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# CURRENT AFFAIRS

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## INDIA SEMICONDUCTOR CONUNDRUM

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "INDIA SEMICONDUCTOR CONUNDRUM". THIS TOPIC IS RELEVANT IN THE "ECONOMY" SECTION OF THE UPSC CSE EXAM.

### WHY IN THE NEWS?

Recently, Tata Electronics, a subsidiary wholly owned by Tata Sons Pvt. Ltd., is collaborating with Powerchip Semiconductor Manufacturing Corporation (PSMC) of Taiwan to establish India's first cutting-edge semiconductor fabrication facility, integrating artificial intelligence capabilities.

### ABOUT SEMICONDUCTOR CHIPS?

- A semiconductor is a substance with electrical conductivity properties that lie between those of conductors like copper and insulators like glass.
- Semiconductor chips are tiny, wafer-like devices made from semiconductor materials, typically silicon, which possess unique electrical properties. Semiconductor chips serve as the building blocks for a wide array of electronic devices, from smartphones and computers to medical equipment and automotive systems.
- The fabrication process of semiconductor chips involves intricate layers of materials and precise patterning techniques. The most common type of semiconductor chip is the integrated circuit (IC), which contains interconnected electronic components such as transistors, diodes, and resistors.

### DEVELOPMENT OF SEMICONDUCTOR CHIPS IN INDIA-

- A semiconductor facility in Morigaon, Assam, will be established by Tata Semiconductor Assembly and Test Pvt Ltd (TSAT) with an investment of Rs 27,000 crore. It is expected to produce 48 million chips daily, primarily serving the automotive and electric vehicle industries.
- Another semiconductor facility in Sanand, Gujarat, will be developed by CG Power in collaboration with Renesas Electronics Corp from Japan and Stars Microelectronics from Thailand, involving an investment of Rs 7,600 crore.
- Both Foxconn and Vedanta proposed to set up a fabrication facility independently in the coming years.

### WHY GOVERNMENT IS FOCUSING ON SEMICONDUCTOR MANUFACTURING-

- **Rapidly growing Market**– India’s semiconductor consumption is on a swift ascent. Rajeev Chandrasekhar, the country’s Minister of State for IT and Electronics, anticipates an expansion to \$110 billion by 2030.
- **Import Dependence**- India depends significantly on imports to meet its domestic semiconductor needs, rendering it susceptible to coercion and supply chain interruptions, particularly with China’s dominance in the global semiconductor industry. Establishing local manufacturing facilities would shield India from potential future supply disruptions and facilitate self-sufficiency.
- **Strategic Significance**– Semiconductors are essential components in various critical industries such as telecommunications, defence, healthcare, and automotive. As such, having a robust domestic semiconductor manufacturing capability is crucial for national security and strategic autonomy.
- **High-skill Employment opportunities**—Semiconductor manufacturing has the potential to create high-skilled jobs and drive economic growth through technology innovation and ecosystem development.
- **Diversify Global supply chains of Semiconductor chips**– Currently, chip production is centralised in a limited number of nations. For instance, Taiwan alone accounts for more than 60% of global semiconductor manufacturing, while combined with South Korea, these two countries contribute to 100% of the production.

### CHALLENGES FOR INDIA-

- **Huge initial investment**- Semiconductor production is a highly intricate and technology-driven industry demanding substantial capital investments, enduring risks, extended periods for development and return on investment, and frequent technological advancements. These factors necessitate substantial and continuous financial commitments.
- **Infrastructure deficit**- Establishing a chip manufacturing ecosystem in a new area poses significant hurdles. It necessitates robust infrastructure, including a consistent power supply and ample clean water, alongside costly water purification setups. Moreover, the process involves numerous chemicals and gasses essential for chip fabrication, adding to the complexity and expenses.
- **Sophisticated technology**- Sophisticated technology is imperative for high-end chip manufacturing, a capability possessed by only a handful of corporations in India.
- **Lack of skilled manpower**- India tremendously lacks skilled human resources, which is imperative for semiconductor manufacturing.

### INITIATIVES TAKEN BY INDIA TO PROMOTE SEMICONDUCTOR MANUFACTURING-

- **Modified Scheme for Setting up of Semiconductor Fabs in India**- The scheme intends to draw significant investments for establishing semiconductor wafer fabrication plants within the nation. Under this scheme, there is a provision of providing 50% fiscal assistance of the project expenditure equally, specifically targeting the establishment of Silicon complementary metal-oxide semiconductor (CMOS) based semiconductor fabrication facilities in India.
- **Design linked incentive Scheme**– It provides monetary benefits and supportive infrastructure for semiconductor design throughout its various developmental and deployment phases. This scheme provides incentives like “Product Design Linked Incentive” and “Deployment Linked Incentive.”

- **India Semiconductor Mission**– It aims to spearhead the formulation of enduring strategies for cultivating a resilient semiconductor and display ecosystem. This specialised and autonomous initiative will be overseen by leading experts from the global semiconductor and display sectors. Serving as the central authority, ISM will ensure the effective and seamless execution of schemes designed to establish Semiconductor and Display Fabrication facilities.
- **Semiconductor laboratory**– The Union Cabinet has sanctioned the Ministry of Electronics and Information Technology to initiate the necessary measures for upgrading and commercializing the Semi-conductor Laboratory (SCL) located in Mohali. The Ministry will investigate the potential for a collaborative venture between SCL and a commercial fab partner to enhance the existing brownfield fab facility.

### CONCLUSION-

Semiconductor chips are vital in modern electronics, yet India faces import dependency risks. Government initiatives like design-linked incentives and the India Semiconductor Mission aim for self-reliance and technological advancement. Strengthening domestic semiconductor capabilities is crucial for innovation, economic growth, and strategic autonomy in India's tech-driven future.

### PRELIMS BASED QUESTION-

**Q1. Consider the following statements about semiconductor technology:**

1. Silicon is predominantly used in the fabrication of semiconductor chips.
2. Transistor is a basic building block of a semiconductor device.

**Choose the correct answer using the codes given below:**

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**ANSWER: C**

### MAINS BASED QUESTION-

Q1. What are the challenges hindering growth in India's semiconductor sector, and what policy measures and reforms could be implemented to overcome these obstacles and foster its development?

**Vikas**

## YEAR OF TECHNOLOGY ABSORPTION

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "YEAR OF TECHNOLOGY ABSORPTION". THIS TOPIC IS RELEVANT IN THE "INTERNAL SECURITY" SECTION OF THE UPSC CSE EXAM.

## WHY IN THE NEWS?

On Monday, The Chief of Army Staff extended his greetings on 76th Army Day. The Chief of Army Staff pointed out that the Indian Army will observe the year 2024 as the **'Year of Technology Absorption'** — a theme that underscores the Army's focus and efforts to leverage technology as a catalyst for transformative change.

"The character of warfare continues to change. To prepare ourselves for the future, we set into motion a holistic transformation process last year. We have made good progress, and many milestones have been achieved. Our capability development endeavours stand on the tower of Atmanirbharta, to which we are firmly committed. The transition towards becoming a modern, agile, adaptive and technology-enabled future-ready force shall continue as part of the Transformation Roadmap," He said.

## WHAT IS TECHNOLOGY ABSORPTION?

Technology absorption refers to the process by which organizations acquire, assimilate, and effectively utilize new technologies to improve their products, services, processes, or capabilities. Technology absorption in the defence sector involves military organizations acquiring and integrating new technologies, such as weapons systems and communication networks, into their operations to improve their capabilities and effectiveness in national security. They integrate external technological knowledge, innovations, and practices into existing operations and systems to enhance performance, competitiveness, and efficiency.

## DISRUPTIVE TECHNOLOGY IN THE DEFENCE SECTOR:

Disruptive technologies in the defence sector are innovations that significantly alter the way military organizations operate, fight wars, and maintain security. These technologies can potentially revolutionize military capabilities, strategies, and doctrines. Disruptive Technology plays a crucial role in Indian defence sectors.

## DISRUPTIVE TECHNOLOGIES IMPACTING THE DEFENCE SECTOR INCLUDE:

- **Artificial Intelligence (AI):** AI enables autonomous decision-making, predictive analytics, and unmanned systems in defence. It can analyze vast amounts of data, enhance situational awareness, optimize logistics, and support decision-making processes on the battlefield.
- **Autonomous Systems:** Autonomous systems such as unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), and unmanned maritime vehicles (UMVs) are revolutionizing warfare by performing military tasks such as reconnaissance, surveillance, logistics, and offensive operations with little human intervention.
- **Cyber Warfare and Cybersecurity:** The growing dependence on digital systems has made cybersecurity and cyber warfare essential in today's conflicts. Innovations like advanced encryption, quantum computing, and machine learning are vital for detecting and responding to cyber threats.
- **Directed Energy Weapons (DEWs):** DEWs, employing lasers or microwaves, can disable or destroy targets with advantages like instant targeting, precision, and cost-effectiveness over traditional weapons.

- **Space-Based Technologies:** Space-based technologies, such as satellites, are vital in modern warfare for various purposes, including communication, navigation, and surveillance. Innovations like small satellites and constellations enhance global battlefield awareness.
- **3D Printing/Additive Manufacturing:** Additive manufacturing technologies facilitate the quick creation and production of parts and military equipment, supporting decentralized manufacturing, lowering logistical challenges, and enabling customizing military gear.
- **Biotechnology and Bioengineering:** Advances in biotechnology and bioengineering can significantly impact defence by creating new materials, medical treatments, and enhancements for soldiers. These biologically inspired innovations offer the potential for improved battlefield protection, sustainability, and performance.
- **Quantum Technologies:** Quantum technologies can significantly enhance defence capabilities through faster problem-solving, quantum computing, and secure communication via unbreakable quantum cryptography.
- **Electromagnetic Railguns and Advanced Munitions:** Electromagnetic railguns launch projectiles at high speeds using electromagnetic forces, providing greater range, accuracy, and lethality than traditional artillery. They also use advanced guided munitions for precise targeting.

#### **HERE ARE SOME KEY CHALLENGES IN TECHNOLOGY ABSORPTION IN THE DEFENCE SECTOR:**

1. **Security Concerns:** The technologies must adhere to strict standards to protect data integrity, confidentiality, and availability. The challenge lies in adopting emerging technologies such as AI, IoT, and cloud computing without jeopardizing security.
2. **Complex Procurement Processes:** The procurement process in the defence sector is lengthy and highly regulated. Bureaucratic hurdles, strict procurement guidelines, and lengthy approval cycles can delay the adoption of new technologies.
3. **Human Capital and Training:** Adopting new technologies in the defence sector is limited by the shortage of skilled personnel and the high costs of training programs.
4. **Cost Constraints:** Limited defence budgets and competing priorities make investing in and adopting new technologies challenging due to cost constraints.
5. **Regulatory Compliance:** Defence organizations face challenges in ensuring new and emerging technologies comply with various domestic and international regulations and standards.

Enhancing indigenous technology in the defence sector involves fostering domestic innovation, research, and development capabilities to create cutting-edge technologies that meet the unique requirements of national defence. "Atmanirbhar Bharat (self-reliant India) is a policy initiative launched by the Government of India to foster economic growth, promote indigenous manufacturing, and reduce import dependency. Atmanirbhar Bharat plays a significant role in India's defence sector.

#### **HERE'S A ROADMAP THAT INDIA COULD FOLLOW TO ENHANCE ITS SELF-RELIANCE (ATMANIRBHAR) IN DEFENCE:**

- Develop a comprehensive policy framework that prioritizes indigenous defence production and technology development. This framework should include clear objectives, targets, and timelines for self-reliance in critical defence technologies and capabilities.
- Increase investment in defence R&D to foster innovation and technology development. Establish dedicated R&D institutions, laboratories, and centres of excellence focused on defence



technologies. Encourage collaboration between the public and private sectors, academia, and research institutions to drive innovation. India spends only 0.8% of its GDP on all R&D, which is very low compared to other developed countries.

- Provide incentives and support for domestic defence manufacturing companies to produce a wide range of defence equipment and systems within India. This could include tax incentives, subsidies, and access to finance. Streamline regulatory processes and create a conducive business environment to attract investment in defence manufacturing.
- Facilitate technology transfer and collaboration with foreign defence companies to acquire advanced technologies and expertise. Establish partnerships, joint ventures, and technology-sharing agreements with global defence firms to leverage their capabilities and strengthen indigenous defence production.
- Invest in skill development programs to build a skilled workforce supporting indigenous defence production and technology development. Establish specialized training institutes and apprenticeship programs to train personnel in designing, manufacturing, testing, and maintaining defence equipment.
- Simplify and expedite the defence procurement process to reduce delays and bureaucratic hurdles. Implement transparent and efficient procurement policies that prioritize domestically developed technologies and products. Encourage participation from domestic companies, including SMEs, in defence procurement initiatives.

### **CONCLUSION:**

Successful technology absorption in the defence sector requires a strategic approach, comprehensive risk management, investment in human capital, and collaboration with diverse stakeholders to leverage emerging technologies effectively and maintain technological superiority in an evolving threat landscape.

Atmanirbhar Bharat initiative aims to transform India into a global manufacturing hub and a self-reliant economy across various sectors, including defence. By promoting indigenous manufacturing, technology development, and innovation, India seeks to strengthen its defence capabilities, promote economic growth, and enhance its strategic autonomy on the world stage.

### **PRELIMS PRACTISE QUESTIONS:**

**Q. Which of the following weapons in Indian defence are indigenously developed?**

1. Pinaka Multi barrel rocket launchers.
2. ALH Dhruv choppers
3. Arjun tanks

**Choose the correct answer using the code given below—**

- A. Only one
- B. Only two
- C. All three
- D. None

**ANSWER: C**

**MAINS PRACTICE QUESTIONS:**

Q. How can India become self-reliant (Atmanirbhar) in the defence sector? Critically examine the challenges of emerging technology in the defence sector.

**Amit Pradhan**



**Yojna IAS**  
योजना है तो सफलता है