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வசையிலா வண்பயன் குன்றும் இசையிலா யாக்கை பொறுத்த நிலம்.

புகழ் இல்லாத உடம்பைச் சுமந்த பூமி, தன் வளம் மிக்க விளைச்சலில் குறைவு படும். — சாலமன் பாப்பையா

An Engels' pause in an AI-shaped world

The other day, Artificial Intelligence (AI) pioneer and Nobel Laureate Geoffrey Hinton, in the *Financial Times*, said that AI will make a few people rich and the rest of us poorer. In doing so, he hinted at an Engels' pause in our modern AI economy.

But what is an Engels' pause? The term refers to a paradox in economic history: in 19th century Britain, industrial output surged, yet ordinary living standards barely budged. It was first called so by Oxford economist Robert Allen, in a seminal paper, after Friedrich Engels, the German philosopher. In early 1800s Britain, wages stagnated, food consumed most household budgets, and inequality widened even as factories hummed, and Britain became the "workshop of the world". Only decades later did sustained improvements in welfare reach the majority, as Allen wrote in his paper.

Today, as AI reshapes the global economy we face a hauntingly similar question: Are we entering a modern Engels' pause, where productivity surges but broad-based prosperity stalls? This becomes particularly pertinent after observing how a recent Stanford paper, titled "Canaries in the Coal Mine? Six Facts about the Recent Employment Effects of Artificial Intelligence", documents younger workers being more vulnerable to AI-induced shifts in the economy. It also comes on the heels of an Indian software giant shedding 12,000 jobs and making an AI pivot. And all of this at a time when a recent MIT study pointed out that 95% of AI pilots are not generating visible gains in organisations due to frictions in complementary capabilities.

So, what precisely gives? For answers we need to turn to the economics of innovation. AI bears the hallmarks of a general-purpose technology (GPT) such as steam power, electricity, and the Internet, and it has the potential to transform multiple industries.

According to Agrawal, Gans, and Goldfarb (2018), AI dramatically lowers the cost of prediction. And yet, GPTs historically unleash not just growth but also dislocation. Complementary innovations, institutional adjustments and new tasks and skills must emerge before benefits are widely shared. Sussex University economic historian Nicholas Crafts discussed this in a 2021 article building on Allen's work, and so did Bojan Jovanović and coauthors (2005) with United States data. The pauses are likely because capital or technological deepening could create gains for oligarch entrepreneurs but not for the rest of us – like Prof. Hinton stated and as a student of this writer pointed out recently.

Some of the markers

What might be the empirical signs of a modern Engels' pause? To start with, we can examine whether there are productivity gains but stagnant wages. In call centres in the Philippines,

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An Engels' pause in the modern Artificial Intelligence (AI) economy might be shorter than its historical counterpart if policy aligns with innovation

generative AI copilots have boosted productivity, some argue, by 30%-50%, with firms enjoying cost savings and faster service. Yet, worker wages have barely moved, and in some cases, workloads have intensified. It is also at a time when inflation is high and cost of living prices make workers feel poorer. It is very concurrent with a recent *New Yorker* cartoon too which showed how an individual is asking ChatGPT why her electricity bills are rising. The dark humour cannot be missed on AI's Engels' pauses.

A second sign of a modern Engels' pause is to observe if there are rising costs of complements. AI productivity requires complements: cloud computing, retraining, data access, and cybersecurity. These are expensive. For workers, the "price of staying relevant" is rising, coding boot camps, new certifications and continuous learning. Much like 19th-century households where higher wages were offset by rising food prices, and more recently in the Philippines, where today's workers may see modest wage growth eroded by the high costs of digital survival.

A third marker would be to observe unequal distribution of gains ultimately deepening global inequality. PwC estimates that AI could add $15.7 trillion to global GDP by 2030. But the benefits will be concentrated in the U.S., China, and a handful of firms controlling foundational models. The IMF (2024) estimates that 40% of jobs worldwide are exposed to AI – half in advanced economies, where high-skilled substitution is likely. This bifurcation suggests a delay, or even denial, of welfare gains for large swaths of the global workforce. This writer's paper in the *Journal of Development Economics* shows that a technology race in India with stronger intellectual property laws caused deep wage inequality. Going forward, could this be the story ahead in much of the world?

Finally, job displacement and task transformation will also be early measures to ascertain a modern Engels' pause. Doctors are being complemented with ChatGPT increasingly. A group of researchers from Tsinghua University in China have started the world's first AI-powered hospital. Meanwhile in education, finance, public management or infrastructure management, AI is slowly making inroads and transforming tasks and displacing jobs, as this writer's recent consulting work with GMR Airports also showed or when we see an Albania launch the first AI Minister, Diella.

Models to follow, steps to take

Overall, the historical resonance on an Engels' pause is sobering. In the Gilded Age of the U.S., productivity soared. But so did inequality, leading to labour unrest and political upheaval. Only with reforms, trade unions, public schooling and welfare states did living standards broadly rise.

The lesson is clear: without AI governance, the Engels' pause may persist.

This brings us to the final point on public policy. How can governments extricate economies out of the malaise of an AI Engels' pause? To start with, skills transitions programmes are going to be key. Singapore offers a promising model. Its SkillsFuture programme provides continuous education credits for workers to reskill. The world's first AI University in Abu Dhabi, the Mohamed bin Zayed University of Artificial Intelligence (MBZUAI) is another example of the role of skilling and new generation AI-related human capital creation.

There also must be thought around redistribution of AI rents, through robot taxes or through Universal Basic Incomes (UBI). Experiments with UBI in the United Kingdom and the European Union, or philanthropic commitments such as the Chan-Zuckerberg Initiative, aim to channel AI gains toward public good.

Finally, AI infrastructure should be treated on a priority basis as a public good. Compute and data are the "food" of the AI economy. If these remain scarce and expensive, productivity gains will not translate into welfare improvements. The launch of K2Think.ai and Apertus from the United Arab Emirates and Switzerland, respectively, in September as public (not private) open AI reasoning models here are nice steps in this direction.

What the challenge is

Some may still argue, with merit, that the Engels' pause analogy is overstated. Unlike in the 19th century, today's societies have stronger welfare systems, democratic institutions (though evidence on democratic backsliding is now quite robust worldwide), and rapid diffusion of technology. Smartphones reached billions within a decade; AI assistants could follow. Moreover, AI's potential to lower costs in health care, education and clean energy could deliver immediate welfare benefits, if governance accelerates deployment equitably. In this sense, the AI Engels' pause might be shorter than its historical counterpart if policy aligns with innovation.

But we still need to be cautious about macro gains and micro stagnation. Political economy teaches us that the Engels' pause is not destiny. Its erasure is also about political will.

The challenge for AI governance students and for policymakers worldwide is thus to ensure that AI is not just a productivity revolution, but a human welfare revolution wherein we ponder on a new theory of change. History warns us that progress delayed is progress denied. So, while the Engels' pause is the ghost at the feast of AI optimism, whether it lingers, how long it lingers and how swiftly it may pass, is up to us.

Context

- Geoffrey Hinton, AI pioneer and Nobel laureate, warns that **AI may enrich a few while making the rest poorer**.

- This evokes the concept of **Engels' pause**: in 19th-century Britain, productivity surged but **wages stagnated** and inequality widened, with benefits reaching ordinary people only after decades.

- The question today: **Are we entering a modern Engels' pause with AI?**

- Studies show **productivity gains (e.g., AI copilots in call centres)** but limited or no wage growth, rising inequality, and costs of complementary skills/infra eroding welfare.

- Risk: A repeat of the Gilded Age scenario where **productivity boomed but inequality and unrest grew**, unless supported by governance, redistribution, and skill-building policies.

Mains Focus Points

(GS-III: Economy, GS-II: Governance, Essay, Ethics)

Engels' Pause Analogy

- Industrial Revolution → productivity ↑, wages stagnant, inequality ↑.

- AI Revolution → similar risks: job displacement, stagnant wages, concentrated gains.

- Raises key question of **productivity vs welfare distribution**.

Economic Effects of AI

- AI is a **General Purpose Technology (GPT)** like electricity, steam, internet.

- Potential: boosts productivity across industries.

- Reality: early gains captured by **big tech firms, advanced economies**.

- Workers face rising costs of **reskilling, cloud/data access, certifications**.

Global Inequality Dimensions

- PwC: AI could add **$15.7 trillion to global GDP by 2030**, but gains concentrated in **US, China, few firms**.
- IMF: **40% of jobs globally exposed to AI**; advanced economies face high-skilled substitution; developing economies face exclusion.
- Deepens **North-South divide** and intra-country inequality.

Early Markers of a Modern Engels' Pause

- **Productivity ↑ but wages stagnant** (e.g., call centres, tech firms cutting jobs while boosting efficiency).
- **Rising costs of complements** (skills training, cloud infra).
- **Unequal distribution of gains** (oligopoly of AI giants).
- **Job/task transformation** (AI in medicine, airports, education, etc.).

Policy Responses

- **Skilling & Reskilling**: Continuous learning models (e.g., Singapore's *SkillsFuture*; MBZUAI in UAE).
- **Redistribution of AI Rents**: Robot tax, Universal Basic Income (UBI), philanthropic funding.
- **AI as Public Good**: Open AI infra, compute, and datasets (e.g., K2Think.ai, Apertus).
- **Stronger Welfare State & Labour Institutions**: Prevent unrest, ensure inclusive growth.

Way Ahead

- AI Engels' pause may be **shorter** than historical precedent if:
    - Welfare systems and democratic institutions act effectively.
    - AI is harnessed for **healthcare, education, clean energy** to directly improve welfare.
- Ultimately, it's a matter of **governance and political will**: productivity gains must translate into **human welfare gains**.

Previous Year Questions

UPSC Prelims 2025

Consider the following statements regarding AI Action Summit held in Grand Palais, Paris in February 2025:

1. Co-chaired with India, the event builds on the advances made at the. Bletchley Park Summit held in 2023 and the Seoul Summit held in 2024.
2. Along with other countries, US and UK also signed the declaration on inclusive and sustainable AI.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Answer: (a

UPSC Prelims 2020

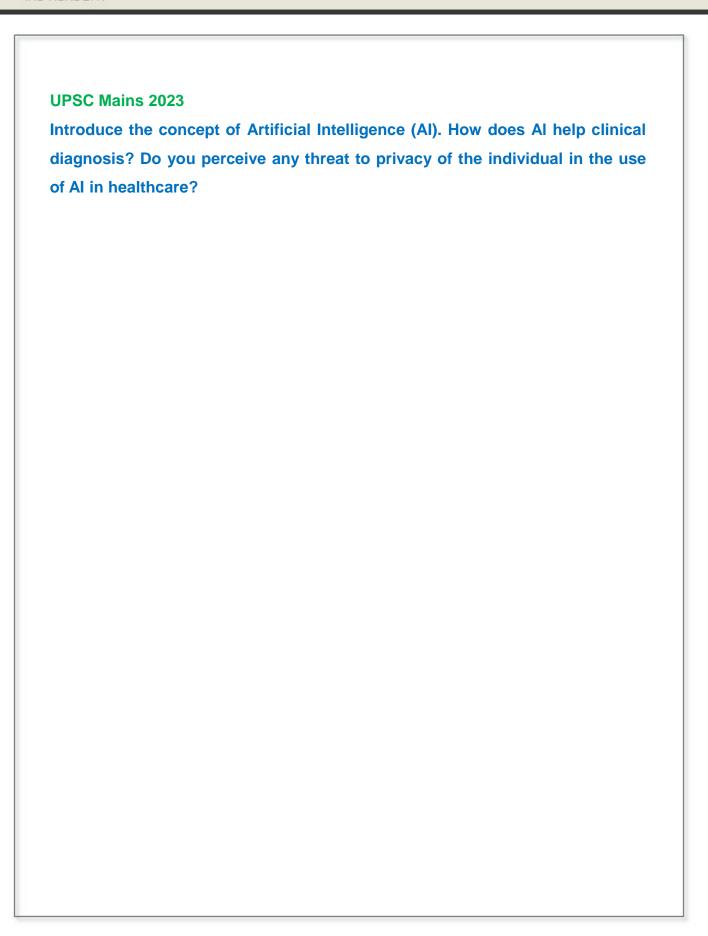With the present state of development, Artificial Intelligence can effectively do which of the following?

1. Bring down electricity consumption in industrial units
2. Create meaningful short stories and songs
3. Disease diagnosis
4. Text-to-Speech Conversion
5. Wireless transmission of electrical energy

Select the correct answer using the code given below:

(a) 1, 2, 3 and 5 only
(b) 1, 3 and 4 only
(c) 2, 4 and 5 only
(d) 1, 2, 3, 4 and 5

Ans: (b)

UPSC Mains 2023

Introduce the concept of Artificial Intelligence (AI). How does AI help clinical diagnosis? Do you perceive any threat to privacy of the individual in the use of AI in healthcare?

What an empty plate of food should symbolise

On September 29, the world observes the International Day of Awareness of Food Loss and Waste (IDAFLW), which will draw attention to a silent crisis that undermines both food and climate security. Globally, nearly one-third of all food produced is either lost or wasted.

As one of the world's largest food producers, India is not immune to this challenge, facing substantial post-harvest losses across multiple sectors. A study in 2022 by NABARD Consultancy Services (NABCONS) – a subsidiary of the National Bank for Agriculture and Rural Development (NABARD) – commissioned by the Ministry of Food Processing Industries (MoFPI), showed that such losses remain alarmingly high throughout the agricultural spectrum.

The economic toll is staggering. Post-harvest losses are estimated to cost India nearly ₹1.5 trillion annually – about 3.7% of agricultural GDP. Fruits and vegetables are the most vulnerable, with losses reaching 10%-15%, while even staples such as paddy (4.8%) and wheat (4.2%) experience significant wastage. Each tonne of food lost represents not only foregone nutrition but also wasted water, energy and labour – at a time when ecosystems are under pressure and the climate crisis is deepening. Scaled to India's vast production volumes, these percentages amount to millions of tonnes of food lost every year, with serious consequences for farmer incomes, national food availability, environmental sustainability and climate stability.

Food loss impacts vary across crops, value chains and regions. Identifying where losses occur and quantifying their greenhouse gas (GHG) emissions is vital for targeted interventions. Addressing these inefficiencies is not only crucial for ensuring food security but also central to India's climate commitments.

The climate connection

In response to this challenge, the Government of India has conducted three rounds of nationwide post-harvest surveys across more than 50 crops, generating valuable insights into value-chain losses at a global scale. The inclusion of

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International Day of Awareness of Food Loss and Waste will highlight the crisis undermining food and climate security — the tonnes of food being lost

Sustainable Development Goal (SDG) indicator 12.3.1 (Global Food Loss and Waste) in the National Indicator Framework further strengthens accountability by enabling systematic monitoring and alignment with international targets, while expanding the knowledge base for food systems transformation.

Building on this foundation, a recent collaborative study by the Food and Agriculture Organization of the United Nations (FAO) and the National Institute of Food Technology Entrepreneurship and Management (NIFTEM), with support from the Green Climate Fund (GCF), provides the first detailed sector-, state-, and operation-wise estimates of greenhouse gas (GHG) emissions from post-harvest loss and retail waste in India. The study covered 30 crops and livestock products.

The findings are striking. Even modest percentage losses in cereals, particularly paddy, translate into more than 10 million tonnes of carbon dioxide (CO_2)-equivalent emissions annually, owing to the high methane intensity of rice. Losses of livestock products are equally damaging because of their heavy resource footprint. In total, food loss from these 30 commodities generates over 33 million tonnes of CO_2-equivalent emissions each year – a preventable burden that could be reduced through more efficient and resilient food systems.

The study shows that in India, most losses occur early in the supply chain – during handling, processing, and distribution – unlike high-income countries where they are consumer-driven. This highlights India's core challenge of gaps in infrastructure, limited technology use and fragmented supply chains.

Practical solutions

The scale of India's food loss challenge is daunting, but solutions are well within reach. A multi-pronged approach that leverages technology, partnerships, private sector commitments, and a shift to a circular economy can drive real change.

Food loss largely stems from weak infrastructure. Strengthening cold chains, from pre-cooling to refrigerated transport and modern storage, is vital for perishables such as fruits, vegetables, dairy and meat. Programmes such as Pradhan Mantri Kisan SAMPADA Yojana (PMKSY) are already working to modernise this backbone of food logistics (SAMPADA is Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters which was subsequently renamed PMKSY).

Alongside major infrastructure, affordable technologies are key. Solar cold storage, low-cost cooling chambers, crates for perishables and moisture-proof silos for grains can help smallholders cut spoilage significantly.

Digital tools such as IoT sensors and Artificial Intelligence (AI)-driven forecasting can improve storage, transport and distribution, removing bottlenecks and cutting losses. The FAO Food Loss App (FLAPP), launched in 2023, allows farmers, organisations and governments to track losses across the value chain. It is used in more than 30 countries.

At the retail end, surplus food can be redirected to food banks and community kitchens, while unavoidable waste can be converted into compost, feed, or bioenergy. Scaling these circular solutions requires strong policy support, including subsidies, credit guarantees and low-interest loans.

A shared responsibility

Food loss spans the entire supply chain, demanding shared responsibility. Governments must integrate loss reduction into climate strategies and invest in resilient infrastructure, while businesses adopt circular models and scale innovations. Civil society and academia can drive research and awareness, and consumers can cut waste through mindful choices and support for redistribution.

The observance of IDAFLW is more than symbolic. It is a call to action. The challenge is immense, but so is the reward. Saving food means saving the climate, conserving resources, and protecting livelihoods. An empty plate should symbolise a meal enjoyed, not resources squandered.

Context

- Globally, **one-third of food produced is lost or wasted**, undermining food security and worsening the climate crisis.
- In India, **post-harvest losses cost nearly ₹1.5 trillion annually** (~3.7% of agricultural GDP).
- Losses are especially high in **fruits and vegetables (10–15%)**, and even staples like **paddy (4.8%) and wheat (4.2%)** suffer.
- Each tonne lost = wasted nutrition + wasted water, energy, labour + higher **GHG emissions**.
- A joint **FAO–NIFTEM–GCF study** shows:
    - **33 million tonnes of CO_2-equivalent emissions annually** from food loss in India.
    - Paddy alone → >10 million tonnes CO_2-eq due to methane intensity.
    - Losses concentrated in **handling, storage, distribution**, unlike consumer-driven waste in developed nations.
- Addressing food loss = key to India's **food security, farmer income, and climate commitments**.

About the Day

- **International Day of Awareness of Food Loss and Waste (IDAFLW):**
    - Observed **every year on September 29** (UNGA resolution, 2019).
    - Aims to raise awareness of the impact of food loss and waste on **food security, nutrition, economy, and climate**.
    - Aligns with **SDG 12.3**: Halve global per capita food waste at retail and consumer levels, and reduce food losses along production and supply chains by 2030.
- In India, IDAFLW connects with ongoing efforts:
    - **National surveys on post-harvest losses** (MoFPI, NABARD/NABCONS).

- **PM Kisan SAMPADA Yojana (PMKSY):** modernising cold chains and food processing.
- **FLAPP (FAO Food Loss App, 2023):** digital tool to monitor and reduce losses.

Mains Focus Points

(GS-III: Economy, Agriculture, Environment, Climate; GS-II: Governance; Essay)

Scale of the Problem in India

- Post-harvest losses = **₹1.5 trillion annually**.
- Major causes: poor **cold chain infra**, **fragmented supply chains**, low tech adoption, weak logistics.
- High vulnerability in **perishables**, significant losses even in cereals.

Climate Connection

- **33 million tonnes of CO2-eq annually** from food loss/waste in India.
- Paddy and livestock products → disproportionately high emissions.
- Food loss reduction = **mitigation strategy** for India's **NDC (Nationally Determined Contributions)** under Paris Agreement.

Solutions & Interventions

- **Infrastructure & Technology**
    - Cold chains, refrigerated transport, solar cold storage, silos.
    - Digital tools: IoT, AI forecasting, FLAPP app.
- **Circular Economy Approaches**
    - Surplus food → food banks, community kitchens.
    - Waste → compost, feed, bioenergy.
- **Policy & Finance**
    - Subsidies, credit guarantees, low-interest loans for infra/tech adoption.
    - Stronger inclusion of food loss targets in **climate and agricultural policy**.

Shared Responsibility

- **Government** → invest in resilient infrastructure, integrate into climate plans.
- **Private sector** → adopt circular models, modern storage/logistics.
- **Civil society/academia** → research, awareness, training.
- **Consumers** → mindful choices, reduce waste, support redistribution.

Way Forward

- **IDAFLW** serves as a **call to action** for nations like India.
- Reducing food loss =
    - **Food security + Farmer income stability**
    - **Resource efficiency** (water, energy, land)
    - **Climate mitigation** (methane & CO_2 reduction)
- "**Saving food is saving climate and livelihoods.**"

UPSC Civil Services Mains Examination

2023

- Discuss the consequences of climate change on food security in tropical countries.
- Provide reasons for India's emergence as a net food exporter since the 1960s.

2022

- Explain the connection between the climate crisis and rising food insecurity and suggest simultaneous solutions.

2021

- Analyze the challenges to crop diversification and the role of emerging technologies.
- Assess how micro-irrigation can help address India's water crisis.

2020

- Identify the main constraints in the transport and marketing of agricultural produce in India.
- Discuss the success and drawbacks of the rice-wheat system in India.
- Suggest measures to improve water storage and irrigation systems for judicious use.

2017

- Analyze the reasons for declining rice and wheat yield and how crop diversification can help stabilize yields.
- Examine the impact of subsidies on cropping patterns, diversity, and farmer economy, and the significance of crop insurance, MSP, and food processing.

2015

- Discuss the concept and components of "Conservation Agriculture" in the Indian context.

UPSC Civil Services Prelims Examination

2022

• **Identify the most important anthropogenic source of both methane and nitrous oxide among cotton, rice, sugarcane, and wheat.**

• **Define "Greenwashing".**

2021

• **Consider statements regarding India's preparation for Climate-smart Agriculture.**

• **Define "blue carbon".**

2020

• **Describe "carbon fertilization".**

• **Identify preferred materials for environmentally sustainable rural road construction.**

2018

• **Describe "carbon fertilization".**

2017

• **Identify potential sites for carbon sequestration to mitigate global warming.**

2012

• **Consider statements about the System of Rice Intensification (SRI).**

Analysing Indian States' macro-fiscal health

In the 2010s, States were able to prosper economically through reforms, better tax collection, and booming growth. Some States even reported surpluses. But the pandemic was a turning point – tax revenues shrank while emergency spending soared, pushing almost every State back

ECONOMIC NOTES

Deepanshu Mohan

When India's national auditor, the Comptroller and Auditor General (CAG), released a decadal analysis on States' macro-fiscal health, one headline somehow travelled faster than anything else highlighted in the study – Uttar Pradesh, long labelled as a backward State lagging in fiscal performance, was said to have recorded a revenue surplus of ₹37,000 crore.

This number, which is more than double of Gujarat's surplus, was hailed as proof that India's most populous State had turned a corner. However, by merely focussing on the number, one missed the bigger picture. Narrowing down on just arithmetic surpluses may be limiting analytical interpretation if not studied more holistically with the form, operational mechanics and choices made for a State's governance.

Economists often urge higher capital spending for growth, while keeping routine costs in check. These numbers decide whether one's neighbourhood hospital has new ventilators; whether a school gets enough teachers; and whether village roads will be repaired this year. India's States run some of the largest budgets in the world – bigger in real terms than many countries. Cumulatively, owing to the constitutional separation of powers, they spend more than the Union government on health and welfare. One must ask though: do States earn enough to pay their bills? Or are they borrowing?

Uneven revenue

In the early 2000s, States were often deep in deficit, spending much more than they earned. Reforms, better tax collection, and booming growth helped many turn the corner by the late 2010s, with a few even reporting surpluses. But the pandemic was a turning point – tax revenues shrank while emergency spending soared, pushing almost every State back. Today, the picture is mixed. While some States appear comfortable, much of their stability rests on volatile sources such as lotteries, mining royalties or land sales.

India's States inhabit starkly different fiscal worlds, much like its diverse ethno-linguistic identities. Maharashtra raised nearly 70% of its receipts internally in 2022-23, while Arunachal Pradesh managed only 9%. Uttar Pradesh, despite a surplus, generated just 42% on its own, relying on Union transfers. In economic terms, this is referred to as a vertical imbalance – rich States fund themselves, while poorer ones lean on Delhi.

Kerala's lottery industry earned nearly ₹12,000 crore in 2022-23; Odisha drew 90% of its non-tax income from mining royalties; and Telangana sold land worth ₹9,800 crore. However, lotteries hinge on sales, royalties on global prices, and land can't be sold twice.

Gross debt borrowings

Let's analyse the numbers from the CAG's decadal analysis report. When States spend more than they earn, they tend to borrow more. They finance that deficit mainly through loans or bonds that must be repaid with interest. The CAG, through its audited State Finances reports, brings us a consolidated national picture, while the RBI's State Finances: A Study of Budgets report provides a consistent framework for comparison. Taken together, these sources show that borrowing patterns between 2016-17 and

2022-23 have diverged sharply in India.

Table 1 deals with States such as Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh and Goa. Andhra Pradesh tripled its borrowings to ₹1.86 lakh crore, while Bihar doubled it, making debt a routine tool even for poorer States. By contrast, Goa kept a tight lid on borrowings, standing out as a rare conservative. Yet the liabilities data shows the weight of these choices: Andhra Pradesh's debt load swelled to 35% of its Gross State Domestic Product (GSDP) by 2023, and Bihar's hovered around 39%, among the highest in India. Assam's rapid borrowing was cushioned by growth, with liabilities easing slightly to 22% of GSDP, while Goa stayed at 27%, still high for a small State.

Table 2 deals with Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, and Madhya Pradesh. Here, borrowings rose in a measured but persistent way. Haryana jumped from ₹28,170 crore in 2016-17 to ₹80,649 crore in 2022-23, nearly tripling its borrowings despite being one of the richer States; its liabilities also climbed to about 31% of GSDP. Gujarat moved gradually upward, from ₹27,668 crore to ₹52,333 crore, while keeping its debt burden steady near 19-20% of GSDP. Madhya Pradesh also almost doubled its borrowings, from ₹29,847 crore to ₹58,867 crore, with liabilities rising to around 29%. The pandemic brought volatility. Karnataka's borrowings spiked to ₹84,828 crore in 2020-21, before being cut back to ₹44,549 crore; even after retrenchment, its liabilities stood close to 28% of GSDP.

Kerala peaked at ₹69,735 crore and later eased to ₹54,007 crore, though its debt burden stayed stubbornly high, at roughly 37% of GSDP. Smaller States remained modest – Himachal Pradesh's liabilities reached almost 48% of its GSDP, while Jharkhand's borrowings hovered between ₹7,000-₹13,500 crore with a steadier load of 27% of GSDP.

Table 3 deals with Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, and Punjab. This cluster highlights extremes. Maharashtra borrowings bulged from a low of ₹26,025 crore in 2018-19 to a surge of ₹1,18,516 crore in 2020-21, before moderating to ₹94,702 crore in 2022-23. However, its large economy kept the debt burden contained at around 20% of GSDP. Punjab remained persistently high, with borrowings ranging between ₹83,627 crore in 2016-17 and ₹89,544 crore in 2022-23; its liabilities climbed to about 45% of GSDP, showing chronic stress. Odisha bucked the trend, cutting borrowings from ₹11,223 crore to just ₹5,347 crore thanks to mining windfalls, and its liabilities fell to nearly 15% of GSDP, the lowest in India.

Manipur's borrowings grew from ₹1,551 crore to ₹11,116 crore; Meghalaya from ₹1,210 crore to ₹6,221 crore; Mizoram from ₹756 crore to ₹4,019 crore; and Nagaland from ₹5,444 crore to ₹7,159 crore. Though small in absolute numbers, these States carry some of the heaviest burdens, with liabilities ranging from about 40-60% of GSDP, marking rising fiscal dependence.

Table 4 showcases Rajasthan, Sikkim,

Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal. Rajasthan and Tamil Nadu emerged as heavy borrowers. Rajasthan quadrupled its borrowings, from ₹43,889 crore in 2016-17 to ₹1,60,565 crore in 2022-23, one of the steepest climbs nationwide, and its liabilities climbed to about 40% of GSDP. Tamil Nadu moved steadily upward from ₹66,143 crore to ₹1,01,062 crore, while its debt ratio rose to around 33%. Telangana surged from ₹44,819 crore to ₹1,26,884 crore, though strong growth kept its liabilities moderate at about 28%.

West Bengal showed moderate growth, from ₹37,524 crore to ₹70,243 crore, with liabilities remaining high at 37% of GSDP. In contrast, Uttar Pradesh slightly reduced borrowings, from ₹67,685 crore in 2016-17 to ₹66,847 crore in 2022-23, holding its liabilities steady at about 31%. Uttarakhand's borrowings also dipped from ₹10,592 crore to ₹9,431 crore, but liabilities were still over 32% of GSDP, while Tripura shrank from ₹1,140 crore to just ₹877 crore but carried a debt load above 30%. Sikkim remained marginal throughout, under ₹2,100 crore, though its debt stood at about 24% of GSDP.

Borrowings spiked everywhere during the pandemic. But what happened afterwards differed: some States like Andhra Pradesh, Rajasthan, and Telangana kept increasing their borrowings; Karnataka, Kerala, and Maharashtra cut back; and a few like Odisha, Uttar Pradesh, and Tripura reduced their borrowings even further, revealing very different fiscal strategies.

The welfare paradox

While some States show surpluses, in reality, they lean heavily on central transfers, off-budget loans, and delayed GST compensation. A lot of these States aren't sufficiently spending on welfare priorities and so any reported surplus may have accounting gains without developmental gains. Also, States like Punjab wrestle with chronic debt; Kerala relies on volatile revenues from lotteries; while Andhra Pradesh and Uttar Pradesh, through free power and farm waivers, see their costs deferred into the opaque machinery of guarantees and special purpose vehicles.

Corporate tax cuts, GST cesses, and rebranded social spending mask the true burden, leaving fiscal prudence a mirage. With the recent GST rejig and a higher fiscal revenue loss expected, one can hardly know its broader impact on fiscal spending by States on their already frugal welfare budgets. Yet, within this fragility, welfare schemes in some centralised funding schemes have proliferated: PM-KISAN deposits, Ujjwala cylinders, and Ayushman Bharat cards circulate like tokens of political theatre in projecting the ruling dispensation and its leader as the face of India's welfare populist base.

It is precisely this tension, of a State that spends lavishly while its revenues strain, that frames India's current welfare paradox. The nation has constructed one of the largest welfare states in the world while sustaining one of the thinnest fiscal bases among middle-income economies while being excessively dependent on borrowings. The paradox reflects a nation-state projecting extraordinary promise, with constrained and inhibitive fiscal capacity, where, a spectacle of care is built on the brink of fiscal scarcity.

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How much are States borrowing?

The CAG's decadal analysis report shows us that the pandemic spiked the borrowing

TABLE 1: State-wise gross borrowing trends (Public Debt Receipts), 2016-17 to 2022-23

State	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Andhra Pradesh	59,923	74,063	97,980	1,12,428	1,61,975	1,59,610	1,86,024
Arunachal Pradesh	1,015	1,767	1,205	1,791	1,516	1,483	2,480
Assam	3,902	8,447	11,755	14,250	17,940	16,670	28,270
Bihar	21,577	13,169	18,668	29,145	35,915	40,445	48,284
Chhattisgarh	5,480	9,652	14,370	19,588	21,582	15,098	10,639
Goa	3,304	3,161	4,989	3,812	7,655	5,160	2,628

TABLE 2

State	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Gujarat	27,668	26,953	43,146	43,491	58,857	46,968	52,333
Haryana	28,170	21,490	34,265	44,432	53,817	55,106	80,649
Himachal Pradesh	8,603	5,600	6,427	10,847	16,749	9,335	22,372
Jharkhand	7,081	8,137	7,803	9,593	13,547	9,840	9,142
Karnataka	31,156	25,122	41,914	50,459	84,528	80,641	44,549
Kerala	23,858	30,234	33,446	60,407	69,735	64,932	54,007
Madhya Pradesh	29,847	21,892	32,497	34,364	65,171	46,285	58,867

TABLE 3

State	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Maharashtra	48,336	49,670	26,025	57,153	1,18,516	90,587	94,702
Manipur	1,551	1,296	3,927	6,314	9,334	12,652	11,116
Meghalaya	1,210	1,225	1,325	1,496	2,442	4,020	6,221
Mizoram	756	894	134	1,148	2,611	4,560	4,019
Nagaland	5,444	5,141	2,907	7,870	11,435	8,709	7,159
Odisha	11,223	12,862	10,003	14,679	20,318	12,780	5,347
Punjab	83,627	45,999	52,098	54,776	63,695	41,175	89,544

TABLE 4

State	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Rajasthan	43,889	28,557	37,847	46,174	89,964	1,01,363	1,60,565
Sikkim	783	1,053	1,145	833	1,565	1,883	2,037
Tamil Nadu	66,143	45,722	47,936	66,774	1,02,867	1,04,485	1,01,062
Telangana	44,819	49,153	50,962	75,533	1,16,586	1,19,053	1,26,884
Tripura	1,140	1,333	1,708	3,258	2,848	1,047	877
Uttar Pradesh	67,685	47,417	51,595	73,809	86,859	75,751	66,847
Uttarakhand	10,592	13,457	15,448	13,113	15,135	7,918	9,431
West Bengal	37,524	45,744	70,197	75,699	75,429	77,581	70,243

* Gross Public Debt Receipts (₹ crore)   Source: CAG, (2025), State finances 2022–23. RBI, (2025), State finances: A study of budgets, 2025

THE GIST

▼
India's States inhabit starkly different fiscal worlds, much like its diverse ethno-linguistic identities. Maharashtra raised nearly 70% of its receipts internally in 2022-23, while Arunachal Pradesh managed only 9%. Uttar Pradesh, despite a surplus, generated just 42% on its own, relying on Union transfers.

▼
While some States show surpluses, in reality, they lean heavily on central transfers, off-budget loans, and delayed GST compensation. A lot of these States aren't sufficiently spending on welfare priorities.

▼
Manipur's borrowings grew from ₹1,551 crore to ₹11,116 crore; Meghalaya from ₹1,210 crore to ₹6,221 crore; Mizoram from ₹756 crore to ₹4,019 crore; and Nagaland from ₹5,444 crore to ₹7,159 crore. Though small in absolute numbers, these States carry some of the heaviest burdens.

Context

- In the 2010s, many States achieved stronger fiscal health through reforms, tax collection efficiency, and high growth.
- Pandemic disrupted this: **revenues shrank, expenditures soared**, and borrowing increased.
- CAG's latest decadal report highlighted Uttar Pradesh's **₹37,000 crore surplus**, but the real story is far more nuanced.
- India's States collectively manage **budgets larger than many countries** and spend more than the Union government on welfare and health — raising questions about sustainability.

Key Issues in States' Fiscal Health

Uneven Revenue Capacity

- Maharashtra → 70% of receipts from internal resources (2022-23).
- Uttar Pradesh → only 42%, rest from Union transfers.
- Arunachal Pradesh → just 9%.
- **Vertical Imbalance:** Rich States self-fund; poorer States depend on Delhi.

Volatile Non-Tax Revenues

- Kerala → lotteries (₹12,000 crore).
- Odisha → mining royalties (90% of non-tax income).
- Telangana → land sales (₹9,800 crore).
- All highly **uncertain & unsustainable**.

Rising Borrowings & Debt

- Pandemic triggered spike in State borrowings.
- Andhra Pradesh & Bihar → sharp increases, debt at **35–39% of GSDP**.
- Goa conservative (27%).
- Gujarat stable (~20%), Kerala persistently high (~37%), Punjab stressed (~45%).

- Small NE States (Manipur, Mizoram, Nagaland, Meghalaya) → liabilities **40–60% of GSDP**.
- Odisha reduced borrowings to **15% of GSDP** (best performer).

Welfare Paradox

- Surpluses often reflect **Union transfers & accounting gains**, not fiscal prudence.
- Populist welfare schemes (free power, farm loan waivers, subsidies) → deferred costs.
- Off-budget borrowings, GST compensation delays, and corporate tax cuts → masked deficits.
- Result: **lavish welfare promises but fragile fiscal base**.

Implications

- **For Development:** Fiscal stress affects investments in health, education, infrastructure.
- **For Federalism:** Reliance on Union transfers increases centralisation.
- **For Stability:** Rising debt burdens → crowding out of future welfare & capex.
- **For Climate & Growth:** Resource dependence (mining, land sales) risks ecological and fiscal sustainability.

Way Forward

- **Broaden Revenue Base**: Improve GST efficiency, strengthen local tax collection.
- **Cap Volatile Revenues**: Reduce reliance on lotteries/land/mining.
- **Sustainable Borrowing**: Link debt to productive capital expenditure.
- **Reform Fiscal Transfers**: More predictable, transparent Union-State transfers.
- **Prioritise Capex over Populism**: Focus on health, infra, education over short-term freebies.
- **Improve Fiscal Discipline**: Transparent reporting, limit off-budget borrowings.

Astrosat, India's first space observatory, completes a decade among the stars

The Hindu Bureau
BENGALURU

India's first dedicated space astronomy observatory, AstroSat, completed a decade of operations on Sunday.

Ten years ago, on September 28, 2015, the PSLV-C30 (XL) rocket carrying AstroSat lifted off from the Satish Dhawan Space Centre in Sriharikota. Though the designed mission life of AstroSat was five years, it continues to provide valuable data.

In the last decade, the multi-wavelength space observatory with five payloads aboard has made major interesting discoveries.

Commemorating the milestone in a post on X, the Indian Space Research Organisation said, "On this day 10 years ago, AstroSat, India's first multi wave-

Keen explorer: Though the designed mission life of AstroSat was five years, it continues to provide valuable data.

length astronomy observatory was launched by ISRO. From black holes to neutron stars, from the nearest star Proxima Centauri to first time detection of FUV photons from galaxies 9.3 billion light years away, AstroSat enabled ground-breaking insights across the electromagnetic spectrum from UV/Visible to

high energy X-rays. Congratulating AstroSat for a successful decade and wishing many more years of exciting results and discoveries."

Five payloads

AstroSat was designed to observe the universe in the visible, ultraviolet, low and high energy X-ray regions

of the electromagnetic spectrum simultaneously with the help of its five payloads.

The five payloads are the Ultra Violet Imaging Telescope (UVIT), Large Area X-ray Proportional Counter (LAXPC), Cadmium-Zinc-Telluride Imager (CZTI), Soft X-ray Telescope (SXT), and the Scanning Sky Monitor (SSM).

Collaborative effort

Astrosat was realised by the ISRO with the participation of all major astronomy institutions, including the Inter University Centre for Astronomy and Astrophysics, Tata Institute of Fundamental Research, Indian Institute of Astrophysics, and the Raman Research Institute (RRI), some universities of India and two institutions from Canada and the U.K.

Context

- On **September 28, 2015**, ISRO launched **AstroSat**, India's first dedicated multi-wavelength space observatory, aboard **PSLV-C30 (XL)** from Sriharikota.
- Designed for a mission life of **5 years**, it has successfully completed **10 years** of operation in 2025, continuing to deliver valuable astronomical data.
- In a decade, AstroSat has contributed to major discoveries, including observations of **black holes, neutron stars, Proxima Centauri**, and the **first detection of far-ultraviolet (FUV) photons from galaxies 9.3 billion light years away**.
- ISRO commemorated the milestone, noting AstroSat's role in expanding India's space-based science capabilities.

About AstroSat

Purpose

- India's first **multi-wavelength space observatory**.
- Designed to observe the universe in **visible, ultraviolet (UV), low-energy X-ray, and high-energy X-ray** bands **simultaneously**.
- Enables study of celestial sources like stars, galaxies, black holes, and neutron stars.

Key Payloads (5 Instruments)

- **UVIT (Ultraviolet Imaging Telescope):** Observes the sky in visible and UV wavelengths.
- **LAXPC (Large Area X-ray Proportional Counter):** Studies X-ray timing and spectra of cosmic sources.
- **CZTI (Cadmium–Zinc–Telluride Imager):** Detects hard X-rays; useful in studying pulsars, black holes, gamma-ray bursts.
- **SXT (Soft X-ray Telescope):** Studies soft X-ray emissions from celestial bodies.
- **SSM (Scanning Sky Monitor):** Monitors X-ray sky for transient phenomena.

Collaborations

- Jointly realised by **ISRO** with participation from leading Indian research institutions:
    - Inter University Centre for Astronomy and Astrophysics (IUCAA)
    - Tata Institute of Fundamental Research (TIFR)
    - Indian Institute of Astrophysics (IIA)
    - Raman Research Institute (RRI)
- International collaboration: institutions from **Canada** and the **U.K.**

Significance

- First Indian observatory enabling **simultaneous multi-band space observations**.
- Strengthens India's capabilities in **astrophysics and space science research**.
- Complements global missions like NASA's Hubble or Chandra, offering **cost-effective, indigenous expertise**.
- Demonstrates India's scientific maturity beyond Earth-observation and planetary missions.

Previous Year Questions

UPSC Prelims 2016

With reference to 'Astrosat', the astronomical observatory launched by India, which of the following statements is/are correct?

1. **Other than USA and Russia, India is the only country to have launched a similar observatory into space.**

2. **Astrosat is a 2000 kg satellite placed in an orbit at 1650 km above the surface of the Earth.**

Select the correct answer using the code given below.

a) **1 only**

b) **2 only**

c) **Both 1 and 2**

d) **Neither 1 nor 2**

Ans d