed 4P framework requires a phased and cost-effective roadmap to ensure the optimum utilisation of limited resources. In the first phase (by 2027), priority should be accorded to **Perception** and **Preparation**, as the introduction of threat evaluation mechanisms, intelligence sharing, doctrine development and training offers significant improvements in situational awareness and operational readiness at a relatively low cost. The second phase (by 2029) should focus on **Prevention** through strengthening inter-agency coordination, regulatory frameworks and law-enforcement support to reduce the likelihood of drone threats. **Protection**, involving the acquisition of detection systems, networked sensors, counter-drone effectors and infrastructure integration, is expected to demand the highest financial commitment and should therefore be implemented progressively (by 2035) based on threat assessments and operational priorities.

Such prioritisation ensures that low-cost, high-impact initiatives are implemented first, while more resource-intensive technological solutions are developed in a sustainable manner, thereby maximising the overall cost-effectiveness of the proposed strategy.

Conclusion

The evolving nature of drone technology, especially pre-programmed drones, poses threats to military forces worldwide including BN. Drones have evolved from their primary role as human-controlled surveillance platforms to pre-programmed lethal weapons. Pre-programmed drones pose unique challenges due to their advanced capabilities, such as autonomous targeting, evasion of detection, swarm attacks and saturation, etc. These capabilities reduce human dependency and make pre-programmed drones resistant to conventional countermeasures like jamming. The purview of counter drone systems, together with their legal aspects, warrants BN being prepared to counter Class-I drones (NATO classification). Therefore, this necessitates that BN develops to achieve a counter-drone capability which remains resilient amid evolving pre-programmed drone threats.

Through the gap analysis, significant deficiencies in BN's ongoing counter-drone capability enhancement initiative are observed when compared to global best practices. Analysis of the UK and US counter-drone strategies indicates a strong emphasis on integrated approach combining both preventive and reactive countermeasures. These strategies focus on continuous threat evaluation, modular and scalable solutions, and stakeholder coordination. In contrast, BN's ongoing initiatives fall short in few areas, such as threat evaluation mechanisms, preventive countermeasures, long-term acquisition planning, policy formulation and skill development. Moreover, BN's existing approaches are largely reactive which focus on acquiring piece-meal systems. These underscore the need for adopting an integrated strategy which would enhance BN’s counter-drone capability against evolving pre-programmed drone threats. Such capability would also remain effective against other types of drones, including operator-controlled drones.

A strategy has been proposed in this paper focusing on an integrated approach cantered on 4P framework (Perception, Prevention, Protection and Preparation). Preventive measures including deterrence, suppression, and avoidance can effectively prevent the threat from materialising, while reactive systems, such as AI-based detection and hard-kill effectors, are essential for neutralising threats once airborne. A set of initiatives, such as developing systematic threat evaluation mechanism, robust prevention system, and adaptive defence network may be considered to achieve resilient capability in countering evolving drone threats. Among the four pillars of 4P framework, Perception and Preparation should receive immediate priority due to their comparatively low implementation cost, followed by Prevention measures. Protection-related technological acquisitions should be pursued progressively. Concerted focus on training and simulation technologies, fostering civil-military collaborations and investing in R&D will play a crucial role in ensuring the long-term success of the strategy.

Recommendations

Following recommendations have been made to elevate BN's ongoing counter drone capability initiative to effectively mitigate evolving drone threats:

a. NHQ may formulate and implement an integrated counter-drone strategy based on the proposed 4P framework (Perception, Prevention, Protection and Preparation), combining preventive and reactive measures to ensure BN remains resilient against evolving drone threats and adopt a phased implementation roadmap prioritising low-cost, high-impact initiatives.

b. NHQ may establish a systematic drone threat evaluation mechanism by integrating relevant stakeholders to continuously assess emerging drone threats. The outputs of this mechanism may be utilised to guide acquisition planning.

c. NHQ may formulate a counter-drone doctrine supported by training curricula, exercises and clearly defined ROE to enhance operational preparedness against evolving drone threats.

d. AFD may establish a joint technical committee comprising experts from all services to develop common technical specifications and interoperability standards for future counter-drone procurements based on operational requirement analysis.

e. AFD may initiate a dedicated joint R&D programme involving experts from military, academia and relevant industries to develop indigenous counter-drone solutions.

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Biography



Lieutenant Commander Ariful Islam, (L), psc, BN was commissioned in the Electrical Branch of Bangladesh Navy on 01 December 2011. He holds a graduation in Aeronautical Engineering from Military Institution of Science & Technology (MIST). As an Air Technical Officer, he undertook Type Training on AW109E Helicopter in Italy, Air Electrical Officer Specialisation Course in Naval Institute of Aeronautical Technology (NIAT), India and Ground Safety Officer course at Flight Safety Institute, BAF. Apart from his specialisation in aviation maintenance, he also completed Long Electrical Course at BNS SHAHEED MOAZZAM, and Advanced Course in Administration & Development (ACAD) at Bangladesh Public Administration Training Centre, Dhaka. He is an alumnus of the Defence Services Command and Staff College, Mirpur. During his service career, the officer has served in Naval Aviation in various appointments, including Officer-in-charge Helicopter Flight Line, Air Electrical Officer, and In-charge Electrical & Avionics Section. He has also served in several warships, including BNS ADOMYA, BNS PROTTOY and BNS ABU UBAIDAH in different capacities. Presently, he is serving onboard BNS PROTTOY as Deputy Electrical Officer.

Developing Junior Leaders for Future Operations: The Effect of Adaptive Thinking on Decision-Making in Bangladesh Army

Major Sheikh Sadi, psc, Inf

Abstract

The paper examines the effect of adaptive thinking on decision-making capability of junior leaders (i.e., non-commissioned officers, junior commissioned officers, and officers up to the rank of Major) for future operations, where adaptive and timely decisions are crucial. It identifies several decision-making constraints including difficulty in operating with incomplete information, reliance on preconceived contingencies, lack of situational awareness, delayed and inaccurate decision-making under pressure, and lack of decision confidence. The research hypothesis posits that adaptive thinking can enhance the decision-making capability of junior leaders in Bangladesh Army. This hypothesis was validated through qualitative and quantitative analysis of the gathered data. Findings strongly suggest that adaptive thinking components such as pattern recognition with partial information, the ability to adjust plans in response to changing tactical environments, and quick and intuitive decision-making under pressure can counteract decision-making constraints. The study identifies a training focus on analytical decision-making and drill-oriented training as key gaps. Based on the findings, the paper proposes the integration of the United States Army's 'Think Like a Commander' programme within existing training modalities. It also proposes an integration and assessment framework with a phased implementation plan. The study concludes by offering a practical framework for systematically developing adaptive thinking to improve the decision-making capability of junior leaders in future operations.

Introduction

Junior leaders, such as Non-Commissioned Officers (NCOs), Junior Commissioned Officers (JCOs) and young officers in Bangladesh Army (BA) have to operate under complex and demanding situations in Counter-Insurgency Operations (CIO) in the Chattogram Hill Tracts (CHT), in aid to civil power duties, or in United Nations Peacekeeping Operations (UNPKO) (Adnan, 2024; Hossain, 2014). The constantly evolving operational landscape requires Junior Leaders (JL) to have improved cognitive capacities to make rapid, independent decisions under substantial uncertainty and complexity (Hannah et al., 2010). In these situations, platoon and company commanders must independently adapt and make decisions under ambiguity (Krulak, 1999).

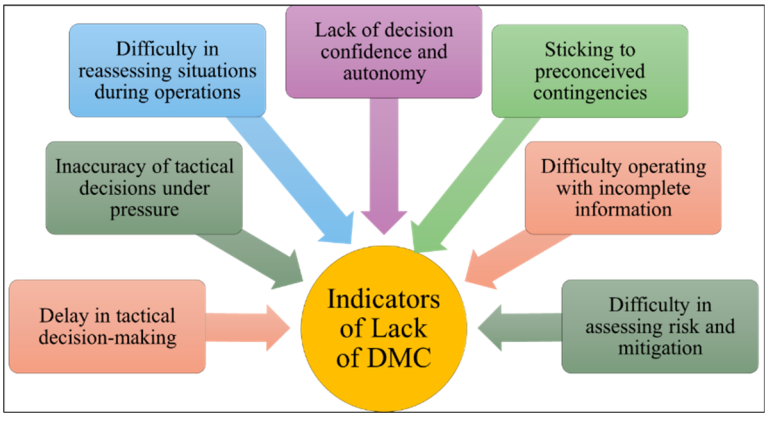
The evolving security landscape requires JL of BA to be adaptive for making quick and timely decisions in multi-domain operations (MDO), from CIO to high intensity conflicts under dynamic and unpredictable situations (CAS's Training Directive, 2025). To adapt to this, advanced militaries globally have institutionalised Adaptive Thinking (AT) training (Spanuello, 2007). AT, which encompasses cognitive flexibility, situational awareness, and real-time problem solving, has been acknowledged as a critical ability for military leaders in order to address these issues (Cojocar, 2011). However, the current state of decision-making capability (DMC) of JL require significant improvement to meet these challenges (Moniruzzaman, 2024; Shovan, 2024). As current training in BA still focuses only on analytical Decision-Making (DM) processes, such as the Military Decision-Making Process (SD in the Field, 2009) and tactical appreciation (JSSDM, 2022), neither of which adequately prepares leaders for the rapid cognitive adjustments required for uncertain tactical situations (Shelby, 2023; USMC, n.d.).

Against this backdrop, this paper initially identifies key DM constraints in JL. Thereafter, it assesses whether and how AT components can enhance DMC by counteracting these constraints. Finally, it identifies gaps in current training modalities, and proposes a framework for integrating AT training within existing training system. The paper is limited in scope to existing and potential infantry section, platoon and company commanders, referred to as JL.

Current State of DMC of JL of BA in the Context of Future Operations

To examine the current capability to make decisions under future operational contexts systematically, seven indicators of DMC were identified. The indicators are appended in the following figure:

Figure 1: Indicators of Lack of DMC



Source: Author's construct based on document study and primary data

a. **Current State of DMC among Infantry JCOs and NCOs**. Regarding the DMC of JCO/NCOs, their self-perceptions were compared with officers' assessments. Interestingly, many JCO-NCOs believed that they were adaptive in DM. However, analysis indicated their adaptive DMC was limited. Officers also assessed that JCO-NCOs struggle with DM under uncertainty. It was found that JCOs/NCOs tend to hesitate in DM, and look up to officers, especially during stressful or high-risk situations. Thus, collective findings suggest that JCO-NCOs' DMC under complex, fast-changing situations remain limited.

b. **Current State of DMC among Infantry Officers (Lieutenant to Major).** All seven indicators of lack of adaptability in DM among officers were found present. The significant indicators found were a lack of situational awareness, followed by a tendency to adhere to preconceived contingencies and difficulty in operating with incomplete information. Despite doctrinal expectations that officers demonstrate initiative and autonomy from officers (Operations of War, 2006), they struggle to adapt, reassess situations, operate under uncertainty, and deviate from plans.

c. Overall Assessment of DMC of JL. Findings regarding both officers and JCOs/NCOs reveal that JL in BA as a whole lack in DMC. Despite expressing confidence, JCOs/NCOs demonstrate deficiencies in core DM components e.g. decision-speed, autonomy, risk-taking and adaptability. Officers were found more critical of their own limitations, particularly in situational awareness and their ability to adapt to dynamic situations.

Although levels of self-perceived confidence vary across groups, the general theme across all sources confirms that JL in BA currently lack adaptive DMC necessary for future operations. It underscores the need for a measure such as AT to enhance JL's cognitive adaptability and improvement of DMC in uncertain tactical environments.

Effect of AT on DMC of JL in BA

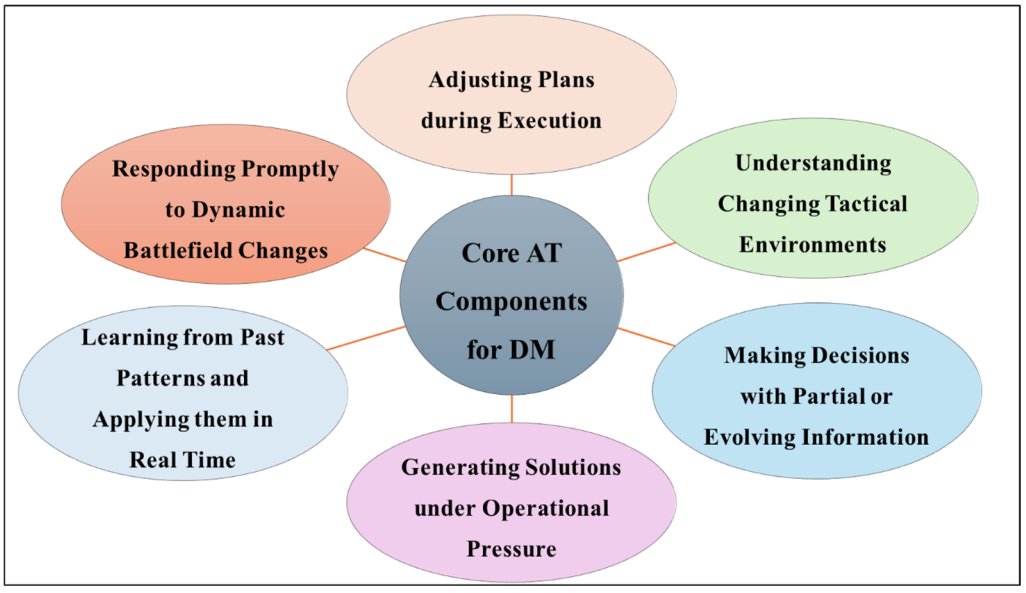
As BA is not preparing its leaders to be adaptive to future operations' DM demands, it is imperative to find out possible ways to improve the DMC of JL in BA. A possible way forward is training on AT.

AT is the ability to adjust cognitive processes and DM in real time, particularly in Volatile, Uncertain, Complex and Uncertain (VUCA) scenario. In military contexts, AT is defined as "thinking on one's feet fr

amed in terms of the battlefield" (Lussier & Shadrick, 2003). It is not simply a type of thinking but a quicker way of responding to the VUCA nature of modern military operations.

Through document study of various military leadership and DM literature six core components of AT were identified. These components are illustrated in Figure 2.

Figure 2: Six Core AT Components



Source: Author's construct based on document Study

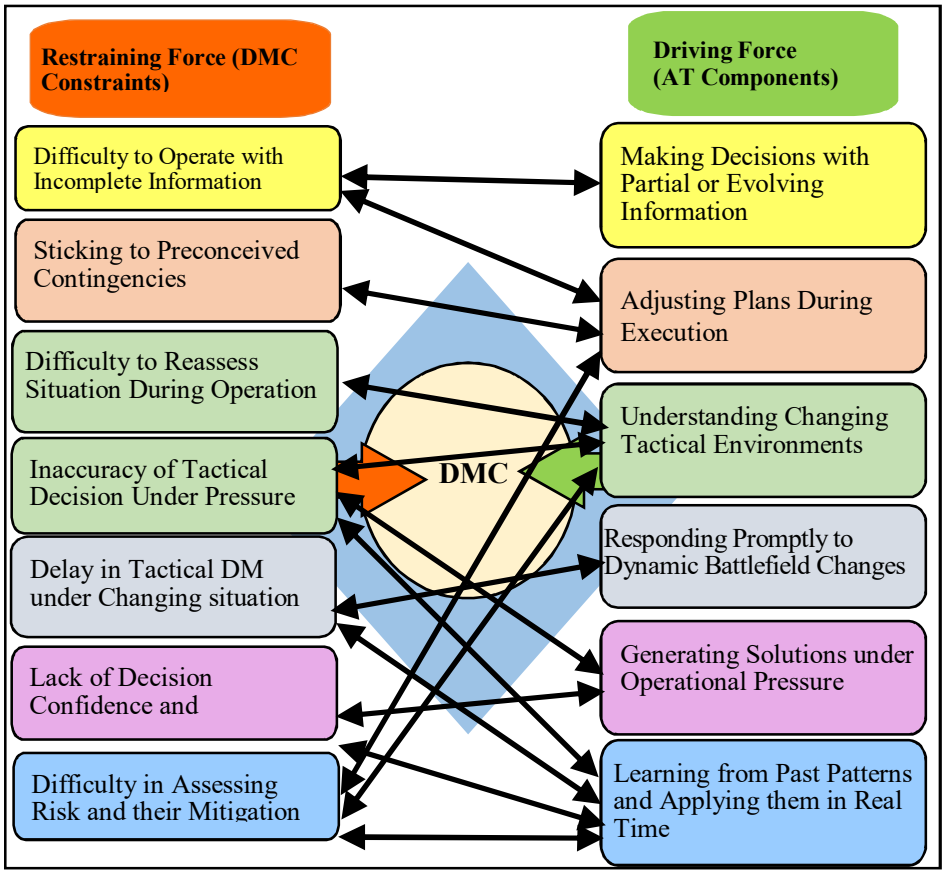
The theoretical foundation of AT originates from two DM models. Firstly, Boyd's Observe-Orient-Decide-Act (OODA) Loop perceives DM as a continuous, fast-response cycle. The model emphasises that tactical advantage lies with adapting with changing scenarios and acting faster than adversaries (Boyd, 1996). Secondly, Klein's Recognition-Primed Decision (RPD) model builds on the idea that DM under time pressure are driven by "recognising patterns from experience" and simulating outcomes (Klein, 2017).

The concept of AT also aligns with Clausewitz's notion of *Coup d'œil*- an intuitive "glance" that grasps the essence of a battlefield situation instantaneously. Clausewitz considered this a rare but essential quality in commanders enabling rapid and accurate judgement under pressure (Clausewitz, 1832/2006). Although he considered it innate, contemporary studies, such as Duggan (2005), suggest that

Coup d'œil can be acquired through scenario-based experience and reflection- an idea consistent with AT training.

A synthesis of gathered data through Force Field Analysis (Figure 3) shows six AT components (driving forces) counteracting DMC constraints (key restraining forces).

Figure 3: Force Field Analysis showing AT components acting as driving forces to counteract constraints in DMC of JL



Source: Author's construct based on thematic analysis of qualitative data

Figure 3 shows that development of certain AT traits can address co-related gaps in DMC (colour-coded for corresponding major AT-DMC relationship). The analysis shows that certain AT indicators are more important than others. In the subsequent paragraphs, the core AT components are discussed as per their priority for BA:

a. **Learning from Past Patterns and Applying Them in Real Time**. Pattern recognition, the quintessential component of AT, reduces sticking to preconceived contingencies, increases decision confidence/autonomy, and

improves accuracy of decisions by relying on the RPD model. In RPD model, a decision maker matches learned cues to patterns, then simulate likely outcomes, and finally act without hesitation (Klein, 2017; Ross et al., 2004; Duggan, 2005).

b. **Adjusting Plans During Execution**. Learning to adjust plans helps a leader to operate with incomplete information and avoid preconceived contingencies. Evidence from 'Think Like a Commander' (TLAC) programme demonstrates that training on plan-adjustment and scenario-based training improve tactical DMC (Shadrick & Lussier, 2004). This also aligns with OODA-loop, where rapid reorientation and action in response to changing situations enhance DM (Boyd, 1976).

c. **Understanding Changing Tactical Environments**. Leaders who can orient faster in complex and ambiguous scenario have a decisive edge over the adversary (Boyd, 1976; Crowley, 2021). Learning to understand the change in tactical environments helps gain better situational awareness and consequently reduces DM inaccuracy.

d. **Making Decisions with Partial or Evolving Information**. This component directly addresses difficulty operating with incomplete information. Simon's (1955,1956) bounded rationality and satisficing explain that a 'good-enough' decision with incomplete information in time is better than decision-delay in changing situation. Klein's (2017) RPD-model also favour this through pattern-recognition.

e. **Responding Promptly to Dynamic Battlefield Changes**. In a time-pressured situations whoever can cycle more rapidly through observe-orient-decide-act gains a decisive advantage (Boyd, 1996; Crowley, 2021). Decision-delay, a DMC constraint identified previously, is therefore a serious pitfall that can be mitigated by making prompt decisions in dynamic scenario.

f. **Generating Solutions Under Operational Pressure**. Training on DM under pressure helps leaders make accurate decisions and enhances DM confidence and autonomy. This is supported by findings from AT-training programmes such as Adaptive Soldier Leader Training and TLAC where scenario-based training has been shown to improve both DM confidence and autonomy (Lumbaca, 2013; Shadrick & Lussier, 2004).

The evidence from quantitative tests, qualitative observations, and force field analysis converge on a single conclusion: AT has a significant positive impact on the DMC of JL in BA. This ascertains a dire need for exploring how AT can be systematically developed among the JL in BA.

Training Gaps and Framework for Integrating AT Training in BA

Western militaries institutionalised AT training programmes such as TLAC, which was proven effective in improving DMC (Lumbaca, 2013; Lussier & Shadrick, 2003; Shadrick & Lussier, 2004). On the contrary, BA lacks a formal mechanism to cultivate AT among its JL. Given the demands of future operations, it is necessary to identify gaps in the training system to incorporate AT training in BA.

Identification of Training Gaps

a. **Review of Course Curricula and Design.** The review of course curricula reveals systemic gaps in both JCO/NCO and officer training. Firstly, NCO and JCO courses remain predominantly drill-oriented, with little opportunity for adaptability in DM. Moreover, exercises are highly predictable and product-based. Assessment system adhere to procedures rather than encouraging adaptive processes. Similarly, officer courses such as Officers' Basic Course (Infantry) and Junior Command and Staff Course emphasise planning, deployment, and contingency frameworks, but they do not expose students to dynamic or ambiguous scenarios. In addition, instructors are not trained to develop AT traits, and no AT-specific methods are present in curricula. Assessment systems reinforce rigidity by valuing correctness of format over the reasoning process. As a whole, these training gaps indicate that current training modalities are not designed to develop adaptive DM skills.

b. **Review of Unit/ Formation/ Annual/ other Trainings.** Similarly, across unit and formation level, BA's regular training modules such as group/ collective training, formation training and summer/ winter trainings does not deliberately train AT. It is not embedded in the training objective, although the indication is available in training directive (*CAS's Training Directive*, 2025). Review of CIO training, and pre-deployment training for UNPKO shows that they focus somewhat on scenario-based training but does not deliberately develop AT.

c. **Case Study-1: Manifestation of AT Training Gaps (BA).** An operational patrol in Ruma, Bandarban was carrying out routine patrol dividing themselves into two groups (500 m apart). En route, the patrol was under ambush. One group, without identifying the threat, opened fire onto another (friendly forces). Failing to assess the situation, they submitted a wrong report to zone headquarters. The other group (under friendly fire) could not identify friend or foe either. As a result, the counter ambush failed. The

incident illustrates how lack of AT traits such as reliance on preconceived contingencies, lack of decision confidence and autonomy and situational awareness, and risk mitigation failure can bring devastating outcome.

d. **Case Study-2: AT-Enabled Performance (US Army)**. A DVIDS news release ("Woman Soldier Receives Silver Star for Valour in Iraq," n.d.) reported that a Military Police squad escorting a convoy near Salman Pak in 2005 was under ambush. The lead vehicles immediately went out of kill zone and the rear team established fire base. The forward group assaulted from flank through trench positions, clearing successive posts and countered the ambush. Throughout the operation, the leaders maintained enemy identification and communication. They also adapted decisions as necessary. This reflects recognition-primed DM, decision autonomy, and risk management; which were adaptive thinking (AT) competencies developed through by AT training.

Inference from Identified Training Gaps

The analysis of courses, the training system, and case studies make it clear that AT is absent as an explicit objective in BA's training design. Although ample time is allocated to practical activities, these sessions are largely consumed by planning, drills, and standard procedures. Leadership training remains limited, with no formal DM models applied. Although pre-deployment training for CIO and UNPKO introduces some scenario-based elements, these remain scripted and predictable, which fails to develop AT. These gaps manifest themselves in the field through operational failure. The Bandarban patrol incident shows the dangers of lack of AT training, while the US counter-ambush case illustrates pattern recognition, DM confidence and autonomy, and the ability to operate effectively under pressure.

The gap is therefore less about the time or resources allocated to tactical training and more about how the allocated time is used. As evident from the training gaps and as confirmed by the experts, a training framework is required to integrate AT among the JL in the BA.

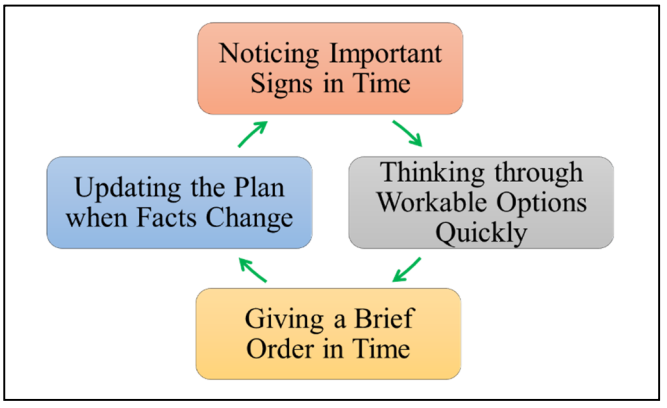
Training Framework for Integrating AT training in BA

Upon analysing the training gaps, and existing AT training frameworks in the US Army, the researcher found that integration of TLAC programme in BA would enhance JLs' DMC.

a. **Background and Rationale for Adopting TLAC in BA**. TLAC was developed following Adaptive Thinking Training Methodology for US Armour Centre's Armour Captains' Career Course to instil AT. It is a vignette-based method (brief scenario problems for rapid decisions and feedback) that strengthens battlefield thinking. It uses short, timed decision drills followed-by coached discussion (Lussier & Shadrick, 2003). Later it was evaluated by separate research and validated to be effective in developing AT (Shadrick & Lussier, 2004). As TLAC incorporated AT training in an existing course, which is the preference for BA, developing a separate training modality is unnecessary. Hence, the framework for integrating TLAC programme will be suggested in the subsequent paragraphs.

b. **Implementation Aim and Scope**. This framework inserts short decision drills and simple assessment system inside existing training modalities. The aim is to improve decisions under uncertainty by following the simple Adaptive Decision Loop as appended below.

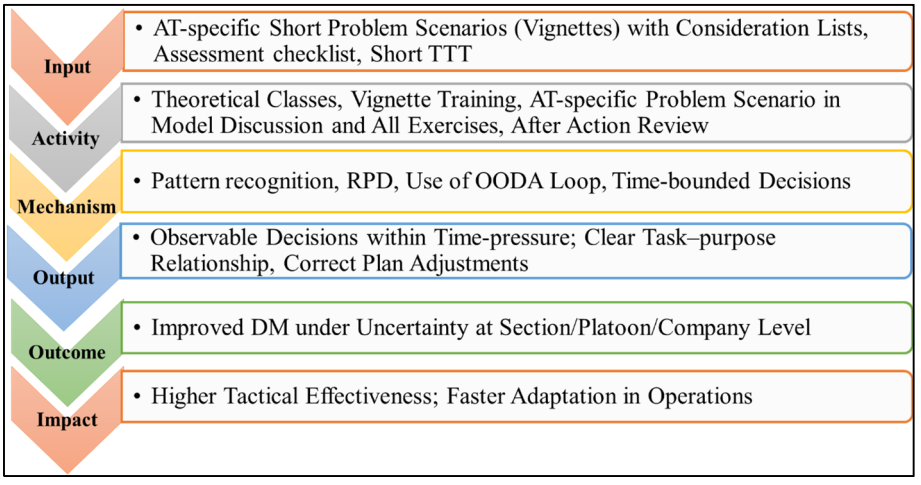
Figure 4: Adaptive Decision Loop



Source: Author's construct based on document study

c. **Implementation Logic Model**. The framework has been developed following the implementation logic model to refocus existing resources and allotted time to integrate AT training as shown in Figure 5.

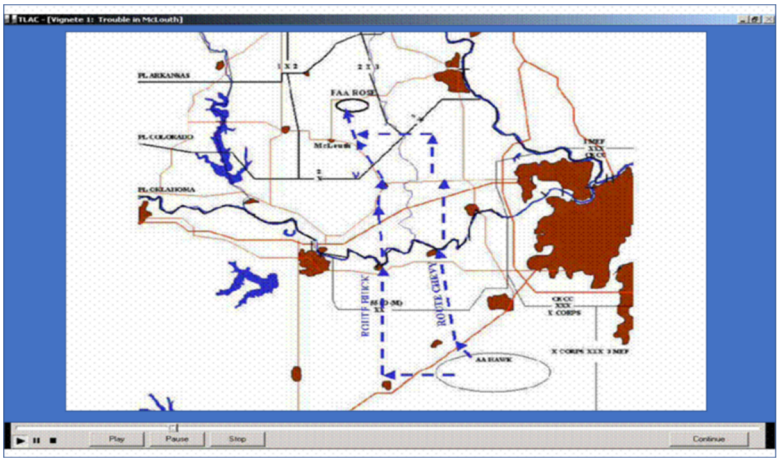
Figure 5: Implementation Logic Model



Source: Author's construct

d. **Training Materials and Scenario Set (Similar to Vignette of TLAC).** Training institutions will prepare short written, hand-drawn, power-point delivered, or video-based problems based on BA-specific scenario from CIO, UNPKO, in aid to civil power duties, or major operations. Each problem should include time-pressure and planned situation change. Similar to TLAC's 'expert indicator lists', a list of 'considerations' (10-16 items per problem) should be developed for each problem which the students will be shown during discussion. An example of vignette of TLAC is given as an example in Figure 6.

Figure 6: TLAC- Vignette Screen



Source: Adaptive Thinking Training For Tactical Leaders (Lussier & Shadrick, 2004).

e. **Instructor Preparation and Facilitation Standards.** A brief 'train-the-trainer' package to be arranged on running the discussion, probing effectively, using the consideration lists, assessing, and recording short after-action notes, following TLAC instructor preparation (Shadrick & Lussier, 2004).

f. **Vignette (Scenario) Based Training: Decision Drills.** Following the theoretical foundation of AT, vignette-based (short scenario based, in narrative and/ or graphical form) training should be introduced early by, inserting short decision drills. Each drill should begin by presenting the problem and setting a strict time limit for reaching a decision. Students will write a one-minute decision statement and a brief order. Thereafter, the instructor will lead a short, focused discussion and students will compare the factors they considered while making their decisions against the list of indicators/considerations.

g. **Adaptation of AT in MD and Tactical Exercises**. In MD and Tactical Exercise without Troops (TEWT) one/two planned problem should be incorporated during discussion in the form of Tactical Decision Games (TDG). The problem should include ambiguity/incomplete information, unforeseen enemy reactions, urgency of the situation and/or the application of the mission command principle (Lattimore-Staple, 2012). The TDG should be followed by a peer-reviewed discussion led by the instructor during which the considerations underlying and the DM process behind each decision will be discussed. Similar problems should be incorporated into Situational Training Exercises and Field Training Exercises using a simulated enemy or scenario-depiction by the instructor.

h. **Assessment**. In each event 5-8% marks can be reallocated to AT. The assessment should be observed behaviour based and outcome oriented. It should also measure the efficiency in DM and the presence of the AT indicators in DM while assessing.

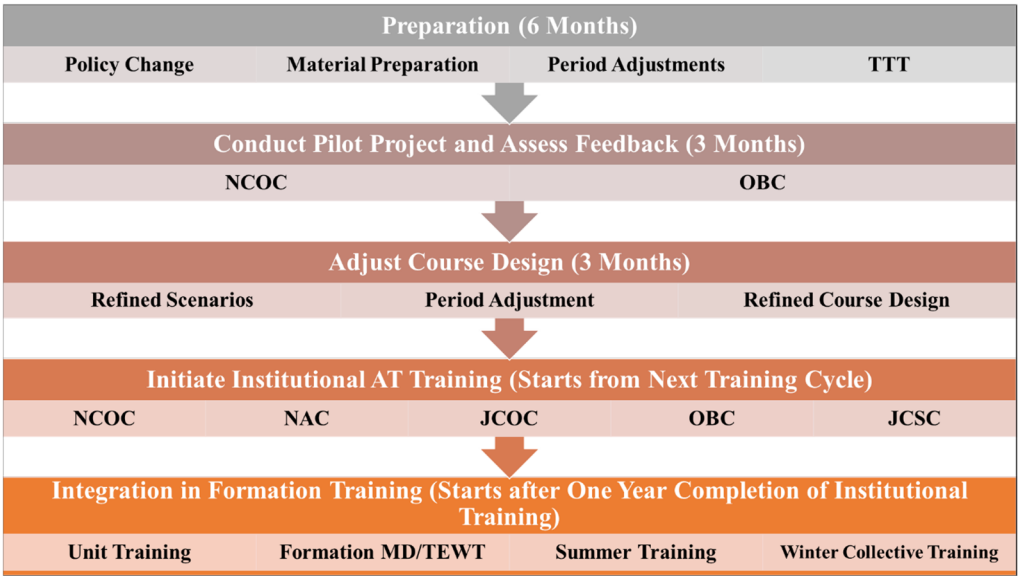
i. **Integration in Formation Training**. After sufficient personnel have been trained, AT training may be incorporated into formation-level training. In this aspect, formation level MD/TEWT, STX (TDG) will be most appropriate. AT specific tests/ scenario-depictions during Summer Training and Winter Collective Training must be planned by the formation. The exercise writing team may benefit from the 'Think Like a Commander Prototype: Instructor's Guide to Adaptive Thinking' (Lussier & Shadrick, 2003).

j. **Feasibility**. This integration framework uses existing period-allotment, instructors, training modules, and routine preparation. No new design, additional periods or equipment are required to implement this design.

k. **Limitations**. This framework is infantry-centric and does not include a long-term evaluation beyond the course duration. Findings should be interpreted accordingly.

l. **Phased Implementation**. An implementation plan over five steps is proposed in figure 7.

Figure 7: Phased implementation plan of AT integration



Source: Author's Construct

This framework demonstrates that AT training can be systematically integrated into BA's existing courses and formation training without additional resources. Through the suggested readjustments of current training module, JL can gradually develop pattern recognition, cognitive flexibility, and decision confidence. Such integration provides a feasible pathway to transform training culture, thereby preparing BA to meet the adaptive DM challenges of future operations.

Conclusion

JL in the BA face the constraint of operating in an increasingly VUCA environment, equipped primarily with training based on analytical approach to DM. However, in the context of future operations, adaptive decisions are essential. Yet, the current training

modality does not prepare the JL of BA to develop these cognitive skills. As a result, present state of DMC of JL is deficient in future operations context. The JCO/NCOs have a misplaced confidence in their own DMC due to their experience. However, their DMC is limited to analytical and hierarchical processes. In contrast, the junior and mid-level officers are more critical of their own DMC. They realise that their DMC is not suited for future operations. As a whole, the JL in BA struggle in DM with incomplete information and reassessing situation during ongoing operation. As they stick to preconceived contingencies, hesitates to take risk or fails to mitigate them, and have low confidence in DM; they cannot give correct and timely decisions under high-pressure environments. They also cannot adapt their decisions or plans when situations change during an operation. Consequently, enhancing the DMC of JL in BA is necessary to meet the DM challenges of future operations.

As AT is a trainable trait, a suitable existing method of AT training (TLAC programme) can be an effective way of AT integration in the current training system. Accordingly, the research proposes integration of TLAC programme within existing training module. It is a scenario-based training module where DM is practiced under time and information constraint, followed by peer and after-action review. The method through its design, develops pattern recognition and enables swift decision under pressure. The design allows integration of TLAC without additional resource or time allocation. The research finally proposes a phased implementation plan. Upon approval, following the plan, courses can run the programme within a year and integration in formation training can start after two years.

Recommendations

Basing on the findings, the following recommendations are made for integrating AT training in BA:

a. Army Training and Doctrine Command (ARTDOC) and Military Training Directorate should collaborate and conduct feasibility study of integrating AT training into existing training system by December 2026.

b. The ARTDOC in conjunction with School of Infantry and Tactics (SI&T), and JCOs and NCOs Academy (JNA) should formulate a comprehensive training module including suggested training materials based on the proposed framework to integrate AT training into the existing training system by March 2027.

c. SI&T and JNA should run a pilot programme based on the recommended training module in OBC and NCOC from July 2027 to assess feedback, and adjust course design by December 2027.

d. ARTDOC and Military Training Directorate should implement the adjusted course design from January 2028 and integrate AT training into formation training system at the earliest possible time.

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Biography



Major Sheikh Sadi, psc, Inf was commissioned with 71 BMA Long Course in the corps of Infantry in 2014. He is a graduate of Defence Services Command and Staff College, Mirpur and an alumnus of Army War College, MHOW, India. He holds a Master's degree from Bangladesh University of Professionals and a diploma from Devi Ahilya University, Indore, India. Apart from his mandatory courses, he attended Basic Para Course, Officers' Military Police Course, training on AGL in Singapore and Junior Command Course in India. Besides regimental appointments, the officer served as Assistant Operations Officer in Army Military Police Unit. As an instructor, he served as a Platoon Commander at BMA. He also served in counter insurgency operations in the Chattogram Hill Tracts. While serving as a Peacekeeper, in DR Congo, he received Force Commander's Certificate of Commendation 'in recognition of "Bravery" in exceptional circumstances'. He is currently serving as General Staff Officer Grade-II in Armed Forces Division, Prime Minister's Office.

Evaluating the Work Environment of BAF R&I and Its Impact on Aircraft Maintenance

Wing Commander Md Miraz Uddin, psc, Engg

Abstract

Bangladesh Air Force (BAF) has been modernising its aircraft to meet future national requirements. Without sound maintenance practices, it is not possible to achieve the best performance from any equipment. For a modern and sophisticated fleet to operate smoothly, the need for smart and effective maintenance is paramount. The work environment of aircraft maintenance facilities is crucial in influencing the performance of aircraft technicians, which ensures the quality of aircraft maintenance. Resource constraints, technicians' prolonged absences from maintenance jobs due to secondary duties, and increased flying requirements often create a heavy workload and fatigue among individuals. Furthermore, inadequate physical facilities and a lack of recognition also affect their performance. These factors ultimately affect the overall work environment of BAF Rectification and Inspection (R&I) Flights, where second-line aircraft maintenance is carried out. Inspired by the practical experience of BAF aircraft maintenance activities, this research has been conducted to evaluate the present work environment of BAF R&I Flights. This research identified the elements of a standard work environment in aircraft maintenance facilities. It assessed the present work environment conditions of BAF R&I Flights using a mixed-methods approach to get both qualitative and quantitative data. The findings validated a significant relationship between work environment and job performance. The research has recommended several measures to implement for the improvement of the work environment to ensure better maintenance outcomes.

Introduction

BAF has been contributing significantly to safeguarding Bangladesh's airspace, thus preserving the state's sovereignty. Over time, BAF aircraft fleets have been upgraded and developed to meet the national requirements. An important factor in the operational readiness of BAF is aircraft maintenance, which comprises specific tasks that require accuracy and adherence to safety protocols. Aircraft maintenance encompasses the identification, detection, and rectification of faults, as well as the overhaul, repair, and modification of aircraft systems, subsystems, and components (Karaoğlu, 2022). In BAF, second-line aircraft maintenance is carried out at the R&I

Flight. Work environments are places where employees are present as a requirement of their engagement in work-related activities (Khuong, 2016). It includes various factors or elements that differ by task, location, time of day, and technician speciality (Bosley & Miller, 2005). The work environment in aircraft maintenance facilities significantly impacts technicians' job performance (Sarah Gharib, 2021). According to the International Civil Aviation Organisation's (ICAO) Human Factors Guidelines for Aircraft Maintenance Manual, a technician's job performance is a key determinant of maintenance reliability, and errors in inspection or repair usually originate from human limitations shaped by work conditions (ICAO, 2002). Therefore, it is essential to assess the existing work environment of BAF R&I Flights.

Despite the fact that BAF is currently maintaining modern aircraft, the work environment of the R&I Flight is an area that demands additional attention. It is considered that, due to resource constraints, manpower shortage, and increased flying requirements, maintenance officers, supervisors, and technicians are committed to ensuring the timely completion of aircraft maintenance, which creates heavy workload and fatigue among individuals. Occasionally, the timely completion of aircraft maintenance gets priority over maintaining a standard work environment. The inadequacy of space for storing tools, ground equipment, and lubricants congests the work environment. Sometimes, a shortage of standard resting places for technicians and inadequate staff for cleaning the maintenance hangar and washrooms may degrade the overall work environment.

The scope of the research includes evaluating the existing physical, organisational, psychological, and cultural domains of the work environment in BAF R&I Flights and assessing their influence on job performance. The research has been conducted through document studies, surveys, interviews, and Focused Group Discussion (FGD) to obtain comprehensive insights into the present conditions. It focused on identifying the key challenges within the work environment, analysing their impact on technician performance, and providing recommendations to improve both working conditions and maintenance quality to ensure operational readiness of BAF aircraft.

Elements of a Standard Work Environment

The elements that determine a standard work environment vary depending on the task to be performed. Over the years, the flying hour generation of BAF indicates that R&I Flights have performed satisfactorily. This also indicates that the existing work environment of the R&I Flight is adequate to fulfil BAF flying requirements. It is also a fact that the existing aircraft fleets are likely to be replaced by more sophisticated

and modern aircraft in the near future. Continuous evaluation of existing practices is required for effective aircraft maintenance management. A good work environment is a crucial determinant of aircraft maintenance effectiveness and reliability, thereby ensuring flight safety. Within BAF, particularly in the R&I Flights, identifying the elements that determine a 'standard' work environment is necessary for maintaining high maintenance standards. The elements or aspects of the work environment can be categorised into three major domains: physical, organisational, and psychological and cultural domains.

Physical Elements of the Work Environment

The physical work environment encompasses various factors, including workplace design, humidity, lighting, temperature, cleanliness of the work area, and noise control. Aircraft maintenance organisations need to acknowledge that these conditions are influential to improve the quality performance, and cooperate with the workforce to review and improve the physical environment (FAA, 2023). Many studies have suggested that the physical work environment plays a critical role in influencing technicians' physical and mental stress. The alterations to design, materials, and layout have resulted in either better or worse outcomes for employees (Sander, 2019). Under the physical domain of the work environment, the following elements are included:

a. **Workplace Layout**: A well-planned workspace layout for aircraft maintenance ensures the smooth movement of technicians. It minimises the risk of injury, as maintenance hangars are filled with a wide range of tools, ground support equipment, and other materials, such as lubricants and petroleum products. Organising and separating different zones for inspection, rectification, modification, and the storage of components or lubricant storage helps to expedite the workflow and reduce human error.

b. **Ventilation and Climate Control**: The required airflow in a maintenance hangar is necessary to maintain a healthy work environment. If the air is stagnant, harmful fumes or gases may accumulate and cannot pass quickly. Moreover, variation of temperatures inside hangars, resulting from less airflow, can affect the health of technicians. Proper air circulation is necessary to prevent moisture accumulation; otherwise, it can lead to corrosion and damage to aircraft components.

c. **Lighting and Noise Control**: Inadequate lighting hampers the timely completion of maintenance tasks. It increases the probability of errors.

Equally important is the control of surrounding high-pitched noise, which often originates from aircraft engine runs, pneumatic testers, or high-velocity rotating parts inside any testers or equipment. Long-term exposure to high-noise environments can cause hearing fatigue, communication problems among team members, and long-term auditory damage among technicians.

d. **Cleanliness and Housekeeping**: Maintaining a clean, dust-free environment and appropriate housekeeping in aircraft maintenance hangars are essential to prevent Foreign Object Damage (FOD). Otherwise, it can compromise flight safety. FOD caused by loose, disorganised tools, debris, or other contaminants can damage aircraft and their components. Regular cleaning, proper tool management, and awareness training are effective measures for the FOD mitigation strategy. Organised workspaces reduce the risk of hazards and enhance technicians' morale (FAA, 2013).

e. **Ergonomics**: Ergonomics in aircraft maintenance hangars helps to lessen the physical and cognitive fatigue of technicians, who often work in stressful and physically demanding positions. Poor ergonomic design contributes to physical strain and long-term health issues, particularly when maintenance tasks involve awkward postures or poorly placed tools.

Organisational Elements of the Work Environment

The organisational elements of the work environment in aircraft maintenance facilities include the less tangible aspects of the workplace, including communication within different levels of organisation, cooperation, shared values, and overall organisational management. A positive organisational environment fosters leadership, effective communication, and commitment to aviation safety. These influence technicians' morale, performance, and the overall quality of maintenance tasks. The best organisational environment conditions occur when the values are promoted with strong leadership, effective communication, and shared objectives associated with flight safety (SOFEMA Aviation Service, 2019). The elements of organisational work environment include:

a. **Leadership and Supervision**: Leadership plays a vital role in promoting and articulating an organisation's vision and strategic objectives. Strong leadership is paramount to fostering a safety culture where technicians are encouraged to report issues and contribute to hazard mitigation without fear of reprisal. Effective supervisors and leaders are needed in the aircraft

maintenance team to mentor staff, provide direction, and monitor adherence to aviation standards. Organisations with engaged leadership demonstrate higher levels of teamwork, continuous learning, and systemic awareness, which are crucial for preventing failures. The LIPS principles, which are Leadership, Independence, People, and Simplicity, proposed after the British maritime patrol aircraft Nimrod's accident, emphasise leadership as the first and most critical component to ensure the safety of aircraft operation and maintenance. Supervisors play a significant role in assigning the right tasks to the right person, real-time decisions, and maintaining discipline in the maintenance work environment. A proactive supervisory role also helps to identify and mitigate procedural shortcomings before any kind of ground incident. Supervision is not only a managerial responsibility, but it is also a foundational measure to ensure the quality of aircraft maintenance and flight safety (ICAO, 2003).

b. **Workload Distribution**: An imbalance between workload and available manpower increases the likelihood of following shortcuts in performing tasks, taking faulty steps, or compromising inspection quality. Excessive workload is a contributor to human error, particularly under time pressure or shift constraints (Sky Brary, 2021). Even skilled personnel's performance can decline when the demands of the task exceed their capacity and time.

c. **Continuous Learning Environment**: Continuous learning is not just a professional necessity in aircraft maintenance; it is a roadmap to safety as well. As technology advances and new regulations evolve, staying updated is very important for technicians and supervisors. By studying various learning resources and engaging in dialogue, aviation maintenance professionals can ensure that they remain confident in their profession (Mujahid, 2024).

d. **Shift Scheduling and Duty Hours**: Poorly managed shift schedules contribute to fatigue, thereby reducing technicians' ability to concentrate during critical maintenance tasks. Organisations must consider both the timing and rotation of shifts to balance the workload of technicians while safeguarding their health and safety. Effective shift scheduling supports not only physical recovery from fatigue but also helps to increase mental alertness, job satisfaction, and maintenance accuracy (Basaria, 2023).

Psychological and Cultural Elements of the Work Environment

Psychological comfort and cultural inclusiveness significantly impact technician engagement and safety. Key elements include:

a. **Safety Culture**: Safety culture refers to the shared values, attitudes, and behaviours that exist across all levels of an organisation. A critical component of safety culture is the presence of a non-punitive, fear-free reporting system, which enables staff to report hazards without fear of reprisal. A strong safety culture empowers employees to take personal responsibility for safety, act to enhance it, and learn from incidents (Douglas A. Wiegmann, 2002).

b. **Team Dynamics and Communication**: In aviation maintenance, trust among the supervisors and technicians plays a significant role in enhancing safety. The lack of communication in aircraft maintenance poses a threat to aviation safety, maintenance reliability, and organisational integrity. By bolstering effective communication practices and encouraging a culture of openness, organisations can minimise the risks associated with communication failures and uphold the highest standards of safety and reliability in aircraft maintenance operations (Shahil, 2024).

c. **Recognition and Motivation**: Technician morale state improves when supervisors or senior leadership extend even verbal recognition and acknowledge contributions during any informal or formal meetings. Fair and just workload distribution is related to increasing the motivation level. Transparent communication, particularly relating to performance feedback and technical information updates, helps technicians feel accountable and valued.

d. **Reporting Culture**: Technicians will be more interested to report maintenance flaws and safety hazards when the environment is congenial, learning-oriented rather than punitive**.** Fear of blame and frequent disciplinary action discourages reporting, leading to the tendency to refrain from reporting various events and latent hazards. When leadership uses a mechanism for systemic improvement rather than finding fault, it builds trust and accountability among the technicians (James F. Parker, 1991).

Table 1: Elements of Work Environment

Dimension	Key Elements
Physical	Workspace Layout, Ventilation and Climate Control, Lighting and Noise Control, Cleanliness and Housekeeping, Ergonomics
Organisational	Leadership and Supervision, Workload Distribution, Continuous Learning Environment, Shift Scheduling and Duty Hour
Psychological and Cultural	Safety culture, Team Dynamics and Communication, Recognition and Motivation, Reporting Culture

Source: Author's self-construct

Present Work Environment of BAF R&I Flight

40.3% of survey participants rated the physical work environment of BAF R&I Flights as 'Moderate', while 32.7% rated it as 'Good'. A good number of participants expressed their concerns regarding the improvement of the existing lighting and air circulation facilities in the maintenance hangars. Many of BAF R&I hangars have insufficient exhaust fans for air circulation. The number of Electric stand fans is also required to be increased in most of the R&I Flights. As a result, working inside the hangars, especially during the humid summer months, becomes difficult. Several participants mentioned that the crew room and classroom for the technicians are required to be modernised, with the latest multimedia facilities. Aircraft spares cannot be stored properly due to a shortage of storage facilities at many R&I Flights, as over time the number of aircraft increased, but not the storage capacity equally. The survey participants have emphasised the necessity of non-slippery floor paint and closed, climate-controlled hangar facilities for aircraft maintenance.

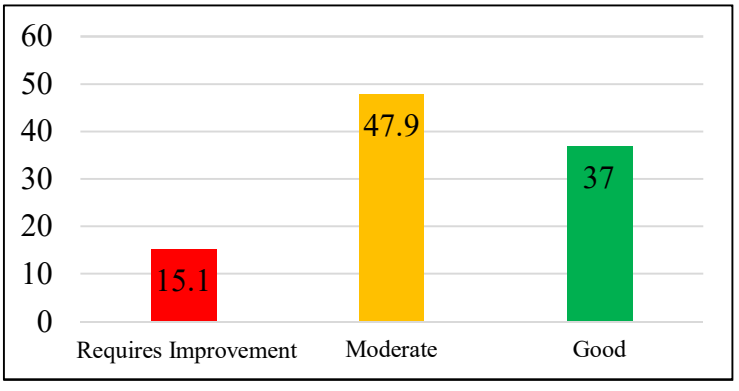
39.3% of the participants believe that the organisational work environment is 'Moderate,' while 44.2% and 16.5% of the participants believe it is 'Good' and 'Requires Improvement,' respectively. Many participants opined that, due to the increased secondary duties of the technicians, they are unable to concentrate fully on the technical jobs for a few days in a month. This gap causes many technicians, particularly those who are comparatively new, to miss the opportunity to learn continuously. Technicians' absence from the technical job environment alters their technical mindset. Sometimes, after completing their secondary duties, when technicians rejoin the activities of the R&I Flight, it has been observed that technicians' technical discipline and awareness have degraded. Technicians recovering from this situation take time, in some cases more than a month. During this period,

supervisors are sometimes hesitant to assign those technicians sophisticated maintenance jobs.

42.6% of the participants rated the work environment in the psychological and cultural domains as 'Moderate,' while 41.3% and 16.2% responded with 'Good' and 'Requires Improvement,' respectively. Many of the technicians opined that if an environment is created where information sharing is smooth and recognition for hard work is increased, the morale of technicians would increase compared to the present state.

After assessing the response of the participants related to the assessment of the present work environment of BAF R&I Flights, it has been found that 47.9% of the participants believe that the overall work environment is 'Moderate', whereas 37% and 15.1% believe that it is 'Good' and 'Requires Improvement' respectively.

Figure 1: Overall Work Environment



Source: Author's self-construct

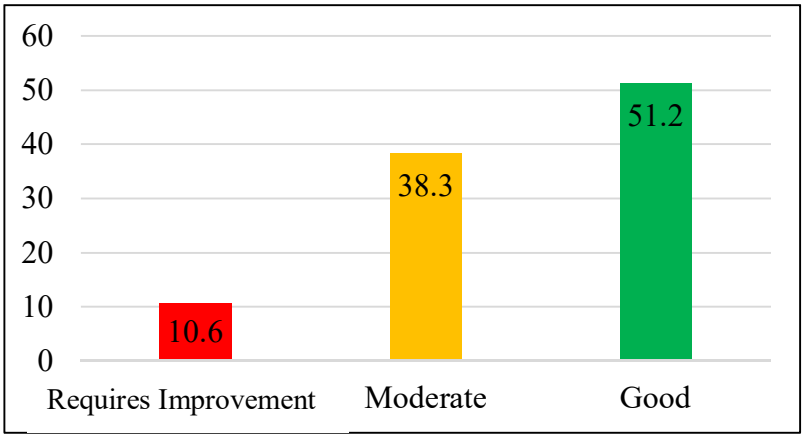
Influence of the Present Work Environment

The influence of the present work environment on the job performance of R&I Flights technicians has been evaluated by viewing both the qualitative and quantitative data analysis to establish causal relationships between the work environment of BAF R&I Flights and the technicians' job performance. Here, the job performance of the aircraft technicians has been assessed, as the effectiveness of aircraft maintenance mainly relies on the technicians' performance in carrying out the maintenance tasks. The survey analysis indicates that 51.2% of participants believe that the job performance is 'Good,' while 38.3% and 10.6% consider it to be 'Moderate' and 'Requires Improvement', respectively.

The analysis finds a significant and positive relationship between the job performance of BAF R&I Flight technicians and the present work environment. Statistical tests, including Pearson correlation on physical, organisational, psychological and cultural domains of work environment, confirm that improvements in the technician's job performance are strongly associated with higher levels of work environment. "Pearson correlation analysis showed a statistically significant positive correlation between the overall work environment and job performance ($r = 0.595$, $p < 0.01$). Examined by domain, the correlation coefficients were $p = 0.000$ for the physical work environment, $p = 0.001$ for the organisational work environment, and $p = 0.001$ for the psychological and cultural work environment. So, it can be said that as the work environment improves, job performance tends to increase proportionally.

Better lighting, ergonomic tools, supportive leadership, open communication, and a culture of psychological safety contribute directly to task completion. In addition, SOP adherence, teamwork, and accountability by the supervisors also improve job performance.

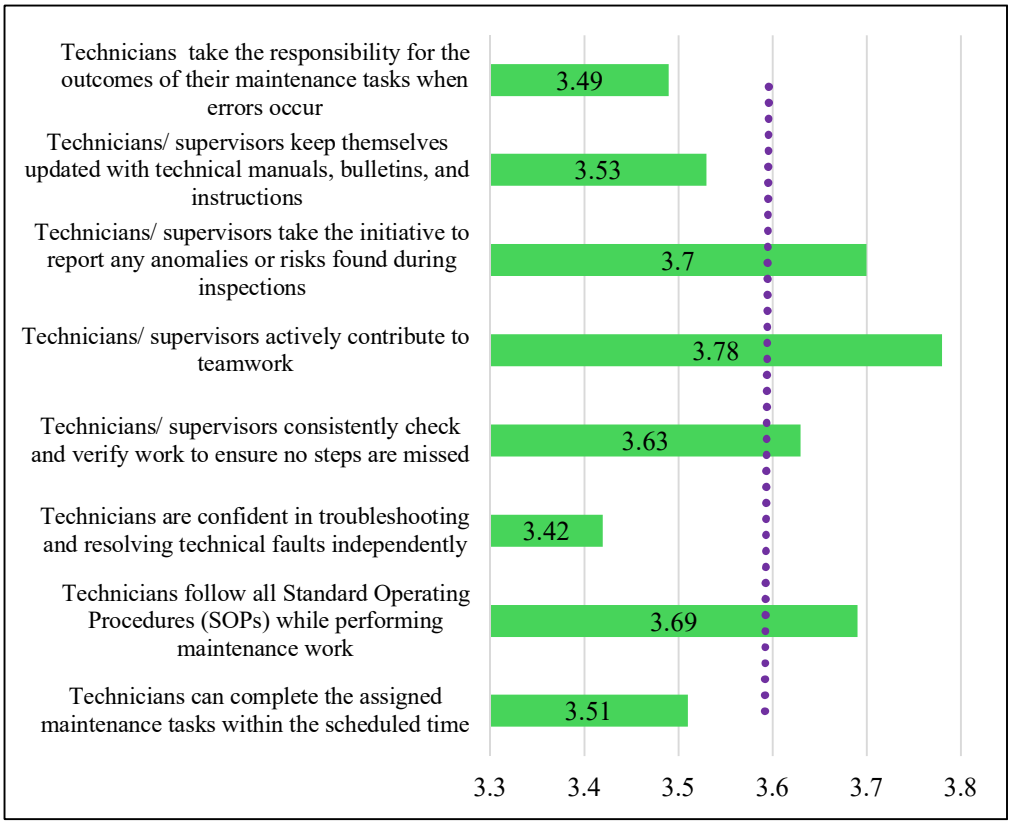
Figure 2: Job Performance Evaluation



Source: Author's self-construct

By analysing the mean value of the responses of the survey, it is found that the overall job performance mean is below 3.6, marking it as 'Moderate' as the mean value 2.23-3.66 falls under 'Moderate'.

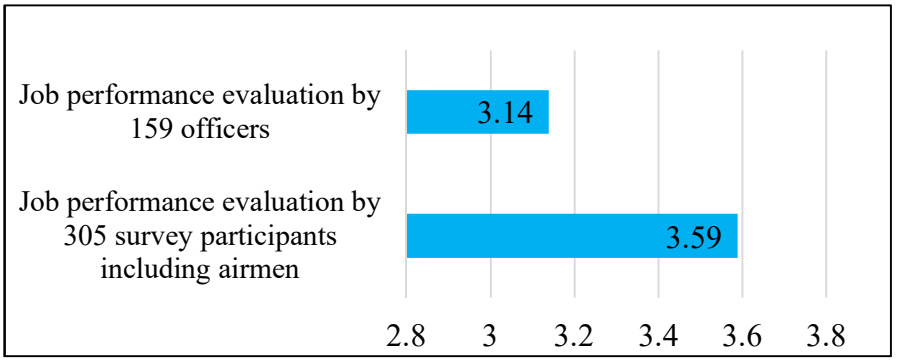
Figure 3: Mean Result of the Survey on Job Performance



Source: Author's self-construct

Analysing the data of 159 officers out of the 305 survey participants, it has been found that the mean result of job performance dropped to 3.14 from the previous overall job performance mean of 3.59. This data indicates that there is a difference in the understanding of job performance between officers and airmen. As officers hold supervisory and managerial responsibilities, they tend to assess job performance against broader organisational standards, which may lead to more critical evaluations. Airmen, by contrast, largely assess performance based on the completion of their immediate technical tasks.

Figure 4: Difference in the Mean Value



Source: Author's self-construct

Several respondents expressed their satisfaction over the success of maintaining second-line maintenance of BAF aircraft independently without any major incidents and marked this as a sign of better technical efficiency. However, a major concern raised by the survey participants is the shortage of manpower, which forces technicians to perform both technical tasks and secondary duties, such as guard duty, administrative work, and attachment to other organisations for extended periods. This multitasking environment considerably reduces the time available for technical work by individual technicians, especially for junior technicians, hampering their learning effectiveness. Technicians mentioned that sometimes, due to secondary duties, they get less time for an actual trade job, which is insufficient for developing confidence in carrying out maintenance tasks in sophisticated aircraft systems. Sometimes, the non-availability of updated tools, digital manuals, and well-structured on-the-job training has also been reported as a barrier to gaining proficiency in performance. Survey participants also emphasised the need for timely recognition of good work, which can help to increase the morale of the technicians. Additionally, several technicians suggested that leadership needs to foster accountability, strengthen supervision and provide better psychological support. Overall, job performance will improve in comparison with its present state if the above factors are taken into consideration.

Limitations of the Research

The survey was conducted among selected personnel from different BAF R&I Flights, and the findings may not fully represent the conditions across all R&Is and aircraft types. The data reflect respondents' perceptions at the time of the survey and may change as conditions evolve. Because the assessment relied on self-reported perceptions collected through surveys, interviews, and FGDs, the findings may be subject to individual bias.

Conclusion

Aircraft maintenance activities constitute one of the most important safety-critical domains in aviation. BAF, operating under resource constraints yet maintaining high operational readiness, faces numerous challenges in maintaining a standardised work environment. For BAF, the operational readiness of both combat and non-combat aircraft depends on the technicians' ability to carry out their maintenance tasks with precision, accuracy, and professionalism. A continuous endeavour to improve the work environment of BAF R&I Flights is necessary to achieve the effective maintenance capability required for the future operation of more sophisticated platforms.

The research has identified three domains of the work environment. These include physical, organisational, and psychological and cultural domains. These domains have been utilised as the analytical lens to find the present work environment conditions of BAF R&I Flights. The job performance of aircraft technicians has been evaluated in terms of the influence of each domain of the work environment. Data from 305 respondents formed the foundation for the quantitative analysis, while rich qualitative data from interviews, the literature review and FGD provided valuable insights.

From the data analysis, it has been found that the overall work environment of BAF R&I Flights was rated as ‘Moderate’ by 47.9% of the total participants, while 37% of the participants rated it as ‘Good’. The remaining 15.1% of the participants considered it to ‘Requires Improvement’. Simultaneously, job performance was rated primarily as ‘Good’ by 51.2% of the participants. However, the mean performance score remained within the ‘Moderate’ range. Statistical analysis revealed a significant positive correlation between the work environment and job performance, confirming that the quality of the work environment directly affects technician performance

Recommendations

Based on the findings, the following recommendations are offered:

a. To upgrade the maintenance hangar lighting, ventilation, and climate control systems to provide a healthier and safer working environment.

b. To upgrade the storage areas for spares and equipment, ensuring better organisation, accountability and safety of spares and reduced risk of damage.

c. To renovate crew rooms and resting facilities to enhance technician morale.

d. To minimise secondary non-technical duties of R&I Flight technicians to ensure consistent presence for trade-specific aircraft maintenance tasks.

e. To standardise best practices across R&I Flights by developing a Work Environment Management Manual for BAF R&I Flight.

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Biography



Wing Commander Md Miraz Uddin, psc, Engg was commissioned in the Engineering branch of the Bangladesh Air Force on 01 December 2009. He obtained his B.Sc in Aeronautical Engineering from the Military Institute of Science and Technology in 2012. He has done various professional courses at home and abroad. Some of the notable courses are Aircraft Structural Health Monitoring Course from Pakistan, Fighter Aircraft Maintenance Course from China, Non-Destructive Testing Course from the Atomic Energy Commission of Bangladesh, and Fighter Aircraft Life Extension Course from 214 MRO Unit. He served as Officer in Charge of MI-17 and F-7 BG R&I Flights, Mechanical Transport Squadrons at different Bases, 214 and 216 MRO Unit. Wing Commander Miraz also served in the UN Mission at MONUSCO and MINURSO as Military Observer. On completion of his graduation from DSCSC, he is now serving at BAF Base AKR as Officer in Charge of the Aircraft Engineering Squadron.

Developing Soft Skills for Enhanced Professional Competence of Junior Officers: Bangladesh Army Perspective

Major Md Mahmudul Hassan, psc, Inf

Abstract

This study explores soft skills as a key contributor to professional competence among the Junior Officers (JOs) of the Bangladesh Army (BA). In the contemporary dynamic operational environment, soft skills such as effective communication, leadership, and decision-making demand greater importance than ever before. Moreover, at the sub-unit level, emotional intelligence and ethical judgement carry equal importance alongside technical skills. The study identifies the status of JOs' soft skill development and its shortcomings, revealing that though the importance of developing soft skills is acknowledged, related training lacks clear objectives, remains unsynchronised, and appears fragmented. Both qualitative and quantitative evidences confirm that systematic and structured soft skill development can significantly enhance the JOs' professional competence. However, the embedded organisational efforts by BA in renowned training institutions are duly considered in the study. The paper recommends a coherent model that integrates existing practices with the proposed way forward, supported by structured objectives to improve soft skills of the JOs in the Bangladesh Army.

Introduction

In the increasingly complex and dynamic security environment of the twenty-first century, military effectiveness is no longer determined solely by technical expertise or physical prowess. Soft skills - the intangible yet indispensable qualities that govern how officers communicate, lead, decide, and relate - have emerged as critical determinants of professional competence. For Junior Officers (JOs) in the Bangladesh Army (BA), mastery of these skills is not merely desirable but operationally essential.

Soft skills in the military, though not a novel concept, has gained formal recognition only in recent times. Defined as quantitatively non-measurable skills gained through progressive training and experience (Cherni & Slimeni, 2024), they encompass cognitive and meta-cognitive skills, socio-emotional skills, and foundational digital literacy (Säälik, 2022). These competencies strengthen leadership, enhance verbal and written communication, sharpen decision-making, and cultivate sound ethical and moral judgement.

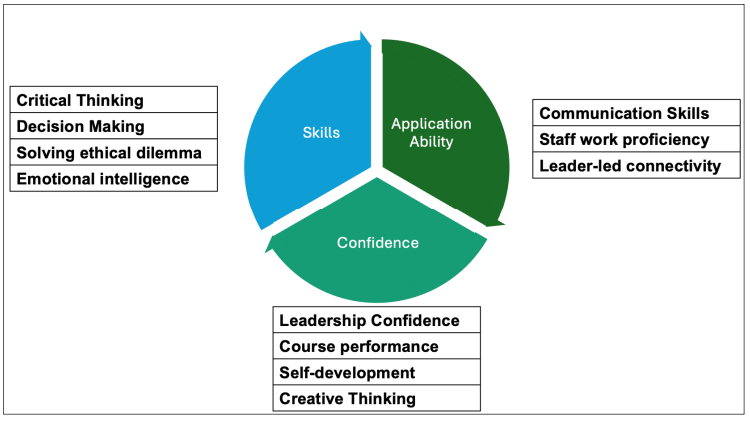
JOs in the BA serve as the institutional backbone of the organisation, bearing direct responsibility for troop leadership, tactical execution, and day-to-day command. Yet, evidence consistently points to a gap in soft skill development - manifested in leadership challenges, communication deficiencies, and inadequate ethical decision-making. Left unaddressed, these shortcomings erode professional competence and diminish operational readiness. The BA, therefore, requires a coordinated, institution-wide effort to address these critical deficiencies and equip JOs to meet future challenges effectively.

This paper investigates the current state of soft skills among JOs in the BA, identifies systemic drawbacks in the existing training framework, and proposes evidence-based ways forward to bridge the identified gap. The central argument is that structured, objective-driven soft skill development is not an optional adjunct but a strategic necessity for building the professional competence of JOs in the BA.

An Assessment of the Status of the Constituents of Professional Competence Among JOs

a. **Defining Professional Competence**. Professional competence refers to a comprehensive set of abilities, skills, and qualifications that enable a person to perform professional assignments effectively and ethically (Säälik, 2022). The military, as a uniquely demanding profession, requires a higher standard of professional competence from its members, particularly junior officers who operate at the critical interface between command and execution. The core constituents of professional competence for a junior officer, depicted in Figure-1, span leadership, decision-making, communication, emotional intelligence, and staff work proficiency.

Figure 1: Cardinals of Professional Competence



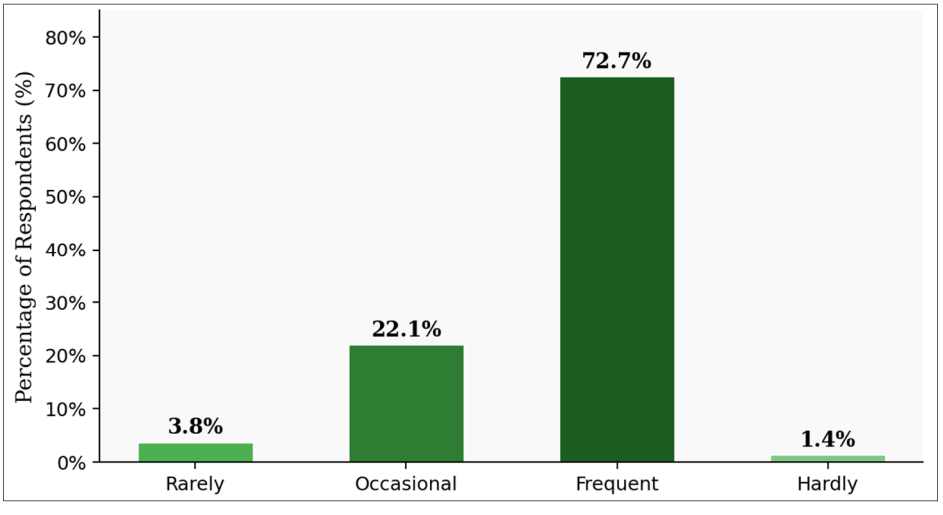
Source: Author's own construct.

b. **Leadership Confidence**. Leadership confidence is a foundational component of professional competence, directly influencing a JO's capacity to command, inspire, and take decisive action under pressure. Evidence from field assessments indicates that the average leadership confidence among JOs is 6 on a scale of 10 - a level that, while functional, falls short of the standard required by modern operational requirements.

A measurable discrepancy exists between demonstrated leadership performance and superior officers' expectations, underscoring the need for targeted interventions to cultivate confidence and resolve. However, praiseworthy leadership confidence was demonstrated by the JOs during the recent In Aid to Civil Administration deployment, except in a few cases.

c. **Decision-Making**. Decision-making constitutes one of the most challenging domains of professional competence for JOs. As illustrated in Chart-1, approximately 72.7% of junior officers frequently face difficulties in decision-making, pointing to systemic gaps in training and preparation. The root causes lie in the absence of structured decision-making frameworks and insufficient technological proficiency. Additionally, JOs frequently report feeling insufficiently empowered to exercise independent judgement, suggesting that the organisational culture of command may itself act as a structural constraint.

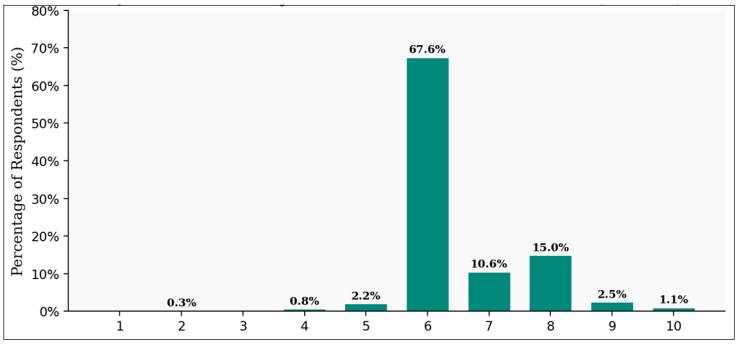
Chart 1: State of Difficulties Faced in Decision Making



Source: Author's own construct.

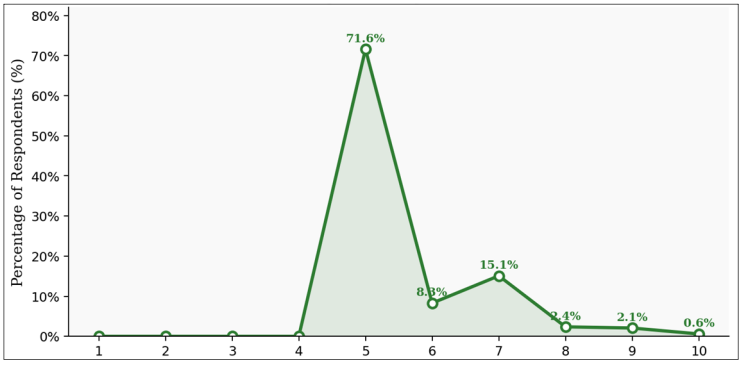
d. **Communication Skills.** Communication skills - encompassing both written and oral dimensions - are indispensable to the daily functioning of a junior officer. The average rating of communication skills among JOs stands at 6 on a scale of 10. As shown in Chart 2, most respondents (67.6%) rated their verbal communication skills at 6, with very few attaining higher ratings. Content analysis of indoor exercises on communication skills conducted during the Junior Command and Staff Course vividly confirms this shortcoming.

Chart 2: State of Verbal Communication Skill



Source: Author's own construct.

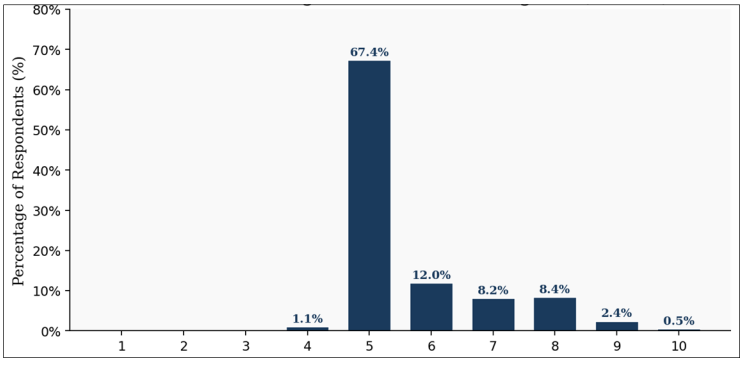
Chart 3: Writing Skill of JO



Source: Author's own construct.

e. **Emotional Intelligence**. Emotional intelligence is a nuanced and profoundly consequential soft skill that underpins effective leadership at the sub-unit level. It facilitates trust-building with subordinates, supports sound decision-making in high-pressure environments, and enables empathetic, situationally aware command. As shown in Chart 4, approximately 67.4% of JOs rated their knowledge of emotional intelligence at 5 on a scale of 10, indicating that this dimension is yet to receive adequate institutional attention.

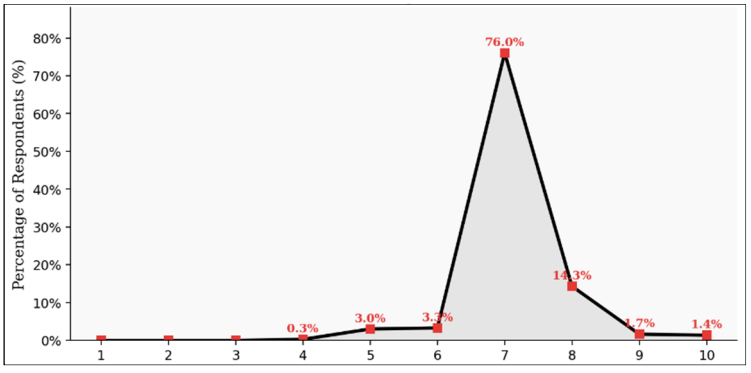
Chart 4: Status of Knowledge on Emotional Intelligence



Source: Author's own construct.

f. **Staff Work Proficiency**. Staff work proficiency is a key performance indicator for JOs, relying on a constellation of soft skills including time management, technological proficiency, creative thinking, and situational awareness. As shown in Chart 5, approximately 76% of respondents rated their staff work proficiency at 7 on a scale of 10. However, a measurable gap persists between actual performance and the expectations of superior officers, highlighting the need for more deliberate and targeted development.

Chart 5: Staff Work Proficiency Indicator

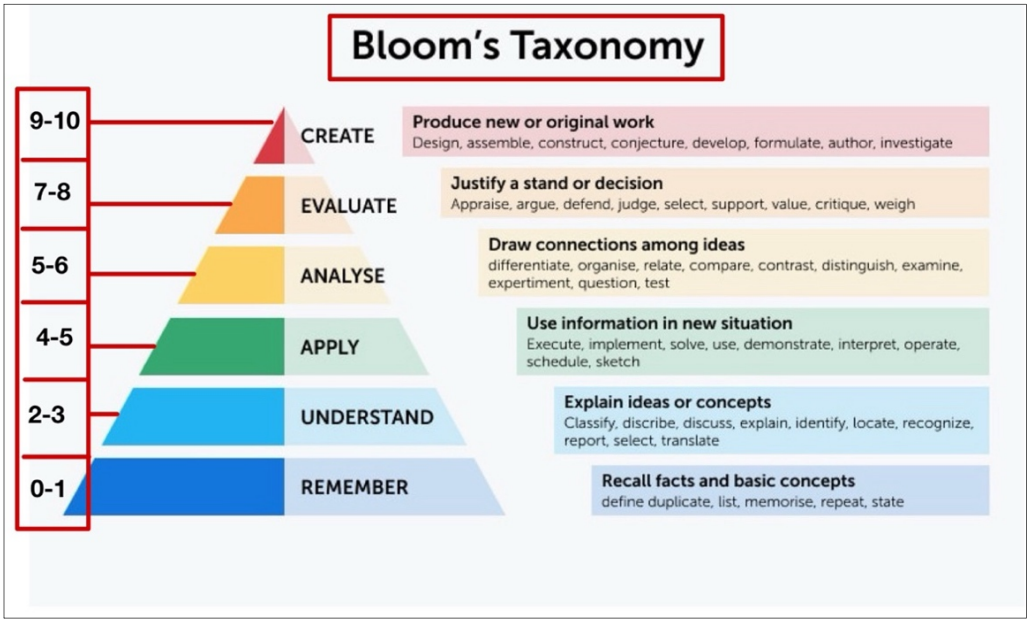


Source: Author's own construct.

Analysis of the State of Soft Skills

Bloom's Taxonomy of Learning offers a rigorous and widely validated framework for assessing the depth of skill acquisition across six hierarchical stages: Remember, Understand, Apply, Analyse, Evaluate, and Create. This taxonomy was employed to assess the current state of soft skills among JOs in the BA, with each stage graded on a scale of 0 to 10 as depicted in Figure 2.

Figure 2: Bloom's Taxonomy of Learning



Source: Adapted from: https://www.valamis.com/hub/blooms-taxonomy.

The conversion table below presents the consolidated assessment of each soft skills constituent against the Bloom's Taxonomy scale, comparing current and expected standards.

Table 1: Conversion Table

Constituents of Professional Competence	Survey Score	Wt	Score-1	FGD Score	Wt	Score-2	Interview Score	Wt	Score -3	Overall (1+2+3)	Level in Blooms Taxonomy
Leadership confidence	7	.5	3.5	6	.25	1.5	6.5	.25	1.62	6.62	**Analyse**
Critical thinking	6.5	.5	3.25	6	.25	1.5	5	.25	1.25	6	**Analyse**
Decision making	6	.5	3	6	.25	1.5	6	.25	1.5	6	**Analyse**
Communication skills	6.5	.5	3.25	6	.25	1.5	5.5	.25	1.37	6.12	**Analyse**
Solving ethical dilemma	6	.5	3	5	.25	1.25	5	.25	1.25	5.5	**Apply**
Develop emotional intelligence	5	.5	2.5	5	.25	1.25	5.5	.25	1.37	5.12	**Apply**
Staff work proficiency	8	.5	4	6.5	.25	1.62	6	.25	1.5	7.12	**Evaluate**
Course performance	7	.5	3.5	6	.25	1.5	6	.25	1.5	6.5	**Analyse**
Leader-led connectivity	8	.5	4	6	.25	1.5	6.5	.25	1.62	7.12	**Evaluate**
Self-development	5	.5	2.5	5	.25	1.25	5	.25	1.25	5	**Apply**
Creative thinking	5	.5	2.5	4.5	.25	1.12	5.5	.25	1.37	4.99	**Apply**

Source: Author's own construct.

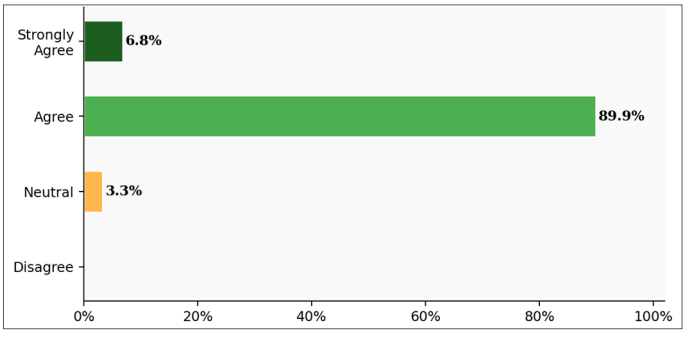
The analysis reveals that most soft skill constituents are clustered at the Apply and Analyse stages (scores 4-6 on the scale), indicating functional competence but a significant gap before reaching the higher-order Evaluate and Create stages. Decision-making and leadership confidence are situated at the Analyse stage (scores 6-6.6), while emotional intelligence and creative thinking are situated at the Apply stage (scores 4.99-5.12). The transition to higher-order stages requires deliberate instructional design, structured feedback, and sustained developmental opportunities - conditions are not yet consistently embedded within the BA training system.

The Drawbacks of the Existing Systems in Imparting Soft Skills

a. **Absence of a Definite Objective**. Setting a clear objective is a primary institutional requirement for the effective development of soft skills. Currently, soft skill learning objectives exist, but they are embedded rather than explicitly defined. Approximately 98% of research participants affirmed that the absence of a clearly defined and visible objective constitutes the primary barrier. Notably, the Communication Skill Development Programme (CSDP) of BMA, which incorporates a soft skill development objective within its three-year training programme (CSDP, 2021), demonstrates that objective-driven development within the BA framework is both feasible and beneficial.

b. **No Stand-Alone Model**. A stand-alone model is a system that can operate independently without requiring integration with other systems. According to the framework proposed by the Ministry of Higher Education of Malaysia (2006), soft skills may be imparted through either stand-alone models or embedded programmes. Training institutions in the BA, including the School of Infantry and Tactics (SI&T), do not currently operate any stand-alone model for soft skill development (Training Implementation Plan of JCSC, 2022). As shown in Chart 6, approximately 89.9% of participants agreed, and a further 6.8% strongly agreed that the absence of a stand-alone model constitutes a core institutional drawback.

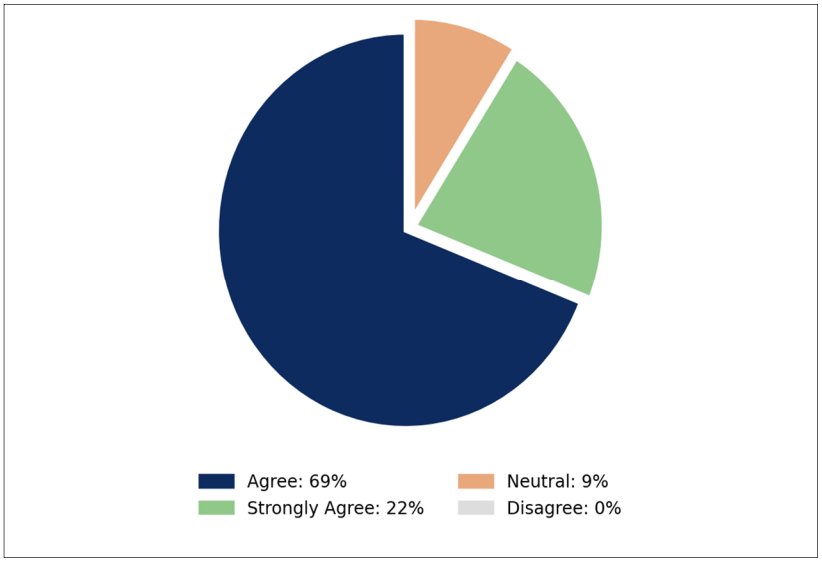
Chart 6: Summary of Opinion on No Stand-alone Model



Source: Author's own construct.

c. **Absence of a Comprehensive Embedded Training Module**. Embedded training modules for soft skill development exist within the BA training system but are neither comprehensive in coverage nor synchronised across core training institutions. SI&T incorporates elements of critical thinking and decision-making through Model Discussions (MD), Tactical Exercise Without Troops (TEWT), Situation Training Exercises (STX), and Field Training Exercises (FTX), yet comparable opportunities are rarely afforded to JOs at the formation level. As shown in Chart 7, approximately 91% of respondents expressed agreement that the absence of comprehensive embedded programmes constitutes a significant drawback (TIP JCSC, 2022).

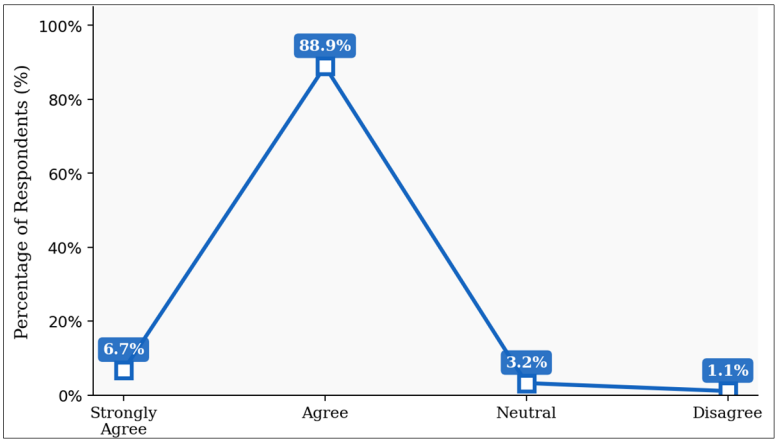
Chart 7: Opinion on Absence of Comprehensive Embedded Programmes



Source: Author's own construct.

d. **Difficulty in Measuring Progress**. The inherently qualitative nature of soft skills renders the measurement of developmental progress a persistent institutional challenge. Assessing growth in leadership confidence or emotional intelligence cannot be meaningfully reduced to objective marking criteria without significant loss of validity (Doyle, 2019). Instructors frequently face difficulties in assigning quantifiable grades to subjective competencies, and no standardised tool currently exists to assess soft skill development across domains. As Chart 8 illustrates, 88.9% of participants agreed and a further 6.7% strongly agreed that difficulty in measuring progress constitutes a significant structural barrier.

Chart 8: Difficulty in Measuring Progress

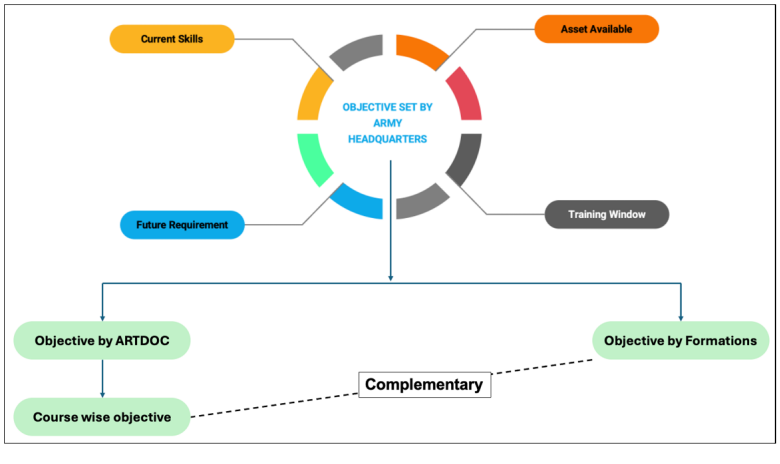


Source: Author's own construct.

Ways Forward to Develop the Soft Skills of JO

a. **Setting Soft Skill Learning Objectives**. The absence of a hierarchy-wide objective is the foundational barrier to progress. An army-level soft skill development objective should be established by AHQ, Military Training (MT) Directorate, considering the current status of soft skills, projected operational requirements, and available means and tools. This overarching objective should cascade into complementary formation-level and institution-level objectives, ensuring coherence and accountability across the training system, as illustrated in Figure 3.

Figure 3: Setting Level-wise Objectives

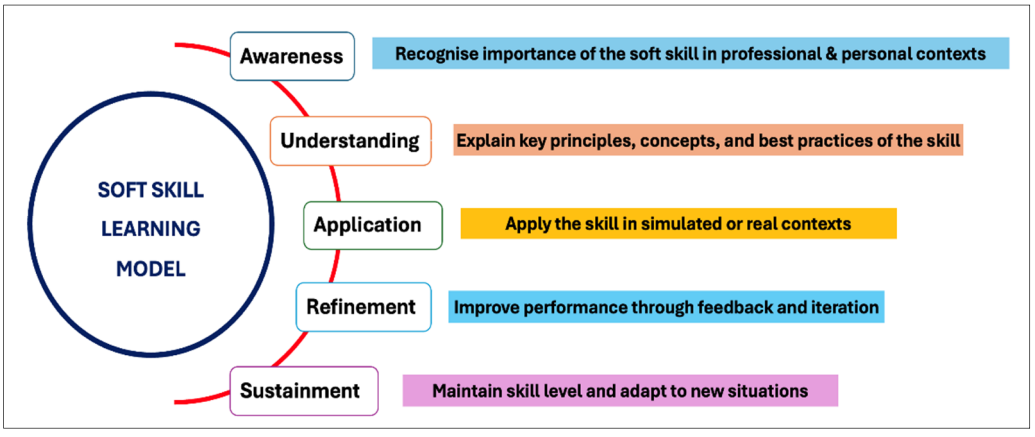


Source: Author's own construct.

b. **Developing Learning Models**. The development of a contextually relevant soft skill learning model is critical for translating objectives into measurable outcomes. A tripartite model is recommended, integrating institutional training (through courses at BMA, SI&T, and equivalent institutions), formation-based activities, and individual self-development (supported through e-learning and mentoring).

The Soft Skills Learning Model depicted in Figure 4 represents an integrated framework that can serve as the institutional blueprint, progressively advancing JOs from the Apply stage towards the higher-order stages of Evaluate and Create.

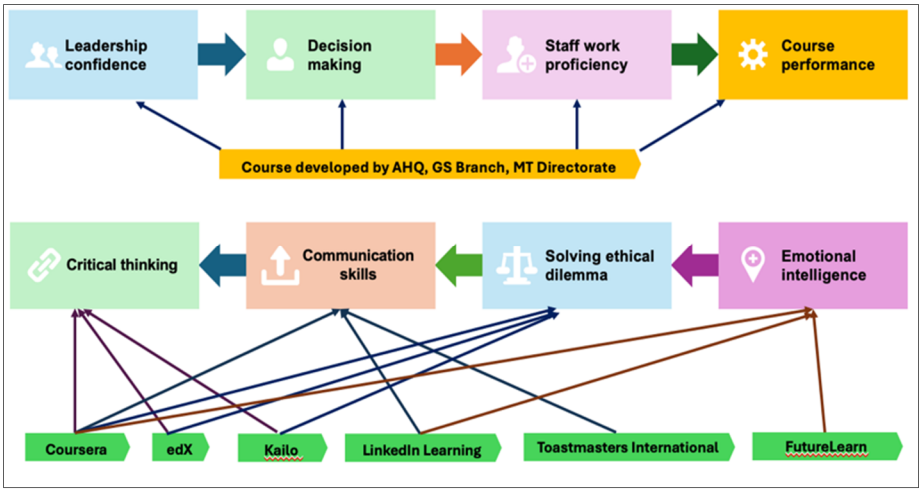
Figure 4: Soft Skills Learning Model



Source: Author's own construct.

c. **E-Learning**. Digital learning platforms offer scalable and cost-effective instruments for soft skill development. While established civil platforms such as Coursera, edX, Udemy, FutureLearn, and LinkedIn Learning provide accessible content on leadership and communication, the unique nature of military soft skills necessitates a dedicated military platform. AHQ, GS Branch, MT Directorate should consider establishing a bespoke Bangladesh Army Online Learning Platform (BAOLP), housing modules tailored to the specific requirements of JOs. Approximately 78% of research participants expressed a strong preference for e-learning as a principal instrument of soft skill development.

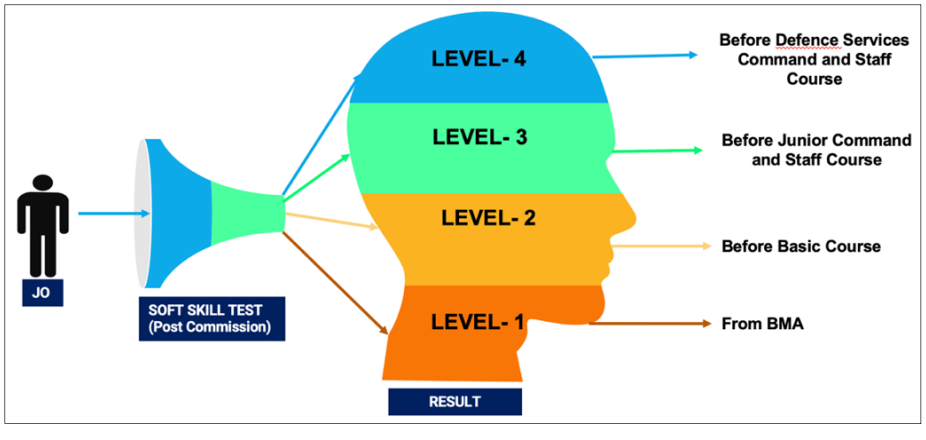
Figure 5: Platform-wise E-learning Tools



Source: Author's own construct.

d. **Current Skill-based Training Package**. Soft skill development should not follow a uniform approach given the significant individual variation in starting competency levels. A diagnostic assessment of each JO's current soft skill standard should be conducted at the commencement of each course and formation training cycle. Based on this assessment, a personalised Skill-based Training Package (STP) should be prescribed, identifying specific competency gaps and recommending targeted e-learning modules, exercises, and mentoring activities.

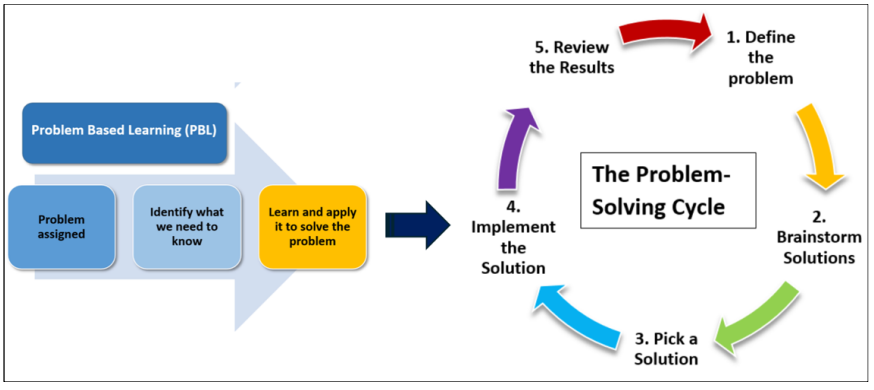
Figure 6: Flowchart of Skill-based Training



Source: Author's own construct.

e. **Problem-Based Learning (PBL).** Problem-Based Learning (PBL) is an instructional methodology proven to enhance soft skills by placing learners in authentic, and complex scenarios that demand communication, collaboration, critical thinking, and decision-making (Suryanti, H. H. S., & Supeni, S., 2019). For JOs in the BA, the existing STX framework provides a natural platform for incorporating PBL. Case studies drawn from military operations, simulation exercises, and role-playing activities should be systematically integrated into course curricula. The PBL cycle depicted in Figure 7 comprising problem definition, brainstorming, solution selection, implementation, and review illustrates the structured approach recommended.

Figure 7: PBL Cycle



Source: https://www.edume.com/blog/benefits-of-scenario-based-learning

f. **E-Learning for Soft Skills (ELESS).** E-Learning for Soft Skills (ELESS) is a digital instructional model designed specifically to develop leadership and interpersonal competencies within e-learning environments (De Freitas, S., & Routledge, H., 2013). Unlike generic platforms, the ELESS model leverages immersive simulation, game-based interaction, and scenario-driven learning to create experientially rich developmental experiences. The Leadership Simulation Game (LSG), developed by PIXEL Learning in 2012, is one of the most widely applied ELESS-based tools for virtual leadership training. By integrating ELESS platforms into the proposed BAOLP, JOs can access structured virtual leadership training that bridges the gap between classroom instruction and live operational experience.

Conclusion

Soft skills play a vital role in enhancing communication, leadership attributes, ethical judgement, and operational efficiency-all key components of professional competence for JOs in the BA. Analysis of the current developmental state reveals that the expected

standard of soft skills stands measurably above the current level, with most constituents clustered at the Apply or Analyse stage on Bloom's Taxonomy of Learning.

The major systemic drawbacks identified include the absence of a clearly defined institutional objective, the lack of an effective stand-alone model, a shortage of quality trainers and training facilities, insufficient synchronisation among training institutions, and time constraints within existing courses. These weaknesses are not insurmountable; existing institutional strengths such as the CSDP at BMA and embedded training modules in courses demonstrate that purposeful soft skill development within the BA framework is both achievable and beneficial.

The ways forward proposed in this paper - comprising the establishment of coherent soft skill learning objectives, the development of a contextually relevant learning model, the integration of e-learning and ELESS platforms, the adoption of Skill-based Training Packages, and the institutionalisation of Problem-Based Learning - collectively address the identified deficiencies in a systematic and progressive manner. Their implementation is projected to advance JOs from the Apply and Analyse stages to the higher-order stages of Evaluate and Create, resulting in a measurable and sustained enhancement of professional competence at the sub-unit level of the BA.

Recommendations

a. AHQ, GS Branch, MT Directorate may commission a feasibility study by April 2027 on the establishment of a dedicated BAOLP, housing ELESS-based modules and personalised Skill-based Training Packages tailored to JO requirements. The study should involve AHQ, GS Branch, Education Directorate, training institutions, and relevant technical agencies, with phased development commencing upon approval.

b. AHQ, GS Branch, MT Directorate may issue directives to training institutions by July 2027 for the systematic integration of PBL methodologies into existing course curricula, leveraging the established STX framework. Formations may additionally implement PBL-based study periods and exercises quarterly from January 2028.

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Biography



Major Md Mahmudul Hassan, psc, Inf was commissioned from the Bangladesh Military Academy (BMA) with 69 BMA Long Course in the Corps of Infantry on 24 December 2012. He subsequently completed his B.Sc. in Military Science under the Bangladesh University of Professionals (BUP) in 2015. He has also achieved his Master's degree from BUP in 2025 in Security Studies. He has served in various capacities in different infantry units and training institutions of the Bangladesh Army. He served in the prestigious Tactics Wing of the School of Infantry & Tactics (SI&T). Besides, he also performed as an instructor in East Bengal Regimental Center (EBRC) and Bangladesh Infantry Regimental Center (BIRC). In addition to the mandatory military courses, he attended the Basic Infantry Course in Pakistan and the Junior Command Course in Sri Lanka. As a member of BANRDB-4, he served with the United Nations Peacekeeping Mission in the Democratic Republic of Congo (MONUSCO). He graduated from DSCSC in 2025 and is currently serving at 28 Bangladesh Infantry Regiment.

Viability of 'Atmanirbharta' for Defence of India in the Present Geo-political Scenario

Squadron Leader Anshu Kumar Singh, psc, Indian Air Force

Abstract

This research explores the effectiveness of 'Atmanirbharta' in defence in ensuring India`s credible military capability in the present geo-political scenario. The research focuses on the efficacy of these initiatives, especially regarding India's credible military capability and their impact on the Indian defence sector since the inception of initiatives like the 'Make in India' campaign in September 2014 and the launch of the 'Atmanirbhar Bharat Abhiyaan' (or the Self-reliant India Campaign), in May 2020. The research provides deeper insights into the need, status and impact of 'Atmanirbharta' in defence of India. The qualitative impact of these schemes has been analysed through reviewing the performance of Indian indigenous weapons, systems, and platforms especially during the Operation Sindoor 2025. The study examines whether 'Atmanirbharta in Defence' can ensure India's credible military capability for India in the present geopolitical scenario. Through a mix of quantitative and qualitative analysis, the study reveals that the path of 'Atmanirbharta' in defence is both essential and viable. It will enhance the credible military capability of India to meet both its internal and external security threats. Statistical testing further shows a positive relationship between 'Atmanirbharta in Defence' and 'credible military capability gains.' However, the study also reveals that the success of 'Atmanirbharta in Defence' depends on stronger R&D, private sector participation, procurement reforms, and ecosystem development. Overall, the study rejects the view that self-reliance cannot support credible military capability, while demonstrating that self-reliance must be pursued as a structured and capability-driven strategy.

Introduction

Shifting alliances and uncertainty define modern geo-politics. Thus, self-reliance in defence is a strategic necessity for all nations. This lesson has been reiterated innumerable times, most recently during the Russia-Ukraine conflict (Rajagopalan, 2023). Owing to global supply chain disruptions, dynamic geopolitical relationships, and evolving security challenges, Prime Minister Narendra Modi, laid the foundation of 'Atmanirbhar Bharat Abhiyan' (Kumar, 2024; Jain & Gill, n.d.; Stalin, 2022) to reduce reliance on foreign imports by promoting indigenous production and

technological innovations(*13-Jds-18-3-2024-PK-Chakravorty.Pdf*, n.d.). Despite concerted efforts towards self-reliance, India remains heavily reliant on imports to meet its military needs. India was the world's second largest arms importer, accounting for 8.3% of global imports between 2020 and 2024(*Sipri International Arms Transfer Summary 2024.Pdf*, n.d.). Lastly, a self-reliant defence industrial base is critical for India`s pursuit of strategic autonomy.

The Russia-Ukraine conflict of 2022 and the Israel-Hamas war of 2023 highlighted the need for a robust industrial framework capable of meeting the demands of the national defence forces. It is only possible through a scalable war industry capable of sustaining high intensity war (Rajagopalan, 2023). The global sanctions on Russia, could have easily broken the will to fight of any nation. However, a strong defence eco-system and steadfast leadership enabled Russia to counter the sanctions and sustain its war efforts. The economic sanctions and supply chain disruptions reiterate the criticality of self-reliance in defence for maintaining an independent foreign policy and autonomous decision making.

Aim

This paper aims to determine the impact of 'Atmanirbharta' in defence on India's credible military capability and to suggest measures to ensure credible military capability through self-reliance.

Indian Defence Ecosystem: Historical Legacy and Policy Constraints

The Indian defence ecosystem was a legacy of British India. The `Industrial Policy Resolution of 1956` made defence manufacturing a monopoly of defence PSUs (*Atmanirbhar in Aerospace and Defence Manufacturing*, 2022). The 1962 Indo-China War highlighted deficiencies in Indian defence production and paved the way for increased domestic arms productions and defence R&D (Behera, n.d.). The Self Reliance Review Committee of 1992, under Dr APJ Abdul Kalam, proposed increasing indigenous content in defence procurement. The entry of the private sector into defence manufacturing in 1991 and progressive increase in the FDI limit from 26% in 2001, to 49% in 2015, and 74% in 2020 have not significantly altered the monopoly of defence PSUs (*Atmanirbhar in Aerospace and Defence Manufacturing*, 2022; *FDI IN DEFENCE SECTOR*, n.d.).

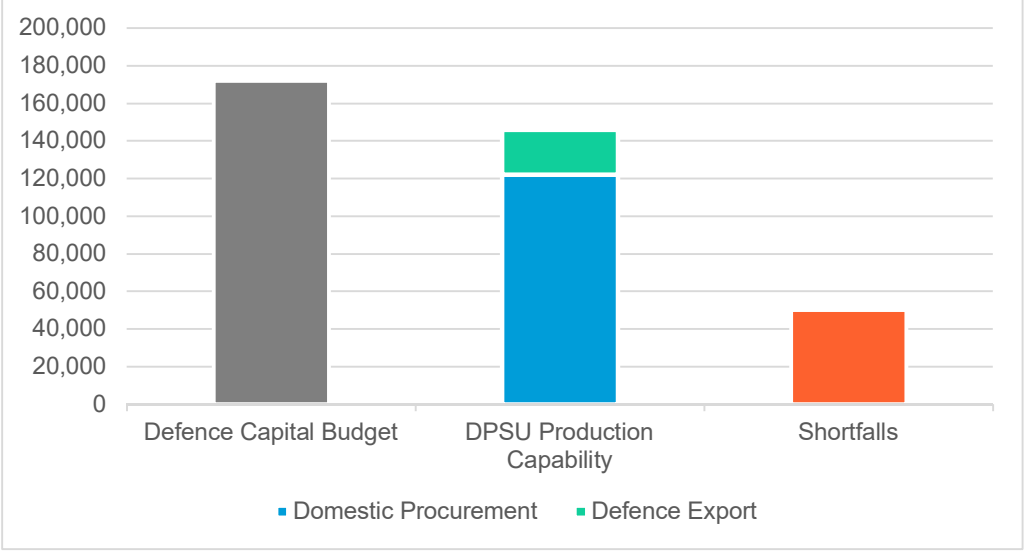
Issues limiting Indigenous Defence Production

The major issues limiting self-reliance in defence are as follows:

Negligible Participation by the Private Sector. The delayed opening of the defence sector to private firms has resulted in inadequate infrastructure, sub-optimal production capability, and higher cost of production.(*327332-an-Overview-of-Indian-Defence-Industry-a-4f293535.Pdf*, n.d.). As a result, private firms miss out on defence contracts which results in stagnation of ideas and complacency by the DPSUs.

DPSUs Inability to Absorb the Capital Defence Budget. The DPSUs can absorb only 71% of the total capital defence budget (as shown in figure 1) ("Defence Budget 2025–26," n.d.).

Figure-1: DPSU Production Capability Shortfalls against Capital Budget (Rs in crores)



Source: Author's Construct (Based on Defence Budget 2025-26)

Defence Budgets and Investment in R&D. India's defence budget is 1.9 % of GDP, which is well below the global median of 3-5 % of GDP. (*Indias-Defence-Budget-2025-26-5271.Pdf*, n.d.). Additionally, the median R&D expenditure of Indian defence firms is 1.2% which is also significantly lower than the global median of 3.4% ("Indian Defence Firms Need to Invest More in Innovations and R&D to Keep Pace with Global Standards," 2024).

Lack of Strategic Planning. India lacks a dedicated professional organisation for comprehensive and all-inclusive defence planning (*Challenges in Defence Acquisitions*, 2022). Thus, most procurements are reactive rather than the outcome of strategic foresight.

Production and Time Delays. Unexpected delays and the lack of accountability among DPSUs have resulted in delayed deliveries of critical indigenous military components.

Procedural Complexities. The defence procurement process is marred by complex multi-stage evaluation, lack of accountability, unrealistic Services Qualitative Requirements(SQRs), excessive controls by the MoD, weak contract management, and lack of transparency in decision making (*Challenges in Defence Acquisitions*, 2022).

Atmanirbharta in Action

To boost self-reliance, the 'Make in India' campaign was launched in September 2014. This campaign was further complemented by the launch of the 'Atmanirbhar Bharat Abhiyaan' (or Self-reliant India Campaign), in May 2020 to promote self-sufficiency.

Technology Development Fund (TDF). The TDF scheme provides financial support to micro, small, and medium enterprises (MSMEs) and startups to produce critical defence technologies and products. (*Atmanirbhar Bharat -Indigenisation In Defence Sector – CENJOWS*, n.d.).

Defence Acquisition Procedure (DAP). DAP 2020 mandates minimum indigenous content in most procurement categories and reserves key segments for Indian vendors only(See Table 1). (*DAP VOL 1 - FINAL 14 DEC 20.Pdf*, n.d.).

Table 1: Mandatory Indigenous Content for Defence Procurements

Category	Indigenous Content
Buy (Indian – IDDM)	Indigenous design and content >= 50%
Buy (Indian)	If indigenous design, then content >= 50%, Else content >= 60%
Buy and Make (Indian)	>= 50% of the Make portion
Buy (Global and Manufacture in India)	>= 50%
Buy (Global)	Foreign Vendor- Nil Indian Vendor >= 30%

Source: DAP 2020

Defence Production and Export Promotion Policy. This policy promotes export of indigenous defence goods to ensure a sustainable business model through subsidies, tax benefits, and collaboration with foreign companies.

'Dare To Dream' Scheme. Under this scheme, DRDO puts forth certain challenges in emerging areas of technology and anyone who solves them is provided technological and financial support (*Atmanirbhar Bharat -Indigenisation In Defence Sector – CENJOWS*, n.d.).

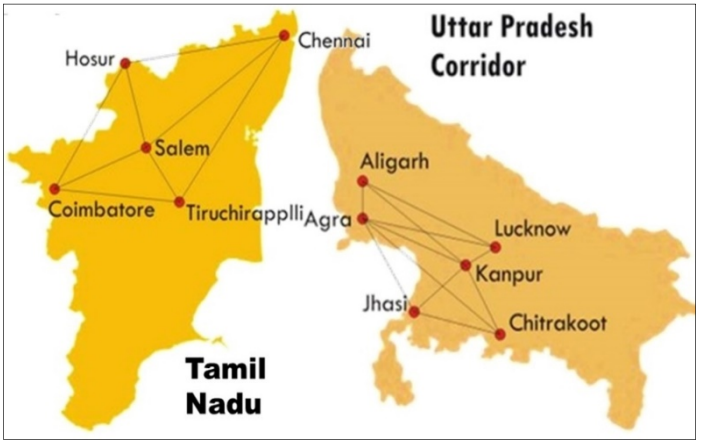
Strategic Partnership Model (SPM). The strategic partnership model envisages collaboration between a foreign Original Equipment Manufacturer (OEM) and a suitable Indian company for the mandatory transfer of technological know-how (*Strategic Partnership*, n.d.).

Positive Indigenisation List (PIL). PILs are a list published by the Ministry of Defence (MOD) consisting of defence items which can only be procured from local manufacturers (*Atmanirbhar Bharat -Indigenisation In Defence Sector – CENJOWS*, n.d.).

Liberalization of Foreign Direct Investment (FDI). Foreign Direct Investment (FDI) limit in the defence sector has been increased to 74% for automatic route, and up to 100% under the government route wherever it is likely to result in access to modern technology (*FDI IN DEFENCE SECTOR*, n.d.).

Defence Industrial Corridors (DIC). Two such corridors have been created by the Indian government namely the UP Defence Industrial Corridor (UPDIC) and Tamil Nadu Defence Industrial Corridor (TNDIC) with an aim to attract investment of about Rs 10,000 crores in each corridor (See Figure 3) (Sabha, n.d.).

Figure 3: Defence Industrial Corridors of India



Source: Zeusnumerix.com

Offset Policy Reforms. Any foreign company that wins a defence contract has to mandatorily invest 30% of the contract amount in Indian defence eco-system.

Mission DefSpace, iDEX. The aim of Mission DefSpace, iDEX scheme, SRIJAN portal, Defence Industrial Corridor is to create an ecosystem which fosters innovation and defence technology development through infrastructure, investment and technological support.

SRIJAN Indigenization portal. This is basically a site that showcases the defence items to be indigenised. There are as many as 39 thousand items listed on the site which the participants can indigenise.

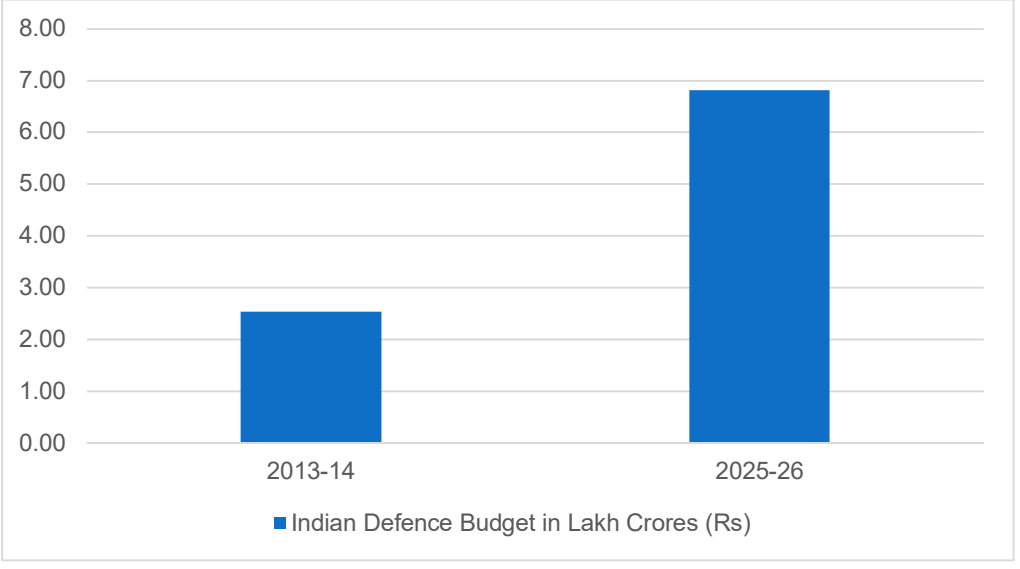
Impact of 'Atmanirbharta' in Defence

The measures instituted under 'Atmanirbharta' in the defence are in their infancy and will take considerable time to make considerable impact. Despite the limited vintage, the positive impact of these initiatives is well evident.

Quantitative Impact

Defence Budget Increase. The defence budget has increased from Rs 2.53 lakh crore in FY 2013-14 to Rs 6.81 lakh crore in FY 2025-26, representing a 170% increase over last 12 years (Figure 4).

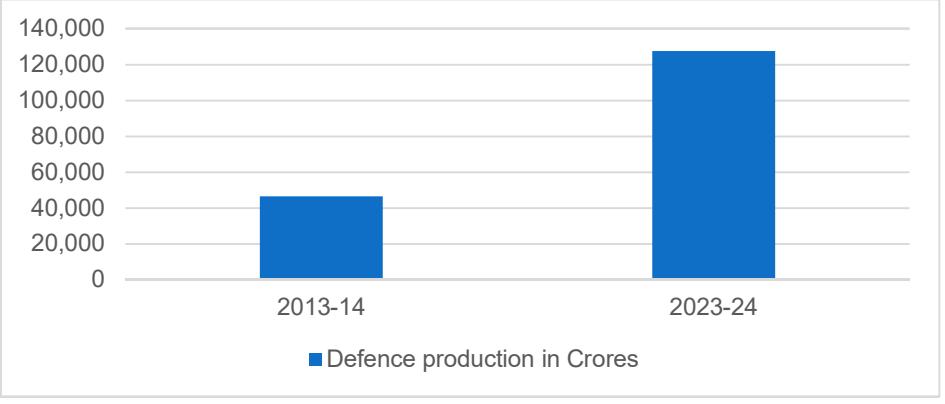
Figure 4: Indian Defence Budget in Lakh Crore (Rs)



Source: Author's Construct (Based on Defence Budget 2025-26)

Growth in Defence Production Capability. The defence production capability has increased from Rs 46 thousand crore in FY 2014-15 to Rs 1.27 lakh crore in FY 2023-24, representing a 175% increase in over 10 years (Figure 5). (*Make in India Powers Defence Growth*, n.d.).

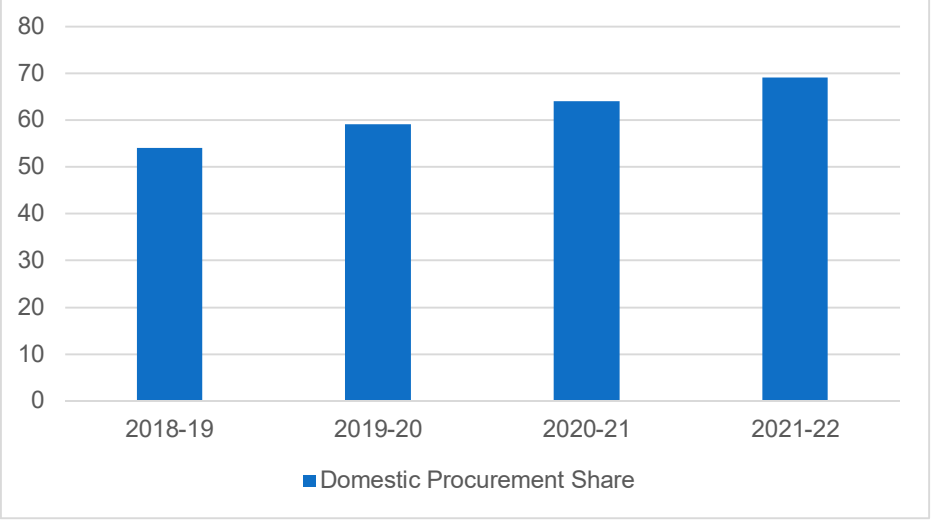
Figure 5: Indian Defence Production in Crores (Rs)



Source: Author's Construct (Based on Defence Production Capability values in FY 2013-14 and 2023-24)

Growth in Domestic Procurement Share. The domestic procurement share has also increased in a stepwise manner from 54% in 2018-19 to 71 % in 2024-25 (Figure 6) (*Atmanirbhar Bharat -Indigenisation In Defence Sector – CENJOWS*, n.d.).

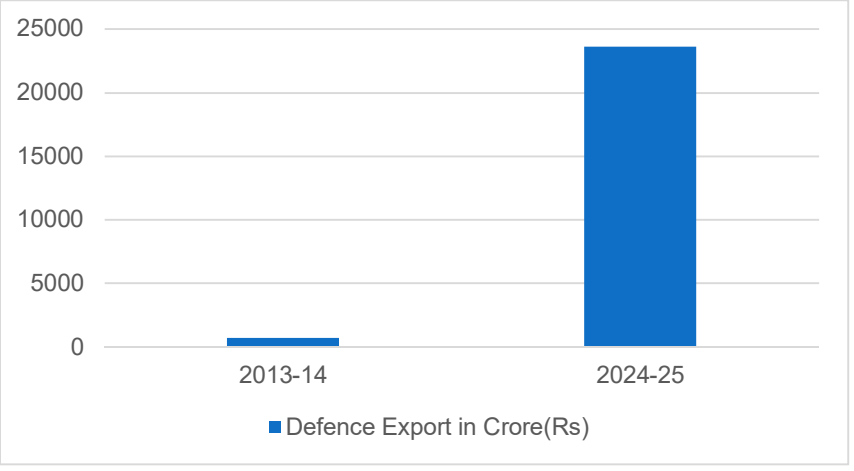
Figure 6: Domestic Procurement Shares (% of total)



Source: Author's Construct (Based on Domestic Procurement Share)

Growth in Defence Export. Indian defence exports have increased from Rs 686 crores in 2013-14 to Rs 23,622 crores in 2024-25 with a target of ₹50,000 crore defence exports by 2029 (Figure 7) (*Defence Exports Surge to a Record High of Rs 23,622 Crore in Financial Year 2024-25, a Growth of 12.04% over 2023-24*, n.d.).

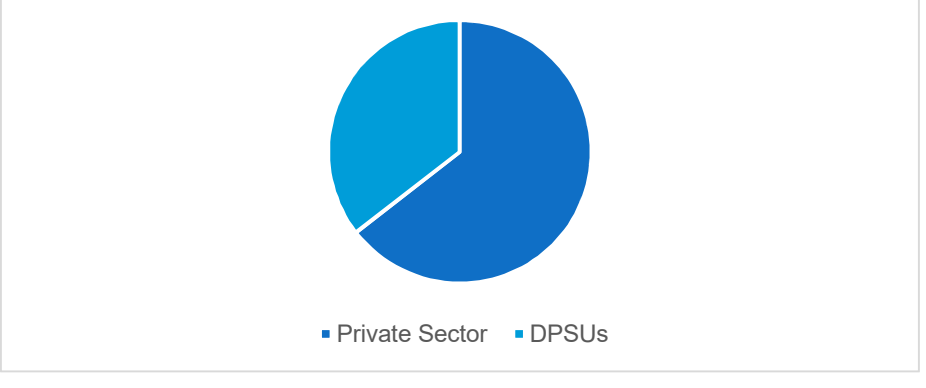
Figure 7: Indian Defence Export in Crore (Rs)



Source: Author's Construct (Based on Indian Defence Export values)

Private Sector Participation. Private sector contributes about 21 % of total defence production. Additionally, the private sector defence export value of about Rs 15,233 crore is about 64% of total defence exports in FY 2024-25 (Figure 8) (*Defence Exports Surge to a Record High of Rs 23,622 Crore in Financial Year 2024-25, a Growth of 12.04% over 2023-24*, n.d.)**.**

Figure 8 Allocation of Exports (DPSUs Vs Private Sectors in %)



Source: Author's Construct (Based on contribution of Private sector to Defence Exports)

Qualitative Impact Analysis through Operation Sindoor 2025

Indian indigenous equipment, platforms, and systems were used extensively during Operation Sindoor 2025. The performance of indigenous defence equipment during Operation Sindoor 2025 is still clouded by narrative warfare between both the nations. However, reports from reputed defence sources such as the Swiss think tank Centre`d Histoire et de Prospective Militaires, Stimson.org, Quwa.org and others have conducted an analytical qualitative assessment of the performance of Indian indigenous weapons, systems, and platforms. The performance of the equipment used during the operation has been used as a reference point for the qualitative analysis of indigenous equipment.

Validation of Integrated Air Defence System. India`s integrated multi-layered air defence network comprising of indigenously upgraded legacy anti-aircraft guns like L70, ZU-23-2B, state-of-the-art indigenous SAMs like Akash, Barak-8 MRSAM, and the Russian S-400 SAM. All these weapons were controlled centrally to choose the most suitable weapon for targeting while avoiding fratricide and duplication of efforts. Seamless air defence coverage was ensured through DRDO developed radars such as Rajendra radar, Rohini 3D radar, Low-Level Light Weight Radar (LLLWR), and Low Level Transportable Radars (LLTR). (Operation Sindoor Highlights India's Indigenous Defence Tech Superiority Over Pakistan, n.d.).

Counter-Unmanned Aerial System Success. The indigenous D4S (Drone Detect, Deter and Destroy System) Counter-Unmanned Aerial System (CUAS), which integrates radars, radio frequency jammers, EO/IR sensors and kinetic kill options also proved its efficacy during this operation ("Operation Sindoor," 2025).

Validation of Precision Strike Capabilities. Indian Brahmos missiles, Anti-radiation missiles, and loitering munitions were used effectively for deep strike behind enemy lines against selected targets.("Operation Sindoor," 2025)

Space-based Intelligence for Real-time targeting. Indian NAVIC (Navigation with Indian Constellation) system along with indigenous satellites such as Cartosat, RISAT, and EOS, supported precision targeting by providing positional accuracy of 10 to 20 cm (*Operation Sindoor Highlights India's Indigenous Defence Tech Superiority Over Pakistan*, n.d.).

Loitering Munitions Success. Nagastra-1 Loitering munition and SkyStriker drones were reported to have been used in strikes against adversary camps and air defence system in depth (Mann, 2025).

Strategic deterrence and Credibility Enhancement. Operation Sindoor highlighted India's offensive and defensive capability and have strengthened perception of India as a credible defence technology developer in international market. In the entire gamut of activities, India also showed restraint and the ability to conduct precisely calibrated operation while demonstrating the potential for escalation, when required.

Performance Superiority. Even though the outcome of Operation Sindoor 2025 remains disputed or only partially verified, Indian indigenous equipment, platforms, and systems were reported to have performed effectively throughout the operation. In several assessments, they were judged to have performed comparably to or better than Chinese or Western origin systems in a contested environment (Peri, 2025). Further, the performance of indigenous systems during the 88 hours conflict put to rest concerns about technological and capability inferiority of indigenous defence products.

Export Validation. The steady increase in defence export orders since the launch of 'Atmanirbhar Bharat Abhiyan' reflects growing interest in Indian defence ecosystem, its products, and the professionalism of Indian defence manufacturers. The substantial increase in defence exports over the past decade points in the same direction. Despite disputed claims over Operation Sindoor battle outcomes, it provided the much needed strategic validation for Indian indigenous defence equipment in combat. It also proved that indigenous defence equipment can significantly enhance Indian credible military capability.

Challenges and Areas for Improvement

India has taken giant strides in the field of self-reliance in defence. However, certain specific sectors which require greater focus or have significant scope for improvement are as follows:

Advanced Propulsion System. India has done remarkably well to produce a competitive state-of-the-art fighter aircraft on its own (the Light Combat Aircraft-LCA Tejas). However, its mass production is stuck due to the unavailability of a suitable engine to power it. The indigenous Kaveri engine project is unable to fulfill the requirement of LCA Tejas and India is heavily reliant on GE-404/414 aeroengine from US. Thus, lack of a suitable aeroengine to propel indigenous fighters is significantly hurting India's self-reliance dream.

Sophisticated Electronics and Specialized Materials. Indian defence firms are still struggling to develop certain niche electronics components and specialized semiconductors. Thus, they are dependent on imports to meet these demands. India is also dependent on imports of certain strategic materials and advanced composites. Therefore, these areas require capability development.

Production Capacity Enhancement. Indian defence firms are relatively new to the field of managing bulk defence orders. Thus, the need of the hour is to enhance production capability significantly to meet both domestic and foreign demands. To achieve this, there is a need for deeper supply chain development and greater quality consistency to ensure continued demand in the market.

Bureaucratic/Procedural Risk. Complex licensing process, bureaucratic red tapes, and unacceptable production delays have adversely impacted Indian self-reliance dreams.

Analysis of the Impact on Credible Military Capability

'Atmanirbharta' in defence has significantly boosted credible military capability and combat effectiveness across domains. It was a far departure from earlier belief that Atmanirbharta' in defence will adversely impact India's credible military capability,

Precision and Lethality. Indian Brahmos missiles is a brand in itself for its accuracy and lethality. It enhances the capability of Indian armed forces to bypass an integrated and layered air defence system to engage targets with pin point accuracy minimising collateral damages.

Air Defence Capability. Indian integrated and multilayered air defence architecture is capable of effectively neutralised the onslaught of aerial volleys. It enhances the AD cover so effectively that in case of saturation attacks, it is capable of stopping aerial projectiles/stand-off weapons/cruise missiles to reach their intended target. The IACCS and D4 C-UAS network have been indigenously designed and developed to integrate a variety of indigenous and imported Air defence System. Meanwhile, India is simultaneously developing Project KUSHA which will be of an S-500 class, capable of very long range interception and Ballistic Missile Defence (BMD).

Integration and Coordination. IACCS and Akash Teer enabled integration of inputs from all sensors to build a composite Recognised Air Situation Picture (RASP). The same feed was available at all levels of the national defence organisation. This enabled quick and calculated decision making in real time, and significant shortening

of sensor to shooter loop. The shorter OODA loop resulted in swifter decision making and faster response. Lastly, platforms like NETRA AEW&C and AWACS could not only transmit data from their primary radars but also receive a composite operational picture from the IACCS network.

Adaptation Capability. 92% of defence contracts ordered in 2024-25 have gone to domestic industry. 14,000+ items have been indigenised under SRIJAN portal. Another 3000 products have been indigenised under PILs(*Make in India Powers Defence Growth*, n.d.-b). Additionally, self-reliance provides the capability to upgrade and integrate latest updates into existing systems. This significantly enhances credible military capability as it reduces dependency on foreign support for integration of latest acquisitions.

Recommendations for further Improvement in Initiatives for Self-Reliance

The current policy changes and government initiatives have significantly propelled India on the path of self-reliance in defence. However, there are few grey areas in which there lies scope for improvement. The following recommendations will guide us to mitigate these grey areas to maintain credible military capability while pursuing self-reliance:

Accelerate Critical Technology Development. DRDO and HAL should lead critical technology development initiatives especially towards jet engine development, UAS, AD shields, Robotics, Semiconductors, Quantum, and AI/ML for battlefield applications.

Enhance Private Sector Participation. The Department of Defence Production (DDP) should spearhead private sector engagement by further easing entry barriers, licensing simplification and targeted incentives for MSMEs and defence startups.

Strengthen Indigenous R&D to Enhance Innovation. The Government of India should increase the defence budget from the current value of 1.9 % of GDP to make it at least 2.5 % of GDP from the next budget onwards to meet its defence needs in the current geo-political scenario.

Monitoring and Oversight Committee. Department of Defence Production (DDP) should undertake strict regular monitoring to ensure accountability at the highest level. It should also establish strategic partnerships between academia, research entities and defence manufacturers

Conclusion

The Atmanirbharta (self-reliance) movement in Indian defence is no longer just an aspirational policy it is visible, measurable, and operationally validated. Dramatic improvements in production, exports, technological sophistication, indigenous platform validation (via Operation Sindoor), and heightened professional confidence combine to make the case for continued pursuit unmistakable.

Nevertheless, to bridge remaining capability and capacity gaps, accelerate progress, and translate success into global leadership, India must sustain reforms, upgrade innovation capacity, and deepen partnerships within and beyond its borders. Additionally, until indigenisation matures, critical technologies should be selectively outsourced to ensure credible military capability. Finally, self-reliance in defence needs a "whole-of-nation" approach integrating efforts across government, industry, academia, and the military to ensure policy coherence, resource mobilization, and resilience. To sum up, if current momentum towards self-reliance continues and concerted efforts are taken to address critical weaknesses, Atmanirbharta in defence will become the cornerstone of India's credible military capability for the decades ahead.

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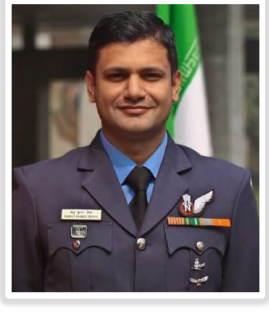
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Biography



Squadron Leader Anshu Kumar Singh, psc was commissioned on 22 June 2013 from the prestigious Air Force Academy (AFA) in Hyderabad. The officer is also a graduate of Rashtriya Indian Military College (RIMC), Dehradun and National Defence Academy (NDA), Pune. He is a Weapon System Operator (WSO) with more than 1500 hours on Su-30 MKI and is qualified on all roles of Su-30 MKI. The officer has participated in numerous multi-national air exercises both at home and abroad. The officer is also a graduate of the prestigious Tactics and Air Combat Development Establishment (TACDE). He has wide experience in instructional duties and has done instructional stint both at TACDE and one of the Su-30 MKI training squadron of the Indian Air Force. Academically, the officer holds a Bachelor of Science degree from Jawaharlal Nehru University, Delhi. The Officer successfully completed DSCSC 2025 from Mirpur.