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Incorporation of Viable Fiber Optics Network with Military Communication Structures: An Analysis in Emergent Nations

Md Mostafizur Rahman

Army IT Support Organization.Dhaka, Bangladesh.
Khan.miraz@gmail.com

ABSTRACT

The categorize operational communication resources used by military or even law enforcement agencies are suffering from frequent disruption due to varied environmental and topological factors. Nowadays, the armed forces of developed nations are exhaustively using wide-ranging satellite-based military communication systems. The developing nations are lagging in these regards. However, to keep pace with the ongoing evolution in commercial telecommunication sectors, most of the developing nations like Myanmar, Bangladesh, Pakistan etcetera have structured a steady fiber optics backbone across the country. This steady communication backbone can be integrated with a military communication system to augment operational communication efficacy to a greater extend. The objective of this research is to identify the possibilities and challenges of integrating nationwide fiber optics infrastructure with a military communication system to boost up the operational communication capabilities to a substantial level. In the order of discussion, both qualitative and quantitative analyses have been carried out. Varied online resources, government publications, administrative census were consulted as primary and secondary data sources. The accumulated data are presented on tables having a mixture of univariate and bivariate analyses. Graphical representations are also made using various forms of charts as foundsuitable.

Keywords: Fiber Optics Network, Operational Communication System, Communication security and Integration

INTRODUCTION

1. Control of the battle has always been considered as the prime concern of commanders down the ages. Among the opposing forces, the commander who could demonstrate better control over his forces won the battle. In ancient times, when the armies were relatively small and the expansion of operation areas was limited, the emissaries on foot or horseback sufficed. With time the battlefields stretched out and the size of the armies amplified exponentially, therefore, such means we're no longer enough. These changes in the battlefield drove the evolution of communication which is considered the best outcome of technological progress through the ages. A silent revolution has been taken place in the field of communication in the last few decades. In the recent past, most of the armies of developing nations have carried out significant restructurings in their military communication system, even though many limitations are still prevailing in terms of technology, infrastructure, advanced capability, and sustainability to suffice ever-growing multidimensional communicationrequirements.

2. Fiber optics network is a gargantuan network consisting of billions of kilometers of optical fibers that underpins today's high-tech telecommunications [1]. The hair-thin glass fibers transmitting voice and data in form of laser light is now considering as the most desired option for long-distance commercial communication With the flourishment of the commercial telecommunication sector across the globe, most of the developing countries are developing fiber optics networks across the length and breadth of an entire country like a web. John Ballato, a materials scientist at Clemson University said "Nearly 500 million km of optical fibers are made per year, and hardly anyone realizes that today's modern conveniences wouldn't exist without them," [2]. The attributes of fiber optics communication system more significantly in possession of tenacious immunity to electromagnetic interference, the capability of spanning over long distances without using repeater stations, negligible transmission loss, and relatively secure from eavesdropping, have made them more desirable for military use. Proper exploration and integration of this resource are likely to boost up the ability to maintain an effective combat communication system during peace and wartime. Such integration would also provide reliability and redundancy in a military communication system as well.

2.Conceptual Framework/Methodology

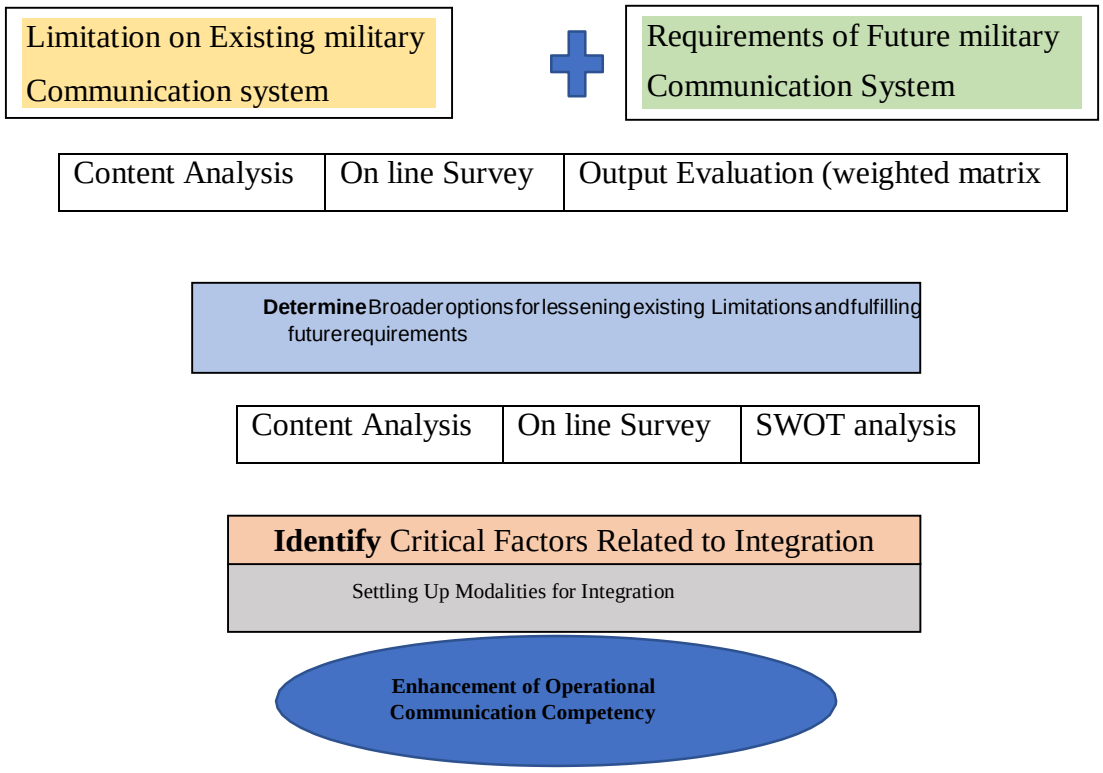


Figure-1: Conceptual framework of the paper Source: Author's self-construct

3. Limitation of Hackneyed Operational Communication System

The conventional combat communication system of developing countries is mostly dependent on radio communication comprising of High Frequency, Very High Frequency, and handheld Ultra High- Frequency radio nets and line of sight communication types of equipment. HF radios are propagating through skywaves and cover a wider range; therefore, they are commonly used to establish communication within headquarters at a different level. Ultra-High Frequency and Very High-Frequency radios are used for short-distance communication (5-8 miles). They are normally used for maintaining communication within proximity of the active conflicting area. All these radio nets are highly susceptible to multifarious enemy Electronic Warfare (EW) activates more significantly from interference, jamming, deception, disclosing own location.

3.1. Survey

A survey has been carried out to examine the actual performance of Very High-Frequency radio sets on the ground. Seven basic parameters have been considered in this regard. These are Real-time communication range (on static and mobile), Voice quality, Data transmission capability, Performance under adverse weather and terrain conditions, Communication security Encryption facilities, and Availability of resources at the unit level to perform operational duties. A total of 25 responders of different countries (serving in United Nations Peacekeeping Operations) gave general opinion through google form both for High Frequency and Very High-Frequency radio communicationsystems.

3.2. Objective of the Survey

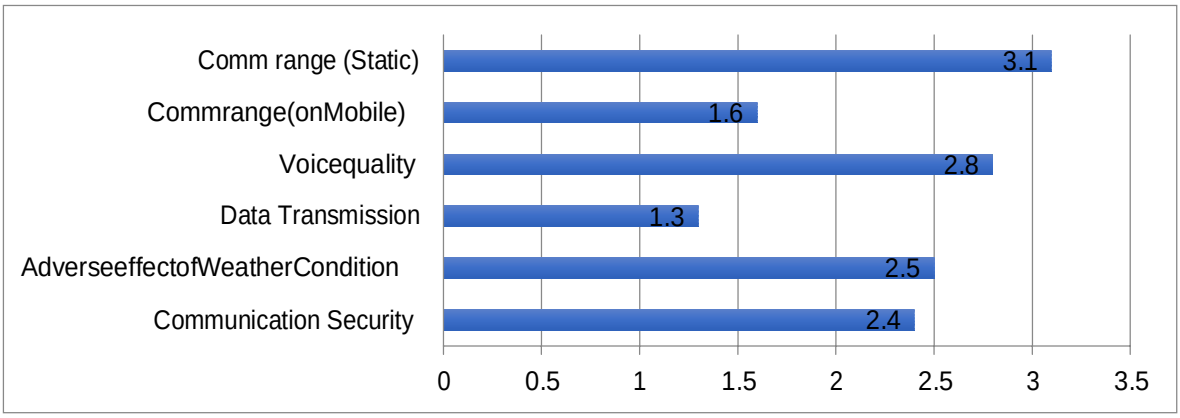
To identify the effectively of Very High Frequency and High-Frequency radio communication in the field

3.3. Assumption

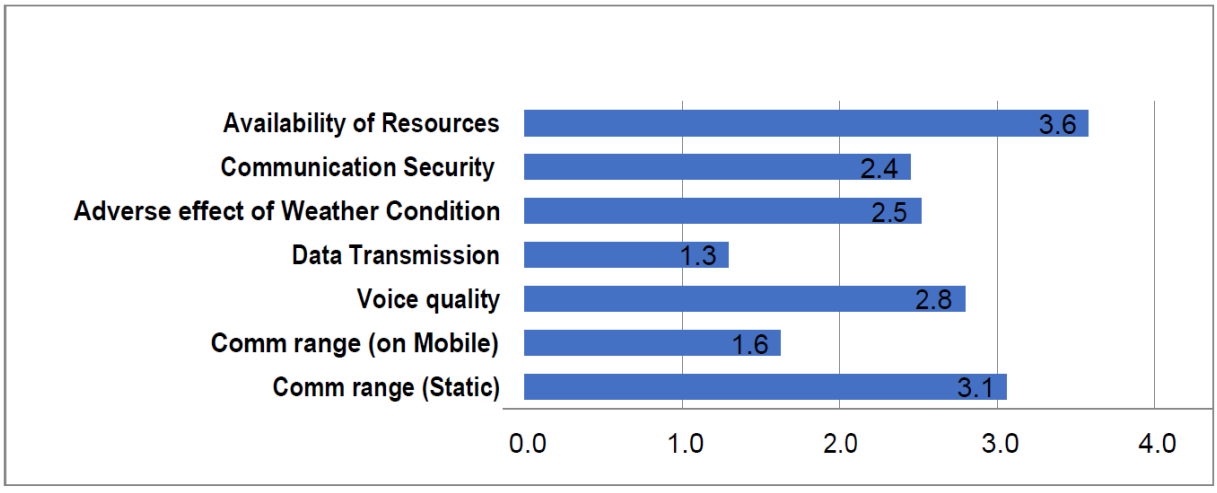
Basing on theory and document study, it is assumed that voice quality and communication range will be good for Very High-Frequency communication. On the other hand, High-Frequency communication suffers from atmospheric effects. Moreover, High-Frequency communication is highly susceptible to interference and EW activities. Therefore, it is assumed that voice quality, and communication range(on mobile), and d data transmission capability will be very poor for High-Frequency radiocommunication.

3.4. Survey Outputs

A summarized result on the above-stated factors has been brought out by using a weighted matrix [Very good (VG): 5 marks, Good (VG): 4 marks, Workable (W): 3marks, Poor (P): 2 marks, Very Poor (VP): 1 marks). Assumptions tally with the survey outputs. Both for VHF and HF radio communication, it shows that resource availability, Communication range (static), and voice quality falls within workable to good range (3.0-4.0). Communication range (on mobile), Communication security, data transmission falls within poor to workable (2.0-2.9). Details are illustrated in Graph 1 and 2respectively.



Graph:1 Analysis on varied Factors of Radio Communication (VHF) Source: Author'sself-construct



Graph-2. Analysis on varied Factors of Radio Communication (VHF) Source: Author'sself-construct

Microwave (MW) or short distance MW communication equipment are extensively using in combat communication which is extremely directional, point to point, Line of Sight (LOS) communication working in Ultra High-Frequency band frequencies. This system can effectively transmit and receive a huge volume of voice and data traffic. A single loop of RR can cover 25 to 30 km distance basing on- ground configuration. Its range of communication can be extended up to 200 km using a repeater

station in between. This communication means is mostly secure and free from hostile Electronic Warfare activities. The griming feature of this communication system is the inconsistency of the network. The entire network will be ineffective if a single loop has become out of order. In a conventional line communication system, the use of copper or coaxial cable creates more loop resistance thus incompetent to cover the desired distance (more than 15 km)

From content analysis through varied online resources following limitations are identified in stereotyped operational communication systems more or less prevailing in most of the armed forces of developing nations:

- Lack of alternate means of communication in active combat zones
- Lack of Electronic Warfare (EW) capability and active Electronic Counter Measures (ECM)measures
- Lack of adequate field repair and maintenance facilities.
- Lack of reliability and communication security.
- Lack of sustainability under hostile environment.

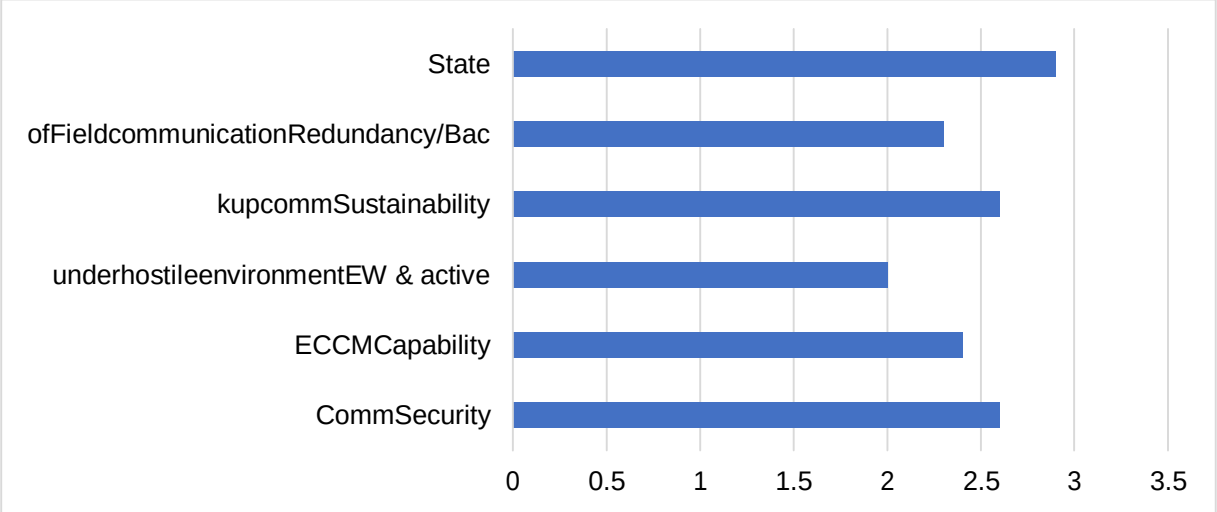
In addition, a survey has been carried out to identify the general limitations prevailing in the concurrent emblematic operational communication system of developing countries. Some fundamental issues have been considered in this regard. Details of the survey are appendedbelow:

4. Objective of this Question

To identify the actual state of operational communication systems prevailing in most of the developing nations.

4.1 Assumption

Conventional military communication system suffers from various limitations. Most of the developing countries are not in possession of apposite active Electronic Counter Measures capability. Moreover, field units deployed in the front line of combat zones have inadequate alternative means of comm. Repair and maintenance facility in the field is also very limited. Details are illustrated in Graph-3 stated below:



Graph-3: Generalize limitations in Operational Communication System Source: Author's self-construct

4.2 Survey Outputs

Assumptions tally with the survey outputs. The overall rating of all limiting factors falls within the poor range (2.0-2.9)

5. Broader Options for Lessening the Limitations of Existing Operational Communication System

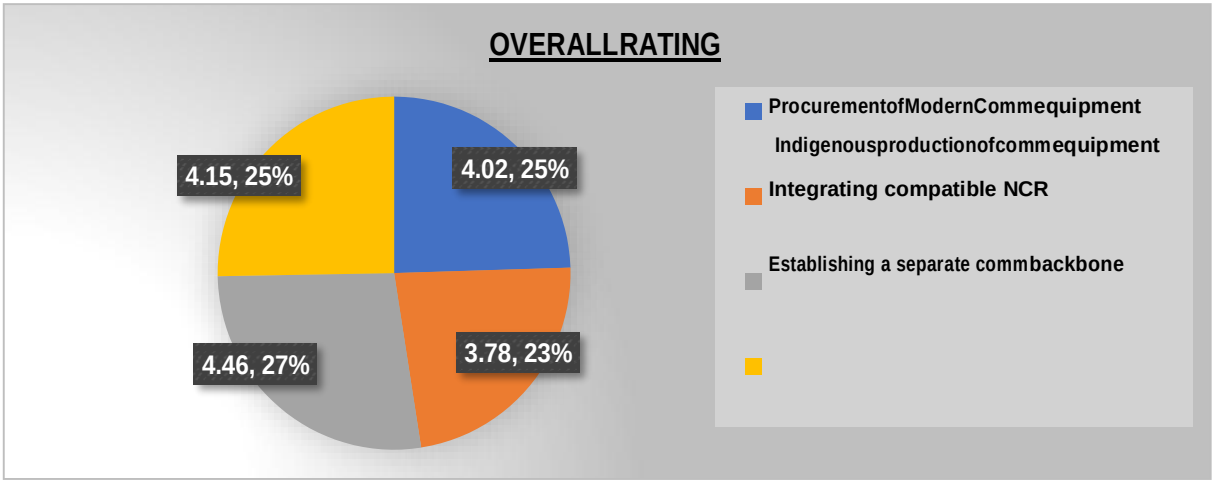
5. The limitations of a hackneyed operational communication system cannot be minimized within a short period. Long-term efforts need to be taken which include: developing infrastructural facilities, the inception of communication security and Electronic Warfare capabilities, organizational restructuring basing on present requirements and future trends of battlefield environments. Moreover, the interoperability issue of varied communication means needs to be minimized to establish a reliable integrated military communication framework. A survey has been carried out to identify the broad options for overcoming the limitations prevailing in a present military communication system. Four probable ways out have been considered in this regard statedbelow:

5.1. Refurbishment of an entire military communication system with the inception of the latest communication technology at a largescale.

5.2. Indigenous production of communication equipment under Technology Transfer (ToT) from developednations.

5.3. Integration of available National Communication Resources (NCRs) more significantly nationwide commercial fiber optics network with the existing military communicationsystem.

5.4. Establishing a separate communication backbone for the military. The survey result is illustrated in Graph-4 below. The summarized result on the above-stated factors has been brought out by using a weighted matrix [as mentioned in para 7(d) of this paper.] The survey analysis is shownbelow:



Graph-4: Broader Options for Lessening the Limitations of Existing Operational Communication System Source: Author's self-construct

6. Survey Analysis

6.1. Assumption

In recent times, government and commercial telecommunication agencies of most of the developing nations have flourished nationwide fiber optics networks. Therefore, converging these resources in the existing military communication system through developing apposite policy and formulating an implementable modus operandi is likely to be the most preferred option.

6.2. Survey Outputs

Assumptions tally with the survey outputs. 46% of responders have opined that integration of Fiber Optics (FO) networks with existing military communication systems will lessen existing limitations of military communication systems to a greater extent which entails less cost and effort. Refurbishment of an entire military communication system (25%) with the inception of the latest technology is certainly the best option. However, it will entail an immeasurable investment, and a developing country like Myanmar or Sri Lanka cannot withstand that expenditure.

7. The perspective of Future Operational Communication System

7.1 Future War Scenario

Future warfare will be heterogeneous warfare in form of Asymmetric war, proxy war, Hybrid war, Network- centric cyberwar. Since future warfare will be short, intense, and joint, therefore, it demands the availability of secure integrated communication means. In the multifarious battlefield environments, modern technology will play a pivotal role to decree the terms of war. Since the army will not be able to fight the battle alone, therefore, it is a paramount stipulation/requirement to integrate all available NCRs under one unified platform.

7.2 Trend of Future Integrated Communication Network: With the chronological progression of science and technology, the trend of modern communication is changing. To keep pace with upcoming technological advancements, the traditional concept of communication should be changed as follows:

7.3 Communication backbone of armed forces or may not be essentially placed near to the deployment areas. Rather, communication will be stretched directly to persons irrespective of their physical location through unswerving portable communication means like SAT Phone, BGAN,etcetera.

7.4 Operational forces should in possession of numerous alternate options to maintain effective rearward communication with respectiveheadquarters.

7.5 Operational communication system needs to be amplified with enormous redundancy and with a good number of alternatemeans.

7.6 Recognition, detection, and identification of media transmission will be quite challenging. When electromagnetic radiation is detected that will disclose most of theintelligence.

8. Available Communication Means To Augment Future Communication Platform

Following communication means should be utilized at an optimal level to augment future communication:

8.1 **Microwave Communication (MW)**

MW saves the cost of establishing a physical cable network. It is less susceptible to weather, power failure and, hostile EW threat (Jamming, interception) MW is of the following categories:

8.1.1 StaticMW

Static MW is generally mounted to form the static network. Although Though Static MW is more susceptible to easy detection it can transmit and receive a huge volume of voice and data. Lack of mobility is another substantial dark side for effective use in a combat communicationsystem.

8.1.2 Portable MW

Portable MW was very light, flexible, and provide a secure means of communication with enormous benefits. Therefore, it (MW) is likely to preserve its efficacy in future militarycommunications.

8.2 **Fiber Optic (FO) Communication**

Fiber Optics network is rapidly unfolding across the globe. It is considered the most unswerving, steadfast, and robust means of communication, It can transmit the highest volume of traffic with less operating cost. In most of the developing countries, the FO network will continue to expand, in both public and private sectors, and will gradually replace many existing microwaves (MW) links

8.3 **Satellite**

Presently, most of the military communication system of developed is satellite network-based. Some of the developing countries start using satellite-based military communication systems. However, extensive use of this sort of communication at the field level is more likely to be impracticable, more significantly for those countries who are not in possession of their apposite military satellite.

9.SWOT Analysis

A SWOT analysis has been carried out to identify the opportunities and challenges of integrating the FO communication network with the existing military communication system. Details are appendedbelow:

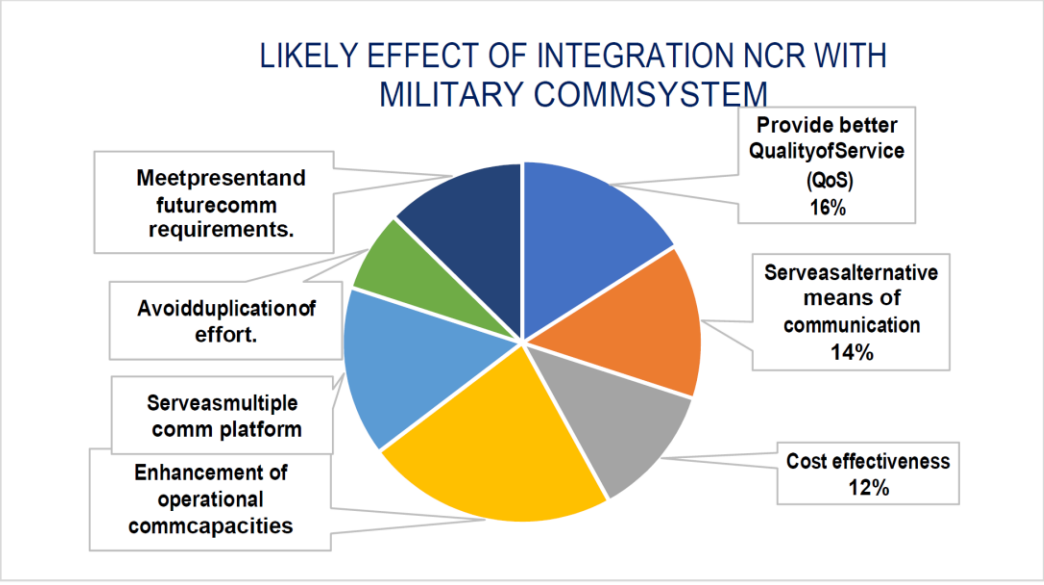
Table: 1 SWOT Analysis on Feasibility (Opportunity and Challenges) of integrating Fiber Optics Network

S	1. Available resources (Countrywide extended network) 2. High data and voicetransmission 3. Negligible transmission loss(below1%) 4. Free from EW threat and atmosphericeffect. 5. Can be used as a multiple communication platforms	**W**	1. Wiredcommunication 2. Require hi-level technicalexpertise 3. Availability of appropriate interfacingdevices.
O	1. Network expansion opportunity up tofield level 2. Establish a good no of alternate communication network	**T**	1. Issues in respect of overall network maintenance and management. 2. Communication security

Source: Author's self-construct

10ADVANTAGES OF INTEGRATION

Integration will save cost significantly in comparison to other preferred options as discussed in (Para x of this paper). A Survey has been carried out to examine the overall effect of integrating the Fiber Optics network with an existing military communication system. Seven more likely effects have been considered (as stated below) in this regard. The survey analysis is appended in Graph-5below:



Graph-5: Advantages of integration Source: Author's self-construct

11. Critical Factors Related To Integration

The factors related to integration are illustratedbelow:

11.1 **Compatibility**

The primary requirements for integration are compatibility and interoperability. The equipment used for integration must be compatible with each other.

11.2 **Co-ordination**

The integration process demands the involvement of all government and commercial NTTN agencies in the same platform. Therefore, coordination between all relevant stockholders will be of utmost importance.

11.3 **Frequencymanagement**

For frequency management following issues need to be dissolved:

11.3.1 Determining the frequency needs before moving into the operationalarea.

15.3.2 Resolving the interference problems between the agencies.

11.4 **Communication security**

Communication security is of paramount importance for a military-owned communication system. Therefore, the major challenge of integrated communication is to safeguard communication security. Here, Communication security comprises of important aspects: Transmission security, Emissions security, and Physicalsecurity.

11.5 **OtherRequirements**

For carrying out an effective integration process, the following prerequisites are needed to be considered:

11.5.1 Planning and operating stages must to harmonious, if not,identical.

11.5.2 Technical parameters must be standardized. This will enhance interface capability and ensure service quality to thesubscribers.

11.5.3 Joint training is an urgent necessity for operators and maintenance personnel to employ different equipment.

12. MODALITIES OF INTEGRATION

Integration for an org like the army demands special consideration and a sometimes special type of networking setting is required as well. Tracing back the current communication system of BD Army this integration may be of "dedicated channel method" or "free channel method". Briefly, these systems are discussedbelow:

12.1 **Dedicated Channel method**

In this type of communication, the link will be established through several dedicated channels/cores of optical fiber.

12.1.1 Advantage.

12.1.1.1 Communication gateway will be available for specific geographical areas.

12.1.1.2 .Some channels may be made free for datacomm.

12.1.1.3. Assist in forming up an independent network

12.1.1.4. Ensure more security and reliability.

12.1.2 Disadvantage.

12.1.2.1 Require more channels to establish networks. 16.1.2.2More involvement ofcost.

12.2 **Free Channel Method**

This type of communication link can be established through some channels basing on the availability of the entire link.

12.2.1 Advantage.

12.2.1.1 Requires fewer channels to form thenetwork. 16.2.1.2.Less costinvolved.

12.2.2 Disadvantage.

12.2.2.1 Gateway may not be available all the time. 16.2.2.2Data communication may not besuitable.

12.3 **Proposed Method**

Analyzing the advantages and disadvantages from above it will be preferable to adopt a dedicated channel method keeping a view of the following:

12.3.1 Unnecessary channels will not beengaged.

12.3.2 Communication security will be ensured at the desiredlevel.

12.3.3 Hi-speed data transmission will bepossible.

12.3.4 Computer networks and also visual channels can be integrated with this communicationsystem.

SUGGESTED ACTION PLAN

13 Like other countries in the world, the BD army needs to adopt the Communication Switching Center concept. Integration of endpoint equipment and availability of access points in the area of operation will be a great challenge.

13.1Formulating a Policy

For most developing countries, It is an utmost requirement to formulate a feasible and sustainable policy, covering all relevant issues of sharing or integrating NCR during an emergency. A proper guideline is to be given at the topmost level of all agencies with appropriate directives.

13.2 Maintaining up to Date Information

Concern authorities dealing with military communication need to maintain a central database of available Fiber optics networks including every possible detail (ie Location of Nodal points, Detail cable diagram, state of internal usage, etc) as per the geographical area.

13.3 Enhancing Professionalism

Incessant/continuous effort should be carried out to develop required technical skills and enhance the professionalism of communicators. It has been observed that there is a serious lack of technical know-how in handling the latest sophisticated communication equipment. Improved technical knowledge will contribute to smooth planning and integratingprocesses.

13.4 Integrated Effort by RelatedAgencies

Technical development process undertaken by different communication service provider organizations need be harmonized with others, should not be a stand-alone effort. In a broader framework, if this integrated approach can be envisaged with national communication agencies, it will further

economize individual efforts, augment communication capabilities and reduce infrastructural cost significantly.

13.5 Ensuring Security Up-gradation of NCRs

Essential measures to be taken to ensure appropriate security classification-specific NCRs being integrated. Otherwise, if this information is revealed to the adversary intentionally or unintentionally, then these vital assets are likely to be the first targets of an enemy air raid. Therefore, it will be very difficult to use these resources during a crisis unless appropriate measures are being taken to ensure security.

CONCLUSION

"Technology is a gift of God. After the gift of life, it is perhaps the greatest of God's gifts. It is the mother of civilization, of arts and science"
- Freeman Dyson

At present modern world is undergoing a new wave of revaluation. Technology is considering the foremost torrential strength in this revaluation and the supreme gift of technology is comm. No army in the world can even think of instigating a campaign without an impermeable, effective, and versatile communication system. An effective communication system gives flexibility to commanders at all levels and allowing them to harmonize with all echelons of command and thereby comport the operation as planned. The strategic gain, tactical skill, planning insight will be of little avail if these are not backed by reliable communication. Commanders at present time like to monitor the entire battlefield scenario sitting from their command post, want to examine the situation in digital means, and disseminate their command to ground commanders at the quickest possible time. This requirement demands the expansion of an apposite communication system right from the HQ held in the rear down to the forward areas where troops are in contact with theenemy.

In a calamitous battlefield environment, a modern army or even the entire Armed forces would not be capable of maintaining an uninterrupted flow of communication alone without the assistance of other national organizations and commercial agencies. Therefore, to fulfill the challenges and requirements of future communication, most of the technologically advanced armies of the world have incorporated their NCR more significantly fiber optics network with conventional military communication systems besides innovating the latest communication equipment. Through this thesis paper, an endeavor has been made to examine and explore the possibilities and challenges of integrating nationwide fiber optics networks with an existing military communication system to enhance operation communication competencies to a significant level. Moreover, the study also leads to identifying some viable operational modalities for integration, which are conducive for uninterrupted, reliable, and secured communicationmeans.

REFERENCES

1) Hossain, Z.,2004. Establishment of Common Comm Backbone for Military. Mirpur Paper, 1(32), pp. 33-39.
2) Islam, MT.,2011. Integration of Commercial Comm Resources to Augment MilitaryComms
3) Choudhury, A.R,2016. Integration of Non-Military and Commercial Facilities Towards Enhanced Comm for ArmedForces.
4) Mohiuddin, P.S.,2011. Integration of Cellular Phone Technology to Enhance Effectiveness of Existing Operational CommSystem
5) Joint Publication 6-0, Joint Comms System. 2 ed. Arlington, Virginia: Department of Defence,USA.
6) Fiber@Home, 2014. About Us. [Online] Available at:http://www.fiberathome.net