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Message from the Chief Patron

It gives me immense pleasure to present Mirpur Papers, Volume 31, Issue 37, September 2025, the flagship academic journal of the Defence Services Command and Staff College, Mirpur. Over the years, Mirpur Papers has evolved into a well-founded platform for scholarly discourse and intellectual inquiry by promoting a culture of research and critical thinking among the officers of the Armed Forces and wider strategic community.

In an era marked by complex security challenges, rapid technological advancement and evolving geopolitical dynamics, the need for informed analysis and strategic foresight has never been greater. The articles featured in this issue reflect a thoughtful engagement with contemporary national, regional and global security issues. These demonstrate analytical depth, originality of thought and a strong linkage between theory and practice, essential for modern military professionals and policy practitioners.

I commend the contributing course participants, faculty members and external scholars for their new insights. Their research will not only enrich professional military education but also the broader discourse on defence, strategy, leadership and national security.

My sincere appreciation to the Editorial Board, for their diligent efforts in maintaining the premium standard of the journal.

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

Editor's Note

It is with a deep sense of accomplishment that we present the 37th issue of Mirpur Papers, a scholarly publication of the Defence Services Command and Staff College, Mirpur. In a time saturated with fleeting content, this publication offers a measured but deliberate rhythm. It provides a platform where rigorous thinking meets creative expression, ensuring that Mirpurs' intellectual output is recorded, preserved and reckoned. For our course participants, it becomes an archive of ideas to revisit; for our faculties, a channel to extend lessons beyond the traditional learning space.

This issue brings together a diverse range of topics. The first paper emphasizes the importance of Emotional Intelligence (EI) and Self-Efficacy (SE) for Bangladesh Navy officers in navigating rapid technological and socio-cultural changes. The second one explores Artificial Intelligence (AI) in modern warfare, urging Bangladesh Armed Forces to integrate AI responsibly to safeguard national security. The third topic highlights defence diplomacy as a crucial tool for Bangladesh to strengthen strategic autonomy and regional posture. The next one examines the induction of UCAVs into Bangladesh Army, stressing indigenous production and infrastructure development. The fifth article introduces Cognitive Warfare, a non-kinetic threat amplified by AI and social media, calling for awareness and countermeasures. The next article identifies transformational leadership as the most effective approach for military training. The seventh one assesses Bangladesh's climate challenges on military operations, recommending adaptation in hardware, outfits, and training. The eighth writeup investigates the prolonged Rohingya repatriation crisis, linking displacement to rising crime and proposing multi-stakeholder solutions. The ninth article evaluates junior officers' professional motivation and its impact on organisational efficiency, recommending leadership development and supportive environment. The next topic assesses cyber security vulnerabilities in Bangladesh Air Force, advocating policy reform and workforce development. Finally, the last one explores indigenous UAV development as a cost-effective strategy for enhancing BAF's operational readiness and self-reliance.

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

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Emotional Intelligence and Self-Efficacy in Mid-Level Officers

Lieutenant Commander Md Tauhidul Islam, (E), psc, BN

Abstract

The study attempts to draw a pen picture of the relationship between emotional intelligence (EI) and self-eficacy (SE) among mid-level officers of Bangladesh Navy (BN). Mid-level officers are the mitochondria of the Bangladesh Navy (BN). The activities of the naval service revolve around their proficiency. The continuous technological and socio-economic changes, multi-cultural exposure and materialistic attitude have introduced many challenges for the mid-level naval officers of BN. Dealing with these challenges requires a demonstration of emotional intelligence and self-efficacy (SE) at a significant level. Considering both current and emerging operational challenges, self-efficacy has become a prerequisite of BN mid-level officers. However, most of the BN personnel are not adequately aware of EI and SE. This inadequacy includes both self-awareness and awareness regarding superiors, peers as well and subordinates. In this connotation, the research has drawn a pen picture of the relationship between EI and SE in BN mid-level officers. Methods like questionnaires (WLEIS and GSE tests) and online surveys were used to assess the EI and SE of BN mid-level officers, revealing high-average scores in both areas. Numerical analysis, key informant interviews (KII), and focus group discussions (FGD) supported the positive relationship between EI and SE, confirmed by a Chi-Square test. The research acknowledges challenges in developing EI and SE, including rigid mindsets, lack of expertise, awareness, and potential false data input. To address these challenges, the study suggests changing mindsets, spreading self-awareness, monitoring, counseling, training, and considering social values and ethics in policy-making. Finally, a few actions were recommended to enhance the emotional intelligence and self-efficacy level of BN mid-level officers.

Introduction

Mid-level officers act as the driving forces of Bangladesh Navy (BN). The activities of the naval service revolve around their proficiency. The continuous technological and socio-economic changes and multi-cultural exposure have introduced many challenges for the mid-level naval officers of BN. Dealing with these challenges requires demonstration of self-efficacy (SE) at a significant level. Considering present and upcoming challenges, self-efficacy has become a prerequisite of BN mid-level officers.

Self-efficacy includes competence with added self-belief. Self-efficacy reflects confidence in the ability to exert control over one's own motivation, behavior, and social environment (Bandura, 1997). It has been proven essential to actual achievement and success. Emotional Intelligence (EI) encompasses one's awareness and mastery of one's own emotions as well as the ability to recognize and understand the emotions of others (Goleman, 2009). Strong Emotional intelligence skills ensure better success in the workplace (Hudson, 2016). On the other hand, this success is affected by SE. Therefore, there is a scope of deriving correlation between EI and SE.

Previous studies have found that there is a positive relation between EI and SE of officers and non-commissioned officers in the U.S. Army and the U.S. Air Force (Hudson, 2016). Moreover, it has also been found that EI has impact on leadership of mid and junior level officers (Karim, 2018). However, hardly any previous study has covered and explain the relationship between EI and SE of BN Mid-level officers. Therefore, this paper aims to draw a pen picture of the relation between EI and SE in BN mid-level officers.

Components of EI and Sources of SE

Components of EI

a. **Self-Awareness**: The term self-awareness refers to the ability to recognize and understand own moods, emotions, and drives, as well as

their effect on others (Goleman, 2009). Self-awareness is indicated by some hallmarks including self-confidence, realistic self-assessment, self-dependent and sense of humor.

b. **Self-Regulation**: Self-regulation encompasses the ability to control or redirect disruptive impulses and moods. It also includes the propensity to suspend judgment – to think before acting. Trustworthiness, integrity, comfort with ambiguity and openness to change are the hallmarks of self-regulation (Goleman, 2009).

c. **Motivation**: Motivation means a passion to work for reasons that go beyond money or status including a propensity to pursue goals with energy and persistence (Goleman, 2009). The hallmarks of motivated people are a strong drive to achieve optimism, even in the face of failure and organizational commitment.

d. **Empathy**: Empathy is the ability to understand the emotional makeup of other people (Goleman, 2009). It also includes the skill of treating people according to their emotional reactions. Expertise in nurturing, building and retaining talent, the ability to navigate cross-cultural sensitivity and service to clients and customers are the key hallmarks of empathy.

e. **Social Skills**: Social skills encompass proficiency in managing relationships and building network including an ability to find common ground and build rapport (Goleman, 2009). However, the hallmarks of socially skilled people are persuasiveness and expertise in building and leading teams.

Sources of SE

a. **Enactive Mastery Experience**: The first and foremost source of self-efficacy is mastery experiences. However, nothing is more powerful than having a direct experience of mastery to increase self-efficacy. Experiencing success, such as mastering a skill or managing a situation

effectively, strengthens self-confidence in that domain, whereas failure can weaken one's belief in their own abilities (Bandura, 1997).

b. **Vicarious Experiences**: The second source of self-efficacy comes from our observation of people around us, especially people we consider role models. Observing people similar to ourselves succeed through their sustained effort strengthens our beliefs that we too possess the capabilities to master the activities needed for success in that area (Bandura, 1997).

c. **Verbal Persuasion**: Influential people in our lives such as parents, teachers, managers or coaches can strengthen our beliefs that we have what it takes to succeed. When we are persuaded that we possess the capabilities to master certain activities,we are more we are more inclined to invest the necessary effort and and persist even when problems arise (Bandura, 1997).

d. **Emotional and Physiological States**: The state we are in will influence how we judge our self-efficacy. Depression, for example, can dampen confidence in our capabilities. Stress reactions or tension are interpreted as signs of vulnerability to poor performance whereas positive emotions can boost our confidence in our skills (Bandura, 1997).

Present State of EI and SE of BN Mid-Level Officers

Evaluation Procedure

To determine the EI and SE states Wong and Law Emotional Intelligence Scale (WLEIS) and General Self Efficacy (GSE) Scale were adapted. Following these scales, total 26 questions have been asked to 120 BN mid-level officers for calculating their EI and SE. There are five options named strongly disagree, disagree, neutral, agree and strongly agree for each reply. The range of points for the options is 1 to 5. Using five-point Likert scale total score was calculated. Moreover, for the grading of both EI and SE, BN grading system for OPR has been considered befitting.

Evaluation of EI

a. **Tabular Representation**: The WLEIS analysis is presented in tabular form. It shows the distribution of officers across six emotional-intelligence (EI) grade categories. The largest group of officers (58) falls in the High Average EI range (6.0–6.99). Smaller numbers fall into the Above Average (28) and Average (14) categories. Very few fall in the Outstanding, Low Average, or Below Average ranges. Overall, most BN mid-level officers demonstrate a high-average level of EI.

Table-1: Overall State of EI

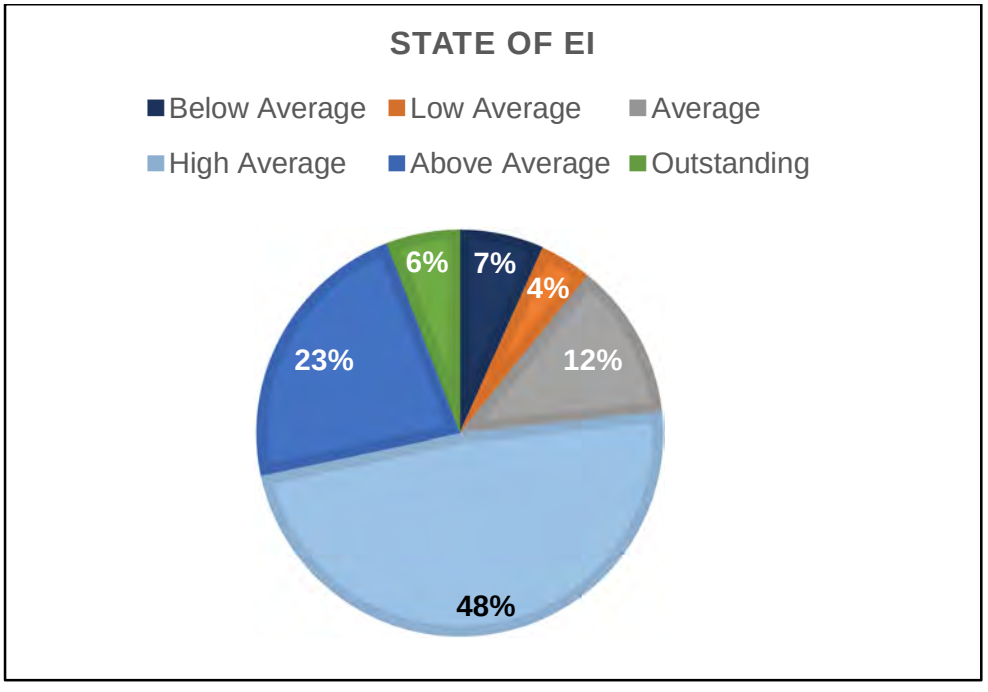
Ser	Grade Name	Grade Point	No of Officers	Remarks
1.	Outstanding	8 and above	7	Most of the BN mid-level officers have **high average** level of EI
2.	Above Average	7.0-7.99	28	
3.	High Average	6.0-6.99	**58**	
4.	Average	5.0-5.99	14	
5.	Low Average	4.0-4.99	5	
6.	Below Average	3.99 and below	8	

Source: Author's self-construct

b. **Graphical Representation**: The attached pie chart depicts that almost half of the officers (48%) are classified in the High Average group, while 23% fall into the Above Average category. The remaining

officers are spread in smaller percentages across the Average, Low Average, Below Average, and Outstanding categories.

Figure-1: State of EI



Source: Author's self-construct

The relevant table, SPSS analysis and graphical representation of overall state of EI of BN mid-level officers depict that most of the BN mid-level officers' EI grade is high average. The percentage is least in the case of low average. The mean score of the EI level is 6.43, which is also within high average range.

Evaluation of SE

a. **Tabular Representation**: The attached table is based on the GSE analysis. It displays the distribution of officers across six self-efficacy (SE) grade categories. The highest number of officers (44) falls within the High

Average SE range. On the other hand, 32 officers in the Above Average range. A smaller group of 17 officers is classified as Outstanding. Moreover, 15 officers fall into the Average category. In a word, the table indicates that most BN mid-level officers exhibit a high-average level of self-efficacy which is similar to the level of emotional intelligent.

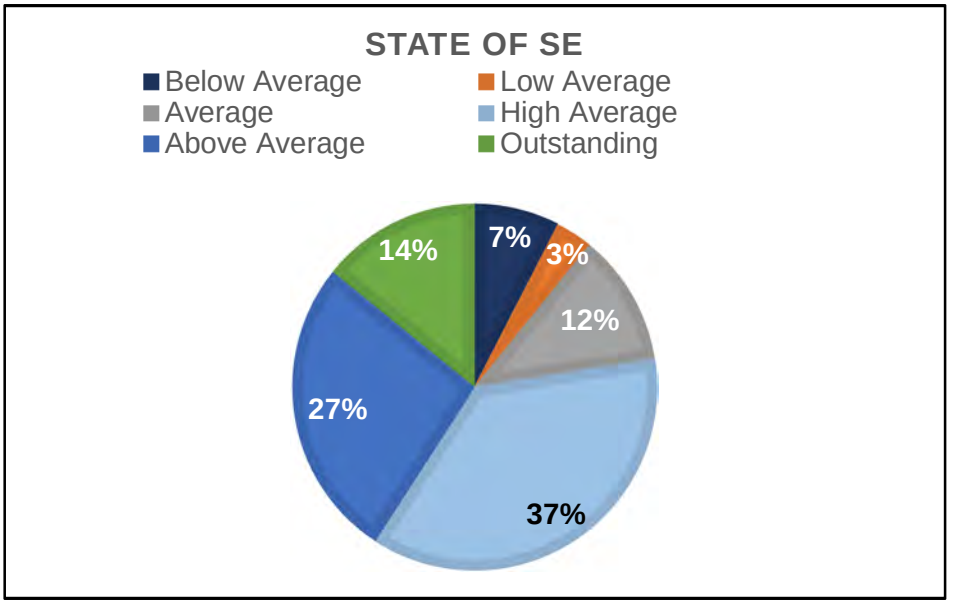
Table-2: Overall State of SE

Ser	Grade Name	Grade Point	No of Officers	Remarks
1.	Outstanding	8 and above	17	Most of the BN mid-level officers have **high average** level of SE
2.	Above Average	7.0-7.99	32	
3.	High Average	6.0-6.99	44	
4.	Average	5.0-5.99	15	
5.	Low Average	4.0-4.99	4	
6.	Below Average	3.99 and below	8	

Source: Author's self-construct

b. **Graphical Representation**: The pie chart below indicates that over one-third of the group (37%) falls within the High Average category. Another 27% are placed in the Above Average category. Smaller proportions are categorized as Average, Outstanding, Below Average and Low Average.

Figure-2: State of SE



Source: Author's self-construct

c. **Deduction**: The relevant table, SPSS analysis and graphical representation of overall state of SE of BN mid-level officers depict that most of the BN mid-level officers' SE grade is high average. The percentage is least in the case of low average. The mean score of the SE level is 6.56, which is within high average range as well.

Correlation: EI and SE of BN Mid-Level Officers

a. **Tabular Analysis of WLEIS and GSE Tests**: A total of one hundred twenty (120) BN mid-level officers took part in the survey. In most of the cases (65.9%) EI and SE of BN mid-level officers fall in the same grade. It indicates that a BN mid-level officer with a higher EI is likely to have a higher SE. Hence, it can be said that there is a positive relationship between EI and SE of a BN mid-level officer. The tabular representation in this regard is shown below:

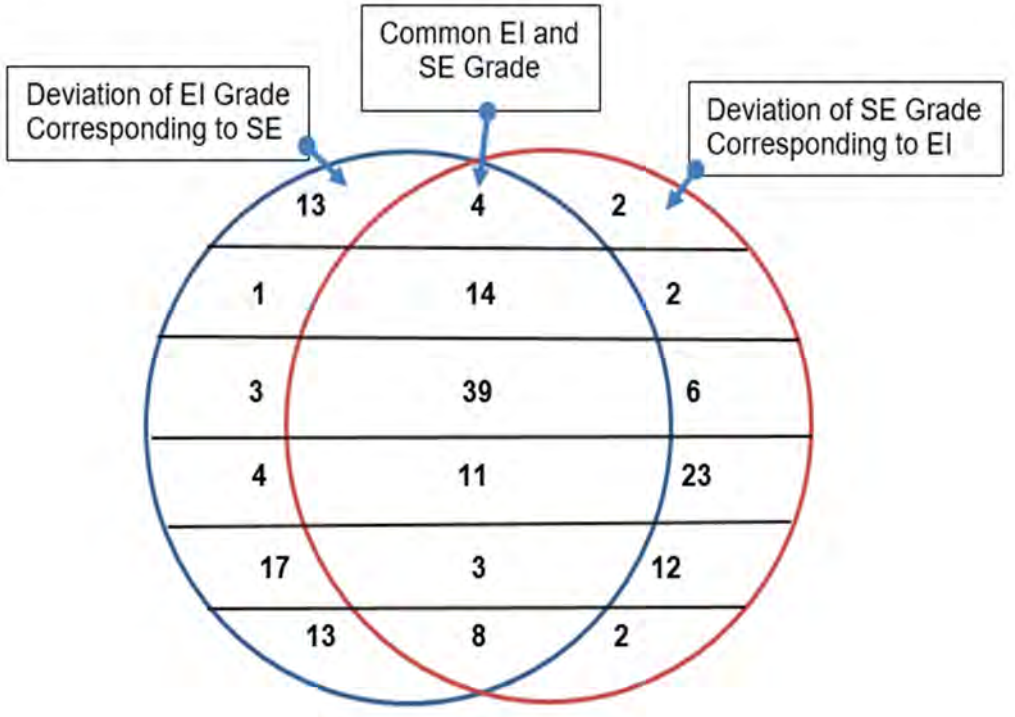
Table-3: Correlated Grading between EI and SE

Ser	Matched Grading for both EI and SE	No of Officers	Percentage	Remarks
1.	Outstanding	4	3.3%	For majority of the BN mid-level officers, **SE increases with the increase of EI**
2.	Above Average	14	11.7%	
3.	High Average	39	32.5%	
4.	Average	11	9.2%	
5.	Low Average	3	2.5%	
6.	Below Average	8	6.7%	
	Total	**79**	**65.9%**	

Source: Author's self-construct

Venn Diagram of WLEIS and GSE Tests. The analysis of the Venn diagram shows that in high average level the frequency of common grading between EI and SE is maximum (39). On the other hand, the deviation rate is maximum (23) in average level for SE grade corresponding to EI. However, for EI grade corresponding to SE, the deviation is maximum (17) in low average level. The Venn diagram is represented below:

Figure 3: Venn Diagram EI and SE Correlation



Source: Author's self-construct

Challenges and Mitigation to Improve EI and SE

Challenges

a. **Knowledge and Awareness**. BN officers have the scope to enhance their knowledge and awareness of Emotional Intelligence (EI) and Self Efficacy (SE) during different professional trainings (FGD-1, 2023). These psychological aspects have not yet been incorporated into the BN academic curriculum. As a result, mid-level officers, like other BN officers, are at a similar level in terms of knowledge on EI and SE.

b. **Motivation and Counseling**. Motivation and counseling act as great healers for mental health. Like other BN personnel, mid-level officers would greatly benefit from more opportunities for counseling sessions with psychologists and superiors. Increasing access to such support can boost their motivation, well-being, and overall performance (Khan C.H., 2023).

c. **Immutable Mind-set**. A list of tasks like raising awareness, arranging training, counseling etc. needs a higher level of effort and dedication to materialize a new concept. Naval personnel with an immutable mindset might prefer to avoid introducing all those hectic tasks.

d. **Limited Number of Experts**. Expert on monitoring, developing and conducting EI and SE tests is inadequate in Bangladesh Navy. Psychologists from BN are hardly trained on these issues (Hossain, 2023). Moreover, the very limited scale of dealing with EI and SE is also another hindrance to developing their expertise.

e. **Monitoring and Recording**. Currently, there is an opportunity to introduce official monitoring and recording of Emotional Intelligence (EI) and Self Efficacy (SE) for BN personnel throughout their service careers. Many leading naval forces, such as those in the USA, Germany, Malaysia, and India, have already adopted this practice, conducting assessments at regular intervals ranging from six months to two years (FGD-2, 2023). Implementing a similar approach in the BN could enhance personal development, leadership effectiveness, and overall operational performance.

f. **Social Evaluation Anxiety**. In our culture, people value their privacy and may feel unsure about sharing their feelings openly. This is also true in the BN environment. By creating a supportive and understanding atmosphere, personnel will feel more comfortable seeking counseling. Building trust will help them open up and make the use of Emotional Intelligence (EI) and Self Efficacy (SE) assessments more successful, leading to better growth and development (Khan C.H., 2023).

Mitigations

a. **Enrichment Programmes**. Seminars, workshops, and academic sessions can serve as important tools to raise awareness among BN personnel about the significance of emotional intelligence (EI) and self-efficacy (SE). These programs allow officers to understand the concepts and learn practical ways to apply them in their professional roles. In addition to BN psychologists, experts from both home and abroad may be invited to share their knowledge and experiences, enriching the learning process (FGD-1, 2023).

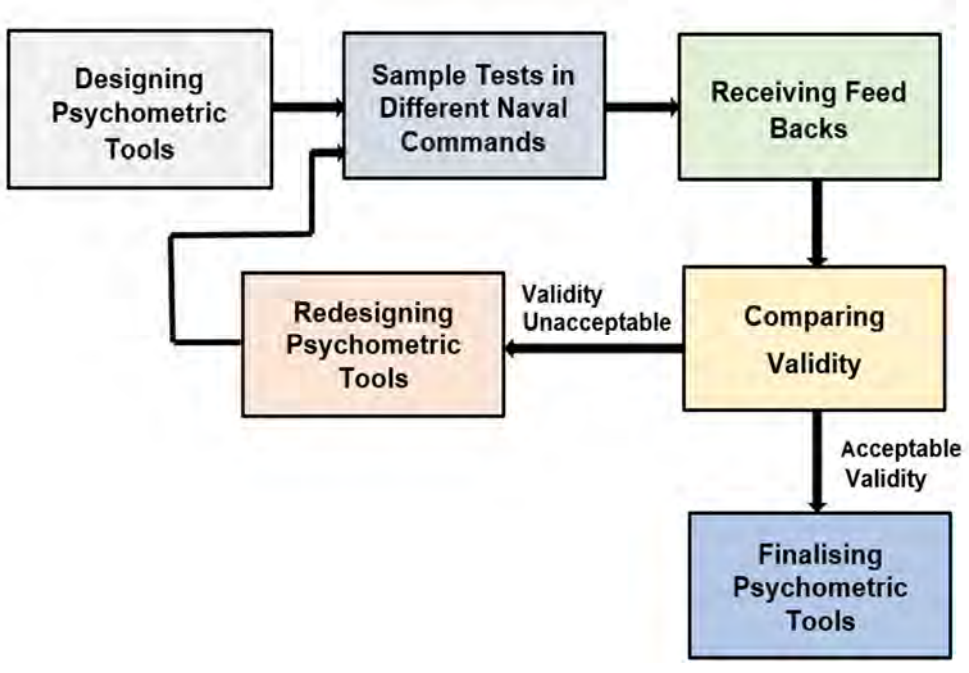
b. **Hiring and Developing Expertise**. BN may engage subject matter experts to train psychologists in identifying, monitoring, and developing tools for emotional intelligence (EI) and self-efficacy (SE). Additionally, courses from renowned national and international institutions can be arranged to deepen psychologists' understanding of EI and SE-related issues, enhancing their ability to support officers effectively (Hossain, 2023).

c. **Optimism and Adaptability**. Positive traits such as optimism and adaptability are essential for improving emotional intelligence (EI) and self-efficacy (SE). By remaining hopeful and adaptable in various service environments, BN mid-level officers can strengthen their EI

and SE, handle challenges effectively, and perform successfully in their professional roles (Khan C.H., 2023).

d. **Implementation of Psychometric Tools**. To determine EI and SE levels correctly, psychometric tools, based on a number of questions, need to be designed in line with the target people's culture, social values, ethos, common practices and so on (Hossain, 2023). The process drawn in the flow chart may be followed to implement psychometric tools for BN personnel:

Figure 4: Process to Implement EI and SE Determining Tools in BN



Source: Author's self-construct

e. **OPR Mechanism**. OPR is one of the effective mechanisms to drive an officer to become professionally sound. If EI and SE states are included in OPR and these states have specific weightage in OPR grading, BN officers will surely be careful about their EI and SE (Khan

C.H., 2023). Moreover, at the juncture of flourishing the career, BN mid-level officers will be highly aware of the emotional concerns through this mechanism.

f. **Joint Psychometric Cell**. EI and SE are seldom addressed in any of our Armed Forces. However, these are not great concerns for all the members of the Bangladesh Armed Forces. Therefore, the approach must not be limited to a single force (Khan C.H., 2023). The joint initiative will ensure the economy of effort and utilization of common resources.

Conclusion

This study draws on the conceptualizations of Emotional Intelligence and Self-Efficacy as outlined by Daniel Goleman and Albert Bandura respectively. According to Goleman, EI consists of five components: self-awareness, self-regulation, motivation, empathy and social skills. On the other hand, Bandura posits that SE emerges from four sources: emotional and physiological states, mastery experiences, vicarious experiences and verbal persuasion. While analyzing components of EI and sources of SE, it is found that these components and sources are interlinked. Moreover, some components of EI influence relevant sources of SE.

In the case of BN mid-level officers, EI and SE are directly linked with the sound professionalism and successful exercise of leadership. Hence, the mentioned components of EI and sources of SE opened up the path to determine relationship between EI and SE of BN mid-level officers. A numerical analysis on WLEIS and GSE assessments of BN mid-level officers was carried out to examine the relationship between their EI and SE. The analysis indicated that the increase in EI level leads to the increase of the SE level of BN mid-level officers.

Challenges are inevitable while taking a new initiative. In the process of developing EI and SE of BN mid-level officers, challenges like rigid mindset, lack of expert people, lack of awareness and false data input from target personnel are to be considered. To mitigate the mentioned challenges primary step should be the change of mindset. Moreover, developing self-awareness and spreading it is an effective way out in this regard. Besides, proper monitoring, regular counseling, training and academic sessions related to EI and SE may be considered as fruitful measures. The measures should naturally incorporate a balanced blend of theoretical insights and practical implications. The policymakers should consider the social values, norms, ethics and common practices in this regard.

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AUTHOR'S BIOGRAPHY

Lt Cdr Md Tauhidul Islam, (E), psc, BN was commissioned in the Engineering Branch on 01 December 2010. He subsequently joined the Military Institute of Science and Technology (MIST) to pursue a BSc in Mechanical Engineering. In addition to completing various professional courses at home, he underwent Type Rating training on the Dornier 228 aircraft in Germany and completed the Honeywell TPE331-10 turboprop engine maintenance course in the USA. As a result, he became a Type Rated and Certifying Engineer for the BN Maritime Patrol Aircraft (MPA) and their engines. He is an alumnus of the Defence Services Command and Staff College (DSCSC), Mirpur. Throughout his career, he has served onboard BNS JAMUNA and BNS ALI HAIDER as Engineer Officer and Senior Engineer Officer respectively. Lt Cdr Tauhid also served in Naval Aviation in multiple capacities, including Air Engineer Officer and Officer-in-Charge of the MPA Flight Line. He is currently serving at the GA-ATS facility in Germany as the Team Leader of the oversee team for the 72 months inspection of BN MPA 8306. He is happily married and blessed with a son.

Harnessing Artificial Intelligence in Modern Warfare: A Path Forward for Bangladesh Armed Forces

Commander Al Imran Tanvir, (ND), PBGMS, afwc, psc, BN

Abstract

The transformative role of Artificial Intelligence (AI) in modern warfare and its implications for the Bangladesh Armed Forces (BDAF) is one of major issues to explore in the present context of global modern warfare. As global militaries increasingly adopt AI to enhance combat effectiveness, surveillance, logistics, and strategic decision-making, Bangladesh must assess the opportunities and threats posed by this technological shift. This paper traces the evolution of military AI, identifies key applications including autonomous weapon systems, drone swarms, cyber defense and evaluates their potential impact on BDAF operations. It distinguishes between lethal and non-lethal uses of AI as well as its value in training, casualty care, and logistics. The research highlights major threats such as system malfunction, data misinterpretation, autonomous misuse, and ethical concerns. To counter these, it proposes a strategic preparedness framework for BDAF, emphasizing cybersecurity, AI research and development, personnel training and collaboration with the global AI community. The study also analyzes AI trends in neighboring countries, particularly India and Myanmar, to assess regional challenges. Concluding with a proposed AI roadmap, the paper underscores the urgency for Bangladesh to integrate AI responsibly and effectively into its defense structure to maintain national security and strategic balance in an increasingly AI-driven military environment.

Introduction

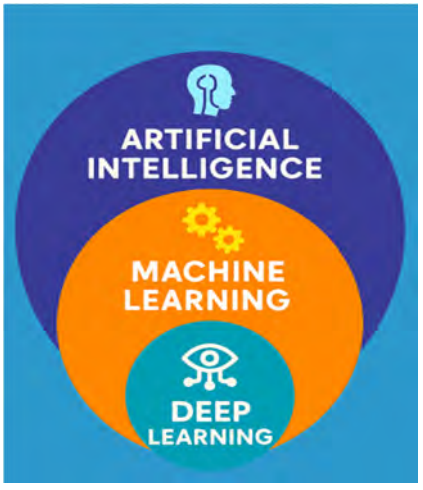
Warfare and the Industrial Revolution have always been closely related, and each industrial revolution has ultimately led to changes in warfare. The nature of combat in the modern era depends heavily on developing technologies. One such technology that has become a reality in the current setting is the "Fourth Industrial Revolution" (4IR) triggered by artificial intelligence (AI), particularly for the military. The demand for change often motivates the military, which is constantly seeking new and improved weaponry and technologies exactly what artificial intelligence (AI) offers (ÖZDEMIR, 2019). The United States of America (USA)'s "National Defense

Authorization Act" (NDAA) defines AI as "an artificial system" developed through computer software, physical hardware, or in another context, AI refers to systems capable of performing tasks that typically require human perception, reasoning, planning, learning, communication, or physical interaction (Greg Allen, 2017).

Statement of Problem

In recent years, Bangladesh (BD) has been making major attempts to adjust to AI. The "Draft National Strategy for Artificial Intelligence of Bangladesh," which outlines a five-year roadmap (2019–2024), was unveiled by the Bangladeshi government. Under the motto "AI for innovative Bangladesh," the nation is gradually but firmly adopting AI. Even if the nation is still developing AI capabilities, it is steadily progressing toward adopting this rapidly advancing technology. According to the "Government AI Readiness Index 2024," Bangladesh ranks 79th among 181 countries. However, the current state of AI within the Bangladesh Armed Forces (BDAF) has remained unsatisfactory and requires correction (Ahmed, 2019).

Figure 1: Artificial Intelligence



Source: Author's self-construct

Background

Militaries all over the world are using AI for a range of purposes, most notably military training. Training scenarios for military personnel are created using AI-powered modeling tools and simulations which include disaster relief efforts, combat circumstances, and humanitarian missions. Several militaries have been using AI-based computer-assisted wargame (CAWG) software for a while now to train and simulate warfare for their personnel. In addition, AI is being used by the majority of

militaries to automate weapon systems like drones and self-driving vehicles. These devices are capable of performing autonomous military operations, surveillance, and intelligence gathering. When modern conflict increasingly depends on AI-driven intelligence, autonomy, and decision-making, BDAF's current capabilities remain in early developmental stages. This gap limits the BDAF's ability to counter AI-enabled vulnerabilities and harness emerging opportunities. As regional actors intensify AI military integration, the BDAF must accelerate its own transformation. Without timely and effective strategic planning, the Bangladesh Armed Forces (BDAF) will continue to face risks and operational and strategic vulnerabilities.

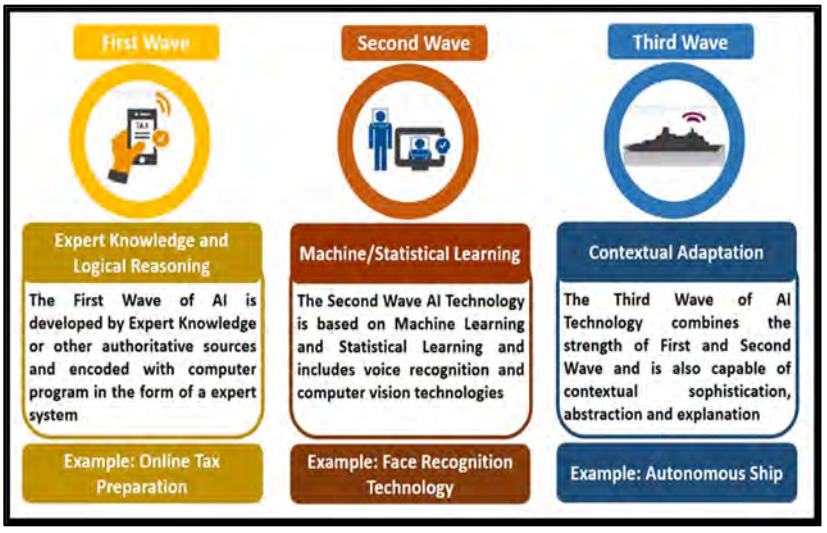
Evolution of military applications of AI

Military AI has made significant technological and functional advances over the past few decades. Military applications of artificial intelligence (AI) started in the 1950s when researchers first explored how computers could be used to mimic human intelligence. Initial efforts in AI concentrated on basic problem-solving and the development of rule-based expert systems. Between 1970 and 1980, the use of AI in military applications proliferated, especially in war management systems, natural language processing for communication, and early robotics and unmanned vehicle applications. Military applications of AI began to gain momentum during the 1990s. Electronic warfare, simulation-based training, and expert systems use AI technology to aid decision-making. In the early 2000s, data processing and machine learning began to impact military applications. AI enabled large-scale dataset analysis, data fusion, and intelligence gathering and analysis. In the mid-to-late 2000s, deep learning, neural networks, and huge data transformed AI. Recognition, image processing, and natural language comprehension advanced substantially in military applications. The use of AI in military operations significantly increased during the 2010s. Robotic devices like drones and UAVs are now used for surveillance and reconnaissance. AI-driven combat decision support systems assist military officers make smart choices.

Development of AI in Military Sector

Since its inception 70 years ago, AI has progressed through three stages of development (Figure-2). Expert systems used rules-based methodologies such as decision trees, Boolean, and fuzzy logic in the first stage. In the second stage, AI engineers developed and applied statistical approaches to create machine learning. These developed email spam filtering and search engines. The third stage, currently underway, incorporated human-like learning methods such as neural networks, defined deep learning, and succeeded in sensing and perception.

Figure 2: The Course of Development of AI



Source: United States Government Accountability Office (Stambaugh, 2018)

Types of AI

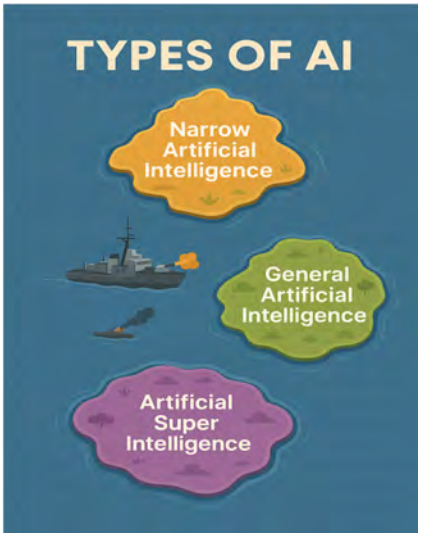
According to the encyclopedia (Copeland, 2023) classifications of AI are discussed below:

a. Narrow Artificial Intelligence, also called "weak AI", is a computer system that can perform a narrowly defined task more efficiently than a human. Today, this remains as the primary area in which the most of AI applications are concentrated.

b. General Artificial Intelligence (General AI), often referred to as "Strong AI", can outperform human achievements in any intellectual task. For example, we can see robots with this type of AI in movies where they act according to their own goals based on conscious thoughts.

c. Artificial Superintelligence (ASI) is expected to be able to outperform humans in almost all areas, but especially in scientific creativity, logic, and wisdom, and also in social skills (Szabadföldi, 2021).

Figure 3: Types of AI



Source: Author's self-construct

Military Applications of AI

AI can enhance military systems such as weapons, sensors, navigation, air support, and surveillance by increasing operational efficiency and minimizing the need for constant human involvement. Reducing the reliance on full human oversight in combat systems helps mitigate human error and allows personnel to focus on other critical tasks. One of the most beneficial military uses of AI is the creation and implementation of autonomous weapons; the update offers guidelines for their safe and moral development and usage (Stambaugh, 2018), (Bistron, 2021) addresses the following military uses of artificial intelligence:

War Fighting Capabilities

Lethal

a. **Autonomous Weapon Systems:** Robots and AI are used by autonomous weapon systems to perform tasks that were previously performed by human operators. These machines are able to behave and make decisions without direct human intervention. These technologies eliminate the requirement for complete human control over the weapon system, which lessens the possibility of human error and frees people to perform other crucial responsibilities.

However, because AI raises moral, legal, and strategic questions, there are ongoing debates about its development and application in weaponry. One of the primary problems with this technology is the potential loss of human control over the use of force (Digital, 2023).

b. **UAS/Drone Swarm:** Drone operations using swarm intelligence are a growing military use of AI. There are several advantages that make drone swarms more effective than individual drones. Military AI-controlled drone swarms behave like insects. For example, a bee will communicate what it observes that could help its hive —likewise, drones may also be able to do in the future. Like bees, they can transmit a target's distance, direction, elevation, and potential vulnerabilities. AI- powered drone swarms can employ this enormous collective intelligence to achieve military goals, a vital frontier in AI military applications.

c**. Fire Support/Target Recognition:** AI can improve battle target recognition. AI can help devices identify and locate targets like these. It can rapidly compile and analyze reports, research papers, news articles, and other data sources more efficiently than humans, aiding defense forces in gaining a clearer understanding of the operational environment. AI systems can forecast opponent behaviors, vulnerabilities, weather, and environmental circumstances, evaluate mission methods, and propose solutions. This saves both time and manpower, giving forces significant advantage over their targets well ahead.

Non-lethal

a. **Strategic Decision Making:** AI's algorithms can gather and analyze information from a wide range of sources to help in decision-making, particularly under stressful circumstances. AI systems are frequently able to assess a scenario quickly and effectively, allowing them to make the optimal choice in a pressing situation (Digital, 2023). Decision making can be accelerated by combining AI's rapid analytical skills with humans' ethical awareness.

b. **Threat Monitoring:** Threat monitoring and situation awareness enhance various military missions by gathering and analyzing data. Unmanned systems can either be controlled remotely or follow pre-planned routes. These AI-driven technologies assist defense personnel in threat monitoring and enhancing situational awareness. In these cases, AI drones can be deployed. These systems can oversee border areas, detect potential

vulnerabilities, and alert response teams. Additionally, they enhance the security of military bases and promote safety during combat operations.

c. **Cyber Security :** AI is capable of preventing unauthorized users from accessing computers, networks, data, and programmers. AI is also capable of identifying trends in cyberattacks and developing defiance mechanisms to fend them off. Long before malware attacks, even making their way into a network, these technologies can identify their simplest behaviors. Advanced AI has a mixed effect on cyber security, just like it does in many other domains.

Figure 4: Use of AI in War Fighting Capabilities

Source: Author's self-construct

Sustenance

a. **Transportation:** AI has a place in the movement of troops, armaments, supplies, and ammunition. The logistics and transportation of these items' are essential to the accomplishment of military missions. AI can help cut down on transportation expenses and human labor by, for instance, calculating the best route to take given the current circumstances. Additionally, it can foresee issues for military ships to improve performance efficiency.

b. **Casualty care and Evacuation:** Military AI employs an algorithm and vast medical database to obtain medical trauma case data, including diagnosis, vital sign sets, drugs, treatments, and outcomes. It uses this data

and manually entered information to generate treatment indications, warnings, and suggestions. In this case, AI needs human direction since it makes recommendations without emotional considerations, while humans must use their emotional talents to make suitable decisions based on these recommendations. AI cannot make medical decisions, but it can quickly analyze data to help people make them (Islam, 2023).

Military Training

a. **Data Processing and Research:** AI can assist military applications by rapidly sorting through data and identifying the most important facts. Additionally, it can help organize data from different databases. Military personnel may be better able to recognize patterns, reach more precise judgements, and formulate plans of action by having a more comprehensive understanding of the circumstances (Digital, 2023).

b. **Combat Simulation:** Military training simulation software uses systems engineering, software engineering, and computer science to create digitized models of combat systems used in operations. Military training simulation software is a virtual "Wargame" used to train soldiers. Training software can prepare soldiers for anything and save them in the long run. AI-based simulation can train soldiers, personalize training programs, and provide fair assessments to change programs. Due to its efficiency over people, combat simulation can save time and money.

Latest Trends of Military Applications of AI

The fields of AI are rapidly evolving. AI has played and is playing a significant role in various warfare. Hence, several AI applications have already been developed for advanced military use. Considering the latest trends, notable military applications where AI has proved its significance are:

a. Autonomous weapon systems.

b. Cybersecurity.

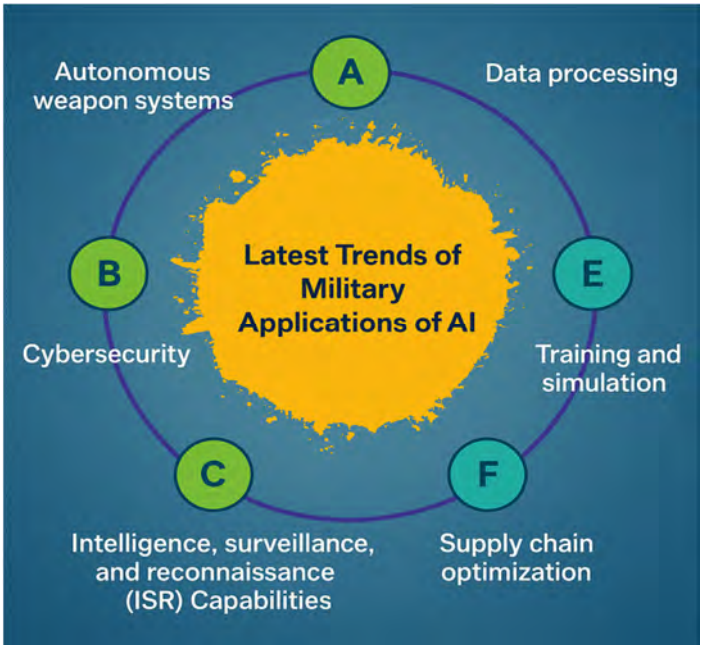
c. Intelligence, surveillance, and reconnaissance (ISR) capabilities.

d. Data processing.

e. Training and simulation.

f. Supply chain optimization.

Figure 5: Latest Trends of Military Applications of AI



Source: Author's self-construct

Potential Vulnerabilities of AI- based Military Applications and Preparedness of the BDAF

AI technology is rapidly advancing and has increasingly integrated into military weapons and defense systems. Applications of AI in the military can enhance decision-making processes and improve data analysis capabilities. However, these technologies pose threats. The BDAF recognizes the importance of adapting to rapidly evolving technologies. The BDAF must assess AI-based military vulnerabilities and prepare accordingly, focusing on regional Navies progress. Ethical development and deployment of AI-based military applications are crucial for the BDAF. To employ AI-based systems securely and effectively, transparency, accountability, and oversight must be implemented.

Figure 6: Use of AI in Naval War

Source: Author's self-construct using AI

Pertinent Vulnerabilities of AI-based Military Applications: Some of the vulnerabilities or risks have deeper ramifications than others on Military Applications which are discussed below.

a. **Autonomous Weapons**: AI-powered weaponry is quite simple that uses AI to select and engage targets. This could include anything from an autonomous drone capable of identifying and tracking targets with facial recognition to a missile designed to navigate precisely through the air. These weapons can cause destruction on a large scale and pose a significant threat to global security.

b. **Malfunction or Hacking:** Attack or hacker-caused system malfunctions can harm both military and civilian populations. These attacks, among other types, can be classified as either poisoning or input attacks. Attacks using AI systems can have grave, even fatal, repercussions because they are embedded into vital military applications. AI assaults can be employed in various ways to accomplish nefarious objectives.

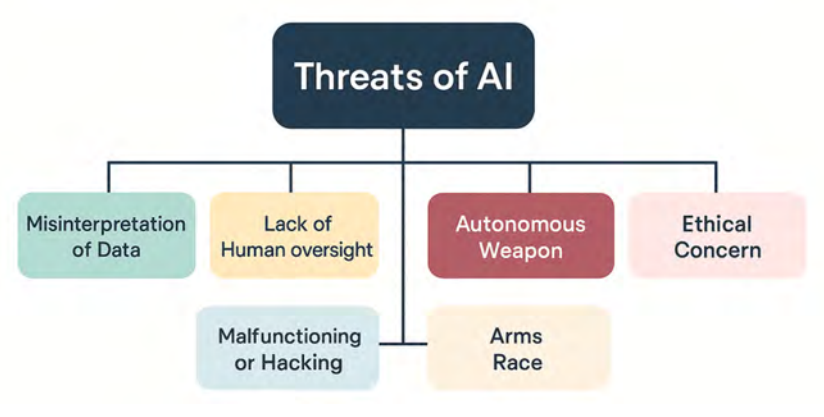
c. **Misinterpretation of Data**: AI systems are only as good as the data they are trained on. If the data is biased or incomplete, it can lead to misinterpretation and misapplication of the technology.

d. **Lack of Human Oversight:** Since AI systems are capable of operating independently, choices may be made without human intervention. This can cause issues when the AI system is making security judgements as it might not be able to accurately weigh the benefits and drawbacks of a certain course of action (Gülen, 2023). AI-based military systems may have unexpected repercussions if human control is lacking.

e. **Arms Race:** AI-based military systems might spark an arms race among nations to produce the most advanced and deadly technology. Global tension and conflict may rise. Due to geopolitical and military pressures, several observers have seen a global superpower arms race for superior military AI from the mid-2010s. An AI arms race is frequently framed as a US-China AI Cold War.

f. **Ethical Concern**: AI-based military applications raise significant ethical concerns. Chief among these concerns is the delegation of life-and-death decisions to autonomous systems, which challenges established norms of accountability and human oversight. The potential for unintended harm to civilians, especially in complex combat zones, is heightened by AI's limitations in judgment and context interpretation. As AI becomes more integrated into warfare, ensuring compliance with international humanitarian law and maintaining moral responsibility remain critical challenges.

Figure 7: Pertinent Threats of AI-based Military Applications



Source: Author's self-construct

The Trends and Implications of AI in Neighboring Countries

India and China are investing in AI and related technologies to modernize their economies and militaries (Kai-Fu, 2018). South Asia is just starting to use AI technologies, and faces hurdles such as a shortage of skilled workers and infrastructure (Khan & Hussain, 2020). AI might alter industries and generate new economic growth prospects in South Asia, particularly in healthcare, agriculture, and finance. AI in military defense raises ethical issues about unexpected repercussions and human rights breaches (Amnesty International, 2022).

Predominance of AI in Indian Military

The Indian military is extensively investing in AI and ML for predictive maintenance, cybersecurity, and picture and speech recognition (Ministry of Defence-India, 2018). AI integration into the Indian military will change operations and provide new warfare capabilities. AI-powered software and hardware platforms improve Indian Navy maritime surveillance, reconnaissance, and combat efficiency. The Indian government's 'Make in India' project aims to boost defense sector domestic manufacturing with AI and other modern technologies (NITI Aayog, 2018). The Indian military is positioning itself to lead regional military innovation.

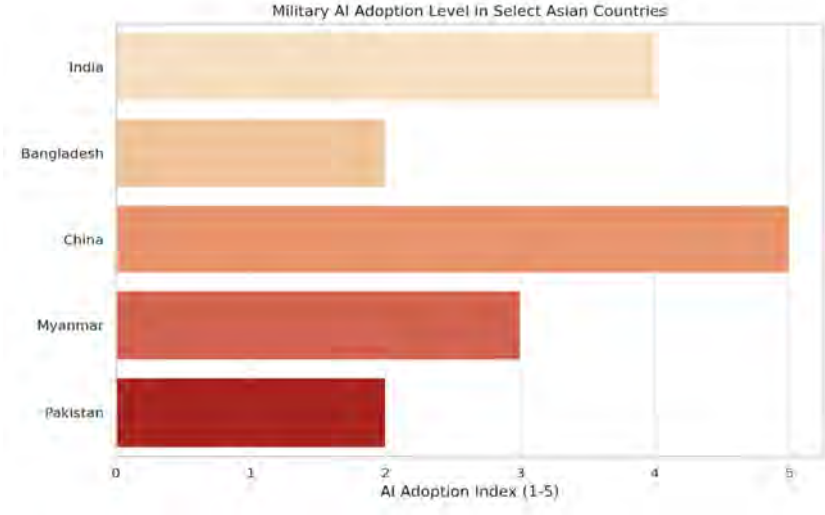
a. **War Fighting Capabilities:** A full integration of AI and ML into Navy operations is underway. AI and ML may be used for maritime domain awareness, maintenance prediction, and decision assistance. The Indian Army is also developing AI-powered drones, autonomous military vehicles, and facial recognition-based surveillance systems to improve ground operations (Ministry of Defence-India, 2018). DRDO is also developing AI-based technologies like a facial recognition system for aircraft maintenance, an autonomous unmanned ground vehicle, and a missile-capable unmanned surface vehicle (DRDO).

b. **Military Training:** AI and ML are being considered for military training in India. DRDO created an AI-based simulator for soldiers to practice shooting and tactical maneuvers (DRDO). To improve troop communication, the DRDO developed an AI-based speech training system. Additionally, the Indian Army has created an AI-powered virtual training system that simulates real-world circumstances to improve troops' decision-making. These examples show that AI and ML may improve Indian military training programs by offering realistic simulations and personalized training.

c. **Future of AI in Indian Military:** The Indian military plans to deploy AI in many sectors. The Indian Army wants to deploy AI to increase operational efficiency, intelligence-gathering, and decision-making to boost national security (Ministry of Defence-India, 2018). AI will prepare the Indian Army for cybersecurity, asymmetrical warfare and geopolitical instability.

Use of AI in Myanmar Military: AI in Myanmar is primarily concentrated on promoting financial inclusion and improving access. Chatbots help banks provide personalized customer service and process financial transactions (Access Now, 2021). Startups also use AI in alternative credit rating systems for persons without credit. Though directly not linked to military operations, effect of AI in financial systems would help Myanmar develop the national AI infrastructures. This development would set a cornerstone for the Tatmadaw to induct AI technologies in military operations swiftly. However, The Myanmar military uses biometric recognition technology, including facial recognition, to control troops and prevent defections (Amnesty International, 2022). The dictatorship is investing in AI-based surveillance and social media monitoring to control information and maintain power. The military is utilizing machine learning algorithms to identify dangers and stifle dissent (Access Now, 2021).

Figure 8: Military AI Adoption Index



Source: Oxford Insights Government AI Readiness Index (Oxford Insights, 2024)

Potential AI based Vulnerabilities which the BDAF may encounter

a. **Cyber-attacks:** AI-based cyber-attacks can exploit the BDAF vulnerabilities, disrupt operations or steal sensitive data. AI-powered malware can evolve to evade detection and defensive measures. Iran's loss of 20 percent of nuclear capabilities due to the Stuxnet attack on its nuclear facilities illustrates the dangerous potential of cyber-attacks.

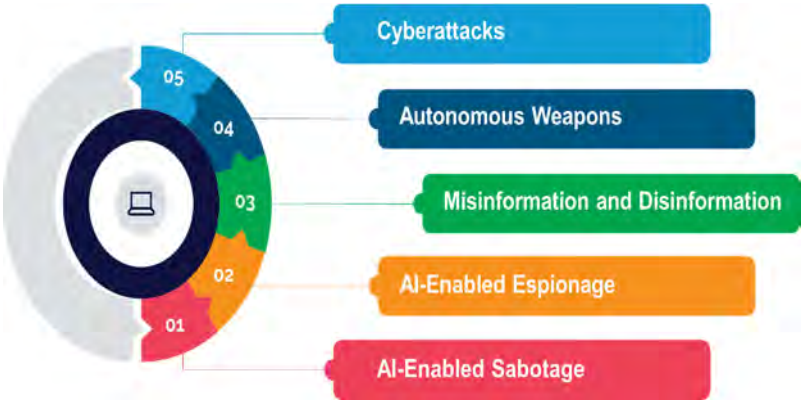
b. **Autonomous Weapons:** AI-based autonomous drones of India carryout randomized sonic missions to the target area with the help of on-board adaptive computers driven by continuous satellite feeds. Other systems like automated targeting systems, AI-enhanced cyberweapons, biased decision-making, and many more used by adversaries can malfunction, make errors or be hacked, leading to unintended or catastrophic consequences of BDAF in operational environment.

c. **Misinformation and Disinformation:** AI-based equipment used by potential adversaries can generate fake news, propaganda, and misinformation, influencing public opinion or confusing military decision-makers. Adversaries can manipulate social media platforms to spread disinformation and sow discord in BDAF.

d. **AI-Enabled Espionage:** AI can be used to conduct sophisticated cyber espionage and steal sensitive information and intellectual property of BDAF. Adversaries can use AI-based systems to analyze vast amounts of data and reveal valuable insights about operations and strategies of BDAF.

e. **AI-Enabled Sabotage:** AI-based systems can exploit the BDAF infrastructure weaknesses, leading to disruption or destruction of critical military assets of BD.

Figure 9: Potential AI Based Threats which BDAF may Encounter



Source: Author's self-construct

Preparedness of BDAF in Countering AI-based Vulnerabilities

The preparedness of the BDAF in countering AI-based vulnerabilities depends on several factors, starting from formulation of AI strategy for Armed Forces. It also includes training of military personnel in AI-based technologies and significant investment by the BDAF in research and development (R&D) of AI-based technologies. According to the Group Research Paper of Armed Forces War College 2023 participants, following areas need to be focused on (Rahman, 2023).

a. **Robust Cybersecurity for AI-based Military Systems:** The BDAF should regularly assess its cybersecurity posture and implement robust cybersecurity protocols that are specifically designed to counter AI-based vulnerabilities. The protocols may include advanced encryption techniques and multi-factor authentication. Regular vulnerability assessments, security audits, and other measures should also be considered to prevent unauthorized access to the systems.

b. **AI-based R&D Systems:** The BDAF can invest in R&D of AI systems to stay ahead of potential vulnerabilities in the future. In this regard, indigenous production capabilities of BD may be enhanced and encouraged. Potential areas of R&D and indigenous production may be focused on unmanned aerial systems, cybersecurity aspects, and intelligence, surveillance, and reconnaissance (ISR) capabilities.

c. **Training Personnel and Developing AI Expertise:** The BDAF personnel should be trained to recognize and respond to AI-based

vulnerabilities, primarily on cybersecurity, supply chain management, data analysis, and also develop their countermeasures against AI- driven vulnerabilities.

d. **Implementation of Robust Authentication and Access Controls**: Strong authentication and access controls, including multi-factor authentication, strong passwords, and regular password changes, should be implemented to prevent unauthorized access to military networks and systems.

e. **Increasing AI Awareness**: The BDAF can organize awareness initiatives for the officers at regular intervals highlighting adverse effects of AI and capabilities of potential adversaries of BD. Moreover, preparing personnel for acquiring knowledge on autonomous weapons and other AI technologies is also important.

f. **Incorporating AI in Military Strategy and Operations**: The BDAF can incorporate AI in military planning and decision-making process. Other areas of AI-based military strategy and operations include C4ISR capabilities, information operations, sustenance capabilities to stay competitive in the modern battlefield.

g. **Collaboration with AI Community:** BDAF can collaborate with researchers and industry experts to develop new defensive measures. In doing so, responsible use of AI-based military systems, sharing best practices, and collaborating on the development of guidelines and regulations can be harnessed.

Proposed AI Roadmap for the BDAF

A proposed roadmap of 16 years has been divided into four phases which are mentioned below and further explained in the figure.

a. **Phase 1: Foundation Phase (2025-2027).** At the beginning, the focus can be given on establishing the policy, organizational, and conceptual groundwork necessary for AI adoption within BDAF. In congruence with the 'Draft National AI Strategy', the formulation of an AI strategy for the BDAF is the first stepping a foundational step in readying BDAF to address AI-driven vulnerabilities. During the 'Foundation Phase', AI will be implemented based on existing resources (civil and non-government

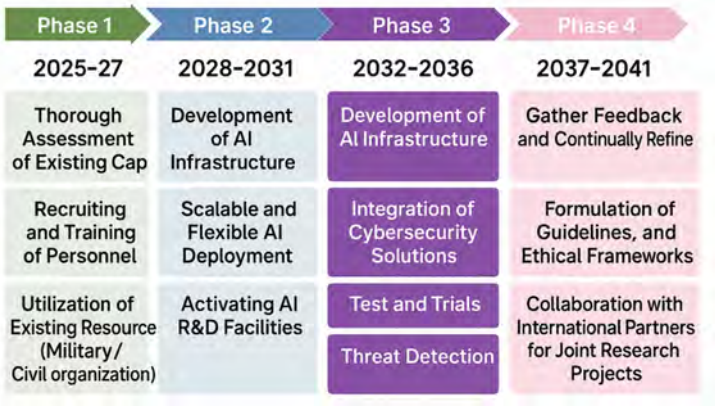
organizations). AFD in coordination with AHQ, NHQ and Air HQ will play the moving role to implement this phase.

b. **Phase 2: Infrastructure Development Phase (2028-2031)**. This phase emphasizes building data infrastructure, cloud computing capacity, secure networks, and the initial establishment of military AI laboratories for research and development. Strengthening cyber defenses becomes critical at this stage to safeguard emerging systems from adversarial interference.

c. **Phase 3: Integration and Implementation Phase (2032-2036).** Once core infrastructure is in place, the BDAF can begin integrating AI into C2 systems, logistics, and training environments. This phase ensures that platforms, sensors, and decision-support tools operate in an interoperable and mission-ready ecosystem. Structured experimentation and field trials help refine the effectiveness and reliability of deployed AI solutions. Military institutes like BUP, MIST, DSCSC and NDC may be utilized to promote training excellence along with other related public and private universities.

d. **Phase 4: Operationalizing and Improvement Phase (2037-2041).** In this stage, AI-enabled systems become fully embedded in operational frameworks across the services. Continuous feedback loops allow for iterative refinement, ensuring that systems remain adaptive to evolving vulnerabilities and mission requirements. Continuous collaboration with the ICT Division and private AI industries will ensure technological alignment, knowledge transfer, and long-term sustainability of the roadmap.

Figure 10: Proposed AI Roadmap for BDAF



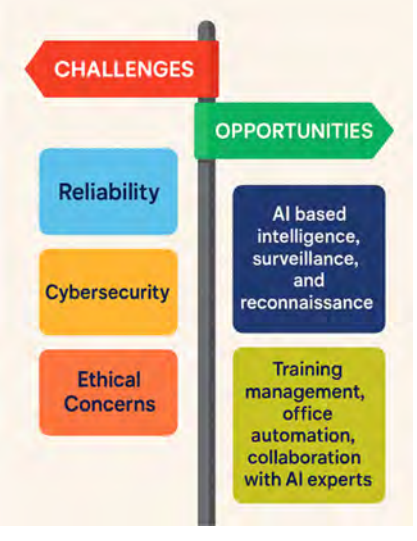
Source: Author's self-construct

Obstacles and Prospects for the BDAF in Adopting AI Technologies

Integrating AI into the BDAF presents both significant challenges and promising opportunities. A major challenge is the shortage of infrastructure and local expertise necessary to create and sustain AI-based systems. Bangladesh's limited AI readiness, reflected in regional indexes, highlights the need for robust policy support, investment in R&D, and skilled personnel. Additionally, the potential risks of cyberattacks, system vulnerabilities, and ethical concerns about autonomous weapons add complexity to AI adoption. Interoperability with existing legacy systems and the risk of foreign technology dependence further complicate integration.

Despite these challenges, the opportunities are immense. AI can transform the BDAF's capabilities in surveillance, reconnaissance, cybersecurity, decision-making and maritime domain awareness. By adopting AI-driven solutions, the BDAF can enhance its operational efficiency, reduce human risk, and respond faster to vulnerabilities. Implementing AI in logistics, training simulations, and autonomous platforms could also optimize resource utilization. Moreover, strategic collaboration with universities, tech companies, and global partners could accelerate BDAF's AI maturity. With a structured roadmap and sustained investment, the BDAF has the potential to leapfrog into a modern, technology-driven force, capable of addressing future maritime challenges with agility and precision.

Figure 11: Challenges and Opportunities for BDAF in Integrating AI



Source: Author's self-construct

Conclusion

The integration of Artificial Intelligence (AI) into military systems has ushered in a transformative era in modern warfare. For the Bangladesh Armed Forces (BDAF), this evolution presents both immense opportunities and formidable challenges. As AI redefines the nature of combat, surveillance, logistics, and strategic planning, the BDAF must recognize the urgency of adapting to these changes to safeguard national security and maintain regional parity. The 5-year 'National Strategy for Artificial Intelligence of Bangladesh' (2019-2024) has been in place, however, the BDAF still lags behind in harnessing its benefits. However, potential opponents have advanced in this area by incorporating it into their battle strategy. Therefore, the BDAF must design a preparedness strategy to resist AI vulnerabilities in future wars.

However, the adoption of AI also brings with it serious concerns. System malfunction, hacking, misinterpretation of data and insufficient human oversight pose significant risks. Ethical dilemmas surrounding autonomous weapons and the potential for an AI arms race further complicate the strategic calculus. Moreover, Bangladesh must prepare to counter AI-driven vulnerabilities from external actors, including cyberattacks, misinformation campaigns, autonomous weapon incursions, and espionage.

To confront these challenges, the BDAF must implement a multi-pronged preparedness strategy. This includes investing in AI-based research and development, fostering collaboration with academic and technological institutions, building AI literacy among military personnel, and ensuring robust cybersecurity for all AI-enabled systems. Training programs must incorporate advanced simulation tools, while command structures must be updated to accommodate AI-assisted decision-making processes.

AI will be a defining element of future warfare and its responsible adoption is no longer optional but essential. The Bangladesh Armed Forces must act decisively and strategically to incorporate AI in a balanced, ethical, and forward-looking manner. With prudent planning and a clear vision, Bangladesh can not only defend against emerging AI vulnerabilities but also harness its full potential to modernize its defense forces and uphold national sovereignty in an increasingly technology-driven battlefield.

Recommendations

Considering the evolutions of AI in the military, capabilities of potential adversaries in AI-based military applications, and preparedness of the BDAF for future conflicts where AI will be extensively used, following recommendations are made:

a. The Armed Forces Division (AFD) may formulate AI strategy to initiate and synchronize the development, and earmark priority areas (preferably ISR cap, training management, data processing) for implementation in the BDAF. According to proposed roadmap, this process may be completed by 2026.

b. The AFD may harmonize different types of simulation initiatives undertaken by various training institutes and organizations in all three services by 2027. As a short-term implementation plan of this project, 'AI-based operational level WG simulation system for AFWC' may be undertaken by NDC.

c. Army formations, Navy flotillas, and Air Bases may conduct study periods, seminars, symposiums periodically highlighting severe impacts of AI and preparedness of the BDAF to increase awareness amongst officers and men.

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Biography

Commander Al Imran Tanvir, (ND), PBGMS, afwc, psc, BN was commissioned in Bangladesh Navy on 01 December 2004. The officer is a Navigation and Direction (ND) specialized officer. He is a graduate of Defense Services Command and Staff College, Mirpur, Dhaka. He is also an alumnus of Armed Forces War College wing of National Defence College, Mirpur, Dhaka. The officer has earned two Master's degree in his credits. He attended many professional courses both at home and abroad. Commander Tanvir has a good mix of command, instructional and staff appointments. He served on various ships of the BN and held positions like Commanding Officer, Executive Officer and Navigating Officer. He also served in Directorate General of Forces Intelligence (DGFI) and Border Guard Bangladesh (BGB) in deputation. He served in the UN Peace Keeping Mission in Western Sahara as UNMO. He commanded BNS SAGAR, the only Mine Sweeper of Bangladesh Navy and three Patrol Crafts. He has served as Staff Officer (Operations) to Commander Flotilla West of Bangladesh Navy. He has received peacetime medal "President Border Guard Medal Seba" from BGB in 2017. Presently, he is serving as Executive Officer of BNS ALI HAIDER, a Guided Missile Frigate (FFG) of Bangladesh Navy.

Defence Diplomacy: An Effective Tool of Statecraft to Promote National Interest of Bangladesh

Lieutenant Colonel Md Wadud Ullah Chowdhury, afwc, psc, Inf

Abstract

Defence diplomacy has increasingly emerged as a core instrument of modern statecraft, integrating military engagement with diplomatic initiatives to address security threats and promote national interests. For Bangladesh, situated between South and Southeast Asia, defence diplomacy has evolved from a peripheral activity to a key foreign policy tool aimed at strengthening regional cooperation, deepening strategic partnerships and enhancing its global image. Early engagement through United Nations peacekeeping operations significantly elevated Bangladesh's international standing and professionalised its armed forces. In parallel, bilateral ties with countries such as China, the United States, Japan and Türkiye etc. have enabled access to training, defence technology and institutional collaboration. Adopting a qualitative and comparative methodology, this study draws on soft power theory, strategic culture and regional security frameworks to analyse the principles and practices of defence diplomacy. Comparative insights from Vietnam, Indonesia and South Korea offer contextual benchmarks relevant to Bangladesh. The study identifies key limitations, including low strategic mobility, underdeveloped defence-industrial infrastructure, political volatility and the absence of a dedicated national strategy for defence diplomacy. Addressing these constraints requires a coordinated and long-term approach that aligns defence diplomacy with national security, foreign policy and economic development objectives. As the security environment becomes increasingly shaped by non-traditional threats such as cyber risks, terrorism and climate-related disruptions, Bangladesh must prioritise institutional capacity, strategic foresight and policy integration. Defence diplomacy, therefore, must be recognised not only as a mechanism for external engagement but also as a platform for enhancing national influence, strengthening institutional resilience and contributing meaningfully to regional and global security frameworks.

Introduction

Diplomacy, historically known as the art of negotiation among several sovereign states, has evolved to encompass a broader variety of effective tools, including political, economic, and military aspects. Among these, the *defence diplomacy* has emerged as a fundamental subset of modern statecraft, especially in a multipolar and security sensitive international environment. Defence diplomacy is the peaceful application of defence resources and relationships of a country to achieve foreign policy objectives, boost alliances, build trust, and prevent conflicts through confidence building measures and mutual engagement[i]. In recent days, the effectiveness of defence diplomacy has expanded extensively, reflecting the intricacies of interstate relations in the post-Cold War world. As traditional warfare stages way to hybrid threats, ranging from terrorism to cyber-attacks, states increasingly employ their armed forces in diplomatic roles to maintain stability and shape regional security architecture[ii].

With limited territorial depth but significant geopolitical relevance, Bangladesh's foreign policy imperatives demand peaceful coexistence, regional cooperation, and sustained economic growth[iii]. In this context, defence diplomacy becomes a proactive mechanism for building strategic partnerships, accessing military technologies, and enhancing operating together effectively with other nations[iv]. The Bangladesh Armed Forces have earned significant international recognition for their professionalism and commitment, particularly through their contributions to United Nations peacekeeping missions. These efforts have enhanced the country's diplomatic presence and reinforced its reputation as a responsible, peace promoting actor in global affairs[v]. Defence diplomacy in Bangladesh, therefore, not only supports its immediate security needs but also contributes to regional trust building, capacity enhancement, and economic diplomacy[vi].

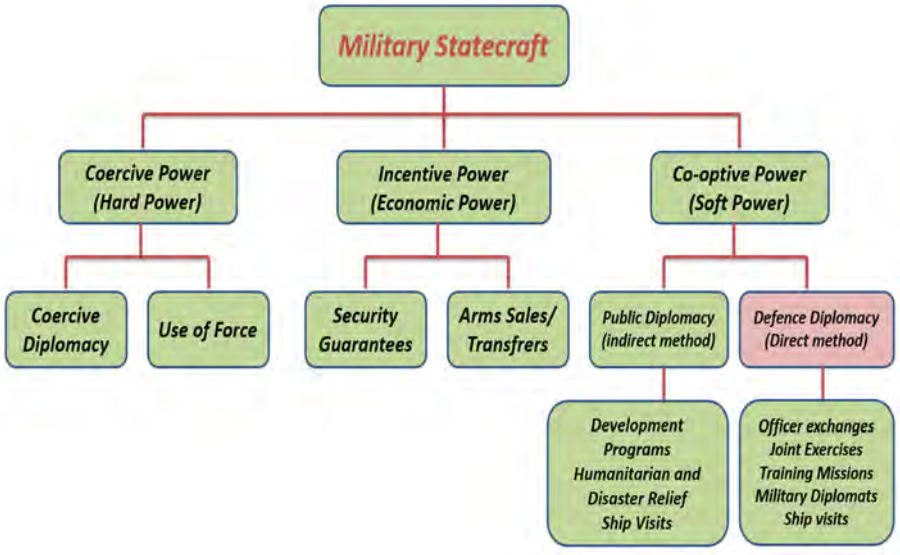
Against this backdrop, this paper aims to explore defence diplomacy as an effective tool of statecraft to promote Bangladesh's national interest. It first outlines the concept, principles, and operational dimensions of defence diplomacy. Subsequently, it analyses the strategic significance and practical applications of defence diplomacy in the context of Bangladesh. The paper concludes by identifying key challenges and presenting actionable recommendations to institutionalise defence diplomacy as an enduring pillar of Bangladesh's foreign and security policy. The paper adopts a qualitative and analytical approach grounded in contemporary theories of international relations and strategic studies, particularly soft power theory, strategic culture and regional security complex theory (RSCT). It draws on both primary sources, such as policy documents, official defence white papers, and peacekeeping records, and

secondary literature including peer-reviewed articles, think-tank reports and comparative studies.

Concept of Defence Diplomacy

Defence diplomacy refers to the peaceful application of defence resources, including military personnel, institutions and infrastructure, to achieve foreign policy objectives through engagement, cooperation, and capacity building with foreign counterparts. It is an essential component of modern diplomacy (Figure-1), positioned at the intersection of foreign policy and national security strategy. Key instruments of defence diplomacy include high-level military visits, joint training exercises, exchange programmes, port visits, defence related dialogues, and participation in multilateral peacekeeping operations[vii]. These activities serve to enhance mutual understanding, build trust, and create transparency among defence establishments.

Figure-1: The Flow Chart of Defence Diplomacy



Source: 'The Velvet Gauntlet: A Theory of Defence Diplomacy[8]'

Defence diplomacy functions as a tool of *soft power*, as defined by Joseph Nye as the ability to attract and coopt rather than coerce[9]. Through collaborative engagements, it projects a nation's strategic values, promotes norms of responsible state behaviour, and cultivates partnerships that are critical for long term peace and regional stability. In this context, defence diplomacy strengthens alliances, supports preventive diplomacy, and contributes to shaping the strategic environment. It plays a strategic role in addressing nontraditional security threats such as terrorism, piracy, cybercrime,

pandemics, and transnational organised crime. Moreover, it supports broader foreign policy goals including democratic governance, human rights advocacy, and economic development by enabling defence sector reforms and security sector governance in partner nations. The location of defence diplomacy in the architecture of military statecraft is shown in figure-1. Examples of defence diplomacy in practice include ASEAN Defence Ministers' Meeting Plus (ADMM Plus) and China's military exchanges under the Belt and Road Initiative[10].

The conceptual foundation of defence diplomacy is closely linked to soft power theory, articulated by Joseph Nye, which posits that states can influence others through attraction, such as values, institutions, and cooperative behaviour, rather than coercion or payment. Defence diplomacy, through peacekeeping, humanitarian operations, and military exchanges, exemplifies this principle by promoting national interests via normative engagement. It also resonates with the framework of strategic culture, which explains a state's behaviour in international relations through its historical experience, military traditions, and institutional norms[11]. Bangladesh's emphasis on peacekeeping and regional stability reflects a strategic culture that favours non-aggression and cooperative security. Furthermore, Regional Security Complex Theory (RSCT), advanced by Buzan and Wæver, provides a regional lens, arguing that geographically proximate states often share interdependent security concerns that must be managed collectively[12]. For Bangladesh, defence diplomacy offers a strategic instrument to balance relations with neighbouring powers and assert agency in a competitive regional order.

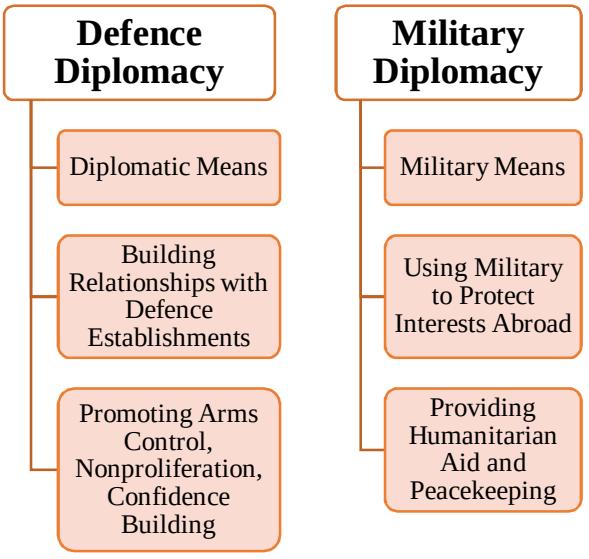
Defence Diplomacy versus Military Diplomacy

Although closely related, *defence diplomacy* and *military diplomacy* represent distinct strategic approaches within the broader domain of international security engagement. Defence diplomacy refers primarily to the peaceful application of diplomatic tools by a nation's defence establishments, both civilian and military, to advance foreign policy objectives and promote national security interests through cooperation, dialogue, and mutual trust building[13]. Key activities include bilateral defence dialogues, joint training programmes, intelligence sharing frameworks, arms control advocacy, and confidence building measures. By contrast, military diplomacy generally refers to the use of military capabilities, often through symbolic or operational means, to achieve diplomatic ends. This includes forward military presence, port calls, peacekeeping deployments, and humanitarian assistance missions that serve to signal commitment, build influence, and project soft or coercive power[14]. While military diplomacy often employs the armed forces in visible operational roles; defence diplomacy is more policy driven, emphasising institutional relationships and

long-term strategic partnerships[15]. A tabular comparison between defence and military diplomacy is shown in figure-2.

In summary, defence diplomacy prioritises the use of diplomacy by military actors to build peace and prevent conflict, while military diplomacy involves leveraging military instruments to reinforce diplomatic messages and strengthen state influence abroad. Both approaches are complementary and may overlap in practice, particularly in joint exercises, crisis response, or post conflict stabilisation operations[16].

Figure-2: Comparison between Defence and Military Diplomacy



Source: Author's self-construct based on content analysis

Basic Principles of Defence Diplomacy

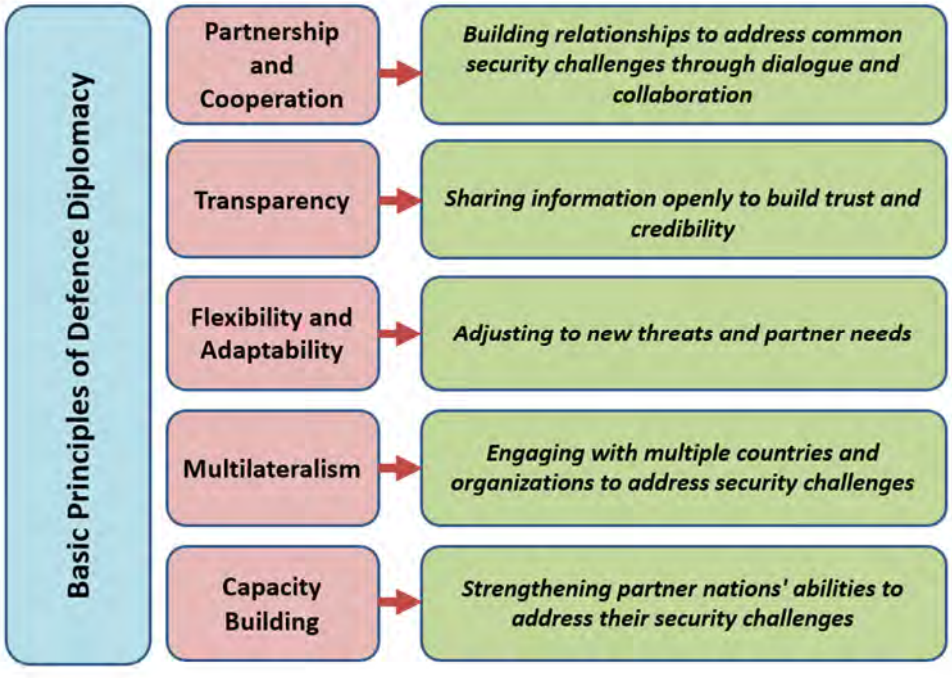
Defence diplomacy refers to the deliberate use of military and defence mechanisms within diplomatic frameworks to advance national security interests, foster strategic relationships, and promote regional stability. As outlined in Figure-3, its foundational principles include strategic cooperation, transparency, adaptability, multilateralism, and capacity building.

Strategic cooperation lies at its core focusing on cultivating long-term partnerships to address shared security concerns such as maritime threats, terrorism, or humanitarian crises. This involves sustained dialogue, intelligence exchange, and joint exercises, promoting alignment beyond mere transactional engagement. Transparency mitigates mistrust and miscalculation by making intentions and capabilities clear. Publishing

defence white papers, conducting inclusive military exercises, and sharing doctrinal information help build credibility and reinforce predictability in military conduct[17].

Adaptability is essential in responding to evolving security challenges ranging from cyberattacks to grey-zone conflicts. Flexible planning and situational responsiveness allow defence diplomacy to remain relevant across shifting geopolitical and operational environments. Multilateralism enhances legitimacy and reach by embedding bilateral initiatives within broader frameworks such as UN peacekeeping, ASEAN-led dialogues, or regional security architectures. Such participation fosters interoperability and burden-sharing among partners[18]. Capacity building enhances the institutional strength of partner countries through training, technical assistance, and defence sector reform. It includes promoting democratic civil–military relations, good governance, and sustainable security practices. These principles collectively position defence diplomacy as a norm-based, preventive, and trust-oriented tool of statecraft shaping a cooperative security environment while advancing national strategic interests[19].

Figure-3: Principles of Defence Diplomacy



Source: Author's self-construct based on content analysis

Facets of Defence Diplomacy

Defence diplomacy represents a strategic blend of military engagement and diplomatic interaction aimed at advancing a nation's security and foreign policy objectives. It comprises several core facets that enable states to foster trust, enhance interoperability, and project influence in the international arena.

a. Bilateral and multilateral defence cooperation involves the establishment and reinforcement of strategic relationships with likeminded nations through defence cooperation agreements, joint military exercises, and coordinated intelligence sharing. These engagements enhance mutual security and promote regional stability[20].

b. Exchanges between military personnel, such as training missions, officer exchange programmes, and joint operations, build familiarity, operational cohesion, and mutual trust. Such engagements are particularly important during peacetime to prevent misperception and promote confidence building.

c. Formal defence cooperation agreements provide a legal and institutional framework for collaboration in areas like procurement, research and development, logistics, and training. These agreements streamline partnerships and enable long term strategic planning.

d. Defence diplomacy often entails providing partner nations with military training, advisory support, and equipment. Assistance may be directed towards peacekeeping readiness, disaster response, border management, or counterterrorism operations.

e. Posted within embassies, defence attachés serve as formal liaisons between the armed forces of the sending and host nations. Their role is instrumental in gathering defence related insights, fostering cooperation, and representing military perspectives in diplomatic discourse[21].

f. Timely and structured exchange of defence intelligence is critical for identifying common threats, such as terrorism and transnational crime. This cooperation improves situational awareness and facilitates coordinated responses.

g. Participation in the UN and regional peacekeeping operations allows states to contribute to global security while gaining operational experience and enhancing diplomatic reputation. It is also a vehicle for engagement with host nations and coalition partners.

h. Military support in the aftermath of natural disasters or humanitarian crises exemplifies soft power projection. It helps build goodwill, strengthens bilateral ties, and showcases a nation's capacity for rapid and coordinated relief operations.

j. Collaboration in defence production, technology transfer, and joint ventures enhances indigenous defence capabilities. It also strengthens strategic partnerships through shared industrial and technological interests.

Significance of Defence Diplomacy as a Tool of Statecraft

Defence diplomacy remains as a pivotal instrument of statecraft, enabling nations to pursue strategic objectives through peaceful military engagement and cooperative security initiatives. In the contemporary security environment, marked by transnational threats, strategic competition, and weakened multilateralism, defence diplomacy helps strengthen regional coordination mechanisms and contributes to shared security efforts. At its core, defence diplomacy facilitates the establishment of military-to-military relationships, allowing for the exchange of information, technical expertise, and best practices. These engagements help build mutual trust, reduce the risk of miscalculation, and promote transparency in security affairs.

Countries can project soft power, highlight technological competencies, and signal their commitment to international norms through structured defence engagements. This, in turn, strengthens diplomatic credibility and opens avenues for broader cooperation, including trade, investment, and technology transfer. Furthermore, defence diplomacy contributes to a state's international image as a responsible and peace-oriented actor. It demonstrates readiness to cooperate on issues of shared concern, such as peacekeeping, counterterrorism, maritime security, and humanitarian assistance. Such visibility can enhance geopolitical relevance and attract foreign direct investment, reinforcing the nexus between security and development. In summary, defence diplomacy is not only a mechanism for promoting peace and stability but also a strategic tool for elevating national influence, safeguarding sovereignty, and enabling long term economic and diplomatic gains.

Significance of Defence Diplomacy for Foreign Policy of Bangladesh

Defence diplomacy serves as an integral component of Bangladesh's foreign policy strategy, playing an indispensable role in safeguarding national interests, enhancing strategic capabilities, and contributing to both regional and global peace initiatives. As a responsible member of the international community, Bangladesh leverages defence diplomacy to promote stability, establish security partnerships, and build trust through

peaceful military engagement. This multidimensional tool of statecraft reinforces Bangladesh's posture as a cooperative, peace-loving state with growing strategic relevance in South Asia and beyond. Significance of defence diplomacy in Bangladesh's foreign policy is portrayed in figure-4.

a. Security Concerns. Bangladesh faces diverse security concerns, including terrorism, insurgency in border regions, illicit trafficking, maritime security risks in the Bay of Bengal, and cross border tensions. Through bilateral and multilateral defence diplomacy, Bangladesh cooperates with regional and global partners to address these threats via intelligence sharing, joint military training, and coordinated maritime security operations.

b. Economic Development. Defence diplomacy contributes to national development by facilitating technology transfers, promoting defence related industrial collaboration, and creating pathways for joint ventures. Engagements with countries like China, Turkey, and South Korea have enabled Bangladesh to import defence technologies while exploring the potential for indigenous production and export of military equipment. This defence industrial cooperation supports economic diversification and capacity building within the national defence sector.

c. Diplomatic Relations. Military engagement often serves as a diplomatic bridge, strengthening bilateral ties and opening new channels for economic, cultural, and technological collaboration. Defence diplomacy provides platforms for high level military exchanges, defence dialogues, and confidence building measures that enhance Bangladesh's regional and global diplomatic profile.

d. Peacekeeping Missions. Defence diplomacy, in this context, supports the integration of peacekeeping experiences into military doctrine and enhances interoperability with global forces, thereby reinforcing Bangladesh's credibility as a global peace contributor.

e. National Defence. Bangladesh's geopolitical location necessitates robust defence preparedness. Strategic partnerships formed through defence diplomacy provide access to modern weaponry, advanced training modules, cyber defence capabilities, and strategic doctrines. These collaborations contribute to the broader military transformation agenda aligned with national security objectives amidst shifting regional dynamics.

f. **Regional and Strategic Posturing.** As South Asia evolves into a contested geopolitical space with overlapping interests of regional and extra

regional powers, Bangladesh's defence diplomacy offers a pathway to maintain strategic autonomy while contributing to regional equilibrium. Proactive engagement in ASEAN related forums and trilateral cooperation initiatives allows Bangladesh to shape and respond to regional developments in a constructive and balanced manner.

Figure 4: Defence Diplomacy in Bangladesh's Foreign Policy

Source: Author's self-construct based on content cnalysis

Evolution of Bangladesh's Defence Diplomacy

Bangladesh's defence diplomacy has evolved from modest beginnings into a strategic instrument of foreign policy, shaped by its historical experience, national priorities, and the evolving geopolitical landscape. Modernisation and diplomacy have been pursued in tandem to reinforce national security goals, to enhance strategic partnerships, support peace and stability, and modernise its military capabilities. The following milestones and engagements illustrate the trajectory of this development.

a. Post Independence Foundations: The Legacy of the Liberation War. Emerging as a sovereign state after a protracted conflict, Bangladesh inherited a nascent military infrastructure that required extensive capacity building. In the immediate post-independence years, diplomatic outreach focused on consolidating sovereignty and initiating security cooperation with friendly nations. The establishment of early defence ties with friendly countries laid the foundation for future military and diplomatic engagements.

b. UN Peacekeeping: A Pillar of Strategic Engagement. Beginning in the 1980s, robust participation in UN peacekeeping operations has enabled Bangladesh to project its commitment to international peace and security. By participating in peacekeeping, Bangladesh has enhanced its global reputation and gained valuable operational experience, benefitted from exposure to advanced military technologies, and developed interoperability with multinational forces.

c. SAARC Engagements: Multilateral Regional Cooperation. As a founding member of the South Asian Association for Regional Cooperation (SAARC), Bangladesh has sought to promote regional security through dialogue and defence cooperation. While SAARC's achievements on security issues remain constrained by political challenges, Bangladesh's participation in regional confidence building measures and defence policy dialogues under this framework underscores its commitment to multilateralism.

d. Bilateral Defence Cooperation with Strategic Partners. Since the the 1990s, Bangladesh has diversified its defence relations by establishing bilateral ties with key global and regional powers. Defence cooperation with China, for instance, has involved the acquisition of military hardware, joint training, and capacity building initiatives, making China one of Bangladesh's principal defence suppliers. The Bangladesh-India defence relationship witnessed a breakthrough with the 2015 Land Boundary Agreement, which enhanced mutual trust and border stability. Engagements with the United States have focused on training, counter-terrorism, disaster response, and maritime security. Joint exercises such as the *Cooperation Afloat Readiness and Training (CARAT)* series underscore growing interoperability and shared security interests. In recent years, new collaborations with emerging partners such as Japan, South Korea, and Turkey reflect diversification of defence outreach. These engagements feature military education exchange, defence technology cooperation, and logistical support arrangements.

e. Consolidation and Modernisation through Defence Diplomacy. Bangladesh's multi vector defence engagements have strengthened both operational readiness and diplomatic leverage. Several emerging middle powers have leveraged defence diplomacy as a strategic tool to enhance regional standing and military professionalism. For instance, Vietnam has actively pursued defence diplomacy with both the United States and China, engaging in naval exchanges and humanitarian operations while maintaining strategic autonomy. Indonesia, through ASEAN-led platforms, has institutionalised military to military cooperation to address nontraditional

threats such as piracy and disaster response, reflecting a balanced civil military interface. South Korea has combined defence exports, joint exercises, and training programmes with partners across Asia and Africa, branding its military as a tool of development diplomacy. These cases underscore that structured, transparent, and multilateral defence diplomacy can significantly elevate national influence, even without dominant military capacity. Bangladesh can draw lessons from these experiences in diversifying partnerships, enhancing regional visibility, and embedding its efforts within multilateral security architectures.

Challenges in Bangladesh's Defence Diplomacy

Despite the strategic benefits of defence diplomacy, Bangladesh faces a range of internal and external challenges (Figure-5) that limit its capacity to fully realise this tool's potential. Addressing these constraints is essential to strengthening the country's international defence engagement and enhancing national security.

a. Risks of Military Entanglement. Participation in multinational operations and overseas engagements, while diplomatically beneficial, carries the risk of unintended involvement in foreign disputes or regional rivalries. Bangladesh must tread cautiously to avoid overextension or the perception of taking sides in contested security theatres, particularly in volatile or politically sensitive environments.

b. Limited Power Projection Capabilities. Bangladesh's armed forces are predominantly configured for internal security, disaster relief, and peacekeeping support. The lack of a blue water navy, strategic airlift capabilities, or expeditionary logistics limits the Bangladesh's capacity to engage in forward defence engagement, thereby constraining its influence in extra regional strategic forums.

c. Political and Institutional Volatility. Periodic political instability and frequent turnover in civil military leadership can hinder continuity in defence policy implementation. This has occasionally disrupted strategic dialogues, reduced institutional memory, and impeded the development of long-term defence cooperation frameworks.

d. Border Security Complexities. Bangladesh's geographic proximity to conflict prone areas, including the Chittagong Hill Tracts and the Rakhine State of Myanmar necessitates a focus on border security and internal threat

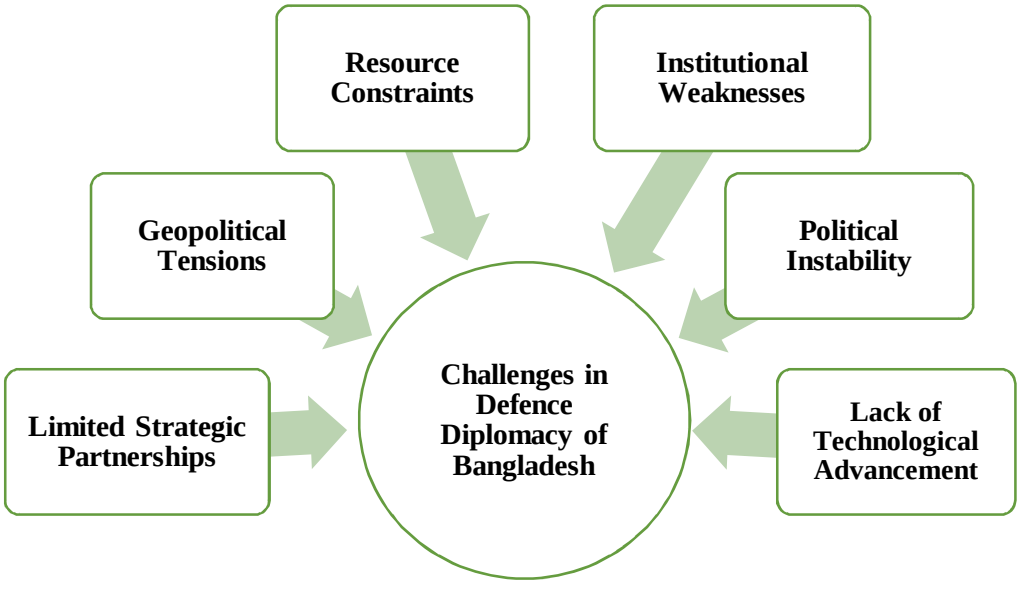
management. Ongoing border tensions and transnational challenges such as refugee flows, trafficking, and insurgency divert resources and attention away from outward looking defence diplomacy.

e. Underdeveloped Military Industrial Base. Bangladesh's domestic defence industry remains in a nascent stage, reliant on foreign procurement for most advanced platforms and systems. This dependence on external suppliers limits the country's ability to offer reciprocal industrial cooperation opportunities often a key pillar of modern defence diplomacy.

f. Diplomatic and Normative Constraints. The use of military tools in diplomatic engagements must adhere to international norms and strategic sensitivities. Misalignment in values, political ideologies, or governance frameworks with partner countries can pose challenges in harmonising joint objectives and maintaining credibility in multilateral platforms.

g. Strategic Ambiguity and Policy Gaps. A lack of a clearly articulated national defence diplomacy strategy constrains Bangladesh's ability to synchronise military initiatives with foreign policy goals. As aresult, engagements tend to be ad hoc, leading to missed opportunities for institutionalising defence relations through structured dialogues, multilateral platforms, and regional security architectures.

Figure 5: Challenges in Defence Diplomacy of Bangladesh



Source: Author's self-construct based on content analysis

Advancing National Interests through Effective Defence Diplomacy: Ways Forward for Bangladesh

Defence diplomacy, when strategically aligned with foreign policy and national security goals, can serve as a force multiplier for Bangladesh. In an increasingly complex regional and global environment, an integrated and forward-looking defence diplomacy approach can significantly enhance Bangladesh's geopolitical relevance, operational capabilities, and diplomatic leverage. The following initiatives are proposed to institutionalise and advance effective defence diplomacy in support of Bangladesh's national interest:

a. Formulation of a National Defence Diplomacy Strategy. Bangladesh should formulate a comprehensive national defence diplomacy strategy, clearly outlining objectives, priorities, and implementation frameworks aligned with foreign policy and security doctrines. A coherent strategy would help harmonise military engagements with diplomatic efforts and ensure long term continuity irrespective of political transitions.

b. Deepening Bilateral and Multilateral Defence Cooperation. Expanding cooperation beyond traditional partners remains key to capability enhancement. Growing participation in multilateral platforms such as the ASEAN Regional Forum and BIMSTEC security dialogues can further enhance regional presence and cooperation.

c. Enhancing Operational Capabilities through Training and Joint Exercises. Capacity enhancement through joint exercises, officer exchanges, and institutional collaboration with advanced militaries can improve Bangladesh's readiness and professionalism. Special focus should be given to joint training on peacekeeping, counterinsurgency, maritime security, and cyber defence.

d. Modernisation and Indigenous Capability Development. Effective defence diplomacy should support the ongoing modernisation efforts under perspective plan. Partnerships that facilitate technology transfer, coproduction, and local manufacturing of military hardware would reduce dependency and enhance strategic autonomy.

e. Leveraging Peacekeeping as a Strategic Asset. Bangladesh's reputation as a top UN peacekeeping contributor should be further capitalised upon by seeking leadership roles, capacity building missions, and training

exchanges within the UN structures. This will strengthen both diplomatic influence and operational expertise.

f. Institutional and Human Capacity Building. Defence and diplomatic personnel should undergo specialised training in strategic studies, international law, negotiation, and conflict resolution. Establishing a dedicated Defence Diplomacy Wing within the Ministry of Foreign Affairs or a joint military diplomatic unit can institutionalise this function. Establishing dedicated think tanks and strengthening existing strategic studies institutions can enrich defence diplomacy through evidence-based research and policy recommendations.

g. Linking Defence and Economic Diplomacy. Bangladesh should explore the integration of defence and economic diplomacy by promoting defence trade, exporting military grade logistics or equipment, and developing a domestic defence industrial base in partnership with foreign firms. This linkage can generate revenue and bolster national industrial capacity.

h. Addressing Non-Traditional Security Threats. The scope of defence diplomacy must be broadened to include nontraditional threats such as pandemics, cyber threats, climate change, and transnational crime. Specialised frameworks and regional task forces should be developed for collaborative response mechanisms.

j. Leveraging Technology and Cyber Defence. Technological modernisation, including the adoption of space-based surveillance, unmanned systems, and cybersecurity architecture, must be embedded into Bangladesh's defence diplomacy planning. Collaborative arrangements with tech leading nations can facilitate access to advanced platforms.

k. Strengthening Public Diplomacy and Strategic Communications. Bangladesh should adopt a robust public diplomacy strategy to highlight its contributions to global peace and regional stability. Strategic communication tools, including social media engagement, defence exhibitions, and international seminars can shape narratives and enhance soft power projection.

Conclusions

Defence diplomacy has emerged not merely as a supplementary aspect of foreign policy but as a strategically integrated instrument of statecraft, particularly for states like Bangladesh that seek to enhance regional engagement without escalating hard

power posturing. This article has demonstrated that effective defence diplomacy lies in balancing strategic ambition with institutional readiness, leveraging cooperative mechanisms to mitigate risks and aligning security engagement with broader national interests. The integration of conceptual principles, regional practices, and Bangladesh's evolving policy trajectory reveals that defence diplomacy is most effective when embedded in a comprehensive, adaptive and norm-based framework. Core drivers- such as trust-building, transparency, interoperability and capacity development should be seen not in isolation, but as interlinked enablers of strategic influence.

Bangladesh's participation in UN peacekeeping, pursuit of bilateral and multilateral initiatives, and commitment to professionalising its armed forces illustrate its potential to use defence diplomacy as both a shield against insecurity and a platform for projecting normative leadership. Yet, challenges such as resource limitations, geopolitical friction, and institutional fragmentation require nuanced engagement strategies. Future success will depend on Bangladesh's ability to articulate a long-term defence diplomacy vision that is responsive to non-traditional security threats, particularly in the maritime, cyber and climate domains while maintaining strategic flexibility in a complex regional security environment. Ultimately, defence diplomacy offers Bangladesh a credible path to amplify its strategic voice, strengthen regional resilience and operationalise its national interest through cooperative security engagement.

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Biography

Lieutenant Colonel Md Wadud Ullah Chowdhury, afwc, psc, Inf joined Bangladesh Army in 2004. He is a graduate of Defence Services Command and Staff College and National Defence College, Mirpur, Bangladesh, as well as Army Command College, Nanjing, China. He also attended Junior Command Course at Army War College, MHOW, India. Lieutenant Colonel Wadud holds a Master's in Security and Development, a Master's in Military Studies and an Executive Master's in Business Administration from Bangladesh, in addition to a Master's in Military Command from China. He is a distinguished instructor of Bangladesh Military Academy and commanded a Mechanized Infantry Battalion. He has several years of experience in counter-insurgency operations in the Chittagong Hill Tracts. He served as Brigade Major of an Infantry Brigade in the south-eastern region of the country, where he gained substantive experience in managing refugee-related challenges. Lieutenant Colonel Wadud served under blue helmet as a contingent member in United Nations Mission in Sudan (UNMIS) and as a Military Observer in United Nations Mission in South Sudan (UNMISS). Presently, he is serving as a Directing Staff at the Defence Services Command and Staff College, Mirpur, Bangladesh.

Integration of Combat Drone in Increasing the Operational Efficiency of the Bangladesh Army: Challenges and Ways Forward

Major Md Ashikur Rahman, Artillery

Abstract

Unmanned Combat Aerial Vehicles (UCAV) or Combat Drones are the most contemporary development in the history of warfare, which has become a game-changer for future warfare (Ref. Required). Considering the strategic implications of the combat drone BD army introduced the concept of inducting combat drones into her inventory in 2023 to enhance the overall operational efficiency. But the full potential of these combat drones could not be utilised due to a lack of skilled manpower and expert knowledge to enhance the overall operational efficiency of the Bangladesh Army. This study intended to identify the challenges of integrating combat drones effectively for enhancing the overall operational capabilities of the BD army**.** The study also focuses on the key challenges for effective integration of combat drones in enhancing the operational capability in the Bangladesh Army to face the challenges of the future battlefield. In this paper, it is recommended that in pursuance of military advancement for enhancing the operational capability, Bangladesh Army should go for inducting both UAV and UCAV along with technology sharing for indigenous production. While developing the infrastructure, the Bangladesh Army should exploit all potential institutions and expertise of multidisciplinary resource personnel available**.**

Introduction

Combat drones are one of the most chosen aerial platforms for increasing the operational efficiency of the modern army because of their political acceptance, minimum human risk, economy of effort, and long endurance. In the last five years, this aerial platform has been extensively used in conventional warfare. The combat drone changed the fate of the 30-year conflict between Azerbaijan and Armenia in 2020. The ongoing Russia-Ukraine war can be another good example of modern drone warfare, where a weaker army has stopped the world's 2nd largest army's invasion of Kyiv on February 25, 2022. Considering the versatile combat and non-combat use of drones, Bangladesh (BD) introduced the concept of inducting combat drones into her inventory in 2023 to enhance operational efficiency.

The inauguration of the 67 Unmanned Aerial Vehicle (UAV) Regiment on December 4, 2023, marked a significant milestone for the Bangladesh Army. This regiment was raised with six Bayraktar TB2 combat drones under the Army Aviation Group of the Bangladesh Army. The BAYRAKTAR TB2 is an armed drone manufactured by Baykar Defence with a range of 150 km, a maximum payload of 55 kg, and an endurance of 20 hours (baykardefense.com). It is considered a 'Medium Altitude Long Endurance (MALE)' UAV, which is an unarmed aerial vehicle. However, those can be converted into armed UAVs during war. The Army Aviation Group is responsible for the overall coordination, maintenance, training, and operations of these drones. Initially, operational training is conducted by the manufacturer company, and subsequently, the regular flying operation is conducted by the 67 UAV Regiment members as per requirement. But, for the smooth operation of a combat drone, there is a requirement for special infrastructure, expertise in maintenance, and skilled personnel to understand the technical aspects as well as tactical implications. The existing operational support facilities, like maintenance hangar, storage facilities, mobile ground control station, communication networks, etc., are not sufficient to operate a combat drone effectively. Though initial training is given to the team at home and abroad, it is not enough to make the operators experts.

Requirement of Combat Drones for Enhancing Operational Efficiency

From natural to man-made disasters, combat drones play an increasingly vital role in enhancing operational effectiveness and response capabilities. Combat drones significantly enhance military operational efficiency by providing continuous, real-time surveillance over large and hostile areas. It can enable the monitoring of enemy movements, target tracking, and collection of high-quality imagery and data. By transmitting live video and sensor data, drones improve situational awareness and offer a clear picture of the battlefield, which allows commanders to make faster and more accurate decisions. Combat Drones can also reduce uncertainty by enabling early detection and improving coordination among air, land, and command units. They greatly reduce risks for soldiers by conducting dangerous reconnaissance, patrol, and strike missions remotely. Armed drones deliver precise strikes on high-value targets, reducing collateral damage, conserving resources, and increasing mission success. Their rapid deployment, long endurance, and ability to switch roles from surveillance to attack provide flexibility in dynamic combat environments. With modifications, combat drones can also enhance coordination and communication by acting as airborne relays in difficult terrain and improve connectivity between dispersed units. Beyond combat, drones can also support disaster and humanitarian operations through search and rescue, damage assessment, and relief supply. During floods, cyclones and other emergencies, drones are widely used to locate trapped

victims, assess damage, and deliver relief supplies to remote and inaccessible areas where conventional rescue teams may face delays or serious risks. In addition to disaster response, combat drones are highly effective in complex and hazardous terrains such as the Chottogram Hill Tracts. These areas are often difficult to monitor due to dense forests, hilly landscapes, and limited infrastructure. Drones can provide persistent surveillance, improved situational awareness, and real-time intelligence for better coordination with ground forces during military or security operations. By reducing human risk, increasing operational reach, and ensuring rapid information flow, combat drones significantly enhance overall operational efficiency in both humanitarian and security missions. After a thorough content analysis and interview of the KIIs the author has formulated five main factors of combat drones in increasing the operational efficiency of the Bangladesh Army, as shown in the figure below. The details are discussed in the subsequent paragraphs:

Figure 1: Requirement of UAV/Drone in Enhancing Combat Effectiveness

Source :Author's self-construct based on content analysis

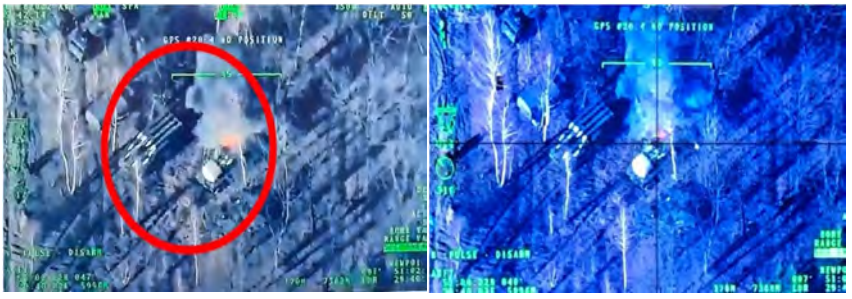
a. **Increased Operational Reach:** By extending future battle space coverage, UAVs can provide greater situation awareness that not only enhances force protection and survivability but also generates greater lethality. The combat drones have long endurance and extended range, which allows the operator to operate far beyond the line of sight. The modern combat drones can fly over a vast distance for a long time without refuelling, can conduct surveillance on a vast area and support the military forces far beyond their operational areas. Subsequently, the BD Army can achieve strategic advantage in various theatres of operation by pre-positioning combat drones at strategic locations and conducting precision strikes on the targets.

Figure 2: A Combat Drone in Surveillance Operation Covering a Vast Area

Source: https://www.cgsbe.store

b. Enhanced Target Acquisition and Precision Strike Capability: The combat drones are equipped with guided missiles and precision munitions during their flying mission, and they can carry out strikes immediately on the targets with minimal collateral damage compared to traditional airstrikes. Current technologies make today's combat drones more sophisticated than ever before, expanding their roles in support of joint operations. As range, altitude, and loiter time increase, combat drones are providing 'the eyes' to support the line-of-sight and beyond line-of-sight reconnaissance, fires, and over-watch. During any military operation of the BD Army, this precise target acquisition is invaluable for eliminating the high-value targets swiftly. This capability was vividly demonstrated during the Russia–Ukraine War, where combat drones were extensively used for real-time surveillance and precision strikes against enemy armor, command posts, and logistics hubs. Moreover, such precision strikes disrupt enemy operations and significantly diminish their capacity to retaliate.

Figure 3: Footage of Bayraktar TB2 in the Russia-Ukraine War for



Target Acquisition

Source: https://www.middleeasteye.net

c. Enhanced Operational Flexibility: Combat drones can be used for persistent surveillance to monitor enemy movements, to track the fleeing enemy, and to identify threats such as ambush, IEDs, or hostile approaches. If a new threat emerges, the combat drones can switch from surveillance to strike mode and enhance operational flexibility. Whether it is a small-scale reconnaissance or a large-scale strike, combat drones can also adjust their mission accordingly and support the operational commander in quick decision-making. They can conduct continuous observation on the targets without the fatigue and limitations associated with human operators. Again, the combat drones can loiter over an area of interest for a prolonged period to collect a vast volume of data, and that can be analysed both in real-time and post-mission scenarios. Subsequently, these data are integrated into strategic planning processes. The military commanders of the BD army will be able to detect the patterns, predict enemy behaviour, and assess threats more accurately by analysing the data. As a whole, the operational efficiency of the BD army can be enhanced.

d. **Cost Effectiveness:** The cost of one combat drone unit is less than the price of a manned aircraft. For instance, the Bayraktar TB2 drone has a single unit cost of approximately $2 to $5 million, significantly less than the expensive fighter jets like the F-35 aircraft, which cost $91 million per unit. Again, the operational cost of F-35 is $16,500 per hour of flight, while a combat drone costs $32 per hour of flight time (McLean, 2014). Furthermore, due to precision strike ability, combat drones do not require multiple sorties or additional munitions to engage the targets. Since the defence budget of the Bangladesh Armed Forces is constrained compared to neighbouring countries, integrating combat drones can significantly enhance operational efficiency at a relatively low cost.

e. **Increased Search and Rescue Operation Ability:** In contrast to piloted aircraft, combat drones can be swiftly mobilised and sent to the crisis areas. It can be deployed in any disastrous area on short notice and can be used for continuous monitoring of search and rescue operations. Consequently, this reduces the vulnerability of the ground forces' lives. In a dynamic conflict zone, when timely intervention determines the outcome between success and failure, the rapid response capability of the combat drone can be the game-changer. After any disaster, the combat drones can be deployed rapidly for immediate search and rescue operations. They can provide live video footage for a long time from a longer distance to the search and rescue operation commander of the BD Army to make immediate decisions, which are faster than traditional methods. A notable example is the Bayraktar TB2, which has been widely used in recent disaster-response scenarios including on 30 July 2021 for real-time surveillance, target identification, and support for operational coordination. Hence, the Search and Rescue operation ability of the BD Army can be increased significantly by deploying combat drones.

Figure 4: Combat Drones Used for Wildfire Fighting Operation in Turkiye, 2021

Source: https://www.baykartech.com/en/fighting-forest-fires

Challenges in Integrating Combat Drones Effectively

The researcher has reviewed multiple documents to identify the challenges for the effective use of combat drones in enhancing the operational efficiency of the BD army. Extrinsic aspects are initially identified through interviews and FGDs, which are later verified by surveys and found that there are three categories of challenges named technical, operational, and logistics. In this article, an attempt is made to appraise the challenges, which are hindrance for getting the best benefit from the

combat drones to enhance the existing operational capabilities of the BD Army. The prime challenges are shown in the figure below for easy comprehension:

Figure 5: Challenges of Employing Combat Drones in the BD Army

Source :Author's self-construct based on content analysis

Technical Challenges

a. Difficulties in Integration with Existing System: The BD Army has an integral command and control, radar, and other surveillance systems, and it is a big challenge to integrate the combat drone with this existing ISR system. The present ISR systems are developed separately and are operated with separate software management, since most of the systems are not from the same origin. Till now, there has been little integration of military surveillance and reconnaissance systems with the full array of intelligence capabilities of the BD Army (Ali, 2016). The combat drone management system is encrypted with its own security key, which cannot be shared with other ISR technologies of different origins.

b. Insufficient Cyber Security: On 5 December 2011, an American Lockheed Martin RQ-170 Sentinel UAV was captured by Iranian forces near the city of Kashmar in northeastern Iran. The Iranian forces jammed the satellite communication of the drone and spoofed the GPS signal to land the drone safely on an Iranian airfield (Shachtman, 2012). Combat drones are always being used for critical military missions. The need to secure the channels in a drone system is very important, since all the critical information related to the mission is sent through wireless communication channels. Another threat to UAVs is the exposure of the GCS to viruses, as in the key-

logging-virus attack (Hartmann, 2013). The possible consequences may be the loss of sensitive data and even the loss of control over the combat drone.

Operational Challenges

a. Unavailability of Experts and Skilled Manpower: Although we have purchased one of the best combat drones in the world, we do not have skilled manpower to operate them smoothly (Bari, 2024). One of the reasons is the low educational qualification of the Junior commissioned officers and Non-commissioned officers, who are involved in the operationalisation of this sophisticated weapon system. During the KII, it was found that many of the members of the 67 UAV Regiment do not have earlier exposure to combat drone technology (Arif, 2024). Moreover, the present institutional education of the BD Army for learning modern drone technology is not enough to grow the expertise. We need more qualified instructors to impart knowledge on drone technology and develop skilled manpower.

b. Lack of Operational Doctrine and GSTP on UAV Tactics: The establishment of a dedicated combat drone organisation is essential before its operational deployment. At present, the BD Army lacks an approved doctrine and standardised tactics for the employment of combat drones. Critical issues remain unresolved, such as how coordination will be conducted before the deployment and who will exercise control over combat drone missions at the division, brigade, and unit levels. To address these gaps and remove existing ambiguities, a comprehensive doctrine is required (Shakawat, 2021). Furthermore, there is currently no formal guidance on the integration of combat drones into attack, advance, or defensive operations. In this context, the development of a training pamphlet is necessary to ensure that personnel acquire the appropriate knowledge and skills regarding the functioning and operation of combat drones.

Challenges in Air Space Management

Bangladesh has less geographical depth, and there is limited airspace that requires effective coordination for the flying mission of a combat drone. The manned aircraft operate within this limited airspace by utilising two long-range radar systems of CAAB. The BD Air Force is maintaining the overall airspace of the BD in coordination with the CAAB for the flying mission of the manned aircraft. Additionally, the difficulty currently arises in obtaining permission to use the airspace for a combat drone flying mission. Recently Bangladesh Cabinet has passed the previously prepared ‘Drone Registration and Flying Policy- 2019’ (Drone Nibondhon

o Uddoyon Nitimala- 2019) as 'Drone Registration and Flying Act 2020' with an aim to tighten the commercial drone use. But a UAV that is operated by the BD Armed Forces would be considered a military aircraft. Therefore, the rules, regulations, procedures, and Rules of Engagement (ROE) should be as of the manned military aircraft.

Logistical Challenges

a. Insufficient Maintenance and Storage Facilities: A basic infrastructure is established to fulfil the minimum requirements for operation, repair, maintenance, storage, and parking of the existing combat drones. But the establishment of a well-equipped combat drone workshop is essential before the operational use of a combat drone (Bari, 2024). There is only one hangar for the munitions, battery, and other repair equipment storage in the 67 UAV regiment of the BD Army (Arif, 2024). Since these munitions are very sophisticated and require special storage facilities, the existing storage facilities are not sufficient. During the interview of KII, it was learnt that a well-structured, separate storage facility for munitions, batteries, and avionics is of paramount importance for the UAV regiment (Bari, 2024).

b. Poor Supply Chain Management: One of the negative sides of UAV is that we do not have any smooth logistics and supply chain system other than procurement (Arif, 2024). All components of combat drones need to be imported from the manufacturing company. Again, BD does not produce any avionics, engines, or spare parts of a combat drone. All the parts are imported from abroad, and procuring from abroad is time-consuming (Shakawat M. S., 2021). During any crisis moment, if the sea and air line of communication of the BD is blocked by the threat forces, then the overall operation and maintenance of these combat drones will be impossible. On the other hand, the cost of avionics and other spare parts of a combat drone is totally determined by the manufacturing company. As such, maintaining a stable supply chain for the combat drones is a big challenge for the BD Army.

Inadequate Budget

Adequate budgetary support is critical for the development, operation, and sustainment of UAV capabilities; without sufficient funding, routine operation and maintenance become difficult (Shakawat, 2021). The researcher identified, through interviews and FGDs, which were later verified by surveys, that the budget currently allocated for the Bangladesh Army's 67 UAV Regiment is inadequate for the smooth year-round operation of its combat drones. In comparison, neighbouring countries

invest more in UAV programmes: India allocates a substantially larger defence budget with frequent high-value UAV procurement, China dedicates massive resources to UAV research, production, and deployment under its overall defence expenditure, and Pakistan also maintains a significantly higher level of funding for drone acquisition and operations. This stark disparity highlights the financial constraints faced by the Bangladesh Army in sustaining an effective combat UAV capability.

Pragmatic Ways to Integrate Combat Drones Effectively

UAVs and UCAVs are rapidly becoming the weapon of choice for the military forces, thereby revolutionising the face of warfare (Lt Gen PC Katoch, 2014). Drones are, thus, seen as marking 'a step forward in humanitarian technology,' and viewed as 'a weapon of choice for future leaders, future armies, future conflicts and circumstances of self-defence' (Bruntstetter, 10 April 2012). The BD Army has incorporated the combat drones into her inventory, but still faces some challenges in getting the best out of this modern technology. Therefore, these challenges need to be addressed immediately to enhance overall operational efficiency. The author reviewed multiple documents to identify effective ways in which combat drones can enhance the operational efficiency of the BD Army. Extrinsic factors were first identified through interviews and focus group discussions (FGDs), which led to the identification of eight ways for the effective integration of combat drones into the BD Army. These proposed ways are illustrated in Figure 6.

Figure 6: Suggested Ways to Integrate Combat Drones in the BD Army.

Source :Author's self-construct based on content analysis

a. **Integration with Existing System:** In the present context, the BD Army has different types of ISR systems procured from different countries, and they use different data formats, communication protocols, and interfaces. For the integration of a combat drone with these ISR systems, at first, we have to make a standardised data format to facilitate interoperability between the combat drone and the ISR system. After that, the combat drone server and

data system can be integrated with the existing surveillance system through the Military Operation Directorate and Army Aviation Directorate at the Army Command Centre. The existing divisional network structure can be added with this centre data server by the army's WAN for secure and faster data sharing. Additionally, the BD Army can also develop its own software for the overall coordination and data sharing among the existing ISR systems.

b. **Development of Sufficient Cybersecurity:** The cybersecurity of the combat drone can be ensured by protecting the system from various threats, including unauthorised access to the operating system, data breaches, signal interference, and malicious attacks. To achieve this, robust, encryption can be applied across all communication links- including aerial platforms, ground stations, external networks, command and control signals, and telemetry data- by leveraging the Army Wide Area Network's optical fibre infrastructure. Secondly, we should establish secondary communication channels to ensure redundancy if the primary channel is compromised or jammed. Then, autonomous self-recovery systems should be enabled beforehand to restore normal operations after detecting cyberattacks or communication interruptions. Finally, the Army Aviation Group should plan for comprehensive cybersecurity training to train drone operators and maintenance personnel, covering topics like secure communication, password management, and recognising phishing attacks.

c. **Development of the Skilled Manpower:** The Army Aviation Group should collaborate with combat drone manufacturers and technology firms to provide cutting-edge technology training for the combat drone unit. They should provide training in troubleshooting and repairing of hardwires and implement job training programs (OJT). It will help the trainees to work with the experienced professionals to gain hands-on experience in combat drone operations, maintenance, and data processing. Besides, they should use UAV flight simulators to allow operators to practice flying in various weather conditions, terrain types, and mission profiles without risk. Additionally, regular field workshops may also be organised, where trainees can practice combat drone deployment, mission execution, and troubleshooting. Furthermore, the situation-based training will provide real-world experience and help in building operational confidence among the operators.

d. **Incorporation of UAV Doctrine and GSTP on Tactics:** A joint service doctrine should be formulated for combat drone employment in defencive and offensive operations. The AFD may take endeavour to formulate this doctrine

by accumulating the suggestions from all the services. In addition to that, a separate organisation may be formulated under the AOC for the overall coordination and information sharing among the platforms. To formulate GSTP on combat drone tactics, ARTDOC and the MT Directorate may make efforts for it. Presently, the MT Directorate has formulated a draft precis on UAS with the basic knowledge on employment and organization, which is not sufficient to gain adequate knowledge on combat drone deployment. A detailed study with adequate knowledge is required for the effective employment of a combat drone.

e. **Publication of Policy for Air Space Management:** The management of airspace for operating the combat drone alongside the manned aircraft requires separate strategies, regulations, and technologies. While doing so, firstly, Airspace should be divided into different classes (A, B, C, D, E, G) with specific rules for each, and a specific corridor or flight path should be included in the policy to separate combat drone from the manned aircraft operations. Secondly, the Unmanned Traffic Management (UTM) system can be integrated with the traditional Air Traffic Management (ATM) to ensure coordinated operation with the combat drone. Besides, the Civil Aviation Authority of Bangladesh (CAAB) may implement protocols for 'see and avoid,' detect and avoid (DAA) systems, and mandatory communication with air traffic control (ATC) in certain scenarios to ensure safe UAV operations. Finally, the pilots and operators should be trained and certified according to the regulatory requirements, including understanding the airspace classification, emergency procedures, and communication protocols with ATC.

f. **Development of Suitable Maintenance and Storage Facilities:** Combat drones are operated, integrating complex systems that require specialised facilities for their maintenance, repair, and storage. There should be a dedicated area for different types of maintenance activities to streamline workflows and prevent cross-contamination between different maintenance processes. There should be a specific storage facility for batteries, especially lithium-based batteries, which are highly sensitive and require strict storage conditions to prevent fires and degradation. Fireproof cabinets or dedicated battery rooms with proper ventilation can be constructed in the 67 UAV Regiment premises. In addition to that, the environment needs to be controlled (temperature, humidity, and cleanliness) in the maintenance and storage areas to protect sensitive components, such as avionics, sensors, and electronics, from damage.

g. **Development of a Smooth Supply Chain Management System:** Combat drone is a sophisticated and complex machine, which requires a steady supply management system, as it helps in maintaining a consistent inventory of critical items and minimising downtime. Since BD does not produce avionics, engines and spare parts of UAVs, so, it does not have a domestic supply chain system for combat drones. At present, the BD Army is importing all the components of the combat drones from abroad, which is time-consuming and expensive, too. However, the existing supply chain can be made more cost-effective and smoother by allowing more vendors to participate in bidding for the tender. Besides, the BD Army can go for a joint venture project with the manufacturer company to produce commonly used avionics and spare parts of the combat drone in BD.

h. **Mitigating Expenditure Challenges**: Although an efficient supply chain management minimises the waste, reduces the excess cost of the inventory, and optimises the procurement process, for the best operational efficiency, a combat drone regiment requires a huge budget. As all the components and sensors of the combat drone are very expensive, indigenous production of these components may reduce the pressure on the overall budget for the combat drone unit. In addition to that, the long-term contract with the manufacturing company for the regular maintenance and repair of components can be a cost-effective option for the BD Army. However, the Army Aviation Directorate should also pursue the AFD for the allotment of sufficient budget for the effective operation of the combat drones.

Conclusion

Operating combat drones alongside manned aircraft requires robust and well-coordinated airspace management. To ensure safe and coordinated flight operations, the Bangladesh Army should integrate an Unmanned Traffic Management (UTM) system with existing conventional air traffic control systems. The installation of technologies such as Automatic Dependent Surveillance–Broadcast (ADS-B) on combat drones would further enhance situational awareness and operational safety. In addition, combat drones require specialized maintenance and storage infrastructure, including dedicated repair facilities for different drone components, controlled storage areas for sensitive equipment, and fireproof storage for batteries. As Bangladesh currently imports all drone components, the establishment of a reliable and efficient supply chain is crucial. Joint ventures with foreign manufacturers for the local production of commonly used parts could reduce costs and ensure the timely availability of spares. Moreover, because combat drones are costly to operate and

maintain, indigenous production of components and long-term maintenance contracts with manufacturers would be economically advantageous and support sustainable operational readiness.

Recommendations

Combat drones are the eyes of the commanders on the battlefield that support the long-range line-of-sight visual reconnaissance and never blink. Based on the writer's study following recommendations can be made for the effective integration of combat drones in the BD Army:

a. To enhance operational capability, the Bangladesh Army should formulate a dedicated doctrine for the integration of combat drones with the existing ISR system under the Military Operation Directorate of the Army Headquarters and within the organizational framework of the Army Command Centre. In addition, ARTDOC may undertake further research on the feasibility and doctrinal incorporation of UAVs and UCAVs into the operational doctrine of the Bangladesh Army.

b. The Army Aviation Group should be entrusted with the responsibility of developing the necessary infrastructure for the effective operation and maintenance of combat drones, with active technical support from experts of the export companies. During the infrastructure development process, the Bangladesh Army should fully utilise all available national institutions and the expertise of multidisciplinary resource personnel. Appropriate support from relevant civilian experts and organisations should be incorporated, where necessary, to ensure greater efficiency, sustainability, and technical reliability.

c. The Aviation Directorate, Army Headquarters, should urgently formulate a comprehensive policy for the effective operation of combat drones within Bangladesh airspace. In addition, it should coordinate and liaise with the Civil Aviation Authority of Bangladesh to ensure the incorporation of combat drone operations into the national civil aviation airspace management policy.

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Biography

Major Md Ashikur Rahman, psc, Artillery was born on 15th October 1993 in Pabna district. He passed SSC and HSC from Rajshahi Cadet College. He joined the Bangladesh Military Academy with the 69th Bangladesh Military Academy Long Course. On being commissioned, he joined 16 Field Regiment Artillery. The officer has served almost all regimental appointments. Besides mandatory courses, the officer completed the 1st Unmanned Aerial Vehicle Course in 2016. He was the Instructor of Gunnery in the Artillery Centre and School from 2018 to 2021. He has participated in the United Nations Mission in DR Congo as an Unmanned Aerial Vehicle platoon commander in 2021-2022. He served as Battery Commander in 50 Field Regiment Artillery under 17 Artillery Brigade. He served as General Staff Officer-2 in the Overseas Operations Directorate of Army Headquarters in 2023. In 2024, he graduated from the Defence Services Command and Staff College, Mirpur, Dhaka. He also obtained a Master's degree in Master of Social Science in Security Studies from the Bangladesh University of Professionals in the same year. At present, he is serving as Grade Staff Officer 2 in the Defence Services Command and Staff College, Mirpur, Dhaka.

Cognitive Warfare: Concerns About the Unprecedented form of Warfare

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There is nothing either good or bad but thinking makes it so.

- William Shakespeare

Abstract

Cognitive Warfare is a relatively new concept in non-kinetic warfare which predominantly gained momentum with the widespread use of digital media. This further got pushed by the use of advance technology like Artificial Intelligence. The goal of this warfare is to destabilise a society or influence people in favour of a target objective. Social media is a great platform in achieving these objectives. Perpetrators seek to influence an individual or a group in society or an entire nation to create division or chaos and move against the decision or action taken by their government or organisation. AI-based deep-fake multimedia or human-like posts and comments on social media are used as tools in this warfare. Such actions were seen in recent wars and various peacetime events. Researchers are looking forward to directly control human cognition process through various technological innovations. Cognitive operations may be carried out anytime from any corner of the world due to its reach and availability of technologies. Hence, it is imperative to grow awareness about this potential danger and adopt proactive and reactive measures to safeguard from its consequences..

Introduction

Warfare has always been evolving keeping pace with the advancement of human race which is factored by technologies and innovations. Besides kinetic warfare, non-kinetic warfare methods have also advanced with time. World War II has marked the development of information warfare, which was followed by psychological warfare during the Cold War. Later, cyber warfare joined the race with the invention of computer and internet technologies. Finally, cognitive warfare, which principally uses the tools of the previous non-kinetic warfare, has introduced a new dimension in the domain of war affairs.

Information warfare controls what people see, psychological warfare controls what people feel and cyber warfare disrupts technological capabilities. In contrast,

cognitive warfare tends to control what people think and how they react (Bernal et al., 2020). The major platforms for conducting cognitive operations are mainstream and social media since they reach people instantly across the world. Hence, cognitive warfare operates on a global stage (Claverie & Cluzel, n. d.). It can be applied in military, economic and other domains as a game changer. It manipulates the perspective of a target population to influence the course of action taken by their authority. Hence, it is said that the theatre of operation for cognitive warfare is the human brain (MacDonald & Ratcliffe, 2023).

This relatively brand-new concept of warfare was first purposefully termed in the United States in 2017 (Claverie & Cluzel, n. d.). By that time, the use of the internet as well as social media had taken a hike around the globe. Thus, perpetrators have begun to gain direct access to mass people to alter their thoughts away from reality to achieve specific objectives. Although the manipulation of perspective has been in existence for decades; the widespread use of the internet and social media made it more effective and dangerous. Today, the targets have become larger and easier to manipulate. Recent wars in Europe and the Middle East show clear evidence of cognitive operations which undermine or influence opponent leadership's decision-making process.

This article seeks to describe cognitive warfare with its growing application through technological progress and highlight some examples of cognitive operations from various events that took place in recent days. The study attempts to explain why this has become a concern, along with possible steps to defend against such operations by potential enemies.

Spelling out Cognitive Warfare

There is no firm definition for cognitive warfare. The core concept is the weaponisation of public opinion to influence public or government policy to destabilise the target in favour of the perpetrator. This can be a part of hybrid warfare which may take place over a long period during peacetime or wartime. The advent of the internet, social media and mass media along with the perceived anonymity these platforms offer, made this warfare more effective and dangerous at the same time. There are overlapping characteristics of psychological, electronic, information, cyber and cognitive warfare which are summarised in the following table (Bernal et al., 2020):

Table 1: **Overlapping Characteristics of Various Non-kinetic Warfare**

Characteristics	Psychological Warfare	Electronic Warfare	Cyber Warfare	Information Warfare	Cognitive Warfare
Use of Mass Trends/Data			√	√	√
Deals with Thoughts and Behaviour	√				√
Capacity for Extreme Public Reach			√		√
Interest in Circulation of Information	√	√		√	√

Source: Cognitive Warfare, An Attack on Truth and Thought (Bernal et al., 2020)

Table 1 shows that while other forms of non-kinetic warfare include different types of characteristics, the cognitive warfare involves all of them. Hence, the cognitive warfare can be regarded as a Non-kinetic form of warfare that combines all the tools of other non-kinetic warfare. The ultimate goal in this warfare is to alter the thoughts of leaders, operators, professionals, military personnel, and on a large scale, an entire nation or a group from among the nations (Claverie & Cluzel, n. d.). To achieve this, it endeavours to instigate biased thinking, interfere with cognitive processes, obstruct decision-making, highlight negative effects etc. (Claverie & Cluzel, n. d.). According to a NATO workshop, the cognitive process is composed of three interrelated aspects: information, decision-making and neuroscience (Cognition Workshop, 2021). Attacks on perspectives, sense of rationality, confidence in decision-making etc. are carried out through feeding misleading information and using tools of neuroscience.

7. There is a thin line of difference between cognitive and psychological warfare. The features of these two types of warfare are overlapping; yet there are notable contrasts. While both deal with the cognition process and influence behavior, cognitive warfare targets enemy population to induce destabilisation. On the other hand, in psychological warfare, own troops and civil population may also be targeted depending on the objectives of the operation. The following table shows the

comparison between these two types of warfare which is based on Lasswell's Model of Communication (Ibrahim et al., 2023):

Table 2: **Comparing Cognitive Warfare and Psychological Warfare based on Lasswell's Model of Communication**

	Cognitive Warfare	**Psychological Warfare**
Who (communicator)	Undefined or attacking nation/non-state actor	Undefined or attacking nation
What (message)	(Combined) use/dissemination of information	Planned use of communications; deliberate manipulation of information, measures of psychological destabilisation and polarisation
Which (medium)	Online or offline	Predominantly offline; increasingly online with time and technological advancements
Whom (receiver)	Target audience mostly undefined; can target every social area	Target audience primarily framed as enemy; generally undefined target audience; can target every social area; target audience can be own troops and the civil population
What (effect)	Destabilisation of or influence on cognitive processes as a prerequisite to affect behaviour	Influencing enemy cognitive processes, enemy behaviour, and one's own cognitive processes and behaviour
When (state)	Across the whole spectrum of conflict, from peace to wartime	Before, during and after wartime, including peacetime

Source: A Systematic Review of Cognitive and Psychological warfare (Ibrahim et al., 2023)

Hence, it is clearly understood that both the forms of warfare almost merges together relating to the targets, means, methods and end states.

Goals of Cognitive Warfare

8. Social media or mass media are used to launch attacks on targeted groups of a community to achieve a particular goal. The principal purpose is to destabilise or influence the community to compel the government to change the course of its action. Bernal (2020) has elaborated the goals of cognitive warfare as follows:

a. **Destabilisation**

(1) Destabilisation is done by inciting pre-existing division in a community or introducing a random idea to create division. Generally, political leaders are targeted who have already created polarity in society over a policy or concept. The probable strategies are as follows:

(a) Increase polarisation.
(b) Reinvigorate movements/issues.
(c) Delegitimise government/leadership.
(d) Isolate individuals/groups.
(e) Disrupt key economic activities.
(f) Disrupt infrastructure.
(g) Confuse communication.

(2) For example, the outbreak of COVID-19 has been utilised by the superpowers to spread conspiracy against each other about the source of the virus to confuse people about the actions of their government and undermine their trust in leadership.

b. **Influence**

(1) Instead of creating division, influence aims to generate a mass consensus of a target group against their ideology. Here the perpetrators manipulate the target's interpretation and understanding of their surroundings. To make this effort more effective, political, economic, social and academic leaders may be influenced by diverting mass followers. The followers blindly receive the messages of the leaders through their social media posts or direct lectures. The strategies of influence include the following:

(a) Promote extremist ideologies.
(b) Manipulate civilian beliefs.
(c) Control key economic activities.
(d) Regulate government actions.
(e) Sway or de-legitimise elections.
(f) Recruit civilians to marginal groups.
(g) Quell dissent.

(2) Recruiting civilians into a terrorist group is an example of influence in cognitive warfare. This type of cognitive operation is also done to change the policy of a foreign country by igniting deep-rooted sentiment among the population.

Cognitive Operations

The potential consequences of cognitive operation may be in the form of psychological influence, cyber-based erroneous effects and undermining individual cognitive abilities (Claverie & Cluzel, n. d.). Perpetrators in cognitive operation may target a whole population or an individual leadership in the political, military, religious or academic sectors (Bernal et al., 2020). Influential characters in these sectors are targeted to divert the population's view. Digital media enhances this effort by presenting the targeted individual in front of mass people instantly. Whether individual or group of people, the attack is carried out with the help of AI after collecting personal information, and with a careful study on the potential psychological effect on the targets. Comments on social media posts are generated through AI, which are difficult to identify. AI-edited images and videos are posted that look real and confuse mass people. This may not work among all the target audiences, but many may become biased either unconsciously or due to a lack of knowledge and intelligence. Thus, perpetrators find it very convenient to carry out the attack remaining unanimous on the internet.

Attack in cognitive warfare may be carried out in coordination with kinetic warfare. It may take place before or during manoeuvring warfare to find a synergetic effect. Combination of these two degrades enemy's decision-making process and the will to fight (MacDonald & Ratcliffe, 2023), which are very crucial for fighting a war. By flooding the open source of information, it may confuse the staff inputs during the planning process. Again, it may target the leaders by feeding them with appropriate misinformation according to their pre-existing false speculation, thus misleading them in decision-making. It may also create divisions among the soldiers and undermine their moral strength by introducing false information.

Contemporary Applications

With the growing number of proxy wars and fighting without shedding of blood, the range and diversity of cognitive operation is becoming more and more relevant. This warfare is not limited only to phenomenal wars, rather it has expanded into other domains like economy, politics etc. This sort of operation was conducted during the 2016 election of the USA to create divisions within the Democratic Party as mentioned before. In this case, Russian cyber forces carried out cyber-attacks to snatch information in order to weaponise public opinion against the political groups (Bernal et al., 2020). Similarly, during the outbreak of COVID-19, multiple actors launched cognitive operations to confuse targeted people and create distrust in their government.

Cognitive Operation was vividly observed in the Israel-Hamas war. Both the belligerents utilised digital media to gain an advantage in the manoeuvring warfare. The objective was to confuse the decision-makers and undermine the public support towards the government's decisions. In the Hamas-Israel war, Hamas probably had the upper hand in utilising social media to earn public support and mocking Israelis (Presstv.ir, 2023). Their released video clips could earn worldwide support for their cause and convince a substantial part of Israelis to move against their government. Not only in the battlefield, Israel was also affected economically due to the digital campaign of boycotting Israeli products mostly in Muslim countries. On the other front, Hezbollah's released video clips on drone footage of sensitive military positions of Israel could create deterrence and influence the Israeli government's decision about impending military action (Al Jazeera, 2024).

AI can now create human-like statements in the comments sections and generate deep-fake images and videos to spread propaganda more realistically. It is difficult for the readers or audiences to differentiate these bots from the real stories. US-based cyber security organisation Imperva reported that in 2023, almost half of the internet traffic was bots, of which, bad bots were 34% (Ali et al., 2024). Another organisation, Baydoun, claimed that pro-Israeli bots used to generate counter-narratives against pro-Palestine content to gain more trust among social media users (Ali et al., 2024).

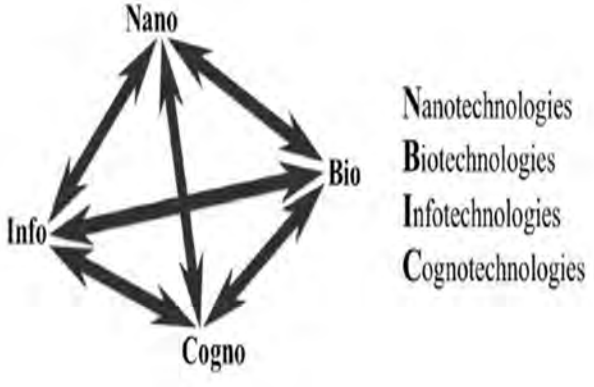
Where Is It Heading to?

The use of mainstream media in iInformation warfare and psychological warfare is now an old story. Soft power has been demonstrated using computers and the internet for a long time, and then the power of social media turned in. Cognitive Operation

deals with cognitive processes in human brain. It is launched through all kinds of media platforms which have been in use for other types of Non-kinetic warfare. Very recently, AI has taken over new roles in this game. The combination of social media and AI has made it more complex. In the past decade, there has been rise of a good number of social media platforms, which attracted billions of users. Hence, AI-generated posts and comments on social media have created a new line of operation in the domain of human cognition.

Scientists have been trying to explore the mechanism of brain functions for various purposes. Through understanding this mechanism and how it integrates and processes information, the application of neuroscience can be optimised in Non-kinetic warfare (Cognition Workshop, 2021). The more this mechanism is explored, the closer we are to being exposed to cognitive attacks (Bernal et al., 2020). Research is in progress to implant human brains with electrical or optogenetic receptors to manipulate the thoughts of human beings. With its success, an influencer can easily be controlled to motivate the target population with certain objectives. Similar effects can be achieved by drugging or using apps-based mental therapy or a combination of any of these (Bernal et al., 2020).

Figure 1: Convergent Technologies as Defined by the US DOD



Source: The Cognitive Warfare Concept (Claverie & Cluzel, n. d.)

Technology is reaching far out to read the emotional state of soldiers on the ground. China has built a smart bracelet which can read the psychology of soldiers through various sensory receptors (Cognitive Warfare, n. d.). On the other side of the globe, a scientific project named NBIC (Nanotechnology, Biotechnology, Information Technology and Cognitive Technology) is in progress to bring four different domains

together to enhance human cognitive capability through an anthropo-technical approach (Claverie & Cluzel, n. d.). Figure 1 shows how these four distinctive domains converge together. One of the goals of the approach is to hybridise human operators with nanotechnologies and other means to feed the human brain with information directly keeping the brain connected (Claverie & Cluzel, n. d.). This will also enhance the information-processing capability of the brain. Thus, it may be well perceived that cognitive warfare will continue to take a new shape both in offensive and defensive fields with technological development and the possibilities are seemingly endless.

Should We be Concerned?

As mentioned before, cognitive warfare has two clear goals: Destabilisation and Influence. The targets are common people who are prone to believe conspiracies and critics. Therefore in a short of war situation, enemy may weaken the unity of the nation, undermine the cause of war and will to fight etc. These may create resistance on the actions of the government, divide people into various groups and thereby defeat own forces before they are actually defeated. Cognitive Operation may generate confusions in own perception on the enemy actions and let the enemy gain advantages in manoeuvre warfare. This is more powerful than the previous forms of non-kinetic warfare; hence, it may multiply the advantages for the enemy. Hence, beside the preparation of conventional warfare, the forces need to counter such attempts from the enemy well before the conflict begins.

18. Cognitive Warfare is not a concern for wartime only; it is not meant for only military applications. Any notorious group with a particular objective may launch this sort of operation at any time. During peacetime, cognitive operations may be used to spread hatred and create divisions among people to create chaos in the society. Very often Bangladesh faces price hikes for essential commodities which results from uncontrolled propaganda. It was observed that people stockpile essential goods fearing the price hike which in turn raises the price more (Islam, n. d.). Although, this may not be a deliberate cognitive operation, this shows how to create panic among the customers in order to achieve targeted price hike; an example of cognitive manipulation through instilling artificial crisis. Such methods may also be applied in stock markets to weaken the national economy. Chaos may be artificially generated in the society to disrupt the economic and social development. This way, peace and development efforts are hindered.

Defence against Cognitive Attack

Defence against cognitive operations can be proactive and reactive. In the proactive method, people should be educated for personal security and safety. For example, in an effort to build a resilient society, Finland provides education on history in schools on propaganda campaign; how this misleads people, differences between disinformation and misinformation etc. (Cord, 2022). In addition to providing education, a means should be developed to differentiate normal online posts or opinions from purposeful cognitive operations. In the reactive method, a predictive warning system, identifying the perpetrators, debunking deep-fake rumours, public and tech diplomacy etc. should be enforced. Human operators, machine learning or AI can identify probable cognitive campaigns through specific patterns of attack. Tech diplomacy is done by liaising with tech giants and local companies to gain control of the information flow and to filter out the perpetrators whenever required. For example, Australia, UK, Denmark, France, Germany and few other nations have created tech diplomacy representations in Silicon Valley that portraits increasing engagement with tech powers to defend national interests (Aoki, 2025, as cited in Ittelson & Rauchbauer, 2023).

The range of potential applications for cognitive operation is enormous, and it may be launched anytime from any corner of the world. Perpetrators will always look for the right opportunity at the right time. It may be a long pursuit or maybe an opportunistic action. Since it can move the mass public against any state decision or action, the consequences might be grave. Hence, it is imperative to keep eye on the vast ocean of internet-based communications, posts and comments. When it demands, counter-propaganda, selective political or military measures, technical liaison with tech giants etc. may be required to avoid the potential damage.

Conclusion

Cognitive Warfare is the most modern concept of non-kinetic warfare which deals with the human cognitive process. This is the successor of other non-kinetic warfare and principally came into effect due to the widespread use of digital media across the world. It is carried out by feeding misleading information and undermining individual cognitive abilities. While it is phenomenally much closer to psychological warfare, it utilises mass information and reaches the mass population in the quickest form to create a greater effect. Perpetrators target individuals, groups of people or an entire nation through the use of digital media. Social influencers or leaders are targeted to influence followers with a particular view against the action of the government or

organisation. AI-generated multimedia information can very easily convince general people with pre-existing speculation. This way a belligerent gains tactical or strategic advantages in both wartime and peacetime. On the battlefield, cognitive warfare can be carried out in coordination with manoeuvre warfare to achieve a synergetic effect, as it may interfere opponent's decision-making and undermine the will to fight.

The world has witnessed the application of cognitive operation in recent days. It was evident in the 2016 US election, during COVID-19 pandemic and various recent wars. The future of cognitive warfare is very unpredictable. The progressive research on hybrid human operators through nanotechnology might open new areas of application of this warfare. Interfering with cognitive control, feeding misinformation directly to the brain etc. will make a huge shift in the definition of means of war in future. We should be ready to face such shifts and adapt our tools and doctrines according to the new challenges. Both proactive and reactive methods are required to defend against any cognitive attack. General people need to be educated about the potential dangers of cognitive operation, and means and methods are required to be developed to identify such attacks. Finally, we need to have clear understanding and be prepared to use progressive technologies to counter this futuristic unpredictable threat.

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Biography

Commander M Alamgir Hossain, (E), afwc, psc, BN was born on 21 July 1979 in Noakhali district. He was commissioned in the Engineering Branch of Bangladesh Navy on 20 December 2001 with 99B batch. He graduated in Mechanical Engineering from Chittagong University of Engineering and Technology (CUET) in 2005. The officer served in various units and staff appointments across his career. He was appointed in different ships including ex British Frigate and missile corvette as Engineer Officer/ Senior Engineer Officer. He has also served in Bangladesh Naval Academy as Instructor Engineering. As staff officer, he served as Base Engineer Officer to COMKHUL and as Staff Officer (Training) in Directorate of Naval Training in Naval Headquarters. He was also appointed in Rapid Action Battalion on deputation. Commander Alamgir participated in a number of professional courses in home and abroad. In 2008, he completed Instructional Techniques Course in India. He also participated in Marine Engineering Specialisation Course (MESC) from BNS Shaheed Moazzam in 2012. He completed the Junior Staff Course (JSC) from Bangladesh Naval Academy in 2010. In Mirpur, he completed Command and Staff Course from the Defence Services Command and Staff College in 2019 and Armed Forces War Course (AFWC) from National Defence College in 2022. He participated in United Nations Peacekeeping mission in Ivory Coast as Military Observer. Other than Ivory Coast, he visited a number of countries around the globe for various official purposes. At present, he is appointed as Deputy Director Naval Engineering (Construction) in the Directorate of Naval Engineering at Naval Headquarters.

A Comparative Analysis of Different Military Leadership Approaches: A Quest for Determining and Promoting the Most Suitable Approach

Lieutenant Colonel S M Mynul Hoque, psc, G

Abstract

Leadership, presumably, is one of the most researched topics both in military and civilian environment. Although all military officers are trained to be competent military leaders; however, to impart effective leadership training, it is important to determine the suitable leadership approach to be adopted. Several theorists have developed different leadership approaches that can be adopted in the military context. Nevertheless, each of those approaches has specific strengths and weaknesses. Hence, it is important to compare those approaches to develop a clear understanding of their suitability in the military context. In this regard, the researcher, through secondary data, has identified different leadership approaches developed by the theorists. Thereafter, the researcher resorted to an objective analysis comparing different approaches. In doing so, the researcher has developed a deliberate scoring system to determine the most suitable leadership approach to be adopted. Based on the scoring system, it is evident that the transformational leadership stands as the most suitable leadership approach in military context. This deduction has been further supported by the key findings from content analysis and case studies. Finally, a few suggestions, including a suggested two weeks' training program, have been put forward to develop transformational leadership in the military. The suggestions are broad in nature, keeping scope open for further research to be conducted on any specific issues. It is to be noted that the research is entirely based on secondary data in the form of content analysis.

Introduction

The Holy Qur'an highlights leadership as a profound moral and spiritual responsibility. Moreover, the Prophet Muhammad (peace be upon him) serves as the ultimate role model of leadership, characterised by competence, mercy, humility, and integrity. Thus, instead of mere domination, leadership in Islam is about service, responsibility, and accountability.

Success in the military largely depends on leadership. Effective leadership, presumably, is the cornerstone that determines troops' morale, cohesion, and the

ultimate victory or defeat (Yukl, 2013). In today's complex and rapidly changing geopolitical environment, the role of military leadership has never been more crucial. As a multifaceted and dynamic endeavor, leadership in military is not just commanding the troops; instead, it is about influencing people, inspiring loyalty, and maintaining discipline while ensuring the mission success (Bass & Bass, 2008). Over time, theorists have developed several leadership approaches. While most of the approaches have their unique characteristics, as Northouse (2021) identifies, some approaches are more suitable in the military context. Thus, it is imperative for the military leaders to develop a deep understanding of different types of leadership, in order to adopt the most suitable leadership approach. In doing so, an in-depth comparative study of different leadership approaches is a pre-requisite for the military leaders.

At this backdrop, this paper has made an endeavor to identify the best leadership approach in military context. In doing so, initially, this paper briefly highlights the importance of military leadership. Thereafter, followed by a comparative study among different leadership approaches, this paper recommends the most suitable military leadership approach. Finally, this paper puts forward few suggestions for promoting the most suitable leadership approach.

Importance of Leadership in Military

a. **Leadership and Operational Efficiency:** Effective leadership ensures coordinated execution of missions, optimal resource utilization, and quick decision-making (Bass & Bass, 2008). In absence of effective leadership, confusion and chaos replace order and discipline (Yukl, 2013). Figure 1 below shows the hypothetic relation between leadership effectiveness and mission success. It predicts a higher rate of mission success with the increased effectiveness of the leaders.

Figure-1: Graph Showing Relation between Leadership Effectiveness and Mission Success

Source: Hypothetical Model based on US Army Unit Performance Assessments, Retrieved from US Army Doctrine Publication 6-22

b. **Impacts on Troops' Morale:** Troops' morale largely depends on the leadership approach (Wong et al.,2003). A good leader fosters trust, loyalty, and confidence. On the other hand, an inappropriate leadership approach may seriously affect the cohesion and morale of the troops (Northouse, 2021). Leadership, often, plays a pivotal role that encourages the troops to fight fiercely in any challenging combat situation.

c. **Influence on Cohesion and Motivation:** A leader plays the most significant role in addressing the needs of his subordinates to facilitate their growth (Bass & Bass, 2008). In line with Maslow's hierarchy of needs, the soldiers aspire to achieve the higher level of needs after their physiological and safety needs are addressed. The three-dimensional role of military leaders—command, managerial, and leadership—can be easily explained by the model as shown in table-1. It clearly shows that leadership may not have much significance to the first two levels of needs of the soldiers. These can be addressed by the superiors as commanders or managers. However, from the third level of needs, where the soldiers desire for cohesion, recognition, sense of accomplishment etcetera, leadership role of the superiors play the dominant role. Figure 2 below shows the hierarchy of needs developed by Maslow; and Table 1 below shows the significance of the hierarchy of needs when it is applied to the soldiers.

Figure-2: Model Showing Maslow's Hierarchy of Needs

Source: McLeod, S. (2023) Maslow's Hierarchy of Needs [Illustration]

Table-1: Model Showing Maslow's Hierarchy of Needs when Applied to the Soldiers

Level of Needs	Application in Military	Dominating Role
Physiological	Food, shelter, rest	Command/Managerial
Safety	Protection, career planning, promotion	Command/Managerial
Belonging	Unit cohesion, spirit-de-corps, service before self	Leadership
Esteem	Recognition, reward, respect	Leadership
Self-actualization	Purpose-driven service, mission achievement, sense of accomplishment	Leadership

Source: Author's self-construct

Appropriate Military Leadership Approach

Importance of Understanding the Leadership Approach

Contrary to the idea that the leaders are born with natural leadership qualities, modern leadership theories suggest that leaders can be made (Rose et. al., 2015). Leadership qualities are particular sets of skills that can be taught. Therefore, it is important to train the potential leaders with a view to making them competent and effective. Before that, it is also important to understand different leadership approaches. Considering the significance of this knowledge, Northouse (2021) has also advocated for developing a deeper understanding of different leadership approaches that will allow military personnel to adopt the most appropriate leadership style.

Leadership Styles in Military Contexts

According to *Army Doctrine Publication (ADP) 6-22*, leadership is "the activity of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization". Military leadership is all about influencing, guiding, and developing others to achieve organizational goals. In doing so, the military leaders have practiced different leadership approaches. To have a better understanding of those, some of the most common leadership approaches are discussed in the subsequent paragraphs.

a. **Autocratic Leadership**: Autocratic leadership is one of the most commonly used approaches of military leadership. It encourages the leader-centric decision-making process, where the leader expects full obedience, without much input from the subordinates. Despite controversies, this approach is significantly effective in crisis management where time is pressing, and quick decisions are sought. Although this approach is likely to be effective in specific scenarios; however, this approach can greatly affect the troops' morale and the subordinates' creativity. As identified by Bass & Bass (2008) and Yukl (2013), this leadership approach affects the troops' intrinsic motivation and initiative as well.

b. **Transformational Leadership**: Transformational leadership, on the other hand, is often considered a highly effective military leadership approach. With this approach, the military leaders encourage the subordinates to perform beyond their capabilities. Transformational leaders instill values and sense of purpose among the subordinates by continuous inspiration and motivation. As Bass (1985) and Northouse (2021) highlighted, transformational leadership approach helps create an environment characterized by trust, cohesion, innovation, and creativity that effectively leads to mission accomplishment.

c. **Transactional Leadership**: Transactional leadership, usually, is based on a "give and take" approach. This approach involves clear tasks and appropriate reward and punishment. Here, the subordinates get clear and specific instructions; and, they are also aware of the consequences of their success and failure. Leaders with this approach provide clear guidance and monitor the compliance to the instructions. Subsequently, they reward the subordinates for obedience; and, penalise the subordinates for non-compliance. According to Bass (1985) and Yukl (2013), this approach may not be as inspiring as the transformational approach; however, this approach of leadership is suitable in the lower and mid-level military command.

Nevertheless, this leadership approach is less likely to earn an emotional commitment from the subordinates (Bass, 1985; Yukl, 2013).

d. **Participative Leadership**: Contrary to the autocratic leadership approach, participative leadership focuses on the involvement of the team members in the decision-making process. In this approach of leadership, the leaders engage the subordinates, value their opinions, and resort to collaborative decision making. This approach, as noted by Northouse (2021), fosters an environment characterized by cohesion and morale. However, it tends to make the decision-making process time-consuming and less effective (U.S. Army FM 6-22) and therefore may not be a suitable approach when immediate decisions are needed.

e. **Servant Leadership**: Although the servant leadership approach may not be commonly found in military environment, yet, it is a suitable approach when the leaders prioritize the subordinates' needs and growth. Leaders with this approach focus on empathy and team interest. Servant leaders are capable to build a working environment characterized by strong interpersonal relationships; however, they may struggle in crisis when immediate decisions are sought. Nevertheless, as Greenleaf (1977) and Spears (1998) identified, this leadership approach may be suitable in peacekeeping missions, not in combat situations.

f. **Situational Leadership**: The concept of situational leadership was developed by Hersey and Blanchard. This approach, mainly, focuses on the adaptability of the leaders. Situational leaders continuously assess the competence, preparedness, willingness, and motivation of the subordinates; and, they adjust their leadership style accordingly. Besides, they also consider the operational environment to determine if their leadership approach needs to be changed. The principal characteristic of this leadership approach is the leaders' flexibility which greatly facilitates mission accomplishment; making it suitable for joint operational environment (Hersey & Blanchard, 1982; Northouse, 2021).

g. **Charismatic Leadership**: As the name implies, charismatic leadership is characterized by the leaders' personality, emotional appeal, and persuasive communication. Charismatic leaders effectively instill loyalty and motivation among the subordinates. Besides, they can easily imbue an urge for mission accomplishment among the subordinates. Such leaders are highly effective during uncertainty as they can infuse high morale among the troops. However,

to avoid mission failure, such leaders need to be competent and visionary as well (Conger & Kanungo, 1987; Bass, 1990).

h. **Laissez-faire Leadership**: Laissez-faire leadership is characterized by minimum guidance and supervision. This approach may be suitable for the experienced and self-disciplined subordinates; however, this approach may not be much acceptable in military environment. Lack of direction in this leadership approach, as argued by Bass & Bass (2008) may lead to confusion, and ultimately, to mission failure. Hence, in the subsequent discussions, this particular leadership approach will be kept out of this paper's purview.

Subjective Comparison of Military Leadership Approaches

All leadership approaches are unique; and, one approach significantly differs from the other approaches. For example, autocratic leadership may affect the troops' morale and initiative, while the transformational and participative leadership enhances troops' morale and promote initiative. On the other hand, transactional leadership ensures correct orders and strict discipline; while transformational leadership focuses on long-term development and intrinsic motivation. Based on the available literature, an attempt has been made to make a comparison among different leadership approaches to determine their effectiveness and suitability. Table 2 below displays a comparative analysis among seven types of leadership approaches from a subjective point of view. Initially, based on the findings from reviewed literatures, the degrees of effectiveness of those approaches have been identified. Subsequently, considering the complex military operational environment, four factors—Troops' morale, crisis management, communication with subordinates, and speed in decision making—were selected to study the effects of different leadership approaches on those factors. Finally, in the last column of the table, suitability of different approaches in different contexts has been determined.

Table-2: Subjective Comparison of Different Military Leadership Approaches

Leadership Approach	Effectiveness	Morale	Crisis Management	Communication	Speed	Suitability
Autocratic Bass & Bass (2008), Yukl (2013)	High in structured settings	Low to moderate	Effective in high-pressure situations	Low (top-down only)	Very Fast	Highly suitable in immediate combat
Transformational Burns (1978), Bass (1985), Northouse (2021)	Very High	Very High	Effective	High (two-way)	Moderate	Suitable, especially for long-term campaigns

Leadership Approach	Effectiveness	Morale	Crisis Management	Communication	Speed	Suitability
Transactional Bass (1985), Yukl (2013)	Moderate to High	Moderate	Moderate	Moderate (reward-based)	Fast	Useful in repetitive/disciplinary roles
Participative Northouse (2021), U.S. Army Leadership FM 6-22	Moderate	High	Moderate (requires consensus)	Very High	Slower	Less suited for fast-paced combat
Servant Greenleaf (1977), Spears (1998)	High in peacekeeping roles	Very High	Moderate	High	Slow	Not ideal in rapid-response combat
Situational Hersey & Blanchard (1982), Northouse (2021)	Very High (context-based)	High	Very Effective (adaptive)	High	Adaptive	Excellent across varied conditions
Charismatic Conger & Kanungo (1987), Bass (1990)	High (shortterm motivation)	Very High	Moderate (emotion-driven)	High (emotionally charged)	Fast	Can be inspiring but lacks structure

Source: Literatures Listed in the First Column of the Table

Objective Comparison of Military Leadership Approaches

Taking lead from the aforementioned subjective analysis, all the leadership approaches have been analyzed through a deliberate scoring system. In doing so, different aspects of leadership approaches, as shown in Table 3, have been allotted with designated marks based on the significance of those aspects in military context. For example, effectiveness and morale have been considered more significant; therefore, those aspects have been allotted with higher marks. Besides, for instance, transformational leadership is considered highly effective in subjective analysis. Therefore, while considering effectiveness, transformational leadership has been graded with higher marks. Thereafter, the total scores have been accumulated; and finally, the leadership approaches have been ranked, in accordance with the obtained scores, to determine the most suitable leadership approach in military.

Table-3: Objective Comparison of Different Military Leadership Approaches

Factors	Auto-cratic	Transfor-mational	Transact-ional	Particip-ative	Servant	Situational	Charismatic
Effectiveness (5)	3 (15)	4 (20)	2 (10)	1 (5)	3 (15)	4 (20)	3 (15)
Morale (4)	1 (4)	4 (16)	2 (8)	3 (12)	4 (16)	3 (12)	4 (16)
Crisis Management (3)	2 (6)	3 (9)	1 (3)	1 (3)	1 (3)	4 (12)	1 (3)
Communication (2)	1 (2)	3 (6)	2 (4)	4 (8)	3 (6)	3 (6)	3 (6)
Speed (1)	5 (5)	3 (3)	4 (4)	1 (1)	2 (2)	3 (3)	4 (4)
Score	32	54	29	29	42	53	44
Rank	5	1	6	6	4	2	3

Source: Author's self-construct

The Most Suitable Leadership Approach

Leadership approaches are situation-centric; thus, one approach of leadership may not be suitable in all circumstances. Instead, leaders' success depends upon leadership style, qualities of followers and situational features (Rose et al., 2015). For example, the autocratic approach is likely to be the most suitable approach in a complex battlefield scenario; however, the same approach may be proved ineffective during peace. Nevertheless, the subjective and objective analyses, as stated above, suggest that the transformational leadership approach, arguably, stands as the most suitable leadership approach in military context. Contrary to the other approaches, transformational leadership produces greater effects. For example, while transactional leadership merely leads to the expected outcomes, transformational leadership results in performance that goes beyond the expectation (Bass & Avolio, 1990).

The concept of transformational leadership was first introduced by James MacGregor Burns in 1978; later, it was expanded by Bernard Bass (1985). Bass & Bass (2008) argue that transformational leadership enhances military discipline by implanting trust, cohesion, and shared values within command structures. Moreover, a meta-analysis by Bass and Riggio (2006) also suggest that transformational leadership leads to higher performance, morale, and job satisfaction which are crucial for mission success in military. A 2017 study by the U.S. Army Research Institute found that transformational leaders had better troop retention and reduced incidents of

misconduct. Apart from the theories, case studies on notable military leaders also advocate for the suitability of transformational leadership approach. For example, Eisenhower's leadership in the Allied invasion of Normandy required not only strategic brilliance but also coalition-building among British, American, and Canadian forces. His ability to inspire diverse forces largely depended on his transformational leadership style.

Developing Transformational Leadership in the Military

Military organizations worldwide—such as the U.S. Army, British Armed Forces, and NATO—emphasize leadership training. Such training is regarded as a core component of professional military education. These institutions invest heavily in simulation exercises, ethical decision-making models, and mentoring programs designed to shape leadership behavior through deliberate practice and feedback (U.S. Army FM 6-22, 2015). This approach is consistent with the perspectives of several scholars. For example, Hersey and Blanchard (1982) and Bass (1985) argue that effectiveness of leaders depends more on training rather than on the leaders' personality traits. Therefore, comprehensive training and established institutional culture are essential for preparing the future leaders and decision-makers. Hence, this part of the paper explores how to promote and develop transformational leadership within military through structured education, mentorship, practical training, and institutional culture. Finally, a two weeks' training program has been suggested to be introduced for developing transformational leadership approach among the junior and mid-level leaders.

a. **Structured Military Education**: One of the most effective ways to develop transformational leadership is implementing structured military education and training. The officers and the cadets should be educated on leadership models such as Bass's Full Range Leadership Model, to enhance their theoretical knowledge (Northouse, 2021). Similarly, as Solaiman (2014) suggested, transformational leadership approach should be formally introduced in the leadership package of Bangladesh Army. Leadership training in different training institutions and courses may focus more on this leadership approach. Besides, transformational leadership training can be introduced in the Command, Leadership and Management (CLM) package of the formation training system to train the officers (Solaiman, 2014). Besides, Solaiman (2014) has also suggested for incorporating more practical approaches like case studies, situation based exercise on leadership dilemma etcetera in the existing training package.

b. **Mentorship and Role Modeling**: Leaders cannot be trained merely by the structured training alone. Leadership is shaped through experience, guidance, and exposure to positive role models. Therefore, mentorship is crucial for leadership development. Senior officers, in this regard have a significant role to play—they must demonstrate transformational leadership in their regular interactions. These interactions should include active listening and mutual trust. Thus, they will be presented as the appropriate role models to be followed by the junior leaders (Bass, 1990). Since transformational leaders lead by examples; they set a standard to be followed by the others. The cumulative effect of mentorship is the gradual institutionalization of leadership values that go beyond command and control structures. Such mentorship may even start at the military academy (Solaiman, 2014). For example, at Royal Military College, Australia, officer cadets are taught on transformational leadership in the third year of their academic program. Then senior cadets get a chance to practice that style in their college leadership roles. Subsequently, the junior cadets can learn the leadership traits from the senior cadets (Bradley & Charbonneau, Spring 2004).

c. **Experiential and Reflective Learning**: In addition to theoretical knowledge, experiential learning is also equally important for developing leadership traits. Field exercises and simulation exercises can be conducted at formation and unit level to provide junior leaders with opportunities to test, reflect, and refine their leadership styles. Besides, reflection plays a crucial role in leadership development. Encouraging leaders to maintain leadership journals, participate in peer reviews, and undergo 360-degree evaluations can help them gain a better understanding of their strengths and areas for improvement. This culture of self-awareness promotes Bass's notion of individualized consideration, where leaders are expected to address the personal needs and development of their subordinates (Bass & Riggio, 2006). Solaiman (2014) has also suggested that the commanders should get feedback from subordinates, colleagues and superiors to assess their own leadership style.

d. **Building a Culture of Trust and Innovation**: Transformational leadership thrives in environments that encourage trust, communication, and innovation. As Bass (1985) argues, transformational leadership needs a bottom-up leadership culture that reinforces intellectual stimulation. This culture can be instilled by encouraging junior leaders to speak up, to challenge assumptions, and to take responsibilities (Bass, 1985). Furthermore, trust must be institutionalized—not just between leader and follower, but across units

and command structures. Open communication channels, psychological safety, and inclusiveness ensure that personnel feel valued and empowered. According to Northouse (2021), transformational leaders not only influence individuals, but they also reshape the organizational culture, encouraging innovation and integrity.

e. **Ethical Leadership and Integrity**: Ethics and integrity are foundational to transformational leadership. In military contexts, where leaders are entrusted with life-and-death decisions, the moral dimension of leadership cannot be overstated. Therefore, the military leaders at the higher ranks should exhibit high ethical standards and moral courage to develop transformational leadership among the junior leaders. Thus, leadership development programs should include ethical education.

f. **Institutional Support and Policy**: Developing transformational leadership is not just the responsibility of individual leaders; rather, it must be supported by institutional frameworks. Promotion systems, performance evaluations, and leadership assessments should incorporate transformational criteria such as empathy, vision, innovation, and team development. Military leadership doctrine must explicitly promote transformational values alongside tactical proficiency. Institutions like NATO and the U.S. Army have already taken steps in this direction. For example, the U.S. Army's "Be, Know, Do" leadership model emphasizes "character, knowledge, and action", the principles that closely align with transformational leadership (FM 6-22, 2015). Embedding these principles into doctrine is likely to facilitate the making of transformational leaders across the military.

g. **A Suggested Training Program for Developing Transformational Military Leaders**: Table 4 below suggests a two weeks' training program that can be introduced at institution and formation level to develop transformational leadership among the junior and mid-level officers. The table contains the likely topics to be covered, methods of imparting lessons and the enabling objectives of the training.

Table-4: A Suggested Training Program for Developing Transformational Leaders

Week 1: Foundations of Transformational Leadership		
Theme/Topic	**Method of Teaching**	**Enabling Objectives**
Introduction to Military Leadership Theories	Lectures, Group Discussions and Interactive seminar	1. To be able to understand the principles of transformational leadership and its effectiveness. 2. To be able to inspire and motivate teams. 3. To be able to lead ethically and to develop trust-based command relationships. 4. To be able to apply transformational leadership in operational settings.
Concept of Transformational Leadership	Case Studies of military leaders, Presentation	
Building and Communicating Vision	Vision-building exercise, Workshop	
Motivating Others and Building Morale	Case studies on motivational military leaders	
Leadership Ethics and Core Values	Ethics dilemmas, case study, Group Work	
Week 2: Application and Practical Leadership Development		
How to build a team and to foster trust among the team members	Team building exercises, Experiential Learning	
How to lead in a VUCA environment	Battle simulation, Wargaming	
Mentorship Development	Seminar, Group Discussion	
Exercise on Ethical Leadership	Decision-making exercise	
Reflection and Evaluation	Feedback, Peer Review	

Source: Author's self-construct

Conclusion

Effective leadership, often through quick decision making and effective coordination, enhances the rate of success of any military outfit. Besides, a good leader effectively creates an environment of trust and confidence that enhances the troops' morale. In addition, the role of leadership is also important to address the subordinates' needs of esteem and self-actualization. Thus, leadership plays an important role in the growth and development of subordinates.

Leadership in the military is not a one-size-fits-all solution. While autocratic and transactional models have historical value, the modern military leaders must be both visionary and adaptable. Therefore, to prepare effective leaders, it is important to know the different leadership approaches. Although all leadership approaches are unique; however, those can be compared with a view to ascertaining their suitability in different contexts. In addition to the subjective analysis inferring to the available literatures, the author's self-structured objective analysis also suggests that the transformational leadership approach could be considered the most suitable leadership approach.

Through structured education, mentorship, practical experience, ethical training, and institutional support, transformational leadership can be cultivated at every level of command. One of the most effective ways to develop transformational leadership is implementing structured military education and training. Transformational leadership approach should be formally introduced in the leadership package of Bangladesh Army. Besides, mentorship by the senior officers is crucial for the junior officers' leadership development. Senior officers must promote and demonstrate transformational leadership. Reflection plays a crucial role in leadership development. Encouraging leaders to maintain leadership journals, participate in peer reviews, and undergo 360-degree evaluations can help them understand their strengths and areas for growth. Besides, transformational leadership can also be developed by ensuring open communication channels, psychological safety, and inclusiveness to ensure that personnel feel valued and empowered. Moreover, leadership development programs should, include ethical education as well. On the other hand, transformational leadership should be institutionally promoted by ensuring that the transformational criteria such as empathy, vision, innovation, and team development are incorporated in the promotion systems, performance evaluations, and leadership assessments. Finally, military leadership doctrine must explicitly promote transformational values alongside tactical proficiency. As warfare evolves, so must the character, skills, and methods of leadership. Developing leaders who are morally grounded, operationally competent, and technologically adept is imperative for modern militaries. Investing in leadership training ensures that armed forces remain effective in both conventional and asymmetric conflicts. Ultimately, leadership remains as the cornerstone of military excellence.

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Biography

Lieutenant Colonel S M Mynul Hoque, psc, G was commissioned in the Regiment of Artillery on 27 December 2001 with 45th BMA Long Course. Apart from the courses at home, he has undergone Intelligence Course for Officers in India and training on clandestine operation techniques in Belgium. He is a graduate of Defence Services Command and Staff College, Mirpur and Army Command and Staff College, Nepal. He served in several field artillery units in different capacities. Besides, he served as instructor class B at School of Military Intelligence. He has also served as a Brigade Major in one of the Infantry Brigades and as a Grade Staff Officer-1 at Headquarters Army Training and Doctrine Command. Besides, he has commanded a field artillery regiment. He has participated in two United Nations' mission in Ivory Coast and DR Congo as contingent member and Staff Officer at Forces' Headquarters respectively. Presently, he is serving as a Directing Staff at Defence Services Command and Staff College, Mirpur. He is happily married and blessed with a daughter and a son

Future Armaments and Personal Gear of Bangladesh Army to Address Climate Change

Lieutenant Colonel Mohammad Mahmudur Rahman Niaz, SGP, psc

Abstract

The climate of Bangladesh is typically categorised by high temperatures, heavy rainfall and high humidity. Bangladesh is recognised worldwide as the disaster-prone state in the globe and susceptible to the effects of global warming. Forecasts show that, with the passage of time, temperature and rainfall will increase here. Moreover, overseas deployment of Bangladesh Army members is increasing, where they have to work in diverse weather conditions. For getting efficient output, army hardware and outfits demand modifications. But unfortunately, no scientific research has been carried out in this field so far. This study is based on a quantitative and qualitative study from mostly secondary data. This paper found that climatic issues like humidity, precipitation, heat and dust pose challenges to military operations. This paper has taken necessary suggestions and recommendations from foreign countries that are working in this field for a long time. After a critical analysis of existing facilities, some measures are suggested. To solve this, we need to incorporate modern facilities, modify outfits, customise armaments, and conduct adaptation training. It is a pioneer research on this topic and leaves a wide scope for further research on this.

Keywords. Adaptation, climate, humidity, precipitation, research.

Introduction

Climate change including increase in temperature is a global concern. Climate change is a universal challenge and none in the world is safe from this threat. Straddling the Tropic of Cancer, Bangladesh experiences a tropical monsoon climate characterised by heavy recurrent rainfall, high temperatures, and high humidity. Bangladesh Space Research and Remote Sensing Organization (SPARSSO) and Bangladesh Meteorological Department examine climate situations and circulate forecast of cyclones, floods, thunderstorms, heavy rains, drought, and cold wave through modern scientific gadgets. Owing to global warming, the Intergovernmental Panel on Climate Change (IPCC) has determined that cyclones, river bank erosion, flooding, tidal surge and salinity will become extreme in Bangladesh in the future.[1] Certainly, variation in climatic components affects military operations seriously. Besides, army operations embrace a varied range of actions beyond just combat, including military campaigns, humanitarian support, peacekeeping, disaster relief, non-traditional security aspects,

and more. These actions serve national security interests and can include both domestic and global deployments. Over the last two decades, many western militaries have steered land-based operations in climatically severe regions.[2]

The gears worn by military members are designed to provide protection, functionality, and comfort while balancing the need for mobility and safety. Against the backdrop of climate change, operations by the Bangladesh Army members will be challenging if these gears do not provide comfort. Besides, Bangladesh is one of the largest troops contributing states in the United Nations (UN) peacekeeping mission. Considering deployment, members of Bangladesh Army have to work in diverse environmental conditions. However, deployment on short notice to a warm operational or training environment, engagement in high-intensity exercise and conducting ceremonial duties in extreme weather may affect output due to excessive thermal strain. Adaptation to the environment is vital to conduct operational, administrative and other tasks successfully. Training, appropriate gear and proper armament can assist adaptation and increase effectiveness. Such adjustments may also introducemedical, professional and logistic challenges, demanding dynamic risks. Very limited research and development have been done to address these issues in the context of Bangladesh Army deployments, both at home and abroad..

Against this backdrop, this paper will first present an overview of weather variation in Bangladesh Army's areas of operation. After that, it will examine the impact of climate on military operational components and challenges posed by climatic variations. Drawing on selected findings, this paper finally suggests modifications to be incorporated in armaments and hardware, to enhance better preparedness of Bangladesh Army.

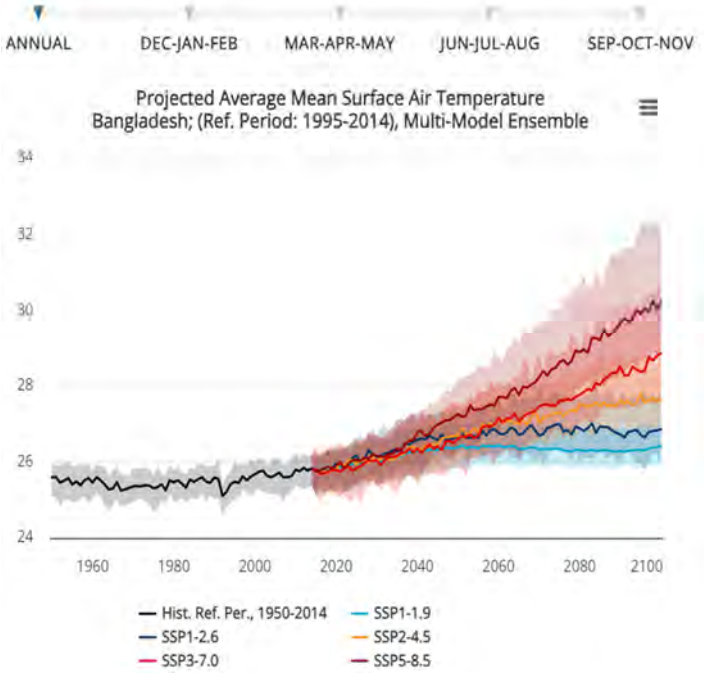
Overview of Weather Variation in Area of Interest of Bangladesh Army

a. **Reasons for Climate Change:** Climate change is the long-standing alteration in the earth's standard temperatures and weather conditions. Gases that block emitted heat of environment are known as Greenhouse Gases (GHG) and are responsible for global warming. GHGs like Methane and Carbon Dioxide available in nature are increasing due to burning fossil fuels, deforestation, and industrialisation. The world is now warming faster than previous records. Consequently, excessive heat and rain hinder the supply chain, physical output and operational efficiency in army operations.

b. **Forecasted Temperature of Bangladesh:** Due to climate change, temperature rise is also predicted in Bangladesh in the future. In figure 2 the prediction is shown by Shared Socioeconomic Pathways (SSPs), which can

deliver insight into forthcoming climates based on distinct emissions. Bangladesh will experience an additional 1 degree Celsius by 2030 and 2.4 degree Celsius by 2100 to its already hot weather.[3] Soldiers require more fluids, medical care and equipment maintenance, which increases the logistical burden.

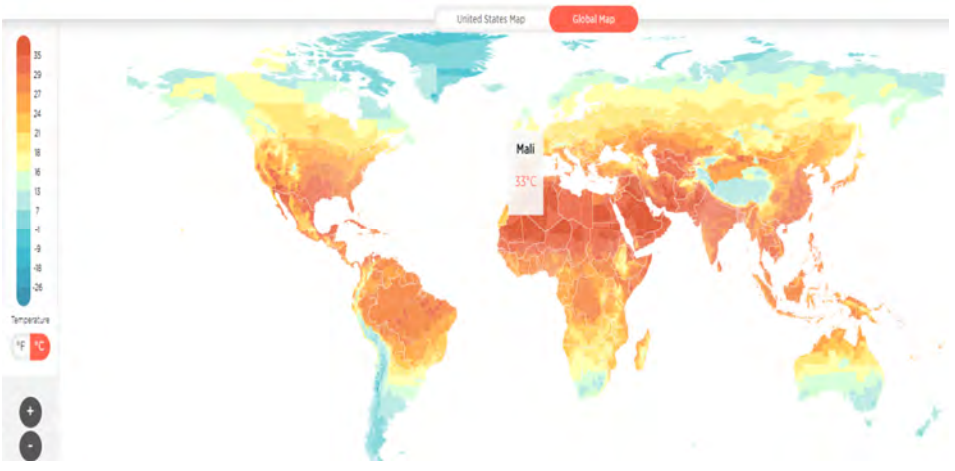
Figure 1: Temperature variation of past and future in the context of Bangladesh.



Source: climateknowledgeportal.[4]

c. **Global Temperature Forecast**: Bangladesh Army members have high demand in UN assignments. They need to be deployed in any corner of the globe. Besides, they may have exercise, training and humanitarian activities in any corner of the world. Figure 2 shows country-wise yearly average temperature within the time span of 2080 to 2099. As an example, the yearly average temperature of Mali will increase by 4 degrees Celsius (C) from that of the present state. Soldiers operating in regions like Central and North Africa will have to address excessive heat, sand storm, low humidity, and solar radiation. Special care against heat stroke, sweat, skin burn, ophthalmic damage, dehydration and redundancy in communication will be vital.

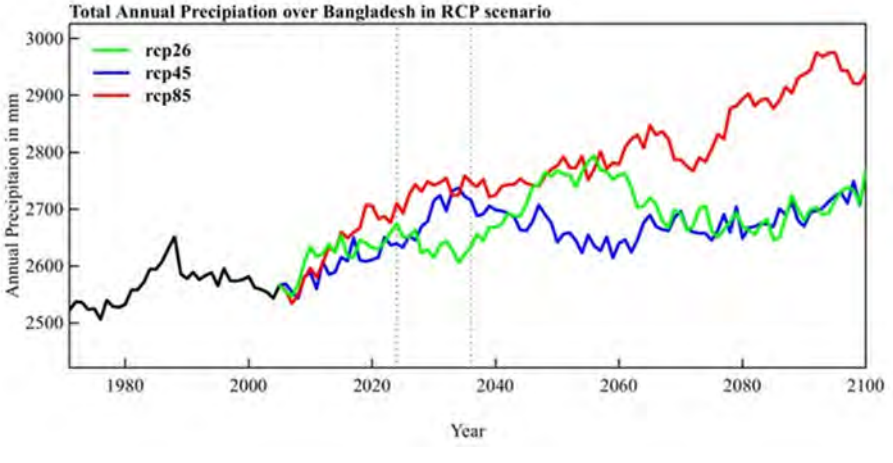
Figure 2: Projected annual temperature within year 2080-2099.



Source: climate impact lab.[5]

d. **Forecast of Precipitation:** Global warming will affect the global water cycle. Frequency of torrential rains and droughts will increase. Average annual rainfall will increase in comparison to the present state across the globe. The annual mean rainfall has been projected to increase around 4 percent by 2030 and 10 percent by 2100 in Bangladesh.[6] The prediction in Figure 3 is based on an analysis of the Representative Concentration Pathways (RCPs). In torrential rain zones, soldiers will have to address floods, landslides, and waterborne illnesses.

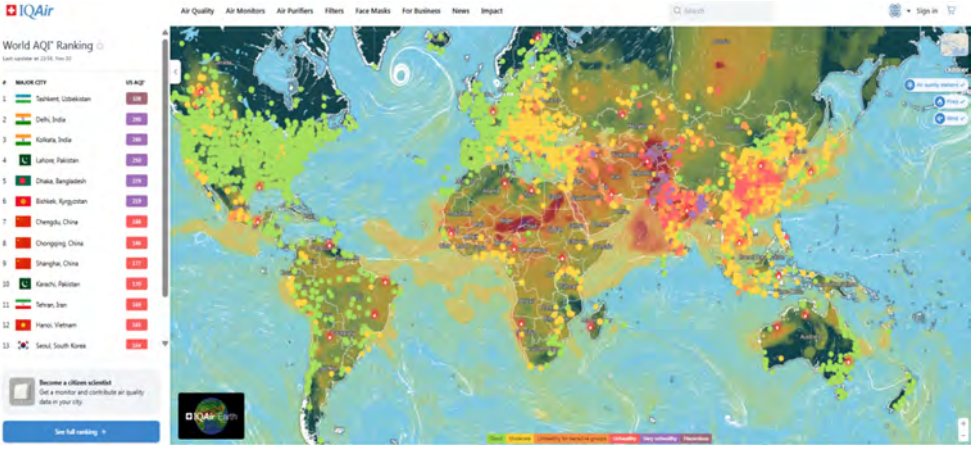
Figure 3: Monthly precipitation (mm) cycle forecast.



Source: Hasan (2024).[7]

e. **Air Pollution:** Harmful contents like lead and dust are gradually increasing in city areas. The air quality of Dhaka is very unhealthy, and it is shown in figure 4. Excessive air pollution can limit outdoor exposures of soldiers without using purifiers, masks, and inhalers.

Figure 4: Air quality index of 30 November 2025.



Source: https://www.iqair.com/air-quality-map.[8]

f. **Difference in Humidity:** The average humidity in Dhaka is approximately 74%, which is high. During the summer, high humidity results in a higher perceived temperature. High humidity causes feelings of stifling and suffocation. Without physical exertion people sweat excessively. However, in desert regions humidity remains comparatively low. People do not feel very suffocated in those regions.

Impact of Climate on Military Operational Components

a. **Weaponry**: Heavy rain or stagnant water can cause rust and malfunctioning of gadgets. The moisture makes the air thicker and that reduces the forward motion of the bullet. Bullets moving through this air have a shorter range and a slightly diverse ballistic arc. Again, shifting from cold to warm environments creates condensation on weaponry, which leads to stoppages. Extreme heat can cause expansion of metal parts, affecting performance of the weapon. In Cambodia, excessive heat caused an explosion at an ammunition warehouse on April 27, killing 22 soldiers.[9] Moreover, excessive heat can weaken the structural integrity of ammunition, expand chemicals of explosives, and damage protective shields.

b. **Vehicles**: High temperatures can contribute to overheating of the engine. Rubber components like tyres and seals can degrade quickly. In the cold, lubricants and oil can thicken. Again, conventional batteries can dry out rapidly in an arid climate and in highly humid weather. These absorb moisture and ultimately lead to shorter validity and leakage. Besides, examples of skidding of UN vehicles at higher speeds on melted asphalt roads have been noticed in North African states. A good cooling system with coolant, tinted windows, strong alternator, Nitrogen-filled tyres with good tread, and solar charged battery are must to address adverse impacts of heat.

c. **Aircraft of Army Aviation:** Aircraft or helicopters face difficulties operating in rain or fog. High temperatures can reduce payload capacity. Moreover, hot climates affect aircraft of army aviation by reducing engine thrust or lift. Temperature affects safety and accuracy significantly.

d. **Electronic Systems:** Extreme temperatures can affect sensors, communication and disrupt readings. High heat can also reduce battery lifespan and performance. As temperatures drop, condensation can form inside electronics, leading to corrosion and short circuits. Normally, for every 10°C increase of temperature, the reliability or lifetime of capacitors reduce to half.[10]

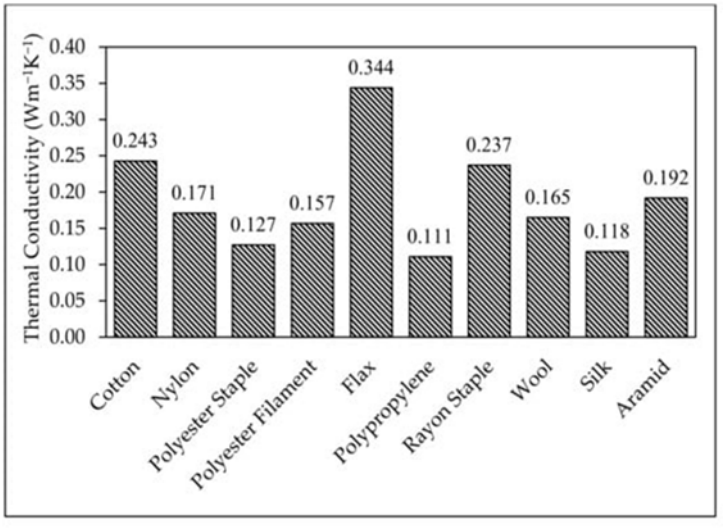
e. **Human Output:** Humidity makes the temperature feel warmer as sweat evaporates slowly. Low humidity can create sensory infection in the eyes and nose of human beings. Consequently, it affects output, sleep disorder, virus infection, and voice disruption.

f. **Effect on Fossil Fuel:** When the temperature increases, fuel expands, leading to a slight reduction in the volume delivered. Conversely, in colder temperatures, fuel contracts. Gasoline experiences minimal expansion and contraction but tends to evaporate in warmer weather. As per the kinematic theory of gases, the molecules are persistently in movement and travel in straight lines till an impact with another molecule or wall of a container triggers them to ricochet in a changed direction. Moreover, in heated environment, these molecules travel faster, causing powerful collisions. When atmospheric humidity remains low, moisture from moist fuels evaporate into the adjacent air.

Some Innovative Options

a. **Combat Clothes:** US Soldiers in Afghanistan wore combat dress with the "MultiCam" design, which has fire resistant properties. Besides, antimicrobial properties in clothes can limit odours and provide comfort to soldiers. Figure 5 shows the thermal conductivity of various clothes. A high thermal conductivity allows heat to pass through the fabric more easily and gives comfort. A higher proportion of cotton can make the wet clothes dry fast and provide comfort in humid or hot conditions. GORE-TEX, e-textiles, eVent, and Polartec NeoShell are some variants of clothing with both waterproof and heat transfer qualities. These use microporous or hydrophilic membranes which allow sweat vapour to escape and block the entrance of any liquid.

Figure 5: The thermal conductivity of various clothes.



Source: Islam, 2023.[11]

b. **Light Strike Vehicle**: These high-speed and light armoured vehicles were first utilised in combat during the Gulf War of 1991. Then the US Army effectively used these to navigate desert terrain quickly, avoid obstacles and carry a variety of mission-specific weapons. However, Special Forces can conduct fast operations by these due to their all-weather off-road mobility. The vehicle in figure 6 has a rear-mounted air-cooled engine which is suited for tropical weather.

Figure 6: Desert Patrol Vehicle

Source: militarymachine. [12]

c. **Human Universal Load Carrier (HULC):** This exoskeleton outfit is built to transmit the load to the frame and reduce the risk of damage to the wearer. This increases carrying capacity, mobility of soldiers and reduces stress. However, the wearer can attach necessary required items considering camouflage and weather conditions. It uses fuel cells as an energy source and can manage heat build-up by dissipation. This will allow soldiers to march long distances with heavy loads in adverse weather conditions.

Figure 7: Human Universal Load Carrier (HULC).

Source: Army Technology.[13]

d. **Compact First-Aid Kits:** This will address the requirement of a medic in an emergency. Important items like tourniquets, an eye shield, a valve for sucking chest wounds, and a strap cutter can address life-risk issues. Cold packs, foil blankets, hydration gels, and mini power banks in first aid are essential for soldiers operating in humid conditions.

e. **Rail Gun:** This gun is a capacitive-discharge device. Its capacitors can generate huge electrical charges to move the operating parts along the rails. Reducing friction and heat, it can operate precisely in adverse weather. It uses liquid nitrogen as heat exchangers to manage the intense heat. However, its advantages like hypervelocity of projectiles, increased range, high kinetic energy, lethality, enhanced safety, larger ammunition capacity, lower cost per round, immunity to counter-measures and multi-mission capability, will certainly increase acceptance among Bangladeshi Soldiers operating in adverse weather or on UN assignments.

Figure 8: Rail gun

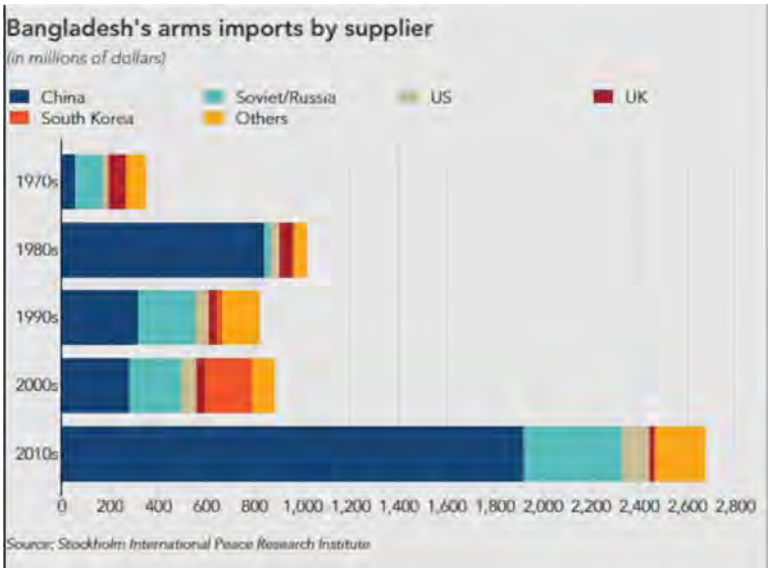
Source: twz.com.[14]

Challenges for Bangladesh Army

a. **Armament Manufacturing States Weather:** The armaments procurement plan is attributed to the government's strategic military modernisation plan. Bangladesh purchases armaments from various corners of

the world, which is shown in figure 9. Diplomatic relations and negotiations also sometimes affect purchase plan. The armaments are manufactured mostly considering the host state's weather condition. These may malfunction in some cases when operating in a different environment.

Figure 9: Import State of Military Hardware of Bangladesh.



Source: Anas, 2019.[15]

b. **Global Deployment Aspects:** Operational ability can be weakened when non-adapted personnel are sent on short notice to a severe climatic region. Clear knowledge is a must on fundamental or extrinsic thermal protection while addressing any threats. Insufficient or sub-optimal heat adjustment can bring consequences like heat stroke or even lead to death. However, initial adaptation of Bangladeshi Soldiers in the desert region take little time and they face challenges like psychological, physical ailments and logistic issues at that time.

c. **Inferior Research:** Very few research have been undertakento innovate suitable gears and equipment considering climate change for Bangladesh Army members. The funding in this is also meagre. Moreover, Bangladesh has limitations in its skilled workforce as well. Still, no variation in gears or armaments of Bangladesh Army members has been noticed during deployment in various climatic zones of the globe.

Few Suggested Options

a. **Personal Gear:** The cloth of combat should be selected to suit varying climate conditions. The options suggested in table 1 can be modified with the passage of time.

Table 1: Comparative analysis between existing and proposed combat clothes

Serial	Subject	Present	Proposed
1	Fabric	Conventional cotton.	High thermal conductive fabric with microporous is suitable in hot climate.
2	Maintenance	Difficult and time consuming in humid condition.	Increased cotton proportion make easy to wash and dry fast.
3	Design	Only one type.	Should vary considering area to reflect or absorb heat with digital print.
4	Cloth combination	Cotton to Polyester ratio is 60:40. Little uncomfortable in hot and humid weather.	Cotton to polyester proportion is 70:30 with hydrophilic fibres which swell in wet state, closing the gaps in the weave to make the fabric waterproof.
5	Water proof	Not water proof	Hydrophilic fibres of polyester, nylon, polyurethane, GORE-TEX, eVent, and Polartec NeoShell

Source: Author's self-construct

The proposed cloth made a balance between thermal conductive and hydrophilic fibre which can provide comfort in hot and rainy climate.

b. **Maintenance of Equipment:** During operations in sandy or desert terrain, equipment must be protected by covers against sandstorms. Extreme temperatures can degrade the performance of most vehicles, sensors, and weapons. Emergency tool kits for field maintenance should be filled with required items. Heat, sunlight, wind, dust, and sand substantially affect

equipment and materials. Moreover, liquid cooling keeps electronics at stable temperatures with enhanced performance. Routine inspections should look for suspected damages. Again, proactive inspections follow maintenance and repairs, ensuring equipment reliability.

c. **Energy Source Alternative to Fuel**: Advanced sonar sensors and infrared cameras can sense a diesel engine from a far distance. These devices track energy density and portability of fluid hydrocarbon fuels. The potential of portable nuclear reactors can be a viable option to provide electricity to both forward operating bases and tactical vehicles. Use of hydrogen as a fuel for unmanned systems and tactical vehicles can enhance deadliness by reducing signs and improve operation over legacy machines. Moreover, static current from electromagnetic induction, the piezoelectric effect, electrostatic induction, and the inverse magnetostrictive effect can be trapped in a battery.

d. **Hybrid Military Vehicle:** These types of light tactical vehicles have improved fuel economy compared to traditional vehicles by more than 20 percent. [16] The patents are relevant to the accessory drive method, battery, inverter and ability of the concerned vehicles. Hybrid electric automobile technology grants silent drive, increased mileage, economic fuel consumption, and increased power that enables it to be used in battle and reconnaissance operations. Moreover, it gets driving power either from solar, fossil fuel or battery. Considering all weather compatibility, vehicles from models like light tactical vehicle, armoured car, combat reconnaissance vehicle, amphibious combat vehicle, and high mobility multipurpose wheeled vehicle can be chosen for Bangladesh Army.

Figure 10: Hybrid Version of the Joint Light Tactical Vehicle.

Source: Wisconsin. [17]

e. **Multinational Training**: Increased participation of Bangladesh Army in overseas or multinational training will enhance adaptability and test functionality of armaments in adverse weather. Primarily, training should provide insights on terrain conditions, elevations, and interpretation of geospatial data. Certainly, these will bring forward scope of improvement and enhance effective decision making. Moreover, expertise can be outsourced after necessary security clearance to conduct in house training. Simulation training can also be conducted in a controlled environment.

f. **Heat Adaptation:** It depicts health cautiousness and enhanced performance by army persons in inclement weather. This skill can be enhanced by recurrent exposure to heat stress, residing in a natural hot climate, or by physical training. Mental state to adopt is also very vital in this aspect. Besides, training in mountain or desert terrain can be planned for this. Longer term heat adaptation can contribute to behaviour changes resulting in effective operation. Moreover, necessary lotion and shade options can be applied to assist.

g. **Alternative to Fossil Fuel:** Battery cells which have a lower terminal voltage than the float voltage must be monitored closely or must be replaced. Coin manganese dioxide lithium batteries can be placed in equipment considering adjustability, as they are heat-resistant. Options like solar energy storing devices, hydrogen cells, and nuclear cells can be developed as alternatives.

h. **Research and Development (R&D):** Bangladesh should have indigenous production capabilities. Self-sufficiency in critical items is required to ensure an uninterrupted supply chain in crisis moments. However, limited outsourcing or in a joint venture, Bangladesh should produce some of the gears and relevant armaments. In this aspect, a dedicated cell of R&D should search to propose innovative gears. However, any software driven equipment should have a contingency to address any cyber threat. Applications of AI technology will boost output, lighten soldiers' loads, and enable faster operations than humans. Moreover, for securely transmitting data to any stakeholder, block chain technology can be very effective.

Conclusions

Climate has been a substantial and occasionally decisive factor in army operations throughout history. Due to climate change, temperature and precipitation will increase

in Bangladesh in the future. Besides, state of humidity and precipitation patterns will become globally irregular. Accurate information on weather and forecasts become progressively worthy for efficient deployment of any army. Extreme temperatures can impact the performance and lifespan of military assets like vehicles, weaponry and electronic systems. Besides performing domestic duties, Bangladesh army members need to be deployed round the globe for training, exercise, and peacekeeping missions.

Varying climate has a profound impact on armaments and can cause malfunctioning. Bangladesh purchases armaments from various corners of the world where armaments are manufactured mostly considering host state's weather condition. However, Bangladesh Army has limited R&D to improve suitable gear or equipment considering climate change. The funding in this is also meagre. Insufficient or sub-optimal heat adjustment can bring consequences like heat stroke, psychological disorder, and logistic malfunctioning.

Heat adaptation in the army should not be viewed in segregation but in the context of war fighting. Training, physical fitness and adaptation can protect against heat related disorders. Bangladesh Army should incorporate alternative energy cells, rail guns, mobility vehicles and suitable ointments for operating in adverse weather conditions. The combat cloth should have a balance between thermal conductive and hydrophilic fibre, which can provide comfort in hot and rainy climate. Besides, Bangladesh should be self-sufficient in producing critical items to ensure an uninterrupted supply chain in crisis moments. Limited outsourcing or joint venture can be fruitful here. Finally, modified hardware and outfits to address climate issues of the future can increase efficiency in operational and routine activities of Bangladesh Army.

Recommendations

This paper has following recommendations:

a. Bangladesh should be self-sufficient in producing gears and armaments to address climate change after necessary R&D.

b. Multinational training and UN assignments can enhance climate adaptability and test sustainable functioning of armaments of Bangladesh Army.

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Biography

Lieutenant Colonel Mohammad Mahmudur Rahman Niaz, SGP, psc, was commissioned in the Corps of Engineers in December 1999. He served in various appointments in four Engineer Battalions, one Independent Engineer Company and one Border Guard Bangladesh (BGB) Battalion. He served as Instructor class-C in Engineer Centre and School of Military Engineering, Instructor class-B in Non-Commissioned Officers' Academy and Instructor class-A in Military Institute of Science and Technology. He also served as Garrison Engineer, Commander Military Engineer Services, and Town Planner of Bangladesh University of Professionals. Besides Mandatory courses, he attended Mid-Career Course at Pakistan. He has completed his Bachelor of Science in Civil Engineering, Masters in Defence Studies, and Masters in Business Administration. Presently he is pursuing for Doctor of Philosophy. He has participated in United Nations mission in Darfur and DR Congo. Besides, he has more than 90 publications in various journals and national dailies and published 6 books. Few of his articles were presented in national and international seminars also. Moreover, till today he has donated blood for 37 times. Presently he is commanding 12 BGB Battalion.

Rising Criminal Behaviour Dmn Due to Protracted Repatriation Process: A Multi-Stakeholder Approach for Bangladesh to Mitigate the Risks

Major Meherab Mehedi, Infantry

Abstract

The protracted repatriation process of Forcibly Displaced Myanmar Nationals (FDMNs), particularly the Rohingya community, has led to significant security, social, and economic challenges for Bangladesh. This research investigates the correlation between prolonged displacement and rising criminal activities among FDMNs, focusing on how the absence of sustainable repatriation solutions exacerbates these issues.

The study identifies key risk factors, including poverty, unemployment, lack of education, and psychological distress, as contributors to the surge in crime within refugee camps. The data, collected through surveys, interviews, and focus group discussions, revealed a strong correlation between the protracted repatriation process and criminal behavior, with statistical models showing a 64.6% variance in crime explained by extended displacement. Economic deprivation emerged as the most critical factor, with psychological trauma and social disintegration further amplifying criminal tendencies.

To address these challenges, the research proposes a multi-stakeholder approach that includes enhanced law enforcement, socio-economic development programs, and community engagement initiatives. The study also emphasizes the need for international pressure on Myanmar to create conditions conducive to the safe and voluntary repatriation of FDMNs. By implementing these strategies, policymakers can mitigate security risks while improving the overall well-being of the displaced community. This research contributes to the broader discourse on refugee crises, offering practical recommendations for managing prolonged displacement and its security implications.

Introduction

The ongoing crisis of the Rohingya population, now residing as Forcibly Displaced Myanmar Nationals (FDMNs) in Bangladesh, has presented one of the most severe humanitarian challenges in the region. The violent military campaign in Myanmar's

Rakhine State in 2017 led to the displacement of approximately 700,000 Rohingya, forcing them into temporary camps in Cox's Bazar, Bangladesh (Kiragu et al., 2011). Despite multiple international efforts and bilateral agreements, the repatriation process has remained in limbo, leaving these individuals in a state of prolonged uncertainty.

This prolonged repatriation has had wide-ranging implications for the FDMNs, affecting their socio-economic well-being, mental health, and safety. Over the years, the camps have become increasingly overcrowded, with living conditions have steadily worsened as international aid continues to decrease. As the situation becomes more dire, criminal activities within the camps have escalated, including human trafficking, drug smuggling, and gang-related violence (Paul et al., 2023). The interplay between socio-economic deprivation, psychological trauma, and increased criminality has transformed the Rohingya crisis from a humanitarian issue into a complex security threat.

The primary aim of this study is to explore the correlation between the prolonged displacement of FDMNs and the rise in criminal activities within their community. By analysing the socio-economic factors, psychological impacts, and involvement of criminal networks, this research seeks to identify the key drivers of criminal behaviour among the FDMNs. Additionally, the study will propose practical interventions to address the root causes of these issues, offering recommendations for the Government of Bangladesh, international organizations, and other relevant stakeholders.

Given the global attention on the Rohingya crisis and the potential for destabilization in the region, understanding the links between protracted repatriation and rising criminality is critical. This research not only highlights the urgent need for effective solutions but also provides insights that could be applied to similar refugee crises around the world. By addressing both the humanitarian and security dimensions of the problem, this study seeks to contribute to a more comprehensive and sustainable approach to resolving the Rohingya crisis.

Research Methodology

This study uses a post-positivist, mixed methods approach to investigate the rise in criminal behaviour among FDMNs due to protracted repatriation. The research will:

1. Examine economic, social, and environmental factors within refugee camps and surrounding areas over the past decade.

2. Use surveys to statistically assess the correlation between socioeconomic indicators and criminal behaviour among FDMNs.

3. Conduct interviews, focus groups, and observations to understand FDMNs' experiences and perceptions.

4. Contextualize findings within existing research on refugee studies and criminology to identify gaps and inform recommendations.

This integrated approach aims to provide a comprehensive understanding to support evidence-based policy and interventions.

Limitations

This study has several limitations. Its geographic focus on Cox's Bazar limits the generalizability of findings to other FDMN populations. The use of purposive sampling may introduce bias, as respondents were selected based on their relevance rather than randomness. Data collected through self-reports and official records may be subject to underreporting or exaggeration. The short study duration might not have captured long-term trends, and while strong correlations were found, causality between protracted repatriation and criminal behaviour cannot be definitively established due to mediating factors like poverty and psychological distress.

Protracted Repatriation of the FDMN: Assessing the Impacts

General

The protracted repatriation of Forcibly Displaced Myanmar Nationals (FDMNs), primarily the Rohingya, remains a significant challenge for Bangladesh. This section offers an overview of the Rohingya crisis, outlining key events that shaped the current repatriation situation. It examines political, security, and socio-economic obstacles that have hindered progress and explores the impact of this prolonged process on the FDMN community. These discussions set the foundation for analysing broader impacts and identifying risk factors that contribute to criminal behaviour within the FDMN population.

The Illusive Return: An Unfulfilled Hope

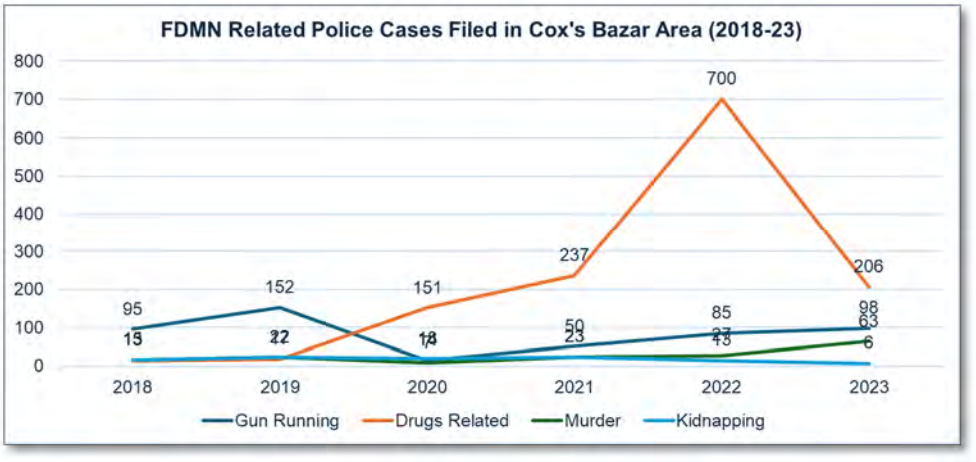
In August 2017, 700,000 Rohingyas were forcibly displaced to Bangladesh. Despite repatriation efforts since the 1970s, Myanmar's refusal to grant citizenship and ongoing violence in Rakhine have stalled progress (Halim, 2023; S. Hossain et al.,

2020). Geopolitical interests and weak international action underscore the need for a coordinated strategy (Md. I. Hossain et al., 2021).

Rising Crime Among the FDMN

Prolonged displacement has increasingly destabilized security in the Cox's Bazar camps. According to data provided by the **Cox's Bazar District Police,** overall reported crimes involving FDMN individuals increased by **64 percent between 2019 and 2021.** This increase coincidedwith sharp escalation in drug trafficking, which expanded by **approximately 40 percent by 2023** (A. M. Hossain, personal communication, June 26, 2024; Paul et al., 2023). Between 2017 and 2023, a total of 725 criminal cases linked to FDMN involvement were recorded in the district, resulting in 103 deaths (Rashid, 2024). Armed groups such as ARSA and RSO also contributed significantly to instability, with over 1,200 major incidents attributed to them in 2022 (Khan & Jinnat, 2023). Figure 1 shows a sharp rise in FDMN-related crimes from 2018 to 2023, with drug cases peaking in 2022. Gun running, murder, and kidnapping also increased steadily, indicating worsening security in the camps.

Figure 1: FDMN related police cases filed in Cox's Bazar Area (2018-23)



Source: Data collected by the researcher (A. M. Hossain, personal communication, June 26, 2024)

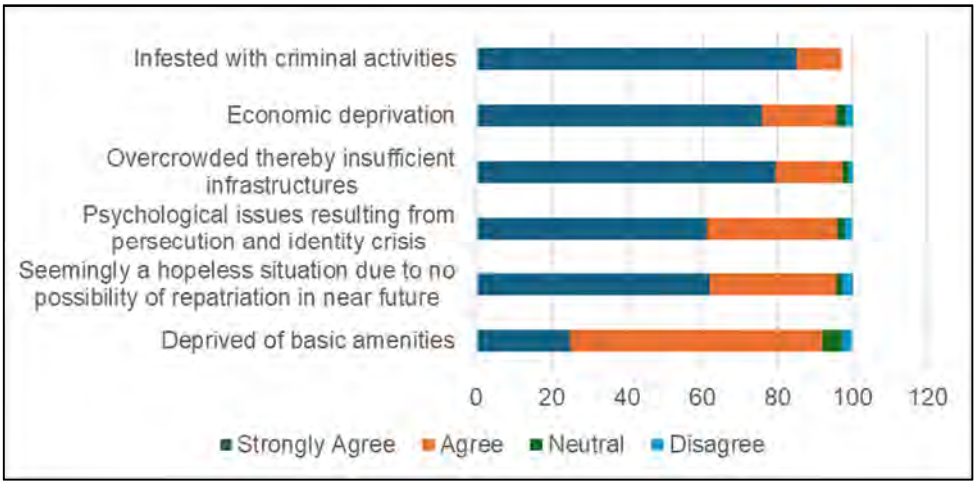
Impacts of Prolonged Repatriation on FDMN's Lives

Social Impacts

Miserable Living Conditions. According to Obaidullah (Interview June 25, 2024), living conditions in Cox's Bazar refugee camps are dire, with extreme overcrowding

being a major issue. Originally meant for fewer refugees, the camps now host nearly one million Rohingya, leading to severe shortages of shelter. FDMNs live in flimsy bamboo and tarpaulin structures, offering little protection from monsoons or cyclones (Md. I. Hossain et al., 2021). Figure 2 shows that more than 80% respondents overwhelmingly perceive the camps as suffering from intense deprivation and structural inadequacies. Notably, the *Strongly Agree* category dominates nearly all variables, indicating not only the presence of these issues but the community's deeply felt intensity of the crisis.

Figure 2: Perceived condition in FDMN Camps



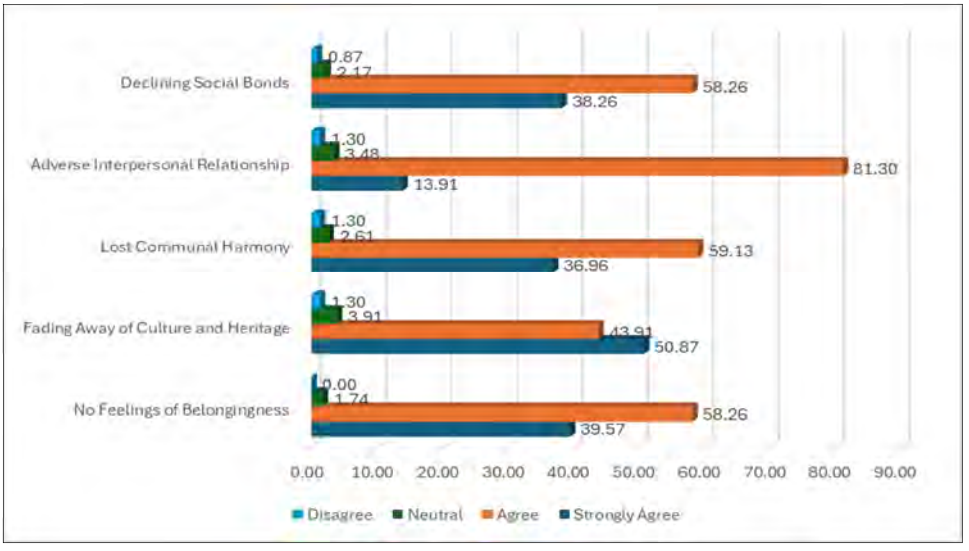
Source: Researcher's construct based on survey results

Lack of Quality Education. In FDMN camps, access to education is severely limited due to a shortage of schools, resources, and trained teachers. Overcrowded classrooms and insufficient teaching materials contribute to high dropout rates (A. S. M. Obaidullah, personal communication, June 25, 2024). Haque (Interview , June 23, 2024) mentions that the long-term consequences of educational deprivation are devastating.

Diminishing Socio-cultural Cohesion. In such a constrained environment, survival takes priority over social bonds, leading to fragmentation and weakened community initiatives (Siddiqi, 2022). As formal structures break down, informal networks emerge, often engaging in illicit activities, providing belonging but perpetuating criminal behaviour (Valli et al., 2019). Figure 3 shows that the protracted repatriation process has significantly weakened social cohesion in the camps. Respondents reported high levels of adverse interpersonal relationships, lost communal harmony,

fading cultural identity, and a lack of belongingness. This erosion of traditional social structures reduces internal community regulation, making individuals more vulnerable to frustration, deviant behaviour, and recruitment by criminal groups.

Figure 3: Response showing general opinion on the effects of prolonged repatriation on the socio-cultural lives of FDMNs



Source: Researcher's construct based on survey results

Economic Impacts

Economic Marginalization. FDMNs lack the legal right to work in Bangladesh, with limited prospects for formal employment in camps or host communities (*Rohingyas and Refugee Status in Bangladesh – Forced Migration Review*, 2024). As Obaidullah (Interview on , June 25, 2024) stated in the interview, "Rohingyas mainly rely on humanitarian assistance for subsistence, with little economic life." This dependency fosters helplessness and demoralization (Akhi, 2021).

Safety and Security Concerns

Breeding Ground for Crime. Overcrowding, lack of basic services, and minimal law enforcement in the camps creates an environment conducive to crime (Siddiqi, 2022). Md. Obaidul Haque Interview on June 23, 2024) noted that overcrowding increases tensions and allows criminals to operate more easily. The lack of law enforcement and judicial access emboldens criminals, perpetuating a cycle of violence and lawlessness.

Radicalization and Extremism. Life in the camps is rife with hopelessness, frustration and injustice providing a perfect breeding ground for extremist ideologies (Uddin & Rahman, 2021). This is not only resulting into endangering FDMN lives by their activities but also indirectly threatening for regional stability as forms of cross border terrorism and the bearing on organized crimes can emerge (Wolf, 2017).

Psycho-physical Impacts

Mental Health. Forcibly displaced Myanmar nationals (FDMNs) have faced severe psychosocial effects from prolonged displacement, including hopelessness, depression, anxiety, and PTSD (Md. O. Haque, personal communication, June 23, 2024; A. C. Perez, personal communication, June 29, 2024). Mental health support in the camps is scarce, despite the acute need, often overlooked in humanitarian efforts. This neglect worsens refugees' conditions, leading to inadequate psychological care (Tay et al., 2019). Furthermore, the stigma surrounding mental health disorders discourages many from seeking help.

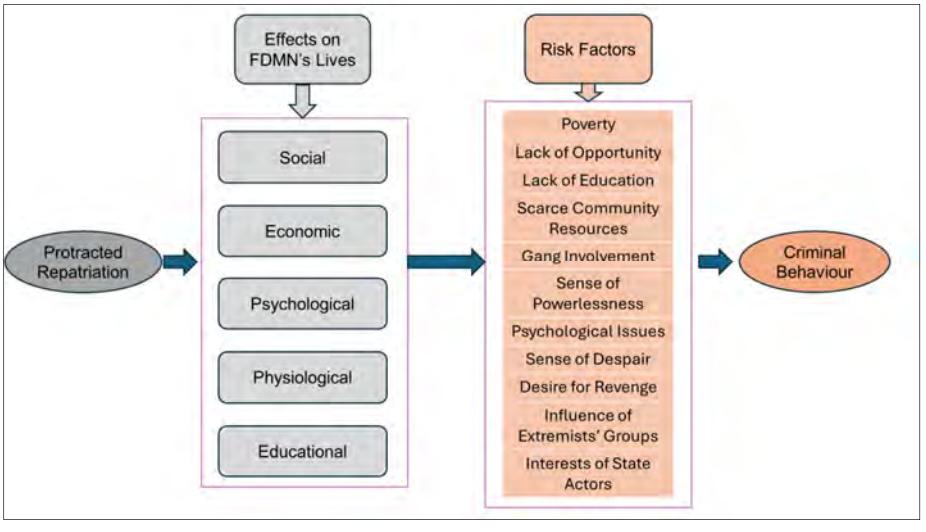
Physical Health. Rohingya refugees suffer from malnutrition, particularly children, leading to increased illness (Joarder et al., 2020). Overstretched medical services struggle to cope (*WHO's Transformative Initiative Enhances Healthcare for Refugees in Rohingya Camps*, 2024). MSF's Anthony C. Perez (interview on , June 29, 2024) reports frequent outbreaks of cholera, measles, and scabies, worsened by malnutrition.

Criminal Risk Factors Arising from the Effects Protracted Repatriation on the FDMN Community

General

This section seeks to provide a thorough understanding of the risk factors that act as driving factors for criminal activities within refugee camps emanating from the effects of their continued stay in the FDMN camps. This section carries out a detailed analysis of concurrent risk factors for criminal behaviour in order to grasp not only what the Rohingyas are facing but also offers an understanding what could this mean at large from regional stability.

Figure 4: Framework for effect dimensions and associated risk factors for criminal behaviour



Source: Researcher's construct.

Specific Risk Factors for Involvement in Criminal Activities

Poverty

Economic deprivation is a major driver of criminal behavior among Rohingya refugees (Md. I. Hossain et al., 2021). Interviews with experts, including Haque, Obaidullah, Habib, Rahman, and Jafar (June 2024), reveal a direct link between poverty and crime in the camps. Many young men, unable to find work, are recruited by drug trafficking rings.

Unemployment

When individuals see no legitimate way to improve their circumstances, they are more likely to turn to criminal activities (M. R. Habib, 2021). Assistant Superintended of Police Mahatab Hossain (intervew on , June 26, 2024) highlighted that the lack of employment opportunities fuels social tension and unrest in the camps. This inequality fosters an environment where criminal behaviour thrives.

Lack of Education

Without proper educational opportunities, most FDMNs remain trapped in poverty and crime (A. N. M. Z. Hossain, 2023). Education not only equips individuals with employable skills but also fosters socially acceptable, non-criminal behaviour (Groot

& Maassenvandenbrink, 2010). Lacking education, FDMN youth often lead unproductive lives, increasing their chances of becoming either perpetrators or victims of crime. Survey data reveals that 96% of respondents view the lack of quality education as a major risk factor for criminal activities among FDMNs.

Scarce Community Resources

Obaidullah (Interview on , June 25, 2024) noted that the lack of community resources, such as recreational facilities and support services, fuels crime in the camps. Boredom and frustration drive delinquency among young FDMNs, while the absence of counselling and vocational training denies crucial support (K. F. Rahman & Arefin, 2024; Vargas, 2023).

Gang Involvement

Amid conditions of despair, gangs offer displaced youths a sense of belonging, specially whenf stable family structures and community support are lacking. Gangs provide material benefits, protection, and a surrogate family, making them appealing to vulnerable individuals (Das, 2023). Once involved, youths are drawn into illegal activities like drug trafficking and violent crimes, risking long-term harm to their prospects and well-being (L. C. A. R. Chowdhury et al., personal communication, June 25, 2024).

Sense of Powerlessness

The psychological impact of powerlessness is a key factor driving individuals to crime (Box, 1983). This desperation often leads to criminal activities as a way to assert control or meet basic needs ("Desperate Rohingyas Turning to Crimes," 2020). One case involved a young refugee who, unable to find legal work, joined a smuggling ring to support his family, illustrating the link between powerlessness and crime (A. M. Hossain, personal communication, June 26, 2024).

Psychological Issues

Psychological issues can impair judgment, increase impulsivity, and reduce stress-coping abilities, leading to criminal behaviour (A. Hossain et al., 2021). Perez (personal communication, June 29, 2024) stressed that untreated mental health problems often push individuals into crime as a way to ease distress. For example, severe anxiety or depression can lead to substance abuse, resulting in involvement in drug trafficking or related activities. Additionally, untreated mental disorders may increase violent behaviour due to heightened aggression and frustration.

Sense of Despair

Despair and hopelessness from prolonged displacement often push individuals toward illegal activities to regain control or escape their circumstances (Molla, 2019). Case studies highlight this link, such as an interview with Additional Deputy Inspector General of Police Md. Amir Jafar (Intervew June 27, 2024), who noted that many young men in the camps join smuggling rings out of frustration and a lack of options, seeking a sense of agency and financial stability.

Feelings of Resentment

The desire for vengeance can drive individuals to criminality, including violent acts and joining extremist groups advocating retaliation against their oppressors (*Report on Rapid Assessment of the Rohingya Crisis and Its Potential for Violent Extremism*, 2019). This often results in criminal acts targeting the host community, ultimately harming social and economic stability (L. C. A. R. Chowdhury et al., personal communication, June 25, 2024).

External Factors

Influence of Extremists' Group. Poverty, illiteracy, and hopelessness in the camps create conditions ripe for violent extremism (Bashar, 2017). Armed groups like RSO, ARA, and ARSA are reported to forcefully recruit young men, spreading fear within the camps (Pérez, 2024). Brigadier General Md. Ahsan Habib (personal communication, June 24, 2024) noted that radicalization clearly fuels criminality, with individuals posing threats both inside and outside the camps, engaging in or preparing for violent acts.

Interest of State Actors. The security environment is influenced by various regional and international strategic interests. A recent article in *The Diplomat* suggests growing pressure on Rohingyas in Bangladesh to join Myanmar's civil war (Pérez, 2024). Habib (Interview , June 24, 2024) highlighted how state actors and extremist groups exploit FDMNs, fuelling criminal activities, while hostile agencies conduct clandestine operations to advance their own agendas.

Assessing the Correlation between Protracted Repatriation and Rising Criminal Activities among FDMN

Regression Analysis

A quantitative survey was conducted among respondents from the FDMN community and relevant stakeholders. Data were analysed in **SPSS** using descriptive statistics and simple linear regression to assess the impact of the protracted repatriation process on criminal behaviours. The regression analysis showed a strong correlation between the protracted repatriation process and the rise in criminal behaviour among FDMNs. With an **R value** of **0.804, 64.6% (R^2 = 0.646)** of the variance in criminal behaviour is explained by the repatriation process. The regression coefficient of **0.854**, significant at the **0.000** level, confirms that prolonged displacement is a major predictor of criminal activities.

Table 1: Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.804[a]	.646	.644	.24177

a. Predictors: (Constant), Protracted repatriation process of the FDMN

b. Dependent Variable: Criminal behaviours among the FDMN.

Source: Author's self-construct

The ANOVA results further support this finding, with an **F value of 415.547** and a p-value of **0.000**, indicating that the model is statistically significant. These results suggest that as the duration of displacement increases, so does the likelihood of FDMNs engaging in criminal activities.

Table 2: Anova Test

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.289	1	24.289	415.547	.000[b]
	Residual	13.327	228	.058		
	Total	37.616	229			

a. Dependent Variable: Criminal behaviours among the FDMN.

b. Predictors: (Constant), Protracted repatriation process of the FDMN

Source: Author's self-construct

One-Sample T-Test

A one-sample t-test evaluated the significance of various risk factors associated with criminal behaviour. Results showed that extreme poverty, lack of employment, scarcity of community resources, and psychological issues were all significant predictors, with **p-values of 0.000**. The t-values exceeded the critical value of **±1.9666**, confirming the importance of these risk factors in contributing to criminal behaviour.

Table 3: One-sample T Test

Factors	N	Mean	Std. Deviation	t	Sign. (2-tailed)
Extreme poverty	230	4.78	.519	22.740	.000
Lack of opportunities for employment and advancement	230	4.57	.555	15.447	.000
Lack of access to quality education	230	4.25	.526	7.270	.000
Scarcity of community resources and support systems	230	4.69	.549	19.088	.000
Gang involvement	230	4.73	.573	19.320	.000
Sense of powerlessness	230	4.63	.665	14.473	.000
Psychological issues, such as trauma and mental health problems	230	4.17	.590	4.247	.000
A pervasive sense of despair and hopelessness	230	4.16	.565	4.320	.000
Desire for revenge, stemming from past grievances	230	4.66	.698	14.360	.000
Influence of extremist groups	230	4.38	.614	9.450	.000
Evil interest of various state and non-state actors	230	4.39	.594	9.992	.000
Identity crisis	230	4.14	.599	3.630	.000
Valid N (listwise)	230				

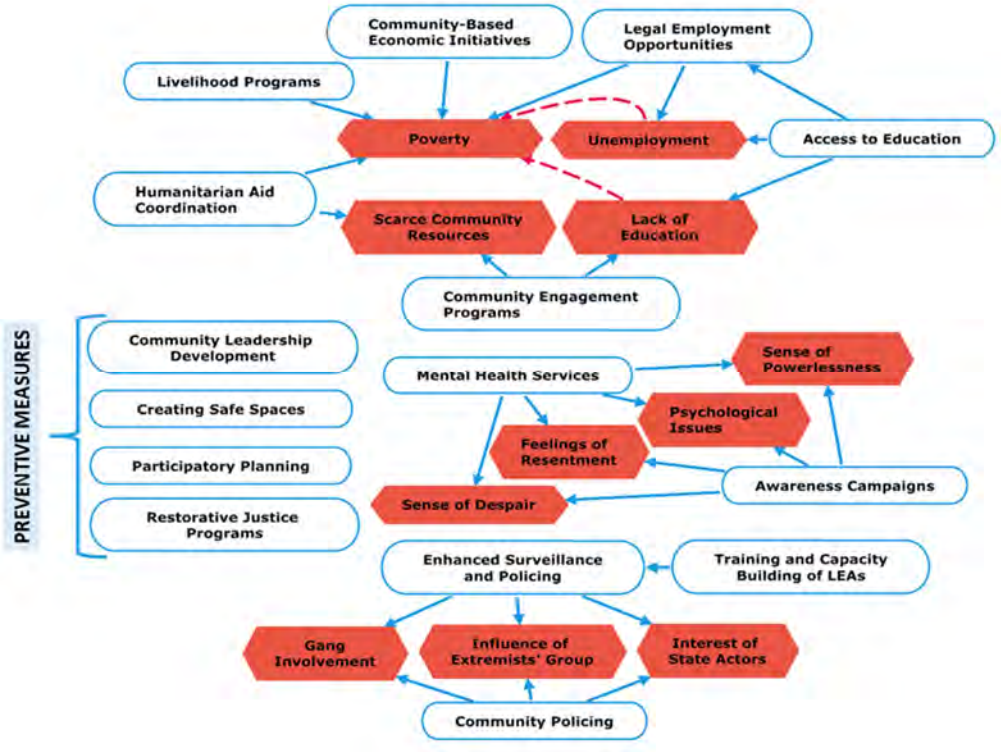
Source: Author's self-construct

Measures for Addressing Rising Criminal Behaviour among FDMNs

General

This section addresses the growing issue of criminal behaviour among Forcibly Displaced Myanmar Nationals (FDMNs) in Bangladesh's refugee camps. The prolonged repatriation process has turned these camps into hubs for illegal activities, posing serious security risks. It proposes a framework to mitigate these risks through stronger law enforcement, improved socio-economic conditions, and enhanced international cooperation.

Figure 5: Mitigation and Prevention Measures

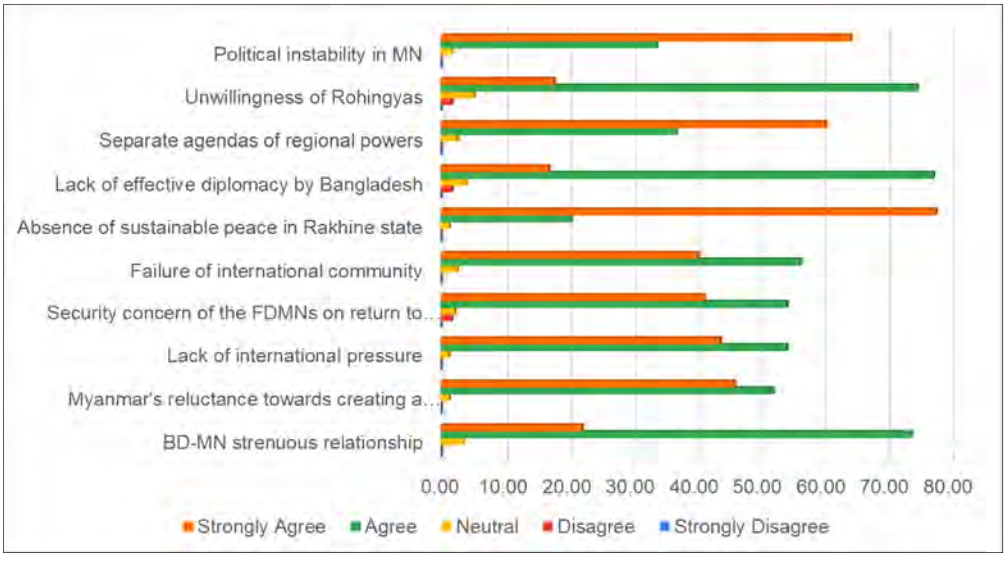


Source: Researcher’s construct

Repatriation: The Ideal Resolution

A swift repatriation could address challenges for both Bangladesh and the FDMN community. However, the process remains stalled with little prospect of progress. The survey identifies "Political instability in Myanmar" and the "Absence of sustainable peace in Rakhine state" as the main obstacles to repatriation, with most respondentsstrongly agreeing on their significance.

Figure 6: What do you see as the main obstacles hindering the repatriation process of the FDMNs?



Source: Researcher's construct based on survey results

Measures for Curbing Criminal Behaviours among FDMN

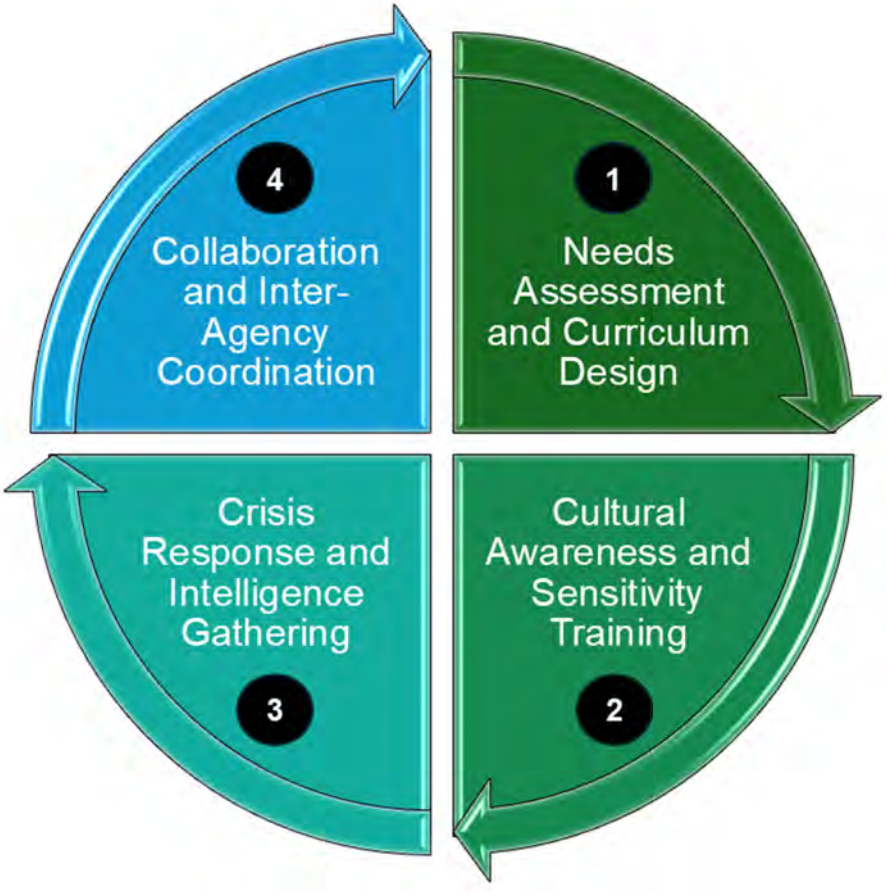
Strengthening Law Enforcement and Security Measures

Enhanced Surveillance and Policing. Enhancing security requires strengthening law enforcement in and around the camps. Using technologies like CCTV and UAVs can help identify and deter illegal activities more effectively.

Community Policing Initiatives. Although some argue community policing is ineffective in FDMN camps (A. C. Perez, Interview, June 29, 2024), its effectiveness could be enhanced through cooperation with law enforcement . Involving FDMNs strengthens security and fosters responsibility within the community (L. C. A. R. Chowdhury et al., personal communication, June 25, 2024).

Training and Capacity Building. Mr. Amir (Interview , June 27, 2024) emphasized the need for specialized law enforcement training in cultural awareness, crisis management, and information gathering to tackle camp security challenges. Enhancing collaboration with domestic and international agencies will improve overall crime prevention. A proposed 4-step **Training and Capacity Building Model** tailored for law enforcement personnel working in the unique camp settings is given below.

Figure 7*: 4 Step Training and Capacity Building Model.*



Source: Researcher's construct

Improving Socio-Economic Conditions

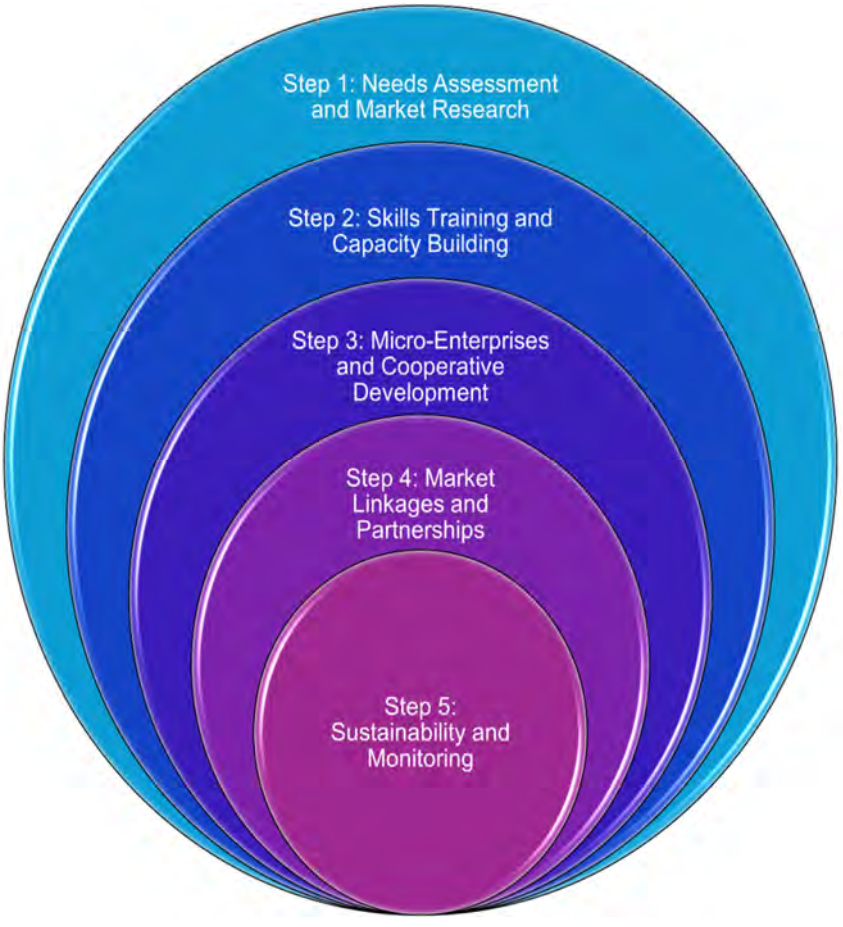
Livelihood Programs. Livelihood initiatives are vital for easing FDMNs' economic burden and fostering stability. Major General Mir Mushfiqur Rahman (Interview, June 24, 2024) emphasized that vocational training in carpentry, tailoring, and agriculture ensures economic autonomy and reduces vulnerability to crime.

Legal Employment Opportunities. Allowing FDMNs formal employment in Bangladesh or through international programs would ease the economic burden on the host community. Abu Saleh Mohammad Obaidullah Interview, June 25, 2024) stressed partnering with local businesses and international organizations for job creation.

Access to Education. Education is vital in breaking the poverty-crime cycle. Expanding schools and offering vocational training can prepare FDMNs for employment, reducing crime. Professor Haque (Interview , June 23, 2024) stressed that education brings hope and supports long-term community development.

Community-Based Economic Initiatives. Encouraging community-based economic initiatives like cooperatives or small-scale enterprises can improve socio-economic conditions. Such projects promote self-reliance, allowing FDMNs to produce and sell goods, fostering income and community support, which helps reduce isolation and criminal behaviour Interview, June 24, 2024). A **Community-Based Economic Initiative (CBEI) Model** that can be used to empower the FDMN community and foster self-reliance is given below.

Figure 8: ***5 Step Community-Based Economic Initiative (CBEI) Model.***



Source: Researcher's construct

Humanitarian Aid Coordination. Effective coordination of aid is crucial to reduce criminality and improve FDMNs' living conditions. Abu Saleh Mohammad Obaidullah (Interview , June 25, 2024) emphasized sustained support in food, shelter, and healthcare, with a focus on long-term education and vocational training initiatives.

Addressing Psychological and Social Needs

Mental Health Services. Mr. Perez (Interview , June 29, 2024) stressed the need for improved mental health services in the camps. Expanded access to individual and group counselling, trauma therapy, and psychiatric care is essential to help FDMNs manage psychological distress and reduce the likelihood of turning to criminal behaviour.

Community Engagement Programs. Cultural, recreational, and educational activities can reduce boredom and prevent crime. Focused Group Discussions emphasized that such activities strengthen social cohesion and prevent gang recruitment, particularly among vulnerable youth (L. C. A. R. Chowdhury et al., personal communication, June 25, 2024).

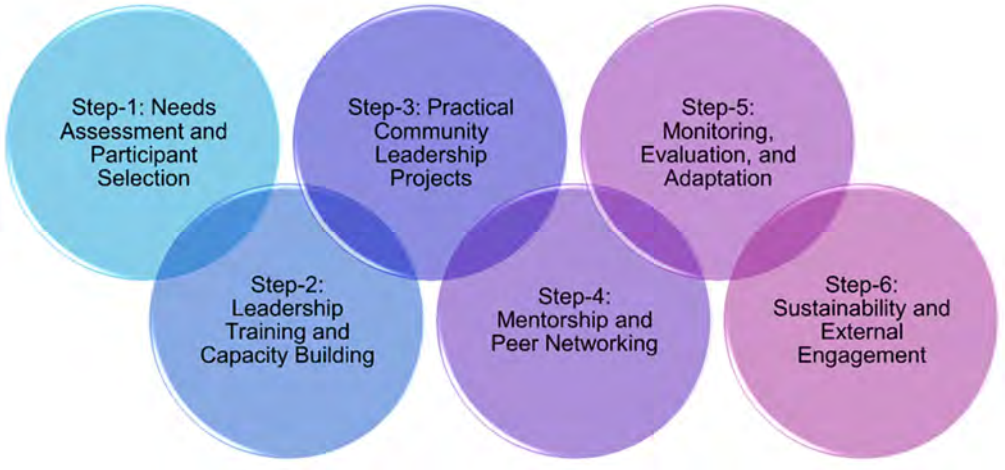
Awareness Campaigns. Reducing mental health stigma in the FDMN community is crucial. Awareness campaigns, suggested by experts, should educate FDMNs and encourage service use, using channels like radio, community meetings, and collaboration with local leaders (A. C. Perez, Interview , June 29, 2024).

Creating Safe Spaces. Providing safe spaces for vulnerable groups, especially women and children, is crucial to addressing FDMNs' social needs. These spaces protect against gender-based violence and support trauma victims, reducing their vulnerability to criminal activities (A. C. Perez, personal communication, June 29, 2024).

Involving the FDMN Community in Solutions

Community Leadership Development. Developing leadership in the FDMN community is vital for self-reliance and positive behaviours. Anthony Caswell Perez (personal communication, June 29, 2024) highlighted the lack of unified leadership. Leadership programs can empower individuals to mediate conflicts, prevent crime, and represent FDMNs in negotiations. To address this challenge, a **Six-Step Community Leadership Development Program (CLDP)** model can be introduced, focusing on a structured approach to leadership growth.

Figure 9: 6 Step Community Leadership Development Program (CLDP) Model.



Source: Researcher's construct

Participatory Planning. Involving FDMNs in planning and implementing programs to improve their socio-economic conditions ensures the success and sustainability of these initiatives. Participatory planning strengthens community commitment and aligns efforts with FDMNs' actual needs (L. C. A. R. Chowdhury et al., Interview .

Restorative Justice Programs. Restorative justice initiatives, focused on reconciliation, can address minor crimes within the FDMN community. Professor Dr. Md. Obaidul Haque (Interview, June 23, 2024) highlighted that community mediation can reduce violence, especially when integrated with Rohingya cultural practices.

Conclusions

This study explored the complex relationship between the protracted repatriation of Forcibly Displaced Myanmar Nationals (FDMNs) and the rise in criminal behaviour within their community. It highlighted the detrimental effects of prolonged displacement, such as social disintegration, economic deprivation, and psychological distress, underscoring the need for coordinated efforts to address the root causes and enable voluntary refugee return.

Key risk factors identified include economic hardship, unemployment, lack of education, and psychological issues, all contributing to increased criminal activity. Data analysis confirmed a strong correlation between the prolonged repatriation process and rising crime, with mediating variables like economic hardship and mental health exacerbating the issue.

Proposed measures include strengthening law enforcement, improving socio-economic conditions, and enhancing community engagement to reduce criminal activities and foster a more stable refugee community. The study emphasizes that addressing socio-economic and psychological issues is crucial for lasting solutions, with coordinated efforts from government, international bodies, and the FDMNs themselves.

Recommendations

To effectively address the issue, the following recommendations are proposed:

Strengthen Law Enforcement and Community Policing

The Ministry of Home Affairs (MoHA), through the Armed Police Battalion (APBN) and Cox's Bazar District Police, should increase law enforcement presence inside the FDMN camps within the next 3 months. Using the **4-step Training and Capacity Building model**, APBN should conduct structured training on cultural sensitivity, crisis management, and intelligence gathering for all officers deployed in the camps within one year. Additionally, APBN and camp-level police should introduce community policing teams including FDMN volunteers by 2026 to enhance trust-building and early threat detection.

Develop Livelihood and Vocational Training Programs

The Ministry of Disaster Management and Relief (MoDMR), in collaboration with UNHCR, IOM, and NGO partners, should roll out livelihood training under the **5-step Community-Based Economic Initiative (CBEI)** model within 2026. Agencies should establish at least 10 new vocational training centres by the end of the fiscal year, focusing on tailoring, carpentry, ICT skills, and small-scale entrepreneurship to reduce the economic incentives for illegal activities.

Expand Mental Health Support Services

The Ministry of Health and Family Welfare (MoHFW), jointly supported by WHO and MSF, should deploy a minimum of 50 trained psychologists and counsellors to the camps within 6 months. A structured mental health program, including trauma counselling and crisis intervention, should be fully operational in all camps by the next annual planning cycle, reducing untreated trauma that contributes to behavioural issues.

Develop Community Leadership

The Refugee Relief and Repatriation Commissioner (RRRC), together with UNHCR and reputable NGOs, should implement the **6-step Community Leadership Development Program (CLDP)** within 6 months. Training modules on governance, conflict resolution, and mediation should be conducted quarterly, creating a pool of at least 200 trained FDMN community leaders by the end of the year to support internal dispute resolution and reduce criminal behaviour.

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Biography

Major Meherab Mehedi, **psc,** Infantry was born on 1 November 1990 in Magura. He completed his Secondary School Certificate at Tikerbila High School and his Higher Secondary Certificate from Dhaka Residential Model College. Commissioned into the Corps of Infantry on 22 June 2011 with 64th Bangladesh Military Academy Long Course, Major Meherab has held diverse roles in unit, staff, and instructional appointments.

He served in various capacities within the 19 East Bengal Regiment (Divisional Support) and 7 East Bengal Regiment, holding key regimental appointments. Additionally, he has held staff appointments, including serving as a Grade 3 Staff Officer in the Counter Insurgency Branch of the 24 Infantry Division. At Army Headquarters, he served as General Staff Officer Grade 2 in the Military Operations Directorate and later as General Staff Officer Grade 2 (Coordination) in the Directorate General of Defence Purchase. In the capacity of an instructor, Major Meherab was Instructor Class 'C' at the School of Infantry and Tactics. His operational experience includes serving under Operation UTTARAN in Rangamati, Operation PURBA PRACHEER in Ramu and participation in UN Peacekeeping Missions in Ivory Coast (UNOCI) and Abyei (UNISFA). Major Meherab completed the Defence Services Command and Staff Course – 2024 from Defence Services Command and Staff College, Mirpur. Currently, Major Meherab is serving as Brigade Major of 65 Infantry Brigade under 10 Infantry Division at Ramu Cantonment. He is married to Dr. Tamanna Tabassum, and they are blessed with a son, Arshan. His hobbies include reading, driving and travelling.

Professional Motivation Vis-À-Vis Organisational Efficiency: A Study on Junior Officers of Bangladesh Army

Major Md Nazmul Hossan, psc, Artillery

Abstract

This study examines the positive influence of professional motivation (PM) among junior officers (JOs) on organisational efficiency (OE) in the Bangladesh Army (BA). A review of the existing literature underscores the importance of motivation for military effectiveness and the challenges of fostering it within the context of the BA. The study explores critical factors affecting the PM of JOs, including shifting societal values, generational differences, and leadership practices. Accordingly, the research states that the OE of the BA will increase as the PM of JOs improves. Using a mixed-method approach, data were gathered through surveys, interviews, and focus group discussions from 306 JOs and senior and mid-level officers. Findings reveal a decline in the PM of JOs, marked by increased transactional loyalty, materialism, and disciplinary issues, which negatively impact OE. However, positive attributes such as enthusiasm and innovation offer opportunities to enhance OE. The study emphasises the need for both organisational and individual approaches to revitalising PM, offering practical recommendations to align individual motivations with organisational goals, improve leadership, and foster a conducive working environment. Moreover, both subjective and objective analyses confirm that enhancing JOs' PM will significantly increase the BA's OE. The study concludes through recommending required modifications and effective strategies to enhance JOs' PM to improve the OE of BA.

Introduction

The military profession, characterised by enduring physical hardship, danger, and the uncertainty of combat, requires leaders to be professionally motivated and committed to organisational success. Influential leadership theories in the military underscore that leaders being professionally motivated must provide purpose, direction, and motivation to their troops to foster mission success (Department of the Army, 2019). Professional Motivation (PM) in the military refers to the factors that drive military personnel to remain committed to their military career and perform assigned tasks with dedication to achieve an organisational goal (Hasan, 2022). A well-motivated

military force often requires less supervision and demonstrates greater commitment to mission success. As a professional outfit, the Bangladesh Army (BA) demands a higher level of PM from its members for effective organisational functioning, where the role of junior officers (JOs) is vital (Kamal, 2016).

The PM of JOs is essential in shaping the motivational behaviour and morale of their subordinates, as they serve as the direct-level leaders who execute the organisational vision (Baki, 2024). When JOs perceive their work as meaningful and aligned with transparent professional pathways, they are more likely to show initiative, resilience, and commitment, thereby directly enhancing organisational efficiency. Conversely, if JOs lack motivation or commitment, their units may suffer from low morale and inefficiency (Bhuiyan, 2024). Thus, JOs' PM is a linchpin for maintaining high standards of performance, discipline, and cohesion in the BA. However, recently, there has been a shift in the PM of JOs, which is significantly affecting OE (Prodip, 2021).

Recent studies indicate that several factors, including social changes, career aspirations, job satisfaction, recognition, and organisational culture, affect JOs' PM (Rahman J. , 2020). JOs demonstrate a declining trend in their PM, marked by increased transactional loyalty, materialism, professional incompetence and disciplinary issues, which negatively impact the organisation's operational and administrative effectiveness. However, their positive attributes, such as enthusiasm, innovation, and logical reasoning, also offer opportunities to enhance OE (Azad, 2024). While JOs demonstrate declining PM, multifaceted factors emanating from individual, organisational, and societal levels pose a credible challenge to improving their PM. Hence, the declining trend in JO's PM and its impacts on the BA warrant closer evaluation to identify the underlying intricacies that are affecting BA's OE.

Evidently, to ensure the effective functioning of BA, the revitalisation of the appropriate state of PM for JOs is imperative, which requires a comprehensive approach. By identifying the key drivers and barriers to JOs' PM, a combined approach at both the individual and organisational levels is necessary to enhance BA's OE. Therefore, this study intends to explore effective ways to enhance OE by increasing JOs' PM.

Present State of PM of JO and Its Impact on OE

In the context of the BA, the motivation of JOs directly affects their performance, decision-making, and leadership abilities, thereby influencing the organisation's overall efficiency (Rahman, 2020). Therefore, it is crucial to examine the current state

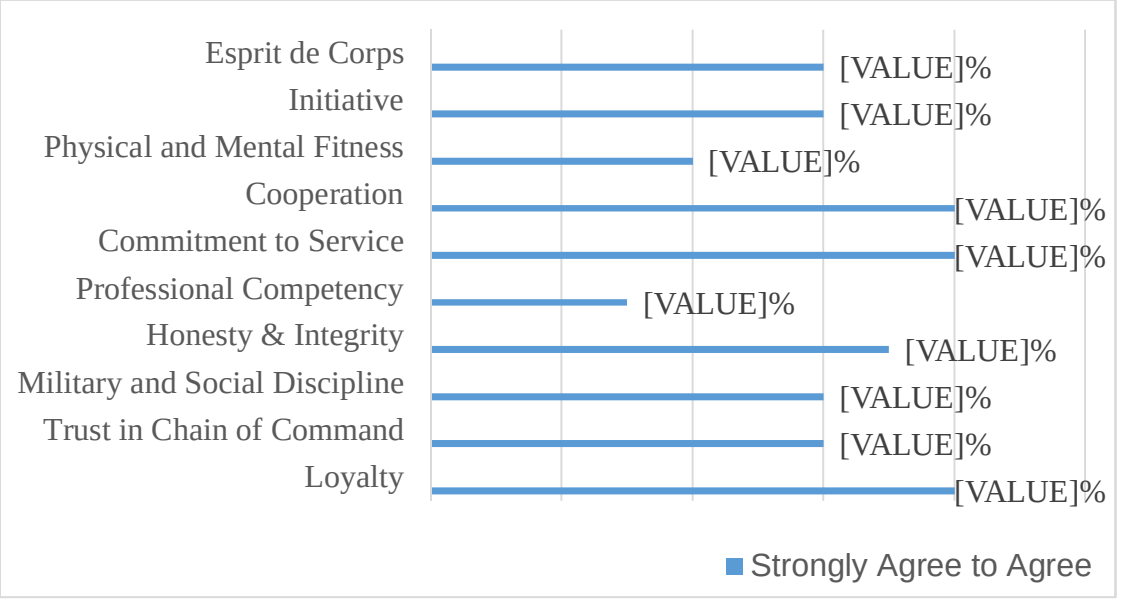
of PM in JOs and understand its impact on the OE, as a starting point for effectively identifying and addressing challenges to enhancing the OE.

a. **Indicators of PM of JOs:** Motivation is a psychological construct that cannot be observed or recorded directly; instead, it is measured in terms of perception, subjective experience, and performance evaluation (Fishbach, 2014). Accordingly, the researcher measured PM of JOs through observable cognitive (e.g., recall, perception), affective (e.g., subjective experience), and behavioural (e.g., performance) responses, using gathered data analysis. The researcher identified several vital indicators to quantify the PM of JOs of the BA, where 92% of Senior Officers (SOs) and Mid-level Officers (MLOs) agreed with the researcher.

Figure 1: Indicators of PM of JOs

Source: Author's self-construct

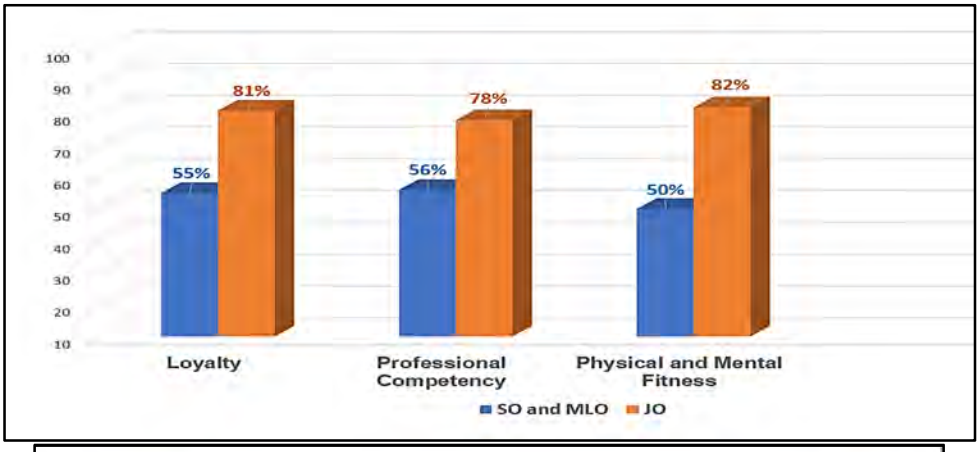
Figure 2: Indicators of PM of JOs

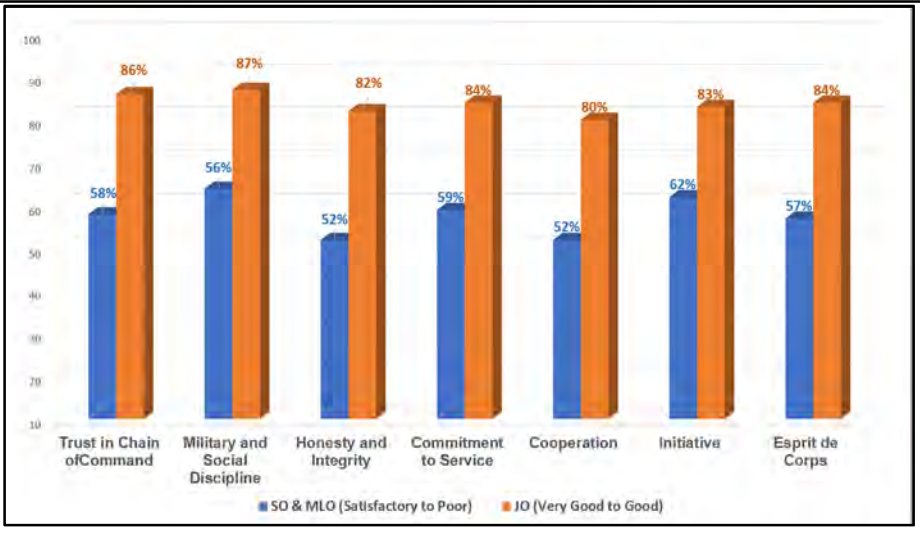


Source: Author's self-construct

b. **Contrasting Views of SOs and MLOs vis-à-vis JOs:** In the survey, contrasting opinions were observed between senior and junior officers. Both respondents opined that loyalty, professional competency, and physical and mental fitness are 'Very Good' to 'Good'. However, the SOs and MLOs believe that other indicators need significant improvement. In contrast, 80% of JOs believe that these aspects are between 'Good to Very Good' amongst the JOs.

Figure 3: Evaluation of PM of JOs





Source: Author's self-construct

Present State of PM of JOs

Both negative and positive trends characterise the current state of JOs' PM. While JOs show a decline in ethical values and professionalism, they also exhibit strong enthusiasm and innovation, which add value to the organisation. These mixed traits reflect shifting motivation patterns that affect organisational effectiveness.

Negative Trends in PM of JOs

a. **Increase in Transactional Loyalty:** Unlike intrinsic loyalty, which is driven by organisational values, patriotism, and a sense of duty, transactional loyalty is based on tangible incentives such as promotions, favourable

postings, and other personal benefits (Islam, 2023). 99% of the survey respondents opined that there is a growing trend of JOs towards selective loyalty based on reciprocity and needs.

b. **Rising Trend of Disciplinary Issues:** According to 90% of MLOs, there is a rising trend of disciplinary issues among JOs, significantly impacting the OE. Instances of increased insubordination, involvement in moral turpitude issues, and deviation from military and social values by JOs indicate the declining PM trend (Khan, 2024).

c. **Materialistic Attitude and Low Morale:** A growing materialistic attitude among JOs and low morale reflect a shift in PM and dedication to service (Abyaz, 2023). 90% of MLOs opined that a materialistic attitude is prevalent among JOs. However, JOs themselves view their materialistic mentality as reasonable rather than detrimental. FGD participants from senior and junior officers (FGD-1 and FGD-3) confirmed the varied perception of increased materialism among the JOs.

d. **Reduced Physical Fitness and Mental Readiness:** 89% of the survey respondents opined that the JOs are not motivated enough to maintain physical fitness. The JOs are less focused on organisational commitments and are reluctant to maintain physical fitness (Bhuiyan, 2024). Moreover, 73% of the survey respondents believe that JOs perform poorly in professional courses, especially those involving physical hardship.

Table 1: JOs' Performance in Recent Courses

Performance Evaluation of JOs in Professional Courses								
Summary of Junior Command and Staff Course (JCSC)								
Course	Total Students	A	B+	B	B-	C	Qualified	RTU
JCSC-70	139	-	22	100	-	-	8	9
JCSC-71	140	-	18	109	3	-	5	5
JCSC-72	119	-	19	93	-	-	-	7
JCSC-73	138	-	14	111	7	1	2	3
Findings: A declining trend in results is confirmed								
Summary of Basic Commando Course(BCC)								
Course	Total Students	A	B+	B	B-	C	F	RTU
BCC-66	124	-	3	73	23	11	2	12
BCC-68	85	-	4	49	19	5	-	8
BCC-72	141	-	30	84	9	1	3	14
BCC-73	132	3	23	69	17	7	2	11
Findings: Poor performance in BCC is evident								

Source: Author's self-construct

Opportunities: Inherent Strengths of JOs

a. **Enthusiasm and Innovation:** Apart from the negative traits, JOs exhibit a few positive qualities, which are critical for adapting to new challenges. Notably, 89% of the SOs and MLOs think they are enthusiastic and innovative in problem-solving, take a proactive approach, and are willing to generate new ideas despite a stereotypical mentality (FGD-3).

b. **Logic-Driven and Seek Explanation:** JOs in the BA are found to be logic-driven and seek explanations from the seniors once the situation contradicts their beliefs (Abyaz, 2023). They value understanding the rationale behind orders and rules, which can lead to more thoughtful, informed decision-making (Momen, 2024). 89% of the survey respondents opined that JOs are not satisfied with merely following orders but strive to provide logical explanations, which are sometimes not commensurate with organisational practice.

Impacts of Inadequate PM of JOs on OE

a. **Negative Impacts on Organisational Standards and Culture:** The decline in PM among JOs negatively impacts the organisational standards and culture of the BA. The gradual increase in moral disengagement and reduced ethical reasoning leads to a materialistic attitude (Turner, 2025). For instance, a recent study shows that JOs are primarily inclined to serve on ERE and deputations, go for early UN missions, and do not want to hold unit-level appointments (Rahman, 2020). Approximately 96% of SOs and MLOs and 80% of JOs recognised that inadequate PM of JOs will negatively affect organisational standards and culture.

b. **Reduced Operational Effectiveness:** 93% of SOs and MLOs and 91% of JOs opined that reduced operational effectiveness is a direct consequence of declining PM among JOs. The reluctance of JOs to pursue professional excellence and reduced physical fitness makes the officers professionally incompetent to meet evolving operational challenges (Azad, 2024). When motivation wanes, it results in poor decision-making, lacklustre performance, and operational ineffectiveness (Bakhtyorovich, 2020).

c. **Declining Trend of Discipline State:** Approximately 91% of SOs and MLOs and 83% of JOs feel a downtrend in discipline standards due to a lack of PM. Of late, JOs are found to be involved in intoxication, drug addiction, illicit relations, theft cases, etc, which tarnish the organisational image

(9InfantryDivision, 2022). If JOs engage in disciplinary activities, it sets a poor example for their subordinates, leading to widespread noncompliance and disrespect for leaders (Prodip M. K., 2021).

d. **Ineffective Leadership Development:** 82% of the survey respondents opined that inadequate professional competency, prioritising self before service, and declining moral integrity significantly affect leadership development. Moreover, ineffective leadership development results in a shortage of capable leaders to inspire and lead the troops and impact the overall OE (Karim Iqbal, 2024)

e. **Negative Impact on Training:** While training is paramount for the effective functioning of the BA, approximately 93% of senior and MLOs and 83% of JOs stated that overall organisational training is affected by inadequate PM of JOs. JOs are often found confined to their gadgets and unwilling to remain present on the training ground (Rahman M. A., 2024). Moreover, slackness in taking physical hardship and pursuing professional excellence results in poor course performance, affecting JO's confidence and competency (Prodip M. K., 2022).

f. **Increased Job Dissatisfaction:** 88% of the survey respondents strongly agreed that job dissatisfaction results from inadequate PM. The JOs consider life outside the army more lucrative and rewarding (Azad, 2024). Consequently, the compounded effects of disengagement, unfulfilled aspirations, and materialistic perceptions contribute to a pervasive sense of job dissatisfaction, ultimately affecting the organisation's morale and efficiency (FGD-2).

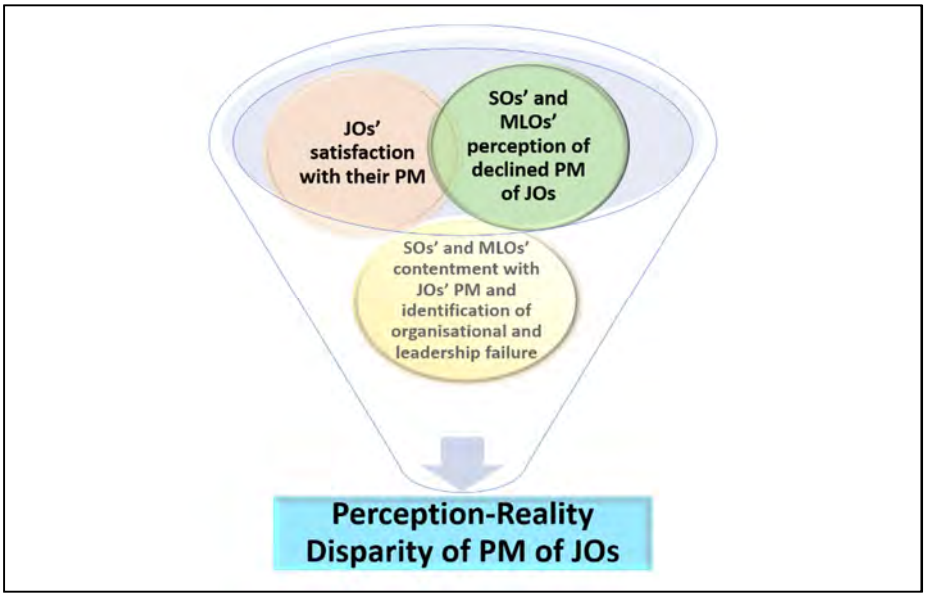
g. **Ineffective Unit Administration:** 88% of the respondents strongly opined that a lack of PM disengages a JO from the unit commitment and responsibilities, impairing effective unit functioning. Moreover, demotivated officers cannot uphold their commitment to the unit or inspire their subordinates effectively. This lack of leadership can result in low morale, trust and respect within the unit, further diminishing administrative effectiveness (FGD-1).

h. **Failure to Utilise the Potential of JOs:** Apart from a few negative traits, the JOs have many good qualities which can positively contribute to OE (FGD-2). However, 87% of survey respondents believe that the BA fails to fully harness their potential. This failure limits JOs' dynamic and innovative

approach, ultimately impacting the organisation's efficiency and effectiveness (FGD-1).

j. **Findings:** Although the Survey of SOs and MLOs indicated a significant declining trend of PM of JOs, and made sensitive observations stating that the PM of JOs needs significant improvement in a few aspects. In contrast, JOs claimed to be professionally motivated and attempted to counter many of the seniors' observations. Hence, it is evident that a perception-reality disparity among different tiers of officers is prevalent, which needs to be addressed to enhance the PM of JOs.

Figure 4: Perception-Reality Disparity of PM of JOs

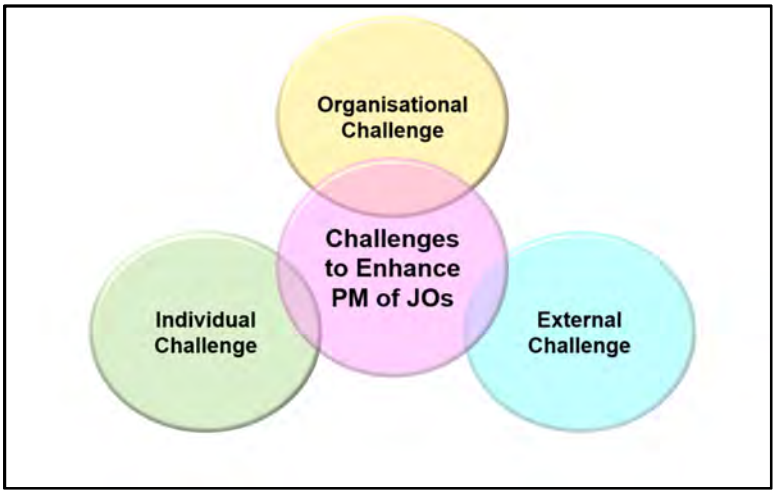


Source: Author's self-construct

Challenges Faced by the BA in Enhancing the PM of JOs

The BA recognises the critical role of the PM of JO in the organisation's overall effectiveness. However, despite several efforts, the army faces multifaceted challenges to enhance the PM of JOs.

Figure 5: Challenges to Enhance JOs' PM



Source: Author's self-construct

Organisational Challenges

a. **Inappropriate Working Environment:** An inappropriate working environment significantly hampers the PM of JOs. Factors such as prolonged office work, working on holidays, the excessive workload on selected individuals who perform better, humiliation by superiors and indiscriminate blaming eventually lead to physical and mental stress, resulting in demotivation (Sabur, 2024). The overstressed and unhealthy working environment leads to compliance over commitment, further eroding JOs' PM and efficiency. 80% of the respondents agreed that an inappropriate working environment is a significant barrier to enhancing the PM of JOs.

b. **Command Climate:** The JOs' PM is significantly shaped by the command climate in the unit, where the PM of MLOs affect the PM of JOs (Bhuiyan, 2024). Often, leaders prefer to exercise their positional power rather than personal power, which fails to create a productive command climate. In some cases, it is observed that the leadership at different levels are not adaptive to the changing mindset and perception of the JOs, and the leaders lack compassion and empathy (Baki, 2024). Moreover, 90% of the survey respondents viewed that the absence of a proper regimented life impairs JOs' professional development (Bhuiyan, 2024).

c. **The Ineffective Application of Reward and Punishment:** 81% of SOs-MLOs and 92% of JOs opined that the ineffective application of reward and punishment highly affects the PM of JOs. Sometimes, rewards and punishments are perceived as unfair or inconsistent by JOs, undermining trust in the leadership and the organisational justice. In addition, JOs do not find professionally recognised appointments very rewarding as these responsibilities affect their personal lives and mistakes are often dealt with punitive measures (Khan, 2024).

d. **Increased Focus on Administrative Matters:** In many aspects, the BA's focus has shifted from its operational activities to administrative commitments (Jamilur, 2024). Nowadays, administrative matters are increasingly emphasised, especially at the unit level, where the JOs mostly remain involved in materialising the superior's plan (FGD-2). JOs do not feel interested or motivated to invest their time and effort in programmes such as Bengali New Year, social evenings, cultural programs, food festivals on different occasions, and excessive involvement in ladies' club programmes (FGD-3).

e. **Biasness and Improper Evaluation:** When performance evaluations are influenced by favouritism and personal biases, trust in the leadership and organisation is eroded, and the PM of JOs is severely affected (Khan, 2024). The superiors sometimes get biased in evaluating the JOs due to personal relationships, stereotype judgment, halo effect, and similarity bias (same unit and arms/ services), which reflects their moral bias (Jamilur, 2024). More than 85% of survey respondents believe that biased and improper evaluation significantly impacts the PM of JOs, and that this perceived injustice eventually leads to demotivation and a decline in morale.

f. **Perception-Reality Disparity:** Most SOs and MLOs believe that there is a sharp decline in the PM of JOs. However, a few also contradict the belief that JOs' PM is satisfactory, but the senior leaders need to change their outlook and utilise the potential of JOs for organisational benefit (Baki, 2024). On the contrary, JOs are satisfied with their PM and their dedication to the service. Despite acknowledging the existence of materialistic mindsets, they argued that serving outside the unit provides safe career progression and a healthy work environment. These differing opinions highlight a perception-reality disparity among the officers of different generations, which affects the PM of JOs and acts as a barrier to utilising the full potential of JOs (Azad, 2024).

g. **Forced Compliance in Bangladesh Military Academy (BMA):** The current training system at BMA severely undermines an officer cadet's (OC) motivation. The OCs are compelled to forcefully comply with the training modalities even though they do not find motivation in many aspects due to their myopic ideologies. The BMA fails to instil a sense of purpose and PM among the JOs due to a wrong training curriculum (Bhuiyan, 2024).

Individual Challenges

a. **Careerism:** 86% of the survey respondents believe that excessive focus on personal career advancement at the expense of organisational objectives and values poses a significant challenge in enhancing the PM of JO. It promotes competition over collaboration, distorts priorities, and can lead to unethical behaviours. Moreover, overemphasis on Officers' Performance Reports (OPRs) leads JOs to adopt play-safe attitudes.

b. **Lack of General Military Competencies:** 88% of MLOs and 75% of JOs opined that a severe lack of general military competencies among JOs is prevalent, which can reduce their confidence and self-efficacy and decrease motivation. The shortfall of necessary skills and knowledge to perform JO's role may effectively result in frustration, lower self-esteem, reduced job satisfaction, and loss of credibility and respect (FGD-2). This lack of competency is the by-product of inadequate training and a lack of commitment to professional excellence, eventually affecting the JO's career and leadership development (FGD-1).

External Challenges

a. **Socio-economic Change:** The evolving socio-economic landscape presents significant hurdles to PMs of JOs by shifting values towards individualism and material success, leading to reduced commitment (Atiqur Rahman, 2024). As a result, the disparity between the JOs' expectations and the realities of military service contributes to a growing sense of impatience and entitlement, further deteriorating the PM. 80% of the survey respondents believe that socio-economic change is highly affecting the PM of JOs.

b. **Impact of Social Media:** Social media significantly shapes perceptions, influences attitudes, and disrupts JO's focus towards organisational commitment (Arif, 2024). Moreover, exposure to the open world and enhanced connectivity are giving rise to multiple interdisciplinary activities and the erosion of moral values. 90% of SOs and MLOs and 83% of JOs

opined that social media can create unrealistic expectations and desires, contributing to a sense of inadequacy and reduced motivation when these expectations are unmet.

c. **Findings:** Analysis suggests that perception-reality disparity forced compliance in BMA, inappropriate working environment, and the absence of a proper reward and punishment system are significant challenges to enhancing JOs' PM.

Table 2: Challenges to Enhancing PM of JOs (SOs and MLOs)

One-Sample Statistics						
Indicators	**Mean**	**Standard Deviation**	**Mode**	**Median**	**Mode Value**	**Remarks**
Inappropriate working environment	4.20	0.75	4	4	Agree	Significant
Command climate	4.26	0.66	4	4	Agree	Significant
Ineffective application of reward and punishment	4.15	0.74	4	4	Agree	Significant
Increased focus on administrative matters	4.41	0.66	4	4	Agree	Significant
Biasness and improper Evaluation	4.29	0.64	4	4	Agree	Significant
Perception- Reality Disparity	4.38	0.63	4	4	Agree	**Most Significant**
Forced Compliance in BMA	4.39	0.60	4	4		**Most Significant**
Careerism	4.30	0.65	4	4	Agree	Significant
Lack of General Military Competencies	4.20	0.65	4	4	Agree	Significant
Socio-economic Change	4.31	0.62	4	4	Agree	Significant
Impacts of social media	4.36	0.63	4	4	Agree	Significant

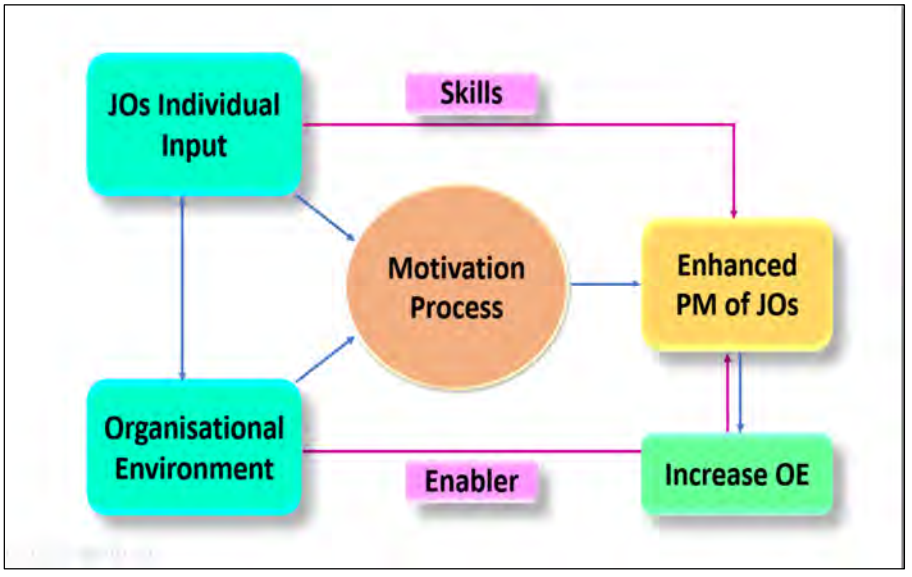
Source: Author's self-construct

Suggested Measures to increase OE through Enhancing the PM of JO

This study shows that there are significant differences in perceptions about PM among the senior and junior officers, which adversely affect the workplace environment (Baki, 2024). Hence, a holistic approach, both organisational and individual, will be

required to address the multi-pronged challenges prevalent in the PM of JOs (Iqbal Karim, 2024). Hence, a concerted effort encompassing both organisational and individual approaches is essential to enhance the BA's OE by increasing the PM of JOs.

Figure 6: Respondents' Opinion about Potential Areas of JOs' Contribution

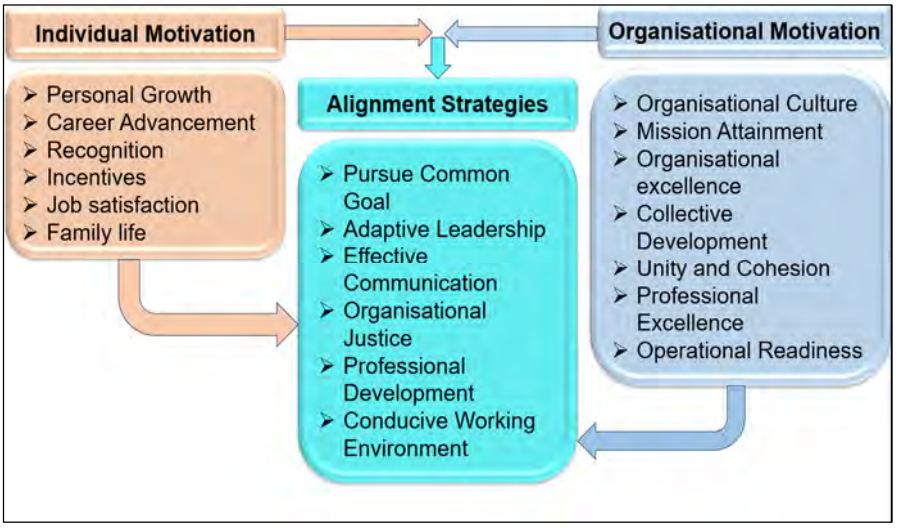


Source: Author's self-construct

Organisational Responsibility

a. **Align Organisational and Individual Motivation for a Common Goal:** Aligning organisational and individual motivation for a common purpose is the most crucial step in enhancing and using JOs' PM for organisational benefit (Iqbal Karim, 2024). Senior leadership and the unit environment need to pay attention to JOs' needs and understand the direction and intensity of individual PMs. Conversely, according to 94% of SOs and MLOs and 90% of JOs, to achieve greater efficiency, JOs must direct their PMs towards the organisation's purpose.

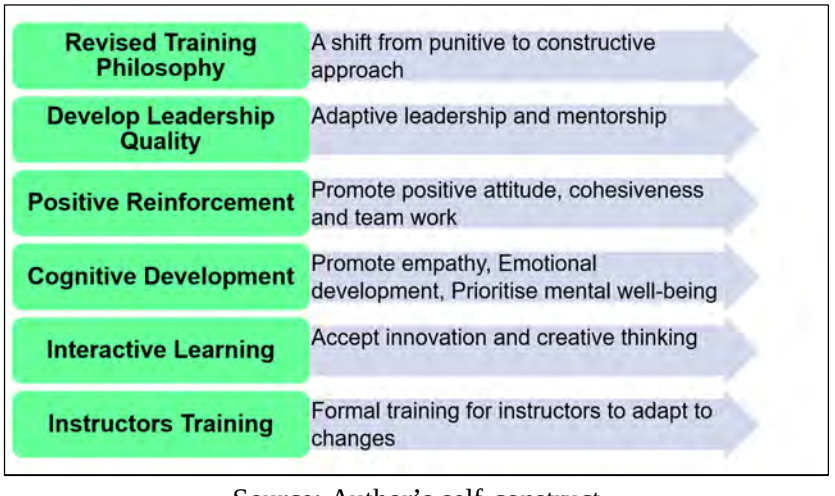
Figure 7: Alignment Strategies of Different Motivations



Source: Author's self-construct

b. **Modification of the BMA Training System:** Since an officer's military career starts with BMA training, the foundation training needs to be modified to instil PM among the JOs. Rather than forced compliance, intellectual and affiliative leadership development are necessary for enhancing an officer's PM. A motivated JO will be better equipped and prepared to work for organisational benefit, enhancing OE.

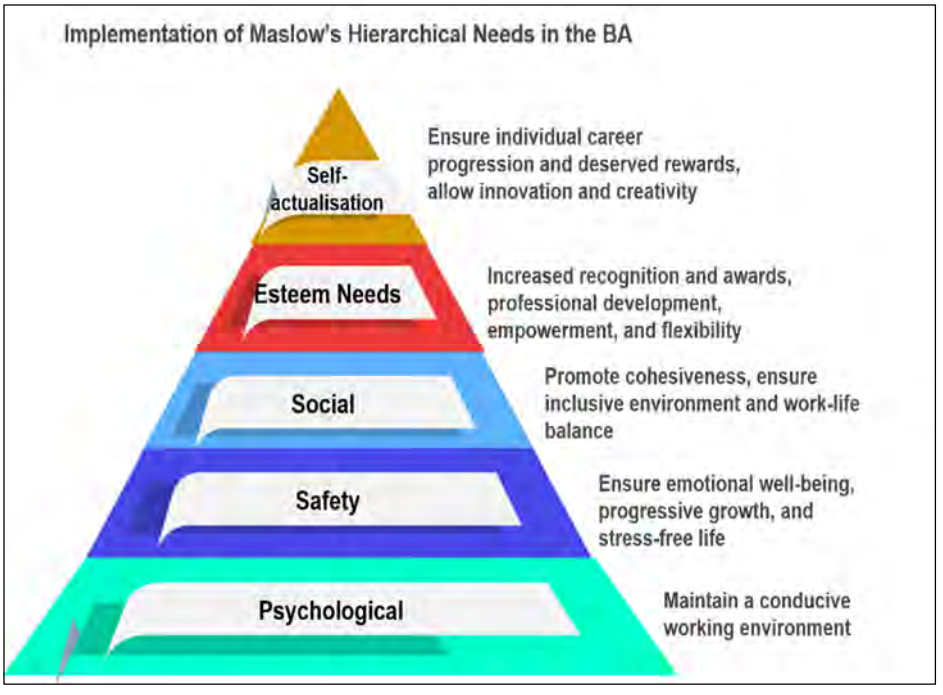
Figure 8: Modification in BMA Training



Source: Author's self-construct

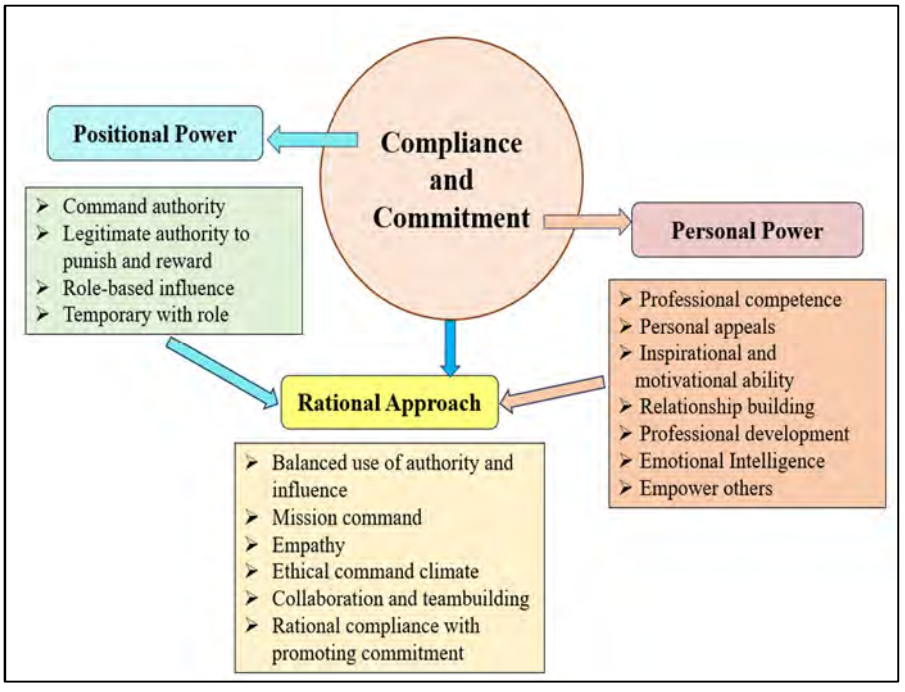
c. **Maintaining a Conducive Working Environment:** 96% of SOs and MLOs and 85% of JOs stated that ensuring a conducive working environment will significantly contribute to increasing the PM of JOs and enhancing the OE. The effort should start with maintaining a healthy unit environment, which includes professional regimentation for officers, mentorship by MLOs, work-life balance, and ethical leadership practices supervised by the CO. Leaders should strike a balance between applying positional and personal power to influence JOs toward organisational benefits (Klann, 2025). In addition, an inclusive environment across the organisation will fulfil JOs' psychological needs (compared to Maslow's Hierarchy of Needs) and motivate them to pursue organisational excellence.

Figure 9: Improvement of Working Environment



Source: Author's self-construct

Figure 10: Rational Application of Power



Source: Author's self-construct

d. **Fostering Adaptive Leadership:** An adaptive leadership approach in the face of inevitable and dynamic societal changes is necessary to reinforce the PM of JOs (Baki, 2024). Adaptive leadership practice will ensure increased engagement and participation of JOs in organisational commitments. 97% of SOs and MLOs, and 78% of JOs, believe that formal leadership training for all levels of officers is a worthwhile requirement to understand dynamic changes and reduce philosophical differences.

Figure 11: Formal Adaptive Leadership Training Module

Formal Leadership Training for Officers

Tiers	Training Components	Objectives	Institution/ Responsibility
Senior Officers (Colonel and above)	➢ Dynamics of generational changeover ➢ Adaptive leadership skills ➢ Mentorship ➢ Ethical decision-making ➢ Organisational justice ➢ Emotional intelligence	➢ Develop the ability to assess dynamic environments and adapt quickly ➢ Open communication and team management ➢ Ensure ethical decision-making	National Defence College through institutional or specialised short-term courses
Unit Level Officers (Lieutenant Colonel and below)	➢ Foundation of military leadership ➢ Effective communication skills and influencing art ➢ Emotional intelligence ➢ Professional ethics ➢ Social media resilience ➢ Team building	➢ Instill a appropriate leadership philosophy ➢ Develop an ability to communicate clearly ➢ Emotional resilience ➢ Develop ethical standards and Be a role model ➢ Mutual trust and cohesion	Respective arms/ services centres and Defence Services Command and Staff College through a separate package in institutional courses

Source: Author's self-construct

e. **Increasing Focus on Operational Readiness:** The BA needs to significantly shift from focusing on administrative tasks to prioritising operational readiness. 96% of SOs and MLOS and 87% of JOs opined that an increased focus on operational tasks and training over administrative matters would increase JOs' motivation and enhance OE manifold.

f. **Avoiding Biases and Maintaining Performance-based Evaluation:** 98% of SOs and MLOs, including 89% of JOs, opined that performance-based evaluation is necessary to prevent biases and uphold the PM of JOs and their contribution to enhancing OE. Organisational justice should prevail in evaluating officers based on their performance and professionalism. A well-balanced blend of rewards, punishments, and professional evaluation will place the right person in the proper role and motivate JOs to perform better, thereby enhancing OE.

g. **Utilising the Strengths of JOs for Organisational Benefit:** The organisation and its leaders need to be open to accepting behavioural changes, innovative approaches, and creative thinking from JOs for the organisation's benefit. 78% of JOs think that they have much potential to contribute to the BA. The effective utilisation of JOs' strengths will ensure JOs' higher engagement and better performance, ultimately contributing to the OE.

Individual Responsibility

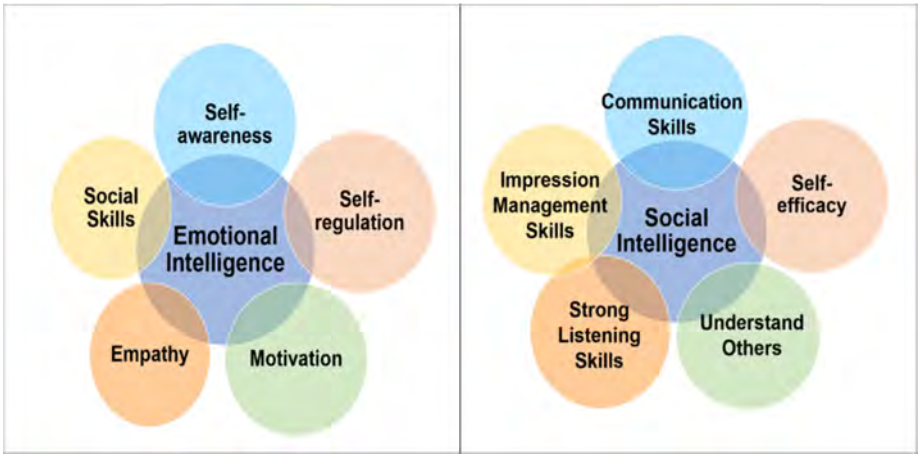
a. **Pursuing Professional Competency:** According to 94% of SOs and MLOs and 78% of JOs, JOs should pursue professional competency to enhance the OE. JOs' PM is reflected in their course performance, yearly OPR, operational deployment performance, and physical fitness.

Figure 12: Indicators of Professional Competency

Source: Author's self-construct

b. **Developing Emotional and Social Intelligence:** 96% of SOs and MLOs, and 85% of JOs, believe that developing EI and social intelligence will increase JOs' PM. Along with the organisational approach, the JOs must also be adaptive to the organisation's requirements, values and practices. JOs need to be flexible in communication skills, respect and maintain organisational culture, understand individual roles and responsibilities, develop self-awareness, self-regulation, and empathy, and build relationships and mutual trust with others. An emotionally and socially intelligent JO remains aware of his duties and can significantly enhance OE.

Figure 13: Develop Emotional and Social Intelligence

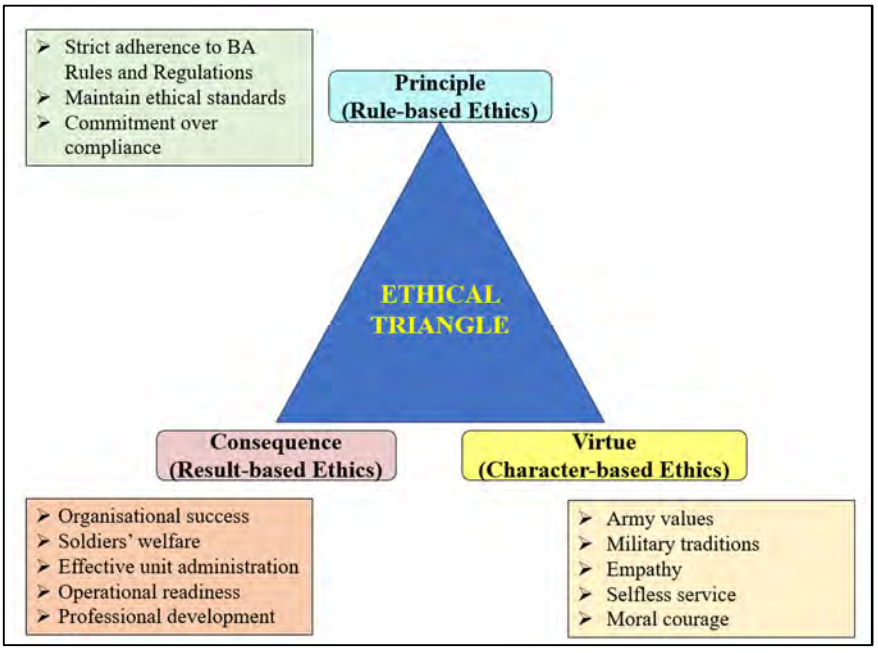


Source: Author's self-construct

c. **Take an Interest in Training and Operational Activities:** JOs should focus on training and operational activities for the BA's overall benefit. 93% of the SOs and MLOs opined that JOs' additional interest would improve training standards in the unit and boost the organisation's operational performance manifold.

d. **Strike a Balance between Personal Aspirations and Professional Successes:** From the outset of an officer's career, a JO must not be too materialistic (monetary benefit, lucrative postings) and ambitious for personal career development (unethical approach for promotion, posting manipulation, harming others for one's own benefit), keeping aside the organisational requirement. JOs always need to prioritise service before self and ethical reasoning, which will facilitate their professional success and enhance the OE. James H. Svara's 'Ethical Triangle' model provides a practical framework for morally sound decision-making, balancing personal ambitions with professional success, leading to ethical leadership (Svara, 2025).

Figure 14: Ethical Triangle



Source: Author's self-construct

e. **Develop Resilience to Prevent Burnout in Social Media:** In the era of technological development, JOs' motivation is significantly affected by social media platforms. 95% of SOs and MLOs and 84% of JOs opined that to uphold the PM, JOs must learn online behaviour and manage screen time to focus on organisational commitments and professional development. They must eliminate the negative aspects of the virtual world and utilise social media to enhance knowledge and skill development. JOs' social media conduct should promote organisational values and positively shape their image among others in society.

f. **Findings:**

Table 3: Organisational Approach (SOs and MLOs)

One-Sample Statistics						
Indicators	**Mean**	**Standard Deviation**	**Mode**	**Median**	**Mode Value**	**Remarks**
Fostering adaptive leadership at all levels	4.35	0.56	4	4	Agree	Significant
Align organisational and Individual motivation for a common goal	4.46	0.59	4	4	Agree	**Most Significant**
Avoiding biases and maintaining performance-based evaluation	4.41	0.60	4	4	Agree	Significant
Maintaining a conducive working environment	4.49	0.58	5	5	Strongly Agree	**Most Significant**
Increasing focus on operational readiness	4.34	0.58	4	4	Agree	Significant
Utilizing the strengths of JOs for organisational benefit	4.31	0.65	4	4	Agree	Significant

Source: Author's self-construct

Table 4: Individual Approach (SOs and MLOs)

One-Sample Statistics						
Indicators	**Mean**	**Standard Deviation**	**Mode**	**Median**	**Mode Value**	**Remarks**
Pursue professional competency	4.36	0.61	4	4	Agree	Significant
Take an interest in training and operational activities	4.31	0.64	4	4	Agree	Significant
Strike a balance between personal aspirations and professional successes	4.33	0.57	4	4	Agree	Significant
Develop emotional and social intelligence	4.38	0.55	4	4	Agree	**Most Significant**
Develop resilience to prevent burnout on social media	4.38	0.61	4	4	Agree	**Most Significant**

Source: Author's self-construct

Conclusion

This study underscores that JOs' PM is not a peripheral issue but a linchpin of BA's OE. In practice, professionally motivated JOs exhibit passion and resilience; their

drive serves as a model for their subordinates. Conversely, a decline in motivation among JOs can erode initiative, discipline and cohesion, undermining the ideals of selfless service and teamwork. The research reveals that SOs and MLOs perceive a cautionary picture of declining JOs' PM, in which JOs show a rising trend in transactional loyalty, materialism, and professional incompetence, thereby affecting BA's operational and administrative effectiveness. Conversely, while JOs also display positive traits that reinforce OE, they believe that the organisation fails to harness their full potential due to a stereotypical outlook. This perception-reality disparity significantly affects JOs' PM, resulting in ineffective leadership development and reduced OE.

Alongside the philosophical differences, the study also identified several organisational, individual, and external challenges in improving JOs' PM. Organisational challenges include an unproductive working environment, improper reward and punishment systems, a flawed evaluation process, and a shift away from operational focus. Moreover, individual factors, such as a lack of professional competency and ethical decline, coupled with external influences from social media and changing societal norms, pose barriers to revitalising JOs' PM. Hence, the research proposes a comprehensive approach to improving OE involving organisational and individual measures. The organisation should foster adaptive leadership to create a conducive working environment that aligns organisational goals with JOs' professional aspirations. JOs, in turn, must develop their professional skills and emotional intelligence to navigate challenges and work effectively. The research findings validate these strategies, demonstrating that improving JOs' PM will substantially enhance the OE in the BA.

Recommendations

Based on the findings of this research, the following are recommended to enhance the OE of the BA:

a. The Army Training and Doctrine Command (ARTDOC) should study the feasibility of the proposed modifications for inclusion in the BMA training curriculum by December 2026.

b. The ARTDOC and Military Training (MT) directorate may introduce formal leadership training for SOs and MLOs to develop organisational leaders under institutional and formation frameworks by December 2026, after checking feasibility and requirements.

c. The ARTDOC may conduct an in-depth study to revise the officers' course report to reflect the participants' leadership qualities.

d. The Military Secretariat (MS) Branch may study the feasibility of modifying officers' performance reports (OPR) to introduce an evaluation of officers' leadership traits and professional motivation.

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Biography

Major Md Nazmul Hossan, **psc, Artillery**, was born on 05 October 1990 in Rajshahi. He passed both the Secondary School Certificate and Higher Secondary Certificate examinations from Pabna Cadet College, earning a GPA of 5.00. He was commissioned from the Bangladesh Military Academy (BMA) on 21 December 2011, as part of the 65th BMA Long Course, into the Regiment of Artillery. He has diverse experience serving in regimental and staff appointments in his career. As a staff, he raised the 18 Field Regiment artillery as a 'raising adjutant'. Besides being a proud gunner, he is also an 'Aviator' and served as a General Staff Officer-2 (Operations) and Flight Safety Officer in the Army Aviation Group. Apart from the mandatory courses for his professional career, he has attended the Aviation Basic Course in the Army Aviation Group and the Flight Safety Officers Course in the Bangladesh Air Force. Currently, he is undergoing the US Army Command and General Staff Course-2026 at Fort Leavenworth, United States. He is a graduate of the Defence Services Command and Staff College, Mirpur.

Requirement of Cyber Security Infrastructure for Bangladesh Air Force: Challenges and Way Out for Future Network Security

Wing Commander Syed Monir Hasan, GD (P)

Abstract

This study critically evaluates the cyber security posture of BAF, identifying key vulnerabilities and proposing necessary improvements. Drawing on surveys, Key Informant Interviews (KIIs), and Focused Group Discussions (FGDs), the research highlights significant gaps in BAF's cyber security infrastructure. These challenges include a shortage of skilled manpower, difficulties in recruitment and retention, inadequate training programs, outdated policy frameworks, budgetary constraints, and the need for continuous monitoring through a dedicated Cyber Security Operations Center (CSOC). The proposed framework emphasizes policy reform, workforce development, process optimization, and technological upgrades. The study confirms the hypothesis that enhancing cyber security infrastructure significantly improves network security, offering critical insights for strategic planning to address evolving threats.

Introduction

The modern world's rapid expansion of cyberspace has introduced significant security challenges, particularly for military organizations. In the 2019 NATO London summit, Secretary General Jens Stoltenberg emphasized cyberspace as a "Domain" of warfare, comparable to land, sea, air, and space, highlighting the need for cyber readiness. Michael Mullen, former U.S. Joint Chiefs of Staff chairman, called cyber threats "the single biggest existential threat." Countries like China, the U.S., and Russia have formed cyber warfare units to counteract these threats (Clarke & Knake, 2011). According to Davis (n.d.), almost 50 countries allocate substantial budgets (Figure 1) exclusively to strengthening military cyber capabilities across both offensive and defensive fronts.

Figure 1: Global military cyber spending, 2022

Source: Adapted from Security Council Research Report on Managing Global Cybersecurity (Davis, n.d.)

Military organizations, including BAF, face unique cyber security challenges. Recent incidents, like the 2023 threat to Bangladesh's central bank and election websites, underscore BAF's vulnerability to cyber-attacks (Center for Strategic and International Studies, 2024). As BAF's digital footprint grows across communication networks and operational systems, it has developed a cyber security framework through its Cyber Warfare & Information Technology (CW&IT) Directorate. However, evolving threats demand ongoing enhancement of BAF's cyber infrastructure (Rahman, 2022).

As the operational domain of BAF undergoes modernization, its cyber security aspects are increasingly vulnerable to cyber threats. To counter these threats, the existing cyber security infrastructure of BAF requires significant development. Therefore, it is essential to evaluate the current cyber security capabilities in the light of the evolving threat landscape to establish an enhanced cyber security infrastructure that improves future network security.

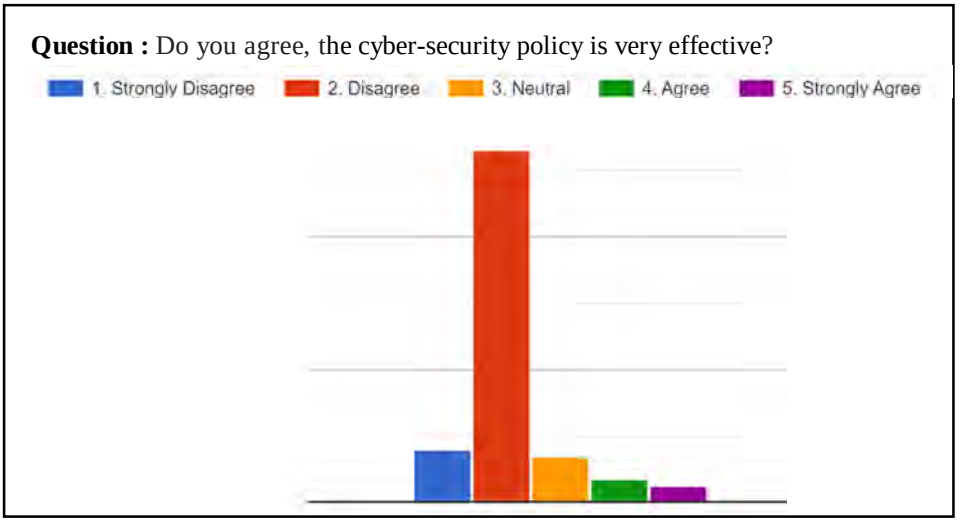
Present Cyber Security Landscape of BAF

BAF's cyber security is managed by the CW&IT Directorate, which has achieved progress in various areas. However, significant gaps in performance remain, requiring urgent attention.

Assessment of Cyber Security (Policies)

Comprehensive Policy Framework. BAF adheres to the Armed Forces Division (AFD) Cyber Security Policy 2020, offering basic guidelines for safeguarding critical infrastructure, while BAF's own cyber policies remain in draft form, aligning with national directives (S. Nayeem, personal communication, June 23, 2024). A Memorandum of Understanding (MOU) with national cyber agencies intended to strengthen capabilities, though policy integration is still at early stages (R. Rahman, personal communication, June 22, 2024). A survey (Figure 2) revealed that only 8.1% of BAF officers find the current cyber security policy effective, highlighting the urgent need for a comprehensive policy review and enhancement.

Figure 2: Opinion about Effectiveness of Cyber Security Policy in BAF



Source: Author's self-construct

Cyber Security Operations. The CW&IT Directorate holds exclusive authority over cyber protection, yet existing policies have not established a permanent, fully empowered CSOC. As a result, BAF continues to operate a temporary CSOC with limited tools and no dedicated cyber specialists. This interim arrangement reflects a policy gap where long-term structure, manpower, and technological investment for cyber defense have yet to be formally institutionalized (S. Tomal, Interview, May 23, 2024).

Legal Framework. Cyber security faces diverse threatswith individuals capable of causing significant damage to BAF's infrastructure. Internal members may also

compromise security. Currently, BAF lacks a comprehensive legal framework to address both internal and external cyber threats, posing vulnerabilities as highlighted by key informants (S. Tomal, Interview, May 23, 2024).

Case Study. BAF's webmail system has repeatedly been targeted with malware-laden emails, often disguised as routine administrative correspondence. Although these attacks were detected before causing operational disruption, BAF has been unable to enforce strong technical or legal countermeasures due to the absence of a dedicated cyber governance framework. As a result, the primary response has been limited to issuing awareness messages and precautionary guidelines to personnel, highlighting a critical gap between threat exposure and institutional capacity to act decisively (R. Rahman, Interview, June 22, 2024).

Budget and Priority. Despite growing recognition of cyber security's importance, BAF's budget allocations remain insufficient, with cyber security receiving less funding than other operational areas. This imbalance hinders the development of advanced defense mechanisms and limits recruitment and training of specialized personnel. Securing funds for high-quality hardware, cyber security appliances, and networking equipment remain a major obstacle, compromising BAF's ability to strengthen its cyber defense capabilities (S. Nayeem, Interview, June 23, 2024).

National and International Collaboration. Effective cyber defense requires both national and international collaboration. BAF has made progress through an MOU with National Cyber Security Bangladesh, receiving bi-monthly reports (Z. Sayeed, personal communication, June 23, 2024). However, this collaboration is limited to visits and reports. International partnerships are crucial for information exchange, advanced technologies, and sharing best practices, vital for a credible cyber security posture (S. Nayeem, Interview, June 23, 2024).

Assessment of Cyber Security (People)

Skilled Manpower. BAF faces a significant shortage of skilled cyber security professionals, as key informants noted that this lack of qualified manpower severely impacts its ability to maintain a robust cyber defense posture. The fast-changing nature of cyber threats requires continuous skill enhancement, a need BAF is currently unable to meet effectively (S. Tomal, Interview, May 23, 2024).

Training Programs. Cyber security training is vital for preparing personnel to be cyber-ready, yet BAF's current programs are limited to occasional lectures, lacking

continuous skill development initiatives, as discussed in the FGD. Existing efforts are sporadic and insufficient, primarily consisting of passive training such as lectures. Survey data (Figure 3) shows that 90.3% of respondents reported receiving only occasional lectures on cyber security. This underscores the urgent need for comprehensive training programs, including hands-on exercises, workshops, and continuous learning, to effectively develop a capable cyber security workforce.

Figure 3: Opinion about Conduct of Cyber security Training in BAF

Source: Author's self-construct

Recruitment. BAF's recruitment process struggles to attract cyber talent due to military protocols like strict fitness standards, lengthy background checks, and rigid hierarchies, as highlighted in the FGD. Additionally, the private sector's competitive salaries, flexible working conditions, and clearer career growth paths further deter cyber security professionals from considering BAF as a career option (N. Imtiaz, Interview, June 23, 2024).

Employment. Cyber security efficiency depends on the proper placement of skilled personnel, but BAF's routine circulations of personnel disrupt continuity, with frequent reassignments every 2-3 years. Long-duration career courses further hinder cyber-related involvement, while the lack of specific qualifications for cyber roles impacts field progression (R. Rahman, Interview, June 22, 2024).

Assessment of Cyber Security (Technology)

Cyber Security Systems. BAF has implemented cyber security systems like Next-Generation Firewalls (NGFWs) with intrusion prevention, Distributed Denial of

Service (DDoS) protection, and application control. System log servers support incident response. However, integration and utilization shortfalls limit these systems' full effectiveness in combating sophisticated cyber threats (S. Tomal, Interview, May 23, 2024).

Cyber Capabilities. BAF's cyber capabilities are crucial for its strategy and threat response, supported by IT infrastructure for military communications, surveillance, and data processing. It effectively mitigates DDoS, geo-restricts services, and protects against malware and man-in-the-middle attacks. The shift toward indigenous software development enhances security, but the initiative faces early-stage challenges (M. Rahman, Interview, June 23, 2024).

Cyber Security Operation Center (CSOC). BAF's temporary CSOC, managed by the Comm Unit, lacks the specialized tools and manpower for effective real-time monitoring and response. Its temporary nature and limited capabilities are significant drawbacks. Establishing a permanent, fully functional CSOC is crucial for continuous surveillance, timely threat detection, and effective incident response (S. Nayeem, Interview, June 23, 2024).

IT Networks Architecture. The BAF Intranet (LAN/WAN) securely connects all bases and units, physically separated from the internet to reduce external threats. However, internal risks require continuous monitoring. The self-managed BAF Internet Network supports Dhaka's Air HQ and residential areas, ensuring external connectivity, though a cyber-attack on the BAF webpage could pose reputational risks (S. Tomal, Interview, May 23, 2024).

Security Implementations. Data center security is managed by a small team of officers, supported by the Comm Unit and Air HQ Unit. Security measures include NGFWs, Virtual Private Networks with Internet Protocol Security (IPSec VPN), and encrypted VPNs for secure communications. Physical security, bandwidth restrictions, and address binding are enforced, but expanding skilled manpower and enhancing infrastructure are needed for full operational potential (S. Tomal, personal communication, May 23, 2024).

Connectivity Solutions. BAF's primary connectivity relies on fiber optics, with redundancy from microwave and Nationwide Telecommunication Transmission Network (NTTN) connections via companies like “Bangladesh Telecommunications Company Limited- (BTCL)” and “Fiber @ Home”. Encrypted data transfer ensures security, but exercises increasing bandwidth demand can cause congestion. While

bandwidth limitations help manage this, system upgrades are needed for future demands (S. Tomal, Interview, May 23, 2024).

Advanced Technologies. BAF's cyber operations software includes built-in AI-enhanced reporting, but it lacks dedicated AI for threat detection and response. This limitation hinders swift identification and mitigation of advanced cyber threats. Integrating AI and machine learning presents a significant opportunity to enhance BAF's overall cyber defense capabilities (S. Tomal, Interview, May 23, 2024).

Assessment of Cyber Security (Process)

Infrastructure. The CW&IT Directorate manages overall control, with local operations handled by C&E Squadrons. However, BAF lacks fully functional cyber monitoring, incident response centers, threat intelligence, and training centers, limiting its ability to manage cyber threats effectively (S. Tomal, Interview, May 23, 2024).

Operation. The absence of a fully functional CSOC hinders BAF's real-time threat monitoring and response capabilities, with current temporary setups insufficient for 24/7 surveillance and incident management (S. Nayeem, Interview, June 23, 2024).

Incident Response. BAF's incident response process lacks clear procedures for detection, containment, eradication, and recovery. This absence of a structured framework can delay reactions and increase damage during cyber-attacks (R. Rahman, Interview, June 22, 2024).

Research. A key challenge for BAF is the absence of dedicated cyber security research facilities, as highlighted in the FGD. Such facilities are crucial for developing innovative solutions and staying ahead of emerging threats. This gap limits BAF's ability to conduct in-depth studies and create advanced cyber defense strategies (M. Rahman, Interview, June 23, 2024).

Challenges to Enhancing Cyber Security in BAF

BAF faces several challenges in strengthening its cyber security, particularly in areas related to policy, manpower, organizational structure, technology, legal frameworks, and collaboration. Addressing these issues is essential for developing a robust cyber defense strategy.

Cyber Security Challenges Related to Policy

Cyber Security Policy Framework. BAF's current cyber security policies are in draft form, aligned with AFD and national standards, but frequent revisions hinder consistent implementation (R. Rahman, Interview, June 22, 2024). Survey data (Table 1) reveals that 83.2% of respondents emphasize the importance of an updated, unified policy framework for improved security. A stable policy is essential for strengthening BAF's cyber defense across all units.

Table 1: Opinion Regarding Requirement of Updated Cyber Security Policy

Aspect	Frequency	Percentage
Question: Do you agree that, an updated Cyber policy (in alignment with national cyber policy) is crucial to meet the challenges?	154	83.2%

Source: Author's self-construct

Inadequate Legal Framework and Regulation. Current legal frameworks inadequately support BAF's cyber operations, creating vulnerabilities and hindering prosecution of cyber criminals. The absence of specific military cybercrime laws and clear protocols for incident response limits BAF's ability to enforce security measures and collaborate with national and international agencies. These gaps weaken BAF's overall cyber defense strategy (S. Tomal, Interview, May 23, 2024).

Low Priority and Budget Issues. BAF's cyber security efforts face challenges due to low priority and limited budget allocation, with competing priorities diverting resources. This underfunding hinders acquiring advanced technologies, comprehensive training, and establishing a fully operational CSOC, weakening overall cyber defense. The lack of preparedness increases vulnerability to cyber-attacks with potentially severe consequences (S. Nayeem, Interview, June 23, 2024). Without prioritization, cyber security efforts remain fragmented and underfunded.

Collaboration. Despite MOUs with national cyber agencies, BAF's collaboration is limited to visits and report exchanges, lacking real-time threat intelligence sharing. A more integrated, proactive approach is needed to align BAF's policies with national strategies and enhance cyber defense (S. Nayeem, Interview, June 23, 2024).

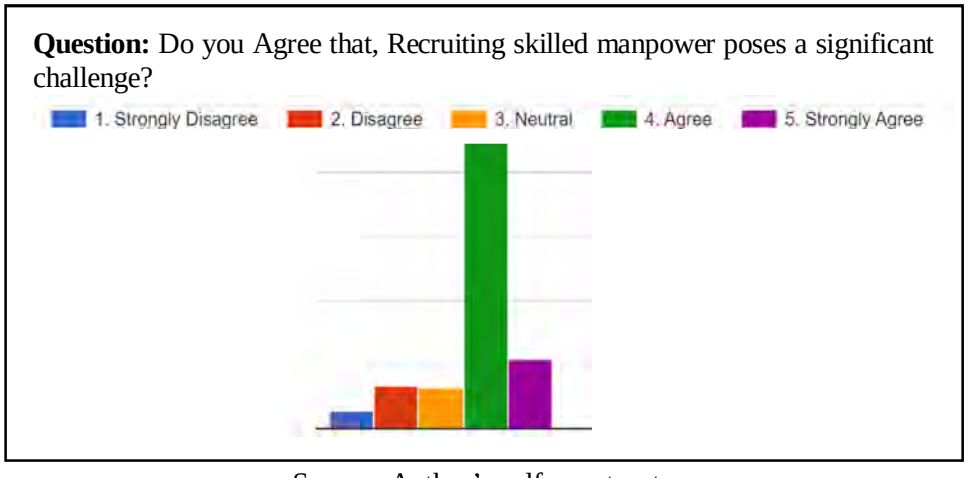
Cyber Security Challenges Related to People

Shortage of Skilled Professionals. BAF faces a critical shortage of skilled cyber security professionals, with many trained personnel leaving for lucrative private sector opportunities. This shortage limits BAF's ability to maintain a strong cyber defense, as airmen lack advanced training in areas like threat intelligence and incident response, leading to a significant loss of investment (R.U. Karim, personal communication, June 23, 2024).

Need for Specialized Training Facilities. BAF's cyber security personnel face challenges due to inadequate training infrastructure and the lack of a dedicated Cyber Security School. Without facilities to simulate real-world attacks or access to certification programs like Certified Information Systems Security Professional (CISSP) and Certified Ethical Hacker (CEH), personnel lack critical skills. Comprehensive training and continuous professional development are essential to prepare BAF's workforce against evolving cyber threats (Z. Sayeed, Interview, June 23, 2024).

Recruitment and Retention Issues. BAF faces significant challenges in recruiting and retaining cyber security talent. High turnover, due to uncompetitive salaries, limited career growth, and competition with the private sector, exacerbates the issue. Additionally, the traditional military recruitment process struggles to attract skilled cyber professionals, with 78.3% of survey (Figure 4) respondents citing recruitment difficulties.

Figure 4: Opinion about Challenges of Requirement in Cyber security Aspect in BAF



Source: Author's self-construct

Adequate Manpower Adjustments. BAF faces challenges in forming an effective cyber security unit due to the lack of a finalized Table of Organization and Equipment (TO&E). This leads to ad-hoc manpower adjustments, causing instability and gaps in expertise. Developing a comprehensive TO&E is essential for managing complex threats, improving team cohesion, and ensuring resilient cyber defense capabilities.

Cyber Security Challenges Related to Technolog

Maintenance of Updated Technology. BAF struggles to maintain and upgrade its cyber security infrastructure, lacking advanced technologies like Intrusion Detection System (IDS), Intrusion Prevention System (IPS), and Security Information and Event Management (SIEM) systems. This limits comprehensive threat detection and response capabilities, despite having basic tools like DDoS prevention and malware protection.

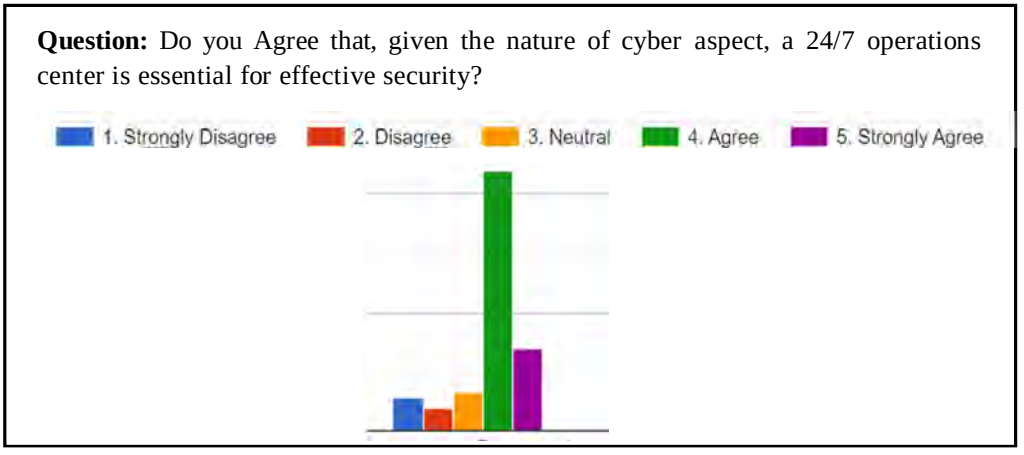
Need for Advanced Tools and AI Integration. Integrating AI and advanced technologies could significantly enhance BAF's threat detection and response capabilities by automating the identification of suspicious activities, detecting anomalies in real-time, and triggering automated responses. Although costly, integrating AI can providelong-term benefits by strengthening BAF’s cyber resilience against sophisticated threats.

Lack of Dedicated Research Facilities. BAF lacks dedicated cyber security research facilities, which limits capacity-building and reliance on external solutions. Although not an urgent requirement, such facilities would improve security and provide long-term benefits despite the high cost. Survey data shows 73.98% of respondents feel that the lack of indigenous R&D impedes BAF's cyber defense efforts.

Cyber Security Challenges Related to Processes

Absence of Dedicated Cyber Units. The absence of a dedicated CSOC poses significant challenges for BAF, as current units managing cyber tasks are overburdened and reactive. Lacking 24/7 monitoring leaves BAF vulnerable to attacks. Survey data (Figure 5) shows 78.3% of respondents’ view is that a CSOC is essential for effective cyber defense, underscoring the need for continuous monitoring and swift response capabilities.

Figure 5 : Opinion about Cyber Security State of BAF



Source: Author's self-construct

Lack of Proactive Threat Intelligence. BAF faces significant challenges in developing internal capabilities to identify and counter emerging cyber threats before they materialize. The current threat intelligence approach is inadequate, limiting the ability to stay ahead of adversaries and proactively anticipate potential threats, which undermineseffective cyber defense strategies.

Need for Continuous Risk Assessment and Mitigation. BAF lacks a robust risk management framework, essential for proactive identification and mitigation of evolving cyber threats. This absence leaves BAF reactive rather than proactive, increasing vulnerability to successful cyber-attacks and undermining the effectiveness of its overall cyber security strategy.

Lack of Comprehensive Incident Response Plan. BAF's lack of a comprehensive incident response plan, including roles, procedures, and communication strategies, hampers its ability to handle cyber threats effectively. The absence of standardized procedures and regular drills results in delayed reactions, increasing the damage during cyber-attacks.

Strategies to Strengthen Cyber Security Capabilities of BAF

To enhance the cyber security capabilities of BAF, strategic solutions are structured around four core categories: Policy, People, Process, and Technology.

Strategies to Strengthen Cyber Capabilities (Policy)

Comprehensive Cyber Security Policy. A comprehensive and unified cyber security policy is critical for BAF to effectively counter cyber threats and safeguard operations. Aligning with national defense strategies, such a policy will enhance BAF's capacity to detect, respond to, and recover from cyber incidents. Survey data (Table 2) shows that 75.8% of respondents believe updated cyber security policies would strengthen operations, emphasizing the need for tailored policies and continuous training.

Table 2: Opinion about Strategic Steps to Enhance Cyber security

Aspect	Frequency	Percentage
Question: Do you agree that, formulation of updated cyber security policies is crucial to meet the challenges?	140	75.8%

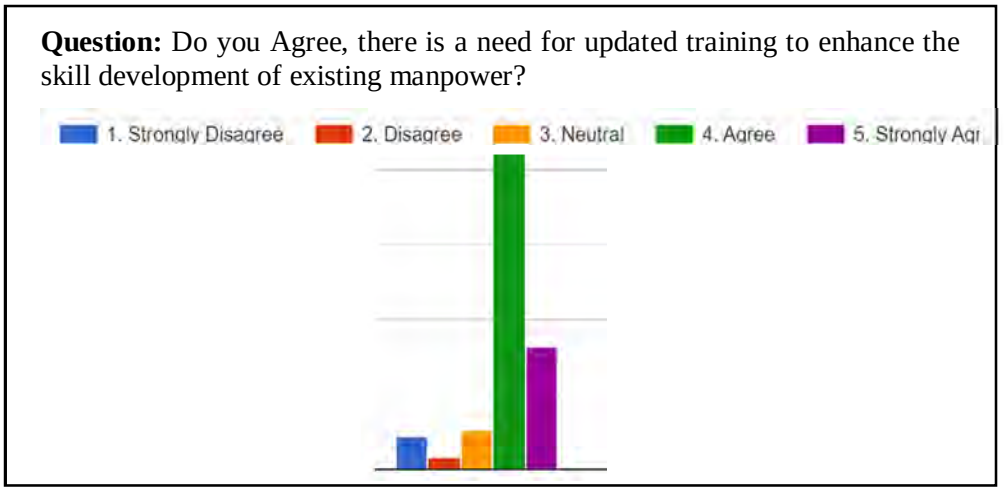
Source: Author's self-construct

Strategic Cyber Security Framework. A strategic cyber security framework is essential for the BAF to manage and enhance its cyber security efforts effectively. Aligning with broader objectives, this framework should integrate existing policies, address vulnerabilities, and boost cyber resilience. Survey data shows 82.62% of respondents believe that BAF requires a robust infrastructure with essential resources like budget, equipment, manpower, and training facilities to strengthen its cyber defense capabilities.

Strategies to Strengthen Cyber Capabilities (People)

Specialized Cyber Training Programs. Specialized cyber training programs are essential for enhancing the skills of BAF cyber workforce. Establishing an IT squadron, as part of Forces Goal 2041, will address manpower shortages. Survey data (Figure 6) shows 84.78% of respondents support updated training to manage evolving cyber threats effectively.

Figure 6: Opinion about Cyber Security Requirement in BAF



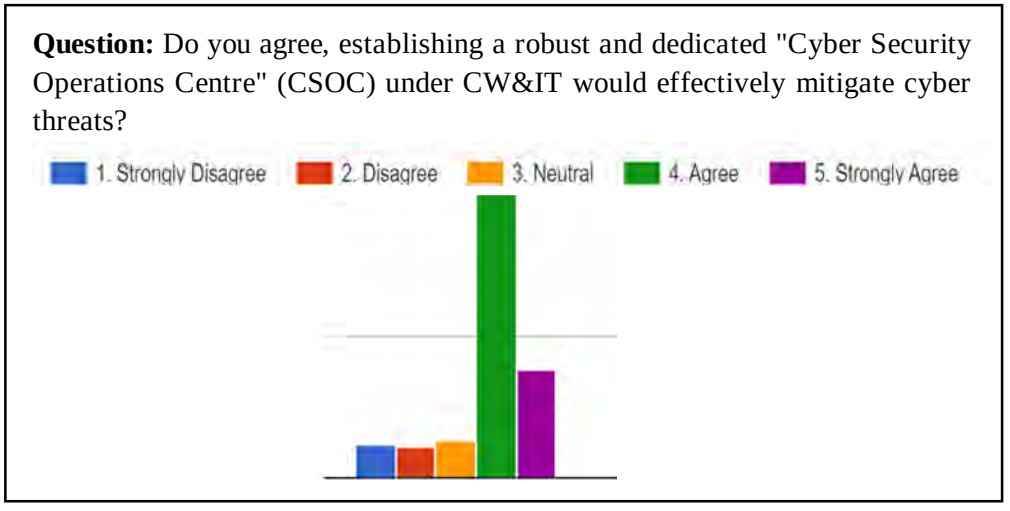
Source: Author's self-construct

Targeted Recruitment and Career Development. Targeted recruitment drives and clear career pathways are crucial for building and maintaining a skilled cyber security workforce within BAF. Collaborating with educational institutions and offering competitive compensation, outreach programs, and continuous professional development can attract top talent. These efforts will ensure a steady pipeline of qualified professionals to meet BAF's growing cyber security needs (N. Imtiaz, Interview, June 23, 2024).

Strategies to Strengthen Cyber Capabilities (Process)

Organizational Structure and Cyber Security Operation. Establishing a centralized CSOC is crucial for coordinating BAF's cyber security activities, including threat intelligence, incident response, and forensic analysis. This will significantly enhance BAF's ability to detect, respond to, and recover from cyber threats. Survey data (Figure 7) shows 90.06% of respondents support the need for a dedicated CSOC under CW&IT Directorate to effectively mitigate cyber threats.

Figure 7: Opinion about Cyber Security Requirement in BAF



Source: Author's self-construct

Implementation and Monitoring. A phased approach to cyber security enhancements will enable BAF to continuously monitor and assess the effectiveness of each solution. Regular evaluations will ensure strategies remain relevant amid evolving threats. Establishing a robust CSOC, centralizing command for cyber security activities like threat detection, incident management, and forensic analysis is critical. This approach also integrates advanced technologies and develops specialized cyber security teams, providing a proactive defense against cyber threats.

Case Study

U.S. Cyber Command. A successful example of centralizing cyber security operations is the U.S. Cyber Command (USCYBERCOM), established in 2009 by the U.S. Department of Defense (Figure 8). USCYBERCOM unified cyber defense capabilities under a single command, improving coordination and efficiency. With advanced technologies like AI for threat detection and a clear command structure, USCYBERCOM enhanced U.S. military cyber operations. BAF can follow this model to strengthen its own CSOC and improve its cyber defense capabilities.

Figure 8: Illustration from U.S. Cyber Command, USCYBERCOM (2009)

Source: U.S. Department of Defense (n.d.), Cybercom. Retrieved from

Relevance for BAF. While the proposed framework offers a clear path forward, BAF may still encounter practical obstacles—including limited budgets, cultural resistance, and weak inter-unit coordination—that could slow down the implementation. USCYBERCOM's experience shows that these barriers can be overcome if cyber reforms are driven by unified command structures, and sustained investment. For BAF, adopting similar discipline—centralized direction, consistent resourcing, and clear lines of responsibility—will be essential to translate its cyber security vision into an effective, resilient CSOC.

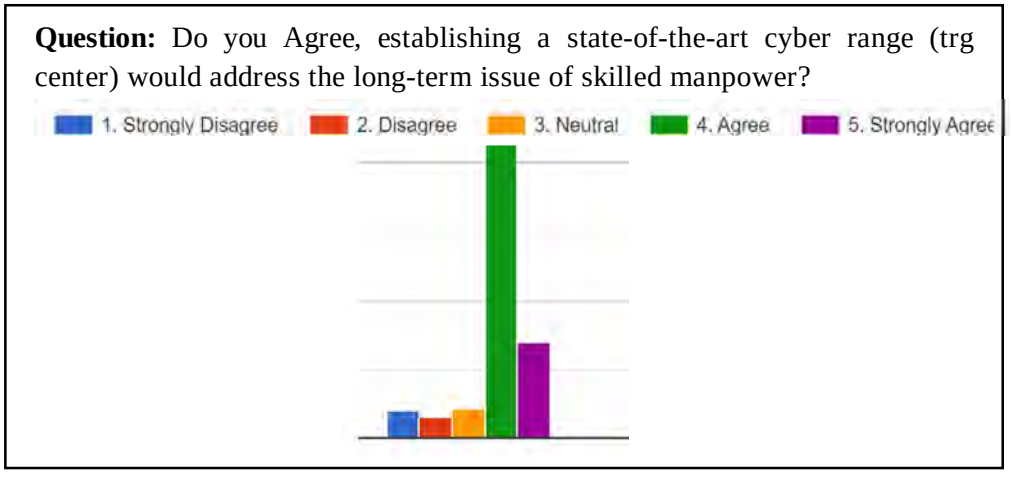
Strategies to Strengthen Cyber Capabilities (Technology)

Integration of Advanced Technologies. To counter evolving cyber threats, BAF must integrate advanced technologies like AI and Machine Learning into its defense infrastructure, despite current resource constraints. AI enhances real-time threat detection, reduces human error, and improves predictive analytics for proactive threat management. While not an immediate priority, investing in AI will strengthen BAF's long-term resilience, though it will require substantialinvestments in both technology and specialized training.

Research and Development (R&D). Establishing dedicated research facilities would foster innovation and allow BAF to develop indigenous solutions tailored to its operational needs. Although not an immediate priority, such R&D efforts could support technological advancements, build self-reliance, and gradually reduce dependency on external solutions in cyber defense.

Enhanced Cyber Range. Developing a state-of-the-art cyber range is a crucial investment for BAF, providing a realistic environment to train personnel and test cyber defense strategies. It supports continuous skill development and addresses the long-term challenge of skilled manpower. Survey data (Figure 9) shows that 84.24% of respondents believe a cyber range would effectively tackle this issue, emphasizing the need for such advanced training facilities.

Figure 9:



Source: Author's self-construct

Modernized Command and Control System. Upgrading BAF's cyber command and control system is essential for real-time decision-making and information sharing across all cyber defense units. This upgrade should include real-time analytics and incident response protocols to ensure effective coordination. A modernized system will unify communications, improve operational efficiency, and support the overall cyber security strategy. Survey data shows that 82% of respondents agree that unity of command across operations, training, and research is critical for effective outcomes.

Conclusions

The research underscores the vital need for a comprehensive and well-coordinated approach to strengthening BAF's cyber security posture. Although foundational structures—such as the CW&IT Directorate and some basic infrastructures are in place, notable gaps remain, particularly in policy modernization, recruitment of skilled personnel, and technological advancement. The study confirms that strengthening these areas is essential for ensuring BAF's long-term resilience against emerging cyber threats.

Key strategies, such as establishing a dedicated CSOC, improving recruitment and retention through competitive incentives, and adopting advanced technologies like AI, are necessary to modernize BAF's cyber defenses. Moreover, the need for collaborative efforts with national and international partners, as well as continuous training and development programs, has been emphasized to maintain operational readiness.

In conclusion, addressing the identified challenges through a unified framework of policy reform, workforce development, process optimization, and technological upgrades will significantly enhance BAF's cyber security capabilities. By implementing these strategies, BAF will not only strengthen its defenses but also set a standard for national cyber security, positioning itself as a leader in military cyber resilience.

Recommendations

Based on the findings and conclusions, the following recommendations are proposed, categorized into short-term and long-term actions:

Short-Term (Within Next 1-3 Years)

Enhance Cyber security Awareness and Training: The CW&IT Directorate may implement a tiered cyber security training program, starting with basic awareness for all ranks and advancing to specialized certifications like CISSP and CEH. This will equip personnel with knowledge of both general and role-specific cyber threats.

Establish Dedicated Cyber security Units: The CW&IT Directorate, in collaboration with the Comm Unit and C&E Squadron, may enhance the current ad-hoc CSOC, converting it into a specialized unit for continuous monitoring and incident response.

Develop a Comprehensive Cyber Security Policy Framework: The CW&IT Directorate may implement a formalized policy framework, aligned with national defense strategies, to ensure clear roles, responsibilities, and procedures for managing cyber threats.

Long-Term (Within Next 5-7 Years)

Strengthen Foundational Technologies: The CW&IT Directorate may prioritize improving foundational cyber security technologies like advanced monitoring systems and real-time analytics, focusing on solidifying core infrastructure before incorporating AI and machine learning.

Dedicated Cyber Security School/ Cyber Range: A feasibility study might explore the creation of a dedicated Cyber Security School/Cyber Range for ongoing specialized training, ensuring a continuous stream of skilled professionals.

Foster National and International Collaboration: The CW&IT Directorate may explore partnerships with national and international agencies to share intelligence, best practices, and conduct collaborative research.

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Biography

Wing Commander Syed Monir Hasan, GD (P) was born on 06 April 1986 in Kishoregonj, Dhaka. He completed his Secondary School Certificate (SSC) from Motijheel Government High School and Higher Secondary Certificate (HSC) from Notre Dame College, two prestigious institutions in Bangladesh. He was commissioned from the Bangladesh Air Force Academy (BAFA) on 01 December 2005 with the 52 Flight Cadet Course (FCC) in the General Duties (Pilot) Branch.

Wing Commander Hasan attended numerous professional courses at home and abroad. During commission, he was awarded with the '*SWORD OF HONOR*' for best all round performance in cadet training. He was also awarded with the '*CHIEF OF AIR STAFF'S TROPHY*' for best performance in Flight Safety Officers' Course at FSI, BAF. He also attended his second 'Junior Command and Staff Course' in Sri Lanka and was awarded with *"COMMANDANT OF THE SRI LANKA AIR FORCE TROPHY FOR EXCELLENCE IN MANAGEMENT STUDIES"*.

Professionally, he is a fighter pilot and has flown PT-6, T-37B, L-39ZA, K-8W, FT-6, A-5IIIA and F-7BG aircraft with 1800:00 flying hours to his credit till date. He served as Instructor Pilot in 11, 15 and 5 Squadron of BAF. Wing Commander Hasan also served as Academic Instructor at Bangladesh Air Force Academy (BAFA) and Air Directing Staff in Bangladesh Military Academy (BMA). Before joining Air Staff Course, he was serving as Instructor Pilot of 5 Squadron BAF. He is married and blessed with three sons.

Indigenous UAV Development to Enhance Operational Capability of BAF: Prospects, Challenges and Way Forward

Wing Commander *Mohammad Ali Kawser, psc, Engg*

Abstract

Bangladesh Air Force (BAF) confronts considerable challenges in bolstering its operational capabilities, primarily due to budgetary constraints. The research explores the viability of indigenous Unmanned Aerial Vehicle (UAV) development as a cost-effective strategy to enhance BAF's operational capabilities. The study examines the potential roles of UAVs within BAF, such as surveillance, reconnaissance, and tactical response, while assessing the feasibility and associated challenges of UAV development. Employing a comprehensive approach integrating literature review, expert interviews, and a detailed cost-comparison, this research demonstrates that indigenous UAV development is not only feasible but also has the potential to significantly elevate BAF's operational readiness. Despite the inherent challenges, including the scarcity of expertise, dedicated manpower, and essential materials, the findings suggest that these obstacles can be mitigated through collaborations, phased development, and targeted training programs, ultimately positioning BAF to achieve self-reliance in UAV technology. The study concludes that indigenous UAV development offers a practical avenue for BAF to sustain and enhance its operational capabilities, in alignment with national objectives of self-reliance and technological advancement. The research provides a detailed roadmap for implementing this strategy, significantly contributing to the broader defence goals of Bangladesh.

Introduction

Bangladesh's defence budget is significantly lower than that of its neighbours (Wisevoter, 2023), making it challenging for the Bangladesh Air Force (BAF) to continuously enhance its operational capabilities. The rising cost of procuring new air assets (Davies et al., 2012) further limits BAF's ability to meet modern operational demands. Given these financial constraints, relying solely on procurement is impractical (Assistant Chief of Air Staff Plans personal communication, June 26, 2024) and unsustainable during wartime (Markowaski, 2010). A more cost-effective solution is to focus on indigenous development alongside procurement (Hung, 2012).

UAVs offer a viable option due to accessible technology, resource availability, and cost-effectiveness. Proven effective in modern warfare from the Bekaa Valley Operation to the Russia-Ukraine war, UAVs have been employed by both advanced nations and non-state actors (Rahman, 2024). However, BAF has yet to fully explore UAV development, potentially missing a crucial opportunity to address operational limitations and remain relevant in modern warfare (Director Air Ops, personal communication, June 26, 2024). The present research investigates the potential of UAVs in enhancing BAF's operational capabilities, assesses the feasibility of indigenous development, and provides a roadmap for implementation.

Prospects of Indigenous UAV Development In BAF

UAVs are increasingly dominant in both peace and crisis, used for ISR, border control, maritime surveillance, combat operations, training, and more (Drones, 2021). However, their specific role in BAF operations remains underexplored (Director Air Operations, personal communication, June 26, 2024).

Scope of Utilization of UAVs in BAF Operations

Offensive Counter Air Operation (OCAO)

As a part of OCAO, Fighter Sweep and Escort are dominated by manned aircraft due to their speed, manoeuvrability, and weapon capacity (Atherton, 2022; Easthope, 2015), limiting UAV applicability. While air-to-air UAV engagements, such as the MQ-9 Reaper with AIM-9X missiles, are still in testing (Rogoway, 2023). UAVs show potential in SEAD and Surface Attack roles, including MUM-T operations (Kim et al., 2019) and Iranian UAV strikes on US bases (US Drone Attack, 2024).

Defensive Counter Air Operation (DCAO)

The UAV technology has not yet advanced enough for air-to-air engagements in these roles (Deputy Director Air Defence, personal communication (Pls clarify if interview), June 26, 2024). However, progress has been made with systems like Iran's Karrar drones (AFP, 2023).

Anti-Surface Force Operation (ASFO)

UAVs have recently proven effective in ASFO (Hanlon, 2005). For example, Ukraine used UAVs to locate Russian forces (ACLED, 2023) and used kamikaze drones as substitutes for artillery shells (Gibbons-Neff & Shyvala, 2024). However, in Anti-surface Vessel/Anti-Ship and Anti-Submarine Warfare, employment of UAVs is limited.

Strategic Air Operation (SAO)

Long-range bombers are favoured for this role (Moody, 1995). However, recent conflicts have seen the use of UAVs for strategic impact. The Houthis used UAVs to strike deep into Saudi Arabia, damaging two Aramco oil installations (Hubbard et al., 2019). In July 2023, Ukraine demonstrated its reach by launching UAV attacks on Moscow (Edwards, 2023)

Combat Support Air Operation

Surveillance and Reconnaissance. The utility of UAVs in surveillance and reconnaissance is the most practiced one since the World War I (AV8Prep, 2023). With various payloads like cameras and radars, UAVs are now an effective tool for providing battlefield intelligence. (Carter et al., 2019).

Air Transportation. UAVs cannot match transport aircraft or helicopters, but technology has enabled them to carry smaller loads effectively. RH-1-A Rhaegal VTOL drone, the highest load-carrying UAV as of 2022, can transport up to 374 kg (Rees, 2022).

Electronic Warfare (EW). UAVs can act as communication relays and carry out jamming while detecting radar installations (Roee, 2024). The ongoing Russia-Ukraine war has highlighted the extensive use of UAVs in EW (MILNYI, 2024).

The applicability of UAVs in various air operations is presented below:

Table 1: Application of UAVs in various Air Operations of BAF (Self-Construct)

Operation	Role	BAF Capable to carry out with Aircraft	Prospects of UAV in BAF
OCAO	SEAD	Yes	Yes
	Surface Attack	Yes	Yes
	Fighter Sweep	Yes	No
	Fighter Escort	Yes	No
DCAO	CAP/QRA	Yes	No
Land/Air Operations	Air Interdiction	Yes	Yes
	OAS	Yes	Yes
	Tactical Air Reconnaissance	Yes	Yes
MAO	Anti-Submarine Warfare	Limited	Limited
	Anti Surface Vessel Warfare	Yes	Yes
	Maritime Anti-Air Warfare	Yes	Limited
SAO		Yes	Yes
Combat Support Air Operations	Scheduled services	Yes	Limited
	Airborne Operations	Yes	No
	Special Air Operations	Yes	No
	Air logistic support	Yes	Limited
	Air mobile operations	Yes	No
	Aeromedical evacuation	Yes	No
	Air-to-air Refueling	No	No
	Surveillance & Reconnaissance	Yes	Yes
	AEW/AWACS	No	No
	Search & Rescue	Yes	Limited
	EA	No	Yes
	EP	Yes	Yes
	ES	No	Yes

The table indicates that UAVs excel in roles like SEAD, surface attack, and tactical air reconnaissance but are less effective in specialized operations such as anti-submarine warfare, search and rescue, and aeromedical evacuation.

Benefits of Indigenous Development in BAF

Better Maintenance

Indigenous UAV development will enhance BAF's maintenance and repair capability (Assistant Chief of Air Staff Maintenance, personal communication(Pls clarify if interview), June 26, 2024). For instance, experience from the BBT-1 project bolstered the repair capabilities for the AW-139's composite airframe (Chief Technical Officer, BBT-1 Project, personal communication, May 28, 2024).

Strategic Independence

Indigenous UAVs can reduce reliance on foreign suppliers and minimize supply disruptions. It addresses foreign exchange shortages and acquisition challenges, fostering import substitution and achieving strategic independence (Ahmed, 2014).

Design Optimisation

Once successful, prototypes can be adjusted for varying requirements (Team Leader, Target Drone Project, personal communication, June 26, 2024). Furthermore, UAVs can act as testbeds for other R&D projects, like IFF and long-range VHF communications, which currently face challenges on operational aircraft.

Cost Optimisation

Indigenous UAVs can be integrated with various payloads. Thus, the cost of separate UAVs for separate purposes may be balanced by using common platforms. (FGD)

Mass/ Batch Production

Cheap production of UAVs is possible with domestic technology. Subsequently, based on the requirement, mass production would be possible. (FGD)

Initial Sustenance During War

Indigenous UAVs can increase BAF's deterrence capability. This allows BAF to sustain operations during early conflict stages without foreign support (Officer Commanding, 25 Squadron BAF, personal communication, June 26, 2024). During

the Russia-Ukraine war, Ukraine's domestic UAV production sustained its efforts in the absence of Western help (Gibbons-Neff & Shyvala, 2024).

Prospects for Export Oriented Defence Industry

Indigenous UAVs can be industrialised to harness the opportunity offered by growing UAV market (Pro-Vice Chancellor, Bangabandhu Sheikh Mujibur Rahman Aviation and Aerospace University (BSMRAAU) (now officially named **Aviation and Aerospace University, Bangladesh (AAUB)**), personal communication (interview??), June 26, 2024).

Contributing towards Vision 2030 And 2041

Design and manufacturing of Indigenous UAVs will not only meet the requirements of BAF but also will create a significant impact on attainment of Vision 2041 and aid in attaining Forces Goal 2030 through being a part of the indigenous defence sector (Assistant Chief of Air Staff Plans, personal communication(interview??),, June 26, 2024; Razzak, 2023).

Feasibility of Indigenous UAV Development

Mission Requirement of BAF

To determine the type of UAV required for BAF, first, the possible mission profile and general specifications to meet the mission profile need to be ascertained. As per the directive from Air HQ, BAF is looking for a Reconnaissance and Combat UAV (Director of Plan, personal communication, June 26, 2024).

Determining The Suitable Platform Size

Based on the literature, Table 2 summarizes the various types of UAVs.

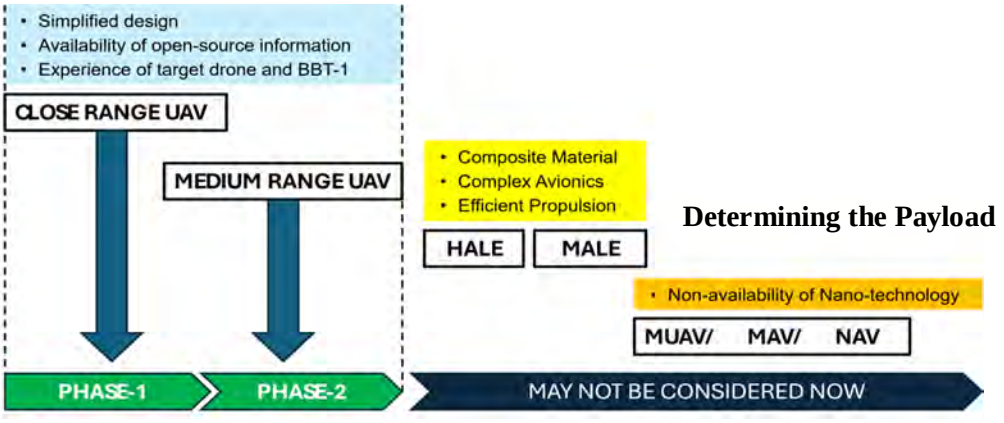
Table 2: Types of UAVs (Self-Construct based on Literature)

CATEGORY	ALTITUDE	RANGE	SIZE / SPAN	MTOW (Minimum Take-off Weight)	ENDURANCE	CAPABILITY: RECCE + CBT
HALE High Altitude Long Endurance	> 15 km	> 650 km	> 10 m	> 600 kg	> 36 hrs	Yes + Yes
MALE Medium Altitude Long Endurance	5 – 15 km	150 – 650 km	5 – 10 m	150 – 600 kg	12 - 36 hrs	Yes + Yes
TUAV Medium Range or Tactical UAV	5 km	100 – 300 km	5 – 10 m	25 – 150 kg	8 – 12 hrs	Yes + Yes
Close Range UAV	1 – 5 km	50 - 100 km	5 – 10 m	25 – 150 kg	1 – 6 hrs	Yes + Yes
MUAV Mini UAV	2 km	< 30 km		2 - 25 kg	< 1 hr	Yes + **No**
MAV Micro UAV	< 2 km	-	< 15 cm	< 2 kg	-	Yes + **No**
NAV Nano UAV	< 2 km	-	< 2.5 cm	< 250 gm	-	Yes + **No**

Source: Author's self-construct

Developing different UAV types presents varying complexities. HALE/ MALE UAVs, known for their extended range and endurance, require advanced engineering for aerodynamics, propulsion, materials, sensors, and navigation (Chamola et al., 2021). MUAVs, MAVs, and NAVs face challenges in miniaturising components with nanotechnology (Wong, 2003). In contrast, tactical UAVs built for short-range military operations have simpler designs and lower development overhead (Murtiyoso et al., 2016), requiring fewer personnel for operation (F. Ahmed et al., 2022). A rich knowledge base and open-source algorithms for navigation are also accessible (Telli et al., 2023). Experience from target drones and the BBT-1 project can further support short to medium-range UAV development in the BAF. Thus, due to their limited complexity and availability of know-how at BAF, the Close-Range UAVs can be a suitable option to start with (Figure 1). Subsequently, in the next phase, Medium Range/Tactical UAVs with added capability may be developed. The experience gained from these two phases would then provide a sustainable foundation for developing higher-capability UAVs in the future. However, the scope of this study is limited to Phase 1 and Phase 2 only.

Figure 1: Selecting UAV-Type to Develop in BAF



Source: Author's self-construct

A comprehensive list has been prepared by studying various sources (Austin, 2010), which contains the probable range of reconnaissance and combat payloads (Table 3).

Table 3: Various Payload Options and Related Considerations

	RECCE / SURVEILLANCE PAYLOAD			COMBAT PAYLOAD		
DESIGN CONSIDERATIONS	ELECTRO-OPTIC	LASER DESIGNATOR	SYNTHETIC APERTURE	Bomb	Rocket	Missile
Weight	1-2 kg	6 kg	0.5 – 13 kg	> 6 kg	> 25 kg	> 50 kg
Location	Internal / External	Internal / External	Internal / External	External	External	External
Aerodynamics Impact	Not reqr for Int instl	Not reqr for Int instl	Not reqr for Int instl	Reqr detailed analysis	Reqr detailed analysis	Reqr detailed analysis
Structural Integration	Internal / External mounting	Internal / External mounting	Internal / External mounting	Internal mounting; Hard-point Bomb-rack	Internal mounting; Hard-point Launch-tube (creates reaction force) Elect interface	Intl mounting Hard-point Launch-rail (reaction force) Elect interface
Stabilisation Requirement	Nose mounted / Turret mounted	Nose mounted / Turret mounted	Nose mounted / Turret mounted	Required	Required	Required

Source: Author's self-construct

Reconnaissance payloads weigh between 1 to 5 kg, while combat payloads exceed 10 kg. Integrating combat payloads significantly affects aerodynamics, whereas reconnaissance payloads can be mounted internally or externally with minimal structural changes (Director Armament and Weapon, personal communication, June 27, 2024). Given the design complexity and weight requirements, the BAF may initially focus on reconnaissance payloads before weapon integration (Deputy Director Plans, personal communication, June 27, 2024).

Selecting the Reconnaissance Payload

Table 4 contains a list of feasible reconnaissance sensors for installing in the Phase-1. Considering the performance, and level of difficulty to integrate, SIYI A8 Mini may be selected initially (SIYI, 2024).

Table 4:Reconnaissance Payload Selection

COMPANY	PAYLOAD MODEL	CATEGORY	WEIGHT	LEVEL OF DIFFICULTY
Mugin UAV	A10TR 10x Triple Sensor AI Tracking Camera	Target POD	2.1 kg	3
Safran Group	EUROFLIR 410	Target POD	Unknown	3
Trillium	HD80-VV-510	Target POD	4.27 kg	3
SIYI	SIYI A2 mini Ultra Wide Angle FPV Gimbal Single Axis	Camera	Approx. 1 – 2 kg	2
SIYI	SIYI A8 mini 4K 8MP Ultra HD 6X Digital Zoom Gimbal Camera	Camera	Approx. 1 – 2 kg	1

Source: Author's self-construct

Selecting Combat Payload

Smart Micro Munition and Mortars due to their lightweight, performance, and applicability (Defence Turkey, 2020), may be primarily selected for integration with BAF UAV. BAF may also endeavour to locally fabricate bombs of 5 to 6 kg taking assistance from BMTF and BOF (Director Armament and Weapon, personal communication (interview??),, June 27, 2024).

Table 5: Weapon Payload Selection

COMPANY	WEAPON MODEL/TYPE	CATEGORY	WEIGHT	INTEGRATION DIFFICULTY	USED IN PLATFORM
Roketsan	MAM-L Lightweight Smart Micro Munition	LGB	22 kg	Medium	BAYRAKTAR TB2
Roketsan	Bozok	GB	16 kg	Medium	BAYRAKTAR TB2
Roketsan	Cirit 70 mm	Missile	15 kg	High	SELEX ES FALCO
Thales	Martlet - Lightweight Multirole Missile (LMM)	Missile	13 kg	Medium	Flyby JACKAL Drone
Roketsan	MAM-C Lightweight Smart Micro Munition	LGB	6.5 kg	Medium	BAYRAKTAR TB2
Raytheon	Pyros	PGM	6 kg	High	Raytheon COBRA UAV
Lockheed Martin	Shadow Hawk	LGB	5 kg	High	SHADOW 200 UAS
Tubitak-SAGE	TOGAN 81 mm mortars	Mortar	5 kg	Medium	BAYRAKTAR TB2
-	**Indigenous 6 kg Bomb**	**Bomb**	**6 kg**	**Low**	**6 kg bomb may be developed locally**

Source: Selecting Avionics

A few basic avionics items will be required for the UAV. From open source, the following specifications of avionics have been collected from the Team Leader, Target Drone Project:

Table 6: Proposed Avionics System

Item	Model	Brand	Qty
Controller	Dragon Link Advanced 433 MHZ WiFi Complete System	Dragon Link	2
	10J Transmitter – 10-Channel Digital Proportional RC System	Futaba	2
Servo	D845WP (50Kg/cm)	Hitec	15
	D980TW 32-Bit (44 Kg/cm)	Hitec	15
Autopilot	Pixhawk 6C (With GPS)	Pixhawk	2
	Pixhawk V5+ (With GPS)	Pixhawk	2
	2023 CubePilot Ecosystem	CubePilot	2
GPS	CUAV C-RTK 9Ps	CUAV	1
	CUAV NEO 3 Pro	CUAV	1

Source: Selecting Powerplant

A close-range reconnaissance UAV generally requires an engine of 25 to 35 HP (Team Leader, Target Drone Project, personal communication, June 26, 2024). A list of engines has been prepared in that has similar HP range.

Table 7: Proposed Powerplants

Major Item	Model	Brand	HP	Feature
Engine	Mini 2 Plus	Simonini	26	Efficient and compact design.
	Simonini 140	Simonini	25	Larger displacement for more power.
	F33 AS	Hirth	28	Reliable and fuel-efficient.
	225CS-018	AIE	36	Liquid-cooled, suitable for general aviation.
	3W-342i B2 TS CS	Motoren & Flugmodelle	32	Twin-spark ignition system.
	3W-342i B2 TS	Motoren & Flugmodelle	32	Variant without the "CS" designation.

Source: Raw Materials for Fabrication

Consulting with the BBT-1 project team members, a gross approximation on various raw material required for fabrication of the airframe in the first phase of UAV development has been prepared. The approximate cost of these materials is $19,335.

Approximate Cost for Phase – 1

The approximate cost of developing the reconnaissance UAV in phase-1 is shown in Table 8.

Table 8 : Total Approximate Cost of Development: Phase-1 (Reconnaissance UAV)

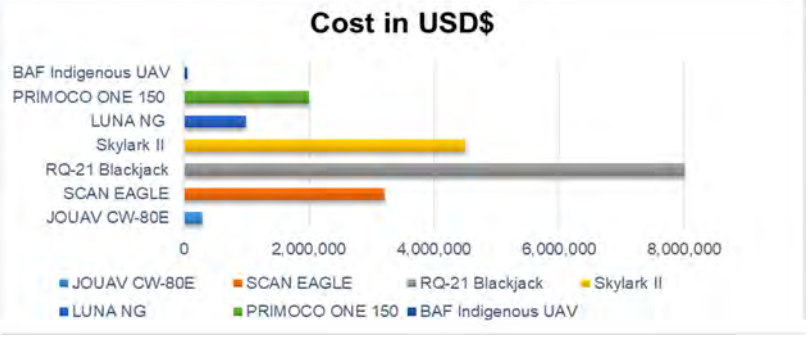
Ser	Name	Price in USD (Approx)	Price in BDT (Approx)	Remark
1	Design of UAV	Considered Nil	Considered Nil	Indigenous Design, vetted against proven ones
2	Fabrication Tools	Considered Nil	Considered Nil	Existing facility of BBT-1 may be utilized
3	Airframe (Raw Materials)	$ 19,335.00	BDT 23,97,000.00	
4	Payload - Recce	$ 1100	BDT 50,000.00	
5	Avionics with accessories	$ 8,000.00	BDT 9,92,000.00	
6	Powerplant with accessories	$ 16,000.00	BDT 19,84,000.00	
Total Cost		**$ 44,425.00**	**BDT 53,73,000.00**	Considering, $ 1 = BDT 121
		USD Forty-Four Thousand and Four Hundred Twenty-Five Only	**BDT Fifty-Three Lacs Seventy-Three Thousand Only**	Total cost may change during procurement

Source: Analysis on Comparison of Cost

Though, it is not possible to literally find the exactly similar UAV commercially, comparable UAVs available in the market have been considered. Figure 2 compares the costs of those UAVs.

Figure 2: ***Price Comparison between BAF Indigenous UAV and Other Military UAVs***

From



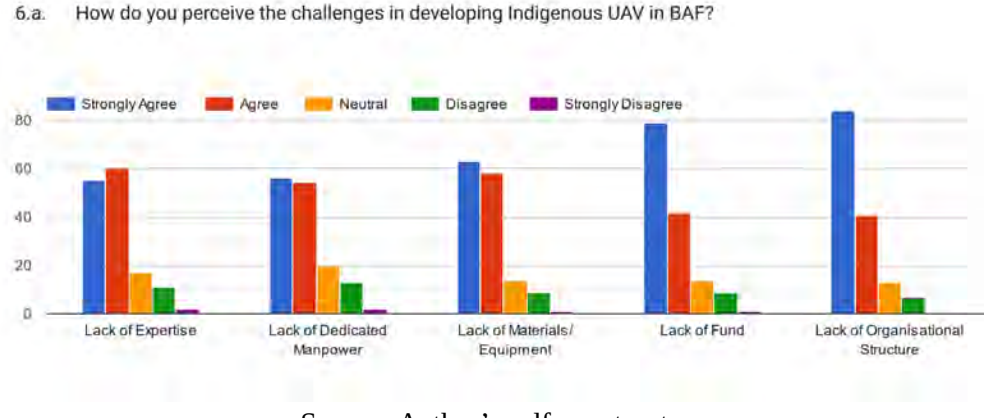
Source: Author's self-construct

Figure 2 it can be seen that the price of commercially available military UAVs can vary from $200,000 to $10 million. Compared to this, the cost forecasted for the indigenous development of UAV in BAF is approximately $44,425, which is quite less. However, the literal comparison only gives an idea that indigenous development is likely to be cost-effective. The total development cost can only be found out after successful completion of the project.

Challenges of Indigenous UAV Development

The survey responses (Figure 3) indicate a strong consensus that the major challenges to developing indigenous UAVs in the BAF include a lack of expertise, limited manpower, insufficient materials and equipment, inadequate funding, and organisational constraints. These challenges are elaborated in the subsequent paragraphs.

Figure 3: Survey Response on Challenges of Indigenous UAV Development



Source: Author's self-construct

Lack of Expertise

Effective airframe, propulsion, and guidance design requires diverse aerospace expertise (Masrur, 2021). Most BAF engineering officers hold B.Sc. degrees but lack experience in aviation research (Air Secretary, personal communication, June 26, 2024). Moreover, the UAV design phase requires skills in MATLAB, Ansys, SolidWorks, autopilot, avionics, and airborne armament, which are not commonly found in the BAF.

Lack of Dedicated Manpower

Personnel involved in R&D projects are often reassigned to meet career requirements, which disrupts continuity. Successful research and production require dedicated individuals who gain experience through sustained involvement. Frequent postings hinder smooth project progress, as seen in the BAF target drone project, which faced delays due to a lack of dedicated manpower (Director Air Training, personal communication (Unstructured Interview), June 26, 2024).

Lack of Research Career Path

For effective career progression in the BAF, engineers and technicians must spend significant time in aircraft, radar, or communication maintenance squadrons. However, time spent on research work does not count as prerequisite service for promotion (Officer-In-Charge, Communication and Electronics, BAF Base Bashar, personal communication(Unstructured Interview), June 26, 2024).

Lack of Materials

Most raw materials for aircraft manufacturing are unavailable domestically, requiring costly imports that hinder research progress. Although alternative materials can be used for basic fuselage components, advanced parts like spars and ribs necessitate materials such as T6 Aluminium, which cannot be sourced in Bangladesh (Assistance Chief of Air Staff (Maintenance), personal communication, June 26, 2024).

Lack of Fund

For any research project to be successful, a continuous flow of funds is required from conceptualisation to realisation, up to the product level. Moreover, often R&D projects do not bring direct results, demanding additional investment, rather than the initial assessment (Deputy Director Plans, personal communication, June 27, 2024).

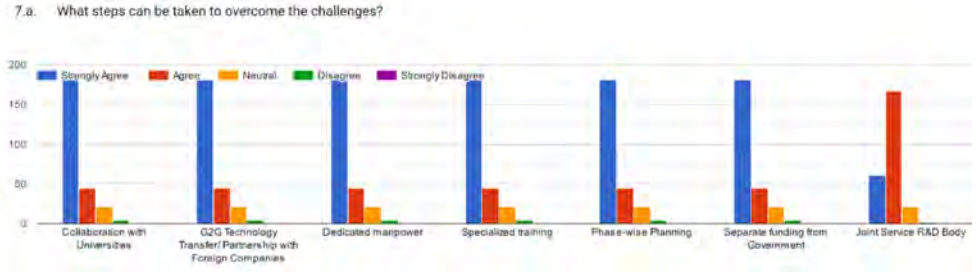
Lack of Organisational Structure

One of the major drawbacks of conducting indigenous research and development in Bangladesh is that there is no dedicated directorate for this purpose(Group Captain Md Asif Iqbal, 2019). As a result of this, there is not always a structured approach to R&D activities (Director Air Operations, personal communication, June 26, 2024).

Way Forward: Mitigation of Challenges

Though there are numerous challenges in developing UAVs in BAF, there are some steps that, if taken, can significantly reduce their impact (see Figure 4).

Figure 4: ***Survey Response on Steps to Overcome the Challenges***



Source: Author's self-construct

Addressing the Manpower Issue

BAF has a skilled workforce from the BBT project (Chief Technical Officer, BBT-1 Project, personal communication, June 26, 2024) who can be assigned to the UAV initiative. Moreover, additional personnel can be engaged to ensure smooth handover, after working at least for two years.

Dedicated engineers and technicians can be recruited, with a distinct career path separate from regular intakes (Assistance Chief of Air Staff Maintenance, personal communication, June 26, 2024).

To ensure that service rendered in R&D does not affect career progression, few steps may be taken. Such as, the R&D service time should be counted toward professional milestones like promotion and posting; the UN mission assignments should be carefully planned to avoid interrupting research work etc.

Enhanced Training

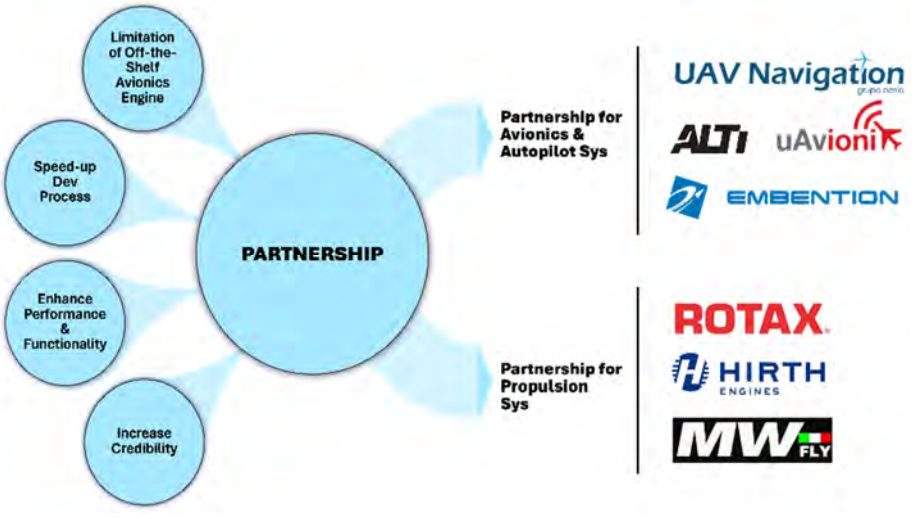
Recently, officers have been trained in ANSYS and MATLAB through efforts by the Directorate of Air Training. It is crucial to continue these courses to maintain a pool of skilled officers. Officers and airmen from the target drone project could also offer local training for the UAV development team (Director Air Training, personal communication, June 26, 2024). However, Bangladesh lacks adequate facilities for practical training in key areas such as Aerodynamics, Structural Design, Payload Integration, and Propulsion. To bridge this gap, foreign experts may be brought in to

provide specialised training, or personnel could be sent abroad to gain hands-on experience in these critical fields.

Consultation and Technical Support

Collaboration with BUET, BSMRAAU, and MIST, which have research expertise and advanced technology, would foster joint UAV projects and innovation. Professors and researchers can assist in solving UAV development challenges, while master's or PhD students could take on research tasks, including autonomous navigation software development (Pro-Vice Chancellor, BSMRAAU, personal communication, June 26, 2024). In the weapon integration phase, support from BOF and BMTF will be crucial for manufacturing armaments and payloads. Strengthening local firms for military support is also recommended (Director Armament and Weapon, personal communication, June 27, 2014). Foreign partners with expertise in avionics, autopilot, and propulsion can provide essential support to speed up UAV development (Director Plans, personal communication, June 26, 2024) (see Figure 5).

Figure 5: Prospects of Foreign Collaboration



Source: Author’s self-construct

Budget Optimisation for Material and Equipment

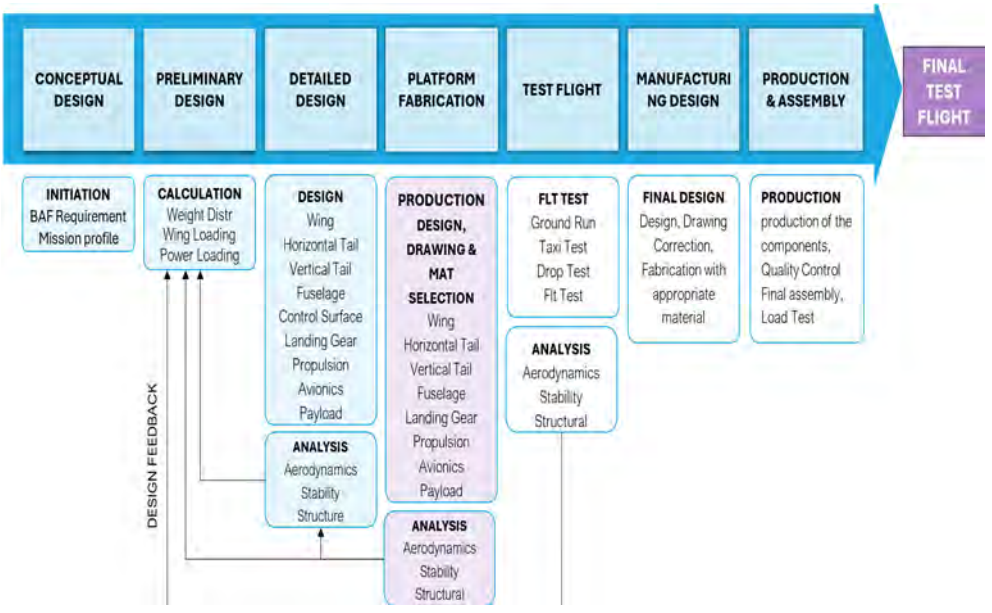
Tools and Equipment. Initial costs for the UAV project equipment, such as high-configuration computers, can be reduced by using existing items from the BBT-1 project (Chief Technical Officer, personal communication, June 26, 2024). Bulk

purchasing through partnerships with foreign companies or G2G contracts can lower down material costs compared to standard procurement methods (Director Engineering, personal communication, June 27, 2024).

Systematic Approach

Academically vetted systematic process of design and development can optimise the design and cost (El Adawy et al., 2023). It will also allow efficient design modifications before the final design is ready for batch production. The systematic approach shown in Figure 6 may be followed in this regard.

Figure 6: Systematic Approach to Indigenous UAV Development

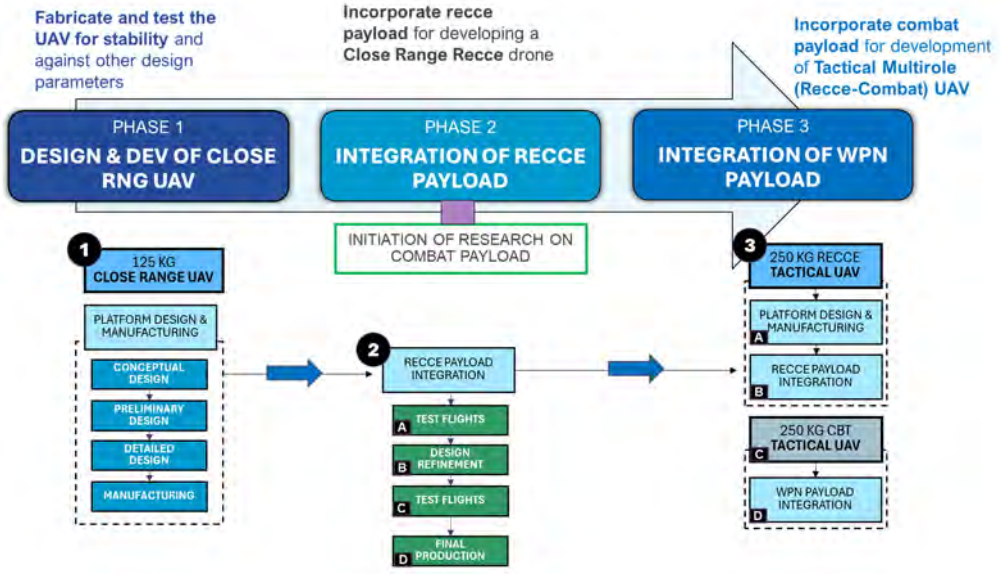


Source: Author's self-construct

Proposed Phase-Wise Work Plan

A phase-wise approach may be undertaken to carry out the indigenous UAV development in BAF. Taking the experience of the aircraft R&D project, BAF may design and manufacture a Close-Range UAV first. Subsequently, a Tactical Combat UAV may be developed (Figure 7).

Figure 7: Three Primary Phases of the Development Project



Source: Author's self-construct

Phase 1

BAF can initially design and develop a close-range UAV weighing 125 kg. The first step involves creating the platform and conducting test flights to assess its suitability for payload integration.

Phase 2

In this phase, a reconnaissance payload will be integrated into the Phase-1 platform. Simultaneously, research on weapon payload integration will begin. Once the close-range reconnaissance UAV proves successful, Phase 3 can commence.

Phase 3

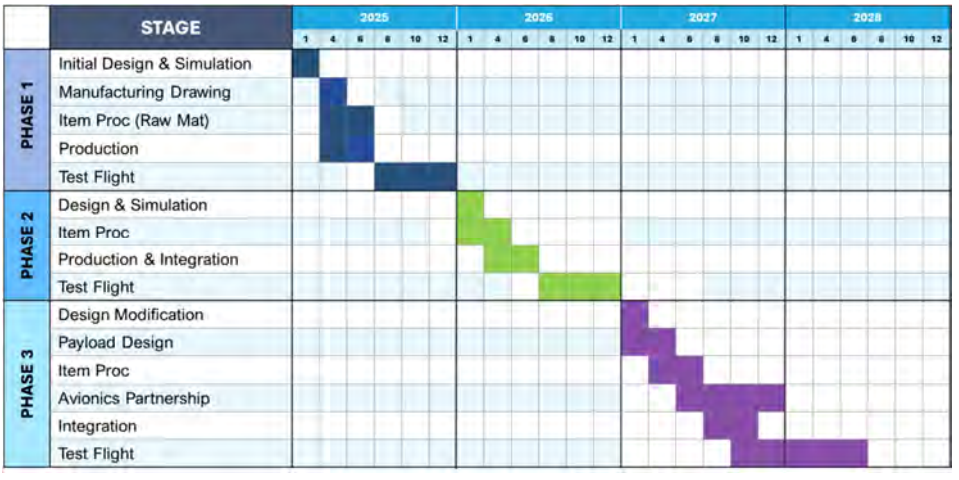
In this phase, BAF would scale up the proven 125 kg reconnaissance UAV to a 250 kg Tactical UAV. After reaching the stable platform, advanced avionics would be integrated.

Development Timeline

The project may begin in January 2025. Design/fabrication of the platform may take about 6 months, up to July 2025; test flights/refinements should be conducted by December 2025. Phase 2 may start in January 2026. Reconnaissance payload

integration and flight tests need to be done by June 2026, with combat payload research starting in parallel. The Close-Range Reconnaissance UAV is expected to be ready by December 2026.

Figure 8: Proposed development Timeline



Source: Author's self-construct

Phase 3 will start in January 2027, with scaling to 250 kg completed by September 2027. Combat payload integration should finish by December 2027, enabling BAF to operate a multi-role UAV by June 2028 (Figure 8).

Conclusions

This research paper explores the potential of indigenous UAV development to enhance the operational capabilities of the Bangladesh Air Force (BAF). It highlights the benefits of locally developed UAVs, such as improved surveillance and reconnaissance, and their roles in tactical combat. The study argues that UAVs are essential for modernising BAF to address current and future security threats.

The key advantages of pursuing indigenous UAV development include enhanced in-house repair and maintenance capabilities, reduced operational costs, and the option for mass production tailored to BAF's needs. This approach would also increase strategic autonomy by decreasing dependence on foreign suppliers and fostering local innovation.

Cost analysis indicates that indigenous UAV development could be a more cost-effective alternative to procuring commercial UAVs, offering long-term economic and strategic benefits. However, challenges such as material scarcity, personnel shortages,

and funding issues were identified. These obstacles can be addressed through strategic investment, human resource development, and collaboration with institutions like BUET, BSMRAAU, and MIST.

The paper advocates for a dedicated R&D course within BAF to drive UAV development forward. While the process may be lengthy and resource-intensive, the strategic and tactical benefits make it worthwhile. A focused, collaborative approach will enable BAF to enhance its operational capabilities and maintain relevance in its region, contributing to its long-term security and technological advancement.

Recommendations

Directorate of Plan may initiate a dedicated R&D effort for indigenous UAV development with adequate manpower and funding in phases.

Opportunities for G2G collaborations and partnerships with foreign companies for UAV development and technology transfer may be explored.

MOUs with BSMRAAU, BUET, and MIST for technical collaboration, alignment of research direction, and training may be signed.

Directorate of Armament may initiate necessary coordination with BOF and BMTF for manufacturing armament required at the later stages of UAV development.

Air Secretary's Branch and BAF Record Office may amend/ make policies to ensure an effective research career of BAF officers and airmen.

Service Headquarters may approach the BD Government to form an organization similar to the Indian DRDO or the Defence Science & Technology Organisation (DESTO) of Pakistan.

Future Research Direction

A detailed study of indigenous UAV development programs in other countries may be conducted to draw appropriate lessons for BD. Also, a more thorough comparative cost-benefit analysis of indigenous development vis-à-vis commercially procured UAVs can be carried out.

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Biography

Wing Commander Mohammad Ali Kawser, psc, Engg was commissioned in Engineering branch of Bangladesh Air Force on 01 December 2003. He obtained his BSc (Engineering) degree from Bangladesh University of Engineering and Technology (BUET) in 2007. He has attended various professional courses at home and abroad like Aeronautical Engineering Course from Air Force Technical College (AFTC), India and Staff Officers' Course in Malaysia. He has served as Officer-in-Charge Flight Line and R&I in various flying squadrons and maintenance wings of BAF. Wing Commander Kawser has also served in UN Missions under UNOCI. Prior to joining Air Staff Course, he served as Officer-in-Charge Communication and Electronics Squadron in BAF Base Bashar.

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Professor Muhammad Yunus, Hon'ble Chief Advisor, Government of the People's Republic of Bangladesh presented certificates to the graduating officers

Graduation Ceremony, DSCSC 2025

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Admiral M Nazmul Hassan, OSP, NPP, ndc, ncc, psc Chief of Naval Staff Bangladesh Navy

Air Chief Marshal Hasan Mahmood Khan, BBP, OSP, GUP, nswc, psc GD(P) Chief of Air Staff Bangladesh Air Force

Mr Muhammad Fouzul Kabir Khan- Hon'ble Adviser-Ministry of Power

Lt Gen S M Kamrul Hassan, BSP, ndc, hdmc, psc, PHD, Principal Staff Officer, Armed Forces Division

H.E. Michael Miller , Ambassador of Delegation of European Union

Photos of Training Activities DSCSC 2025

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Exercise Shomudro Jatra (Navy Wg)

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