

Prelims Exam Topics

ANTHROPIC'S MYTHOS AI AND ITS IMPLICATION

Context

- AI firm **Anthropic** introduced its advanced model **Mythos**, capable of detecting deep software vulnerabilities.

About Mythos

- **Advanced Cybersecurity AI:** Detects hidden vulnerabilities in legacy and modern systems (found bugs in **Linux kernel, OpenBSD, FFmpeg**).
- **High Code Intelligence:** Analyses large codebases and identifies flaws missed by human experts (hundreds of severe vulnerabilities detected).
- **Part of Claude Ecosystem:** Belongs to Anthropic's Claude models (similar to earlier launched Haiku, Sonnet, Opus, however Mythos has highest capability).
- **Dual-Use Nature:** Can be used for **defence (patching bugs)** or **offence (exploiting vulnerabilities)**.
- **Access:** Project Glasswing partners will receive access to Claude Mythos Preview to find and fix vulnerabilities or weaknesses in their foundational systems
 - **Why Not made Public:** Public release could enable hackers to exploit vulnerabilities before fixes are applied.

About Project Glasswing

- **Global Cybersecurity Initiative:** A consortium of **~40 companies** working to detect and fix vulnerabilities before public release.
 - Includes firms like **Microsoft, Apple, Cisco**.
- **Large-Scale Investment:** Backed by **~\$100 million programme** for scanning global codebases.
- **Objective:** Secure foundational software systems before attackers gain similar AI tools.

Impact on Indian IT Industry

- **Risk to Bespoke Software:** Indian IT service firms develop **custom enterprise software for global clients**, which could be vulnerable to AI-assisted vulnerability discovery.
- **SaaS and Product Ecosystem Threat:** Indian **Software-as-a-Service and deep-tech firms** face risks if vulnerabilities are rapidly exposed.
- **Shift in Cybersecurity Paradigm:** Traditional **bug bounty ecosystem may weaken** as AI automates vulnerability detection.
- **Dependence on Global Software Stack:** Indian IT companies rely heavily on **global open-source platforms and enterprise software**, which Mythos is analysing for vulnerabilities.
- **Competitive Pressure:** Indian IT companies may need to invest more in cybersecurity tools and AI-driven vulnerability scanning.

Impact on Internal Security

- **Critical Infrastructure Risk:** Systems like **banking, telecom, power grids, SCADA, IoT networks** may be exposed (high systemic risk).
- **Government Systems Vulnerability:** Legacy systems (e.g., **Aadhaar, GST platforms**) may contain undetected vulnerabilities exploitable by AI.
- **State-Sponsored Cyber Threats:** Adversarial states could use similar AI tools for **cyber espionage and infrastructure attacks**.
- **Transition Period Risk:** Short-term phase may see **increase in cyberattacks before defences stabilise** (“cyber tsunami” risk).

HORMONAL BASIS OF HIGHER SKIN INFECTIONS IN MEN

Context

- A study by researchers found that **male sex hormones** enhance bacterial communication, increasing susceptibility to skin infections

Why Men Experience More Skin Infections

Male hormones (**testosterone, androgens**) activate bacterial signalling systems that increase infection severity. Its impact are:

- **Quorum Sensing Activation:** Testosterone stimulates **bacterial quorum sensing** (chemical signalling enabling bacteria to coordinate virulence once population density rises).
- **Skin Hormone Production:** Human skin itself produces small quantities of sex hormones (via **sebaceous glands**), making hormones readily available to microbes.
- **Increased Bacterial Virulence:** Hormonal signals enhance pathogenic behaviour of bacteria like **Staphylococcus aureus** (major global cause of skin infections).

Limited Effect of Female Hormones: Female hormones (**oestradiol, progesterone**) did **not activate bacterial quorum sensing**, explaining lower infection susceptibility.

Its significance to Deal with Skin Infections

- **Hormonal Interaction Research:** Understanding how **androgen hormones influence bacterial behaviour** may help design therapies that neutralise hormone-triggered virulence.
- **Quorum-Sensing Inhibitors:** New therapies aim to block **bacterial communication (quorum sensing)** rather than kill bacteria (e.g., **enantiomer-testosterone (ent-T)** suppresses virulence of *Staphylococcus aureus*).
- **Targeted Anti-Virulence Drugs:** Instead of broad antibiotics, **anti-virulence treatments** reduce bacteria’s ability to cause disease, lowering selective pressure for resistance.
- **Improved Skin Barrier Care:** Maintaining **healthy skin microbiome and barrier function** (hygiene, moisturisation, wound care) reduces bacterial colonisation.
- **Future Therapeutic Strategy:** Precision treatments may **modulate host-microbe interactions** rather than eliminate bacteria, preserving beneficial microbes while preventing infection.

INDUCTION VS INFRARED COOKTOPS

Context

- Due to **LPG shortages during the West Asia conflict**, many Indian households shifted to electric cooking options such as **induction and infrared cooktops**,

Working Principle

- **Induction Cooktop:** Works on **electromagnetic induction** where an electric coil generates a changing magnetic field that induces currents in a **ferromagnetic vessel**, and the vessel's resistance converts this energy directly into heat.
- **Infrared Cooktop:** Works on **radiant heating** where electricity heats a coil or halogen element beneath a glass surface, producing **infrared radiation** that is absorbed by the cookware, generating heat for cooking.

Difference Between Induction and Infrared Cooktops

Feature	Induction Cooktop	Infrared Cooktop
Heating Principle	Electromagnetic induction heats vessel directly	Radiant heat from heated coil warms vessel
Energy Efficiency	Very high ($\approx 85-95\%$)	Moderate ($\approx 70-80\%$)
Cookware Requirement	Requires ferromagnetic cookware (cast iron, magnetic steel)	Works with almost any cookware (steel, aluminium, glass, ceramic)
Heat Transfer	Direct heating of vessel	Indirect heating through glass surface
Temperature Control	Precise electronic control (pulse-width modulation/frequency control)	Phase-angle control of coil heating
Energy Loss	Minimal heat loss	Higher heat loss to surroundings
Impact on Power Grid	More efficient, stable electrical load	Can distort current waveform and reduce power factor
Safety	Surface relatively cool (only vessel heats)	Surface becomes hot due to heated coil

Mains Exam Topics

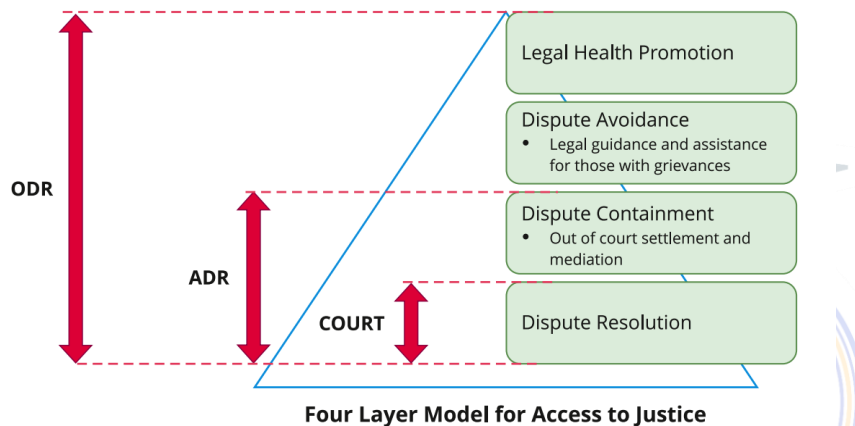
ACCESS TO JUSTICE

Context

Chief Justice of India said India's justice system problem is limited access due to costs delays complexity and barriers, not lack of laws, making access to justice the primary impediment for citizens

About Access to justice

Access to Justice signifies a core democratic principle whereby every individual, irrespective of their social or economic background, has the opportunity to seek and secure remedies through formal or informal justice mechanisms for their grievances. In the absence of meaningful access to justice, individuals may find themselves unable to assert their rights, challenge injustices, or obtain redress for the harms they endure.



Legal and constitutional provisions

1. Constitutional provisions:

- **Article 14 (Equality Before Law):** Guarantees all citizens equality before the law and equal protection of laws. The Supreme Court has expanded this to include the right to access justice, ensuring that every individual can approach the courts without any form of discrimination.
- **Article 21 (Right to Life and Personal Liberty):** Recognized as a cornerstone of access to justice, Article 21 protects the right to seek legal remedies for violations of personal liberty and fundamental rights.
- **Article 39A (Free Legal Aid):** A Directive Principle aimed at ensuring that no person is denied legal assistance due to economic or other incapacities. It mandates the state to promote justice based on equal opportunity, with special attention to vulnerable and marginalized groups.
- **Articles 32 and 226 (Constitutional Remedies):** These provisions empower individuals to directly approach the Supreme Court (Article 32) and High Courts (Article 226) for the enforcement of their rights, thereby facilitating meaningful access to justice.

2. Statutory and institutional framework:

- **Legal Services Authorities Act, 1987:** This Act established the National Legal Services Authority (NALSA) to provide free legal services to the weaker sections of society.
 - **Section 12** identifies beneficiaries, including women, children, SCs/STs, persons with disabilities, and those below the poverty line.

- **Lok Adalats** established under this Act offer low-cost, quick dispute resolution mechanisms.
- **Tele-Law and E-Lok Adalats** initiatives extend legal advice and dispute resolution to remote and underserved areas using technology.

3. Public interest litigation (PIL):

- **Expansion of Locus Standi:** The concept of PIL allows any concerned citizen or organization to approach the courts on behalf of those whose rights are violated, even if they are not directly affected.
 - **Eg: MC Mehta v. Union of India (1987)**—one of the landmark PILs—was filed for addressing environmental pollution in Delhi, leading to key judicial interventions in environmental law.

Elements of the Right to Access to Justice

Element	Meaning	Supporting Data/Examples
Availability of Legal Remedies	Citizens must be able to approach courts and legal institutions to seek redressal for grievances.	<ul style="list-style-type: none"> ● Vishaka v. State of Rajasthan (1997): Led to the formulation of guidelines to address sexual harassment at the workplace. ● Use of writs like Habeas Corpus allows individuals to challenge unlawful detentions.
Affordability	Legal processes should be financially accessible, especially for economically weaker sections.	<ul style="list-style-type: none"> ● Article 39A mandates free legal aid to prevent denial of justice based on economic constraints. ● In 2021–22, over 21 lakh individuals benefitted from free legal aid through NALSA.
Awareness and Information	Citizens must be aware of their rights and the means available for legal redress.	<ul style="list-style-type: none"> ● NALSA’s Know Your Rights campaigns empower citizens through legal awareness. ● The National Commission for Women conducts outreach programs to educate women on issues like domestic violence and workplace rights.
Fair and Transparent Procedures	Judicial processes must uphold principles of fairness, equity, and transparency.	<ul style="list-style-type: none"> ● Maneka Gandhi v. Union of India (1978): Reinforced that the right to a fair hearing is an essential part of Article 21. ● Live-streaming of court proceedings promotes judicial transparency and public trust.
Physical and Legal Accessibility	Courts and legal services should be physically reachable and provide appropriate representation.	<ul style="list-style-type: none"> ● Gram Nyayalayas bring the judiciary closer to rural populations; over 400 courts settled 25,000+ cases as of 2023. ● Legal aid clinics in law colleges extend legal assistance to underprivileged individuals.

Barriers to Access to Justice

Various Barriers	Nature	Illustration
Social Barriers	Caste-Based Discrimination	Dalits have been historically denied access to shared community resources like village wells.
	Lack of Legal Awareness	Rural populations unaware of provisions under the Legal Services Authorities Act, 1987 offering free legal aid.
	Low Literacy Levels	Illiterate farmers often fail to comprehend rights under land acquisition laws.
	Gender Bias	Social stigma discourages rural women from reporting domestic abuse.
Economic Barriers	High Legal Costs	Many undertrials depend on overburdened legal aid lawyers due to inability to afford private counsel.
	Court-Related Expenses	Daily wage workers are unable to travel long distances to attend court hearings.
	Bribery in Law Enforcement	Citizens are often forced to pay police to file an FIR in theft cases.
	Extended Pre-Trial Detention	NCRB data shows over 75% of undertrials are from economically weaker sections.
Legal Barriers	Procedural Complexities	Civil dispute proceedings delayed due to slow service of summons under procedural laws.
	Police Inefficiency	Forensic delays occur as evidence is sent to labs in far-off states.
	Institutional Corruption	Bribes demanded for accessing certified copies of court orders.
	Lack of Competent Legal Aid	Inadequate legal representation in cases like Bandhua Mukti Morcha hampers justice for bonded labourers.

Measures to strengthen access to justice

1. Strengthen Legal Aid Infrastructure

- Enhance the reach and effectiveness of existing legal aid services, including the National Legal Services Authority (NALSA)

- Deploy trained paralegal volunteers at the grassroots level to connect underserved communities with formal legal mechanisms.

2. Digitize the Justice Ecosystem

- Accelerate the implementation of the e-Courts project to streamline case management and improve transparency.
- Ensure robust access to digital services such as e-filing, virtual hearings, and online grievance redressal, particularly in rural and remote areas.

3. Build Legal Capacity and Professional Training

- Conduct regular training and capacity-building programs for judges, legal aid lawyers, and court staff.
- Include mandatory modules on case management, digital literacy, and social justice in legal education and professional development.

4. Promote Legal Awareness and Civic Education

- Launch awareness campaigns to educate citizens especially in rural and marginalized areas about their legal rights and remedies.
- Use schools, panchayats, community centers, and social media platforms to promote understanding of legal aid services, Lok Adalats, and complaint redressal systems.

5. Address Procedural Delays and Judicial Backlogs

- Set clear timelines for case disposal and impose penalties for unjustified delays.
- Expand judicial infrastructure by increasing the number of judges, introducing efficient case tracking systems, and integrating AI for intelligent docket management.

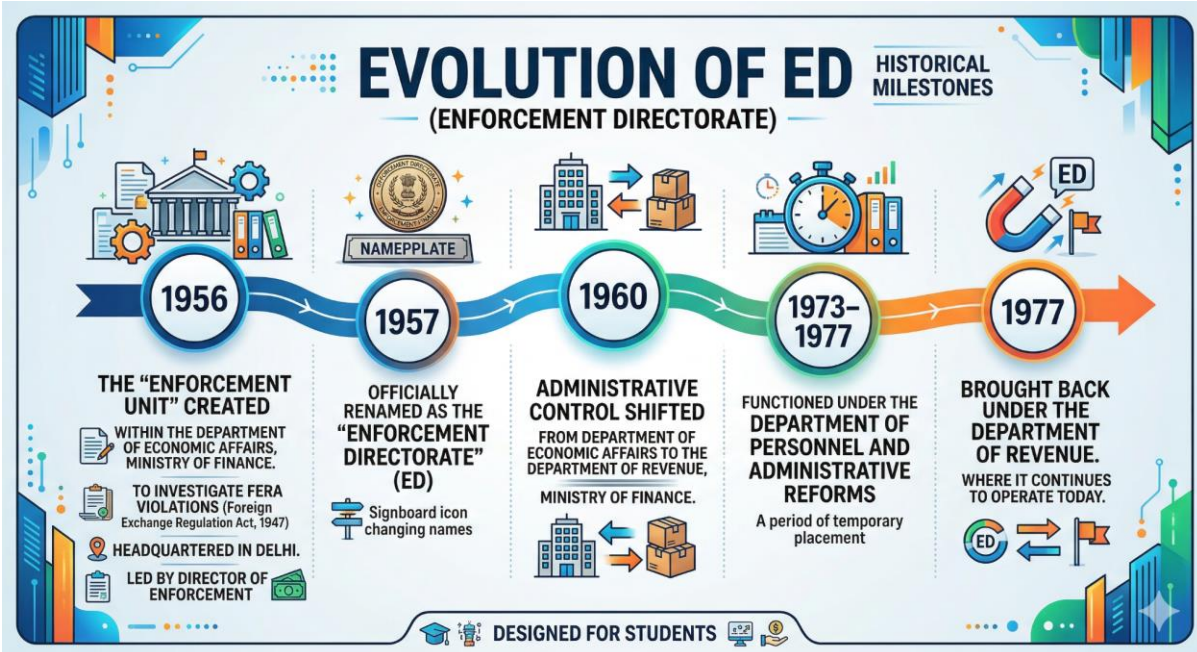
ENFORCEMENT DIRECTORATE ACTION IN WEST BENGAL

Context

Enforcement Directorate has intensified action in West Bengal, conducting raids, seizures, and issuing summons in multiple money laundering and corruption cases in the run-up to the State Assembly elections

About ED

The Enforcement Directorate (ED) is a key investigative agency in India responsible for probing money laundering and foreign exchange violations. Over the years, its mandate has expanded to tackling a broader range of economic offences and safeguarding financial integrity. However, the agency has drawn criticism for the extensive scope of its powers and the potential for misuse, underlining the urgent need for reforms to ensure investigations are both fair and accountable.



Composition and Structure of the ED

The Enforcement Directorate is structured with a hierarchy of officials to ensure smooth and efficient functioning.

Key positions include:

- Director of Enforcement (ED)
- Special Directors
- Joint Directors
- Deputy Directors
- Other investigative and administrative officers

Recruitment of ED Officials

The ED recruits officers through two main channels:

- Direct recruitment
- Deputation from other government services, particularly:
 - Indian Revenue Service (IRS)
 - Indian Police Service (IPS)
 - Indian Administrative Service (IAS)

Director of Enforcement Directorate

- The Director is the head of the ED and is responsible for overall administration, supervision, and strategic direction of the agency.

Appointment of the Director

- The appointment is governed by the Central Vigilance Commission Act, 2003 (CVC Act)
- The Central Government appoints the Director based on the recommendation of a high-level committee comprising:
 - Central Vigilance Commissioner (CVC)
 - Vigilance Commissioners

- Secretaries from the Ministries of Home Affairs, Personnel, and Finance
- Under the CVC Act, 2003, the **Director has a fixed tenure of 2 years.**

Key Functions of ED

- **Enforcement of Laws:** Implements the provisions of key financial legislations, including the Foreign Exchange Management Act (FEMA), the Prevention of Money Laundering Act (PMLA), and the Fugitive Economic Offenders Act (FEOA)
- **Investigation of Financial Offences:** Conducts investigations into a range of economic crimes, such as money laundering, foreign exchange violations, and banking frauds.
- **Exercise of Investigative Powers:** Has the authority to arrest individuals, conduct searches and seizures, and summon documents and individuals for questioning during the course of its investigations.
- **Inter-agency Coordination:** Collaborates with other enforcement and regulatory bodies, including the Central Bureau of Investigation (CBI), Income Tax Department, and Customs Department, to address complex economic offences.

Statutory functions of ED

1. Prevention of Money Laundering Act, 2002 (PMLA)

- A criminal statute aimed at curbing money laundering and enabling the confiscation of assets derived from such activities.
- The ED is entrusted with: Investigating the origin and movement of illicit assets.
 - Provisionally **attaching properties linked to proceeds of crime**
 - Assisting in the prosecution of offenders and facilitating confiscation of assets through designated Special Courts.

2. Foreign Exchange Management Act, 1999 (FEMA)

- A civil law enacted to regulate foreign exchange transactions, facilitate external trade and payments, and promote a stable foreign exchange market.
- The ED's responsibilities under FEMA include:
 - Investigating suspected violations of foreign exchange rules.
 - Conducting adjudication proceedings.
 - Imposing penalties on individuals or entities found guilty of contravention.

3. Fugitive Economic Offenders Act, 2018 (FEOA)

- Enacted to prevent economic offenders from evading legal proceedings by remaining outside Indian jurisdiction.
- Under FEOA, the ED is empowered to:
 - Identify and attach properties of declared **Fugitive Economic Offenders (FEOs).**
 - Facilitate the confiscation of such assets and ensure they are transferred to the Central Government.

Associated challenges

- **Scope and Overreach:** The ED has been accused of stretching its jurisdiction to cover ordinary crimes beyond its legal mandate.
 - **Impact:** This dilutes the agency's core function and raises concerns over arbitrary use of power.

- **Lack of Transparency in Investigations:** The Enforcement Case Information Report (ECIR) is treated as an internal document, with little public disclosure or clarity on how cases are chosen.
 - **Impact:** Erodes trust in the investigative process and raises questions about fairness.
- **Alleged Political Misuse:** The ED is often accused of being used as a tool to target political opponents under the pretext of financial scrutiny.
 - **Impact:** Undermines the agency's neutrality and damages public confidence.
- **Harsh Penalties for False Complaints:** High penalties for filing false or frivolous complaints, particularly against public servants.
 - **Impact:** Discourages even genuine complainants from coming forward due to fear of retaliation.
- **Ban on Anonymous Complaints:** Only formally identified complaints are allowed.
 - **Impact:** Limits whistleblowing and inhibits reporting of sensitive issues like corruption.
- **Lack of Transparency in Handling Complaints Against the PM:** The process for investigating complaints against the Prime Minister lacks public transparency.
 - **Impact:** Raises concerns about accountability at the highest levels of government,
- **No Suo Motu Powers:** The ED cannot initiate investigations on its own without an external complaint or referral.
- **Procedural Formalism in Complaint Filing:** Greater focus on technicalities of complaint filing rather than the substance of the issue.
 - **Impact:** Creates barriers for complainants and diverts attention from addressing the core problems.

Way forward

- **Enhance Clarity and Transparency:** Introduce clear, standardized guidelines for case selection and investigation procedures.
- **Uphold Due Process:** Ensuring fairness and procedural integrity in investigations is essential. Accused individuals should be granted access to the Enforcement Case Information Report (ECIR) or equivalent documentation to enable a fair defense and promote an equitable legal process.
- **Establish Independent Oversight:** To address concerns about political misuse or overreach, an independent oversight body should be created or strengthened.
- **Focus on Training and Ethical Conduct:** Regular training and capacity-building for ED personnel is vital to promote a multidisciplinary and legally sound approach.
- **Promote Data Transparency and Public Reporting:** Publishing comprehensive data and performance metrics - including case numbers, conviction rates, asset recoveries, and investigation timelines would significantly improve transparency and allow public scrutiny of the agency's effectiveness.

INDIA'S PAYMENT REVOLUTION

Context

India's digital payment ecosystem is in the news following the release of January 2026 data, which shows a record-breaking **21.70 billion transactions worth ₹28.33 lakh crore.**

About India's Payment Revolution:

- India's Payment Revolution is the rapid transition from a cash-heavy, traditional banking system to a scalable, real-time, and inclusive digital infrastructure.
- It is anchored by the JAM Trinity (Jan Dhan, Aadhaar, Mobile) and spearheaded by the Unified Payments Interface (UPI), which has democratized financial access for everyone from street vendors to large corporations.

Factsheet

- **Transaction Volume:** 21.70 billion transactions in a single month.
- **Transaction Value:** ₹28.33 lakh crore processed monthly.
- **Retail Dominance:** UPI accounts for 81% of all retail digital transactions in India.
- **Global Standing:** India contributes 49% of total global real-time payment transactions.
- **Network Growth:** UPI-linked banks increased from 216 in 2021 to 691 by January 2026.

Evolution of Payment Systems Since Independence:

- **Traditional Era:** Post-independence, the system relied on barter in rural areas and paper currency/cheques in urban centers, which were slow and often excluded the poor.
- **Institutional Formalization:** The introduction of systems like RTGS (2004) and IMPS (2010) enabled 24/7 electronic transfers but remained limited to those with formal bank accounts.
- **The Structural Breakthrough (JAM):** The launch of Pradhan Mantri Jan-Dhan Yojana brought millions into banking, while Aadhaar provided a digital identity for seamless authentication.
- **The UPI Radicalization (2016):** UPI simplified money movement by replacing complex account details with a simple Virtual Payment Address (VPA) and QR codes.
- **Global Expansion (2024-2026):** UPI became a global gold standard, now operational or linked in countries like France, UAE, Singapore, and Mauritius.

Importance of Payment Systems in the Economy

- **Financial Inclusion:** Dissolves the divide between urban and rural areas, bringing the financially invisible into the formal economy.
- **Economic Efficiency:** Real-time settlements reduce operational delays and the costs associated with physical cash management.
- **Transparency and Leakage Reduction:** The Direct Benefit Transfer (DBT) system ensures government aid reaches beneficiaries directly, eliminating intermediaries.
- **Formalization of Credit:** Digital footprints allow small merchants and informal workers to access formal credit and insurance products.
- **Global Leadership:** Strengthens India's role in the global fintech landscape, serving as a reference model for international bodies like the IMF and World Bank.

Challenges Associated with Digital Payments

- **Cybersecurity Risks:** As volumes grow, so does the risk of sophisticated phishing, identity theft, and digital fraud.
- **Digital Literacy Gap:** While access has expanded, the deep-tech understanding required to resolve transaction failures remains a hurdle for first-time users.

- **Connectivity Issues:** In remote regions, inconsistent internet and mobile network access can disrupt real-time transaction reliability.
- **Data Privacy:** Managing the massive amount of financial data generated requires robust legal frameworks to prevent misuse.
- **Infrastructure Load:** The sheer scale of 20+ billion monthly transactions puts immense pressure on bank servers and the central NPCI switch.

Way Ahead

- **Enhanced Security:** Implementation of the RBI's 2026 mandate for multi-layer authentication, including biometrics and secure tokens.
- **Product Diversification:** Scaling features like UPI Lite for small-value offline payments and UPI AutoPay for recurring bills.
- **Credit Integration:** Expanding Credit on UPI to allow pre-approved credit lines, turning a payment tool into a full financial service platform.
- **Deep-Rural Outreach:** Leveraging the expansion of mobile connectivity to ensure the last mile in remote village mandis is fully digitized.
- **Cross-Border Dominance:** Linking UPI with more international payment systems to facilitate cheaper and faster global remittances.

