



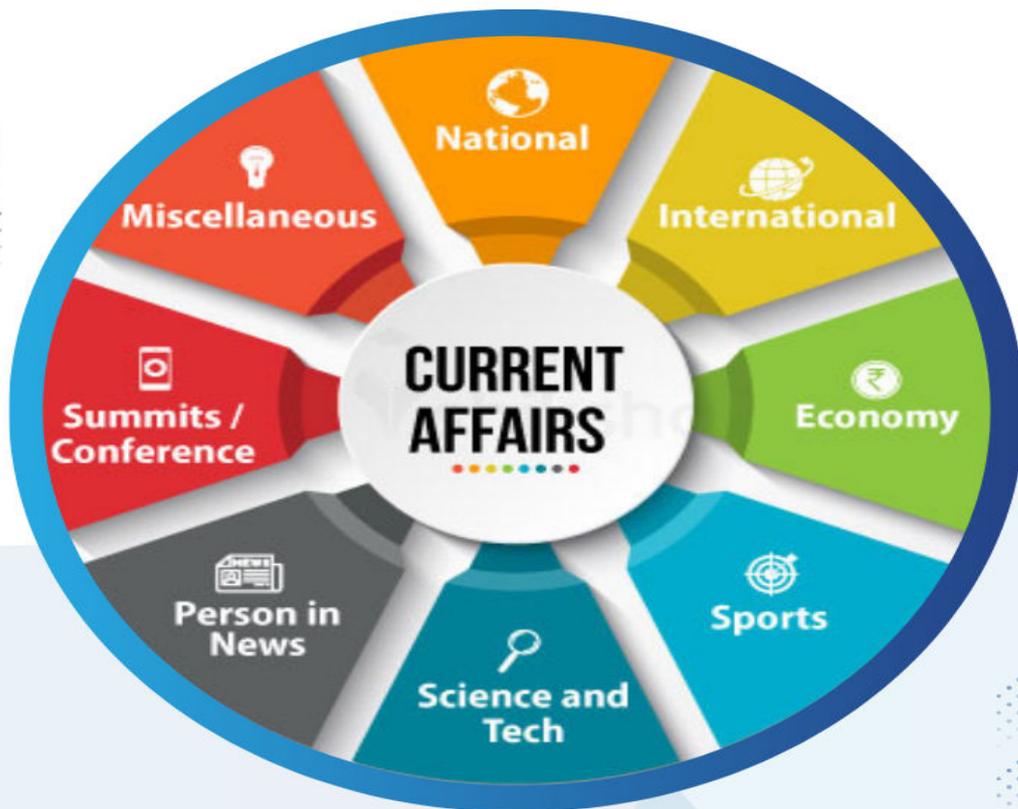
“ We help you reach for the star ”

# **VIDHVATH IAS KAS ACADEMY** & **STUDY CENTRE**

## **DAILY CURRENT AFFAIRS**

**FOR UPSC CIVIL SERVICE EXAMINATION**

**DATE: 02/03/2026 (MONDAY)**



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## 1. The Evolving Spectrum of India's Energy Sector

- **Diversified Generation Mix:** India has transitioned from a fossil-heavy grid to a multi-source spectrum, ranking **4th globally** in renewable capacity. Non-fossil sources now exceed **50%** of total installed capacity, with solar reaching **140 GW** and wind at **54.65 GW** as of early 2026.
- **Green Hydrogen Leadership:** Under the **National Green Hydrogen Mission**, India aims for **5 MMT** annual production by 2030. This is supported by the **SIGHT programme** (₹17,490 crore) to decarbonize "hard-to-abate" sectors like steel and fertilizers.
- **Nuclear Renaissance:** The **SHANTI Act, 2025** has modernized the legislative framework, allowing limited private participation and statutory status for the **AERB**. The goal is to scale nuclear baseload from **8.78 GW** to **100 GW** by 2047 using indigenous **Small Modular Reactors (SMRs)**.
- **Digital Energy Infrastructure:** The **India Energy Stack (IES)** represents a shift toward **Digital Public Infrastructure (DPI)**, enabling consent-based data sharing and the monetization of distributed assets like rooftop solar and EV chargers for common consumers.
- **Distribution & Efficiency Reforms:** The **Revamped Distribution Sector Scheme (RDSS)** and the transition from PAT to the **Carbon Credit Trading Scheme (CCTS)** focus on the financial viability of DISCOMs and market-based incentives for industrial emission reductions.
- **Global Stewardship:** Through the **International Solar Alliance (ISA)** and the **Global Biofuels Alliance (GBA)**, India is positioning itself as the voice of the Global South, leading international cooperation on energy security and climate equity.

### Key Definitions

- **Green Hydrogen:** Hydrogen produced via electrolysis of water using renewable electricity, with emissions not exceeding **2kg CO<sub>2</sub>e/kg H<sub>2</sub>**.
- **Baseload Power:** The minimum amount of electric power a grid must deliver constantly; traditionally provided by coal/nuclear due to their steady output.
- **Digital Public Infrastructure (DPI):** Platforms like IES that provide open, interoperable, and secure digital layers for public and private service delivery.
- **Carbon Credit:** A tradable permit representing the right to emit one tonne of carbon dioxide or the equivalent amount of a different greenhouse gas.

### Constitutional & Legal Framework

- **Entry 38, List III (Concurrent List):** Electricity is a concurrent subject, allowing both Union and State legislation.
- **Article 48A (DPSP):** Mandates the State to protect and improve the environment.
- **SHANTI Act, 2025:** Modernizes the Atomic Energy Act, 1962; introduces graded liability and private sector entry in nuclear energy.
- **Electricity (Amendment) Bill, 2026:** Aims to enhance DISCOM accountability and promote competition in the distribution segment.
- **Energy Conservation (Amendment) Act, 2022:** Provides the legal basis for the Carbon Credit Trading Scheme (CCTS).





### Additional Key Pillars

- **PM-Surya Ghar:** Targetting **23.9 lakh** households for rooftop solar to decentralize power.
- **PM-KUSUM:** Focuses on de-dieselization of the farm sector through solar pumps.
- **SMR Development:** Allocation of **₹20,000 crore** for five indigenous Small Modular Reactors by 2033.
- **UDIT Portal:** A digital tool for transparency in energy efficiency monitoring and compliance.

### Conclusion

India's energy transition is a calibrated shift from "energy poverty" to "energy agency." By integrating advanced manufacturing (PLI schemes), digital rails (IES), and legislative updates (SHANTI Act), the nation is balancing the trilemma of **security, affordability, and sustainability**. This multi-modal approach ensures that the journey toward **Net Zero 2070** remains economically viable while fostering domestic self-reliance (Atmanirbharta).

### UPSC Relevance

- **GS Paper II:** Government policies and interventions; Statutory/Regulatory bodies (AERB, ISA).
- **GS Paper III:** Infrastructure (Energy); Environmental conservation; Science & Technology (Nuclear/Hydrogen).
- **Prelims:** National Missions (NGHM, Numa), International Alliances (GBA, ISA), and capacity rankings.

## 2. National HPV Vaccination Campaign: A Paradigm Shift in Women's Healthcare

- **Strategic Initiative:** Launched on February 28, 2026, the nationwide Human Papillomavirus (HPV) vaccination programme targets **1.15 crore girls aged 14 years**. The campaign provides the vaccine **free-of-cost** at government facilities, aiming to eliminate cervical cancer, which is the second most common cancer among Indian women.
- **Vaccine Profile & Efficacy:** The campaign utilizes **Gardasil-4**, a quadrivalent vaccine protecting against HPV types 16 and 18 (cancer-causing) and 6 and 11 (wart-causing). A single dose has demonstrated **93–100% effectiveness** in preventing the targeted HPV strains if administered before the onset of sexual activity.
- **Institutional Framework:** The programme is supported by a **US\$250 million partnership with GAVI**, the Vaccine Alliance. Implementation is integrated into the National Immunisation Schedule, leveraging the **U-WIN digital platform** for registration and the **eVIN (Electronic Vaccine Intelligence Network)** for real-time supply chain monitoring.
- **Implementation Protocol:** A dedicated **90-day intensive campaign** ensures maximum reach, with vaccinations conducted at Government Health Facilities equipped with functional Cold Chain Points (CCP) and dedicated medical officers for managing Adverse Events Following Immunisation (AEFI).
- **Global Alignment:** With this launch, India joins over **160 countries** in the global fight against cervical cancer. Projections suggest that achieving elimination targets could avert **74 million new cases** and **62 million deaths** globally by 2120.



- **Vision of Equity:** The programme is a cornerstone of the "Swasth Nari Sashakt Parivar" vision, focusing on preventive oncology and reducing the disproportionate burden of cancer-related maternal mortality.

### Key Definitions

- **Cervical Cancer:** A type of cancer that occurs in the cells of the cervix (the lower part of the uterus that connects to the vagina), almost entirely caused by persistent high-risk HPV infections.
- **Human Papillomavirus (HPV):** A group of more than 200 related viruses, some of which are spread through vaginal, anal, or oral sex. High-risk types (16 and 18) are responsible for the majority of cervical cancers.
- **GAVI (The Vaccine Alliance):** A global health partnership of public and private sector organizations dedicated to "immunisation for all."
- **U-WIN Platform:** A digital ecosystem for maintaining a central registry of routine immunizations, facilitating digital self-registration and QR-based vaccination certificates.

### Constitutional & Legal Provisions

- **Article 21:** The Right to Life includes the right to health. The Supreme Court has repeatedly held that the State has an obligation to preserve life and provide health facilities.
- **Article 47 (DPSP):** Directs the State to regard the raising of the level of nutrition and the standard of living of its people and the **improvement of public health** as among its primary duties.
- **Seventh Schedule (List II, Entry 6):** Public health and sanitation, hospitals, and dispensaries are primarily State subjects, though the Union coordinates national health programmes under the Concurrent List (Entry 29: Prevention of extension from one State to another of infectious or contagious diseases).

### Additional Key Points for Analysis

- **Disease Burden:** India accounts for **25% of global cervical cancer deaths**, with approximately 80,000 annual fatalities.
- **Exclusion Criteria:** The vaccine is contraindicated for pregnant individuals, those with yeast allergies, or those who have previously completed an HPV vaccine cycle (e.g., Cervavac, Cervarix).
- **Cold Chain Management:** Maintaining the vaccine between **2°C to 8°C** is critical for potency, managed through the eVIN system.
- **Socio-Economic Impact:** 20% of children who lose their mothers to cancer do so because of cervical cancer, making this a critical intervention for family stability.

### Conclusion

The transition of the HPV vaccine from a luxury private-market commodity to a free universal public health intervention marks a milestone in India's preventive healthcare. By addressing the "silent killer" of women

### World Cervical Cancer Day: Nov. 17

*The day highlights:*

#### **90-70-90 targets for cervical cancer elimination**

- 90% of girls fully vaccinated with HPV vaccine by age 15
- 70% of women screened with a high-performance test at 35 and 45
- 90% of identified women receiving treatment



Cervical cancer is largely preventable, highly treatable when caught early, and can be eliminated as a public health problem within a generation — with a comprehensive prevent-screen-treat approach.



through a digitally-tracked, single-dose strategy, India is not only bolstering its domestic health infrastructure but also contributing significantly to the WHO's global goal of cervical cancer elimination.

### UPSC Relevance

- **GS Paper II:** Government policies and interventions for development in health; Issues relating to the development and management of Social Sector/Services relating to Health.
- **GS Paper III:** Developments in the field of Science & Technology (Biotechnology and Vaccines).
- **Essay/Social Issues:** Women's empowerment through health equity; Developmental goals and maternal mortality.

### 3. PM MITRA Parks: Strengthening India's Textile Value Chain

- **Strategic Allotment and Investment:** The recent allotment of **190.44 acres** of industrial land to 23 investors in the **PM MITRA Park, Virudhunagar (Tamil Nadu)** marks a significant milestone. This move has unlocked committed investments worth **₹2,192.21 crore**, spanning integrated plants, yarn manufacturing, and technical textiles, with a target to generate **15,000 jobs**.
- **The PM MITRA Scheme Framework:** Launched to realize the vision of **5F (Farm to Fiber to Factory to Fashion to Foreign)**, the scheme aims to develop **7 Mega Integrated Textile Regions and Apparel Parks**. These parks are designed to provide world-class industrial infrastructure to attract cutting-edge technology and boost Foreign Direct Investment (FDI) and local investment in the sector.
- **Integrated Value Chain & Logistics:** The Virudhunagar Park, located on NH 44 and near **Tuticorin port**, facilitates an integrated value chain—reducing logistics costs and turnaround times. With an execution cost of **₹1,894 crore**, the park includes "plug-and-play" facilities, which are essential for MSMEs to start operations without heavy initial capital expenditure.
- **Sustainability & ESG Compliance:** A core highlight of the park is the **15 MLD Zero Liquid Discharge (ZLD)** common effluent treatment plant and a **20 MW solar power plant**. These green initiatives ensure that textile processing—traditionally a water-intensive industry—aligns with global environmental standards and sustainable manufacturing practices.
- **Governance and Execution:** The project is managed by a **Special Purpose Vehicle (SPV)** involving both Central and State governments, ensuring a collaborative federal approach. With infrastructure works worth **₹550 crore** currently under execution, the Virudhunagar site is on track for completion by **December 2027**, reinforcing India's competitive edge in the global textile market.



### Key Definitions

- **PM MITRA:** Pradhan Mantri Mega Integrated Textile Region and Apparel. It is a central scheme to create a massive ecosystem for the entire textile value chain at one location.
- **Zero Liquid Discharge (ZLD):** An engineering approach to water management where all water is recovered and contaminants are reduced to solid waste, ensuring no discharge of pollutants into local water bodies.



- **Technical Textiles:** Textile materials and products manufactured primarily for their technical performance and functional properties rather than aesthetic or decorative characteristics (e.g., medical textiles, geotextiles).
- **Plug and Play:** Ready-to-use industrial infrastructure (sheds, electricity, water connectivity) provided to businesses so they can begin production immediately upon allotment.

### Constitutional & Legal Provisions

- **Seventh Schedule (List I & List III):** While "Industries" generally falls under the State List (Entry 24), the Union has the power to legislate on industries declared by Parliament to be of public interest (Entry 52, Union List). The textile sector often sees collaborative policy-making.
- **Article 298:** Grants the Union and State governments the power to carry on any trade or business and the acquisition, holding, and disposal of property.
- **Ease of Doing Business:** The SPV model aligns with the government's mandate to simplify regulatory hurdles and provide a "Single Window Clearance" system for industrial growth.

### Additional Key Pillars

- **Global Competitiveness:** By co-locating spinning, weaving, processing, and printing, the parks aim to achieve **economies of scale**, similar to large-scale textile hubs in China and Vietnam.
- **Special Purpose Vehicle (SPV):** Each park is overseen by an SPV (e.g., PM MITRA Park Tamil Nadu Ltd.) with a paid-up capital shared between the Center (51%) and the State (49%).
- **NICDC Role:** The National Industrial Corridor Development Corporation (NICDC) acts as a technical partner, ensuring the parks integrate with India's broader industrial corridor strategy.

### Conclusion

The momentum in PM MITRA Park, Virudhunagar, underscores a strategic shift from fragmented textile units to integrated mega-clusters. By combining logistical advantages with sustainable infrastructure like ZLD and solar power, India is positioning itself as a reliable, green, and efficient global textile hub. This "Park-led" development is essential for achieving the \$250 billion textile production target by 2030.

### UPSC Relevance

- **GS Paper II:** Statutory, regulatory, and various quasi-judicial bodies; Government policies and interventions for development in various sectors.
- **GS Paper III:** Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment; Industrial policy and its effects on industrial growth.
- **Prelims:** Locations of the 7 PM MITRA Parks (Tamil Nadu, Telangana, Gujarat, Karnataka, Madhya Pradesh, Uttar Pradesh, and Maharashtra) and specific features like the 5F vision.

## 4. ANVESH-2026: Redefining India's Sustainable Food Ecosystem

- **Strategic Convergence:** The International Conference ANVESH-2026 (Advanced Next Generation Vision for Emerging & Sustainable Healthy Foods) served as a global platform at NIFTEM-Kundli, bringing together policymakers, scientists, and industry leaders to align the food processing sector with the **Viksit Bharat-2047** vision.
- **Technology-Driven Transformation:** A primary focus was placed on bridging the rural-urban divide by taking modern food processing technologies directly to farmers. This aims to ensure that



technology-driven development reduces post-harvest losses and enhances value addition at the primary production level.

- **Sustainable Innovation & Circular Economy:** The conference emphasized "**Waste Valorization**"—the process of transforming agricultural residues into high-value products—and the adoption of a circular economy to minimize environmental impact while maximizing economic output.
- **Next-Gen Food Trends:** Discussions spanned critical future-oriented themes including **Plant-Based Proteins**, "Clean-Label" technologies (using natural ingredients), Nutraceuticals, and Personalized Nutrition, reflecting a global shift toward health-conscious and sustainable consumption.
- **Digital Integration & Traceability:** The event highlighted the role of digital transformation in supply chain management, focusing on food safety, real-time traceability, and regulatory compliance to meet international standards and boost India's food exports.
- **Academic-Industry Synergy:** A high-level roundtable involving over 40 Vice Chancellors deliberated on reimagining India's higher education ecosystem to address skill gaps and foster entrepreneurship in the food technology domain.



### Key Definitions

- **Waste Valorization:** The process of reusing, recycling, or composting waste materials and converting them into more useful products including chemicals, materials, or fuels.
- **Clean-Label Technology:** A consumer-driven movement in the food industry demanding products with natural, familiar, and simple ingredients that are easy to recognize and pronounce, with no artificial additives.
- **Nutraceuticals:** Products derived from food sources that provide extra health benefits in addition to the basic nutritional value found in foods (e.g., fortified cereals or vitamins).
- **Viksit Bharat-2047:** The Government of India's roadmap to make India a completely developed nation by the 100th anniversary of its independence.

### Constitutional & Legal Provisions

- **Article 47 (DPSP):** Directs the State to raise the level of nutrition and the standard of living and to improve public health as among its primary duties.
- **Food Safety and Standards Act, 2006:** The primary law for regulating food safety in India, which established the FSSAI. ANVESH-2026 discussions on traceability and safety align directly with this legislative framework.
- **Seventh Schedule (List II, Entry 14):** Agriculture, including agricultural education and research, is primarily a State subject; however, the Union plays a major role in "Industrial Development" (List I, Entry 52) which encompasses food processing.



### Additional Key Pillars of the Conference

- **NIFTEM-Kundli's Role:** Recognized as an Institute of National Importance, NIFTEM-K is the lead agency for driving innovation and setting standards in food technology.
- **Global Participation:** With researchers from **25 countries** and over 500 registered participants, the conference positioned India as a thought leader in the Global South for food security and nutrition.
- **Entrepreneurship Focus:** The inclusion of 61 exhibitors, including MSMEs and startups, highlights the shift toward making food processing a viable "Value Chain" for young entrepreneurs.

### Conclusion

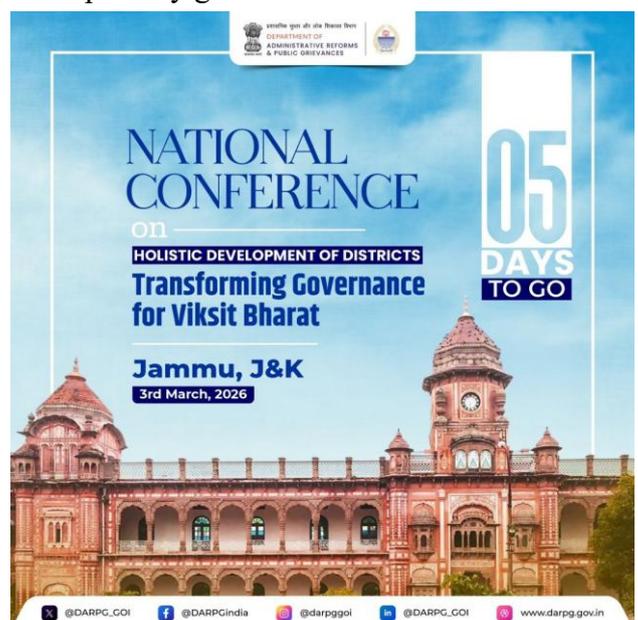
ANVESH-2026 underscores that the future of India's food security lies at the intersection of traditional wisdom and modern technology. By focusing on sustainable processing, alternate proteins, and waste valorization, India is moving beyond mere production toward a sophisticated "Trash to Treasure" model. This transformation is vital for increasing farmers' income, ensuring nutritional security for 1.4 billion people, and establishing India as the "Food Basket of the World."

### UPSC Relevance

- **GS Paper II:** Government policies and interventions for development in various sectors (Food Processing); Issues relating to Poverty and Hunger.
- **GS Paper III:** Economics of Animal-Rearing; Food processing and related industries in India (scope, significance, and supply chain management); Science & Technology- developments and their applications in everyday life.
- **Prelims:** NIFTEM's location and status; Ministry of Food Processing Industries (MoFPI) initiatives like PMKSY (Pradhan Mantri Kisan SAMPADA Yojana).

## 5. National Governance Conference 2026: Holistic District Development

- **Conference Theme and Objective:** Organized by the Department of Administrative Reforms and Public Grievances (DARPG) in Jammu, the conference centers on "Holistic Development of Districts: Transforming Governance for Viksit Bharat." Its primary goal is the dissemination of award-winning governance models to improve service delivery and citizen welfare.
- **Institutional Collaboration:** The event marks a significant collaborative effort between the Central Government (DARPG) and the Government of Jammu & Kashmir. It serves as a platform for District Collectors and senior administrators to share "Prime Minister's Awards for Excellence in Public Administration" winning initiatives.
- **Scalability of Best Practices:** The sessions focus on successful models from diverse regions like Eluru (Andhra Pradesh), Gomati (Tripura), and Kargil (Ladakh). By showcasing these, the government aims to institutionalize and scale up impactful grassroots innovations across the country.





- **Focus on Aspirational Blocks and Innovation:** Technical sessions specifically target the development of aspirational blocks and "innovation projects" (such as PRISM 10 in Parvathipuram). This emphasizes the transition from basic governance to technology-led, data-driven administration.
- **Regional Governance Milestones:** A dedicated segment highlights J&K's local innovations, including RFID-enabled Yatra management by the Shri Mata Vaishno Devi Shrine Board and the e-Suvidha initiative in Ramban, signaling a robust digital push in the Union Territory.
- **Path to Viksit Bharat:** The conference underscores the "Saturation Approach" for flagship schemes and effective grievance redressal. It identifies the "District" as the primary unit of change to accelerate India's journey toward an inclusive, citizen-centric developed nation by 2047.

### Key Definitions

- **Viksit Bharat:** The government's vision to transform India into a developed nation by 2047, the 100th year of its independence, focusing on economic growth, social progress, and good governance.
- **Saturation Approach:** A governance strategy aimed at ensuring 100% coverage of eligible beneficiaries under various government flagship schemes without any leakage or exclusion.
- **DARPG:** The Department of Administrative Reforms and Public Grievances; the nodal agency of the Government of India for administrative reforms and redressal of public grievances.
- **Good Governance:** An approach to government which is committed to creating a system that is transparent, accountable, responsive, effective, and efficient.

### Constitutional & Legal Provisions

- **Article 312:** Relates to All India Services. The conference involves the "Steel Frame" of India (IAS/IPS) in reimagining public service delivery.
- **73rd and 74th Amendment Acts:** These constitutional amendments institutionalized Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs). The conference's focus on "Districts" directly complements the spirit of decentralized governance.
- **Statutory Bodies:** The mention of the Shri Mata Vaishno Devi Shrine Board reflects the role of statutory autonomous bodies in implementing technology-led governance (RFID management) under specific state/UT legislations.

### Additional Key Pillars of Governance

- **Digital Public Infrastructure (DPI):** Use of platforms like e-Suvidha and RFID highlights the reliance on DPI to ensure transparency and ease of living.
- **Cross-Learning Ecosystem:** The participation of 200+ delegates from different states fosters "Cooperative Federalism" by allowing states to learn from each other's successes and failures.
- **Grievance Redressal:** A core focus area of the conference is strengthening mechanisms like CPGRAMS at the district level to ensure the administration is responsive to the common man.

### Conclusion

The National Governance Conference in Jammu acts as a catalyst for "Minimum Government, Maximum Governance." By shifting the focus to the holistic development of districts, the government recognizes that the macro-vision of Viksit Bharat can only be achieved through micro-excellence at the district level. This gathering of administrative minds ensures that innovation is not localized but is documented, shared, and replicated to create a uniform high-standard of governance across India's diverse geography.

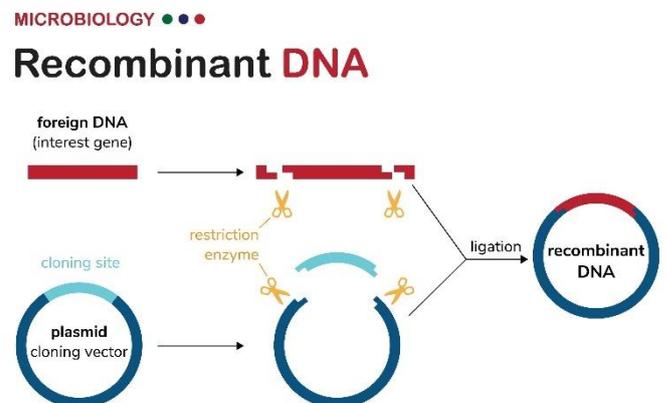


## UPSC Relevance

- **GS Paper II:** Governance, Constitution, Polity, Social Justice; Important aspects of governance, transparency and accountability, e-governance applications, and models.
- **GS Paper IV:** Public/Civil service values and Ethics in Public administration; Case studies on innovative public service delivery.
- **Prelims:** Prime Minister's Awards for Excellence in Public Administration; DARPG's role; Themes of National Conferences on e-Governance.

## 6. Bio-Driven Economy: BRIC-RGCB's New Frontier in Biotechnology

- **Infrastructure Milestone:** The inauguration of the **Central Facility for Recombinant Cells and Sensors** at BRIC-RGCB, Thiruvananthapuram (costing ₹60 crore), marks a major leap in India's drug discovery and genomics capabilities. It houses engineered cells and advanced screening systems to serve as a national hub for academia and industry.
- **BioE3 Policy & Biomanufacturing:** The government is leveraging the **BioE3 Policy** (Economy, Environment, and Employment) to transition India toward a \$300 billion bioeconomy. This policy focuses on high-performance biomanufacturing to drive sustainable growth and climate-resilient agriculture.
- **Exponential Startup Growth:** India's biotechnology ecosystem has witnessed a tectonic shift, growing from roughly 50 startups in 2014 to over **11,000 in 2026**. This 16-fold expansion in the bioeconomy (from \$10 billion to \$166 billion in a decade) reflects robust policy support and deep-tech funding.
- **Advancements in Cell Therapy:** A new **GMP (Good Manufacturing Practice)** facility (₹80 crore) is being established at BRIC-RGCB to bridge the gap between lab research and commercial production of biologics. It will specifically boost **CAR-T cell therapy** and other advanced cell-based treatments for cancer.
- **Strategic Convergence:** The facility aligns with national missions in **Agri-Genomics** (to enhance crop resilience) and **Medical Genomics** (to tackle rising non-communicable diseases like cancer and diabetes). It also promotes "pay-and-use" models for private industry to foster innovation.
- **Health & Preventive Research:** The center's focus on cancer biology (oral, breast, cervical) and HPV vaccination research supports India's broader public health goals, emphasizing that advanced research must translate into affordable preventive healthcare outcomes.



## Key Definitions

- **Recombinant Cells:** Cells that have been genetically altered by introducing foreign DNA to produce specific proteins or study disease mechanisms.
- **Bioeconomy:** An economic model based on the sustainable use of biological resources (plants, animals, microorganisms) to produce food, energy, and industrial goods.



- **GMP Facility:** A system for ensuring that products are consistently produced and controlled according to quality standards, essential for pharmaceutical and cell-therapy manufacturing.
- **CAR-T Therapy:** Chimeric Antigen Receptor T-cell therapy; a type of immunotherapy where a patient's T-cells are reprogrammed in a lab to find and destroy cancer cells.

### Constitutional & Legal Provisions

- **Article 51A(h):** Part of Fundamental Duties, it mandates every citizen to develop "scientific temper, humanism and the spirit of inquiry and reform."
- **Article 39(f):** Directive Principles of State Policy (DPSP) emphasize that childhood and youth are protected against exploitation; research in pediatric genomics and preventive vaccines aligns with this.
- **The Biological Diversity Act, 2002:** Regulates access to biological resources and ensures equitable sharing of benefits, which is central to India's growing bio-driven economy.
- **BioE3 Policy (2024):** A landmark executive policy framework by the Department of Biotechnology (DBT) to promote high-performance biomanufacturing in India.

### Additional Key Pillars

- **Deep-Tech Incentives:** The government is providing dedicated funding for startups involved in complex technologies like synthetic biology and precision medicine.
- **National Science Day Connection:** The facility was inaugurated on **February 28** (National Science Day), commemorating the discovery of the Raman Effect and emphasizing "Indigenous Technologies for Viksit Bharat."
- **Marine Biotechnology:** Encouragement for coastal institutions like BRIC-RGCB to link biotech research with marine biodiversity and fisheries for blue-economy growth.

### Conclusion

The establishment of the Central Facility for Recombinant Cells and Sensors signifies India's shift from being a biotechnology consumer to a global innovation leader. By integrating cutting-edge research in cell biology with a robust biomanufacturing policy (BioE3), India is creating a self-reliant (Atmanirbhar) ecosystem. This infrastructure not only promises breakthroughs in life-saving cancer therapies like CAR-T but also secures the nation's future in agricultural productivity and environmental sustainability through agri-genomics.

### UPSC Relevance

- **GS Paper III:** Science and Technology- developments and their applications and effects in everyday life; Awareness in the fields of IT, Space, Computers, Robotics, Nanotechnology, and Biotechnology.
- **GS Paper III:** Issues relating to intellectual property rights; Indian Economy (Bioeconomy growth and startup ecosystem).
- **Prelims:** BRIC (Biotechnology Research and Innovation Council); BioE3 Policy targets; CAR-T therapy mechanisms; National Science Day significance.



## 7. Geopolitical Shift: Elimination of Iran's Supreme Leader

- **Operation Epic Fury:** On February 28, 2026, a joint US-Israeli military operation, codenamed **Operation Epic Fury** (US) and **Roaring Lion** (Israel), targeted and killed Iran's Supreme Leader, **Ayatollah Ali Khamenei**. The strikes hit 24 of Iran's 31 provinces, decapitating a significant portion of the Islamic Republic's senior political and military command.
- **Stated Objectives & Legal Status:** US President Donald Trump cited an "imminent threat" of nuclear and intercontinental ballistic missile (ICBM) development as the justification. Notably, the strikes were conducted **without UN Security Council approval**, framing the action as a pre-emptive defense against an "existential threat" to global security.
- **Regime Stability & Succession:** While the loss of the Supreme Leader is a historic blow, Iran's theocratic structure includes a defined succession system. An **interim leadership council** (reportedly including President Masoud Pezeshkian and Ayatollah Alireza Arafii) has been formed. The ultimate survival of the regime depends on the **Islamic Revolutionary Guard Corps (IRGC)** maintaining internal order against potential civil uprisings.
- **Global Oil & Economic Impact:** The conflict has immediate implications for global energy security. With Iran threatening to close the **Strait of Hormuz** (a transit point for 20 million barrels of crude daily), oil prices have surged toward **\$80 per barrel**, threatening to destabilize global inflation targets and fiscal budgets.
- **Retaliation & Regional Escalation:** Iran has launched waves of missile and drone strikes targeting Israel and US military installations in the Gulf (Bahrain, Kuwait). This "Axis of Resistance" response risks a wider regional war involving proxies like Hezbollah and the Houthis, who have vowed "merciless" revenge.
- **Implications for India:** India faces a dual challenge: the safety of its large diaspora in the Gulf and the impact of rising crude prices on its economy. New Delhi has officially called for **sovereignty and territorial integrity** while urging all parties to return to dialogue and diplomacy to prevent a total collapse of West Asian stability.



### Key Definitions

- **Supreme Leader (Rahbar):** The highest-ranking political and religious authority in the Islamic Republic of Iran, holding final say over all state matters, including foreign policy and the military.
- **IRGC (Islamic Revolutionary Guard Corps):** A multi-service primary branch of the Iranian Armed Forces intended to protect the country's Islamic republic system from internal and external threats.
- **Strait of Hormuz:** A strategic chokepoint between the Persian Gulf and the Gulf of Oman, critical for the global oil trade.
- **Regime Change:** The replacement of one government regime with another by use of force (military or political), often orchestrated by external powers.



## Constitutional & Legal Provisions

- **UN Charter Article 2(4):** Generally prohibits the threat or use of force against the territorial integrity or political independence of any state.
- **Article 51 (Self-Defense):** Allows for the use of force in self-defense if an armed attack occurs. The US justification relies on a broad interpretation of "anticipatory" or "pre-emptive" self-defense.
- **Iranian Constitution (Article 107-111):** Outlines the role of the **Assembly of Experts** in appointing a new Supreme Leader and the formation of a provisional leadership council in case of the leader's death or incapacity.

## Additional Key Points

- **Internal Dissent:** The strikes follow months of intense domestic protests in Iran, which the US has cited as a reason to encourage the Iranian public to "take back" their country.
- **International Response:** Russia and China have condemned the assassination as a violation of international law, whereas several Western nations have described it as a "defining moment" for Iranian freedom.
- **Airspace Disruptions:** Major aviation regulators (including India's DGCA) have issued safety advisories, making large swathes of West Asian airspace a "no-go zone."

## Conclusion

The elimination of Ayatollah Ali Khamenei represents the most significant geopolitical disruption in the Middle East in decades. While the US and Israel aim for a "New Iran," the immediate result is a vacuum of power and a high risk of asymmetric warfare. For the world, the focus shifts from diplomatic containment to managing the fallout of a decapitated regional power, where the line between liberation and total regional chaos remains dangerously thin.

## UPSC Relevance

- **GS Paper II:** Effect of policies and politics of developed and developing countries on India's interests; Indian Diaspora; International Relations (West Asia).
- **GS Paper III:** Security challenges and their management in border areas; Linkages of organized crime with terrorism; Energy Security.
- **Prelims:** Location of Strait of Hormuz, Persian Gulf; Role of IAEA; International Laws on Sovereignty.

## 8. Empowerment Through Mobility and Energy: New Initiatives for Delhi

- **Integrated Transport Solution:** President Droupadi Murmu launched the 'Pink National Common Mobility Card' (NCCM) to streamline public transport. Unlike the previous paper-based single-journey slips, this digital smart card allows eligible women residents of Delhi to travel free on DTC and cluster buses while also serving as a paid wallet for the Delhi Metro and Regional Rapid Transit System (RRTS).
- **Tiered Mobility System:** The initiative introduces a color-coded card system to categorize commuters:





**Pink** for eligible women (free bus travel), **Blue** for general commuters, and **Orange** for monthly pass users. This phased rollout aims to digitize the entire transit ticketing ecosystem in the national capital.

- **Energy Security for Vulnerable Families:** Under the ‘Sashakt Nari, Samridh Delhi’ initiative, the government will provide two free LPG cylinders annually to all ration card-holding families. This benefit is timed with major festivals (Holi and Deepavali) to alleviate the financial burden on low-income households during peak consumption periods.
- **Direct Benefit Transfer (DBT) Mechanism:** The LPG subsidy is implemented via DBT, where the equivalent market price of a cylinder is credited directly to the Aadhaar-linked bank account of the female head of the household. This ensures transparency, reduces leakages, and promotes financial inclusion.
- **Digital Identity Integration:** For the Pink Card, minimal documentation is required, but each card is strictly linked to the beneficiary’s Aadhaar and mobile number. This linkage verifies age, gender, and residency, preventing misuse while ensuring a seamless user experience across 50 dedicated issuance centers.
- **Socio-Economic Objectives:** These schemes are designed to increase female labor force participation by reducing commuting costs and improving health outcomes by incentivizing the use of clean cooking fuel over traditional biomass.

### Key Definitions

- **National Common Mobility Card (NCMC):** An inter-operable transport card launched by the Ministry of Housing and Urban Affairs, allowing users to pay for travel, toll duties, and retail shopping across India.
- **Direct Benefit Transfer (DBT):** A mechanism to transfer subsidies or benefits directly into the bank accounts of beneficiaries, aimed at reducing delays and eliminating middlemen.
- **Clean Cooking Fuel:** Energy sources like LPG or electricity that produce minimal indoor air pollution compared to solid fuels (wood, coal, dung).
- **Saturation Approach:** A governance strategy aimed at ensuring 100% coverage of all eligible beneficiaries under a specific welfare scheme.

### Constitutional & Legal Provisions

- **Article 15(3):** Empowers the State to make special provisions for women and children, providing the constitutional basis for gender-based subsidies like free transport.
- **Article 39:** Directive Principles of State Policy (DPSP) mandate the State to direct its policy toward securing that the ownership and control of material resources are distributed to subserve the common good.
- **Article 47:** Obligations of the State to raise the level of nutrition and the standard of living of its people and the improvement of public health (relevant to clean fuel/LPG schemes).
- **Aadhaar (Targeted Delivery of Financial and Other Subsidies, Benefits and Services) Act, 2016:** Provides the legal framework for using Aadhaar-linked DBT for the LPG cylinder scheme.



### Additional Key Points

- **Institutional Setup:** 50 specialized centers, including DM and SDM offices, have been designated for card issuance to ensure grassroots accessibility.
- **Transition to Digital:** The shift from paper slips to Pink Cards allows the government to collect precise data on travel patterns, helping in better fleet management and urban planning.
- **Festival-Linked Welfare:** By linking LPG benefits to Holi and Deepavali, the state addresses the seasonal spikes in household expenditure.

### Conclusion

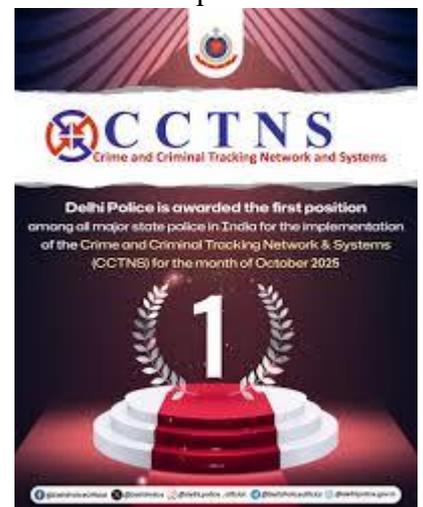
The simultaneous launch of the Pink Mobility Card and the free LPG scheme represents a holistic approach to urban governance. By integrating technology with social welfare, Delhi is addressing the twin challenges of "Time Poverty" (through better transport access) and "Energy Poverty." These initiatives not only empower women by enhancing their mobility and financial autonomy but also set a precedent for using digital public infrastructure (DPI) to deliver gender-sensitive urban services.

### UPSC Relevance

- **GS Paper II:** Welfare schemes for vulnerable sections of the population; Governance, Transparency, and Accountability (DBT and Aadhaar linkage).
- **GS Paper III:** Infrastructure (Public Transport); Energy Sector (LPG as clean fuel); Inclusive growth and issues arising from it.
- **Essay/Ethics:** Gender-inclusive urban planning; State's role in promoting the "Ease of Living."

## 9. Digital Policing Excellence: Delhi Police Leads CCTNS Implementation

- **Top Performance Ranking:** The Delhi Police has secured the first position among all States and Union Territories in the implementation of the Crime and Criminal Tracking Network & Systems (CCTNS) for January 2026. This follows a consistent track record, having achieved a perfect 100% score for three consecutive months in late 2025.
- **Monitoring Mechanism:** The rankings are determined by the Ministry of Home Affairs (MHA) and the National Crime Records Bureau (NCRB). Performance is evaluated via the **Pragati Dashboard**, which assesses the quality, quantity, timeliness, and accuracy of crime-related data uploaded to national databases.
- **Data-Driven Governance:** Achieving a 100% score signifies the seamless digitization of First Information Reports (FIRs), investigation details, and criminal antecedents. This shift toward technology-driven policing enhances the "inter-operability" of the criminal justice system across state borders.
- **Citizen-Centric Services:** A high CCTNS score translates to improved public service delivery, including faster online verification for passports/employment, easier tracking of case status by complainants, and more efficient reporting of lost properties or missing persons.
- **Institutional Professionalism:** The success is attributed to the coordinated efforts of the Crime Branch CCTNS team and district units. It reflects a high degree of





digital literacy and administrative discipline within the force, setting a benchmark for other regional police departments.

- **Strategic Integration:** This achievement aligns with the broader vision of **Smart Policing**, where real-time data analytics help in predictive policing, identifying crime hotspots, and maintaining a centralized National Database of Crimes and Criminals.

### Key Definitions

- **CCTNS:** A Mission Mode Project under the National e-Governance Plan (NeGP) aimed at creating a comprehensive and integrated system for enhancing the efficiency and effectiveness of policing through a nationwide networking infrastructure.
- **NCRB:** The National Crime Records Bureau, an Indian government agency responsible for collecting and analyzing crime data as defined by the Indian Penal Code (IPC) and Special and Local Laws (SLL).
- **Pragati Dashboard:** An online platform used by the MHA to monitor the real-time progress of CCTNS implementation across various parameters in different states.
- **Inter-operable Criminal Justice System (ICJS):** A national platform that enables the seamless transfer of data and information among different pillars of the criminal justice system, such as Police, Jails, Courts, and Forensic Labs.

### Constitutional & Legal Provisions

- **Seventh Schedule (List II, Entry 2):** "Police" is a State subject. However, the Union provides technical and financial assistance under the "Modernization of Police Forces" (MPF) scheme to ensure national security standards.
- **Article 246:** Grants Parliament and State Legislatures the power to make laws, under which the Union coordinates national databases for crime prevention and investigation.
- **Criminal Procedure Code (CrPC) / Bharatiya Nagarik Suraksha Sanhita (BNSS):** These provide the legal framework for recording FIRs and conducting investigations, which are now being digitized through CCTNS to ensure legal transparency.
- **Information Technology Act, 2000:** Provides legal recognition to electronic records and digital signatures, which is foundational for the validity of e-FIRs and digital case diaries.

### Additional Key Points

- **Evidence-Based Policy:** Data from CCTNS allows the NCRB to publish the annual "Crime in India" report, which is the primary source for academic research and government policy formulation.
- **Modernization Focus:** The 100% score indicates that almost all police stations in the Delhi jurisdiction are now connected to the central server with high-speed internet and trained manpower.
- **Impact on Transparency:** Digitization reduces the scope for manual tampering of records at the police station level, ensuring greater accountability toward the judiciary and the public.

### Conclusion

The consistent top-tier performance of the Delhi Police in CCTNS execution serves as a blueprint for the digital transformation of law enforcement in India. By achieving absolute accuracy and timeliness in data management, the force has demonstrated that technology is not just an add-on but the backbone of a modern,



responsive, and accountable police system. This success is a vital step toward realizing the "One Nation, One Police Grid" concept, essential for national internal security.

### UPSC Relevance

- **GS Paper II:** Governance, Transparency, and Accountability; e-Governance applications, models, successes, and limitations; Important aspects of the criminal justice system.
- **GS Paper III:** Internal Security; Role of external state and non-state actors in creating challenges to internal security; Challenges to internal security through communication networks.
- **Prelims:** Mandate of NCRB; Objectives of CCTNS; Pillars of the ICJS project.

## 10. Analysis of the Sixteenth Finance Commission: Fiscal Implications and Transitions

- **Vertical Devolution and Semi-Permanence:** The Sixteenth Finance Commission (SFC) retained the States' share in the divisible pool of central taxes at **41%**. This decision effectively solidifies the significant shift initiated by the 14th Finance Commission (which raised the share from 32% to 42%, later adjusted to 41% due to Jammu and Kashmir's reorganization), imparting a sense of stability to vertical fiscal transfers.
- **The "Grand Bargain" on Cesses and Surcharges:** To address the Centre's increasing reliance on non-shareable cesses and surcharges (which reduce the actual divisible pool), the SFC proposed a "grand bargain." It suggested that States might accept a technically smaller percentage share if the Centre agrees to merge these levies into the regular tax pool, thereby expanding the overall base of shareable resources.
- **Shift in Horizontal Distribution Criteria:** The SFC introduced "contribution" as a new criterion, measured via a State's **Gross State Domestic Product (GSDP)**. This aims to reward economic efficiency but creates a paradox: while the "Income Distance" criterion favors poorer states, the "Contribution" criterion benefits richer, industrialized states. To balance this, the Commission used the **square root of GSDP** to dampen extreme distributive effects.
- **Discontinuation of Specific Grants:** A major departure in the SFC's approach is the decision to drop **Revenue Deficit Grants (RDGs)** and state-specific/sector-specific grants. This has led to a reduction in total effective transfers (devolution + grants) as a percentage of the Centre's gross revenue receipts, projected at **32.7%** for 2026-27, down from the 14th Finance Commission's peak of 35.6%.
- **Winners and Losers in the New Formula:** The revised weights have resulted in projected losses for populous and low-income states like **Uttar Pradesh, Bihar, Madhya Pradesh, and West Bengal**, as well as smaller North-Eastern states. Conversely, high-GSDP states (richer states) stand to gain, though the absence of equalization grants under **Article 275** leaves a gap in addressing specific cost and need differentials.
- **Omissions and Economic Assumptions:** The SFC's methodology faced criticism for not factoring in the revenue-reducing impacts of the **September 2025 GST reforms**. Furthermore, its projections rely on an 11% nominal GDP growth rate, which exceeds current budget estimates, potentially leading to an overestimation of available resources for the award period.



सत्यमेव जयते

Finance Commission



## Key Definitions

- **Vertical Devolution:** The division of tax revenues between the Union government and the State governments.
- **Horizontal Devolution:** The criteria-based distribution of the states' share among the various states (e.g., based on population, area, or income distance).
- **Divisible Pool:** The portion of gross tax revenue of the Centre that is shareable with the States under **Article 270**, excluding cesses and surcharges.
- **Income Distance:** The gap between a state's per capita income and that of the state with the highest per capita income; used as a measure of fiscal need.
- **Cess and Surcharge:** Additional taxes levied by the Centre for specific purposes (e.g., Education Cess). These are not part of the divisible pool and stay entirely with the Union.

## Constitutional & Legal Provisions

- **Article 280:** Mandates the President to constitute a Finance Commission every five years to recommend the distribution of net tax proceeds.
- **Article 270:** Governs the distribution of net proceeds of taxes between the Union and the States.
- **Article 275:** Empowers Parliament to grant aid to specific States in need of assistance, often used for "Equalization Grants" for health and education.
- **Article 280(3)(bb) & (c):** Requires the Commission to suggest measures to augment the Consolidated Fund of a State to supplement resources of Panchayats and Municipalities.

## Comparison of Devolution Criteria

Criterion	15th FC Weight	16th FC Shift	Impact
Income Distance	45%	Retained/Modified	Favors low-income states
Population (2011)	15%	Adjusted	Rewards demographic management
Area	15%	Retained	Supports larger geographic states
Contribution (GSDP)	0% (New)	Introduced (Sq. Root)	Benefits economically advanced states
Tax Effort	2.5%	Dropped	Removes incentive for fiscal discipline

## Conclusion

The Sixteenth Finance Commission's report reflects a transition toward rewarding economic performance (Contribution) while maintaining a baseline of vertical equity (41% share). However, by abandoning the safety net of Revenue Deficit Grants and Article 275 equalization grants, the Commission has created a "sharp-edged" formula that significantly impacts the fiscal space of both the poorest and the smallest states. The proposed "grand bargain" on cesses remains a critical but uncertain pivot for the future of Indian fiscal federalism.

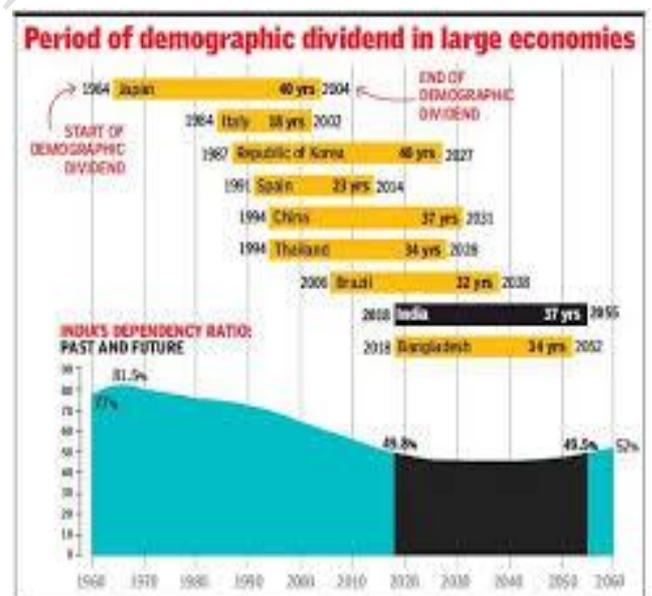


## UPSC Relevance

- **GS Paper II:** Federal structure and devolution of powers and finances up to local levels and challenges therein; Appointment to various Constitutional posts, powers, functions, and responsibilities.
- **GS Paper III:** Indian Economy and issues relating to planning, mobilization, of resources, growth, development, and employment; Government Budgeting.
- **Prelims:** Constitutional Articles (270, 275, 280); Composition of the divisible pool; Criteria for horizontal devolution.

## 11. Harnessing the Demographic Dividend: Reforming India's Skill Ecosystem

- **Critical Window of Opportunity:** India's demographic dividend is projected to end by **2040**, leaving a narrow window to transform its labor force. Currently, only **1.3%** of Indian secondary students are enrolled in vocational education, compared to approximately **50%** in developed economies like the European Union and China.
- **Funding and Strategic Gaps:** While the **National Education Policy (NEP) 2020** aims for 50% vocational exposure by 2025, the sector suffers from fragmented ministerial schemes and low budgetary allocation. In Germany and China, vocational education receives **11%** of the education budget, whereas India lacks transparent, consolidated data on such spending.
- **CAG Audit Findings (2025):** A recent audit of **PMKVY (2015-22)** highlighted significant "financial impropriety," including **94.5% invalid bank accounts** and a low placement rate of **41%** for short-term trainees. This underscores the failure of a quantity-focused, supply-driven model in achieving sustainable employment.
- **Proposed Skill Financing Reforms:** Experts suggest transitioning from direct government funding to **Skill Loans** and **Skill Vouchers**. Vouchers empower the learner to choose the institution, creating a competitive, demand-driven market that incentivizes quality delivery and upskilling in AI, digital, and green sectors.
- **Industry Ownership via Skill Levies:** Adopting a **Reimbursable Industry Contribution (RIC)**—a model used in over 90 countries—can shift the system from being "employer-engaged" to "employer-owned." By linking contributions to payroll and returning them for training, funding remains stable and insulated from political cycles.
- **Data-Driven Policy Correction:** Real-time labor market information is essential. Mandating online job boards to share aggregate data for AI modeling and integrating it with the **National Career Service (NCS) portal** can replace outdated, one-off skill gap studies with a dynamic planning system.





## Key Definitions

- **Demographic Dividend:** The economic growth potential that can result from shifts in a population's age structure, mainly when the share of the working-age population is larger than the non-working-age share.
- **Vocational Education:** Education that prepares people to work as technicians or in various jobs such as a tradesman or an artisan.
- **Skill Vouchers:** A financing tool where the government provides a coupon to a student, who then "spends" it at an accredited training provider of their choice.
- **Reimbursable Industry Contribution (RIC):** A system where industries pay a small levy based on payroll, which is then reimbursed to them specifically for training their own workforce.

## Constitutional & Legal Provisions

- **Article 21A:** Right to Education is a Fundamental Right; though focused on 6–14 years, it provides the philosophical basis for lifelong learning.
- **Article 41 (DPSP):** Directs the State to ensure the **Right to Work and Education**, especially for those in need, which includes providing technical skills for employability.
- **Seventh Schedule (List III, Entry 25):** "Education, including technical education, medical education and universities... vocational and technical training of labour" falls under the **Concurrent List**, allowing both Centre and States to legislate.
- **National Skill Development Corporation (NSDC):** A Public-Private Partnership (PPP) under the Ministry of Skill Development and Entrepreneurship (MSDE) aimed at catalyzing the skill landscape.

## Additional Key Points

- **Institutional Role of CAG:** The **Comptroller and Auditor General (Article 148)** serves as a watchdog, ensuring that public funds allocated for Skill India are used effectively and transparently.
- **Global Best Practices:** Singapore's "SkillsFuture" and Croatia's voucher systems are cited as successful models of purchasing power in the hands of learners.
- **Shift to Demand-Based:** Moving away from a "Supply-Driven" model (where government chooses what to teach) to a "Demand-Driven" model (where industry requirements dictate training).

## Conclusion

The transition from "Galgotian blunders" to becoming the "Skill Capital of the World" requires a structural shift in financing. By empowering students through vouchers and involving industry through levies, India can correct its strategic errors. As the 2040 deadline approaches, course correction is no longer optional but a prerequisite for avoiding a demographic disaster and ensuring a productive, future-ready workforce.

## UPSC Relevance

- **GS Paper II:** Issues relating to development and management of Social Sector/Services relating to Health, Education, Human Resources.
- **GS Paper III:** Indian Economy and issues relating to planning, mobilization of resources, growth, development and employment; Inclusive growth.



- **Essay/Mains:** Demographic Dividend: Opportunity vs. Challenge; The role of technology in vocational education.

## 12. Technological Warfare: Evolution of Regional Air Defense Networks

- **Integrated Regional Network:** The 2026 hostilities have seen the emergence of a newly integrated air defense network involving the U.S., Israel, and the UAE. Unlike the June 2025 "12-Day War," this system relies on enhanced interoperability, combining U.S. Terminal High Altitude Area Defense (THAAD) and Patriot batteries with the UAE's South Korean-origin **Cheongung II** and Israel's multi-layered shield.
- **The "Cheongung II" Advantage:** The UAE's activation of the Cheongung II system marks a shift toward 360° situational awareness. Unlike older Patriot versions with a 120° radar cone, Cheongung II uses a **Vertical Launch System (VLS)** and a rotating multi-function radar, allowing it to engage threats—including low-flying "sea-skimmer" cruise missiles—from any direction without repositioning.
- **Economics of "Saturation Attacks":** Iran's strategy involves "saturation attacks"—launching vast swarms of low-cost drones and missiles to deplete expensive interceptor stockpiles. To counter this, the coalition is "rationing" high-end interceptors (like the **PAC-3 MSE** costing \$4 million per shot) and deploying cost-effective alternatives like the **Indirect Fire Protection Capability (IFPC)** and high-energy lasers.
- **Debut of Directed Energy:** Israel has operationalized the **"Iron Beam"** laser system to handle drone swarms and mortars. By neutralizing threats at a cost of "a few shekels" per shot, it preserves the inventory of expensive **Tamir** (Iron Dome) and **Stunner** (David's Sling) missiles for more complex ballistic threats.
- **Iran's Defensive Resilience:** Iran has deployed its indigenous **Bavar-373** (using Sayyad-4B missiles) and the **Arman BMD** system, which boasts 360° radar coverage. While designed to rival the S-400, these systems face challenges from the sheer volume of U.S.-Israeli precision strikes and the "reload gap," where batteries remain vulnerable while being replenished.
- **Logistical Bottlenecks:** A critical concern for the U.S.-led coalition is the "production-to-consumption" mismatch. Industrial manufacturing of advanced interceptors like THAAD and Patriot currently lags behind the high-tempo expenditure seen in active combat, with replenishment estimated to take over 1.5 years at current capacities.



### Key Definitions

- **Interceptor:** A missile or kinetic projectile designed to find and destroy an incoming threat (missile, drone, or aircraft) before it reaches its target.
- **Hit-to-Kill Technology:** A modern interception method where the interceptor destroys the target through pure kinetic energy (physical collision) rather than an explosive blast.
- **Saturation Attack:** A military tactic of overwhelming a defense system by firing more projectiles than the system's sensors can track or its launchers can engage simultaneously.



- **Endo-atmospheric vs. Exo-atmospheric:** Systems that intercept targets within the Earth's atmosphere (e.g., THAAD, Patriot) versus those that engage them in space (e.g., Arrow 3).

### Constitutional & Legal Provisions

- **Article 51 of the UN Charter:** Recognizes the inherent right of individual or collective self-defense if an armed attack occurs against a Member of the United Nations.
- **Customary International Law (Necessity & Proportionality):** Legal principles requiring that any military response, including the use of missile defenses, must be necessary to repel an attack and proportionate to the threat.
- **The Hague Conventions:** Regulate the methods of warfare, including the requirement to distinguish between military targets and civilian objects, a principle central to the deployment of precision missile defenses.

### Comparison of Key Defense Systems (2026)

System	Origin	Primary Role	Key Feature
THAAD	USA	Terminal phase ballistic missiles	High-altitude, kinetic kill
Cheongung II	S. Korea (UAE)	Cruise & Tactical missiles	360° Radar; Vertical Launch
Iron Beam	Israel	Drones & Mortars	High-energy laser; near-zero cost
Bavar-373	Iran	Long-range threats	Indigenous S-400 equivalent
SM-6 (Dual)	USA	Ballistic & Surface threats	Naval-based versatility

### Conclusion

The ongoing conflict represents a paradigm shift in aerial warfare, where the "cost-per-kill" ratio has become as strategic as the technology itself. While integrated networks and laser defenses provide a formidable shield, the sustainability of this protection is threatened by industrial supply chain constraints and the strategic use of "saturation" by adversaries. For regional security, the focus has moved beyond individual "batteries" to a seamless, automated, and multi-national "grid" of sensors and shooters.

### UPSC Relevance

- **GS Paper III:** Science and Technology- developments and their applications; Indigenization of technology; Security challenges and their management in border areas.
- **GS Paper II:** Effect of policies and politics of developed and developing countries on India's interests (West Asia conflict impact on energy security).
- **Prelims:** Technical specifications of S-400, THAAD, Iron Dome; Major defense partners of India (S. Korea, Israel, USA).