Evolving Technologies—A Tool of Strategic Competition: Options for India

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Abstract

The author briefly highlights how Information, Communication Technologies, Electronics and Cyber (ICTEC) and concomitant technologies are outpacing changes that are being witnessed in the environment. He then goes on to logically explain how these advancements in mobility and networking space will affect various broad sections in the military to achieve strategic dominance and leadership role. Shrinking of time and expansion of space/area of influence are clearly brought out in the now possible Network Centric Environment (NCE) that is emerging. However, at the national level, strategic and long-term economic and military dominance have to go hand in hand by achieving a sustainable competitive advantage in the world order. He then goes on to briefly examine the factors that influence strategic sustainable competitive advantage and goes on to list out where India stands in terms of international indexes. The next

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portion outlines some of the initiatives and directions are taken by the Government towards a well-thought-out vision relating these to well-articulated theory in academic circles. Citing recent bold decisions, the author expresses hope that India is on the right path of donning a leadership role in the world.

Introduction

With the advent of information technology and the information age, nations are finding it difficult for their policies and regulations to keep pace with the rapid changes brought about by technology. Borders, as we know them today, are no longer relevant as they were before; hierarchies are changing, and technology is becoming a strategic tool in the hand of Nations and individuals. The rate at which the technology-based change is happening is ever-increasing and the physical way of doing things is giving way to the digital way of doing things—digital highways are more acceptable than physical highways. Every day we have a new technology, or a new application derived out of these technologies, being adapted for ease of doing business. Time and space parameters in military parlance are getting disrupted positively—the time taken for doing things is becoming less and less while the area of influence is increasing, thus leading to greater opportunities as well as challenges. New efficiencies and adaptabilities now enabled in certain industry verticals, duly buoyed by information technology, are causing these industries in becoming critical industries of the nation.

Technology Bringing Paradigm Shift in Strategic Contour

While all technologies across the board are getting enhanced at various speeds, contexts and nuances, a simple scan of the environment will show that most of the technologies that are rapidly changing across all verticals are either directly in the Information and Communication Technology (ICT) domain or are complementary to this field. In fact, this domain

has now expanded to include Electronics and Cyber too—leading to the more relevant acronym ICTEC. This is a domain that transcends civil and military sectors both. Technologies like 5G, and later 6G, and concurrently enabled automation, human enhancements, digital twins, drones artificial intelligence, data analytics, blockchain, cyber currencies, quantum computing etc are all intertwined to bring in an experience that improves the way we live and work.

Primarily these technologies bring in disruptive experiences, optimise existing processes and are increasingly seeing the advent of artificial intelligence in predictive processes. The basic things that are changing as mentioned earlier are time and space, efficiency, flexibility, and adaptability—with a lot of emphasis on distributed data, software enablement and near real-time computation. Since the focus of technological change is currently around mobility, it would be wise to examine changes that have occurred in the last one decade and are likely to occur in the next few years.

The centre of attraction during the transition from 2G to 3G/4G was the smartphone, a device. The human being became interactive with the device and thus with the environment. During the change from 4G to 5G the focus of disruption now shifts to the networks and all concomitant factors. 5G is a new technology that offers very low latency, and very high speeds with massive aggregation capabilities and is thus capable of integrating an interoperating humans and machines including sensors. This opens mega possibilities, and challenges, in all aspects of life. There is no gainsaying that adjunct and complementing ICTEC technologies like artificial reality, augmented reality, virtual reality, machine learning, natural language processing, and robotics amongst others, are becoming critical in military and civil domains both.

In the military domain, the macro rules of warfighting remain the same, but these new strategic and operational tools of technologies, especially information technology, will help to secure an advantage over

the adversary by controlling information and utilising it in a shorter time frame and over longer distances, thus upsetting the Observe, Orient, Decide and Act (OODA) loop of the adversary. The factors that will get affected in this domain are briefly listed below.

- **Emerging Environment**. The environment that is likely to prevail in the near future will have high-quality, always-available networks, which are safe, secure, adaptable, flexible and connect/interoperate with multiple applications, devices and personnel at the same time. On top of these networks will reside applications derived out of legacy as well as emerging technologies mentioned above. The interconnect between the network—application—user/sensor will be through smart devices. This grid will work off data stored in core network data centres, edge data centres and many other flavours of storage. The computing will be done, by choice, over the network, edge or personal device depending on the situation. The network elements will increasingly become software-defined, having their own advantages and disadvantages—but giving a huge amount of flexibility and adaptability. This situation is akin to the NCE that has been talked about, over decades. The sensor network, whether embedded in weapon systems or stand-alone, will form an IOT network enabled by the underlying networks and software. Many of the decisions taken in this environment will be controlled by artificial intelligence and connected control systems which may include configuration/reconfiguration and operational empowerment—like the firing of a weapon system under some circumstances. The data patterns that drive the Artificial Intelligence (AI) engine will emerge out of the experience and/or simulations using Virtual Reality (VR), Augmented Reality (AR), machine learning (ML) and deep learning (DL). Of course, the critical functions will remain under the control of the human being manning the machines. The skill sets for such a situation/environment will be of a very different nature from as

prevails today. Cyber security will be ingrained from the grassroots level to the top level. Fresh challenges and opportunities for sure.

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- **Time and Space**. There will be a huge reduction/compression of time available to collect, process and compute information to derive intelligence for the decision maker and thereby effect/operationalise winning strategies and plans over larger areas of influence.
- **Weapon Systems and Platforms**. Almost all weapons systems and platforms will become smart with embedded sensors and control systems. Many of the functions will be fully controlled by AI while some will require human intervention.
- **Decision Support Systems (DSS) and Battlefield transparency**. A huge amount of enterprise and environment-wide databases will be interconnected, data correlated and analysed by AI engines to arrive at DSS based on data analysis that will support the decision maker by creating a smart picture, enabling battlefield transparency like never before using software tools.
- **Logistics and Supply Chain**. The use of sensors, software tools, control systems and data analytic tools will help in more efficient flexible adaptable and Just in Time logistics, supply chain and commensurate maintenance effort. This is true for both the military and civil sectors and developments will take place in both sectors, for optimum results.
- **Human Capital**. The skilling, reskilling and empowerment of human capital are equally important in the civil and military domains. The use of ICTEC Technologies will aid in network-centric training of human capital using tools like AR, VR, AI, and 3D Printing. Robotics, data Analytics and drones will help in keeping the support

systems, based on networks, like health, etc. at an optimum level of performance. Emerging higher lethality enhanced kinetic weapons, information and cyber capability and a lesser involvement of troops—are now being increasingly seen in achieving victory over the adversary collectively.

At the enterprise level, care must be taken, however, to ensure that the planning of such a system should be articulated as a user requirement by the concerned branch and executed by a well-trained technical branch. It'll be suicidal if done otherwise or if say 5G is planned with the mind-set of 4G or 3G. Clearly, three layers emerge—first, the creation of a secure, versatile enterprise-wide network with adequate resilience—covering up too and beyond the troop deployment on borders; secure and distributed data centres with AI-based management of networks, data and connected control systems. Second, the creation of applications that will take care of the user requirements as spelt out both strategically end operationally and thirdly, adequately trained manpower to take advantage and exploit the benefits of such a network-centric environment.

All these segments will be well advised to make full use of trust technologies like blockchain, Big data, Data Analytics and derivative technologies that are emerging like Drones, 3D printing, deep fakes, etc. A different look at cyber defence and offence will also have to be built in from the drawing board stage itself. This will have to be supported by an agile and similarly placed manufacturing base and a sound supply and logistic system. This aspect will draw a lot of strength from corresponding civil systems as there are a huge number of similarities.

Opportunity for India to use Technology as a Tool of Strategic Competition

In the current environment, India has a few unique advantages that it can leverage towards its march towards leadership. These are—Demographic

Dividends at least for the next 25 years, English speaking population, an innovative bent of mind, an acclaimed leader in Information Technology nee ICT, a vibrant democracy, and resolute leadership.

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However, for any nation to gain strategic importance in the world order by leveraging the sustainable competitive advantage it possesses, or can possess, to become a leader in economic, technology and military domains, there has to be a commensurate focus on its Economic and Military strengths. In the emerging information age, India certainly enjoys an inherent advantage over other nations, but is that sufficient for it to become a strategic leader in the emerging world order? The quick answer is yes it can if it handles the situation with foresight and strategic vision. There are two verticals that any nation must develop against the competition to achieve sustainable leadership using emerging technologies. The first is sustainable economic growth based on an indigenous industrial manufacturing base that caters not only for domestic needs but also for the international market, and the second is a strategic dominant military strength that is sustainable. The world has been looking at India as a very big market to be exploited by industrialised countries, especially in the consumer and defence market. They are now sitting up and looking at India with different lenses—as an emerging leader.

The government of India has already taken certain bold steps to ensure that the equipment that is deployed in such a network-centric environment and the weapon systems, etc. which are used in warfighting domain or in critical dual use, like telecom, come from only trusted sources/country, and duly tested. The military will then have to take off from there. It is going to be exciting times provided we change the mindset and go beyond traditional hierarchical military organisations.

In the common domain of civil and military, the government of India has taken certain bold and far-reaching steps, that will be strategic, and will boost the Indian manufacturing, including in the defence area. Both the carrot and the stick have been used to keep inimical agencies oblique countries out and yet Increase the domestic manufacturing base by offering incentives like Production Linked Incentives (PLI). This is adequately matched by policies and laws. A massive clean-up of archaic laws and processes is now underway for the benefit of the nation.

There is competition in all spheres amongst nations, industries and between individuals. To have a competitive advantage, we have to offer differentiated, cost-effective, exclusive, sustainable, and integrated services and products to the world market at appropriate levels as applicable. There will always be competitors who will be trying to enter the market with imitable or substitutable products, lower costs, better bargaining power of suppliers and highlighting disruptive factors prevailing in the internal and external environment. The aim of the country is to dynamically address these challenges, achieve and sustain the leadership position while challenging others, higher in the pecking order than us, in areas where we have inherent advantages.

The four determinants that help achieve global competitive advantage have been very clearly enunciated by Porter in his book "The Competitive Advantage of a Nation". These are—factor conditions, demand conditions, related and supporting industries, and strategy/ rivalry (Porter, 1990). 'The Porter Diamond Theory of National Advantage' explains how factors like Institutions, Infrastructure, IT and automation, R&D, Health, Skilled workforce, the markets, ease of doing business, financial stability, uncomplicated legal and administrative setup and government intent and stability can be facilitated by governments to act as catalysts to improve a country's National Advantage (Porter, 'The Porter Diamond Theory of National Advantage' n.d.).[1]

Fortunately, in the last few years, India has shown an integrated strategic resolve in all the aspects mentioned in the previous paragraph. With a very clear-cut vision, a resolute Indian government has created a favourable business environment with a sound administrative setup, legal backup, sound economic systems and a large skilled workforce to attract foreign investment into India. From expanding the spread of internationally acclaimed academic institutions, creating world-class communication infrastructure, funding indigenous R&D, streamlining the capital markets, adopting international standards, and creating a broad resolute and responsive legal framework, TO displaying a political will to take difficult but decisive disruptive decisions, both externally and internally, spread over the civil and military domain, have made the world sit up and view India as an emerging leader whose precedent-setting actions are being now emulated. The Prime Minister's clarion calls for *Atmanirbhar Bharat* and Make in India initiative are now bearing fruit, thanks to follow-up policies like Gati Shakti, the PLI scheme and proactive actions in cutting-edge technologies like 6G. These actions have tremendously improved the FDI confidence in India.

It is pertinent to note that, hey due to the slew of measures mentioned above, India's positioning in the world Competitive Index has significantly improved as shown below.[2]

- **Economic Performance:** It has improved from 37th in 2021 to 28th in 2022.
- **Government Efficiency:** It has improved from 46th in 2021 to 45th in 2022.
- **Business Efficiency:** It saw a huge improvement from 32nd rank in 2021 to 23rd in 2022.

Another important index is the global innovation index, GII, which ranks countries using digital-age innovation and deep science innovation

which are essential ingredients in the information age. Here too, India ranks 40th among the 132 economies featured by the GII in 2022.[3, 4]

Not only indexation, but practically on the ground too, it is heartening to note that the government of India has focused strongly on the emerging environment and have taken measurable steps to usher in divisions in the Ministry of Information and Electronics Technology (MIETY), Ministry of Defence (MOD), Department of Telecommunications (DOT) and Ministry of External Affairs (MEA) for the purpose of formulating not only technology and its applications but also the accompanying policies and strategy formulations. While the focus is rightly on Make in India, International collaborations haven't been lost sight of.

At the citizen level, the versatility of the Indian mind can be seen in the payment system e.g., UPI, that India has given to the world. It can easily be said that today India is at the head of the curve in the adaptation of a safe and secure digital payments system, one of its kind Aadhar and an integrated ICT network system. Other significant Indian advantages are its Democratic processes, its demographic dividend, unique geo-practical positioning, very large skilled manpower, a notable presence in international technology institutions, acclaimed expertise in software and systems, an innovative population, a new governmental focus on R&D, on startups, and on innovation hubs. With technology now becoming an integral aspect of international relations, foreign policy and military relations, India has already embarked on a path to advance its strategic interests using technological tools, amongst others.

In the recent time, for the first time India has clearly sent out signals of its firm desire for initial self-sufficiency, and later becoming a supplier of defence equipment to the world, by issuing positive indigenisation lists, Defence Acquisition Procedure 2020, opening Defence Production in areas like fighter aircraft, helicopters, submarines and tanks through a strategic partnership model and Innovations for Defence Excellence IDEX. Similarly, on a broader ambit, introducing the concept of Trusted

sources in Telecom and Trusted countries in the new Data protection bill are first-time strategic decisions that avoid isolation and yet protect the Indian interest.

Focus Areas that can Propel India to be a Global Leader in Dual-use Technologies

India needs to focus on developing dual-use technologies for both military and civilian agencies and special attention should be paid to research and development for manufacturing state-of-the-art defence platforms, Defence Minister Rajnath Singh said on October 4 while addressing an event organised by the Defence Research Development Organisation (DRDO).[5]

In dual-use technology, India needs to be focused on areas where it can develop a unique strength that is not easy to replicate so that it can achieve sustained competitive advantage in the focus areas. Clearly, India needs to tap into technologies like AI, AR, VR, Robotics, space and drones delving into its strengths of software development and using its demographic dividend to the utmost. Additionally, as a parallel track, encouraging world manufacturing to shift base into India would certainly help in achieving our goals of a leadership role. It must be kept in view that research and development take time, investment and a talent pool to drive this to compete with the best in the world. The systems that cannot be developed indigenously due to high cost and high-end technology, India must take the route of joint development with strategic partners.

In the services sector, skilled manpower pools and space segments are attractive areas to focus on. In the defence sector, however, India certainly needs to first become self-reliant in its production capabilities of the hardware, weapons, and indigenous software and spend more on Research and Development in critical sectors like defence, communications and cyber. Fortunately, discernable beginnings have been made in this direction by the Government of India.

Conclusion

The world is undergoing a metamorphic change in all sectors as it transits into the Information age. This includes the Defence sector where we see war fighting methodologies getting modified by the infusion of ICTEC in a big way in all aspects of the fighting machine. This is a time when conventional leadership roles are getting disrupted, and we are seeing the emergence of a new world order driven by technology majorly. However, the leadership of a nation can only be sustainable if it is spread over both economic and military spheres. India is uniquely placed in an advantageous position because of its inherent strengths in some technologies, its demographic dividend, and a clear political desire to achieve the leadership mantle. However, care must be taken that we do not spread our resources thin but instead concentrate on a few areas of focus where we not only have strengths, but which will also contribute to India's emergence as a leader in both economic and military domains. India will also have to put more focus on R&D-led indigenisation in dual-use technologies and services.

India is at the cusp of a change, and we must intelligently grab this unique opportunity to obtain a sustainable competitive advantage in our quest of becoming a global leader.

Notes

1. 'The Porter Diamond Theory of National Advantage'.
2. https://iasscore.in/current-affairs/mains/the-world-competitiveness-index-2022
3. https://www.wipo.int/global_innovation_index/en/2022/index.html
4. HBR 1990.
5. *The Hindu* October 4, 2021.