CLAWS SEMINAR REPORT

NATIONAL SEMINAR

BIG DATA - APPLICABILITY IN THE DEFENCE FORCES

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The Centre for Land Warfare Studies (CLAWS), New Delhi, is an autonomous think tank dealing with contemporary issues of national security and conceptual aspects of land warfare, including conventional and sub-conventional conflicts and terrorism. CLAWS conducts research that is futuristic in outlook and policy-oriented in approach.

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CONTENTS

Chapter No		Title	Page Number
		Outcome Statement	4
		Future Scope of Work	8
		Road Map	9
1		**INTRODUCTION**	
	1.1	Introduction	10
	1.2	Data Deluge in the Defence Forces	10
	1.3	Big Data Analytics – A Solution	11
	1.4	Seminar on Big Data – A Turning Point	13
	1.5	Seminar Objective	13
	1.6	Programme Agenda	14
2		**SESSIONS**	
	2.1	Inaugural Address	16
	2.2	Keynote Address	17
	2.3	Session I : Result and Discussion	19
	2.4	Session II : Result and Discussion	23
	2.5	Session III :Result and Discussion	27
	2.6	Valedictory Address	32
3		**MISCELLANEOUS**	
	3.1	Abbreviations	34
	3.2	Conclusion	35

OUTCOME STATEMENT

Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road.

– Stewart Brand

Big Data analytics is an asset that potentially can offer tremendous value or reward to the data owner, and it poses tremendous challenges not only due to its volume and velocity of being generated, but also its variety (variety means the data collected from various sources and can have different formats from structured data to unstructured data) and veracity (veracity concerns the trustworthiness of the data as the various data sources can have different reliability). Defence and security forces will face information overload when projects under various stages of development are inducted under Operational Information Systems (OIS) and Logistic Management Systems (LMS) and as and when new systems are added with evolution in military affairs.

Lt Gen Philip Campose the Vice Chief of Army Staff inaugurating the seminar was of the opinion that asymmetric threats may make the "...weaker adversaries to take on means that were revolutionary to level the mismatch...." He elaborated that technologies like Big Data Analytics which is a recent development have intervened into a situation where war or battles can be won without addressing the core military adversaries, such as the banking system, communication systems and various systems like electricity and water are vulnerable targets and can in effect make a country come down on its knees. Thus in that context, he claimed seminars on niche technologies like this become very important to educate the military leadership and the future generation of officers to make them understand the tools available to be used in upcoming scenarios/realms/threats of warfare.

Lt Gen KJ Singh the Western Army Commander delivering the keynote address said dwelling into Big Data Analytics is a major leap and at the same time, people in defence forces will have to be made aware of big data and trained in the skill sets required for its use. He suggested that while developing the platforms for the technology, "*one solution fits all*" approach should be avoided and the architecture must be kept flexible as the ground situations vary and are continuously subject to change. With technology available it will be prudent to exploit it to our advantage so that we are future ready.

The inaugural seminar on big data for defence and security forces **"Big Data-Applicability in the Defence Forces"** was held at Manekshaw Centre on 18 Feb 15. Supported by Microsoft, CISCO and ORACLE, the event saw a day full of engrossing debate, capturing the perspectives of experts from the

user community, industry, academia and the Ministries. The participants were from the Three Services, Strategic Community, Veterans, Media, Industry, Ministries of Defence, Home, Science and Technology, Consultants, R&D Organisations and ICT academia

The key conclusions from the discussion:-

"Make in India" Initiatives

- **Creation of a Centre of Excellance with a Chair** for taking ahead the Big Data initiative started by CLAWS for the Defence Forces. Details to be worked out in consultation with DST.

- **Integration and analysis of unstructured data** from multiple sources is still a challenge and Defence Forces should engage with the industry, think tank and academia at the earliest to resolve this issue.

- **Analytics know how must be indigenous.** Partnership between R&D, think tanks, academic organisations and user agency can generate analytics know how. Industry can partner as a translation agency.

Sector Identification for Implementation of Big Data Applications in Defence Forces

- **Intelligence and Surveillance.** Seamless Integration of Strategic Intelligence with Operational and Tactical Intelligence across Defence Services and other Agencies can be made feasible using Big Data analytics. Areas of Signal Intelligence, Cyber Intelligence and intelligence from Social Media platforms can be integrated with operational and tactical platforms/sensors thus providing actionable intelligence to troops on ground and value inputs to decision makers to timely deploy resources and take corrective actions.

- **Border, Maritime and Space Management.** Better management of Land Borders, Maritime Security and Space Vigilance can be achieved by having Terrain/Traffic/Asset Analytical Layer on Digital/Raster Maps. It will act as a useful tool in formulating plans and promote better inter services and inert-ministry coordination.

- **Operational Planning.** For conventional and sub-conventional conflicts the tools available for Border, Maritime and Space Management can be dove tailed into operational planning matrix to enable better decision support tools to the planners as visualisation platforms with real/ near real time situational/ operational picture.

- **Logistics Management.** It will revolutionise the Supply Chain Management system by creating diagnostic tools for Fleet / Equipment Management, Ammunition Management (manufacturing – storage – replenishment), inventory visibility of material, supplies and FOL by appling analytics on the ERP outputs. Big data analytic tools will help in Health Care management for both serving and retired soldiers.

- **Fiscal and Financial Management**. Creating compatible management solutions linked with procurement, acquisition and financial allocation will help in better analysis and fiscal and financial prudence across all departments and ministry by use of forecast and simulation tools of big data analytics.

- **Disaster Management**. Big Data Applications for Disaster Management will enable predictive modelling and preventive prescription. Post disaster, damage assessment in scale and financial terms, and rescue cum movement of relief can be analysed from big data based.

- **Future Technologies**. Future of cyber and unmanned system will put data strain on the existing system, hence data analytic tools need to be based on future technologies for better absorption in the defence forces.

- **Cognative Analytics**. Cognitive analytics with behaviour prediction will be a essential tool required by the Defence Forces for higher level decision makers.

- **Analysis of Archival Data**. Historical data can give insights into the future hence analytics should be applied into the huge archive with the defence forces .

Skill Set Development

- This being new science there is a need for skill mapping and capability development within defence forces through systematic training curricula.

- The training institutes of the Defence Forces should introduce data analytics curriculm like Analytically Enabled Combat Management Systems Course which will have modules like Cross Warfare Optimisation, Improving Situational Awareness with Big Data Applications and Prediction & Forecasting.

- Training on Big Data Analytics to be started from this training cycle in an incremental fashion.

Big Data Analytics Awareness & Exploitation

- For the uniformed persons Big Data Analytics is a relatively new technology, earliest exposure would be advantageous.

- We should learn from our past experience of projects, which were implemented but did not meet the user aspirations, these should be factored in when formulating the Big Data initiatives for the Defence Forces

- Big Data visualisation tools for better asset visibility for future wars

- Future focus will be on insights and not on information. While developing Big Data Analytics following issues are important :-
  - Operational Efficiency and Performance Monitoring. Work parameters and evaluation standards can be created by using Data Science to access operational efficiency and help in improving performance.
  - Ease of Access. Big Data Applications to be available to users as a service over captive cloud of Defence Forces.
  - Security Protocols. Big Data Applications which can raise flags in the system even if there is small departure from the given patterns.

First Mover Advantage

- Our adversaries are also advancing in this field and we need to respond to that
- Big Data Road Map to gain the First Mover Advantage.

Security and Ethics

- Urgency for implementing Big Data Analytics should not lead to compromise of data security
- Caution against use of Big Data Analytics without defining ethics.
- Few challenges that need to be addressed in the Data Eco System Research identified as Privacy, Ethical Aspects, Technical, Risk, Thrust and Valuation.

To quote Lt Gen Anil Bhalla, DGDIA and DCIDS (Int), "Knowledge of the mechanics and details of big data analytics are not only important to exploit it but also to collapse the distances between policy, planning and operations." This seminar, "Big Data – Applicability in the Defence Forces" is a first step in the Big Data initiative by the Defence and Security Forces. It was an attempt to discuss, discover and understand contours of Big Data strategy to be adopted by the forces by bringing together all the stakeholders.

Lt Gen B S Nagal, PVSM, AVSM, SM (Retd)
Director
CLAWS

FUTURE SCOPE OF WORK

1. **Creation of Centre of Excellence for Big Data Initiatives with a Chair.** There is need to create a Centre of Excellence under the Department of Science & Technology (DST) umbrella that looks only at the defence forces and their requirements. DST has the mandate for the same as per Government of India's recently announced Big Data Initiatives. The objective of the DST programme is to connect all the verticals of the Government. DST can act as an enabler for the Centre of Excellence but its mandate needs to be defined. Regarding the defence establishments, there is the issue of sanitisation of excellence centres in terms of data and tools. The academicians do not have experience of their own. There are institutes under DST that are willing to setup such centres. The scope can be further enhanced by adding a Chair of Excellence to be funded by DST. The chair can be held by an Army Officer at CLAWS so that the expertise gained by CLAWS can be harnessed to facilitate phased implementation of Big Data projects in the Defence Forces.

2. **Setting up Protocol for Sharing of Simulated Data and Signing Non Disclosure Agreements.** Defence forces cannot share data with the academic institutions due to its sensitivity. However, there can be simulated data on which the R&D institutes are ready to prove their concepts. This can be done by removing the sensitive parts of the data while maintaining its structure and pattern. Based on that data, applications can be developed by institutes like IIT Delhi who have shown their willingness that can then be used to create awareness about big data. If a protocol can be developed inside the defence organisations to remove the sensitive information from the data, then the academia can work on these along with a non-disclosure agreement. This will help not only timely adaptation of technology like Big Data by the defence forces but many projects currently and in the future can also see intervention by the experts.

3. **Organise Round Tables with Defence Forces for Development of Visualisation Tools.** Few visualisation tools using Big Data analytics will need to be developed as a proof of concept to be used by Operations, Intelligence and Logistic branches in Defence Forces. Round table will be organised with Defence Forces, think tank, academia and industry for furtherance of this scope in terms of identification of application and methods of implementation.

4. **Big Data Training.** Being a new science not many are aware of Big Data application and relative edge we can have over our adversary if we have an analytical platform with trained persons to man it. Training of personnel can be undertaken under the aegis of appropriate branch at Army HQ.

5. **Policy Formulation.** Industry and Academia have come up with various suggestions to assist the Defence and Security Forces in their Big Data Initiatives. There is a need for a Round Table with Military Operations, Military Intelligence and Information Security & Technology Directorates to formulate policies to approach Academia and Industry after addressing the organisational imperatives. CLAWS as a Think Tank can help in promoting such an effort.

ROAD MAP

Defence Forces will have to communicate to the industry the exact requirement of the forces in terms of Big Data Analytics which as a joint venture between the industry, the academia, Government and the user group can be produced. Creation of model or institution to translate user requirement to the industry will be the first major step in this direction. This model or institution can then work to create an implementable model of Big Data Analytics so that the helix that is academia, the industry and the Government can come together and work for a Big Data eco system for the security of the country. Security being a major thrust area for the Department of Science and Technology (DST), their suggestion to Ministry of Defence to create a Centre of Excellence to allow DST to support this activity will be taken up in all earnest.

A perceived Road Map is delineated below:-

1. **Stage 1** In house Policy Formulation Round Table to include MO, MI and IS & T Directorates to discuss the organisational imperatives and outcome of this seminar in terms of proposals from DST, IIT Delhi and Industry.

2. **Stage 2** Organise training on Big Data Analytics under the aegis of appropriate branch at Army HQ for a batch of 20 persons at the earliest who can in turn assist various formations in creation of visualisation tools as per their requirement.

3. **Stage 3** Establishment of a Centre of Excellence for Big Data Initiatives at CLAWS with encompassing representation from industry and academia so that the exact requirement of applications to be developed can be conveyed to the developers.

4. **Stage 4** Establishment of Sub Centre at Command Headquarters with assistance of CLAWS to identify user requirement for application development. Presentation of proposal at the Army Commanders' Conference.

5. **Stage 5** Organise Round Table with stakeholders from Operations, Intelligenceand Logistic branch to formalise development of visualisation tools as PoC for testing usefulness of Big Data Applications.

6. **Stage 6** Formulate protocols in consultation with Army Cyber Group and Signal Dte for sharing of data with institutions like IIT Delhi who are ready to develop applications after removing sensitive information from defence related data with non disclosure agreement.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Every day, we create 2.5 quintillion bytes(one quintillion bytes = one billion gigabytes) of data — so much that 90% of the data in the world today has been created in the last two years alone. This data comes from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cell phone GPS signals to name a few. This data is **big data.** Big Data analytics has brought a big opportunity for organizations. Companies capture trillions of bytes of information about their customers, suppliers, and operations. IT organizations are exploring the analytics technologies to explore web-based data sources and extract value from the social networking boom. In the western world, organizations are wondering about the kind of business intelligence they could derive from all the information they have at their disposal. The organizations are trying to leverage Big Data by trying to make sense from the data that they have and by securing it. Already the forward thinking players of the banking, insurance, manufacturing, retail, wholesale, health care, communications, transportation, construction, utilities, and education are successfully using big data by exploiting meaningful information from all the Data they have and using those information in formulating their strategic moves. Those companies who will be able to use Big Data successfully will be clearly ahead of those who will react slowly to capitalize on Big Data.

In the case of defence and security forces, data from intelligence systems across the entire spectrum of intelligence gathering for external adversaries and proxy war/ terrorism/ insurgency/ militancy, space intelligence/ surveillance/ reconnaissance, environment of the three armed services during peace and war, information from peace and war operations, analysis of cyber attacks, misuse of social media by inimical forces, data from the print and electronic media, data from archives, and OIS, LIS Projects planned and under implementation and its MIS will constitute the big data which will have to be analysed to gain meaningful insights into it. This will then have to be disseminated in a faster time frame to the commanders for decision-making and action. Information supremacy gained over the adversary this way will be very important factor in all types of future engagement.

1.2 Data Overload in Defence and Security Forces

In the next three to five years, there will be huge data sets with the defence and security forces, which will have to be analysed to gain insights from it. The advent of technologies such as software and hardware that instantly analyzes natural human language, and massive amounts and varieties of big data flowing

from sensors, mobile devices, and the Web, will help them find answers to questions like, "What is the enemies intent" or "How is his preparation" or "Why are our veterans suffering from a particular life style disease at a particular place?"Big Data systems literally sift through the data and identify patterns and trends on the fly, then present them in a way that's easy for people to understand. Trends can then be fed back into systems for further analysis that allow for new kinds of questions to be asked.

1.3 Big Data Analytics – A Solution

National security and Defence related data being generated from multiple sources would have to be fully analysed for national decision-making, military operations and better situational awareness in future, especially at the national and joint services level. From an operational perspective, "bigger picture" will be required for optimal resource deployment, leading to successful operations. As per in house R&D at CLAWS following stakeholders have been identified who will be benefitted by Big Data Applications in enhancing their overall productivity:-

(a) **Intelligence**. Inputs for national and military intelligence are obtained continuously during peace and war, the quantum increasing exponentially during crisis and war. Human analysis of this information and intelligence data is well beyond physical capability; therefore Big Data analytics will provide requisite output for decision making and conduct of operations. During peace terrorism/ proxy war/ left wing extremism/ conduct of training by opponents/ deployment of forces/ sponsoring of non state actors are a few examples of inputs likely to be received and analysed. Conversion of satellite data and technical encrypted intercepts require special tools which will be provided by big data analytics. Algorithms can be developed to analyse hundreds of thousands of open-source documents generated each hour and compare them with the human intelligence gathered and billions of historical events and then have predictive capability to anticipating specific incidents and suggest measures proactively. The information about a suspicious person can be queried with big data tools on social networks, shopping sites, and entertainment sites, and from the web logs of the search carried out in the net and the actions can be taken

(b) **Operations**. Network centric warfare, manoeuvre warfare, counter terror operations, counter-insurgency operations and covert operations all stand to gain from big data analytics by offering options and permutation/ combinations to decision makers to firm on plans and strategies. Big data can combine multiple data sources in the same view with dashboard like applications in real time. It can show where of the data through smart mapping. Scope for predictive analytics and forecasting can overcome operational challenges in real time. Ground, air, sea and strategic forces will be assisted in conduct of their operations

(c) **Logistics**. Future war will require rapid and fast move of forces with limited time for completion of operations to beat enemy reaction. Matching logistic movement and advance

placement of critical ammunition/ equipment will permit forces to operate unhindered. Computerised Inventory Control Project (CICP) of the Ordnance Corps will automate their logistic management. On the data collected by CICP, Big Data can provide advance Business Intelligence (BI) tools for Pattern Recognition, Modelling, Simulation and Forecast. This can add value since all procurement can be based on analysis of pattern of consumption leading to a lean inventory stock.

(d) **Mobilisation / Movement**. Real-time route optimisation of all types of forces/ convoys which are GPS and RFID enabled can be done by studying the pattern of data generated from convoy movements fitted with sensors. Similarly critical equipment and vehicle having a bearing on the operational efficiency can be fitted with sensors and study of the data generated by the sensors showing all wear and tear will change the maintenance philosophy of armed forces.

(e) **Medical**. In the field of health care Big Data applications can be used for one time data capture of all defence personnel which can be then updated regularly when changes noticed. This will not only improve patient data security and accessibility but also predicting and bettering response speed to disease outbreaks. Big data analytics can through some surprising insights if applied on the huge data base of the retired personals which is growing at a fast pace. It can also find use in early disease / Bio-terror outbreak identification.

(f) **Human Resource**. Big Data promises to revolutionise the way armed forces manage and improve the human resources. The analytics can be used in the fields of recruitment, testing, promotion, pay and allowances, medical data and disability management, finances, manpower planning and post retirement management of veterans. The same tools if applied on data bases of applicants for officers' cadre may throw some insights which may streamline our process leading to better intakes and making up the deficiency in the junior ranks.

(g) **Cyber Security**. Network managers will be dealing with millions of attacks every day, Big Data analytics can be applied to spot advanced persistent threats – such as socially engineered attacks designed to steal government information which has happened in the past (Chinese attack on our Websites).Most hackers have a modus operandi, which once identified can be used to predict the form of future attacks and put appropriate defensive measures in place. The application can also be used for offensive aspects of cyber security.

(h) **CI/CT Operations**. Big data collected by drones, satellites, UAVs/ technical intercepts etc can be automatically analysed based on big picture provided by intelligence, surveillance and reconnaissance (ISR) data which can be created as part of Big Data initiative. This will allow the CI/CT operations to be carried out in real time. Data intensive GIS based applications can be used with big data platforms in the hinterland to assist forces deployed to fight left wing extremism.

(j) **Disaster Management**. Disasters affect every country on earth and effective disaster management is a global challenge. Harnessing the big data associated with disasters and disaster prevention and then applying big data analytics can help in all four phases of disaster management: prevention, preparedness, response, and recovery.

1.4 Seminar on Big Data – A Turning Point

This was the first time the Defence Forces conducted a seminar on Big Data under its aegis and being debut seminar on the subject it was themed **"Big Data – Applicability in the Defence Forces"**. The participants were from the Three Services, Strategic Community, Veterans, Media, Industry, Ministries of Defence, Home, Science and Technology, State Governments, Para Military Forces, DPSUs, Consultants, R&D Orgs, ICT and academia.

After a full days deliberation and hearing the experts from the academia and industry it was proved beyond doubt that Big Data Science cannot be ignored by the Defence and Security Forces of the country in view of the geo-strategic environment and the asymmetric threats.

1.5 Seminar Objective

The use of analytics to solve critical and complex problems is currently undergoing a technology–enabled revolution. From data acquisition and discovery to real-time planning, prediction, and action – anywhere, anytime is becoming order of the day. The time was ripe for comparing notes and sharing ideas on the current status of the development of Big Data particularly for defence and security applications. The Seminar had the following objective:-

(a) To spread awareness about applicability of Big Data for Defence initiatives amongst the uniformed personals.

(b) To learn from academia and industry about Big Data opportunities with use cases and make them aware of our requirements.

(c) To brain storm and arrive at a workable recommendation with timelines and deliverables for shaping our big data initiative.

1.6 Programme Agenda

0930h – 1000h	**Inaugural Session**
0930h – 0935h	**Welcome Remarks: Lt Gen BS Nagal, PVSM, AVSM, SM(Retd) – Director CLAWS**
0935h – 0945h	**Keynote : Lt Gen KJ Singh, AVSM* – GOC -in-C,Western Command**
0945h–0955h	**Inaugural Address: Lt Gen Philip Campose, PVSM, AVSM*, VSM, ADC – VCOAS**
1030h – 1200h	**SESSION I: BIG DATA AWARENESS AND BIG DATA ANALYTICS EXPLOITATION**
	Chairperson: Lt Gen Nitin Kohli, AVSM, VSM - SO-in-C
1030h – 1040h	Introductory Remarks by the Chair
1040h-1055h 1055h-1110h 1110h-1125h 1125h-1140h 1140h-1200h	1. An Introduction to Big Data Science and Big Data Vision for Defence and Security Forces - **Mr Mandar Inamdar (MICROSOFT)** 2. Big Data Analytics : Current and Future Perspective -**Mr Ravi Kumar Kattar -(CISCO)** 3. Role of Educational Institutes in Big Data Training – **Dr Srabashi Basu, Bridge School of Management** 4. Big Data Applications for Defence and Security – Requirement Analysis-**Lt Col Haridas M, CLAWS** 5. Interactive Session

1210h – 1340h	**SESSION II: BIG DATA ANALYTICS: USE CASE CENTRED AROUND MILITARY APPLICATIONS**
	Chairperson: Rear Admiral B R Taneja,NM,VSM- PD(SC),Naval HQs
1210h-1220h	Introductory Remarks by the Chair
1220h-1235h 1235h-1250h 1250h-1305h 1305h-1320h 1320h-1340h	1. Big Data Analytics by Armies and Security Forces of Developed Countries- **Mr Sunder Ram (ORACLE)** 2. Open Source Platforms for Big Data Analytics -**Mr Sanjay Krishen and team (INTEL)** 3. Big Data Visualisation for Naval Intelligence - **Ms VishakaDongre (SaS)** 4. Real Time Predictive Analytics to Improve Forecasting and Results for Defence Forces-**Mr Rakesh Mohandas (IBM)** 5. Interactive Session
1430h-1600h	**SESSION III: BIG DATA INITIATIVES : THE PROGRESS SO FAR AND THE MILESTONE AHEAD**
	Chairperson : Dr KR Murali Mohan Head, Big Data Initiative Division, Govt of India.
1430h-1445h	Introductory Remarks by the Chair
1445h-1505h 1505h-1525h 1525h-1540h 1540h-1600h	1. R&D in the field of Big Data and Big Data Analytics-Current and Future Perspectives- **Dr Santanu Chaudhury (IIT Delhi)** 2. Big Data Analytics as an Application in NATGRID –use case - **Mr Rajeev Arora, IAS,** **Joint Secretary – NATGRID** 3. Technology Leap with Big Data Initiatives: Reality or a Myth- **Mr Sandeep Saxena (TCS)** 4. Interactive Session
1600h-1610h	**Valedictory Address : Lt Gen Anil Bhalla, PVSM, AVSM, VSM – DG DIA & DC IDS (Int)**
1610h-1615h	**Closing Remarks : Lt Gen BS Nagal, PVSM, AVSM, SM(Retd)- Director CLAWS**

CHAPTER 2

SESSIONS

2.1 Inaugural Address

Lt Gen Philip Campose, PVSM, AVSM*, VSM, ADC – Vice Chief of Army Staff delivered the Inaugural Address.

Addressing the panel and audience, Lt Gen Philip was of the opinion that in the commercial world the concept of big data seems to be relatively old compared to the awareness in the Defence Forces. This technological evolution should have touched the forces long time back. He stressed on the geo-strategic environment in which the army operates in two folds:

1. The External threat environment which constitutes the territorial disputes right from the time the country was born commonly referred to as the traditional threats and

2. Internal threat that involves insurgency and militancy environment where Army is again involved.

Elucidating the audience of asymmetric threats he assumed the "...weaker adversaries to take on means that were revolutionary to level the mismatch...." The General Officer acknowledged that technology has intervened into a situation where war or battles can be won without addressing the core military adversaries as the banking system, communication systems and various systems like electricity and water are vulnerable targets and can effect make a country come down on its knees. He expected the army to quickly absorb and apply new technologies. It is slow in acquisition process or absorbing new concepts, strategies and also the use of technology. Thus in that context, he claimed seminars like this become very important to expose the military leadership and the future generation of officers to make them understand the upcoming scenarios/realms/threats of warfare.

In his words, "Our adversaries are also advancing and we need to respond to that."To sum up he pointed out that with the age of deterrence, along with fighting wars we must also think enough on how to prevent wars and with cyber threat evolving, the threat can come from any part of the world diluting land based limitation. He concluded by saying that he will study the recommendations of the seminar once it reaches him.

2.2 Keynote Address

Lt Gen K J Singh, AVSM*-GOC -in-C, Western Command delivered the Keynote Address.

Addressing the eminent panellists and the audience at large that consisted representative from armed forces, academia and corporate domains, Lt Gen KJ Singh was reminded of the early days when the army used the GDK316 computers with *Cobol* -a syntax driven language, on which he had spent hours fixing bugs. He referred Big Data as the most important global trend of the present decade and pointed towards its fast gaining popularity. He defined Big Data not as a technology but a phenomenon resulting from the vast amount of raw information generated across the society and as a by-product of its networks collected by the commercial and government organizations. For the defence forces Big Data Analytics will be very important since it will give the hidden insights from the Big Data sets the systems will generate in future. He acknowledged that the challenge lies in management and exploitation of these large data sets as he pointed out to two critical dimensions; velocity and veracity. In his words "For us*[Indian Army]* velocity is the key parameter; one who fires first shot accurately survives to fire the second shot and veracity or verification....which is the challenge of having data in open environment, processing and putting it on platforms to distribute it to those who need to know in real-time." In this regard, he cited a case when a US naval ship shot down commercial Iranian airliner mistaking it for an enemy aircraft. It was the most modern ship and yet was not able to detect data on real-time and ended up killing innocent civilians. Data analysis could avoid causing collateral damage and yet shield ourselves from attacks.

Remarking that there is a need to learn from the earlier experience of systems like ASTROIDS and the time CICP is taking to get fielded in the Indian Army. Big data initiative according to him is a major leap. At the same time, people in defence forces will have to be made aware of big data and trained in the skill sets required for its use. He suggests that while developing the platforms for the technology, *one solution fits all* approach should be avoided and the architecture must be kept flexible as the ground situations vary and are continuously subject to change. Being appreciative about big data technologies he mentioned his experience discovering the fruits of Big Data Applications when the satellite imagery transfer with annotations from Delhi to Chandigarh took place in a near real time frame. Open source platforms also need to be studied and the ROI to the Army as an organisation to be kept in mind.

2.3 Session 1: Big Data Awareness and Big Data Analytics Exploitation

Big Data field being relatively new, this Session was dedicated to spread awareness about this field to the participants in uniform so that its applicability in the field of defence and security can be well understood by them .It will help them learn how to leverage the power of big data and analytics to drive better outcomes in decision making aspects. Also the industry and academia was made aware of the big data analytics need of the defence and security forces.

Chair : Lt Gen Nitin Kohli , AVSM ,VSM , SO-in-C

Panel : Mr Mandar Inamdar (MICROSOFT)

Mr Ravi Kumar Kattar (CISCO)

Dr Srabashi Basu (Bridge School of Management)

Lt Col Haridas M (Senior Fellow, CLAWS)

Result and Discussion

The session began with a very pertinent fact that, 'What is Big today may not be big tomorrow'. The numbers of inputs from the sensors have increased which include text, audio, video, signatures and images of all shapes and sizes. The rate of data generation is huge. The panel defined the Big Data as an evolving term which includes any voluminous amount of structured, semi-structured and unstructured data that has the potential to be mined for information. Although big data doesn't refer to any specific quantity, the term is often used when speaking about petabytes and exabytes of data. Use of Big Data Analytics in the US presidential elections, by the retail giant Wal-Mart which transacts nearly 1 million deals every hour as also the Large Hadrons Collider (LHC) which calculates six hundred million collisions per second and the Human Genome Project were discussed. There is urgency about Big Data sciences in the commercial world but the defence forces needed to be a little cautious with regard to IPR and data secrecy. The example of DGIS looking after all details of the proposed C4I2 systems of the army was brought out.

The panel then analysed the **'BIG DATA VISION FOR THE FORCES'** and gave some fascinating facts about data creation like every five years the data increases by 10X and analysts spend 80% of their time looking for data and only 20% time for its analysis. They emphasised on the Defence Forces dealing effectively with the rising tide of sensors and communication devices and data and the V's associated with Big Data i.e. Volume, Velocity and Variety. They called for a greater amount of focus on the need for fierce Velocity in the armed forces as there was no second chance available to the fighting commanders and soldiers. Example of banking fraud which must be detected and avoided with real time access to information rather than after the complete fraud has taken place since this will collapse the banking industry was discussed. Defence applicability of the Big Data Analytics in the areas such as force mobilisation and combat readiness, maintenance and reporting overhaul, maritime surveillance, operational efficiency and performance management, real time access to supply data, total asset visibility and skill mapping and training management was identified. They also touched upon analytics industry expertise in data analysis, transformation and visualisation of data and provision of a complete data platform including outlines of the cloud computing abilities and hybrid platforms.

Analysing **'BIG DATA ANALYTICS: CURRENT AND FUTURE PERSPECTIVE',** the panel claimed that the internet growth was going to be staggering and an 'Internet Minute' would mean a lot of things in the future and importance of 'veracity' of data will also include variability, visualisation and value in it. They spoke of the much highlighted 'internet of things' and added by the end of the decade 50 billion connected devices would exist in the world and would produce unbelievable amount of data. The panel noted the systems available today were not capable of handling extremely large amounts of data. Data from sensors have a different data structure and most of them are proprietary. They enunciated fields like Cloud based services, Rich Media analytics, End user self service like visual data recovery, Productive analysis and machine learning,Consumer service delivery, Value added content sales like organisations servicing the market related to or Big Data Revolution may interest the defence forces. They also cautioned against

using analytics without ethics and pronounced limits like privacy and socio-economic profiles to be taken care of in the said domain. Defence forces should leverage use cases which will bring about visible changes.

Next the panel analysed **'ROLE OF EDUCATIONAL INSTITUTES IN BIG DATA TRAINING'** for increasing the efficiency of the forces to handle the huge volume of data generated. They spoke of the importance of data generated from Sonar's and Electronic Warfare System and GPS data collection as well as coastline security. The panel focussed specifically on cyberspace vigilance as an added dimension of the Big Data domain for the armed forces. 'Actionable Data' according to them held the key for success of such an initiative in the defence domain with separation of signals from noise. It should be proactive and not reactive and even small departures from the given pattern must raise flags in the systems algorithms. They contrasted the human computational limitations with the capabilities of number crunching machines in warfare and said that delay in decision making and limited automation could be disastrous for the forces and cited the importance of utilising even the unstructured data when even our structured data usage capability was severely restricted. They were of the opinion forces should think about analytically enabled combat management systems, cross warfare optimisation, improved situational awareness and integration of data types. They exhorted the training institutes to elevate educational level of big data analytics and brought out the importance of manpower movement, forecasting plans, skill set management, reducing impediments in service delivery for the veterans and improving health care facilities for the soldiers through Big Data initiatives for which skill development will have to be undertaken in a phased manner.

Lastly the panel analysed the areas for **'BIG DATA APPLICATIONS FOR DEFENCE AND SECURITY FORCES'**. Having seen the Gartner's Hype Cycle and McKinsey's Prediction it was but natural for CLAWS to undertake research in this area. They spoke of the various Operational/Logistics/MIS systems like ASTROID, CIDSS, ACCCS, ARPAN, MISO etc. going to generate huge data sets once these systems become functional in the near future. Voids creeping in because of the limitations of the existing system which cannot handle Bid Data was discussed which will be unacceptable in the Joint Operational scenario. The industry should look into the feasibility to develop Thematic Analytic Terrain Layer on the SOI /DSM Maps which will give the forces probable routes of infiltration, voids in the placement of sensors, voids from sensor fan analysis etc. Will be beneficial if it can create above mentioned layer on satellite imagery of trans-border areas where the actual battles will be fought. For intelligence gathering too, they were of the opinion correct algorithms can be developed like predictive capabilities so that suspicious elements and activities could be tracked. On the logistic front on the data collected by ERP Applications like CICP and EMERALD, Big Data applications can provide tools for Pattern Recognition, Modelling, Simulation and Forecast. This can add value since all procurement can be based on analysis of pattern of consumption leading to a lean inventory stock. On the similar lines big data applications can add value in managing mobilisation, making maintenance philosophy proactive,predict and better, response speed to disease outbreaks and spot advanced persistent threats in the field of cyber security. For military operations it will give options and permutation/ combinations to decision makers to firm on plans and strategies and predictive analytics and forecasting can overcome operational challenges in real time. They remarked as the day unfolds more areas will be identified with the help of experts from this field

The panel also identified the opportunities and challenges associated with big data. They spoke of the need to create uniformity in the structure of data and platforms and avoiding the need of working in isolated silos, and increasing the skill levels of personnel in the defence forces to handle big data challenges. They emphasised on creating a Big Data Roadmap for the future and thus gain the first over advantage in this field. This will generate the confidence to adapt this technology in the long term and provide better asset visibility and a more secure national security environment to our great country and its people.

2.4 Session II: Big Data Analytics: Use Cases Centred around Military Applications

This session deliberated how big data technology can be used for military applications be it operations, intelligence, logistics or HRD. The session concentrated on practical applications and utilization of big data for military applications cutting through the marketing hype and helped participants understand the benefits of Big Data. Use cases of big data analytics was discussed with various examples by the industry experts to showcase the power of big data analytics.

Chair : Rear Admiral B R Taneja, NM, VSM, PD (SC)

Panel : Mr Sunder Ram (ORACLE)

Mr Sanjay Krishen (INTEL)

Ms Vishaka Dongre (SaS)

Mr Rakesh E Mohandas(IBM)

Result and Discussion

The panel observed "Big Data and Data Analytics" are the new buzz words and the Defence forces need to look at in a right perspective". The massive amount of data generated needs to be streamlined for processing as it will aid in net centric warfare.The forces so far dealing with structured data are more or less clear what it aims to achieve with the current progress made in the systems developed around it. It can be concluded sufficiently that the first challenge of big data i.e. collation and assimilation of data is being dealt with efficiently and thus it does not present a huge challenge to the defence forces.The current training also caters to the third and final step i.e. taking decisions based on the data available and so that too does not pose a challenge currently.

The real challenge lies in data analytics which arises from the failure of the defence forces to articulate to the developer what exactly is the requirement of the forces. The only solution to this problem is to set up models and institutions that in turn can communicate to the industry the user requirements .The panel was of the opinion that the time is ripe for a collaborative venture between the user,the R&D institutions and the industry experts.

The Panel next discussed on **"BIG DATA ANALYTICS BY ARMIES AND SECURITY FORCES OF DEVELOPED COUNTRIES"**. Aspects related to Project MITRE which was set up by MIT as a separate system to help federal government projects in USA was analysed. The system is for combat operations. It defines a particular space in real time depending upon a particular situation and tracks instances within a particular space e.g. identify a potential bomb threat. The US has deployed UAV's which pickup information in real time. They have identified certain boundaries and setup different kinds of conditions ,on when they need to be warned, whenever there is any movement of an object within or outside the defined space. The main essence is to implement and make use of technology which captures events in real time and applying decision making tools for optimum results. It was further brought out that as part of Intelligence Operations in the Middle East where the US Army is fighting an asymmetric battle, big data applications was looking at threats from a series of information sources which may not be conventional information sources and calculating the probability of an event occurring and act on. Another aspect which was brought out on Vehicle and Ship Maintenance, was related to sensor in the equipment or vehicle which sends back information regularly about the state of the equipment based on which the maintenance activities are undertaken. This helps in proactive maintenance philosophy. It helps in improving the health of equipment as well as the maintenance of the equipment. Next ARFORGEN the US technology for dealing with problems concerning series of deployments was discussed and the benefits analysed. With use case it was brought out , Big Data applications have proved to be useful in Disaster Management as it aids effective utilization of available resources and aids spontaneous decision making acting upon real time information. It has also helped in Cost Analysis and in fraud detection as one can look across the systems and pullout commonalities.

Next the panel spoke on "**OPEN SOURCE PLATFORMS FOR BIG DATA ANALYTICS"** and informed the participants how Drones and Satellite imaging technology provides a 'no risk' means of reconnaissance. Images or videos are captured and analyzed for frame-by-frame changes. Big Data Applications enabled erecting and countering incursions and impending attacks. Discussing another use case the panel informed how Audio Receptors record and continuously transmit ambient sounds from the action area. Audio data from all the receptors is processed and position of shooter is triangulated. The GPS Location of shooter is thus transmitted to the soldier in the line of fire for necessary actions. This involves Big data analysis. It was also told that the future Wearable Technology will transmit Bio-indicators like Heart rate, respiratory rate, blood pressure etc. to base for every soldier on a mission. Data is processed in real time and health conditions of entire battalion areanalyzed.

Putting all this together, analysing the data comprising of video data, images, audio, text, bio indicators data which are mostly unstructured is done on Hadoop platform which takes massive amount of unstructured data, distributes it across various processing nodes and has the ability to scale from one server to another and it can do it at a high fault tolerance. Hadoop framework is a combination of various software's, database but a combination of all working together which can produce result to be presented to the relevant user. It was brought out currently Intel has aPoC up and running at the College of Military Engineering, Pune which runs servers and carryout log analysis and this installation is available for all the three services. Setting up such a model in not very time consuming.

Next the panel spoke on "**BIG DATA ANALYTICS FOR NAVAL INTELLIGENCE**" The panel was of the opinion that the focus of Commanders now is not on information but insights. Analytics play a crucial role in developing these insights. It helps predict and mitigate threats thus making way for timely intervention. On the maintenance side Reactive maintenance not only covers the "run to failure" parts and assets, but also the assets whose performance is monitored by operators. It was further elaborated Preventive Maintenance cycles are usually conservatively calculated by the manufacturer of the asset. By analyzing the conditions that led to issues in the past, the cycles can be optimized based on specific conditions. The more historic sensor data is available, the more granular these (combined) conditions can be. Additionally, disruptions of operations and/or maintenance costs can be reduced even further by optimizing the scheduling of maintenance jobs during the planning horizon. In Predictive Maintenance the conditions of a single asset are analyzed to predict likely failures before they occur, so that maintenance can be performed when it is necessary and in a planned manner, so that the impact on operations in minimised. Maintenance Optimization finally can be applied tactically to optimise maintenance schedules taking into account risk, required skill sets, required service parts, etc. to minimise maintenance costs and/or downtimes. It can also be applied strategically to optimize the maintenance strategy for assets based on their real performance and conditions.

Challenges posed by the multi-fold increase in data leading to Big Data management issues and Big Data Visualisation in maritime surveillance was discussed by narrating relevant use cases.

Next **"REAL TIME PREDICTIVE ANALYTICS TO IMPROVE FORECASTING AND RESULTS FOR DEFENCE FORCES"** was discussed. It was brought out predictive analytics as the name suggests involves data analysis based on the results for prediction of the likely future trends in a particular domain. It makes use of simulation algorithm. It takes all the parameters into consideration to arrive at a particular output. Also applied on data in motion. It enables to protect valuable information assets from insider theft or sabotage and uncover potential threats by integrating and analyzing large amounts of information. Predictive Analytics can provide a prediction of risk and impact that can be used to identify and mitigate insider threats. Salient aspects of the Optimisation Program by the US Army was brought out. On the advance side of Data Science the latest initiative on Cognitive Analytics was discussed. It was brought out how it is different from predictive analytics. It was informed that there is no need of too much of intervention and in human spoken language the system can be queried and it will give you solutions. System carries out the speech analytics, refers to the database, computes the data and comes up with a response. Sample analytics for Defence involves insider threat detection, cyber security, fraud detection, IED Risk assessment, identification of suspicious cargo etc. Important use case in the field of security, human capital and logistics where big data analytic have been applied was discussed.

2.5 Session III: Big Data Initiatives: The Progress so far and the Milestone Ahead

To build analytics momentum there has been considerable actions by the Government, Industry players, academia and R&D Institutes. This session was dedicated to know more about the key actions taken so far by various stake holders to build an analytics eco system in India and the salient aspects of the Big Data Initiative of the Government being driven by the Department of Science and Technology (DST).

Chair : Dr K R Murali Mohan, Head, Big Data Initiative Division, DST

Panel : Mr Rajeev Arora, IAS, JS and CEO (NATGRID)

Dr Santanu Chaudhury (IIT Delhi)

Mr Sandeep Saxena (TCS)

Result and Discussion

The concluding technical session began with the panel highlighting three key issues regarding big data and its analytics as the availability of data, The owners of the data, particularly in the government sector and the Access to data. It was brought out that the Government of India has initiated a National Data Sharing and Accessibility Policy (NDSAP) and it was notified as a gazette notification in 2012. The policy states that any data generated by a government-funded institution has to be shared and made available to the public in open domain. If any organisation feels that the data needs to be secured and it has some security value, then the dataset shall be flagged and sent through a different channel to preserve its security. Based on NDSAP, as of today, there are 65,000 datasets available. The authenticity of the data is the responsibility of the organisation that is generating the data. It was also brought out the Department of Science and Technology (DST) under the Government of India has started a programme called the Big Data Initiative six months back. The objective is three-fold:

- Big Data technology has a lot of job potential. NASSCOM and World Economic Forum amongst other institutions have predicted the analytics business will be is USD 25,000 billion. There will be a lot of demand for data scientists, data engineers and analysts. The programme concentrates on skill development, particularly in engineering and other inter-disciplinary subjects.

- The DST which promotes science and technology as a whole, big data is one such initiative emerging under the area. The promotion of big data science will be done through the academic institutions across the country. The DST will support financially the faculty and researchers to implement their ideas and algorithms and come out with developmental tools. Connecting the academics to the development needs of the country is also a focus area.

- The development of entrepreneurship skills. There maybe big data analytics as a service and the industry can provide it as a service across the globe. Through the Entrepreneurship Development Board, the DST will provide seed money to a number of startup companies.

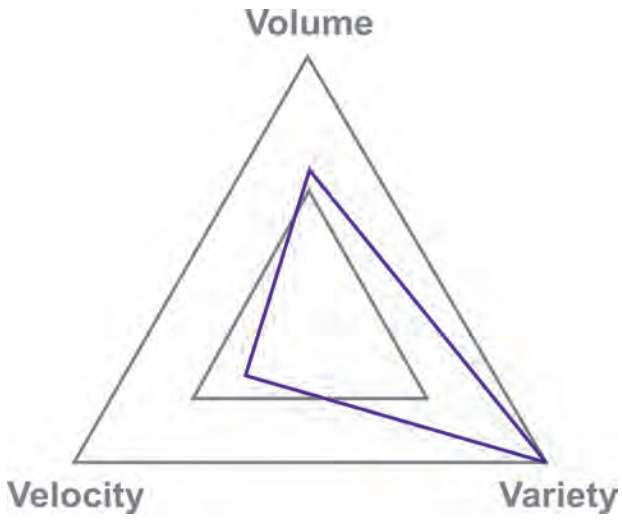
It was highlighted that there is a need for an implementable model so that the helix,i.e. the academia, the industry and the government can come together and work for the security issues which has been identified as an important aspect by the DST. Ministry of Defence could possibly create a centre for excellence at CLAWS to allow the DST to support this activity as a civil organization where the academia,the industry and the user can be brought under one umbrella for taking the big data initiative of the defence forces ahead.

The panel then discussed **"BIG DATA ANALYTICS AS AN APPLICATION IN NATGRID"**and informed that National Intelligence Grid (NATGRID) is probably one of the few projects in the country at present that is putting into action the potential of big data. NATGRID was setup after the 2009 Mumbai attacks and is primarily a big data analytic facility for the law enforcement agencies. There is a large amount of data and the law enforcement agencies access the data on individual basis. The agencies' request access

to the databases on a personalized query based on the certain legal framework that has been provided to them. The result is that many of the agencies are able to capture a part of the picture but not the insight into the whole picture to tell them what is likely to happen. It was informed it is in this context that NATGRID was established. Similar agencies exist in other countries, including the NCTC in the United States and GCHQ in UK. These agencies are not created as part of one law enforcement agency as their utility will not be achieved in such a case.

The mandate of NATGRID includes the databases in the country, including the National Population Register, the airlines data, the telecom data, and other similar data. NATGRID provides a platform between the data user agencies and the data providing agencies. It has a static database of its own where non-sensitive data is present and updated on a regular basis, and there exists a transactional data that rests with the provider of the data. As and when any user organisation needs information on an entity or individual, a query is sent to NATGRID. The query is first run through the NATGRID database and if not resolved, information is sought from the individual data providers. NATGRID is also tasked with creating Open Source Intelligence (OSIN) tools. The ultimate development is of NETSTAR which will take about one-and-a-half to two years. This facility will be available to all the user organisations and the law enforcement agencies, which also become the provider organisations. This will add value to the data available and ease the collection, collation and standardisation of data, which would make it usable, actionable intelligence input. The panel was of the opinion though technologies are available for big data but there are other challenges that exist which must be looked into.

Next the panel discussed on the **"CONTOURS OF BIG DATA ANALYTICS"**. Panel was of the opinion approach towards big data has to be inter-disciplinary as it involves Engineering (CS, EE), Science (Statistics, Mathematics, Life Sciences) and Social Science (Psychology, Sociology, History, Economics). Increasing volume of data also increases the veracity and the uncertainty due to data inconsistency and incompleteness, ambiguities, latency, deception, and model approximations.



The above figure taken from the Department of Defence of the United States was used to explain how variety of data is critical in defence. In defence context, other than standard data there exists varied and unstructured data with large quantities of imagery and video generated every day. The other sources of data include text material, language issues, voice interceptions, sensory data, and statistical and numerical data. ARGUS of USA was discussed. The hardware and technology exists to handle the large volumes of data but the problem arises in integrating the data from multiple sources. The database technology has moved from SQL Engine, based on relational and row-based databases, to Scalable No-SQL Engines, which are column-oriented. Panel spoke about the benefits of Clustering Algorithm, cognitive intelligence and cognitive analytics. Panel was of the opinion like many other organisations Defence forces cannot share data with any third party due to its sensitivity. However, simulated dataafter masking the sensitive parts of the data while maintaining its structure and pattern can be made use of for research purpose with the R&D institutes.

Based on that data, applications can be developed by institutes like IIT Delhi to create awareness about big data. If a protocol can be developed inside the defence organisations to remove the sensitive information from the data, then the academia can work on these along with a non-disclosure agreement. The panel highlighted the following:-

- Analytics tool for unstructured data is a big challenge.
- Analytics know-how must be indigenous.
- Partnership between R&D, academic organisations and user agency can generate analytics know-how.
- Translation Agency can be industry partner.

Next the panel discussed **"TECHNOLOGY LEAP WITH BIG DATA INITIATIVES: REALITY OR A MYTH"** and brought out that Event Identification is the filtering of information that is relevant from amongst the huge amounts of data. An important task after ingesting the data is harnessing that data, that relates to harvesting or data analytics. The panel discussed the work in the field of semi-structured and unstructured data pieces. Subsequently, there are search aspects related to the data. Visualisation includes derivation of relevant information from the unstructured corpus of data. There is intentional injection of information in social media that is done to incite and to entrap nefarious characters. Works related to big data analytics as follows was highlighted to the seminar:

1. Crawling Indexing and Mining Open Data Source (CIMOD).
    - Voice and OCR indexing of video.
    - Topic discovery and aggregated browsing of Twitter feeds.

- Topic discovery and tracking in web news.
- Breaking new reporting and tracking developing news stories.

2. Shaping Terrorist Organisational Network Efficiency (STONE) – Case study of LeT.
3. Counter Terrorism.
4. Network Analytics for Intelligence.
5. Prediction Location of IED Weapons cache.

Discussing on the challenges that need to be addressed in Data Ecosystems Research the panel identified Privacy, Ethical, Technical, Risk, Trust and, Valuation as some domain which needs focus. It was also informed there are firms in India who are also researching on cognitive aspects and human centric systems the purpose of which is to predict behaviour in certain conditions.

2.6 Valedictory Address

Lt Gen Anil Bhalla, PVSM, AVSM, VSM, DG DIA and DC IDS (Int) delivered the Valedictory Address

Lt Gen Anil Bhalla informed his organisation is aware of the importance of this technology and they are closely examining technological aspects associated with it. He informed while there was a fair amount of work going on in the new field and government policies are being shaped, as a defence intelligence user, analytics of results is where he comes in. At the same time he regards that knowledge of the mechanics and the details are also important. The General Officer describes his responsibilities as the process of (obtaining technology) acquisition/collection, coalition, sharing, dissemination and execution and the aim is to collapse the distances between policy, planning and operations. He assured the audience that the police and internal intelligence agencies are using the resulting deduction and have fair amount of networking between them.

He referred to the knowledge level of the technology of Big Data as he stated, "Harness it, Framework it and Organise it." He pointed out that despite the best of analysis NATO alliance couldn't stop any of the recent attacks in mainland Europe and that the technological intelligence needs to work with human intelligence. Apart from the dynamics of the analytics of the big data; the next step is of integration, fusion, and dissemination of the relevant data.

He concluded by raising the question as of how to bridge the gap between the ends mentioned above? He was optimistic after brainstorming with the industry, academia and other user stakeholders forces will be able to apply the emerging results in the interests of national security and defence domain.

CHAPTER 3

MISCELLANEOUS

3.1 Abbreviations

1.	BI	–	Business Intelligence
2.	CI/CT	–	Counter Insurgency/ Counter Terrorism
3.	DST	–	Department of Science and Technology
4.	DSM	–	Defence Series Map
5.	ETL	–	Extraction, Transformation and Loading
6.	ERP	–	Enterprise Resource Planning
7.	GIS	–	Geographical Information System
8.	GPS	–	Global Positioning System
9.	ISR	–	Intelligence, Surveillance, and Reconnaissance
10.	KB	–	Kilobyte 1,024 Bytes
	MB	–	Megabyte 1,048,576 Bytes
	Gb	–	Gigabit =1 billion bits
	GB	–	Gigabyte 1,073,741,824 Bytes | One billion Bytes
	TB	–	Terrabyte 1024 GB, 1,048,576 MB, 8,388,608 KB, 1,099,511,627,776 Bytes and 8,796,093,022,208 bits.
	PB	–	Pettabyte 1024 TB, 1,048,576 GB, 1,073,741,824 MB, 1,099,511,627,776 KB, 1,125,899,906,842,624 Bytes and 9,007,199,254,740,992 bits
11.	MIS	–	Management Information System
12.	NATGRID	–	National Intelligence Grid
13.	PoC	–	Proof of Concept
14.	RFID	–	Radio Frequency Identification
15.	ROI	–	Return of Investment
16.	UAV	–	Unmanned Aerial Vehicle
17.	SOI	–	Survey of India

3.2 Conclusion

At the end of the day it emerged that Big Data is touching all walks of life ranging from law enforcement and banking to healthcare and retail. Big data applications are being used for stock market sentiment analysis, fraud management in financial sector, handling of traffic congestion in transportation, genomic analytics in medicine, cyber security detection and real time multi modal surveillance in law enforcement and many more. Knowing how to extract meaningful, actionable insights from the data collected by the defence forces will be crucial for successful operations in future. We should tame big data before our adversaries use it to gain an advantage over us.

With this in the background the first seminar on Big Data came out with meaningful and workable recommendations based on all the discussions during the seminar in the form of an action plan with road map to ensure that the info deluge which the Defence and Security forces are going to face in future is tackled effectively by big data applications. How a collaborative approach between the Indian Defence forces, Indian Industry, R&D Institutes, academia and think tanks can come up was a key take away. We are in the development area of big data and hence all challenges and issues regarding big data can be overcome and benefits of big data analytics achieved if defence forces are supported and encouraged in their endeavor in this field of technology.

*"Organizations that adopt a full range of analytics capabilities can **discover** what is happening, **determine** why it is happening, **predict** what is likely to happen and **prescribe** the best action to take"*

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