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*Published in collaboration with*  
**Menaka Prakashan**  
(Publication division of MediaNext)  
2117, Sadashiv Peth,  
Vijayanagar Colony,  
Pune – 411 030, Maharashtra

Email: [sales@menakaprakashan.com](mailto:sales@menakaprakashan.com)  
Webstore: [www.menakabooks.com](http://www.menakabooks.com)

For subscriptions: 9823 69 69 60

Printed at:  
Vikram Printers, Parvati,  
Pune – 411009

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Single issue price ₹ 400	Annual Subscription ₹ 2000 (Includes postage)	Please turn to last page for subscription form. To subscribe online, please visit <a href="http://www.menakabooks.com">www.menakabooks.com</a>
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# CASS Journal

## Vol. 5, No. 2, April-June 2018

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## Editor's Note

In the last quarter, a landmark event took place. In a historic decision, China removed the two-term limit on presidency, clearing the decks for the all-powerful President Xi Jinping to rule the world's most populous country for life. Scrapping the 35-year old rule brought by "paramount" leader Deng Xiaoping to prevent the country from returning to one-man rule like that of Mao Zedong, China's largely ceremonial parliament amended the Constitution by lifting the two-term limit. With term limits gone, Xi can rule China until he retires, dies or is ousted. He is already dubbed as the country's next Mao, founder of modern China who ruled from 1949 until his death in 1976.

China watchers say the country, which has a one-party rule, could well be headed for a single-man rule. Xi, who succeeded Hu Jintao in 2012 as General Secretary of the Communist Party, became China's President a year later. Over the years, Xi has come to hold a vice-like of China. Besides being the General Secretary of the Communist Party, he is the Chairman of the Central Military Commission -- the supreme body of the Chinese army. Although the post of General Secretary is more powerful than that of the President in China, the latter is used to deal with the outside world. Currently and in the near future, there seems no leader who could challenge a towering Xi. This has startled the global community and could affect India's security calculus.

The other important event is the first step taken by India towards eventually having integrated theatre commands, where all the manpower and assets of the Army, Navy and IAF are under the operational control of a single

three-star general in theatre commands, by amending command and control rules for joint organisations and establishments. It has been reported that the government has notified new “statutory rules and orders” to ensure an officer from any one service can now “exercise direct command” over personnel from the other two services, who are all governed by different acts and rules, in tri-service organisations.

The move has been implemented especially for the strategically-located Andaman and Nicobar Command (ANC), which was established as India’s first theatre command in October 2001 but has largely failed to achieve its potential due to internecine turf wars among the three services, general politico-bureaucratic apathy, fund crunches and environmental concerns.

It might seem a minor structural reform but represents a huge cultural, fundamental shift in the Indian military system. If the country is to have a chief of defence staff (CDS) and theatre commands in the years ahead, this tweaking of the Army, Navy and IAF rules is the first step towards it.

This issue carries a wide range of articles dealing with national security. The first article on Artificial Intelligence, Big data and Connectivity by Shri Vinayak Davray brings out that “Artificial intelligence, big data and connectivity are changing the industry rapidly, and its impact on the world order is huge and unimaginable.” Leaders of a few countries have appreciated the challenge and directed their research scientists and leaders of industry to gear up their resources to face that challenge. Those taking a lead would reap the benefits of new world order. The others would be left behind. In the article ‘Status of India’s Coastal Security: Challenges, Concerns & Way Ahead’ the author opines that Indian policymakers and security forces did not take into serious consideration the various sea-borne illegal activities that were undermining the coastal security of the country for a long time. Thus, responses to the threats and challenges were formulated only after the crisis situation had become too intense to be ignored. Most importantly, many of the policies were formulated without preparing the ground for their implementation. This top down and reactive approach towards coastal security has resulted in several inadequacies in the coastal security architecture. The ISI and Pakistan Army in particular are actively involved in aiding and abetting various fault lines in the Indian society. The need of the hour is joint man ship between IN, ICG, Police, Intelligence agencies and various Government ministries. The glass is more than half full but we still have miles to go to achieve full proof coastal security.

Aniket Bhadane in 'State of Research on User Training against Phishing with Recent Trends of Attacks' has presented a survey of literature on User Training approaches to counter phishing and the current trends of phishing attacks. Phishing messages and websites masquerade as a trusted source and continue to be a problem for corporates and individuals causing huge tangible and intangible losses. Phishing is a wide-spanning attack and cannot be solved in one single way. It requires a collaborative effort in all directions. Solutions to mitigate phishing are mainly detecting the attack using automated software techniques, training users, and designing better interfaces to guide users in taking informed decision. Book Review of 'The Colonel's Blog' by Col Bipin D Shinde tells us that late Lt Col Vijay Vishwanath Natu of 9 Gurkha Regiment was the original blogger in a period which had a very limited and a not so responsive social media and when internet and mobile phones were absent. More than a thousand letters were written by him since 1989 and published in most Indian newspapers. 'Role of Women during War: Issues, Efficacy and Prospects' by Sneha Kulkarni brings out that the spectrum of philosophy of the Armed Forces is a multiform subject, both in terms of perception and in terms of its more utilitarian, administrative meaning. Utilization of Women under human resource philosophies, policies, programs and practices have been adapted and revised. These factious changes are accumulating evidence of the progress of Women in Military, which has been made in inspecting and responding diversity in the Armed Forces, along with the problems that remain unresolved; mainly focusing on complete synthesis of Role of Women in Armed Forces issues.

The next interesting article is 'KAUTILYA'S ARTHASHASTRA AND ITS RELEVANCE IN 21st CENTURY'. Arthashastra is the seminal treatise on statecraft by Kautilya of the fourth century BC era which ushered in and assisted the establishment of Mauryan Empire, the first politically united Bharat. The treatise since has been ingrained in the Indian Culture and was followed till 12th Century without much dilution. Kautilya further qualified that well-governed state will have less to fear from subversion and revolt and will be in a better position to disrupt the domestic stability of its adversaries. It would also be able to move with greater surety towards the execution of tasks that necessitate the large-scale mobilisation of economic and military power. A state that neglects the quality of the administrative elite and institutions upon which the execution of policy depends does so at the greatest possible peril to itself. Thus, India in 21st Century and as

emerging power needs a Comprehensive National Strategy with clear cut enunciated National Priorities and these are required to be derived from our ancient all-inclusive treatise of Arthashastra written 2400 years ago.

In 'Chinese Investments Abroad & Lessons for India' Maj Gen Nitin Gadkari concludes that China has made substantial progress in chartering its journey from a recipient to a major donor nation. As on date China has more outflow of capital to foreign shores than what comes inside China. Today China is the biggest donor nation having surpassed the US and other western nations. It's been a deliberate state policy to pursue this path. The journey has helped China find the raw materials and energy to fuel its economy and be the second largest economy in the world. It has fearlessly pursued its goals in spite of much criticism from Western nation and even domestic population. Yet it is steadfast in its belief that in following its stated policies it would create a win-win situation for itself and the host nation. In the last article on 'Applications of Global Navigation Satellite System (GNSS) in National Land Survey and Records' Dr Kibe argues that 'The Ministry of Urban Development, The Department of S&T - of which Survey of India is a part - and all stake holders in various States in India must come together to Forge a National Plan for GNSS Geodetic surveying, and Records and in modernising all Development Plans across the board uniformly and quickly. All Smart city projects and major infrastructure development plans of the GOI and private sector must use the modern GNSS techniques for which necessary infrastructure in Space has been assiduously built by the Indian Space Research Organisation / Department of Space over the last 20 years.



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Date: 31<sup>st</sup> March 2018



## Artificial Intelligence, Big data and Connectivity

*Vinayak Davray*

The annual meeting of World Economic Forum (WEF) at Davos in Switzerland concluded in late-January. It was a moment of pride that the Indian Prime Minister Narendra Modi was invited to inaugurate the main session of the forum. He was articulate in describing the economic challenges faced by world and India. The coverage given by Indian media probably missed the parts of discussions that revealed an underlying fear of something beyond apprehensions. “Artificial intelligence, big data and connectivity are changing the industry rapidly, and its impact on the world order is huge and unimaginable.” Leaders of a few countries have appreciated that challenge and directed their research scientists and leaders of industry to gear up their resources to face that challenge. Those taking a lead would reap the benefits of new world order. The others would be left behind. However, a large number of countries are naïve and unable to perceive the challenges around the corner.

At one time India was considered a leader in information technology. Advances in this field are so rapid that one needs to keep abreast all the time. “Keep innovating or perish,” is the order of the day. Where the leaders and industry become complacent, they lag behind in no time. It is a long struggle for the one time leaders to catch up; particularly in the spheres like artificial intelligence, big data and connectivity.

### **ARTIFICIAL INTELLIGENCE (AI)**

According to the father of artificial intelligence, John McCarthy, AI is: “the science and engineering of making intelligent machines, especially intelligent

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*ISSN 2347-9191 print*

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*CASS Journal, Vol. 5, No. 2, April-June 2018, pp. 9-21*

computer programs.” Artificial intelligence is a way of making a computer, a computer-controlled robot, or software that can think intelligently, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

### **Robotics**

Development of robotics was the direct result of application of AI. The scientists applied the technology to make initially simple and later complex robots. The development of intelligent robots fascinated humankind. While exploiting the power of the computer systems, the curiosity of human, led him to wonder, “Can a machine think and behave like humans do?” Thus, the application of AI started with the intention of creating similar intelligence in machines that we find in humans. The world of computers and electronics has known about artificial intelligence for some time. AI evolved as science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering.

The scientific developments in this field rapidly transformed in to technological tools in the last few decades. That progress is exponential. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving. Again the countries, which have perceived the importance of AI, have geared up their resources to its development. Having applied that technology, the developed countries are already using all sorts of automated, semi-intelligent and intelligent machines and robots in virtually every field of human life. Smart-transportation systems are here to stay. Conversion of entire transportation and communication system in a smart-way is on the way in many countries.

### **Smart-systems**

AI is the ‘brain’ of any smart-system. It can be programmed to behave as good as a human brain, perhaps without the drawbacks of human failures. The AI-revolution is expected to surpass the changes brought about in human society by the industrial-revolution of the nineteenth century, or even the Information Age-revolution of the twentieth century. However, many others are ignorant about the AI and view these developments with awe.

Massive use of AI has overshadowed the industry all over the world, particularly the manufacturing industry. With the advent of AI, the human work-force in that industry has virtually shrunk to less than ten per cent of what it was a decade back. That trend is continuing in all other fields. No one can stop it, as the mother machine-tools that make other machines, the back-bone of the industry, are largely being made based on AI. Wherever artificial intelligence has penetrated, the requirement of man-power reduced drastically. That followed job-losses in a big way.

## **BIG DATA**

The term has been in use since the 1990s, with some giving credit to John Mashey for coining or at least making it popular. Big data usually includes data sets with sizes beyond the ability of commonly used software tools to capture, curate, manage, and process data within a tolerable elapsed time. Big data philosophy encompasses unstructured, semi-structured and structured data; however, the main focus is on unstructured data. Big data is so voluminous that traditional data processing application software are inadequate to deal with them. Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, and information privacy.

Big data 'size' is a constantly moving target, as of 2012 ranging from a few dozen terabytes to many petabytes of data. It became even larger since. Big data requires a set of techniques and technologies with new forms of integration to reveal insights from datasets that are diverse, complex, and of a massive scale. Data sets grow rapidly - in part because they are increasingly gathered by cheap and numerous information-sensing Internet of things devices such as mobile devices, aerial (remote sensing), software logs, cameras, microphones, radio-frequency identification (RFID) readers and wireless sensor networks. The world's technological per-capita capacity to store information has roughly doubled every 40 months since the 1980s; as of 2012, every day 2.5 exabytes (2.5×10<sup>18</sup>) of data are generated. By 2025, IDC predicts there will be 163 zettabytes of data. One question for large enterprises is determining who should own big-data initiatives that affect the entire organization.

## **Dimensions**

A consensual definition that states that "Big data represents the Information assets characterized by such a high Volume, Velocity and Variety to require

specific Technology and Analytical Methods for its transformation into Value.” Additionally, a new V “Veracity” is added by some organizations to describe it, revisionism challenged by some industry authorities. The technical drivers of big data, the 3Vs, have been expanded to other complementary characteristics of big data:

- Volume: big data doesn’t sample; it just observes and tracks what happens.
- Velocity: big data is often available in real-time.
- Variety: big data draws from text, images, audio, video; plus it completes missing pieces through data fusion.
- Machine learning: big data often doesn’t ask why and simply detects patterns.
- Digital footprint: big data is often a cost-free byproduct of digital interaction.

### **Business Drivers**

The business drivers seek to do more analytics with fewer costs. Successful businesses soon realized the following:

- Prioritize big data projects that might benefit the businesses.
- Analyzing big data sets will become a key basis for competition, and leaders in every sector will have to grapple the implications of big data.
- Big data analytics were rapidly emerging as preferred solution to business and technology trends that are disrupting.
- Enterprises should not delay implementation of big data analytics.

Data must be processed with advanced tools (analytics and algorithms) to reveal meaningful information. For example, to manage a factory one must consider both visible and invisible issues with various components. Information generation algorithms must detect and address invisible issues such as machine degradation, component wear, etc. on the factory floor.

Analysis of data sets can find new correlations to “spot business trends, prevent diseases, combat crime, etc.” Scientists, business executives, practitioners of medicine, advertising and governments alike regularly meet difficulties with large data-sets in areas including Internet search, fin-tech, urban informatics, and business informatics. Scientists encounter limitations in e-Science work, including meteorology, genomics, connectomics, complex physics simulations, biology and environmental research.

### **Technologies**

A 2011 McKinsey Global Institute report characterizes the main components and ecosystem of big data as follows:

- Techniques for analyzing data, such as A/B testing, machine learning and natural language processing.
- Big data technologies, like business intelligence, cloud computing and databases.
- Visualization, such as charts, graphs and other displays of the data.

Multidimensional big data can also be represented as tensors, which can be more efficiently handled by tensor-based computation, such as multilinear subspace learning. Additional technologies being applied to big data include massively parallel-processing (MPP) databases, search-based applications, data mining, distributed file systems, distributed databases, cloud and HPC-based infrastructure (applications, storage and computing resources) and the Internet. Although, many approaches and technologies have been developed, it still remains difficult to carry out machine learning with big data.

Some but not all MPP relational databases have the ability to store and manage petabytes of data. Implicit is the ability to load, monitor, back up, and optimize the use of the large data tables in the RDBMS. DARPA's Topological Data Analysis program seeks the fundamental structure of massive data sets and in 2008 the technology went public with the launch of a company called Ayasdi.

The practitioners of big data analytics processes are generally hostile to slower shared storage, preferring direct-attached storage (DAS) in its various forms from solid state drive (Ssd) to high capacity SATA disk buried inside parallel processing nodes. The perception of shared storage architectures - Storage area network (SAN) and Network-attached storage (NAS) - is that they are relatively slow, complex, and expensive. These qualities are not consistent with big data analytics systems that thrive on system performance, commodity infrastructure, and low cost.

Real or near-real time information delivery is one of the defining characteristics of big data analytics. Latency is therefore avoided whenever and wherever possible. Data in memory is good - data on spinning disk at the other end of a FC SAN connection is not. The cost of a SAN at the scale needed for analytics applications is very much higher than other storage techniques.

## **Applications**

Big data has increased the demand of information management specialists so much so that Software AG, Oracle Corporation, IBM, Microsoft, SAP, EMC, HP and Dell have spent more than \$15 billion on software firms

specializing in data management and analytics. In 2010, this industry was worth more than \$100 billion and was growing at almost ten percent a year; i.e.: about twice as fast as the software business as a whole.

Developed economies increasingly use data-intensive technologies. There are 4.6 billion mobile-phone subscriptions worldwide, and between one billion and two billion people accessing the internet. Between 1990 and 2005, more than one billion people worldwide entered the middle class, which means more people became more literate, which in turn lead to information growth. The world's effective capacity to exchange information through telecommunication networks annually was 281 petabytes in 1986, 471 petabytes in 1993, 2.2 exabytes in 2000, 65 exabytes in 2007 and 667 exabytes in 2014. According to one estimate, one-third of the globally stored information is in the form of alphanumeric text and still-image data, which is the format most useful for most big data applications. This also shows the potential of yet unused data; i.e.: in the form of video and audio content.

While many vendors offer off-the-shelf solutions for big data, experts recommend the development of in-house solutions custom-tailored to solve the company's problem at hand if the company has sufficient technical capabilities.

### **International Development**

Research on the effective usage of information and communication technologies for development (also known as ICT4D) suggests that big data technology can make important contributions but also present unique challenges to International development. Advancements in big data analysis offer cost-effective opportunities to improve decision-making in critical development areas such as health care, employment, economic productivity, crime, security, and natural disaster and resource management. Additionally, user-generated data offers new opportunities to give the unheard a voice. However, longstanding challenges for developing regions such as inadequate technological infrastructure and economic and human resource scarcity exacerbate existing concerns with big data such as privacy, imperfect methodology, and interoperability issues. There have been umpteen areas of applications: manufacturing, healthcare, education, media, sports, etc.

### **Role of Internet of Things (IoT)**

Big data and the IoT work in conjunction. Data extracted from IoT devices provides a mapping of device interconnectivity. Such mappings have been

used by the media industry, companies and governments to more accurately target their audience and increase media efficiency. IoT is also increasingly adopted as a means of gathering sensory data, and this sensory data has been used in medical and manufacturing contexts.

Kevin Ashton, digital innovation expert who is credited with coining the term, defines the Internet of Things in this quote: “If we had computers that knew everything there was to know about things - using data they gathered without any help from us - we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best.

These days everything is driven by big data; right from product-design and market-strategy to election-strategy, -planning and -execution, ... you name it. Our dependency on electronics is increasing day by day. Unknowingly we ourselves contribute to that collection of data. Who collects big data? All electronics service providers have the capability to collect it. Who creates such big data? It is well-known that large players like Microsoft, Hadoop, IBM, Oracle, Google, etc. have created vast data from many sources. Who owns big data? The owners of electronics service providers own big data. Who are the owners of electronics service providers? The answer to that question is a tricky one, because many of them work behind the screens. However, it is interesting to know who ‘controls’ these owners. There lies the real power. That real power-source is the countries, which have recognized the importance of big data. The others look up to those countries for using that big data.

## CONNECTIVITY

Connectivity refers broadly to social connections forged through mediated communications systems; that is, since the arrival of the World Wide Web and the spread of mobile communications, mediated connectivity has been quietly normalized as central to a consolidating ‘global imaginary.’ One aspect of this is the ability of the social media to accumulate economic capital from the users’ connections and activities on social media platforms by using certain mechanisms in their architecture. According to several scholars (e.g.: van Dijck and Poell) “it is a key element of social media logic, having a material and metaphorical importance in social media culture.” This concept originates from the technological term of ‘connectivity’ but its application to the media field has acquired additional social and cultural implications. The increasing role of social media in everyday life serves as the basis of such connectivity

in the 21st century. It shows the interrelations between the users' activities on social media and at the same time the empowerment of the social media platforms with the data that was produced by the users and given to those services for granted.

In a short span of decades we have experienced the enhanced connectivity from a simple mobile hand-set to smart-phone. Connectivity developed with the rise of the Internet, first with the introduction Web 1.0 and later Web 2.0. New improvements in equipment, software, the advancement of speed and access have increased the level and quality of connectivity. Along with these improvements, new media such as social networking systems (e.g. Facebook, Twitter, Google+), websites that provide access to user-generated content (e.g. Youtube, Myspace, Flickr), trading and marketing sites (e.g.: Amazon, eBay, Groupon) and also game sites (e.g.: FarmVille, The Sims Social) have become an essential part of everyday life of an average user: "Just as electricity in the 19th and 20th centuries transformed societies by penetrating every fiber of people's personal and professional lives, network connectivity is probably the most powerful transformative force in early 21st-century cultures."

This made a shift in the understanding of the nature of connectivity and moved the initial focus just from a technical side of the notion to its increasingly acquired techno-socio-cultural character. Connectivity is built on the principles of Web 2.0 that promote openness, create the vision of empowerment of the user in the generation of a new content and coordination of the information flow on the Internet. These mechanisms encourage staying in touch with each other despite distances and share as much data as possible.

Van Dijck mentions three concepts implemented in the technological side of connectivity which result in the connective structure of the platform and in the creation of its additional social and cultural dimensions. These are platform, protocol and interface.

Several scholars mention in their works the ambiguity of the term 'platform' that promises to bring openness, access, to be neutral and help people build social connections and participate in online activities, but in fact implies a more complicated structure of the media, most of the time created for the profit purposes and as the enhancement of control under the users. As for the protocols and interfaces, the algorithms behind the platform are intransparent and presented to the user as intermediaries for 'staying in touch,' being connected, encouraging to make those connections, but at the same time the platform itself "facilitates the cultivation of 'weak ties' as well as the



fabrication of ‘strong ties.’” Therefore, connectivity becomes a new type of social capital gained from the platform’s working principles.

### **Internet of Things (IoT)**

Everyone is eyeing the next big thing after the .com boom which will make riches. World has never being the same after advent of the internet. Investment gurus and statisticians may have many proposals to make but one thing is for sure, the next big move which will shape the century will depend on internet and embedded technology; i.e.: Internet of Things is what interests major players now. What we do, how we do and when we do is never going to be the same when the physical environment around us gets lively and starts communicating.

Internet of Things (IoT) is here and is becoming an increasing topic of interest among technology giants and business communities. The hype is not baseless as there are enough evidences to support the success of “Internet of Things” in the coming years. According to a report by Gartner there will be 30% increase in the number of connected devices in 2016 as compared to 2015 with 6.4 billion IoT devices entering the realm of internet of things. The number is further expected to increase to 26 billion by 2020. So one might simply ask “What is Internet of Things” and how it is going to impact our lives and career opportunities. There is a lot of complicated technology and terminologies at work in the IoT world but here I will try to keep things simple to explain the concept of Internet of Things easily.

### **Definition**

IoT is simply the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data making them responsive. More than a concept Internet of Things is essentially an architectural framework which allows integration and data exchange between the physical world and computer systems over existing network infrastructure.

### **Important Components**

Many people mistakenly think of IoT as an independent technology. Interestingly internet of things is being enabled by the presence of other independent technologies which make fundamental components of IoT. The fundamental components that make internet of things a reality are:

- Hardware-Making physical objects responsive and giving them capability to retrieve data and respond to instructions
- Software-Enabling the data collection, storage, processing, manipulating and instructing
- Communication Infrastructure-Most important of all is the communication infrastructure which consists of protocols and technologies which enable two physical objects to exchange data

### **Why IoT will be successful in the coming years?**

As the telecommunication sector is becoming more extensive and efficient, broadband internet is widely available. With technological advancement it is now much cheaper to produce necessary sensors with built-in wi-fi capabilities making connecting devices less costly. Most important, the smart phone usage has surpassed all the predicted limits and telecommunication sector is already working on its toes to keep their customers satisfied by improving their infrastructure. As IoT devices need no separate communication than the existing one building IoT technology is very cheap and highly achievable.

### **Internet of Things Infographic**

To put things simply any object that can be connected will be connected by the IoT. This might not make sense for you on the forefront but it is of high value. With interconnected devices you can better arrange your life and be more productive, safer, smarter and informed than ever before. For instance how easy it will be for you to start your day if your alarm clock is not only able to wake you up but also able to communicate with your brewer to inform it that you are awake at the same time notifies your geezer to start water heating. Or you wearable wrist health band keeps track of your vitals to inform you when you are most productive during the day. These are just few examples but applications of internet of things are numerous.

On large scale transportation, healthcare, defence, environment monitoring, manufacturing and every other field you can imagine of can be benefited from IoT. It is very to conceive the whole application domain of internet of things at the moment but you can clearly understand why it is such an interesting and hot topic at the moment.

### **The Challenges of IoT**

Like any other technology there are challenges which make the viability of IoT doubtful. Security is one of the major concerns of experts who believe virtually endless connected devices and information sharing can severely compromise one's security and well-being. Unlike other hacking episodes which compromise online data and privacy with IoT devices can open gateway for an entire network to be hacked. One such flaw is well presented by Andy Greenberg on wired.com where he works with hackers to remotely kill his Jeep on the highway. Another very relevant example is provided by W. David Stephenson in his post Amazon Echo: Is it the smart home Trojan Horse? You can estimate the amount of personal and private data the connected devices will be producing once they are on a network. The major challenge for IoT tech companies is to figure out how the communication in the internet of things realm can be made truly secure.

### **What to Expect**

Any object that can be connected will be connected by the Internet of Things. IoT is truly a game changing concept and whatever challenges may be present, there will be rapid growth in the number of connected devices. There is still need for us to understand concepts of IoT and the flaws that are underlying. As more and more devices start to connect the need will force technocrats to come up with most advanced concepts and methods to ensure growth of this technology. By the time what we can do best is to educate ourselves on various IoT technologies and keep experimenting with new stuff. The smart-systems can't be driven only by AI. In order to implement a smart-system successfully, it needs big data and connectivity as well. That is the reason why the same large players have committed huge resources in developing enhanced connectivity. We are already experiencing various smart-systems around us, which are going to be a part of our daily life.

## **CONFLUENCE OF ARTIFICIAL INTELLIGENCE, BIG DATA AND CONNECTIVITY**

The confluence of big data, artificial intelligence and connectivity is already driving the industry. Whether we like it or not, we can't resist or stop it. The labour-unions in India, at one time, had thought that they could resist the use of computers in Life Insurance Corporation and colour-TV in India. What happened is a history. As the change is inevitable, why not be a part of it and

reap the benefits. If we commit our resources in the right places, we can still catch up with it; otherwise we'll miss the boat.

Yes, there is a down side as well. All these developments, particularly in the field of AI, are going to bring huge job-losses. Populous country like India is not going to like it. However, we need to realize the inevitability of the situation. Sooner or later we have to face the reality and find ways to enhance the job-creation in a big way, for an ever-increasing population. It is one of the major targets of each government. However, it is not adequate to feed ever-increasing population. If the application of artificial intelligence is going to bring about massive job-losses, what is going to happen to 1.3 billion population of India?

No amount of development can cope with providing even civic services to the rate of population explosion. Limited growth in job-creation can never compete with the growth in population. The failure of the population-control experiment, in the decade of 1970s, is well-known. Hence, no leader in India is ready to recognize the Frankenstein of population explosion; and not ready to address that subject.

Improvement in technology brings about changes in the industry. The workers need to be retrained to cope with the application of new technology. Our skilled workers decline to retrain themselves; what to talk about the unskilled and semi-skilled workers. Motivating the workers for retraining is a sensitive task and a perpetual difficulty faced by the industry.

One of the Indian journalists has recently quoted a foreign policy-maker in New York, "India continues to disappoint. Infra-structure remains shabby, policies unclear and middle-class remains too small to matter." Rather than finding the ways to face the situation by developing ourselves and making progress in the above fields to be abreast with the world, we choose to devote our precious time and resources on some infructuous political and social dialogues in the media.

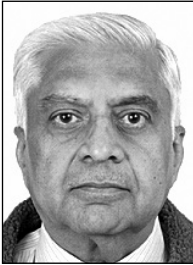
FORE School of Management, New Delhi, took a big lead in conducting a conclave at New Delhi on 'Confluence of Artificial Intelligence and Big Data Analytics,' in January 2018. The prime minister of Israel, Benjamin Netanyahu, addressed the conclave. He described Israel's contribution in this area and offered Israel's assistance to India. How many other Indian universities have taken interest in this subject?

It's a shame that Indian mainstream-media, print and electronic, have not bothered to discuss the above issue so far. Whereas, the international

media like CNN, BBC and associated print media are on dot, discussing this subject every week since the late-January 2018. There is a little chance that the regional media in India would catch up with the subject any sooner. When spoken with a regional journal, its reaction was, “the subject is too technical for us.” If not the media, who else is going to enlighten the people at large on such issues?

Through this article, I urge media, universities, scientists and researchers to commence a dialogue on the subject; and motivate our political leaders to commit resources to develop big data, artificial intelligence and connectivity; lest we are left behind.

## VINAYAK PURUSHOTTAM DAVRAY



Wing Commander Vinayak Purushottam Davray has worked with International Civil Aviation Organization (ICAO), based at Montreal, Canada. He was commissioned in the flying branch of the Indian Air Force in June 1963. He flew Canberra Bombers and Reconnaissance aircraft and participated in Indo-Pakistan wars of 1965 and 1971. He was Assistant Director at Air Headquarters. He was a senior-instructor on Boeing-737 and Airbus A-320 aircraft at the Central Training Establishment of Air India from 1981 to 1990. He was Assistant General Manager at the Malaysian Flying Academy, Malacca, from 1990 to 1991. There he successfully implemented training standards of the British Civil Aviation Authority for the pilots of Malaysian Airlines.

Wing Commander Davray led a team of experts that establishing Civil Aviation Authority at Kingdom of Bahrain from 1995 to 1997 and worked there as Director of Aviation Safety from 1997 to 2005.

## Status of India's Coastal Security: Challenges, Concerns & Way Ahead

*Brig Hemant Mahajan*

### CURRENT SCENARIO

Since last nine years, the Indian government has undertaken a number of proactive measures to restructure coastal security and push the defensive perimeter further away from the coast into the seas. The focus was on building national maritime domain awareness (NMDA) grid via a number of organisational, operational and technological changes. It has set up the National Command Control Communication Intelligence (NC3I) network that hosts the Information Management and Analysis Centre (IMAC).

It connects radar stations located along the coast and on the island territories, and helps collate, fuse and disseminate critical intelligence and information about 'unusual or suspicious movements and activities at sea'.

The IMAC receives vital operational data from multiple sources such as the AIS and the long-range identification and tracking (LRIT), a satellite-based, real-time reporting mechanism for reporting the position of ships. This information is further supplemented by shore-based electro-optical systems and high-definition radars. Significantly, maritime domain awareness is also received through satellite data.

There are 74 AIS receivers along the Indian coast and these are capable of tracking 30,000 to 40,000 merchant ships transiting through the Indian Ocean. The AIS is mandatory for all merchant ships above 300 tons DWT and it helps monitoring agencies to keep track of shipping and detect suspicious ships.

The radar chain 'provides real time surveillance cover up to 25 nautical miles around the areas of high sensitivity and traffic density along our entire coast line.

## **AIM**

The aim of this article is to analyse the evolution of coastal security over the years, review the present challenges & concerns & recommend what else should be done to improve coastal security further.

## **ANALYSIS EVOLUTION OF COASTAL SECURITY**

Indian policymakers and security forces did not take into serious consideration the various sea-borne illegal activities that were undermining the coastal security of the country for a long time. Thus, responses to the threats and challenges were formulated only after the crisis situation had become too intense to be ignored. Most importantly, many of the policies were formulated without preparing the ground for their implementation. This top down and reactive approach towards coastal security has resulted in several inadequacies in the coastal security architecture.

For example, coastal radar chain, NAIS is helpful in tracing only those vessels fitted with AIS transponders and not the fishing vessels. Also, the spoofing of AIS would always remain a possibility which could undermine this surveillance method. Hence boarding operations of suspicious ships by Indian Coast Guard (ICG)/Police is the only real solution. The ICG should carry out boarding operations based on intelligence input's or if there is suspicion.

## **THE CHALLENGES**

Non-traditional threats have been increasing, particularly over the past few decades. These include maritime terrorism, piracy, natural disasters and regional crises which have acquired greater incidence and prominence. The coastal security book has been written after a comprehensive review of India's maritime environment, including prevailing threats, challenges and future trends. The coastal security strategy shall continue to be reviewed and refined, in relation to developments in the maritime environment, so as to remain contemporary and relevant.

The involvement of several organisations in coastal security has led to various coordination problems among them. The tendency of each of the concerned organisations to zealously guard its own turf, reluctance to work under or along with other organisations citing differing organisational culture and goals, and propensity to hold on to intelligence, have all prevented the coastal security arrangement from working effectively. Although a number of measures such as the formulation of standard operating procedures, conduct of joint coastal security exercises, establishment of joint operation centres and setting up of coordination committees have been undertaken, these have not proven adequate for overcoming the strong forces of dissonance among these organisations.

Most importantly, the organisations involved in coastal security suffer from inadequate capabilities in terms of manpower, assets, presence, and mind-set.

## THE CONCERNS

Monitoring the movements of thousands of fishermen and their fishing boats/trawlers which venture into the sea everyday is essential to ensure foolproof security of India's coastal areas.

In addition to the six monthly exercises, one time thorough check has to be carried out by the security forces led by the ICG to carry out physical check of all suspicious fishing vessels. All documents must also be linked up to Aadhar cards.

NAIS will be helpful in tracing only those vessels fitted with AIS transponders and not the fishing vessels.

Distress Alarm Terminals (DATs) are being provided to fishermen so that they can alert the ICG if they are in distress at sea. The fishermen have to be educated to utilize them.

Monitoring compliance measures as per International Ship And Port Security (ISPS) code could be given to ICG. Similar powers could be granted to the Indian Navy(IN).

It is acknowledged that the container can be used by terrorist organizations to illegally transport a nuclear weapon, dirty bomb, arms or ammunition. The containers should be scanned thoroughly under X-ray machines to ensure 100 per cent security. Explosive-detection bulk and trace scanners should be installed at various key points on ports, to minimise security breaches.



It is not enough to have a contingency plan for oil spills, to respond to devastating emergencies. The focus needs to be on monitoring movement, augmenting information collection, proper training and ensuring that the ICG is well-equipped to handle such situations along with other government agencies. The ICG must be supported through appropriate statutory backing and proper funding.

Sunderban marshy land is a safe haven for Inter Services Intelligence Agency of Pakistan (ISI) agents both because of difficult terrain and vote bank politics of the state government. They must be kept under constant surveillance. The ICG, which has a presence in the area, does not have the mandate to patrol the creeks of the Sunderbans as they lie inside the shoreline and these form part of internal waters. Relaxed patrolling and surveillance of the coastal waters during the rainy season also raises security concerns.

## **WAY AHEAD :WHAT ELSE CAN BE DONE**

### **Comprehensive National Coastal Security Policy**

There is a need to evolve India's coastal security doctrine by involving all the stakeholders. This will clearly bring out roles and tasks of all stakeholders comprehensively. This could be done say by HQ Integrated Defence Staff (IDS) involving IN, ICG and other stakeholders. There is also a need to publish general Staff publication on the above subject. This publications will provide necessary guidelines to all involved in Coastal Security. We must analyse the threat perception in relation to its occurrence in near (up to one year), middle (one to five years) and long-term future (five to 15 years) so that force structuring and security preparedness can be planned accordingly. The threat perception timeline should be aligned to the budget year.

- We should have a threat response plan ready for handling threat proactively by pre-emption and prevention.
- We must integrate all military and security forces under a unified command or under HQ Integrated Defence Staff or Chief of Defence staff when created. Till then, Joint Operational Centres (JOCs) should become controlling HQ and not coordinating HQ.
- We must organize all non-military maritime agencies under one controlling agency, say State Maritime Boards. It should become controlling HQ and not coordinating HQ.

- We must Initiate plan of action for international cooperation on dealing with poachers, smugglers, pirates, terrorist, human smuggling and cooperate with as many countries as possible for its elimination.

## **THE NATIONAL STRATEGY FOR COASTAL SECURITY (NSCS)**

All coastal security initiatives should be brought together in a comprehensive document. The strategy should be to prevent terrorist attacks and criminal or hostile acts, protect coastal-related population centres and critical infrastructure, minimize damage and expedite recovery, and safeguard the ocean and its resources. Various plans that should be in place are:-

- National plan to achieve coastal domain awareness ,
- Global coastal intelligence integration plan,
- Coastal operational threat response plan ,
- International outreach and coordination strategy
- Coastal infrastructure recovery plan,
- Coastal transportation system security plan,
- Coastal commerce security plan and domestic outreach plan.
- While it is necessary to improve “MDA” In Indian Ocean via multilateral cooperation, it should not clutter our coastal security MDA.
- System of Awards: Award ‘CNS Unit Citation’, to IN, ICG and police stations on the coast to the best units will improve their operational efficiency .
- Hold Intelligence Seminars: Each coastal state, Western and Eastern, island territories should hold intelligence seminars, say, once a year to forecast short- and long-term security challenges.
- Bilateral and Multilateral Exercises: The exercises with friendly countries should be done during the time of high security alerts given by the Intelligence agencies, whenever possible. They will act as deterrent for any mischief by inimical forces.
- Setting up of Maritime Courts: Maritime courts can be set up to adjudicate in cases of infringement of maritime law in addition, powers of prosecution and detention could be given to the ICG.
- Representation of IN and ICG: It should be made mandatory on the major port management trusts and state maritime board in the country.
- BSF Water Wing: The existing water wing of the BSF needs to be strengthened for effective patrolling in areas of West Bengal, and Gujarat.

## **MARITIME SECURITY ADVISOR (MSA) AND MARITIME SECURITY COUNCIL (MSC)**

Since coastal security involves multiple agencies, both at the centre and the state levels, the requirement for a lead coordinator at the centre is something that needs consideration. The formation of an MSC as single window for all maritime security issues, to be headed by an MSA, will be an important step ahead. It is recommended that suitable experienced, retired officer above the rank Rear Admiral (and equivalent) of ICG, IN, Military, Police, other experts should act as a MSA.

### **The CNS should officiate as one till the decision is taken.**

There exists an urgent need of an MSA to the state government who could facilitate and expedite implementation of coastal security measures.

### **Cooperation among States for Countering Security Threats**

India will require cooperation among states to handle and respond to multiple threats. In countering any threat, forewarned is forearmed. What is needed, therefore, is an efficient security system that can challenge any security breach. The system should be capable of carrying out multiple functions such as denial, prevention, delay, detection, assessment and quick response.

### **Better Regulation for Exclusive Economic Zone (EEZ)**

Management of the mushrooming traffic in our coastal waters, comprising shipping, fishing and other small craft, together with the increasing number of production and exploration platforms and their attendant craft is of crucial importance. This is not just to prevent accidents but also from the security angle. The introduction of AIS has made things easier. Port Vessel Traffic Management System (VTMS) keeps a track of ships but there is no system in place for hundreds of smaller craft that ply our coastal waters.

- Regulation of vessels in our EEZ will only be possible once traffic separation schemes near these dense areas are demarcated and unambiguously defined. Poaching of foreign fishing craft in our waters is a problem. The best solution is to increase our fishing fleet and fish in areas around our island territories.
- Another aspect of management and regulation requiring attention is the lack of communication between various stakeholders, for example, between oil explorers and fishers, and also between oil explorers and other

support craft in the field. Instances were recounted of fishing nets getting entangled and seismic survey craft fouling the anchor cables of OSVs in the area.

### **Setting up Communication Control Centre (CCC) in each Major Port and Shipyard**

Every major port and shipyard should set up a communication and control centre, integrating all security and marine operational functions including the cargo and security gate complex. The CCC should serve primarily as the port's security nerve centre, from where security personnel should monitor and operate all communications and surveillance systems as well as emergency response systems throughout the port.

- Compulsory verification of antecedents in respect of all employees and those port users who are issued with entry passes for access into the port's sensitive areas is a must.
- The issue of security passes should not be outsourced and in all cases should be handled by the CISF
- Security of passenger vessels bound for Lakshadweep and Andaman Islands requires special attention. Ports handling these vessels may enforce a system requiring passengers to carry an identification card / document.
- It is recommended that the public places of worship should be re-located outside the Port premises. The present practice of allowing access to outsiders stopped forthwith.

### **Streamline the Flow of Traffic on the Entire Coast Line**

The recommended routes off Mumbai exist and are largely followed by shipping in territorial waters. As traffic increases, we will need to establish geographical reporting points for each port just inside our territorial waters along with waiting areas and mandatory routes for entry into all major ports. Legitimate merchant traffic both ocean going and coastal would need to follow these routes and this would streamline the flow of traffic making the job of the maritime enforcement agencies easier. Alternative routes to reduce congestion in territorial waters, especially around major ports, around the southern coast and where ever the traffic is dense, must be done. This will result in better monitoring of suspicious vessels.

- There is a need to provide a safe and regulated transit passage to the shipping community and also strictly monitor it.

- Regulation of vessel movements in our EEZ will be possible after the traffic separation schemes near these dense areas are demarcated and unambiguously defined.

### **Tracking of Fishing Vessels and Boats**

It has emerged that GSAT- 6 technology under trial with IN appears to be a cost-effective technology for transponders on smaller boats. The NCSMCS reviewed the issue in its 14th meeting held on November 24, 2016, wherein the committee was informed that GSAT-6 satellite-based technology, under trial with Indian Navy and Indian Space Research Organisation (ISRO), is the most suited.

### **Monitoring Fishing Traffic**

Fishing operations worldwide are undertaken as per the UN Code of Conduct for Responsible Fisheries (CCRF), which includes registration, proper equipping and manning, and installation of position reporting equipment. India, though a signatory of CCRF, suffers from poor implementation of this code. While several measures have been initiated, the sheer numbers of fishing vessels, coupled with a certain amount of inertia makes their implementation difficult. Therefore there is need for a fool proof system that can account for all fishing boats at sea. Such a system must be able to enforce physical compliance to extant regulations.

- There is also the need to consider punitive measures to ensure enforcement of ID and registration-related measures for fishing vessels. This would need the support of committees of local fishing harbours who, along with the Marine Police and Fisheries department, could ensure compliance to equipment fit, especially position reporting equipment, movement of boats, and so on. Non-compliance could be penalized by withholding of diesel subsidy and cancellation of license, among other measures.
- Creation of 'modern' fishing harbours will reduce the number of landing points along the coast, thereby reducing surveillance challenges. Diesel subsidy should be linked up with compliance of fisheries regulations. Fisheries Department should be made responsible for fisheries control and monitoring.

### **Fishing Boats to have Tracking Devices**

The government is all set to install tracking devices in small fishing vessels free of cost, to monitor their movement and curb security threat along the

coastline. The ministry has estimated the cost of each transponder at about Rs. 16,800, and sought funds to the tune of Rs. 336 crore for installing two lakh transponders in small boats.

- The home ministry will bear the entire expenditure on transponders while the project will be implemented by the Department of Animal Husbandry, Dairying and Fisheries under the Agriculture Ministry. Technical assistance would be given by the Directorate General of Lighthouses and Lightships (DGLL) under the Shipping Ministry.
- The Coastal Surveillance Network (CSN) and NAIS keep track of the country's maritime security. However, for meaningful surveillance efforts, there is also a need to tag the fishing boats and small coastal vessels with identity and other details. At present, even though our radars can detect these vessels, we have no way to ascertain their identity.
- The AIS (P) can be implemented through the National Automatic Identification System (NAIS) —a set-up connecting 74 AIS sensors installed on lighthouses along the entire coastline—connected with six regional control and two coastal Control centres, besides one national data centre and having monitoring stations at IN, ICG and other centres. To increase the distance of tracking, ISRO is also close to launching a space segment for AIS (P). The ministry has also identified 20 islands out of a total of 1,382 offshore islands that will be developed to help track fishing vessels and boats.

### **LET US HOPE THAT IT WILL BE FULLY BE IMPLEMENTED BY 2018**

#### **Crossing of International Maritime Border Line (IMBL) by Indian Fishermen**

The MOD should engage with other ministries and state governments to bring in consensus on having a Union Legislation in this regard so as to introduce a uniform punishment system for those who cross the IMBL and accordingly empower the ICG to penalise the offenders. Maintenance of forward posture at IMBL with an aggressive outlook is necessary especially on the Pakistan border. We must track down rogue elements that encourage gullible fishermen to fish across the IMBL.

### **Security Profile Check on the Coast Line**

The flourishing dhow traffic between India, Pakistan and the Gulf destinations has to be monitored for security reasons. Studies of the population and security profile needs to be studied. Smuggling cartels and criminal gangs have to be identified and modus operandi of transportation mechanism between the coastal areas and hinterland niches of the smugglers, Hawala operators and the underworld gangs have to be found out.

### **Territorial Army(TA) for Coastal Security**

The systematic strengthening of part-time concept in coastal security is in national interest. The "Citizens' Army" represents the complete society and careful nurturing of this organisation can provide the nation with a readymade reserve that can be instrumental in addressing all dimensions of enemy designs. The Coastal TA and Intelligence battalions could put under command the ICG/IN/Army.

### **Recommendations For Indian Coast Guard ICG**

The ICG is a major service with regard to coastal security. Many aspects have to be looked into to make it more effective.

### **Implement Recommendations By Public Accounts Committee (PAC) In Time Bound Manner**

The PAC highlighted various shortcomings and lapses in the functioning of the ICG, namely, delay in and non-approval of 15-year perspective plans and 5-year ICG Development Plans, such as huge shortfall in utilisation of sanctioned funds, inadequate/lack of infrastructural facility, lack of coordination between the IN and the ICG, non-achievement of planned acquisitions, defective acquisition procedure, inadequate force level, shortage of manpower and equipment, shortfalls in decommissioning and replacement of obsolete vessels, huge number of outstanding refits, legal limitation faced by the ICG and so on. These and other relevant issues should be dealt on priority.

In spite of the Ministry curtailing the projected requirement, the actual Capital expenditure as a percentage of capital outlay ranged between 82 per cent in the 9th Plan and 53 per cent in the 10th Plan. This has resulted in the non-achievement as well as shifting of plans in terms of the physical acquisitions of ships and aircrafts.

The MoD should analyse the hindrances affecting defence procurements, put in place quicker replacement in case a company fails to deliver order well in time, infuse novel ideas in the system and overhaul the country's defence procurement procedure further so that all the targeted acquisition are timely achieved.

The ICG is severely constrained due to lack of adequate infrastructural facilities. Planning, sanction and establishment of ICG stations and aviation units should be carried out in a highly professional manner on a mission mode and it should be ensured that stations are activated with the envisaged manpower and other infrastructure to ensure that activated stations did not suffer from limitations.

### **Make Up Shortage of Manpower**

As on 9th March, 2015, there was a total shortage of 3,068 officers and enrolled personnel in the ICG. The Ministry reportedly plans to fill up the existing shortage of officers by 2020 .The vacancies in the ICG should be filled up without further delay.

The ICG did not have its own training infrastructure and all basic trainings for its officers and enrolled personnel; they were provided a makeshift training centre at Kochi by the IN. The ICG academy was to be commissioned in 2017.

With the reduction of crew onboard and multitasking of the crew come problems peculiar to ergonomics. More focused training, curriculum development, certification, newer and more practical quality standards may be able to mitigate the human error leading to almost 90% of perils at sea.

### **Cross Attachment among Security Forces**

To improve the skills of officers in various agencies, it is suggested to have officers on deputation to and from IN, ICG, State Police, so that they can use their domain knowledge to improve skills in other organisations as well as become nodal points for coordination. All other stakeholders should do cross attachment with IN/ICG for better implementation of coastal security

### **Augment the Capabilities of Marine Police**

It is incumbent upon the respective state governments to recognize the severity of sea-borne threats and take effective steps to augment the capabilities of the marine police.



Encouraging recruitment of retired IN, ICG, Army engineers, EME personnel in the marine police is required. A separate cadre for marine police officered by state police officers should be raised as early as possible.

States should encourage recruitment of fishermen in the marine police force by spotting and nourishing talented individuals in the fishermen community. State governments could also raise a separate cadre for marine police along the lines of a short-service commission officered by state police officers. States should also concentrate on the issue of training the marine police.

Marine Police should focus on coastal security and not on law and order.

### **Coastal Security and Other Agencies**

The most effective way of increasing maritime security was the inculcation of a culture of security amongst all stakeholders. This could be achieved by better and regular training, increasing awareness of security issues by lectures, workshops and seminars, greater interaction and cooperation between port administrations and shipping companies on security matters.

### **Intelligence, Surveillance and Databases**

The multi-agency centre under IB must give a monthly and quarterly assessment of all aspects of coastal security such as illegal trade, infiltration of arms, ammunition, FICN, foreign nationals etc., so that worthwhile assessment of efficiency of security agencies can be carried out.

All government agencies deployed on the coast should be held responsible for obtaining own actionable intelligence. Each state should raise Home Guards and intelligence battalions comprising fishing community and locals residing on the coast line, to gather actionable intelligence and for performing coastal security duties.

NTRO must play more active role in gaining technical intelligence for coastal security.

Intelligence on drug cartels, trans-national crime syndicates, terrorist organisations, poachers, pirates, their supporters is very poor. The need of the hour is actionable intelligence as resources will always be in short supply. The Navy should also take lead in developing international cooperation in intelligence sharing, especially with respect to neighbouring countries.

Imparting basic skills to the fishermen in intelligence gathering and to cultivate them as effective informers must be done by all department for their own security.

### **Actionable Intelligence is the key**

Preventing the next terror attack and any other security breach requires actionable intelligence. Police, Naval and ICG leadership should be able to give clear directives to intelligence organization and must monitor it. Intelligence collection is a formidable challenge which must be met head on.

- Precise and real-time intelligence is a force multiplier; a handful of highly dedicated and skilled professionals can achieve more success than much larger force level.
- All defensive measures are costly and any defence can be penetrated. At times, it is necessary to punish the terrorists by taking the war to their bases and launch pads. Blaming intelligence agencies is not the answer. We urgently needs to streamline intelligence management.
- Techint has a CI aspect too relating to ensuring the security of the communications. Signal Intelligence is well-equipped to perform this role. In the MoD, intelligence elements of the four services and Techint (SIGINT, DIPAC etc.) should be grouped into one integrated department and designated as DG DIA. It should be headed by a director who can be called the Director of Service Intelligence (DSI). These assets should also be used for coastal security.
- We need to create intelligence folders for all coastal districts containing intelligence about suspects, vulnerable areas on the coast line. Intelligence about sea wing of various terror organizations must be updated. If any gaps found, they must be removed.
- The economic intelligence wing of all above organizations should be tasked to focus on front organizations of antinational elements and known supporters of smugglers, illegal traders, criminals on the coast.
- Can we carry out intelligence encirclement of Pakistan and other enemies?
- Language barrier is an impediment to gathering intelligence, even within different Indian states. Navy and ICG personnel are basically proficient in English and Hindi, but not with the regional languages. These skills must be improved.
- India must deploy a 10-satellite constellation for its coastal surveillance. We have the capability.

### **Inculcating Patriotism and Commitment to the National Cause in the Coastal Areas**

We should create awareness of the duties and responsibilities of citizens, through the introduction of imaginatively conceived modules, in the educational curricula in the schools, colleges and professional training institutions. The Department of Education in the Ministry of Human Resource Development (HRD) and the State Governments, may be involved in this extremely important endeavour. In this context, a proposal that it should be made obligatory for youth to either undergo national service, National Cadet Corps (NCC) or a stint in the Territorial Army (TA) should be considered.

Ministry of Information and Broadcasting and the State Governments, will need to be involved in this effort.

### **Remove Legal Constraints and Empower ICG**

While the Maritime Zones of India Act, 1981 empowered the ICG to enforce its provisions against vessels found engaged in unauthorised survey, data collection etc., prosecution of offenders can be launched only after obtaining the approval of the Ministry of External Affairs, the nodal Ministry for the Umbrella Act, that is, the Maritime Zones of India (MZI) Act, 1976.

- Laws for regulating Indian deep-sea fishing vessels in the Indian EEZ beyond territorial waters are required so that ICG can monitor the activities of deep sea fishing vessels.
- All other related maritime activities, relevant amendments to the Acts, rules, regulations and Manuals need to be effected early to make the ICG empowered and competent enough to carry out its duties more effectively. This would be possible by bringing in all classes of ships and vessels under the ICG's purview. The amendments required by the ICG must be carefully drafted and proposed again to MEA. Most bills are still pending because of lethargy of bureaucracy and parliament. The Inter-Ministerial Group to work on amending Indian legislations to address the same must complete all such legislation by 2017.
- The Coastal Security Bill drafted in 2013 is yet to be tabled in the Indian Parliament. The draft of Piracy Bill placed before the law makers in 2012 lapsed due to priority given to other issues. Legal limitations faced by the ICG in performing its mandate to take action to impound vessels,

involved in carrying out activities like unauthorised survey, data collection detrimental to national interest must be overcome.

- There are no laws for regulating Indian deep sea fishing vessels in the Indian EEZ beyond territorial waters. In the absence of necessary regulations, ICG is not in a position to monitor the activities of deep-sea fishing vessels. The Marine Fisheries (Regulation and Management) Bill, 2009 is still at the draft stage and needs to be passed at an early date. Legal constraints and lack of empowerment of ICG, IN, Police must be overcome for better coastal security and all such bills should be passed on priority.
- The Nayak Committee report presented a new draft CRZ notification in 2015. The report should be implemented at an early date.
- Lack of laws leads to exploitation of Indian seafarers by the touts and international shipping companies. The unscrupulous recruitment agencies have to be punished for their misdeeds. Fake recruitment agencies have to be prosecuted under the law.
- All cases of Indians who are still in the custody of pirates need to be resolved in a definite time frame.

## CONCLUSION

The newspapers and TV Channels have reported many cases of corruption, inefficiency and dereliction of duty by security agencies. Please refer to the videos on coastal security shot by the TV channels, especially, on yearly anniversary of 26/11. All such reports of investigative journalism should be investigated further and corrective action taken if found guilty.

It is not enough to have seminars at regular intervals. They need deep and detailed study and debate. This can be done by think tanks. However tasking of subjects for research and seminars should be done by the service HQ.

All possible efforts should be made to recruit people knowing local dialect necessary for intelligence gathering. The history of coastal security should be studied by all regularly so that we do not repeat the mistakes again. Bangladeshi infiltration via sea is a serious threat to coastal security and has to be stopped. Keeping a watch on Bangladesh coast especially Sunderbans will help. Sagarmala is going to be game changer and will also require enhanced coastal security.

26/11 has prompted the Union and State Governments to announce a series of policy measures intended to modernise and improve the coastal security

apparatus. Regrettably, past experience has shown that implementation remains tardy and inefficient, leaving many gaps which the anti nationals have exploited. It can only be hoped that the biggest gap in India's security – the inefficiency of administration – will be overcome this time around, and that a measure of urgency will attend the implementation of current plans for a stronger coastal security system.

The ISI and Pakistan Army in particular is actively involved in aiding and abetting various fault lines in the Indian society. The need of the hour is joint man ship between IN , ICG , Police , Intelligence agencies and various Government ministries . The glass is more than half full but we still have miles to go to achieve full proof coastal security.

### **BRIG HEMANT MAHAJAN YSM (RETD)**



Brig Hemant Mahajan is a prolific writer and speaker on all aspects of National Security. He has served extensively in Counter Insurgency Operations in Jammu & Kashmir, Punjab and North East. His unit was awarded COAS Unit Citation, GOC-In-C Northern Command Unit Appreciation, 18 gallantry awards, including YSM for the officer. He commanded a Brigade in Operation Rakshak again in very intense insurgency areas of Poonch, Krishna Ghati, of Jammu and Kashmir. He has led number of military delegations abroad to further military diplomacy and improving defence cooperation. Post retirement he has written nine books.

## State of Research on User Training against Phishing with Recent Trends of Attacks

*Aniket Bhadane, Dr. Sunil B. Mane*

### INTRODUCTION

Phishing attacks masquerade as a trustworthy source, often spread using socially engineered messages using media such as emails, social media, SMS, online multiplayer games, VoIP, etc. to persuade victims to perform certain actions of attacker's benefit [1]. These actions can be persuading the user to enter sensitive information on a phishing website; clicking a malicious/phishing link in an email; performing certain actions, such as money transfer, installing malicious software etc., as stated in the socially engineered message. Social engineering is psychological manipulation of people to make them perform certain actions [2].

Phishing attacks caused loss of over \$3 Billion in last 3 years [3] and have seen an increase of 65% in 2016 over 2015 [4]. Spear Phishing attacks constituted 90% of all phishing attacks. A Spear phishing attack costs \$1.6 Million on average, and \$3.7 Million is spent a year by an average 10,000-employee company dealing with phishing attacks [5]. Very recent major phishing incidents include phishing attempts after Equifax data breach, the Google Docs phishing attack and the DNC hack. Phishing emails and websites were found masquerading as Equifax after its massive data breach [6][7]. In the Google Docs phishing scam, almost 1 million Gmail users were affected [8]. And the DNC hack [9] led to the leak of 19,252 emails and 8,034 attachments from the DNC, the governing body of the United States' Democratic Party.

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*ISSN 2347-9191 print*

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*CASS Journal, Vol. 5, No. 2, April-June 2018, pp. 38-53*

The past work on phishing can be categorized into four categories: understanding why people fall for phishing, automated software techniques to detect phishing, training people to not fall for phishing attacks, and better user interfaces to help people make better decisions when confronted with an attack [10].

Although a very important part of cyber security, User Training approaches have not received much attention from the research community and industry. There exists no software mechanism till date which is able to filter all types of phishing messages. Some phishing messages do reach the end users. So it is important for users to make better decisions and not fall for these attacks. This can be done by providing efficient User Training and Better Interfaces. We provide an ordered study of the current state of research on User Training approaches to mitigate phishing. This survey also provides details of recent studies on specific trends in phishing that are seen nowadays. We do not cover related topics in details, such as spam, but we do touch upon such points wherever required.

In Section 2, we give a Background on details of Phishing alongwith recent trends of these attacks. Section 3 describes User Training approaches as present in the literature. In Section 4, we provide the learnings of our study, and conclude in Section 5.

## BACKGROUND AND RECENT TRENDS OF ATTACKS

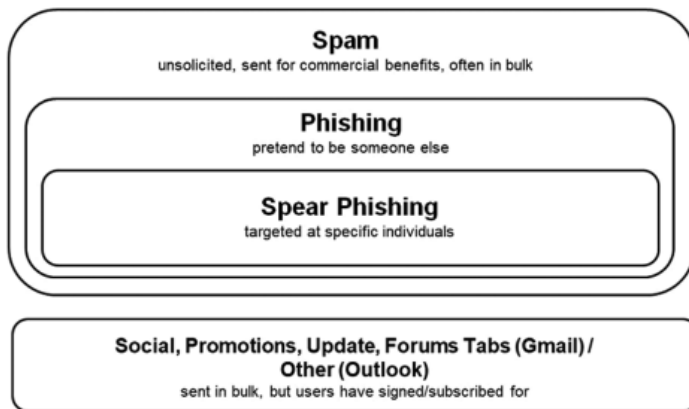


Figure 1: Classes of Messages in the vicinity of Phishing Messages.

Spam messages are “unsolicited” messages sent for commercial benefits, often in bulk quantities. Spam messages, in general, do not need to pretend to be someone else. For example, a health and medicine company advertising its products. Whereas, Phishing

messages are subset of spam messages, which “pretend to be someone else”. Such as a phisher pretending to be from paypal to get sensitive information from user. Gmail provides the option to divide the inbox into Primary, Social, Promotions, Update, and Forums Tabs. The emails in later four categories are also sent in bulk quantity. But these are the ones that users have “signed/subscribed for” and can sometimes be personalized for the user. For example, a user has signed for receiving weekly newsletter from some site. The site will be sending bulk emails to all its subscribers. Such emails will go into user’s Promotions tab since user has subscribed for it. Outlook also provides the option to divide the inbox into Focused and Other Tabs, with the Other tab having mails such as those in Gmail’s later four category tabs. We’ve shown this diagrammatically in Figure 1. Gmail adds Phishing emails to the Spam folder itself. On viewing mails in the spam folder, it shows a warning message in red or yellow banner describing the type of message. Also, Gmail maintains sender reputation [11] as a feature to decide whether a message should be treated as spam or not, among other spam related features. We observed a spam/phishing mail sent from a reputed sender landed in receiver’s inbox, whereas the same mail sent from a less reputed sender landed in Spam folder. Self-reputation can be seen in Gmail Postmaster [12]. Mail service providers implement anti-phishing measures on server side. Also various anti-phishing browser extensions are available on the client side which can be installed by individual users.

Phishing is a semantic attack. It exploits human vulnerabilities by targeting the way humans interpret content displayed on the system. This is commonly done using social engineering.

A phishing attack or a phishing taxonomy using phishing messages has three major stages: First stage corresponds to Attack Lure where the victim(s) receive a socially engineered phishing message. Second and Third stages correspond to Attack Exploit, where victim(s) perform action as suggested in the message, and attacker exploits the action performed by the victim(s) for his benefit.

Phishing messages masquerade/impersonate as a trusted identity and use social engineering techniques to persuade user to perform actions of phishers’ benefit. As phishing is carried over various communication media, the psycho- logical and behavioral factors leading to users’ response to attacks also depends on the media.



Phishing messages persuade users to click on an URL in the message and entering sensitive information on resulting page, or replying to the message with sensitive information, or performing money transfer, etc. When using phishing websites to steal users' credentials and sensitive information tied to the target site, phishers may use free web hosting services, or register a new domain, and may also use compromised machines to host their files. Many phishing attacks made no attempt of disguising URL as target site and were successful. Very few phishers registered domain names that were confusingly similar to the brands, which shows that phishers do not need deceptive URLs to fool users [4]. Today, most of the phishing sites are created using Toolkits, which makes it very easy for attackers to create websites visually similar to their targets. The phishing website's URL may be customized to create innumerable URLs by adding random parameters, with all these URLs pointing to the same phishing site.

Phishers may use vulnerabilities in the DNS to divert internet traffic to their phishing websites. In case of DNS (Domain Name System) cache poisoning, the DNS returns IP of the phishing website instead of the correct IP of the domain name. In another technique, domain shadowing, phishers compromise a legitimate domain name's DNS to set up new subdomains. These new subdomains can then be used to point to the phishing content.

Social media platforms such as Twitter have their own phishing and malware detection mechanisms but are frequently bypassed with the use of URL shorteners and multiple redirections [13]. Automated spear phishing tools have also been developed to generate phishing tweets. One such tool [14] uses machine learning techniques to generate tweets based on existing spear phishing data, and the topics extracted from timeline posts of the target and of those they retweet or follow.

Phishing messages also employ Technical Subterfuge. These schemes plant crimeware onto PCs. An attacker can send an email to an employee masquerading as IT department of the company, asking the employee to install a security patch which is actually a malware.

If the victim performs action as desired by the attacker, the attacker then exploits this action performed by the victim. For example, if the attack involves stealing of sensitive information or credentials, phishers may monetize the information themselves or sell the information on underground network marketplaces. Or if the attack involves installation of a malware, the attacker fetches/monitors sensitive data.

A particular type of phishing which constituted 90% of all phishing attacks is Spear Phishing. Spear Phishing is one of the biggest threats to corporates today with these being 95% of all attacks on corporates [15]. In contrast to normal phishing attacks, which target general public, spearphishing attacks are targeted at specific individuals or employees of an organization. Attackers gather specific information about their targets through their social network or acquaintance etc., and use this information and to create customized phishing messages for the particular target group.

A form of spear phishing attack, called Whaling, is directed specifically at senior level executives in businesses and other high-profile targets. At toy making company Mattel, a high level financial executive received an email requesting money transfer of \$3 Million, impersonating as from the newly assigned CEO [16].

The calculation of cost of damages caused by phishing attacks differ extensively, and are largely dependent on the assumptions made by the organizations when calculating the damages and different departments affected within the organization. Phishing attacks not only cause direct damage, but also indirect damage, such as damage of reputation, leakage of source code and intellectual property, etc. [1]

Phishing Honeypots (network decoys) can be used by researchers and organizations to bait attackers. They are purposely kept vulnerable, so that attackers can be lured to use such resources. These honeypots are isolated and monitored. They can be used to capture activities of phishers, which can then be used for research purposes to get better understanding of attack flow and trends.

Many Phishing websites are found to redirect automated scripts or bots, such as web crawlers, to legitimate domain, but redirect browsers to phishing domain. This is done using robot.txt file, which is used by websites to communicate with web crawlers [13].

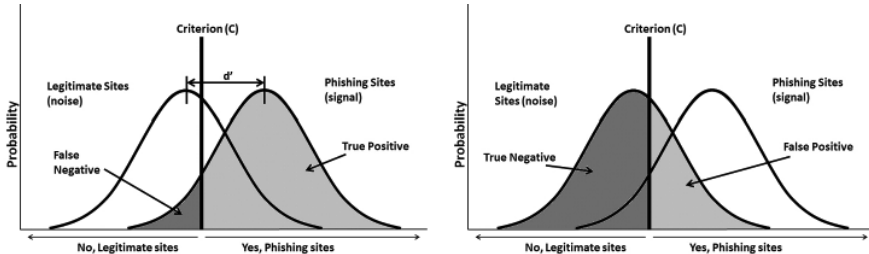
**Other recent trends of phishing that we observed are:**

- Social media phishing attacks increased by 500% in Q4 of 2016. Huge increase was seen in use of fraud accounts masquerading as customer support of popular brands. This tactic is relatively new and is called angler-phishing, where attackers register and use fake Twitter accounts masquerading as customer support of some brand [17].
- Specific brands were attacked more than regular on specific occasions, such as holiday season [4].

- The top ten targets faced over 75% of all the phishing attacks in 2016 [4].
- Attackers also were found to be using IP filters on Phishing sites, to disallow people from other countries to visit the site and even people from the target company [4].

It is important to block an attack in the initial few hours of the attack, as a large percentage of users read the phishing message till the blacklists are updated. As found by Jagatic et al. [18], most of the users fell victim to a phishing attack in the first few hours of the attack itself.

Signal Detection theory (SDT) has been used by various studies to measure user vulnerability to phishing attacks [19][20][21][22]. SDT is used to quantify or measure the ability of users to distinguish between signal (phishing) and noise (legitimate). It has two factors involved: Sensitivity ( $d'$ ) and Criterion (C). Sensitivity measures users' ability to differentiate between signal and noise. It is the gap between the means of the two distributions. The further apart the distributions, the greater the sensitivity or  $d'$ . Criterion is defined as the user bias or tendency when making a decision. It is measured by how far their decision threshold (criterion line) is from the intersection of the two distributions.



**Figure 2: Use of Signal Detection Theory (SDT) in Phishing.**

Regions  $C < 0$  and  $C > 0$  indicate more cautious/alert users and less cautious/alert users respectively. Figure 2 shows how the criterion line divides the graph to depict false positives, true positives, false negatives, and true negatives. A User Training approach should typically aim to i) increase users' cautiousness/alertness by shifting the criterion line to the right; ii) increase users' sensitivity, by increasing the separation between the two distributions, so people would be able to better differentiate between phishing and legitimate; or iii) a combination of i) and ii) [19].

## TRAINING USERS

User Training can be used for increasing user awareness about phishing attacks and teaching them how to detect such attacks so that they can take better informed decisions in such circumstances. User Education and Training is an important part of online security, but it has not received enough attention from the phishing community.

In a recent study by Deloitte, more than 70% organizations mentioned lack of security awareness of employees to be their major vulnerability. More than 4 out of 10 organizations don't provide security education to their education [23]. A survey by PWC showed that organization providing security education to employees are half as likely to fall for such attacks [24].

Training increases the cost to the company and consumes time. But an employee falling for a phish can cause considerable amount of damage to the company. Some studies have shown training programs to be helpful [25][26][27][28], while some disagree or say that training has mixed benefits [29][30][31].

Security is largely considered as a secondary goal, and educating users about things which are not related to their primary tasks may hit their cognitive limits [30].

As evaluated in [26], after training people with the best available training programs, users were able to detect more phishing attacks, but still could not detect 29% of the attacks. Most companies have annual policy based training that's required for compliance, which have shown to be ineffective to change employees' behavior. Caputo et al. [29] surveyed employees' behavior with phishing emails in a large organization. They found that the anti-phishing training did not help in changing employees' behavior when dealing with spear phishing emails. Users are seen not to be utilizing in their daily behavior, the knowledge they received during the training.

Users are found to not retain the knowledge [32] learned during the training and tend to forget after short period of time. Hence, there are studies advocating that training needs to be continuous. Organizations, banks, etc. send periodic security notices via emails or SMS's to their employees or clients about phishing threats. But such periodic notices have been found to be ineffective in changing users' behaviors [27]. Studies [25][21][1] have shown that anti-phishing training is most effective when it is done at the time when user is dealing with a phishing attack, and when it is done periodically.

Most training programs have focused on adults. Lastdrager et al. [33] explored training of school going children against phishing. Majority of children in USA and Europe access the internet daily. Attackers can get information about a target from their social networks and children in their social network can be used to get information of the target (e.g.: of his/her parents). Their results showed that training children against phishing works only for the short term. Although, they also suggest that such security programs in school curriculum can be helpful in making future generations aware of security threats.

Oliveira et al. [32] mention that demographic-tailored training and prevention approach will increase the effectiveness of security measures because a demographic-targeted solution will impose lesser requirements on people and will match their specific vulnerabilities.

Our learning was that the best way of training against phishing attacks is “at the moment of attack - periodic - demographic tailored” training.

Research on User Training against phishing is mainly done on developing Micro Games or Embedded Training.

## MICRO GAMES

In 2007, Sheng et al. [19] developed Anti-Phishing Phil (Figure 3), a game which educates users about various parts and cues to identify phishing and legitimate URLs. They used leaning sciences to build intervention based designs, and found it to be more effective than security notices emailed by companies to users. The mouse pointer is visualized as a fish, and asks users to hover the fish over worms which then show URLs. The game educates users about URLs and the fish has to eat (safe) or reject (phishing). Their evaluation with more than 4500 people showed 61% improvement in users’ ability to identify phishing URLs and also decrease in false positives. Though the game teaches about URLs, it does not give real time experience of detecting a phish or about the social engineering techniques used in attacks.

Control-Alt-Hack [34] lets users interact with cards in a board game, through which it teaches users about different social engineering techniques attackers use. But this game is not meant for teaching users to identify phishing attacks; it makes users more aware about tricks used by attackers.

Recently, Wen et al. [35] developed game called What.Hack (pronounced what dot hack). They give example of DNC hackings during the 2016 US presidential election, where staff were tricked into sharing passwords which

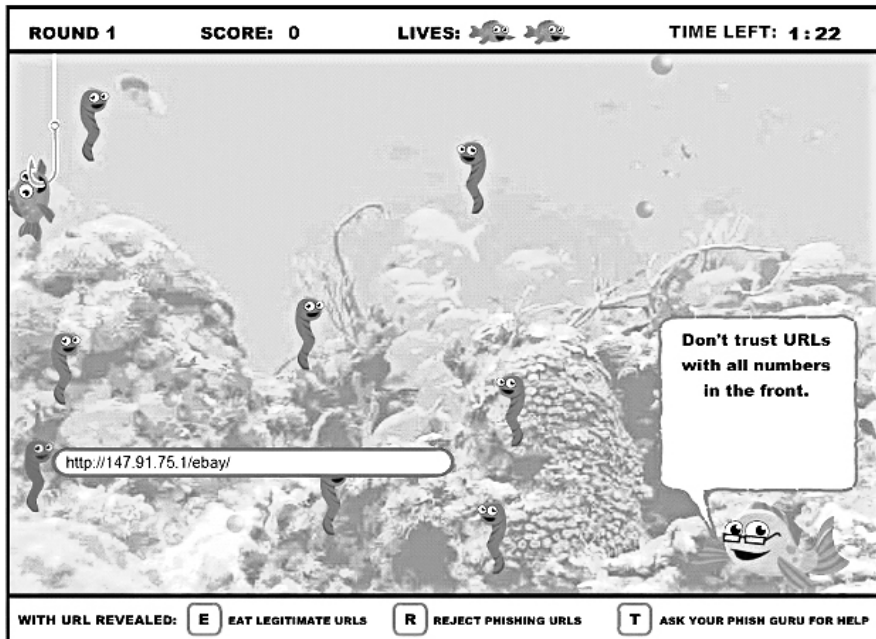


Figure 3: Anti-Phishing Phil micro-game.

granted access to confidential information by fake Google security emails. They mention that vulnerabilities such as these are due to insufficient and tiresome training when it comes to information security, and a potential solution is the introduction of more engaging training methods, which teach information security in an active and entertaining way. The authors mention that existing games teach users about specific aspects of phishing, such as teaching for phishing URLs, but not for malicious attachments. The authors incorporate such combined phishing techniques in their game. What.Hack presents a sequence of puzzles in a story-based game context, to teach users about social engineering threats. The player is provided with a rulebook that tells the players which emails are safe or unsafe. The player is asked to correctly identify phishing emails else it will have negative consequences. The authors have yet to test the effectiveness of their game.

Several commercial offerings are available, but their details are not available in public literature, for example Email Security or Anti-Phishing Phyllis by Wombat Security (Figure 4) [36]. It teaches users to identify phishing attacks, using interactive training and character-driven training game.

## EMBEDDED TRAINING

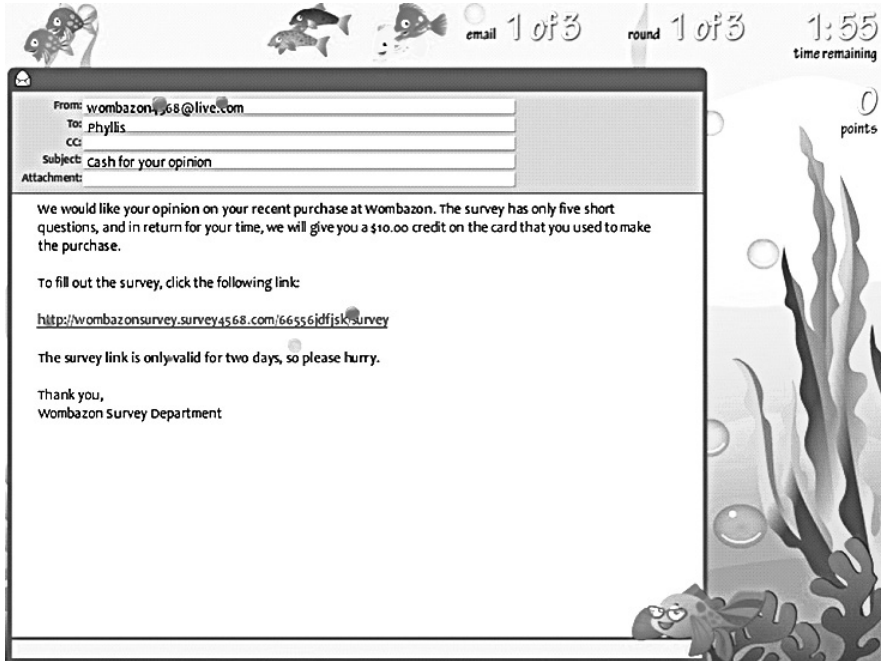
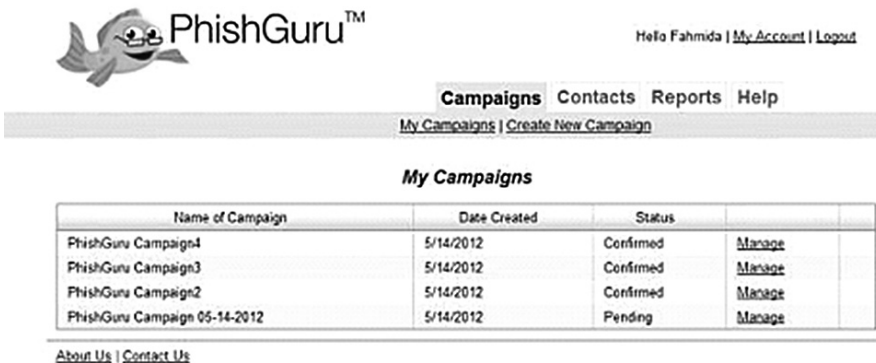


Figure 4: Anti-Phishing Phyllis micro-game.

In this type of training, the educational material is embedded, i.e. integrated, into the daily primary tasks of users. An approach where simulated phishing emails are sent to users to train them, have been used with Indiana University students [18], West Point cadets [37], and New York state office employees [38]. The approach led to an improvement in users' phishing detection ability.

Kumaraguru et al. [39] developed PhishGuru (Figure 5), which sends simulated phishing emails to users in their normal use of emails, and uses interventional educational messages to educate them. When the users fall victim to the attack, such as clicking on a link in the phishing email, the system teaches users about the attack. They use intervention type design to show educational messages. They tested two different design types, text-graphics and comic strip, to show their interventional educational messages. They found comic strip design type to be more effective than text-graphics.

## DISCUSSION



The screenshot shows the PhishGuru web interface. At the top left is the PhishGuru logo, a cartoon fish. To its right is the text 'PhishGuru™'. Further right, it says 'Hello Fahmida | [My Account](#) | [Logout](#)'. Below this is a navigation bar with 'Campaigns' (highlighted), 'Contacts', 'Reports', and 'Help'. Underneath is a sub-bar with 'My Campaigns | [Create New Campaign](#)'. The main content area is titled 'My Campaigns' and contains a table with the following data:

Name of Campaign	Date Created	Status	
PhishGuru Campaign4	5/14/2012	Confirmed	<a href="#">Manage</a>
PhishGuru Campaign3	5/14/2012	Confirmed	<a href="#">Manage</a>
PhishGuru Campaign2	5/14/2012	Confirmed	<a href="#">Manage</a>
PhishGuru Campaign 05-14-2012	5/14/2012	Pending	<a href="#">Manage</a>

At the bottom of the interface, there are links for 'About Us' and 'Contact Us'.

Figure 5: PhishGuru embedded training.

Phishing attacks have shown to be evolving over time, and continue to be a threat to corporates and individuals. Phishing cannot be dealt in one specific way, but requires a collaborative effort in all directions. Use of psychological factors and demographics can help in designing user training approaches for phishing detection. Interdisciplinary fields such as Learning Sciences, Cognitive Sciences and Educational Psychology can prove to be helpful in designing training approaches for enabling retention of knowledge learned in training and its application at the time of attack. Instead of only giving knowledge about these attacks to users, it is also important to teach them how to deal with these attacks in real time. And training users at the time of the attack has been found to be the most effective way of training users. As we mentioned in previous section, the best way of training against phishing attacks is “at the moment of attack - periodic - demographic tailored” training.

## CONCLUSION

In this paper, we provided details on different approaches for Training Users to deal with phishing. Phishing remains to be a major security threat for the corporates and for the general internet users. Phishing is not limited to a single communication media, and spans across different types of media such as E-Mails, Social Media, online multiplayer games, etc. We provide an organized study covering User Training approaches against phishing, which we found to be lacking in the existing literature. Phishing, being a



multifaceted attack, requires research to be done in all aspects. Technical solutions to mitigate phishing are not 100% effective and some attacks do reach the end users. Moreover, phishing attacks, especially Spear Phishing attacks, continue to become more sophisticated and cause loss of billions of dollars and also intangible loss such as damaged brand reputation. To build effective countermeasures, it is important to understand the psychology of users which makes them fall for phishing attacks. Training of users is effective if they retain the learning and are able to apply it in case of an attack. It is important to train users “at the moment” of the attack, periodically, and considering various user demographics. No single way can mitigate phishing; hence it requires collaborative effort in all directions. It is important to secure all doors to not allow phishers to conduct such attacks.

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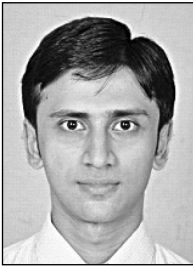
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## BOOK REVIEW OF 'THE COLONEL'S BLOG' AUTHORED BY COL. BIPIN D. SHINDE

### 'The Colonel's Blog'

*Commander Uday Natu*

'The Colonel's Blog' is a most befitting tribute to a dear father, a hardcore soldier and a true citizen by his son Cdr(IN) Uday Natu. The Colonel here is the Late Lt Col Vijay Vishwanath Natu of 9 Gurkha Regiment.

The Colonel was inducted into the 1962 Indo-China Conflict as a freshly commissioned army officer. He saw through the 1962, 1965 & 1971 wars but passed away in 2004 after losing his battle to illness. He was the original blogger in a period which had a very limited and a not so responsive social media and when internet and mobile phones were absent. More than a thousand letters were written by him since 1989 and published in most Indian news papers. In a small measure, reliving a miniscule portion of history, from Narsimha Rao to Vajpayee and from Gulf War to the Kargil Conflict, this book is a collection of 'Letters to the Editor' very neatly compiled by Cdr (IN) Uday Natu..

The vivid recollection /short memory lane, 'The Personality Behind The Letters' by Mrs Mrudula Natu starts with her marriage to 'The Colonel' in 1965 just before the war with Pakistan in 1965 followed by separation till 1966 when posted to HQ Southern Command, Pune. Thereafter, various transfers and finally settling down in Army Welfare Co-operative Housing Society, Salunke Vihar, Pune in 1986 upon leaving the service. It also mentions about her husband's interests in social, civic and environmental issues and about being vocal/vociferous in the print media. Mention is also made about cumulative ten years stint in Hotel Blue Diamond and Mahindra Uginie with a proper retired life thereafter. She remembers him as well disciplined and a stickler for routine. He has been the perfect perception that Infantrymen were

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*ISSN 2347-9191 print*

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*CASS Journal, Vol. 5, No. 2, April-June 2018, pp. 54-57*



*The Colonel's Blog* -  
Notion Press, Chennai 2018,  
Price Rs. 375.  
ISBN 978-1-948473-86-6

a unique blend of the Stoics and the Epicureans – stoic in their integrity, courage, valour and honour, and epicurean in their zest for life and living each day as it comes, to its fullest. Infantry men adored life and anyone who was part of their life would be precious to them .

Very thoughtful of him, in 'How to Read the Book', the Editor lays out the plan of the book and challenges the readers to jump in to the topics of their choice. They will enjoy reading so without feeling disconnected at any stage. However, he also requests them to read 'Glimpses of 'What Lies Ahead' before the main reading. .Life might have not been easy for the son of an Army officer. However, there were no landmines, no bullets whizzing past , no horrors of death and maiming , or an talk of fatigue and hunger after marching days on end , searching for the elusive enemy. Cdr(IN) Uday Natu never allowed to feel so by his father the Colonel.

Factuals of the ravages and hardships undergone by the Colonel and his soldiers during the Indo-China war of 1962 , description of growth, advancement and urbanization of Pune associated with civic issues as experienced by the Peshwa Baji Rao I during his mystical 'revisit' to Pune and the ever live topic of girls vs boys with special reference to NCC and love & marriage have been placed in 'Glimpses of What Lies Ahead'. These are the articles by the Colonel published in newspapers like Indian Express, Maharashtra Herald and The Times of India then. It also has an article on the nitty gritty of an adventure activity in the NCC. This reading generates curiosity, excitement and interest amongst the reader. Paying attention to this part prepares one for the volume, variety and quality & nature of subjects, issues and facts that would be encountered during reading of the three main topics viz, Soldier Speak, Protect the Environment, Save the Earth and Citizen Speak. It sets in imagination in a serious reader.

The section 'Soldier Speak' is on the Indian Armed Forces-the struggle within and the challenges faced when out of uniform. However, it is not about recrimination but more about possible solutions. Late Lt Col Vijay V Natu, was himself well convinced that liberation of Kuwait, with an advance from Turkey, was most suitable. Here he displayed his expertise in ground warfare from the infantry point of view. Then he even urged the military thinkers and writers including Gen K Sunderji (Retd) to educate the non-military public of India.

Critical of the media, the Colonel has asked for producing Infantry serials comparable to Star TV and BBC with help of Film and Television Institute of India. He had clear thoughts on not to celebrate the Infantry Day and justified so while remarking on the absence of the then Southern Army Commander during barakhana in Dunkirk Lines, Pune Cantonment. Remorse full that he was always that the Queen of the Battle was being overshadowed by Armour & Artillery kings. Undoing of Cadre review and review the Official Secret Act were very dear to him as seen from his die hard and convincing views. The media, especially Indian Express was all praise from the Colonel, for its valuable role in giving due recognition to the Indian Armed Forces. An Israel like policy has been suggested to deal with Pakistan and Kashmir including offensive defence. A strong criticism of the weak willed government, advocating 'tit for tat', attack across LOC (Surgical strike of today), dismantling of ISI etc have been clearly spelt out.

Don't Forget the Veteran- this theme presents a collection of published letters of the Colonel, which are 360 degree view on the retired soldier. The bias within and outside, failure of grand schemes like the MCC (Maharashtra Cadet Corps), misuse of invaluable, highly skilled and specialised troops for garrison duties, neglect of the ex-servicemen by the State, pension, OROP and the likes are issues of pain and criticality. It is intriguing to many today to know that the Ex-Servicemen Trust was floated by a political party i.e. the Shiv Sena.

A major attention has been given to the environmental and civic issues that were so close to the Colonel's heart. Recommendation for India to sign a PNPT (Population Non Proliferation Treaty) after due deliberations in the Rio Earth Summit has been made. Pollution problems, CFC gases, Protect Pune Plan, preserving forest lands, protecting heritage sites, Sinhagad Fort protection etc gets due attention. All water related issues and solutions have been discussed.

'Citizenship is a tough occupation which obliges the citizen to to make his own informed opinion and stand by it'- has been very aptly stated by the Colonel. General civic issues and Pune specifics have been deliberated upon. Some of which have been resolved and yet some require more efforts and finesse by all- policy makers, upholders and the general public. Futility of the Raigad Rope Way and Right to Recall the PCMC Mayor are the highlights.

National issue ranging from scams, police reforms, black money, electoral process, foreign policy, States Reorganisation & Reforms, rural development, lawlessness and backwardness in certain States and problem solving by modernization, corruption and political lawbreakers etc have been intensely voiced in Citizen Speak.

The book makes for a very interesting and thought provoking, sometimes explosive reading that is attributed not only to its contents but also to the peculiarity and novelty of the layout and naming of chapters.



Thus this book is not limited to the subjects and issues of the armed forces. In fact more than fifty percent is on civic issues, environmental apprehensions and many that touch the everyday life of a citizen. I would view this book as a history of events spanning from 1990 to 2004, encompassing national level politics, the armed forces and the environment. It is Pune centric for civic issues.

I recommend reading of 'The Colonel's Blog' by a wider spectrum of the society i.e., students of all faculties, government officers and staff, military officers and men of all three services alike, libraries of all colleges and universities, defence institutions etc. I would like to strongly reason out the recommendation. The book is indeed inspiring for one to take up issues in one's sphere of work in right perspective for the good of the organization and the individuals in it. Secondly, one can pick up an issue or a subject close to one's heart, to be pursued post retirement for public good. You need not be an expert. It does not have to be the print media only. In fact, a multitude of forums, means and mediums, platforms are available today.

Readers can also take a lesson or two from Cdr (IN) Uday Natu, of methodically editing, compiling, correlation and an impressive presentation of such a vast writing done by the Colonel. It has been commendable. You may not be a writer or originator of written work and original ideas, but one can assist someone and produce such a fabulous and interesting reading.

The book has been published by Notion Press, Chennai in 2018 and is available in hard case and paperback by ordering online from the publisher.

So, relive the tumultuous period of 1989 to 2004 through a collection of published articles and letters to the editors, 'The Colonel's Blog' from a military veteran, environmentalist and a civic activist. A must read book.

## **COLONEL BIPIN D. SHINDE**



A veteran from Army Air Defence, Bipin D Shinde , has a vast experience from the staff and field tenures in the Army and related DRDO and NCC , along with civil administration as District Sainik Welfare Officer, Pune and Deputy Director, Department of Sainik Welfare, Maharashtra, Pune for four years. He is also skilled in editing, compiling, proof reading, Marathi typing etc. (bdsshinde@yahoo.co.in)

## Role of Women during War: Issues, Efficacy and Prospects

*Miss. Sneha Kulkarni*

### **PRELUDE: UNFOLDING THE ROLE OF WOMEN DURING WAR**

The society and its ideology is moderating in an expeditiously altering arena; where the separation between Non-Combat and Combat Roles; has become obscure by the concepts of Asymmetrical Threat in the context of Modern Warfare. Given this uncertain world scenario, the circumspect for not allowing Women to voluntarily serve in Combat Roles; is no longer determinative; because it is positioned on the biased conclusions and false conjectures of those; who refuse to accept that men and women are equal. In spite of it is clear that, many women have neither the ability, nor the desire to serve in combat roles, “If Women Have What It Takes And A Desire To Serve, Why Not Let Them?” With the virtuous training and the support from authorities of the Armed Forces at all levels, there is no reason not to employ qualified Women Soldiers in Combat Roles and Warfare. The Armed Forces of various Nation-States has faced many convokes to contest over the past few years, and the commissioning of Women in Warfare, if ever approved, will be no different. Along with previous challenges, the countries with a vision of upgrading Armed Forces will expect its Superiors and Leaders to respect its foundation by being Mentors; knowing what to do and doing what is right; with Women at Combat Roles.<sup>1</sup>

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*ISSN 2347-9191 print*

*© 2018 Centre for Advanced Strategic Studies*

*CASS Journal, Vol. 5, No. 2, April-June 2018, pp. 58-68*

With retrospections of contemporary course of time, the paradigm shift is Women have joined the all manner of ranks of the Armed Forces in most Western nations and now in developing Nation-States too. At the same time, elementary disapproval and defiance appear to have been defeated; as there is still debate over the proficiency of employing Women in some and specific occupations, roles and areas of expertise in Armed Forces. Many stagnant nations do not allow Women to serve in Combat Roles, specifically in the course of Warfare and this thought highlights some of the core concerns, some edging on myths regarding the participation of Women in the Armed Forces and distinctively in Warfare; thereby intended to add some clarification, to what has become a continued debate. The context of this debate is the general experience of the nation-states in expanding the portrayal and performance of Women in their military units. The fundamental impediment for Women in participating utterly in the Combat and Non-Combat Roles of Armed Forces today, has little to do with their “physical and mental abilities”, but in a certain degree revolves around “social and cultural issues” characterizing a “Warrior” frame of reference; which is considered to be masculine in natural appearance. In identifying those characteristics and abilities that are becoming increasingly necessary within a Contemporary Armed Forces, it is imperative to discuss the strategic importance of shifting the point of convergence to relevant delving to ensure that credible information informs decision making, with respect to the personification of Women in the Warfare peculiarly.<sup>ii</sup>

Discrepancies of developing significance in the prospects of Role of Women in Armed Forces include those of Age, Gender, Sexual Orientation, Family Status, Disability Status, Language, Race, National or Ethnic Origin, and Religion. Some are biologically determined aspects like Skin Color, Sex, etc. However in reality all of the differences that are important to the services like Military, the Ethic and Habits, Leadership Capability, Preferences for certain type of work, Intellectual Orientation, etc. which can be developed through Education, Training, and other forms of training, Socialization, Experience and Ethical Molding. Furthermore, there is such spacious exception within apparently homogeneous groups that a general impression or stereotype of a group tells us very little about any given individual. The same holds for generalizations from an individual to a group.<sup>iii</sup>

## PRAXIS: INCARNATION OF WOMEN AT WAR

Since the mid 1970s into the early 1980s, societal and developmental experts began to scientifically address, arguments relating to the impact of women on previously all complete-male Military Units of Armed Forces. Corresponding research acquainted both; First, policy decisions to widen the role of women and Second, to undertake research in the area of warfare related employment for women. A present day analysts of worldwide experience share their thoughts as, “The degree to which mixed gender integration has occurred in the Armed Forces, has been significantly over stated for the warfare. Once a woman enrolls in the warfare, the barriers become primarily cultural and social.”

India is one of an increasing number of nations, which actually employ women in the combat arms, since many other allied nations have removed limitations on the role of women in their Armed Forces. However, at some extent, exclusion of women from the course of war remains in place in Australia, France, Turkey, the U.K., and the U.S. While New Zealand currently has a combat exclusion for noncommissioned members, it is implementing a multi-phased integration program with a goal of integration into all roles. Also, there are a number of cases where general warfare exclusions do not exist, but where women are excluded from specialized “Elite units”. For example, Ireland does not permit women to serve in the Anti-Terrorist Army Ranger Wing. Similarly, women have not served in so called “Assaulter” roles in Canada’s Elite Anti-Terrorist Unit and Joint Task Force (JTF). Although women are not formally excluded from such roles; the physical standards have been set so high that very few women can be expected to meet them or if they do, to sustain the proximate training process, which functions to further “Weed Out” candidates in general. The question here arises that, whether the standards applied reflect the actual requirement. Greece, the Netherlands, Portugal and Turkey have exclusions for women from submarine or other naval services.<sup>iv v</sup>

Comprehensively, it is seen that, numerous factors can affect the participation rates of women and men in the Armed Forces, in addition to government mandated roles, ethos, ethics, internal values and norms of warfare. Nonetheless, the question is, seeming over emphasis on a “Warrior Ethics”, which is centralized predominantly on Combat Operations and War Fighting, to the prohibition of Other Military Operations and Roles; that is Peace Support, Humanitarian and Domestic Support etc. in an organization of Armed Forces in post modern society. The signification of a primary focus on the “Warrior Framework” and

women's participation in the warfare are needed to be considered in deliberate thoughtful and applicatory practices.

## **POLEMIC PARLANCE: A WARRIOR SHELL OF WOMEN**

Voluminous discourse have been fired up on the role of women in the Armed Forces up to the present time; and most precisely in relation to the ability of Women to adapt to and perform warfare roles; has been actively motivated by Socio-Cultural panorama, streaming from an exclusively Male-Oriented Warrior Framework and to a certain degree beliefs underlying it. vi By the same token; till time, much of the social and behavioral systematic empirical evidences have been downplayed or ignored in favor of anecdotal evidence, personal opinion and/or uninformed conjecture. However, fundamental questions have been voiced, regarding expansion of role of women, which call for responses, planted on the evidence available today. vii Stated quite succinctly, in a United States Heritage Foundation article, below are five such questions, which permit us to address issues revolving around; First, the physical and mental suitability of women for Warfare Operational Roles; Second, the impact of women on group cohesion and effectiveness and Third, public and personal attitudes toward women in Armed Forces.

These are:

1. Are women physically suited to the rigors of ground combat?
2. What are the potential consequences of women and men operating in intimate proximity away from home for extended periods of time?
3. What has been the experience of nations that have men and women in mixed combat units?
4. How do women serving in the Armed Forces feel about being assigned to combat units?
5. How will bearing and raising children affect a woman's readiness to deploy on short notice, as is frequently required of military units?

## **PHENOMENAL GRAVITY OF WOMEN AS WARRIOR**

The utmost significant pre-requisite for warfare, is physical fitness, which includes aerobic conditioning, strength and endurance, occupying the major part in Armed Forces. Reasonably, more than any other discourse, this has been used most frequently to pick an argument, for the exclusion of women from

warfare and combat operations. Recent studies have underlined a new light on this matter and it begins with reference to an example from outside the Armed Forces Organization.

To be mentioned, United Kingdom (UK) Ministry of Defence concluded that “By using new methods of physical training, Women can be built up to the same levels of physical fitness as men of the same size and build.” Further, the U.S. and other Nation-State’s Armed Forces recognize differential physical aptitude “by age but not by gender.” Therefore, the thought we must have to focus on, why some of the same kind of logic cannot be applied to physical differences between men and women. However, the physical ability criteria for inclusion of women in warfare; appear to be both inconsistent and discriminatory to women, emphasizing male areas of physical competence.<sup>viii</sup>

In 2002, the UK Ministry of Defence conducted one of the most influential studies in recent years on the comparative physical abilities of women and men. On the basis of this study, the U.K. opted not to employ women in combat roles. The review of over 100 studies showed that women had on average less upper and lower body strength than men and that fewer than one percent of women could match the average man’s strength. Additionally, women were less aerobically fit and less able to carry out repetitive lifting and carrying tasks. Hence once again, training was shown to dramatically improvement in performance of women and “Women and men exhibit similar relative gains in strength to resistance training programmes and in some studies, women show a slightly greater gain than men.” Furthermore, the same report indicated that aerobic fitness training yielded a greater response among women than men and reduced the aerobic fitness gap between the sexes. As the report points out, this increase may be due to “an initially lower state of training among women on entry in the Armed Forces.”<sup>ix x</sup> This reasoning is reinforcing arguments made earlier in connection with the arguments made on unsuitable physical features of women and simultaneously, the impact of physical education requirements in schools and colleges, specially designed for female candidates.<sup>xi xiii</sup>

Most services and roles in the Armed Forces are not based on kosher standards established to perform the tasks. It follows that, in some instances, not tied to authentic occupational standards, the lower physical performance of women, may resolve into simply be irrelevant. Henceforward, it is essential for various developing and developed Nation-States, to mould the defence strategies and policies of respective Armed Forces, which will include, implement and initiate an ethical framework for women as a human resource for warfare, specially to

develop the requirements of physical standards of women, by taking insightful consideration of following points;

1. Identification of the operational requirements of warfare
2. Identification of the physical capability required to complete the operations
3. Developing pragmatic assessment which ensue the capability to complete the operation
4. Structuring parity in standards of the warfare operational tasks

### **PANORAMA OF NATION-STATES WITH JOINT MEN & WOMEN WAR OPERATIONAL UNITS**

Some Nation-States like Russia, Israel, historically, have employed women in operational units at times of war and then either disbanded such units shortly after the war or seized to utilizing women as human resource in more traditional roles of Armed Forces. This has been taken by some as an indicator, of the failure of women in the combat roles of war courses. Be that as it may, such decisions may be guided more by political or cultural or religious influences, than by strategically & tactically designed organizational considerations of Armed Forces.

In recent years, court decisions and public pressures have forced to Armed Forces of various Nation-States, opening more roles to women. For example, Germany now permits women in war operational units; thusly joining Canada, Denmark, Norway, Spain, and Sweden in opening up all warfare positions to women. Some have argued that these countries do not represent good examples of possible dangers of mixed gender war operational units; because they have not played leading roles in recent years in waging war or sustaining war like situations. As a UK Ministry of Defence report put it in 2002, "Those nations that optimize their forces for high-intensity warfare, which see war fighting rather than Operations Other Than War (OOTW) or peacekeeping as their purpose, appear most cautious about deploying women in combat units."<sup>xiii xiv</sup> This postulate, those Nation-States that may participate more frequently in peace support and humanitarian operations never go to war and that their militaries do not view themselves as warfare capable forces. This is certainly not the case for many of the Nation-States that allow women in war operational units. Also, peace support operations undertaken since the end of the Cold War often have had operation related requirements that closely resembled war fighting. Many Nation-States have now had at least some experience of

mixed gender war operation units, with little evidence of negative impacts on effectiveness or cohesion or readiness. Armed Forces fears about mistreatment of Women prisoners of war have been realized.

### **PICTURE OF WOMEN: AT WARFARE AS WARRIOR**

Organizational attachment is seen as an essential element of war operation units. Developing an environment of organizational cohesion takes time. Ethics elaborate that; all members of the unit must share common experiences and build confidence in each other. The fact that women can become pregnant and require time off to give birth and nurse children has been argued as having a potentially negative impact on such cohesion developing endeavors. However, this argument discounts the fact that, extended absences from units can be caused by many reasons, pregnancy being one of the least important.

Women were; in multi- terms as likely as men to recite family or children as their most important reason for having either no interest in joining the Armed Forces or obligations by other societal means for their joining. Withal, for most parts, those women who do choose to join Armed Forces, are likely to have contemplated family relevant issues and are also making a choice similar to that of men, corresponding to their present as well as future family commitments. Albeit, women in general, still have disproportionate responsibility for raising children, men increasingly share this role; for this reason, exception in one parent situations; the burden of family should be looked upon as a joint responsibility. Determinately, similar to other large scale employers, the Armed Forces have highlighted that morale, motivation and retention of women and men depend on policies that provide greater ability to balance the demands of family and service to the organization. Comprehensively, such policies form parts of the overall human resource support structure, of most contemporary Armed Forces of Nation-States have included.<sup>xv xvi</sup>

Another issue here is; First, whether or not women are interested in being employed in war operation units and roles and Second, the degree to which such is the case and the basis for their views one way or the other. The answer is, expanded exposure for women to Armed Forces and war operation unit services, will no doubt have the influential impact as that of making service positions more appealing and interesting.

Warrior Ethos and the Warrior Ethic have been defined in various ways to convey the central elements and values of the culture, including moral



and ethical courage, tactical skills, emotional and physical stamina, loyalty to comrades, and determination to accomplish the mission. xvii While many analysts would argue that, the Warrior Framework is uniquely being applied to the war operational units and there is an increasing emphasis on “Warrior Like” characteristics, as essential to all Armed Forces. Research over the past decades has established plentiful barriers to the integration of women into various roles in the Armed Forces and Warfare system. xviii xix Suggestible approach is that, Warrior characteristics expressed through the terms as “Warrior Ethos”, “Warrior Culture”, and “Warrior Spirit”; will progressively dominate the development of policy and doctrine of Warfare and subsequently the Armed Forces. In addition, this changeover will secure legitimacy within organizations of Armed Forces, to identify artistry and attributes other than Traditional Warrior Attributes, which will become more and more significant for the future. Hence, the treatment of women in the Warrior Culture, therefore, appears to be based on assumptions, unrelated to Women’s abilities and aptitude to perform in the Warfare and Armed Forces.

### **PROSPECTS: PROMISING ROLE OF WOMEN AS WARRIOR OF FUTURE**

Throughout the time, physical strength and stamina do remain to play a significant role in Soldier Effectiveness in the course of War and Armed Forces. The question remains as; to whether the same physical standards are required to achieve the purpose of avant-garde Armed Forces and war strategies. The traditional arguments of physical and mental suitability of women, for warfare appear to have been productively countered, by growing evidence showing, that many women would be able to participate at the highest levels, comparable to men if given the proper training, orientation and leadership. Nor have the affirmations of a negative percussion of women on organizational cohesion and effectiveness of Armed Forces, been supported by empirical evidences. More than this, even those Nation-States, which have been most vehement in their opposition to women involvement in warfare, have not exempted women from “Near Combat Roles.” Elevated worth of technology, rather than vigor, is becoming a signet of modern warfare. The days of mass infantry ground attacks are less extensive, at least for most Armed Forces in various Nation-States.

The emerging warfare roles of peace building and peacekeeping; the Armed Forces have increasingly confronted a large scale mosaic of warfare

situations; ranging from conventional warfare to urban terrorism and guerilla skirmishes. The weaponry and skill sets needed to perform the duties of the modern military have changed; suggesting the need to consider a range of psychological, physical and cognitive competencies that go beyond absolute brute strength and vigor. This does not mean that physical fitness, physical conditioning and training are not important, but does underline a thought that, instinctive strength and vigor is not an actual occupational requirement of modern warfare. There are ample of evidences, that the requirements of Warrior Framework are developing dynamically and hence the importance of deriving standards of warfare are based on requirements to actualize the objective of Armed Forces through the prospect of utilizing the efficacy of women warrior ethos and ethics.

The Armed Forces are inseparable part of the society closely associated with the culture of the polity, bureaucracy, social structure. The Women are base of societal architecture and security concerns. The Armed forces, a framework developed for maintenance of territorial sovereignty, safety, security and good will of the nation, obviously have to consider the inseparable asset of the country, Women as its own part to perform all the essential work devoted to nation. The need is to develop and promote a set of ideas to press the worldwide society and governments to adopt pragmatic and foresighted policies towards the Women to unfold their life style and permit them to perform all credible operations in all the branches of Armed Forces proven by their efficacy. Therefore various aspects of Women and Armed Forces including issues, efficacy and prospects have to be studied, discussed and analyzed for benefit of not only Women and the Forces but also the society to which they belong.

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## Chinese Investments Abroad & Lessons for India

*Maj. Gen. Nitin Gadkari*

China has been investing outside its shores in foreign countries as a matter of its economic and foreign policy. China's investments worldwide have now grown bigger than any other country or any other monetary institution. The Chinese have wisely chosen the countries where they have put their money. Apart from investing in US and Europe, China has invested in Under-developed or developing economies. Such a choice has given the Chinese an advantage of reaping the early bird takes the worm advantage. Most of the official assistance from China has come in Africa, South and South East Asia and Latin America. Most of these countries have either rich mineral deposits or oil deposits, which are crucial to the growth of the Chinese economy. In doing so the Chinese have come under criticism of doing business with rogue and corrupt regimes. There is also widespread discontent amongst the local population where they have invested. There appears to be lack of transparency and lack of empathy towards the local population in the Chinese dealings. But the Chinese claim that they invest in these countries to help the growth of the local economy and up liftmen of the country's common people. These claims don't cut ice as China seems to pursue its self-interest in the garb of the philanthropic discourse.

This articles discusses the official assistance and investment by China around the world and its use as a tool for furthering its national interests, and what lessons it has for India.

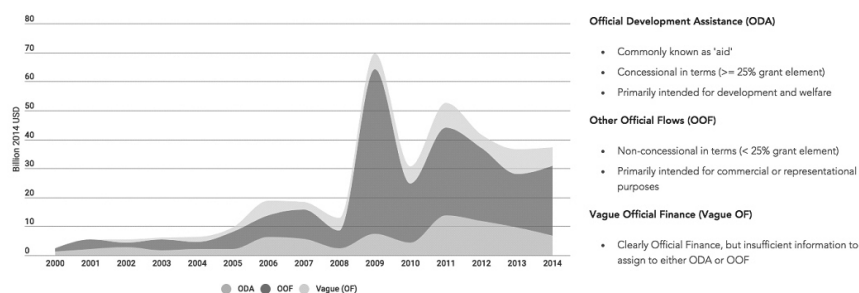
## STATISTICS OF CHINESE INVESTMENTS

There are many ways for a country to invest in another nation. There are primarily three routes of investments. First is a grant or free aid, usually given to poor countries with no ability to stand on their own to generate any economic activity or in case of severe natural or man-made disasters like civil war in Somalia or an earthquake or tsunami. The second is a governmental route through the OECD (Organisation of economic cooperation for development) also called as the official assistance and is usually provided in form of the ODA (Official Development Assistance) and the OOF (Other Official Flows). This category is mainly for development and welfare, and hence is offered on concessional terms. The OOF component has more commercial intent and hence has lesser concessional elements in it. And the third route is the private investment, called FDI (Foreign Direct Investment). The third category; FDI is purely commercial and has all the merits and pitfalls of a commercial dealing.

China has the distinction of being the first developing country which has surpassed the developed nations in terms of its investments abroad. China has

### What's Included in China's Official Finance?

China's official finance is less concessional than that of other large players



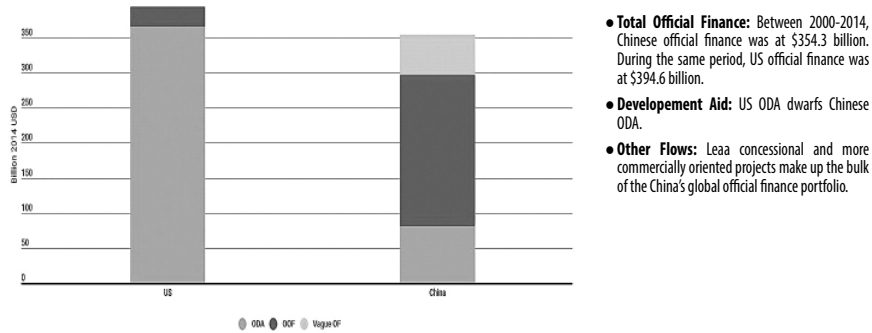
source: [aiddata.org](http://aiddata.org)

been secretive about its official assistance to foreign countries and it's a very difficult to gather the requisite data. Yet some western agencies like AIDDATA and Heritage Foundation have tried to study the Chinese data over 15 years i.e from 2000 to 2014 and have come up with some astounding facts.

**Official Assistance : ODA.** China's Official assistance figures suggests some strange analysis. China's ODA is far less than China's OOF. The graph below indicates these differences:

### How Does China Compare Against the United States?

Similar sized portfolios with very different compositions



source: aiddata/org

In comparison with the US, China invests more on OOF which means its official help to countries has more component of commercial interest than philanthropic desires. The total official assistance spent amount by China in the last 15 years has been \$ 354.4 billions (US.) Out of this the ODA commitments are only \$ 79.7 billion (US) which is mere 23% of the entire official commitment of China. Whereas it spent \$ 216.4 billion (US) on OOF commitments which is a strong 61% of the entire amount. Compare this to the US it spends over 90 % of its official assistance budget on ODA.

China prefers spending its official assistance on energy needs, transport and supply, industry mining and construction. If this breakdown was further carried forward to ODA and OOF separately it would show that China spends most on energy needs when assisting through the OOF and while dispensing the ODA it looks at transport and storage as major area. This analysis needs to be coupled with; what are China's most favoured destinations for official assistance? Interesting is the category of countries which China prefers as its official assistance destination. In the category of ODA, it has seven African countries from where China prefers to extract the raw materials for its industrial needs. The countries which receive OOF, fall under two categories; the ones from which China depends on its energy needs and second where China has strategic interests. The top ten under each category are given in table below.

<b>ODA</b>	<b>OOB</b>
Cuba (\$6.7 billion)	Russia (\$36.6 billion)
Cote d'Ivoire (\$4.0 billion)	Pakistan (\$16.3 billion)
Ethiopia (\$3.7 billion)	Angola (\$13.4 billion)
Zimbabwe (\$3.6 billion)	Laos (\$11.0 billion)
Cameroon (\$3.4 billion)	Venezuela (\$10.8 billion)
Nigeria (\$3.1 billion)	Turkmenistan (\$10.1 billion)
Tanzania (\$3.0 billion)	Ecuador (\$9.7 billion)
Cambodia (\$3.0 billion)	Brazil (\$8.5 billion)
Sri Lanka (\$2.8 billion)	Sri Lanka (\$8.2 billion)
Ghana (\$2.5 billion)	Kazakhstan (\$6.7 billion)
<b>Total= \$79.7 billion (US)</b>	<b>Total = \$216.4 billion (US)</b>

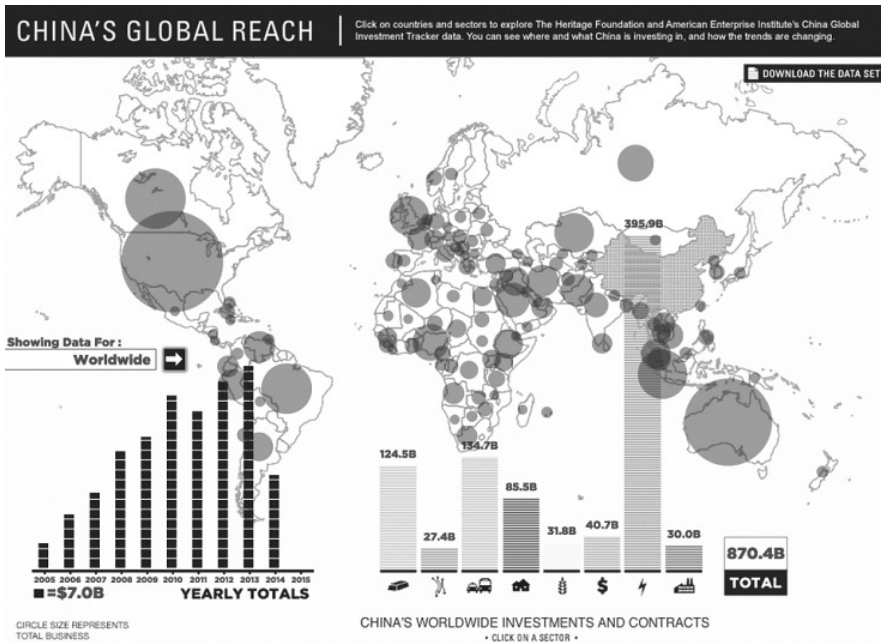
Source: [aiddata.org](http://aiddata.org)

FDI : Chinese FDI s are massive as compared to their official assistance. Once again it is not easy to get China's FDI figures in totality, yet data collected over 15 years suggests that Chinese investments abroad in terms of FDI are amounting to \$ 870 billion (US) upto 2015. According to another source: The Global China Tracker, Chinese FDI from 2005 to December 2017 is to the tune of \$ 2100 billion (US). The map below shows where all the Chinese have invested, and it would be hard to find a continent where they have not.

The Chinese have invested heavily in the US Government bonds and US Securities: As of September 2008, China was the largest holder of U.S. treasuries at approximately 6 percent of the total. Australia is another country which is of special interest to the Chinese due to its growing agriculture and mining needs, though mining industry in Australia has run into a downturn. The map given below represents Chinese FDI up to 2012 and the same has grown manifold as the global tracker data has shown.

Out of the \$ 870 billion, China has invested \$395 billion in energy sector, thus showing China's motives for such large FDI investments. Recently due to excess capacities existing at home China has reduced its indulgence in





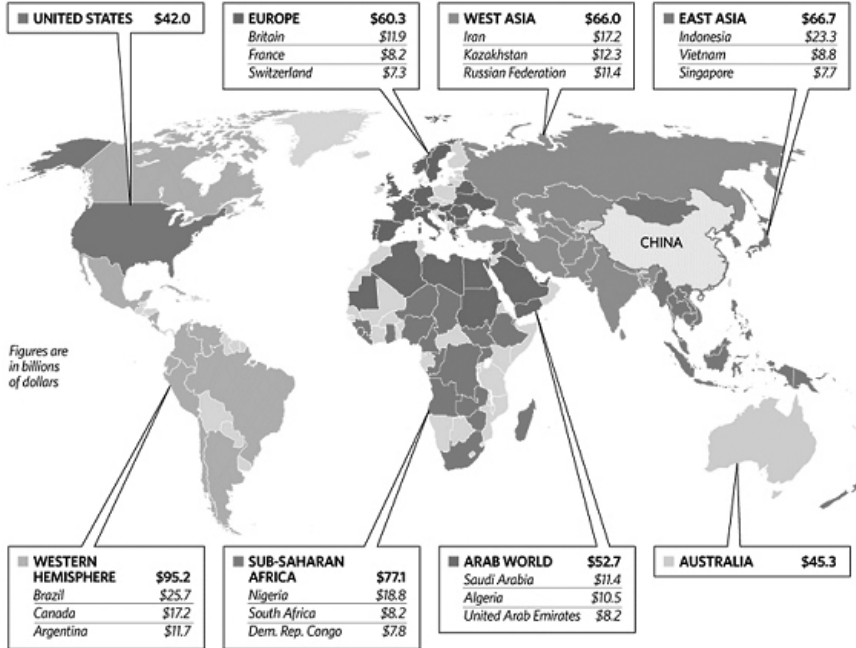
source: Heritage Foundation

oil and concentrated more on exporting these excess capacities to the third world countries. China's interests in Africa has to be viewed in this context. China made forays in Africa starting with Angola in 2004, when Chinese program for road investment was agreed to by the Angolan government in exchange of share of Angola's oil. Five years later China became the biggest trading partner not only with Angola but for whole of Africa. In 2014 China, has pledged investments worth \$20 billion (US) for development of infrastructure in Africa. In December of 2015, Chinese chairman Xi JinPing on a visit to Africa offered a package of \$ 60 billion (US) for the infrastructure development of African countries. Chinese investments in Africa are in billions of dollars and they cover everything from real estate to minerals to financial services. Countries like Chad, Niger and Sierra Leone owe Chinese 15 times more than what they receive from IMF. There are already voices of dissent in Africa. They are already complaining, " *We lose all the job creation opportunities as all jobs are made by Chinese in China*". There have been arguments from Pro China authors, that China does not

MAP 1

**China's Worldwide Reach**

*The Western Hemisphere continues to draw the most attention from Chinese companies, but growth is occurring more rapidly in the U.S. for investments and the Arab world for engineering contracts.*



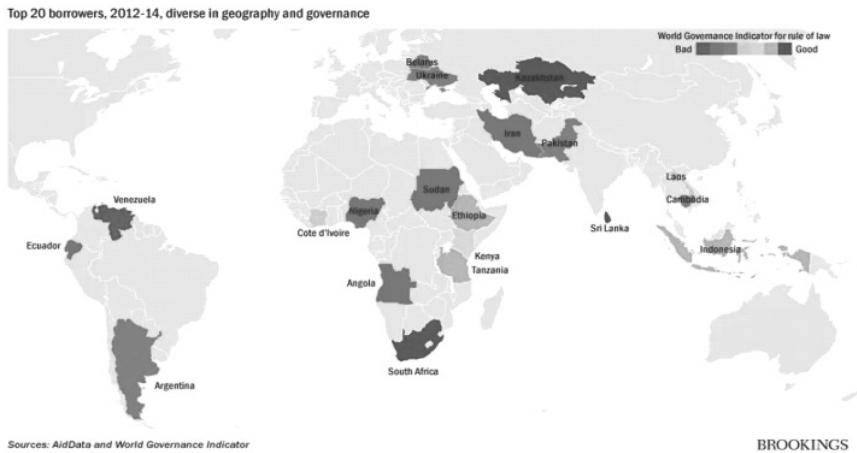
Source: The Heritage Foundation, China Global Investment Tracker dataset, updated July 2012, [https://thf\\_media.s3.amazonaws.com/2012/xls/China-Global-Investment-Tracker2012.xls](https://thf_media.s3.amazonaws.com/2012/xls/China-Global-Investment-Tracker2012.xls)

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invest for its own interests alone and has the interests of the local economies also in mind. However, such an argument holds little weight when we look at the number of troubled countries and regimes China does business with. The map below shows how China conveniently does business with troubled, corrupt and debt ridden countries of the world. To name a few; Angola, Zimbabwe, Sudan, Iran, Venezuela, Argentina. China's track record of lack of transparency in signing contracts and doing business with the highest levels of the government leads the China watchers to believe that all is not above board and such corrupt and debt ridden regimes help the Chinese cause more than the host nation.

## ANALYSIS OF CHINESE INVESTMENTS

China's entry in the foreign assistance market is relatively recent. Till year 2000, China was a recipient country of international monetary assistance as it was grappling with its macro-economic problems to put the Chinese economy on strong footing so as to take on the mighty economies of the G5 nations. China has taken a very bold, calculated and strategic decision to change that status since 2000. They made forays into relatively poor economies and countries which were debt ridden and who could not secure financial help from either western institutions or developed countries. With the promise of changing the landscapes of their respective countries with soft loans, the Chinese have secured the use of resources such as raw material, oil, or even strategic footprint in form of real estate for furthering Chinese national interests, China signed deals with their heads of states. Such a move was counterbalanced by investing in equally sound economies such as the US, European countries, Oil rich Russia and mineral rich Australia. As the Chinese economy peaked around the end of the first decade of the 21 century these investments came to bear handsome dividends for the Chinese. The oil fueled its economy and the raw materials from African and other Asian countries and Australia provided the wherewithal for the production industry. During the peak of its manufacturing cycle, China produced excess of finished products like steel and other such



Source: Aiddata& World Government Indicators

goods which the local economy could no more consume, thus leaving huge inventories. This compelled the Chinese to start an infrastructure and real estate growth in countries where the Chinese invested, mainly the poor countries in Africa. Thus, the Chinese insistence on developing infrastructure as a precursor to economic growth.

So much for the process, what the Chinese did not bargain for, was the collateral effects Chinese investments would have on local economies. The Chinese companies had little or no experienced of working abroad due to their late entry and thus it led to clash of cultures in most places where they set up industry. The importing of Chinese labour and finished product to be used in the local industry infuriated the domestic workforce and population. The combination of these two led to major roadblocks for production for the Chinese specially in the third world countries in Africa and Asia. Many of the Chinese projects started to fail and China had to do a great amount of damage control. China has suffered major problems in African countries such as Zimbabwe, Tanzania, Ethiopia, Uganda, Democratic Republic of Congo, Chinese project in Myanmar, Srilanka and Nepal in Asia have come under a lot of opposition from the local population. Even China's pet project the CPEC (China Pakistan Economic Corridor) under the BRI (Bridge and Road Initiative) has come criticism in Pakistan and China had to make some amendments to the original route. Hence China's track record of foreign investments has been at best mixed. China is relatively a new entrant in the field and hence it will take time to get its act right, yet there is caution needed at their end not to plunge so quickly in all continents and countries where their local knowledge and support is inadequate.

## LESSONS FOR INDIA

India has a long way to cover before it can catch up with China. Indian governments over the years have not thought of foreign investments as an instrument of its foreign policy. India like China had been a recipient of foreign aid and still is, yet today India is net donor. *“From one of the highest recipient of multi-lateral development aid, India has quietly transitioned into the role of provider as in the last three years it has given more aid to foreign countries than it has received. This was informed by Minister of State for External Affairs General VK Singh in a written reply to the Parliament. “India is currently a net donor of foreign aid. In the last three years, India has provided more aid to*

*foreign countries, than it has received,” Singh said in response to a question on Wednesday.*”According to the data on World Bank’s website, India has received \$3.2 billion in 2011, \$1.6 billion in 2012 and \$2.4 billion in 2013. The top donors have been- World Bank, Japan, Germany, Asian Development Bank, United Kingdom, France, Global Fund United States and European Union. Yet India has a foreign aid budget of \$1.6 billion for the period 2015-16. The major beneficiaries of this aid are: Bhutan being allotted the largest share of 63% (\$981 million), primarily on account of developing the hydor power industry there. The next highest recipient is Afghanistan at 7% (\$108 million). Other recipients include Sri Lanka at 5% (\$80 million), Nepal at 4% (\$67 million), Bangladesh and Myanmar at 3% each (\$43 million) and Maldives at 2%. Moreover, African countries are also slated to receive 3% of this amount. India’s foreign aid has been growing continuously over the past few years, rising from \$442 million in 2009-10 to \$1.6 billion in 2015-16 (at an average of 24 percent).

While India is progressing yet it has a long way to go. India’s FDI in the years 2012 to 2014 has been to the tune of net inflow for investment equivalent to \$86.10 billion (US) against an outflow of \$20.22 billion (US). This is rather paltry to the Chinese sum of \$850 billion (US), even when spread over a period of 15 years.

Some of the lessons that India can learn from China’s investments are:

- Invest where national interests are served. (India is on track on this one)
- Make foreign investment a tool of foreign policy.
- Spread the investment wisely like any private equity amongst countries which are a combination of good and risky returns. Risky returns would cost you some sleep but will pay handsomely for your economic growth. Hedge your investments in countries which will give guaranteed steady returns.
- Go into unchartered territories first and take advantage of the early bird takes the worm phenomenon.
- Be aggressive when it comes to investments abroad. Don’t get deterred by competition.
- Use official assistance (ODA&OOF) and FDI in consonance towards forwarding of national interests.

## CONCLUSION

China has made substantial progress in chartering its journey from a recipient to a major donor nation. As on date China has more outflow of capital

to foreign shores than what comes inside China. Today China is the biggest donor nation having surpassed the US and other western nations. It's been a deliberate state policy to pursue this path. The journey has helped China find the raw materials and energy to fuel its economy and be the second largest economy in the world. It has fearlessly pursued its goals in spite of many criticism from western nation and even domestic population. Yet it is steadfast in its belief that in following its stated policies it would create a win win situation for itself and the host nation.

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## **MAJOR GENERAL NITIN GADKARI (RETD)**



Major General Nitin Gadkari (Retd) has had a distinguished career of 37 years in the Army. He has been writing regularly for professional journals and magazines. He has done his PhD in Organisational Behaviour, from Osmania University. The officer also headed the College of Defence Management, Secunderabad. Currently he is settled in Pune and pursuing his interests in writing.

## Kautilya's Arthashastra and its Relevance in 21<sup>st</sup> Century

*Lt. Gen. Michael Mathews*

*“Without political will and good governance, no economic goals can be achieved. Without economic and administrative governance, populist ambitions cannot be realized in their true spirit”*

### INTRODUCTION

*Arthashastra* is the seminal treatise on statecraft by Kautilya of the fourth century BCE era which ushered in and assisted the establishment of Mauryan Empire, the first politically united Bharat. The treatise since has been ingrained in the Indian Culture and was followed till 12th Century without much dilution. During the later Medieval Period and Modern Period, it seems to have lost its sheen and after British Rule as a Nation our thinking was prejudiced by the Western Culture and the priceless document languished as unknown to the world. Professor R Shamashastry rediscovered the book in 1904, published in 1909, and wrote its first English translation in 1915. Ever since then, only two more translations that are English have been written. One by Professor R P Kangle and the other by Shri L N Rangarajan. Now the question arises is, whether the treatise written in 4th Century BCE is still relevant in 21st Century?

There had been a significant shift in the political, economic and social conditions in the past 2400 years. From the autocratic and monarchical system of governments many nation states have shifted to the democratic

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*ISSN 2347-9191 print*

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*CASS Journal, Vol. 5, No. 2, April-June 2018, pp. 80-103*



form of government. The dominance of superstitious attitudes of the society has been replaced by the scientific outlook. Agriculture dominated economies have shifted to manufacturing and service activities. Internet revolution has virtually made the world borderless even in a politically demarcated world. Kautilya developed his theories based on the ultimate superiority of the King and the Kingdom as a way of governance in synchronisation with the social, economic political and security conditions prevalent in his time. But, Kautilya's Arthashastra contains some universal truths that surpass the boundaries of time and space. Infact its relevance is increasing day by day when the nations are grappling with myriad complex issues for suitable permanent solutions, but in vain. The thoughts of the modern strategists, economists and diplomats are based on paradigms that may not be time tested. On the other hand the human progress portrayed in the *Arthashastra* visualises the symbiotic progress of spirituality, moral values and materialism which has stood the test of time. Kautilya's approach to various problems was very scientific, rational and practical; it was not dogmatic and utopian. The real test of usefulness of any treatise is not just its comprehensiveness or just the beauty of its logic, but also the demonstration of its practical application in real life situations with enduring success, for which the Mauryan Empire bears the testimony.

Kautilya the perceptor and his masterwork the *Arthashastra* are much misunderstood. Chanakya is maligned and often ridiculed as a teacher of unethical, not to say immoral practices and as an advocate of the theory that "the ends justifies the means". The only theory anyone recalls is the '*mandala theory*', "Every neighbouring state is an enemy and the enemy's enemy is a friend". This popular view is not so simplistic but also untrue. The paper endeavours to emphasize the relevance of Kautilya and the *Arthashastra* in the 21st Century.

### THEME OF *ARTHASHASTRA*

प्रजासुखे सुखं राज्ञः प्रजानां च हिते हितम्  
नात्यप्रियं हितं राज्ञः प्रजानां तु प्रियं हितम्

*"In the happiness of his subjects lies the king's happiness; in their welfare his welfare. He shall not consider as good only that which pleases him but treat as beneficial to him whatever pleases his subjects"*

Kautilya's *Arthashastra* treated populace as the centre of gravity and the priority was symbiotic relation between the ruler and populace focusing on their welfare. Any nation irrespective of the system of government it has, which deviates from this theme is bound to perish even in today's modern world and it thus opens up chapter for the relevance of *Arthashastra* in contemporary world dynamics.

### WHO WAS KAUTILYA?

Kautilya is also known as Vishnugupta and Chanakya. Name Kautilya was derived from his gotra, Chanakya from his father Chanak and Vishnugupta was the name he earned while undergoing preaching's at Takshila presently in Pakistan. A number of stories revolve around this enigmatic character. Chanakya vowed to destroy the Nanda dynasty as he was insulted by the arrogant King of Pataliputra, Dhana-Nanda ordering him to leave a feast after he had started eating. He destroyed Nanda and instated Chandragupta as King. Chandragupta, who ruled from 324 to 301 BCE, thus earned the title of a liberator and the first emperor of *Bharata* or India. Another story related to his birth, that he was born with complete set of teeth, a sign of becoming King which was inappropriate for Brahmins. Chanakya's teeth were therefore broken and later prophesied that he will rule through another. So, Chanakya was a born Kingmaker who set out with a definitive purpose to replace an unjust king with a just king. Chanakya was a fearless personality, not afraid of death, disgrace or defeat, was compassionate of the poor and evil to schemers. While embarking on this mission he found the earlier works on statecraft unsatisfactory in many respects, and he composed own definitive work presenting ideas of statecraft, in his great treatise, the *Arthashastra*. Kautilya was the organizing genius behind the autocratic centralized state that Ashoka inherited and expanded. Mauryan political system reached a very high level of structural delineation and cultural secularization, as its traditional orientations and attitudes gave way to more dynamic decision-making processes. India attained political unity for the first time under the Mauryas. In the pre-Mauryan age, there was no centralised administration. History tells that Chandragupta Maurya was the first Indian king who established his rule over an extended India, an India greater than even British India, the boundaries of which lay beyond the frontiers of modern India along the borders of Persia. If we take into account the slowness of land and

sea travel 2400 years ago, administering such a vast area was the equivalent to ruling the entire globe today.

## MEANING OF *ARTHASHASTRA*

Artha is one of the *purusarthas*, the others being *dharma*, *kama* and *moksha*. Artha has a more wider meaning than just wealth. The source of livelihood is wealth and the wealth of the nation encompasses the territory and its inhabitants. *Shastra* is science, therefore the science by which the wealth of a nation is acquired and maintained in achieving the purpose of Dharma in context of a nation is Arthashastra.

## CONTENT AND FORM

Kautilya's Arthashastra contains 15 *adhikaranas* or books. The books have total of 150 Chapters, 180 topics and total of 6000 *shlokas*. It is also interesting to note that educational practices during Ancient India and Medieval Period were mostly by rote thus the literature was passed down the generations verbally. The first five books deal with '*tantra*' i.e. internal administration of the state. The next eight books deal with '*avapa*' or its relations with neighbouring states and the last two are miscellaneous in character. Book Six enumerates the seven *prakritis* which are constituents of ideal state. Book Seven contains the six *gunas* or the foreign policy. The eighth *adhikarna* is concerned with *vyasanas*, i.e., the calamities, shortcomings or weaknesses affecting the various *prakritis*. The ninth *adhikarna* deals with preparation for war and describe the kind of troops that should be mobilised for an expedition, proper seasons for starting an expedition, precautions to be taken and the dangers to be guarded against before starting, and so on. The tenth *adhikarna* deals with fighting, and describes the camping of the Army, its marching on a campaign, various modes of fighting, types of battle arrays and other related topics.

## UNIQUENESS OF *ARTHASHASTRA*

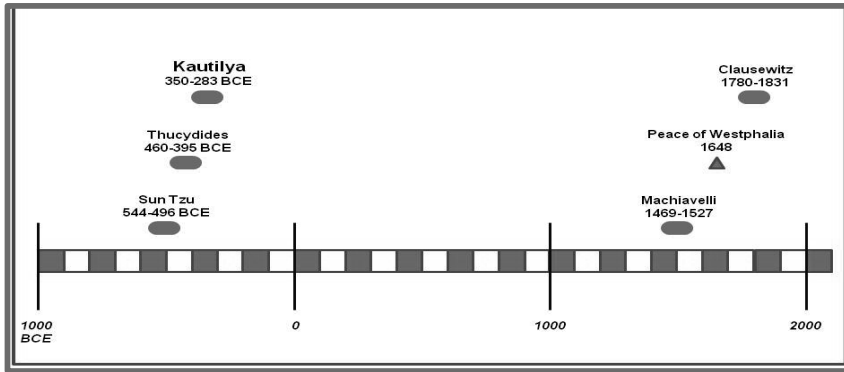
*Arthashastra* is unique since it contains universal truths which transcend the boundaries of time and space. The treatise comprehensively covers governance of state by dwelling in detail about economics, foreign policy, internal administration to include Law and Order, Human Resource

Management, Conflict Management both internal and external and Utilisation of Military with an ultimate theme of Yogakshema which is the social welfare of the society. Kautilya was pragmatic in his approach and has focused on ends rather than means. He is probably the first to give more importance to treasury and prophesied that economy of a state should take priority since it was the source of power and welfare. Thus, all the aspects of a nation state whether it is a monarchy or democracy has been dealt within *Arthashastra*. There can be two schools of thought regarding the relevance. One may argue this as popularly known in military parlance “situating the appreciation”, so to say that it is happening and we are interpreting the treatise to fit the narrative. The other can be more pragmatic and accept it as a reality, learn, deliberate and apply. This treatise in sanskrit can always be interpreted in different ways and the outcome is directly related to the ingenuity, vision and wisdom of the interpreter.

### CONTEXT OF KAUTILYA IN HISTORY

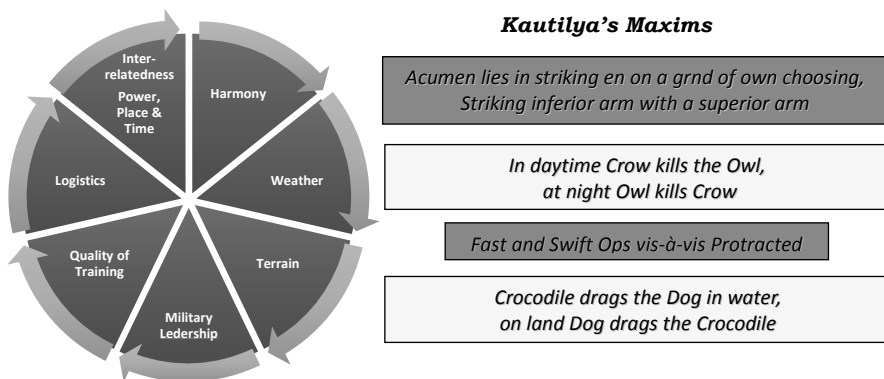
Various versions do exist on the date of *Arthashastra* whether it was written during the period of Chandragupta or post Mauryan period. But it is very clear Kautilya lived between 350 BC to 283 BC post Sun Tzu and Thucydides. Thucydides dealt with political realism wherein the state relations are constructed upon the emotion of fear and self-interest. Sun Tzu was a Military General and most of his writings revolve around tactical concepts touching operational and strategic realms vis-a-vis Kautilya's *Arthashastra* which has been written as a statesman evolving Grand Strategy to tactics. Therefore, Kautilya's breadth and depth of analysis is far superior to that of contemporary thinkers of that era.

2000 years down the line a similarity is drawn with Machiavelli and his treatise “The Prince”. Machiavelli is considered as founder of the modern political science, a discipline based on the actual state of the world and not the Utopian ideal state echoing very similar thoughts of Kautilya. Clausewitz through his famous treatise “On War”, initiated the concept “War is the continuation of policy by other means” and “War is an act of force to impose on enemy our will”. Clausewitz also talked about asymmetrical war including violence by non-state actors. The peace of Westphalia brought in the idea of sovereignty of nations, territorial integrity and principle of non- interference in another country's affairs became the basis of International Law. But the globalization, terrorism and violence by non-state actors has questioned the



**Figure 1: Context of Kautilya vis-à-vis other eminent Strategists in History<sup>6</sup>**

validity of the Westphalian system. There are commonalities between the Sun Tzu’s Art of War and Kautilya’s *Arthashastra* as far as Military domain is concerned; both highlighted the importance of Weather, Terrain, Military Leadership, Quality of Training, Logistics and Inter-relatedness of Power, Place and Time. Kautilya’s prowess lies in describing each aspect of Intelligence, Covert Operations, Leadership and Management of External Relations as separate operational manual. In brief, the teachings of Kautilya is much wider in scope and has maintained its relevance all through its historical timeline.



**Figure 2: Commonalities between SunTzu and Kautilya on Warfare**

## KAUTILYA'S VIEWS OF A NATION STATE

The King of the Kautilyan state is not an absolute monarch. Kautilya bound the King in an implicit social contract to ensure social welfare, internal stability, and security from external aggression. Rangarajan defines the King's contract with society as a three-fold obligation i.e., *Rakshana* (protection of the state and subjects), *Palana* (administration of the state), and *Yogakshema* (welfare of the population). His views on nation state do find relevance in present context. Firstly, State has an obligation to pursue self-interest even more than glory. Secondly, no alliance is conceived to be a permanent system and even within alliance one must pursue to increase own power and manoeuvre to strengthen its position, at the same time prevent neighbouring states to align against it. Thirdly, the purpose for ruthlessness should be to build harmonious empire. Fourthly, emphasis on separation of politics from religion and theology. Infact he was the first one to propose strategic objectives should take priority over religion and morality. Fifthly, Kautilya was of the view equilibrium will never exist and *Vijigishu* should always endeavour to increase his power since *matsya-nyaya* (law of fishes) is universal. The geo-politics over the last two centuries is no different from the Kautilyan theory except for minor deviations forced upon by the environmental realities at various timelines of the history.

## ELEMENTS OF A STATE

Whatever the form of government, the presence of certain elements is essential to make a state. This is embodied as seven *Prakritis*. *Swamin* is the ruler in present context the leadership of prevailing government. *Amatya* is the ministers, intellectuals and diplomats. *Janapada* is the people, territory of the people including skills and infrastructure. *Durga* is the fortified capital in present context to defend the territory and people. *Kosa* is the treasury or economy of a nation in present context. *Danda* is the Army and *Mitra* is the ally. The *Mitra* or the ally is the ruler of different similarly organized state. Considering, ally to be the foreign element, the state essentially has six elements. *Vyasanans* are calamities which can ruin any of the *prakritis* and the state must guard against these. The *Shastra* also refers to the three powers that operate in a state. They are *Utsabashakti*, the personal energy and drive of the ruler, *Prabhavashakti*, the

power of the Army and treasury and *Mantrashakti*, the power of counsel and diplomacy. Kautilya maintains that *Mantrashakti* takes precedence over both and *Prabhavashakti* takes precedence over *Utsahashakti*.

## STATE FOREIGN POLICY

*Sadgunya* or six *gunas* or policies which sums up foreign policy. *Samdhi* is making a treaty containing conditions i.e the policy of peace. *Samsraya* is seeking shelter with another king or forming an alliance. *Asana* is the policy of remaining quiet or neutral. *Yana* is marching on an expedition. *Dvaidhibhava* is dual policy of *Samdhi* with one king and *Vigraha* i.e the policy of hostility with other. The purpose of all policies is to grow stronger in the long run than the enemy.

## INSTRUMENTS OF FOREIGN POLICY

Alongside the *Sadgunyas*, there are four *Upayas* i.e *Saman*, *Dana*, *Bheda* and *Danda* meant for overcoming opposition. The first two should be used to subjugate weak kings, the last two for strong kings. They sum up the means that are helpful in securing the submission of other to own will. *Arthashastra* emphasizes that “*State is fragile organization and the statesman does not have the moral right to risk its survival on ethical restraint*”.

In present context, the *prakritis* are the essential elements of Comprehensive National Power (CNP), *sadgunyas* are the policies to deal with foreign nations and *upayas* are the means to overcome resistance being presently applied by all progressive nations.

## CATEGORIES OF VIGRAHA

Kautilya does not limit the policy of war (*Vigraha*) to physical conflicts alone. Kautilya classifies war into four categories: diplomatic offensive measures (*Mantrayuddha*), an open war at a designated time and place (*Prakasayuddha*), a secret war i.e. using treachery and psychological warfare to surprise the enemy (*Kutayuddha*), and an undeclared war i.e. using clandestine methods, assassinations, and secret agents (*Gudayuddha*). The treatise talks about breaking up confederacies and oligarchies by sowing dissension using “undeclared war”. Kautilya’s principles indicate his

clarity of thought for consolidating the capture of territories and creating an enduring victory.

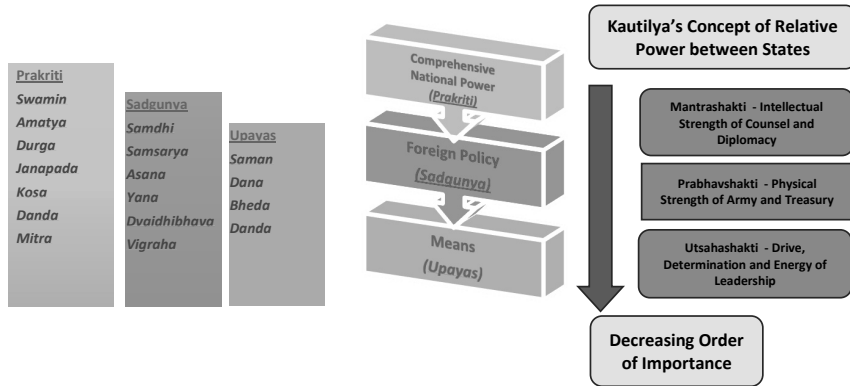


Figure 3 : Kautilya's Concept of Nation State enunciated in Arthashastra

## KAUTILYA'S STRATEGY

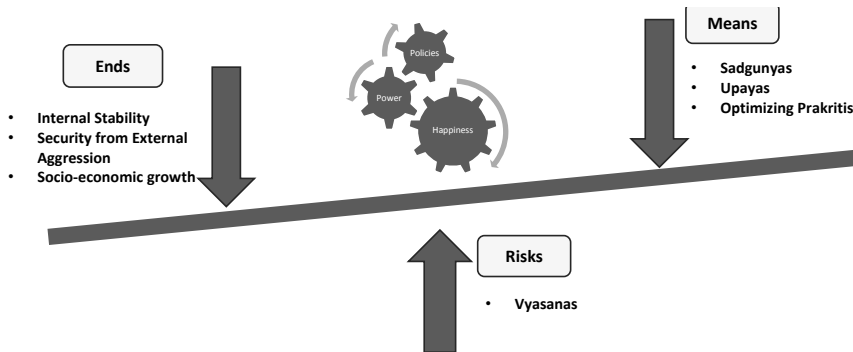
Kautilya's political purpose drives the design of strategy and strategic choices by the *Vijigishu*. Kautilya's political purpose was the happiness of the state and this objective drove the Kautilyan state's strategy. In line with contemporary emphasis on adopting a proactive strategy, Kautilya insists the *Vijigishu* to prevent the state's stagnation or decline. Instead, Kautilya pushes for the adoption of strategies, which would assure continued progress of the state and the decline of enemy states. Kautilya has clear ends, ways, and means in his doctrine. Kautilya's respect for risks in strategy is evident in his elaborate examination into the aspect of *Vyasana* (calamities) which can reduce the strength of a state's constituent elements. Kautilya's macro strategy of optimizing and prioritizing state's *Prakriti* addresses the inherent risks in strategy. Kautilya's treatise provides clear territorial, socio-economic and relative power end states for the *Vijigishu's* state. Kautilya's ways for reaching the end state are by optimizing the prakriti, while the means are the *sadgunya* (six- fold policy) as well as the *upayas* (four stratagems).



Kautilya's treatise includes contemporary concepts of pre-emption and prevention. For a weaker king facing a belligerent stronger king, Kautilya prescribes pre-emptive options using diplomacy, information operations, and covert military operations. Kautilya advises the weaker king to adopt strategies, which would prevent the stronger state from launching successful offensive operations, thus preventing the capture of the weaker state.

Kautilya holds contemporary concepts such as information operations and perception management as vital for the *Vijigishu's* policy formulation and execution. Kautilya's offensive usage of information operations is visible in his advice for breaking up rival states by sowing dissension through undeclared warfare. Kautilya indicates that a conqueror perceived as righteous will face relatively less opposition in securing the submission of the defeated king.

Akin to the contemporary theory for consolidating operational victories into strategic successes, Kautilya encourages the *Vijigishu* to win over both the defeated king and the vanquished population through pragmatic and ethical policies underpinned on successful perception management practices. Instead of forcing the vanquished population to change their culture, Kautilya advises the *Vijigishu* to adopt the captured state's culture. Kautilya's doctrine sagely prescribes ethical, just, progressive, and favourable policies for the captured territories.



**Figure 4: Kautilya's Strategic Acumen**

### Comparison with the Contemporary CNP

There is a need to have a comparative look at the concept of CNP as on today and that enunciated by Kautilya. The contemporary framework

of national power propounded by Ashley J. Tellis, comprises three realms: national resources, national performance, and military capability. National resources are the “building blocks” which enable a nation to dominate “global economy and increase its hegemonic potential”. National performance analyzes a country’s capacity to convert the latent power of national resources into tangible usable power. The state’s military capability, which is the “first line of defence” against competitors in a fluid system of international politics, forms the third realm of national power. Scholars assert that political will and the populace’s domestic support for the government both play a key role in conversion of a state’s latent power into an operational reality. The *Arthashastra* and contemporary strategic thought are analogous in several aspects i.e. elements of power are almost similar propounded 2400 years ago. The treatise exhibits concepts of both realist and idealist schools of thought. While remaining grounded in dharma (morality and ethics) Kautilya propounds hegemony as a solution to survival in an anarchical environment. Therefore, the nay challengers to the relevance of Kautilyan concept need to rethink.

Tellis Model	Kautilya’s Equivalent Prakritis
<b>National Resources</b> Technology Enterprise Human Resources Financial/Capital Resources Physical Resources	<b>Janapada and Kosa</b>
<b>National Performance</b> External Constraints Infrastructural Capacity Ideational Resources	<b>Swamin and Amatya</b>
<b>Military Capability</b> Strategic Resources + Conversion Capability = Combat Proficiency	<b>Durga and Danda</b>

Figure 5: Comparison of Kautilya’s Concept and Tellis Model of CNP

## CONFLICT RANGE

*Sadgunya* policy can be associated to a war-peace continuum. Kautilya's six fold policy shows the similarity to the conflict continuum of the contemporary range of military operations. A nation state will always have to deal within the war – peace spectrum and have *prakritis* modulated especially the Danda or the Military. Consequently, the strength of Military will have major impact on other *prakritis* and CNP.



Figure 6: Conflict Continuum

## MANDALA THEORY

Kautilya based his mandala on the contention that there are twelve primary kings with Vijigishu (the conqueror) at the center: -

- A king ruling contiguous to the conqueror's territory is an enemy (*ari*).
- A king contiguous to the enemy but separated from the conqueror only by the enemy, is an ally (*mitra*) of the conqueror. A neighbouring foe of considerable power is styled an enemy; and when he is involved in calamities, he becomes assailable; and when he has little or no help, he becomes destructible; he deserves to be harassed or reduced.
- In front of the conqueror and close to his enemy, would be situated kings such as the conqueror's ally. Next to him, the enemy's ally (*arimitra*), and next to the last, the conqueror's ally's ally (*mitramitra*), and next, the enemy's ally's ally (*arimitramitra*).
- In the rear of the conqueror, there would be situated a rearward enemy (*pārshnigrāha*), a rearward ally (*ákranda*), an ally of the rearward enemy (*pārshnigráhására*), and an ally of the rearward ally (*ákrandására*).
- That foe who occupies a territory close to that of the conqueror is a natural enemy; while he who is merely antagonistic and creates enemies for the conqueror is a factitious enemy.

- The one who is situated close to the territory of the immediate enemy of the conqueror is a natural ally; while he whose friendship is courted for self-maintenance is an acquired ally.
- A king who occupies a territory close to both the conqueror and his immediate enemy in front and who is capable of helping both the kings, whether united or not, or of resisting either of them individually is termed a *madhyama* (middle) king.
- A king who is situated beyond the territory of any of the above kings and who is very powerful and capable of helping the enemy, the conqueror, and the *madhyama* king together or individually, or of resisting any Front of the Conqueror (*Vijigishu*)
- of them individually, is a neutral king (*udāsína*).

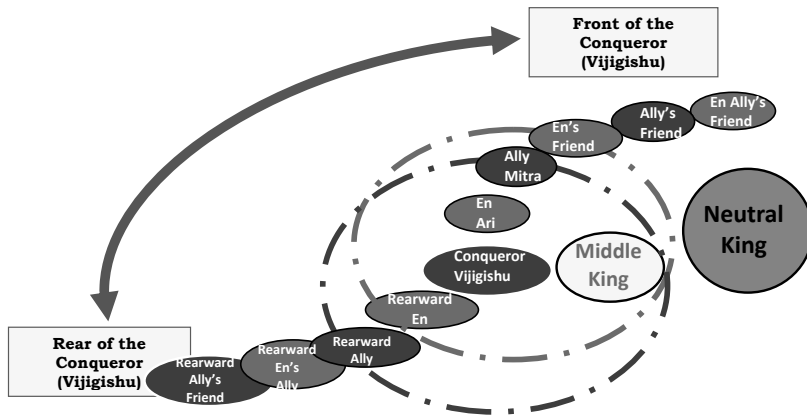
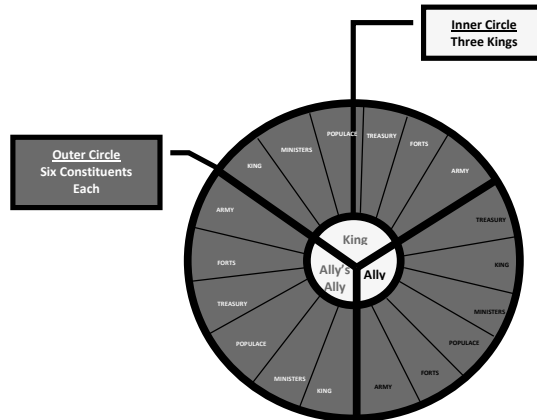


Figure 7: Schematic representation of Kautilya's Mandala

All the advice in the *Arthashastra* is directed to the would-be conqueror (*Vijigishu*). The underlying assumption is that neighbours always turn hostile. Another assumption is that a common enemy creates allies. But the categories of enemy and ally are not fixed. Under certain conditions, allies can become friends and vice-versa. The twelve types of combinations are classified by the *Arthashastra*; they are not to be taken as the permanently existing situation in a *mandala*. Kautilya assumes that except for the neutral and 'indifferent' kings/

states, all others in the *mandala* are of equal strength. Therefore, in a concrete situation, the *mandala* gets divided into two more or less equal blocs, with one bloc's leader seeking to establish hegemony over all the others. The strengths of blocs being equal, diplomacy, strategy and tactics assume great importance in attaining hegemony.

Interplay of Kings or nation states will depend upon the capability of *Vijigishu* or the Ari to influence the six *prakritis* of own, Ally and Ally's Ally which will form 18 constituents. Similarly, to emerge stronger within the *mandala*, the *prakritis* of Middle King as well as Neutral King forming 72 constituents are required to be influenced by *Vijigishu*.



**Figure 8: Schematic representation of Interplay of Three Kings and their 18 Constituents**

By way of broad strategy, the Arthashāstra recommends that the would-be conqueror should first proceed against the hostile neighbour and, with the newly-acquired power, tackle the neutral king/state. If he succeeds, he should proceed against the most powerful or 'indifferent' king. That would complete his hegemony over the *mandala* as a whole, for the rest would fall in line. If there are no neutral or 'indifferent' kings, the conqueror should first tackle his enemies and then secure the allegiance of an enemy's allies. In the event there are only two other states, one hostile and the other friendly, the would-be conqueror should crush the neighbouring state regardless of whether it is hostile or friendly and then proceed against the other. Finally, if there are

number of neighbouring states, they should be tackled one by one, gaining strength in the process.

## EVOLUTION OF GLOBAL ORDER IN 21ST CENTURY

Classical alliances could be seen during initial period of 20th Century when the race for colonialism was at peak. Tri-entente and Tri-alliances both pre-WWI alliances were akin to Kautilya's *mandala* concept. Also, the mismanagement of after effects of WWI led to WWII, major cause being the reparations and exploitation of the German people much against the teachings of Kautilya. WWII commenced with invasion of Poland, the weaker state sandwiched between Allies and Germans. If we consider Germans as Vijigishu with France as enemy (Ari) and Russians as Rearward Enemy, the *mandala* of Kautilya seems to fall in place. During, both WWI and WWII one could see Italy changing equations based on the self-interest much similar to *sadgunya* of *Arthashastra*. One assumption can be made when the nations with similar strength are in conflict zone the cultivation or management of allies by the policies suggested by Kautilya seems pragmatic.

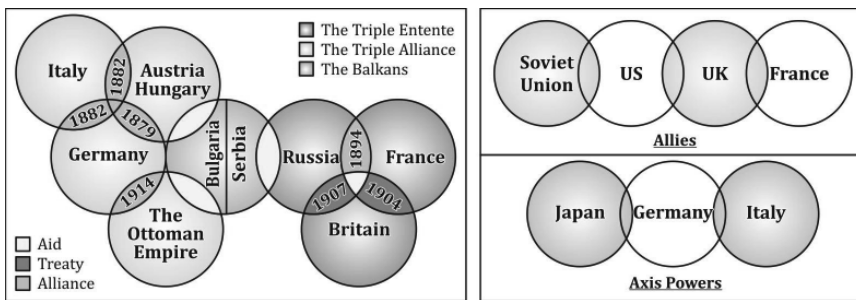


Figure 9: Schematic representation of Pre WWI and Pre WWII Alliances

Post WWII, much stronger alliances were formed in the form of NATO, leading to formation of two superblocks based on US and USSR. The cold war era saw development of WMDs, arms race, overt and covert manoeuvres apart from contest for energy and global commons. The nations chose to align themselves based on their self-interests. Nehru was known to be admirer

of Kautilya, probably the Diplomatic Enclave the extension of Lutyens was therefore named Chanakyaपुरी. The influence could be seen in the foreign policy during formative stage of the nation when Nehru chose to be non-aligned with either of the super-block till India grows in strength. The policy shaped the development of the nation. However, to increase their respective strength in Indian sub-continent both US and USSR made forays to cultivate allies in Pakistan by US and in India by USSR.

Beginning of 21st Century saw disintegration of USSR and World emerging into unipolar one dominated by the US. US went into Gulf War I to prove its hegemony and later into Gulf War II inspite of opposition from many other nations. Therefore, if US is compared to Kautilya's *Vijigishu* which had already emerged as strong power, the other states bow allegiance to its interests even though the differences exist. The *Vijigishu* thus crushes weaker states at its will – the examples being invasion of the Iraq and Afghanistan. If we analyse these wars further, both are militarily successful but strategically a stalemate since the populace (*Janapada*) in Kautilya's parlance was not given its due importance. The Modern World is learning that population is Centre of Gravity at the cost of human casualties and economic losses while tackling insurgencies. The same was prophesied by Kautilya almost 2400 years back

The evolution of information age in this century and continuous revolution in technology has changed the power dynamics of the World. The power of information has taken a form of force which all the nations across the globe need to reckon with. A major shift is seen from military alliances to economic cooperation's, lately giant cooperation's like Apple, Google, Facebook and Amazon have grown bigger than the governments and can buy off any of their competitors. Therefore, the economics is governing the geo-politics as taught by Kautilya.

## GLOBAL ORDER IN 21ST CENTURY

The global order portends the multi-polar world but US still remains the most powerful nation both economically and militarily. There is shifting of locus of power from Euro-America to Asia with emerging China and India, resurgent Russia and Japan strengthening its military to tackle challenges posed by China and North Korea in East China Sea.

Though the militaries across the world are shrinking in strength the sophistication and military expenditures are increasing manifolds. WMD proliferation is a reality today and the world is yet to arrive at any consensus on NPT, CTBT or FMCT. This will remain a sore issue in near future especially with the likelihood of these weapons falling in the hands of Non-state actors. The nations are in race of sophisticating the delivery means by Land, Sea and Air for completing the Triad.

Geo-economics is driving the world over geo-politics and accordingly number of cooperation's are emerging globally as well as regionally BRICS, SCO, ASEAN and SAARC to name a few. BRICS have overtaken G7 countries as far as economic growth is concerned with latest IMF figures suggesting cumulative GDP of BRICS at \$ 37.4 trillion while that of G7 is \$ 34.5 trillion.

The race of energy will continue to drive the geopolitics and the century is likely to see dawning of post-petroleum age within a decade. The knowledge century is emerging as information century with number of innovations and inventions within a decade of 21st Century exceeding that of the complete 20th Century.

Non-state actors will continue to challenge the external as well as internal security means. These non-state actors can easily receive financial aids from external nations. The military wings of these groups do not move from the area of conflict; instead they create conflicts right from their homes to controlled areas and then to areas where they desire to control. Contrary to the state funded troops, these non-state military wings continue to attain extensive funds, financial and technical assistance from offshore accounts and untraceable bogus organizations. Arrangements like these allow the military wings to continue their fights without any external or third front opinions thus diminishing the boundaries.

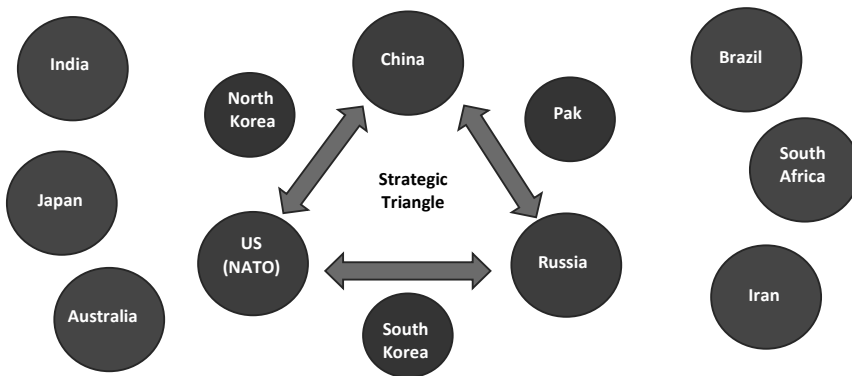
National defence is no longer ensured only through maintaining the sanctity of one's borders, but is also highly dependent upon the ability to navigate safely through the global commons. These commons—sea, air, space, and cyberspace—enable militaries to protect national territory and interests, as well as facilitate the passage of goods, people, communication, and data upon which every member of the international community depends. Yet, a number of emerging trends are threatening this freedom of action needing absolute actions to protect global commons.



## POSSIBLE SCENARIOS

Asia is likely to remain a theatre of great power competition. China's economic and strategic footprint in Asia is enormous. At the same time, many Asian powers are looking to avoid their bets against excessive dependence on a particular major power. US will retain a significant role in global politics as well as in Asia. China, Russia and US, these three powers will retain primacy owing to their economic and military strength. Therefore, the global dynamics will portend around this Strategic Triangle.

The triangle does not exist in a vacuum. There are other relationships, especially with countries like India, Iran, Japan and Pakistan that will influence the triangular dynamics. Furthermore, each country in the triangle has other interests in a host of sectors and has a range of imperatives at different levels – sub-national, national, regional and global. These powers therefore are likely to increase their clout through other growing nations like India, Japan, Pakistan or nations having considerable economic growth like Brazil and South Africa or neighbours within the region affecting each other. All these nations are similar to *mandala* of Kautilya and likely to pursue their self-interests based on the Kautilya's *sadgunas* to meet their economic and military objectives. Therefore, theory of increasing one's own strength and decreasing the strength of the rivals is much applicable in the present context.



**Figure 10: Schematic representation of Possible Scenarios – No Permanent Allies**

## ASIAN CONTEXT – CHINA AS VIJIGISHU

As a *Vijigishu* (would-be conqueror), China represents Kautilya’s ideal of an aspiring regional power pursuing the twin objectives of “power” and “happiness.” The concentration of China’s internal power in the political leadership is similar to Kautilya’s prioritization of *prakritis*. However, unlike Kautilya’s king with his social contract, China does not exhibit an obligatory leader–population contract. China’s *mandala* or circle of states keeping Japan (*ari*) and India (*pārshnigrāha*) as an adversary provides a viewpoint for Asian subtleties. China’s military modernization and diplomatic offensive strategy against the US and simultaneous strengthening of economic inter-linkages is in line with Kautilya’s strategy against a superior state. China’s foreign policies do bear certain similarities to Kautilya’s various options of the *sadgunya* concept.

China’s *mandala* model indicates the importance of the US (Neutral King) role in Asian dynamics. Developing alliances with India and Japan are key aspects of the US counter-balance to China in Asia. China’s lack of allies creates vulnerability in China’s policies. Repeated disruptive actions in the South China Sea have renewed tensions with US led countries in the region. Both China and Russia (Middle King) are distrusted by West for opposing US global dominance. As well both countries do not support the values of democracy being embraced by US, Japan and India. Therefore, China is founding mutually supportive alliances with Russia and Pakistan to form together a new bipolar global order and neutralize challenges posed by US, Japan and India.

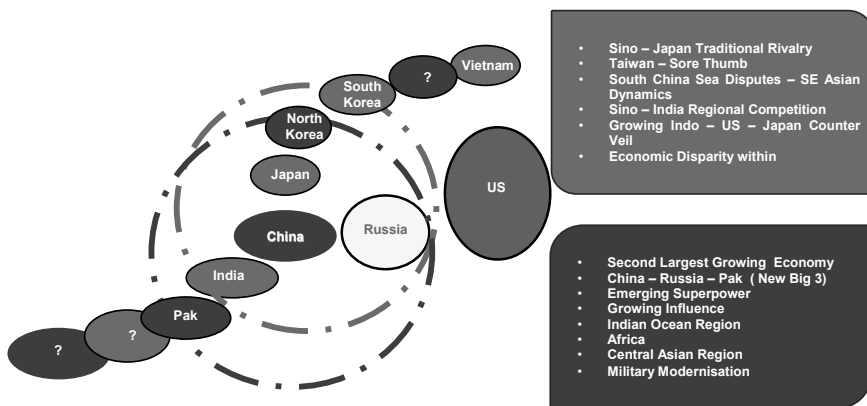


Figure 11: China as Vijigishu

The ideological drivers of China's growth are akin to the *Arthashastra's* objective of continued national progress through the pursuit of national power. Although the *mandala* theory oversimplifies China's international relations and does not provide a cohesive picture of the international power system, China's *mandala* can identify potential regional alliances for promoting Chinese interests as well as strategic alliances for countering the Chinese threat. Kautilya's concepts of relative power and the six-fold policy also hold true for contemporary China. Consistent with Kautilya's concept of relative power, China designs its foreign policy based on the relative power status of other nations. China adopts a different approach for interacting with the US or Russia, as opposed to interactions with weaker nations like Vietnam or the Philippines. China's foreign policy choices are in line with Kautilya's *sadgunya* (six-fold) policy and his advice for a weaker state challenging a stronger state.

China's policies of military modernization, peace treaties, and dual policy resemble Kautilya's six-fold policy. Kautilya's policy of *Yana* (Preparing for War) is similar to China's policy of military modernization. Similar to Kautilya's concept of *Sandhi* (peace treaties), China used peace and peace treaties for progressively developing its national power. Kautilya's concept of undeclared warfare can describe China's cyber warfare against the US. With India, China adopts Kautilya's policy of *Dvaidhibhava* (Dual Policy) by adopting Pakistan as an ally and maintaining confrontational relations with India.

## INDIAN CONTEXT

Applying Mandala Theory in Indian Context and assuming India as a *Vijigishu*, Pakistan as *Ari*, China as *Parsanigraba* (Rearward Enemy), Russia as Middle King and US as Neutral King number of options emerge for India. India is required to work on the *prakritis* prescribed by Kautilya. Therefore, there is a need of stable and strong political leadership, diplomacy to work towards achieving national goals, optimum exploitation of national resources to include technology, skills and talent of the young population, secure national interests globally and protect territory against both internal subversion and external aggression, strengthen economy and emerge as economic power, maintain military to meet future challenges across the full spectrum of conflict continuum and lastly, multiply the strength by cultivating alliances and having strong allies.

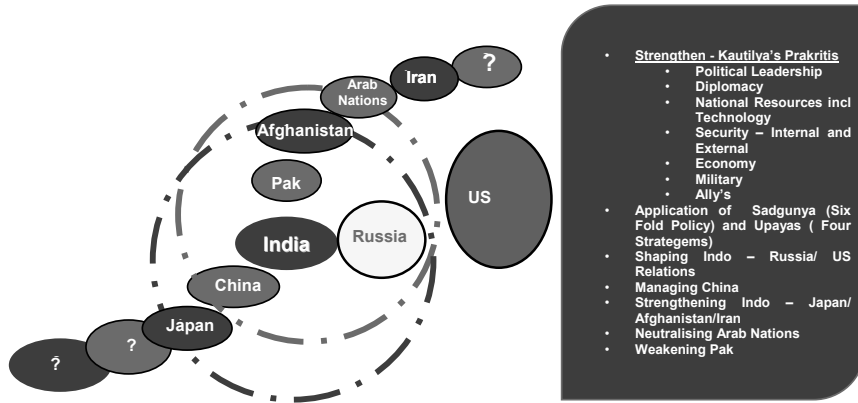


Figure 12: India as Vijigishu

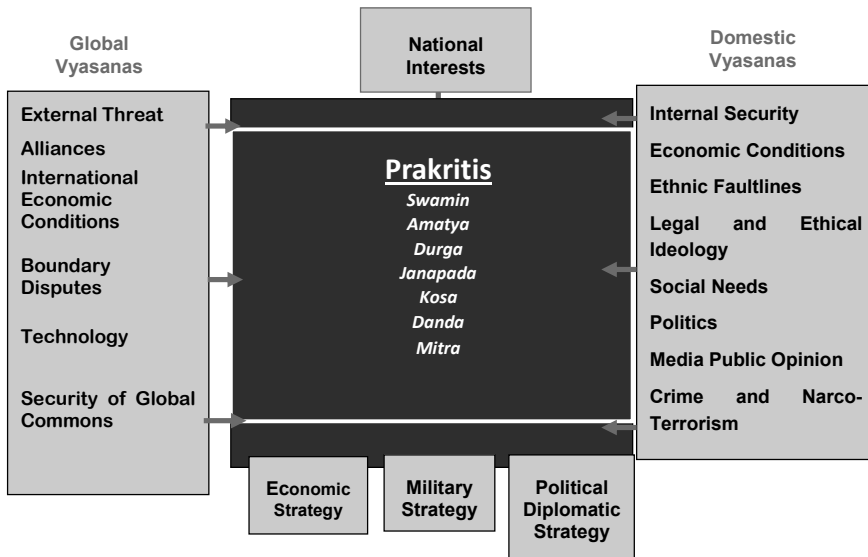
In present context, it is clearly indicative as far as foreign policy goes India needs to shape the Indo – Russia and Indo – US relations by engaging across all elements as mentioned in Kautilya's *prakritis*. This will enable India to strengthen its clout by having support of Middle and Neutral King in crisis. Moreover, it emerges that *Parsanigraha* China needs to be managed by developing military deterrence, overcoming trade imbalance and increasing counter balance by cultivating alliances. As also, the would-be friends i.e Japan, Afghanistan and Iran needs to be cultivated in favour of India by engaging *prakritis* of these nations. Simultaneously, there is need of neutralizing Arab nations who favour Pakistan (Ari) economically and ideologically. Lastly, its a pre-requisite to keep Pakistan in check diplomatically, intellectually, militarily, economically and ultimately weakening it vis-à-vis India.

This is simplistic application of Kautilya's *Mandala* theory giving out various options for India to progress as *Vijigishu*. But there is need to understand interplay between different *prakritis*, overcoming the *vyasanas* affecting these *prakritis* and working out multiple templates to arrive at Comprehensive National Strategy.

## NATIONAL PRIORITIES

Having gone through the *Arthashastra*, the question arises, Does India have a clear cut National Strategy? Even though various National

instruments are working towards achieving common goals, this may not be enough for emerging power like India with national interests extending across the globe and global commons. Even the ally's or the nations closer to India would want her to lay down clear cut strategic guidelines in the form of White Paper or National Strategy. Comprehensive National Strategy is fundamental need especially when India is facing unbalanced external environment with China, Pakistan having developed Tactical Nuclear Weapons (TNWs) for full spectrum deterrence keeping the nation at ransom with use of nuclear weapons and vitiated Internal Security situation due to sponsored terrorism. Kautilya's Arthashastra is definitely a tool to derive Nations Strategy and working out National Priorities.



**Figure 13: Factors affecting National Priorities**

Kautilya advocated overcoming vyasanas within the nation state should take priority over other threats and strengthening prakritis will enhance CNP. Hence, observing nations priorities through Kautilya's prism

will aid to arrive at their inter-se importance. Firstly, overcoming vyasanas related to internal security, socio-economic and ethnic fault-lines. Secondly, overcoming immediate external two front threat posed by Pakistan and China through military modernization and developing credible deterrence capability. Thirdly, incapacitating Sino-Pak growing nexus in the immediate future by cultivating alliances in US, Russia and Japan. Fourthly, ensure security of global commons especially affecting nation's interests by developing appropriate force projection as well as soft power capability to ensure sustained economic growth. Fifthly, resolution of boundary disputes though important but waiting for opportune moment is pragmatic. Lastly, tackling issues related to janapada viz ecological balance, keeping pace with technology, crime activities and narco-terrorism especially flourishing through Golden Triangle and Golden Crescent will form the priority of nation.

## CONCLUSION

We have still the same distrust of one nation by another, the same pursuit of its own interest by every nation tempered only by considerations of expediency, the same effort to secure alliances with the same disregard of them in self-interest, the same kind of intelligence service maintained by one nation in the territory of another which is found to be referred to in the Arthashastra. It is difficult to see how rivalry and the struggle for supremacy between the nations can be avoided and the teaching of the Arthashastra which is based on these basic facts rendered altogether superfluous until some sort of a one-world government or an effective supra-national authority is established. But until that happens, the teachings of this Arthashastra would in actual practice be followed by nations, though it may be unknown to them and though it may be openly condemned by those that know it.

In so far as the nature of human beings remains the same and states behave as they always have done, Kautilya is relevant. Kautilya argued that State is fragile org and the statesman does not have the moral right to risk its survival on ethical restraint, therefore national interest should override moral principles in as much the moral order depends upon the continued existence of the state.

Kautilya further qualified that well-governed state will have less to fear from subversion and revolt and will be in a better position to disrupt the

domestic stability of its adversaries. It would also be able to move with greater surety towards the execution of tasks that necessitate the large-scale mobilisation of economic and military power. A state that neglects the quality of the administrative elite and institutions upon which the execution of policy depends does so at the greatest possible peril to itself. Thus, India in 21st Century and as emerging power needs a Comprehensive National Strategy with clear cut enunciated National Priorities and these are required to be derived from our ancient all-inclusive treatise of Arthashastra written 2400 years ago.

*“The arrow shot by the archer may or may not kill a single person. But stratagem devised by a wise man can kill even babies in the womb”*

## **LT GEN MICHAEL MATHEWS**



Lt Gen Michael Mathews, VSM\*\* an alumini of National Defence Academy, Khadakvasala, Pune (NDA) got commissioned into 101 Engineer Regiment Corps of Engineers, Indian Army on 19 Dec 1981 and went on to command 103 Engineer Regiment. The Offr has tenated a large number of appointments within and outside the Corps of Engineers before being appointed as the Commandant, College of Military Engineering, Pune on 01 Feb 2017.

## Applications of Global Navigation Satellite System (GNSS) in National Land Survey and Records

*Dr. S. V. Kibe*

### INTRODUCTION:

The Indian Space Research Organisation (ISRO) has built-up an impressive space infrastructure in GNSS. The Indian Space Based Augmentation System (SBAS) called GAGAN and the indigenous Indian Regional Navigation Satellite System (IRNSS) are a part of this contribution by India to GNSS. IRNSS is a regional navigation system used by the Indian mobility.

Both GAGAN and IRNSS are essentially positioning systems – capable of providing the absolute position to the user through a small handheld receiver called GNSS receiver. GNSS is being used the world over for various applications such as in Railways, pilot-less cars, precision tracking of mobile assets, geo-fencing, precision agriculture etc. With the advent of smartphones equipped with GNSS chipsets, raw satellite range measurements are available on these smartphones enabling the user to make precise point positioning (PPP) extremely useful for Land survey and records.

### GNSS LAND SURVEY WORLDWIDE

There is an urgent need for a paradigm shift in the Land Survey and Records techniques in India. The entire developed World has changed over from land based to GNSS Land survey techniques which are very accurate, fast,

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*ISSN 2347-9191 print*

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*CASS Journal, Vol. 5, No. 2, April-June 2018, pp. 104–110*



inexpensive and provide digital data for Land records. Even western nations such as England, Norway, Sweden, France, Germany, Australia who do not have their own National Space programmes have switched over to GNSS techniques for Land surveys and Records in the last five years. India has an advanced Space programme and we have the most advanced Satellite systems which are part of the Global Navigation Satellite System (GNSS). The Remote Sensing satellites of India provide high fidelity ground pictures. We need a National Reference datum like the WGS-84, ITRF, PZ 90 etc. The Development Plans (DPs) of States, Union territories, Cities, Municipal Corporations, semi urban and Rural Land masses will benefit immensely with accurate, reliable and speedier implementation through Digital Space based technology for which the Infrastructure is readily available. The need of the hour is to take the Country forward by leapfrogging to GNSS Surveying techniques which are a World standard today. Indian Land survey and mapping can be completed in a short period of time with uniform accuracies pan India. Moreover, all the elements including GNSS receiver technology are available in India

## **DEVELOPMENTS IN THE LAST THIRTY YEARS**

GPS became available as a civilian geodetic survey technology in the early 1980s. It has since revolutionised not only geodesy, but surveying operations as well. GNSS is today a fundamental tool for the land, engineering and hydrographic surveyor. The majority of GNSS survey tasks relate to the determination of high accuracy coordinates in a well-defined reference frame, typically using differential GNSS positioning techniques based on the analysis of carrier phase measurements. Carrier phase based positioning is capable of distinct “levels” of accuracy – sub-meter, few decimetres, centimetre, and even sub-centimeter – through a unique combination of special instrumentation, sophisticated software and field operations. The evolution of GNSS from a Geodetic surveying technology to a versatile surveying tool has seen precise positioning implemented in real-time using ever shorter spans of measurements, and even when the user receiver is in motion. Furthermore, new techniques based on precise single point positioning as well as wide-area reference receiver networks, are starting to find wider use. See the European Land survey scene below

Today, around the World, GNSS is unchallenged as the primary technology for geodetic surveying.

## GNSS AS A SURVEYING TECHNIQUE

In fact, the key features of differential GNSS techniques compared to non satellite (or terrestrial) geodetic surveying techniques is that intervisibility between pairs of observing GNSS receivers is not necessary. The distance between GNSS receivers may range from a few kilometres for land or engineering survey applications to hundreds or even thousands of kilometres in the case of global geodesy applications.

For Geodetic surveying great care is taken to build robust monuments upon which the GNSS receiver antennas are mounted – concrete pillars, steel pins, metal tripods or poles– fixed to bedrock or attached to stable structures. It is to be noted that all mathematical concept, measurement principles, operational procedures and applications were first developed using GPS technology.

Permanent GNSS reference receivers or Continuously Operating Reference Stations (CORS) have been universally installed in all Western European countries, Australia, US etc. CORS range from single receiver installations to vast network of CORS across entire such as the global IGS (International GNSS Stations) network. This network helps establish, maintain and densify geodetic datums. They help in the alignment of national datums to other well known datums such as ITRF or WGS-84. Availability of geodetic products and services including those provided by IGS and other service providers for real-time GNSS positioning help in the development of standardized data and transmission formats that support GNSS interoperability.

One of the key benefits of use of GPS technology for Geodetic surveying is the improvements in Reference datums such as WGS-84, ITRF, PZ 90 etc itself. which have been carried out with assistance from hundreds of Ground receivers all over the World.

GPS, GALILEO and GLONASS constellations are global and are planned with a minimum constellation of 24 satellites in Medium Earth Orbits (MEOs). A set of Geo-stationary satellites that complement and enhance the Position, Navigation and Time (PNT) services of GPS are called Space Based Augmentation Systems (SBASs) such as WAAS of US, EGNOS of Europe, MSAS of Japan and GAGAN of India. These SBASs were primarily intended to provide increased safety and accuracy when GPS is used for aircraft approach and landing requirements of Civil Aviation.

All the four SBASs to GPS are operational. The Indian SBAS GAGAN (GPS Aided Geo Augmented Navigation) has been certified for APV 1.0 standards of International Civil Aviation Organisation (ICAO) in May 2015 and the Indian DGCA has made the use of GAGAN mandatory to all civil aviation airliners by 2019. Regional systems such as IRNSS of India or QZSS of Japan compliment the global systems regionally. GPS/GLONASS/GALILEO receivers are low cost devices and the Global market for

such receivers is over US \$ 30 billion yearly. Indian companies make these receivers now called GNSS receivers as well.

Geodetic surveying is just one ground application of GNSS. GNSS is routinely used in many other applications such as Precision agriculture, Railways for Anti-collision systems, Intelligent transport systems, Location based services, Mobile-phones used for Positioning and Security applications etc.

## **THE INDIAN GNSS INFRASTRUCTURE**

Over the past 15-20 years, the Department of Space together with other National agencies has built an impressive GNSS and Remote Sensing infrastructure in the country.

The GNSS space based infrastructure includes three Geo-stationary Satellites - GSAT- 8, 10 and 15 which are an integral part of GAGAN, the Indian Regional Navigation Satellite System (IRNSS) consisting of Seven satellite in Geo-stationary and Geo synchronous orbits and Ground control networks for GAGAN and IRNSS.

The Ground based infrastructure includes 15 reference stations of GAGAN placed at 15 airports in India, The Master Control Facilities for GAGAN and IRNSS at Bangalore, Hassan, Bhopal and Delhi. The Indian Industry is capable of designing GNSS receivers with indigenous technology. What more does a country require?

## **GNSS CHIPSETS IN SMARTPHONES**

The Indian market is flooded with Smartphones equipped with GNSS chipsets that can be used for PPP. Notable among them are PIXEL 2, HUAWAI Mate 10/ P10 phones. These phones use the European Broadcomm or Qualcomm GNSS chipsets capable of receiving raw satellite measurements

useful for PPP with positioning accuracy of about 30 cm or better. The user has the capability to use these phones both for PPP for Land Survey and Records as well as for communicating the derived position location to a Central Processing facility through the normal phone function.

## THE INDIAN LAND SURVEYING SCENE

Survey of India, The National Survey and Mapping Organisation of the country under the Department of Science & Technology, is the OLDEST SCIENTIFIC DEPARTMENT OF THE GOVT. OF INDIA. It was set up in 1767 and has evolved rich traditions over the years. In its assigned role as the nation's Principal Mapping Agency, Survey of India bears a special responsibility to ensure that the country's domain is explored and mapped suitably, provide base maps for expeditious and integrated development and ensure that all resources contribute with their full measure to the progress, prosperity and security of our country now and for generations to come.. The history of the Survey of India dates back to the 18th Century. Forerunners of army of the East India Company and Surveyors had an onerous task of exploring the unknown. Bit by bit the tapestry of Indian terrain was completed by the painstaking efforts of a distinguished line of Surveyors such as Mr. Lambton and Sir George Everest. It is a tribute to the foresight of such Surveyors that at the time of independence the country inherited a survey network built on scientific principles. The great Trigonometric series spanning the country from North to South East to West are some of the best geodetic control series available in the world. The scientific principles of surveying have since been augmented by the latest technology to meet the multidisciplinary requirement of data from planners and scientists.

Organized into only 5 Directorates in 1950, mainly to look after the mapping needs of Defense Forces in North West and North East, the Department has now grown into 22 Directorates spread in approx. all parts (states) of the country to provide the basic map coverage required for the development of the country. Its technology, latest in the world, has been oriented to meet the needs of defense forces, planners and scientists in the field of geo-sciences, land and resource management. Its expert advice is being utilized by various Ministries and undertakings of Govt. of India in many sensitive areas including settlement of International borders,

State boundaries and in assisting planned development of hitherto under developed areas.

Faced with the requirement of digital topographical data, the department has created three Digital Centers during late eighties to generate Digital Topographical Data Base for the entire country for use in various planning processes and creation of geographic information system. Its specialized Directorates such as Geodetic and Research Branch, and Indian Institute of Surveying & Mapping (erstwhile Survey Training Institute) have been further strengthened to meet the growing requirement of user community. The department is also assisting in many scientific programs of the Nation related to the field of geo-physics, remote sensing and digital data transfers.

However. This is not enough. There is a paradigm shift required in the National mindset about the use of GNSS techniques for Land survey and records.

The Indian Everest system for land surveying is old and needs to be replaced by modern GNSS surveying techniques.

## CONCLUSION

There is no time to waste any longer. The Ministry of Urban Development, The Department of S&T - of which Survey of India is a part - and all stake holders in various States in India must come together to Forge a National Plan for GNSS Geodetic surveying, and Records and in modernising all Development Plans across the board uniformly and quickly. All Smart city projects and major infrastructure development plans of the GOI and private sector must use the modern GNSS techniques for which necessary infrastructure in Space has been assiduously built by the Indian Space Research Organisation / Department of Space over the last 20 years.

## **DR. SURESH V. KIBE**



Dr. Suresh V. Kibe has over 44 years' experience in Satellite Communication and Satellite Navigation. He led the GNSS team in the Indian Space Research Organisation (ISRO) from 1993 to 2010.

He was responsible for establishing the Indian Satellite based Augmentation System GAGAN which has been certified by the Indian Director General Civil Aviation (DGCA) for APV-1 standard of the International Civil Aviation Organisation (ICAO). He chaired the Signals Committee of the Indian Regional Navigation Satellite System (IRNSS) from 2006 to 2009.

He was invited by the DG,ESA as an International Fellow in GNSS at ESTEC in 1996. He was invited by the Administrator NASA to be an International Member of the PNT Advisory board for GPS from 2007 – 2011. He chaired the second meeting of the International Committee on GNSS (ICG) held in Bangalore in Sept.2007

He has filed an International patent on Use of Low Density Parity Check Convolutional codes (LDPCCC) FEC in GNSS data structure on 27.08.10.

He retired from Govt. service in early 2011 and since then has been a technical consultant in Satellite Communication and GNSS to EC, Korea etc.

He has several technical publications in IEEE Trans. Communication, IEEE Journal of Solid State Circuits, IEEE Trans in Instrumentation etc. He has contributed extensively to the ITU=R WP-4C and UN OOSA publications on GNSS.

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