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ISSUE BRIEF
IB/05/25

INDIA'S TECHNO-NATIONALISM DRIVING ITS FOREIGN POLICY

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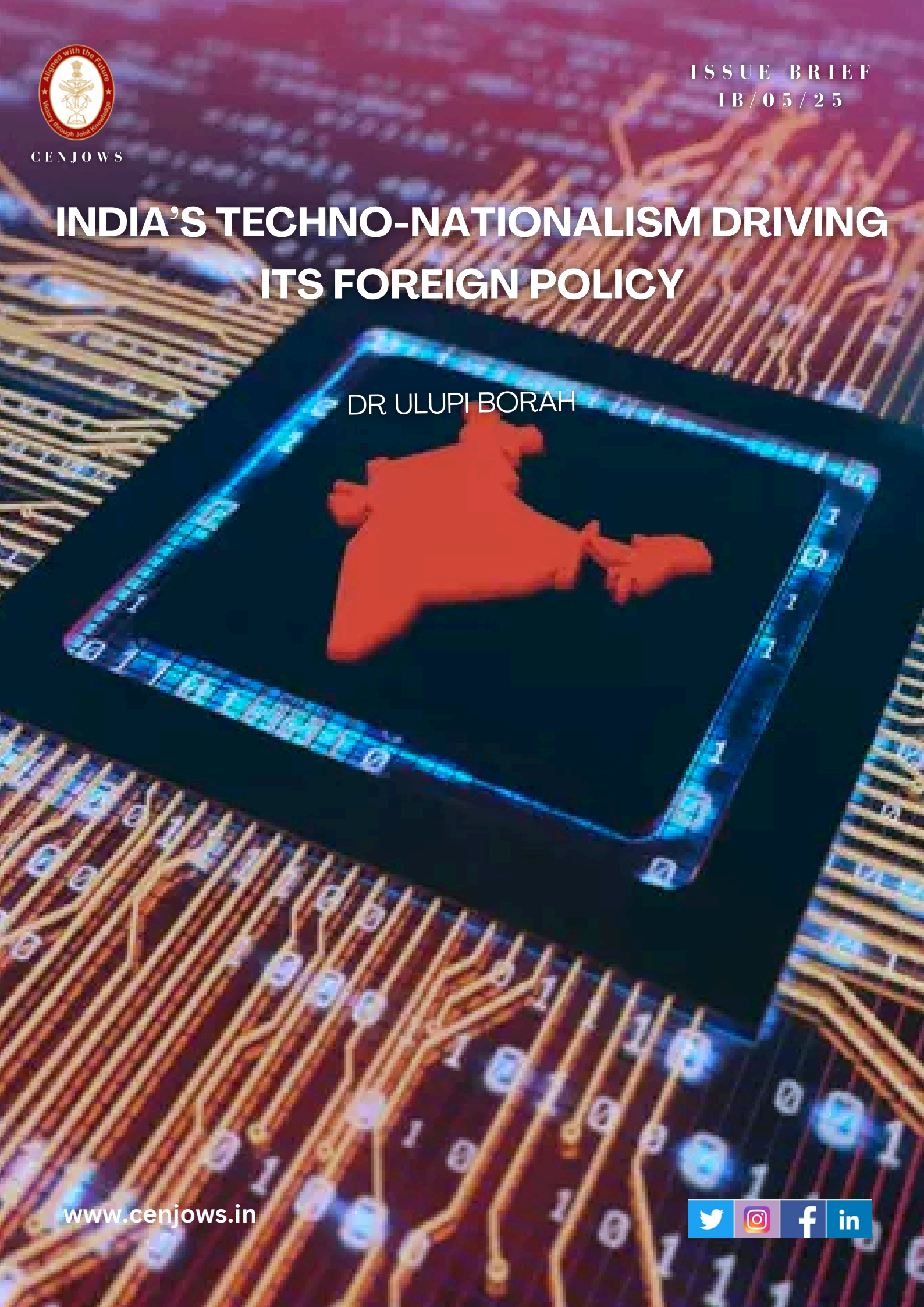

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INDIA'S TECHNO-NATIONALISM DRIVING ITS FOREIGN POLICY

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Abstract

The national governments through techno-nationalism promote their indigenously built technology while trying to protect their own interests and reduce the reliance on imports. To achieve this, governments pass policies and regulations too. Today, New Delhi has made techno-nationalism a critical factor and emphasises on indigenously producing its technologies. Atmanirbhar (self-reliance) Bharat is one of its initiatives aimed at playing a larger role in the world economy. Apart from this, India Semiconductor Mission, Digital India and New Emerging and Strategic Technologies remain crucial for India to achieve its goals. New Delhi is also collaborating with its global partners such the US and Japan to gain self-reliance. The paper delves into the various initiatives undertaken by the Government of India in its pursuit of techno-nationalism, with a significant emphasis on indigenously built technology. It also explores the challenges India faces and the strategies to mitigate them.

Introduction

The idea of "techno-nationalism" links technological advancement and technology to social stability, economic prosperity, national identity and security.[1] Through this

concept, a nation aspires to become an active player at a global level mostly in the field of technology. This has a direct impact on a country's policy choices for trade and industry.[2]

The concept first emerged in Europe and North America during the Industrial Revolution. Countries like Britain, the US and Germany leveraged their technology to boost their economic growth and strategic power. Thereafter, the movement came to Asia, where China, Japan and South Korea took the lead. China's "Made in China 2025", or Japan and South Korea's dominance in the automobile, semiconductor and electronics sector, are testaments to this. Vietnam and Taiwan are also emerging as key players in this movement.[3]

The idea of combining technology with nationalist policies so as to set India on the path to becoming a global player is not new. Ever since India's independence, priority has been placed on access to advanced technology, in a bid to develop the Indian economy. PM Nehru's approach was rooted in the ideas of socialism and secularism, which was based on the science-based approach of the West. By the 1980s, the concept of techno-nationalism emerged. This led to differentiating scientific advancements as being either general or defence oriented. Thus, while general scientific advancements were promoted, certain sectors such as defence were prioritised.[4]

In 2014, when PM Modi came into power, this shift towards techno-nationalism got a further boost. Several policy initiatives and projects were undertaken under this to achieve self-sufficiency. This paper focuses on some of the key policies and initiatives undertaken recently, for the growth of techno-nationalism in India. The paper also lists certain challenges that India faces in achieving technological self-sufficiency. Recommendations have been offered to overcome those challenges.

Techno-Nationalist Initiatives in India

New, Emerging and Strategic Technologies (NEST)

India has embraced the concept of techno-nationalism with open arms. The "New, Emerging and Strategic Technologies" (NEST) division has been established by the

Ministry of External Affairs (MEA) to engage in “tech diplomacy”. The main task of this agency is to provide policy guidance on:[5]

- Shaping the international order over emerging technologies.
- Navigating the competitive supply chains for strategic technology.
- Aligning India’s national policies on technology with international standards and geopolitical developments.

India is an active participant of global discussions on emerging technologies such as AI, quantum computing, semiconductors, 5G, cybersecurity, etc. and to demonstrate this in global regulatory framework is important.

India’s Information Technology Act of 2000

With the emergence of new technologies, it is equally important to protect those technologies. Officially enacted on 17 October 2000, the Information Technology Act, 2000 is the primary Act governing cyberspace and technology in India. The Act was enacted to regulate the internet and its applications, including e-commerce, cybercrimes, data security etc. The Act follows from the United Nations Commission on International Trade Law (UNCITRAL) Model Law on Electronic Commerce (MLEC) of 1996.

The Act lists out acts which are considered cyber contraventions under section 43, and cybercrimes starting from section 65. The Act also contains provisions governing digital and electronic signatures, regulatory authorities as well as computers and its systems and resources.[6] The Act has extra-territorial jurisdiction, meaning that it can apply to foreign nationals and entities that engage with India or its citizens in cyberspace.[7] Thus, any technology that is developed or put into use for India must comply with the provisions of the Act.

Atmanirbhar Bharat Abhiyaan

“Atmanirbhar Bharat” (self-reliant India) is a campaign initiated under PM Modi to make India play a key role in the global sphere. The aim of this initiative is to ensure India’s self-reliance, efficiency and ability to compete with other nations. There are five pillars

under the initiative - Infrastructure, Economy, Demand, Vibrant Demography and System.

Historically, India has been highly dependent on foreign imports for its defence equipment, with Russia being the largest supplier.[8] With the aim of reducing dependence on foreign imports while supporting domestic production, several projects were undertaken under the “Atmanirbhar Bharat Abhiyaan” for indigenisation of defence technology.

- **Akashteer:** In April 2024, Bharat Electronics Limited developed an “Air Defence Control & Reporting System” called Akashteer or Sky Arrow to improve the tactical capabilities of the Indian Army.[9] A total of 455 systems are expected to be delivered by March 2027.[10] Akashteer would enable the Army to monitor low level airspace as well as control Ground Based Air Defence Weapon Systems more efficiently.[11] By integrating this system with the Indian Air Force’s Integrated Air Command and Control System (IACCS), a more comprehensive coverage of airspace can be achieved. One site has already been integrated as of January 2025. This works into the efforts for achieving jointness of the three armed forces.[12]

- **Indigenous Long-Range Hypersonic Missile:** On 16 November 2024, the Defence Research and Development Organisation (DRDO) successfully carried out the test for India's first “long-range hypersonic missile”. Developed by Dr. APJ Abdul Kalam Missile Complex (Hyderabad) along with other DRDO laboratories and industry partners, this missile has the capacity to carry diverse payloads for 1500 km range or more. The missile can reportedly travel at Mach 6 speed and carry out complex mid-flight manoeuvres that can outmatch current interception technology. This technology has catapulted India into an elite club of nations that have tested hypersonic weapons in the atmosphere.[13]

- **Asmi Machine Pistols:** Another feature in atmanirbharta was the induction of 550 “Asmi” machine pistols in the Indian Army’s Northern Command in November 2024. Colonel Prasad Bansod of the Army developed these pistols in collaboration with DRDO. They were manufactured by Lokesh Machine (Hyderabad). These pistols are built for close-quarter combat as well as

specialised operations. They can be operated with one hand and can be used as both a pistol as well as a submachine gun.[14]

- **Project 17 Alpha:** In 2019, the Indian Navy launched its Project 17 Alpha (P-17A) guided-missile frigates (FFG). 4 of these frigates are being built by Mazagon Dock Shipbuilders (MDL) and 3 by Garden Reach Shipbuilders & Engineers (GRSE). 75% of the systems and equipment used for building these frigates were sourced indigenously. The frigates succeed the Project 17 (Shivalik Class) Frigates. These Nilgiri-class stealth guided missile frigates boast advanced radar, sensor, weapons and combat suit systems.[15]

- **India-US Space and Defence Collaboration Programme:** India is also collaborating with the US as part of a Space and Defence Collaboration Programme. 7 Indian start-ups were selected in January 2025 to be a part of this exchange. These companies will collaborate with the US's Department of Defense, Defense Innovation Unit as well as other government agencies to explore emerging technologies in the space and defence sector.[16]

  Nevertheless, India continues to import a major portion of its military technology from countries such as Russia, France and the US. In March 2025, a contract worth $248 million was signed between New Delhi and Moscow for the acquisition of 1000 HP engines for T-72 tanks used by the Indian Army. This contract also includes a technology transfer agreement between Rosoboronexport (Russia) and Armoured Vehicles Nigam Ltd (India).[17]

Digital India

On 1 July 2015, India launched the Digital India initiative with the aim of transforming the nation into a digital and knowledge based economy. The initiative covers diverse sectors such as digital governance, broadband, AI (Artificial Intelligence), mobile connectivity and access to the internet. Under the initiative, much of India's infrastructure has been digitized, strengthening India's place as leader in the global digital economy.[18] Several defence oriented initiatives have been undertaken under Digital India. Some of them have been discussed in the following paragraphs:

- **Indrajaal Autonomous Drone Defence Dome System:** In 2023, the Indrajaal autonomous “Wide Area Anti-Drone”/“Counter-Unmanned Aircraft System” (C-UAS) system developed by Grene Robotics was launched. It is an AI (Artificial Intelligence) powered network-centric system that includes 12 proprietary modular technologies. These can be used either in combination or separately. The system has the ability to independently protect a region of almost 4000 sq km from threats including incoming weapons, Low-RCS targets, UAVs and loitering munitions.[19]

  After the demonstration for the project, Lt. Gen Gurmit Singh stated that it “marks a groundbreaking advancement in defence technology that is set to reshape the security landscape for defence, public infrastructure, and private sectors. This system will not only enhance our nation’s self-reliant military capabilities but also address the urgent need of the hour to defend against the increasing threat of drones.”[20]

  With the ability to provide a 360 degree protection from aerial threats, Indrajaal signifies a critical step forward in India's autonomous defence technology.[21]

- **Earth Observation Satellite Networks:** By 2030, the market for small satellites and space data is projected to grow upto $ 45 billion. India aims to be a key player in this sector. This can be done by investing in advanced space infrastructure and developing indigenous satellite systems. In furtherance of this, the Indian National Space Promotion and Authorisation Centre (IN-SPACe) is collaborating with private enterprises for building Earth Observation (EO) constellations. In December 2024, applications were received from 30 companies for the same. Currently, India is dependent on agencies such as Indian Space Research Organisation (ISRO) or European Space Agency (ESA) for gathering EO data. With these constellations in place, India would not only lead in the space market, but achieve data sovereignty as well.[22]

Semiconductor Technology

India's efforts at developing a semiconductor industry dates back to the 1960s. Companies such as Hindustan Aeronautics Ltd (HAL) and Bharat Electronics Ltd (BEL)

spearheaded the initiatives for this.[23] However, it was only in 2021-2022 that the Indian semiconductor sector saw firm developments with the 'Modified Semiconductor Policy'. The India Semiconductor Mission was established in December 2021 to further this agenda.[24] The Mission had an investment of INR 76,000.[25] Many strategic partnerships and incentives have been undertaken under the Mission to promote India's semiconductor industry.[26]

- **India-US Semiconductor Collaboration:** The US is the world leader in semiconductor technology and has announced the US-India initiative on Critical and Emerging Technology (iCET) in 2022.[27] The two countries have also signed a Memorandum of Understanding (MoU) to strengthen their supply chain in this sector. To cater to the military needs, the US and India are focusing on creating compound chips and the US Military is collaborating with Bharat Semi and 3rdiTech in this initiative.[28] The India Semiconductor Mission has greatly supported this venture between the two nations. This project will further strengthen the collaboration between the two countries as part of the Indo-Pacific Economic Corridor.[29] Phase 1 of the project is slated to start in 2027, with 50,000 units being produced annually.[30]

  While addressing a gathering in New York, PM referred to the agreement and stated that "The day is not far when you will see made-in-India chips in America. This small thing will take India to another level. And this is Modi's guarantee."[31]

- **Morigaon Semiconductor Plant:** Tata Electronics is in the process of establishing a semiconductor assembly and testing unit at Morigaon, Assam. The unit is expected to be completed by mid-2025. The unit has an investment of INR 27,000 crore ($3.6 billion appx). Around 48 million chips will be produced by the unit on a daily basis. It will employ cutting-edge technology such as Integrated System in Package (ISIP) and flip chip. The facility would generate considerable direct and indirect employment, leading to significant economic growth in the region. Furthermore, the target sectors for the chips produced include electric automobiles, consumer electronics, automotives and telecommunications, in both the domestic and international markets. This would position India as a key player in the global supply chain for semiconductors.[32]

- **Uttam Active Electronically Scanned Array (AESA) Radar:** DRDO has developed an indigenous radar system called the Uttam Active Electronically Scanned Array (AESA) Radar. The key components of the system use Gallium Arsenide (GaAs) semiconductors.[33] This gives it enhanced efficiency and performance compared to other radar systems. It features more than 980 transmitter-receivers (TR), giving it a high range of detection as well as the ability to track multiple targets. This technology was initially developed for TEJAS, the Light Combat Aircraft.[34] In November 2024, Bharat Electronics Limited (manufactures) announced that the radars have been configured by DRDO for the TEJAS MK-1A jets. The indigenous design allows for simplified customisation, upgradation and maintenance, based on feedback from the Air Force.[35]

- **BEL and IIT-Mandi Collaboration:** In April 2024, a MoU was signed between the Bangalore based Bharat Electronics Limited (BEL) and IIT-Mandi for cooperating on technology research as well as product development. Research and development of semiconductors forms an integral part of this partnership.[36] Regarding the agreement, BEL stated that "It will support indigenisation of products/solutions being supplied by BEL to its customers and is in line with the Government of India's 'Make in India' initiative."[37]

- **SSPL Semiconductor Technology**: In 2024, DRDO's Solid State Physics Laboratory (SSPL) managed to develop indigenous methods to make 4-inch "Silicon Carbide" (SiC) wafers and fabricate Gallium Nitride (GaN) "High Electron Mobility Transistors" (HEMTs) with an output of almost 150W. Development of "Monolithic Microwave Integrated Circuits" (MMICs) capable of producing 40W of power was also achieved. The production was achieved at the Hyderabad based Gallium Arsenide Enabling Technology Centre or GAETEC. The new technology offers better performance, energy efficiency as well as reduced weight and size of components. This state-of-the-art GaN/SiC technology will play a key role in enhancing India's capabilities in defence, green energy and aerospace. This is an important step forward for the Indian semiconductor sector.[38]

Space Sector Initiatives

- **Lunar Polar Exploration Mission** (**LUPEX**): India's ISRO is collaborating with Japan's JAXA to carry out a lunar mission titled Lunar Polar Exploration Mission (LUPEX).[39] The estimated launch date for the mission is 2028-2029. The targeted landing site for this mission is the South Pole of the moon. The lunar rover would carry out in-situ measurements over an area of 500-1000 m. It would also check for potential deposits of water-ice. The lander, mission payload and planning would be provided by India. The launch vehicle, rover and payloads would be provided by Japan. The rover would carry ground penetrating radars, spectrometers as well as water analysis equipment provided by both countries.[40]

- **India-Japan Space Debris Removal Satellites:** Space debris and orbital congestion has become a growing concern for space faring nations. In light of this, several initiatives have been undertaken on a global scale, to solve the problem. A recent example is the partnership between India's InspeCity and Japan's Orbital Lasers. The two companies have signed a preliminary agreement for collaborating on space debris removal. The companies aim to study if laser-equipped satellites can be used to remove debris from the Earth's orbit. The two companies also plan to examine business opportunities for providing in-space services like extending the life of a spacecraft and de-orbiting a defunct satellite.[41]

Challenges

- **Dependence on Foreign Technology**: Despite its efforts to achieve self-sufficiency, India is one of the largest importers of defence technology. The recent deal with Russia for import of HP engines is a testament to this. As per the reports of Stockholm International Peace Research Institute (SIPRI), India ranked in the top 3 importers of arms importers in 2019-23. In contrast, the US and France ranked first and second, respectively, in terms of arms supply.[42]
  Much of the country's chip supply is also dependent on imports. This is true for both raw materials as well as finished products. This limits India's capabilities in

manufacturing advanced weaponry or electronics. It also makes the country vulnerable to any disruptions in the supply chain for critical components.

- **The China Factor**: China has made very rapid progress in the field of technology. This was possible due to its significant investments backed by political will and a trained workforce. It also controls supply chains for many strategic technologies and components. This creates a competitive disparity that threatens India's own efforts towards techno-nationalism. India is also heavily reliant on Chinese imports to meet domestic technology needs. This has significant implications for the country's security and economic development.

  Recently, China announced restrictions on the export of processing technology for critical minerals. Restrictions have also been placed over the movement of equipment and engineers from the country. Export controls have also been imposed on battery technology. This move comes on the heels of the tariffs imposed by the US, as well as a trade dispute with Europe over automobiles. As a result, many Taiwan based companies are facing challenges in sending machinery and personnel to India.[43] Disruptions in supply chains from China will have a big impact on India.

- **Weak Semiconductor Sector**: India's advancements in the semiconductor sector is still far behind its peers. This is due to various factors such as the capital intensive nature of the sector as well as strict requirements of infrastructure and labour. India has allocated $10 billion for the sector in its semiconductor policy of 2021.[44] In contrast, China has invested almost $100 billion towards its semiconductor sector, since 2014.[45]

  Furthermore, while India is capable of manufacturing and designing chips, fabrication of wafers remains a challenge. Setting up a fabrication plant requires around $15- $20 billion. Apart from capital, fabrication also demands specialized infrastructure and highly skilled labour force. There is still a gap between the existing infrastructure and what is required to achieve India's vision of establishing itself in the sector.

The deficiency in investment also limits innovation and advanced R&D in the sector. In a sector as competitive and strategic as semiconductors, any limitations can become a stumbling block for India.

Recommendations

- **Developing Indigenous Technology**: India has already stepped foot on the path of developing its indigenous technology with projects such as NETRA, NavIC and Uttam AESA Radar. However, it is still dependent on foreign technology to a large extent, to meet its domestic needs. It needs to put more emphasis on strengthening its domestic technology, especially for critical sectors such as defence, telecommunications, space, etc. Funding and investment for research and development (R&D) must be prioritised. Collaboration with like-minded nations over exchange of technology and knowledge can also boost domestic innovation.

- **Establishing a Skilled Workforce**: Technological and economic development cannot be achieved without a skilled workforce. And despite India's large labour capacity, the country lacks professionals who are proficient in emerging technologies. This can be attributed to the lack of training and opportunities in the field, as well as brain drain to more developed countries. India needs to take firm steps to set up a technically skilled workforce. More opportunities may be provided to retain this workforce within the country. Joint training programs and workshops can also be undertaken with technologically developed allies.

- **Increased Public Private Partnership:** The Indian government has undertaken several measures to make the country economically and technologically self-sufficient. The role of the private sector here is immense especially when it is about innovation and finance. New Delhi could focus on greater involvement of the private sector in its pursuit of techno-nationalism. The ATMP/OSAT facilities in Assam and Gujarat require support from the government and the involvement of the state governments are equally crucial in this.

- **Infrastructural Readiness and Reduced Bureaucratic Hurdles**: It should also be ensured that the plans are executed on time without much bureaucratic

hurdles and delays. There should be infrastructural readiness even before the semiconductor fabs are approved. The operational time period could be set between 3 to 5 years.

- **Laws as Regulatory Measures:** Government of India could emphasis on measures related to cyber security and data protection. New Delhi has already laws such as the Information Technology Act of 2000 and Digital Personal Data Protection (DPDO) Act of 2023. These laws could be utilised for regulatory measures.

Conclusion

The behaviour of nation states is progressively being influenced by a desire to obtain, manipulate or secure emerging technology as well as their supply chains. Policy decisions at a global level are being determined by this desire. India is also increasingly focusing on techno-nationalism to achieve self-sufficiency and economic growth. This is evident from its recent trend of technology oriented policy choices. Significant investments have been made to boost its vision of a vikshit bharat. Development of indigenous technology, with a focus on R&D, has been prioritised.
However, the nation still lacks the financial and technological capabilities to achieve its target. The rapid advancement of China as a technology giant has not helped matters. India needs to further enhance its investment capabilities and collaborate with like-minded nations. It also needs to establish a highly technical and skilled workforce. Lucrative opportunities also need to be provided to retain this trained workforce within the country. The government's efforts towards achieving technological self-sufficiency can be augmented by partnerships with the private sector. In this way, the vision of a developed and atmanirbhar India can be achieved.

DISCLAIMER

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