

Prelims Exam Topics

STEM CELL THERAPY FOR FRAILTY IN AGEING POPULATION

Context

- A recent clinical study showed that **mesenchymal stem cell therapy can improve physical function in elderly people with frailty**, suggesting that frailty (earlier seen as normal ageing) may be **biologically treatable**.

About Frailty

- **Definition:** Frailty is a condition of **reduced strength, endurance and recovery capacity**, making elderly individuals more vulnerable to stress (illness, injury).
- **Multifactorial Nature:** Caused by combined effects (**chronic inflammation, muscle loss, vascular ageing, immune dysfunction, long-term stress**).
- **Key Features:**
 - Reduced mobility and fatigue
 - Higher risk of falls and hospitalisation
 - Slower recovery after illness
- **Prevalence:** Affects **~25% of people above 50 years globally** (rapid rise expected with ageing population; India's elderly population projected **~20% by 2050**).
- **Policy Gap:** Often **underdiagnosed and lacks standard treatment protocols**, especially in developing countries.

About Mesenchymal Stem Cells (MSCs)

- Mesenchymal stem cells are **multipotent stem cells found in bone marrow and adipose tissue**, capable of differentiating into **bone, cartilage and muscle cells**.
- **Biological Properties:**
 - **Regenerative ability:** Repair damaged tissues
 - **Immunomodulation:** Reduce inflammation
 - **Paracrine signalling:** Release bioactive molecules promoting healing
- **Immune Advantage:** Do not strongly trigger immune response (**low rejection risk; minimal need for immunosuppressive drugs**).
- **Clinical Use:** Used experimentally in **regenerative medicine, orthopaedics, cardiovascular repair, and ageing-related conditions**.

How It Tackles Frailty

- **Reduces Inflammation:** MSCs release molecules that **lower chronic inflammation (a key driver of ageing-related decline)**.
- **Promotes Tissue Repair:** Helps regenerate **muscle and vascular tissues**, improving strength and resilience.

- **Improves Physical Performance:** Patients showed **improved walking capacity** (e.g., ~60 metres more in a 6-minute walk test) → meaning they could **walk longer distances without fatigue**, indicating better endurance and functional ability.
- **Enhances Recovery:** Improves the body's ability to **recover from stress, illness or injury**.
- **Improves Vascular Function:** Acts on **small blood vessels**, improving blood flow and reducing ageing-related damage.

ISRAEL–LEBANON DIRECT TALKS

Context

- Israel and Lebanon held their **first direct diplomatic talks in decades**, mediated by the United States, amid escalating conflict involving **Hezbollah** and the broader **Iran–Israel confrontation**.

Participants in the Talks

- **United States (Mediator):** Led by **Marco Rubio**, facilitating dialogue and pushing for **reduction of Hezbollah influence and regional stabilisation**.
- **Israel:** Represented by diplomatic officials (e.g., Ambassador Yechiel Leiter), focusing on **security concerns and disarmament of non-state actors**.
- **Lebanon:** Represented by government officials (e.g., Ambassador Nada Hamadeh Moawad), emphasising **ceasefire, humanitarian relief, and sovereignty of Lebanese armed forces**.
- **Notably Excluded:** **Hezbollah** was **not part of the talks**, though it remains a key actor influencing ground realities (continued attacks during negotiations).

Historical issues Between Israel and Lebanon

- **Absence of Formal Diplomatic Relations:** Both countries **do not recognise each other diplomatically**, maintaining a hostile relationship since Israel's creation (1948).
- **Repeated Conflicts:**
 - **1982 Lebanon War:** Israeli invasion targeting PLO presence
 - **2006 War:** Major conflict between Israel and Hezbollah
 - **2023–24 & 2026 clashes:** Linked to Gaza and Iran conflicts
- **Hezbollah Factor:** Founded in **1982 with Iranian support**, Hezbollah acts as a **powerful militia and political actor in Lebanon**, dominating southern Lebanon and engaging in conflict with Israel.
- **Ongoing tensions:** along the **Blue Line (UN-demarcated boundary)** and Israeli presence in southern Lebanon.
- **Security Zone Strategy:** Israel has historically attempted to maintain a **buffer/security zone (up to Litani River ~30 km)** to prevent cross-border attacks.

Key Demands

Issue	Israel's Demand	Lebanon's Demand
Hezbollah Disarmament	Complete disarmament and removal of Hezbollah and other non-state armed groups	Gradual reduction of Hezbollah's military role and integration under Lebanese state authority (armed forces to be sole security provider in south Lebanon)

Ceasefire	No immediate ceasefire; linked to security guarantees and Hezbollah disarmament	Demand immediate ceasefire to stop casualties, enable humanitarian relief and civilian return
Security Zone	Establish buffer zone up to Litani River (~30 km)	Oppose buffer; demand complete Israeli withdrawal and restoration of territorial sovereignty
Military Operations	Maintain freedom to conduct strikes and surveillance against threats	End Israeli airstrikes, incursions and violations of airspace/territory
Border & International Mechanism	Strengthen monitoring along Blue Line with international oversight to ensure demilitarisation	Expand UNIFIL (United Nations Interim Force in Lebanon) role and deploy Lebanese Army in southern Lebanon (to replace non-state actors and ensure long-term border stability)

STRATEGIC OPPORTUNITY FOR INDIA-SOUTH KOREA IN GULF WAR

Context

- The ongoing Gulf conflict has exposed Asia's **deep dependence on Gulf energy and maritime routes**, highlighting structural vulnerabilities but also opening **strategic cooperation opportunities for countries like India and South Korea**.

Vulnerability of Asia to the Gulf War

- **High Energy Dependence:** Asia imports **~70% of its crude oil from the Gulf** (China, India, Japan, South Korea heavily reliant), making it highly exposed to supply disruptions.
- **Critical Maritime Chokepoint:** The **Strait of Hormuz (≈20% of global oil trade)** is vital; any disruption directly threatens Asian economies.
- **Limited Diversification:** Unlike the U.S. (energy producer) and Europe (diversified sources), Asia remains **structurally dependent on West Asia**.
- **Economic Vulnerability:** Industrial economies (Japan, South Korea, China, India) rely on **stable energy flows for manufacturing and growth**, making them sensitive to price shocks.
- **Dependence on External Security Provider:** Asian countries rely on **U.S. naval presence to secure sea lanes**, creating strategic vulnerability amid changing U.S. commitments.
- **Threat to Freedom of Navigation:** Iran's attempts to **control transit in Hormuz challenge UNCLOS norms**, directly affecting Asian trade interests.

How Gulf War Presents Opportunities for India and South Korea

- **Strategic Convergence:** Shared concerns on **energy security and maritime security** create scope for deeper **India–South Korea strategic partnership**.
- **Maritime Security Cooperation:** Potential for **joint naval coordination, information sharing, logistics agreements and sea lane protection**.
- **Reducing Overdependence on U.S.:** Encourages **Asian-led security frameworks**, reducing reliance on U.S. naval dominance.

- **Defence Industrial Collaboration:** South Korea's expertise (**shipbuilding, naval platforms**) can support India's **naval modernisation and fleet expansion**.
- **Energy and Infrastructure Cooperation:** Participation in Gulf infrastructure projects (**pipelines, ports, logistics corridors**) to bypass chokepoints like Hormuz.
- **Nuclear Energy Collaboration:** South Korea's advanced **nuclear technology (SMRs)** can support India's **clean energy transition**.
- **Geoeconomic Opportunity:** Joint engagement in **West Asian economic transformation projects**, reducing long-term vulnerability to disruptions.

FILM PIRACY AND LEGAL FRAMEWORK IN INDIA

Context

- The recent leak of the Tamil film *Jana Nayagan* before its theatrical release highlights the growing challenge of **film piracy in India**,

Legal Framework on Film Piracy

Copyright Act, 1957:

- **Section 63:** Punishes infringement with **imprisonment up to 3 years and fine up to ₹2 lakh** (covers unauthorised copying, sharing).
- **Section 63A:** Provides **enhanced punishment for repeat offenders**, reinforcing deterrence.
- Applies to all **creative works (films, music, digital content)**.

Cinematograph Act, 1952 (Amended 2023):

- Targets **unauthorised recording and transmission of films in theatres or digital form**.
- Imposes heavy penalty of **up to 5% of film's production cost** (significant deterrent for big-budget films).
- Specifically addresses **pre-release and theatrical piracy**, which causes maximum damage.

Information Technology Act, 2000:

- Deals with **digital offences (unauthorised access, hacking, data theft)** relevant in online piracy.
- Enables action against **platform misuse and illegal digital dissemination**.

Judicial Mechanisms:

- **John Doe Orders:** Pre-emptive orders against unknown offenders to prevent piracy before release.
- **Dynamic Injunctions:** Allow courts to **continuously block new piracy links/websites** as they emerge.

Scope of Liability: Law covers entire chain—**original leaker, distributors, and even individuals sharing pirated links**, expanding accountability.

How Film is Leaked

- **Insider Leak in Supply Chain:** High-quality leaks often originate from **authorised individuals (editors, post-production teams, distributors, OTT handlers)** where **carelessness or intentional sharing** leads to unauthorised circulation.
- **Pre-Release Access Points:** Films circulate internally for **censorship, distribution and preview screenings**, creating multiple **vulnerable points for data breach**.

- **Digital Extraction (Digital Rights Management Bypass):** Once available on OTT or digital systems, pirates **bypass DRM protections** to extract near-original quality video files.
- **Theatrical Copy Leakage:** Though theatres use **encrypted hard drives and projection systems**, leaks may still occur if **security protocols are compromised**.
- **Rapid Online Dissemination:** Content spreads via **torrents, cloud storage links and encrypted messaging apps (Telegram)**, enabling **mass replication within hours**.

What Happens if Film is Leaked

- **Irreversible Digital Spread:** Once leaked, content becomes **difficult to fully remove** due to **mirror websites, torrents and private sharing networks**.
- **Legal Action Initiation:** Authorities may **arrest suspects (including original leakers and link sharers)** and initiate criminal proceedings.
- **Takedown and Blocking Measures:** Studios deploy **anti-piracy agencies** and seek **court-ordered dynamic injunctions** to block piracy links.
- **Forensic Tracking:** **Watermarking technologies** help identify the **source of leak**, especially in early distribution stages.

THREE CRUCIAL ISSUES BETWEEN US AND IRAN

Context

- Despite the failure of recent U.S.–Iran talks, a workable deal still exists around **three core issues**—**nuclear (HEU), maritime (Hormuz), and regional conflicts**, with both sides needing credible commitments.

Three Crucial Issues

1. Iran’s Highly Enriched Uranium (HEU) – Possible Solutions

Option	Feasibility	Key Issues / Explanation
Regime Change / Conquest	Very Low	Requires full-scale war and occupation (high cost, global instability, politically unacceptable)
Military Raid to Seize HEU (~400 kg; ≈10–12 bombs potential)	Low	HEU likely dispersed across multiple hardened sites; large-scale operation needed with high risk of failure
Coercive Pressure + Limited Deals	Medium	Sanctions/military pressure may force concessions but unlikely to fully eliminate nuclear risk
Iran Voluntary Transfer (with safeguards)	High	Most practical if combined with incentives (sanctions removal, economic reconstruction support)

While coercive options face **high military and political costs**, a sustainable solution requires **Iran’s voluntary cooperation**, which in turn depends on **credible verification mechanisms** to ensure long-term compliance.

Modes within Voluntary Transfer

Mechanism	Explanation

IAEA Safeguards Model	International monitoring ensures enrichment limits ($\leq 3.67\%$); builds global legitimacy but faces U.S. trust deficit due to past compliance concerns
Bilateral US–Iran Mechanism	Joint inspections and oversight; increases U.S. confidence but may face sovereignty concerns from Iran

2. Strait of Hormuz Issue

Aspect	Details
Core Issue	Iran militarising Hormuz ($\approx 20\%$ global oil flow) to gain leverage and raise funds for post-war reconstruction
US Proposal	Joint mechanism to ensure safe passage (including possible revenue-sharing arrangement)
Key Constraint	Toll on shipping violates freedom of navigation under UNCLOS and may trigger similar claims globally
Resolution Path	Lift sanctions + release frozen assets to compensate Iran economically instead of toll collection
Outcome Logic	With reduced economic pressure, Iran has less incentive to weaponise the strait

3. Israel–Lebanon Conflict (Hezbollah Factor)

Aspect	Details
Core Issue	Conflict between Israel and Hezbollah , an Iran-backed armed group
Israeli Position	Seeks disarmament of Hezbollah to eliminate missile and drone threats
Lebanese Constraint	Hezbollah’s deep political integration limits state ability to enforce disarmament
Resolution Path	U.S. and Iran pressure respective allies to bring them to negotiation table
Possible Outcome	Ceasefire + phased disarmament within broader regional settlement

The three issues are **interconnected (nuclear capability, maritime leverage, and regional proxies)** and cannot be solved in isolation. Military options are largely impractical, while **coordinated diplomacy (sanctions relief, verification mechanisms, and regional negotiations)** offers the most viable path toward a durable settlement.

RIGHT TO VOTE VS. RIGHT TO CONTEST

Context

The ongoing controversy over the Special Intensive Revision (SIR) of electoral rolls by the EC has sparked a nationwide debate. The issue has brought attention to the distinction between the right to vote and the right to contest elections, along with concerns about electoral fairness.

Reasons for Controversy

- Allegations of large-scale deletion of voter names, including eligible voters.
- Concerns regarding disenfranchisement, especially among marginalised groups lacking documentation.
- Judicial interventions, with petitions questioning transparency, fairness, and procedural safeguards.

Right to vote vs Right to contest

RIGHTS	RIGHT TO VOTE	RIGHT TO CONTEST ELECTIONS
About	<ul style="list-style-type: none"> ● A statutory right under the Representation of the People Act. 	<ul style="list-style-type: none"> ● A statutory right, but with stricter conditions.

	<ul style="list-style-type: none"> ● Available to all citizens above 18 years, subject to eligibility. ● Forms the foundation of democratic participation. ● Any disruption directly affects democratic legitimacy. ● Article 326: Establishes universal adult suffrage. 	<ul style="list-style-type: none"> ● Requires: <ul style="list-style-type: none"> ○ Fulfilment of eligibility criteria ○ Compliance with nomination procedures ○ Absence of disqualifications ● More regulated and restrictive than voting.
Similarities	<ul style="list-style-type: none"> ● Voting is universal and inclusive, while contesting is selective. ● Errors in electoral rolls (due to SIR) can indirectly influence electoral outcomes, thereby affecting candidates. 	
Impact of SIR	<ul style="list-style-type: none"> ● Disenfranchisement: Exclusion from rolls directly denies citizens their voting right. ● Unequal Impact: Vulnerable groups are disproportionately affected: <ul style="list-style-type: none"> ○ Migrants ○ Rural poor ○ Elderly ● Declining Trust: Repeated controversies may reduce confidence in the electoral system. 	<ul style="list-style-type: none"> ● Changing Electoral Dynamics: Altered voter lists can influence electoral outcomes. ● Reduced Representativeness: Exclusion of groups may distort the true will of the people. ● Political Tensions: Can lead to allegations of bias and increased polarisation.

DELIMITATION AND WOMEN'S RESERVATION

Context

The Union government has introduced three major Bills, including the Constitution (131st Amendment) Bill, 2026, to implement 33% reservation for women in the Lok Sabha and State Assemblies.

Three major bills introduced

- **Constitution (131st Amendment) Bill, 2026:** Proposes expansion of the Lok Sabha and seeks amendments to Articles 81 and 82
- **Delimitation Bill, 2026:** Establishes a revised framework for the Delimitation Commission
- **Third Bill:** Facilitates reservation for women in State Assemblies and Union Territory legislatures

Key provisions

1. Expansion of Lok Sabha: Increase in strength from 543 seats to nearly 850

- Up to 815 seats for States
- Around 35 seats for Union Territories
- Reflects a ~50% rise in representation
- Aligns with the capacity of the new Parliament building

- Likely to result in smaller constituencies geographically

2. Women's Reservation (Target: 2029 Elections)

- Although 33% reservation was approved earlier through the Constitution (106th Amendment) Act, 2023, its implementation depended on delimitation after the Census.
- Due to delays in the 2021 Census, the government proposes using 2011 Census data.
- Aims to implement reservation from the 2029 general elections.

3. Redefinition of "Population" (Article 81)

- Shifts from using the "last Census" to any Census chosen by Parliament through law.
- Provides flexibility to Parliament in deciding the basis for delimitation.

North-South Divide: A Key Concern

- Southern states (e.g., Tamil Nadu, Kerala, Karnataka) have achieved lower population growth due to effective family planning.
- Pure population-based seat allocation could reduce their representation compared to northern states with higher population growth.
- Delimitation was frozen in 1976 and extended in 2001 to maintain regional balance until after 2026.

Structural Changes in Delimitation

1. Modification of Article 82

- Renames it from "readjustment after each Census" to "readjustment of constituencies".
- Removes the compulsory link between delimitation and decadal Census cycles.

2. Lower Decision Threshold

- Earlier, postponing delimitation required a two-thirds majority.
- Now, decisions may be taken by a simple majority, increasing political discretion.

3. New Delimitation Commission

- To function based on:
 - Latest Census data
 - Administrative boundaries
 - Physical features and public convenience
- However, no clear formula for seat distribution across states has been specified.

Key Challenges

- **Constitutional Tension:** Balancing "one person, one vote" with maintaining regional representation.
- **Weakened Safeguards:** Reduced constitutional checks may allow political misuse of delimitation.
- **Census Delays:** Dependence on outdated data (2011 Census) is a temporary solution.
- **Uncertain Timeline for Women's Reservation:** Implementation hinges on timely completion of delimitation.

Way Forward

- **Define Clear Seat Allocation Formula:** Ensure fairness while adhering to constitutional principles.
- **Strengthen Independence of Delimitation Commission:** Provide clear guidelines and autonomy to enhance credibility.

- **Reintroduce Safeguards:** Ensure delimitation cannot be easily manipulated for political gain.
- **Expedite Census Process:** Timely and updated population data is critical for fair representation.

UPI COMPLETES 10 YEARS

Context

- UPI has completed 10 years of its operations since its launch in 2016.
- **Network:** It has grown significantly, with participating banks increasing from 216 in 2021 to 691 by 2026.
- **Global Presence:** UPI is now live in over eight countries, including the UAE, Singapore, Bhutan, Nepal, Sri Lanka, France, Mauritius and Qatar.
- **Financial Inclusion:** UPI has enhanced inclusion by providing low-cost, easy digital payment access across urban and rural areas.

Unified Payments Interface

- UPI is a **real-time digital payment system** that enables instant bank-to-bank transfers via mobile phone.
- **Regulator:** Operated by the National Payments Corporation of India (NPCI).
- **Interoperability:** UPI allows seamless transactions across multiple banks and apps using a single interface (UPI ID).
- **Key Features:** Supports instant payments, 24×7 availability, QR code payments, and peer-to-peer (P2P) and peer-to-merchant (P2M) transactions.
- **Security Framework:** Uses two-factor authentication & secure protocols to ensure safe transactions.

Factsheet

- **Transaction Volume:** UPI recorded 21.70 billion transactions in January 2026.
- **Transaction Value:** Total value reached ₹28.33 lakh crore in January 2026.
- **Retail Share:** UPI accounts for 81% of India's retail digital payments.
- **Global Share:** India contributes 49% of global real-time payment transactions via UPI.
- **Global Ranking:** Recognised as the world's largest real-time payment system by the IMF.

National Payments Corporation of India

- NPCI was set up in 2008 as a not-for-profit entity under RBI and Indian Banks Association to consolidate retail payment systems.
- **Regulatory Oversight:** NPCI operates under the supervision of the RBI and provisions of the Payment and Settlement Systems Act, 2007.
- **Key Products:** NPCI has developed major payment systems including UPI, RuPay, IMPS, AePS, FASTag, and National Automated Clearing House (NACH).

Mains Exam Topics

MINIMUM WAGE CRISIS IN INDUSTRIAL AREAS (NOIDA, MANESAR & NCR REGION)

Context

Thousands of factory workers in Noida staged protests demanding:

- Minimum wage hikes
- Better working conditions
- Overtime pay

The protests turned violent in several instances, indicating rising frustration among workers.

Immediate Trigger:

- A 35% minimum wage hike in Haryana (after protests in Manesar) led workers in neighbouring regions like Noida to demand similar revisions.
- These protests reflect growing distress due to rising living costs, especially amid inflation linked to global factors such as the West Asia conflict.
- Workers argue that wages have not kept pace with increasing cost of living.

Delay in Minimum Wage Revisions

- Minimum wage has two components:
 - **Base Wage**
 - Fixed component of wages.
 - Ideally revised every 5 years.
 - **Cost of Living Allowance (DA)**
 - Linked to Consumer Price Index–Industrial Workers (CPI-IW).
 - Revised twice a year to reflect inflation changes.

Issue of Delayed Revisions

Base wage revisions have been significantly delayed:

- Haryana revised wages after 10 years
- Uttar Pradesh last revised in 2012, relying only on interim hikes
- Although many states carried out half-yearly DA revisions, they failed to revise base wages.
- The delays became more pronounced after Covid-19, worsening the situation.
- This has created a widening gap between inflation-driven expenses and stagnant base wages, exposing structural weaknesses in India's wage policy and labour welfare system.

Rising Cost of Living and Worker Distress

Inflation Trends (CPI-IW Data, Base Year 2016)

- National inflation (Feb 2021 – Feb 2026): 24.8%
- Higher inflation in key industrial regions:
- Gurugram: 27.9%

- Faridabad: 27.2%
- Ghaziabad, Noida, Delhi: 27.4%
- Wage Growth vs Inflation
- Haryana: Wage growth only 15%
- Uttar Pradesh: 24.6%
- Delhi: 20.6%

This mismatch indicates that real incomes of workers have declined, particularly in the Delhi-NCR region.

Industrial and Global Pressures

Rising input costs due to:

- US tariffs
- Disruptions like the Strait of Hormuz crisis
- Impact on industries:
- Delayed wage payments
- Increased job insecurity

Rising Household Expenses for Workers

- Workers, many of whom are migrants, face increasing financial pressures:
- LPG cylinders in black markets costing up to ₹4,000
- Rising room rents
- Increasing food prices

These rising expenses have significantly worsened workers' financial burden.

- The combined effect of:
 - **Inflation**
 - **Wage stagnation**
 - **Industrial slowdown**

has intensified economic stress, leading to protests and labour unrest.

Labour Codes and Worker Expectations

- Expectations After Notification (November 2025)
- Workers expected higher and uniform wages after the introduction of new labour codes.
- Widespread belief that minimum wage would increase to ₹20,000 per month.

Uncertainty in Implementation of Labour Codes

Four Labour Codes came into effect in November 2025:

- Code on Wages
- Code on Social Security
- Industrial Relations Code
- Occupational Safety, Health and Working Conditions (OSH) Code
 - However:
 - Final rules are yet to be notified by Centre and states
 - Draft rules issued in December 2025 created uncertainty

Concerns Raised by Experts and Workers

Risk of Exploitation

- Flexibility without safeguards may lead to:
- Longer working hours
- Increased workload without proportional pay

Lack of Uniformity Across States

- States frame their own rules:
- Regional disparities in wages
- Differences in working conditions
- Creates confusion for both workers and employers

Weakening of Collective Bargaining

- Trade union recognition left largely to states
- No uniform system for collective bargaining
- Reduces workers' negotiating power

Conclusion

The protests in Noida and Manesar highlight deep structural issues in India's labour system:

- Delayed wage revisions
- Rising inflation
- Policy uncertainty
- The gap between:
 - Rising cost of living
 - Stagnant wages

Way Forward

- Ensure timely revision of base wages
- Provide clear and uniform implementation of labour codes
- Introduce strong safeguards against exploitation
- Align wages more effectively with inflation trends.

FOOD WASTE IN INDIA

Context

- The International Day of Zero Waste (March 30) highlights the growing concern of food wastage. It reflects a paradox like large-scale food loss coexisting with hunger and malnutrition.

Food waste and food loss

- **Food waste:** Refers to both edible and non-edible food discarded at the retail and consumption stages, including households, restaurants, and food services (UNEP Food Waste Index Report, 2024).
- **Food loss:** Occurs in the earlier stages of the supply chain, such as harvesting, storage, processing, and transportation, before food reaches consumers.

Data on food wastage

- **Global Food Waste:** As per the **UNEP Food Waste Index Report 2024**, approximately 1.05 billion tonnes of food are discarded globally each year. Households account for 60%, followed by food services (28%) and retail (12%)
 - This widespread wastage reflects inefficiencies in supply chains, policy shortcomings, and consumption habits.
 - At the same time, nearly 783 million people suffer from hunger, and over 3.1 billion individuals cannot afford a nutritious diet, exposing a deep moral and systemic imbalance.
- **India's Contradiction:** India is the second-largest contributor to food waste globally, losing nearly 78–80 million tonnes annually, valued at about ₹1.55 lakh crore, second only to China.
 - Although India's per capita food waste (55 kg/year) is lower than that of countries like the U.S. and Germany, the country ranks 111th on the Global Hunger Index, with nearly 194 million undernourished people.
 - This stark contrast highlights the disconnect between availability and access to food.
- **Punjab case study:** Punjab, a major agricultural hub, produces surplus food but faces significant post-harvest losses due to climatic stress and weak infrastructure.
 - Nearly 20% of fruits and vegetables are lost after harvest
 - Over 8,200 tonnes of foodgrains were damaged in FCI storage between 2019–2024, the highest in the country
 - Key challenges include inadequate storage facilities, poor cold-chain systems, limited mechanisation, and inefficient packaging and grading, as pointed out by NITI Aayog.

Causes of food waste in India

- **Over-purchasing:** About 67% of urban households waste food due to lack of proper meal planning.
- **Inadequate storage:** Around 40% of food production is lost due to insufficient storage and weak supply chains.
- **Socio-cultural practices:** Events like weddings often lead to 10–20% food wastage due to over-preparation.
- **Weak Supply Chain Infrastructure:** Inefficiencies result in losses worth ₹92,651 crore annually.
- **Perishability of Food Items:** Nearly 16% of fruits and vegetables are wasted due to short shelf life and poor handling.
- **Retail and Hospitality Sector:** The food service industry generates nearly 22 million tonnes of waste each year.

Implications of Food Waste

- **Environmental impact:** Contributes 8–10% of global greenhouse gas emissions, mainly due to methane from decomposing food.
- **Economic loss:** Annual loss of around ₹1.52 lakh crore, impacting agricultural productivity and income.
- **Food insecurity:** Despite large wastage, over 20 crore people in India face hunger daily.
- **Social inequality:** Urban food excess contrasts sharply with malnutrition and scarcity in rural areas.

- **Resource depletion:** Wastage leads to loss of valuable inputs like water, land, and energy used in food production.
- **Impact on sustainable development:** Hampers progress towards:
 - SDG 2 (Zero Hunger)
 - SDG 12.3 (Reducing Food Waste)

Government initiatives

- **Pradhan Mantri Kisan Sampada Yojana (PMKSY):** Promotes food processing and cold storage to reduce post-harvest losses.
- **Integrated Cold Chain Scheme:** Strengthens farm-to-market cold storage networks.
- **Rural Godown Scheme:** Improves storage capacity in rural areas.
- **Save Food, Share Food Initiative:** Encourages redistribution of surplus food through NGOs.
- **Indian Food Sharing Alliance (IFSA):** Facilitates food recovery and distribution via partnerships with food banks.
- **Mid-Day Meal Scheme & Poshan Abhiyan:** Ensure efficient use of food to combat malnutrition.
- **Consumer Awareness Drives:** Campaigns like Jaivik Bharat promote responsible consumption.
- **Food Donation Guidelines:** Provide a framework for safe and legal redistribution of surplus food.

Conclusion

Food waste in India reflects systemic inefficiencies and behavioural issues. Addressing it requires better infrastructure, policy support, and responsible consumption practices to ensure food security and sustainability.