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RBI DEPR PHASE 2
PAPER 2

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PAPER 2 — QUANTITATIVE METHODS & INDIAN ECONOMY

Instructions

Total marks: 100. Time: 3 hours.

This paper has TWO sections — Section A (Quantitative Methods) and Section B (Indian Economy), each with 4 questions.

Attempt any FIVE questions in all, with a MINIMUM of TWO questions from each section.

Each question carries 20 marks. Show all steps of calculation clearly.

SECTION A — QUANTITATIVE METHODS

Q1. [Total: 20 marks]

(a) Differentiate the following function with respect to x: $Y = (5/\sqrt{3})\cdot(4x^2 - 8x) + e^{(5x^2 - 3x)}$ [8]

(b) The cumulative investment in a project t years from now is given by $I(t) = 220(1 - e^{-0.15t})$ (in $ million), where $220 million is the total sanctioned outlay. (i) Find the level of investment achieved and its instantaneous rate of growth (dI/dt) at t = 5 years. (ii) Find the time period t at which cumulative investment of $200 million will be achieved by the economy. [12]

Answer:

(a) Note: This function consists of two additive terms: a polynomial term scaled by a constant, and an exponential term with a quadratic exponent. We differentiate each term separately using the sum rule, applying the power rule to the first term and the chain rule to the second (since the exponent itself is a function of x).

Step 1: Differentiate the First Term

First term: $(5/\sqrt{3})\cdot(4x^2 - 8x)$

Since $5/\sqrt{3}$ is a constant multiplier, we differentiate $(4x^2 - 8x)$ with respect to x and multiply by the constant:

$d/dx\ (4x^2 - 8x) = 8x - 8$

So the derivative of the first term = $(5/\sqrt{3})\cdot(8x - 8)$

Step 2: Differentiate the Second Term Using the Chain Rule

Second term: e^(5x² − 3x)

For a function of the form e^u, where $u = 5x^2 - 3x$, the chain rule gives:

d/dx [e^u] = e^u · (du/dx)

Here, $du/dx = d/dx(5x^2 - 3x) = 10x - 3$

So the derivative of the second term = $(10x - 3)\cdot e^{(5x^2 - 3x)}$

Step 3: Combine Both Derivatives

$dY/dx = (5/\sqrt{3})\cdot(8x - 8) + (10x - 3)\cdot e^{(5x^2 - 3x)}$

Step 4: Simplify the First Term (Rationalising the Denominator)

$(5/\sqrt{3})\cdot(8x - 8) = (40x - 40)/\sqrt{3}$

Rationalising by multiplying numerator and denominator by √3:

= [40√3·(x − 1)] / 3

Final Answer

dY/dx = [40√3(x − 1)] / 3 + (10x − 3)·e^(5x² − 3x)

(Equivalently, this may be left in the unrationalised form: dY/dx = (40/√3)(x − 1) + (10x − 3)·e^(5x² − 3x) — both are correct; rationalising is a matter of presentation convention.)

Conclusion

The derivative combines a simple linear term (arising from the quadratic polynomial component) with an exponential term whose coefficient (10x − 3) reflects the chain-rule adjustment for the quadratic exponent — a structure commonly encountered in economic applications such as marginal cost or marginal revenue functions that combine polynomial and exponential (e.g., compound-growth-related) components.

(b) This is a standard exponential approach-to-saturation function, commonly used to model cumulative investment that grows over time but asymptotically approaches a fixed ceiling — here, the total sanctioned outlay of $220 million (since as t → ∞, e^(−0.15t) → 0, so I(t) → 220). We are asked to evaluate the level and instantaneous growth rate of investment at a specific point in time, and separately to find the time at which a target cumulative investment level is reached.

(i) Level of Investment and Instantaneous Rate of Growth at t = 5 years

Step 1: Calculate I(5) — the cumulative investment level

I(t) = 220(1 − e^(−0.15t))

At t = 5:
I(5) = 220(1 − e^(−0.15×5)) = 220(1 − e^(−0.75))

Using e^(−0.75) ≈ 0.4724:

I(5) = 220(1 − 0.4724) = 220 × 0.5276

I(5) ≈ $116.08 million

Step 2: Derive dI/dt — the instantaneous rate of growth of investment

Differentiating I(t) = 220(1 − e^(−0.15t)) with respect to t, using the chain rule (the derivative of e^(−0.15t) is −0.15·e^(−0.15t)):

dI/dt = 220 × [−(−0.15)·e^(−0.15t)] = 220 × 0.15 × e^(−0.15t) = 33·e^(−0.15t)

Step 3: Evaluate dI/dt at t = 5

$dI/dt\,|_{t=5} = 33 \times e^{(-0.75)} = 33 \times 0.4724$

$dI/dt \approx \$15.59$ million per year

Interpretation: At the 5-year mark, the project has achieved a cumulative investment of approximately \$116.08 million (about 52.8% of the total sanctioned outlay of \$220 million), and at that instant, investment is flowing in at a rate of approximately \$15.59 million per year. Notably, this instantaneous growth rate is considerably lower than what it would have been near t = 0 (where dI/dt would equal $33 \times e^0 = \$33$ million/year) — reflecting the diminishing-growth, saturation-type nature of the investment path as it approaches the \$220 million ceiling.

(ii) Time Period at Which Cumulative Investment Reaches \$200 Million

We need to solve for t such that I(t) = 200:

$200 = 220(1 - e^{(-0.15t)})$

Step 1: Isolate the exponential term

$200/220 = 1 - e^{(-0.15t)}$

$0.9091 = 1 - e^{(-0.15t)}$

$e^{(-0.15t)} = 1 - 0.9091 = 0.0909$

Step 2: Take the natural logarithm of both sides

$\ln(e^{(-0.15t)}) = \ln(0.0909)$

$-0.15t = \ln(0.0909)$

Note that $0.0909 \approx 1/11$, so $\ln(0.0909) = -\ln(11) \approx -2.3979$

$-0.15t = -2.3979$

Step 3: Solve for t

$t = 2.3979 / 0.15$

t ≈ 15.99 years, i.e., approximately 16 years

Interpretation: It will take approximately 16 years from the start of the project for cumulative investment to reach \$200 million — i.e., roughly 91% of the total \$220 million sanctioned outlay. Consistent with the saturation nature of the function, reaching this near-complete level of investment takes disproportionately longer than the earlier 5-year period covered in part (i) — the project achieved just over half its total outlay (\$116 million) within the first 5 years, but requires roughly three times as long (about 16 years) to reach \$200 million, illustrating how the rate of new investment progressively slows as the sanctioned ceiling is approached (consistent with the declining dI/dt derived above).

Conclusion

This investment function exemplifies the common "exponential decay toward a ceiling" pattern seen in capital expenditure schedules, technology diffusion, and project disbursement profiles — rapid initial investment that gradually tapers off as the sanctioned outlay is approached. Understanding both the instantaneous rate of investment (via the derivative) and the time required to reach specific milestones (via solving the level equation) is valuable for project appraisal, cash-flow planning, and monitoring whether actual disbursement is tracking the originally projected schedule.

Q2. [Total: 20 marks]

(a) (i) Define the Marginal Physical Product (MPP) of a factor of production and briefly explain its economic significance. (ii) For the production function $Q = L^2K^2$, derive the Marginal Physical Product of Labour (MPPL) and of Capital (MPPK). (iii) Hence examine whether the function exhibits constant, increasing or decreasing returns to scale. [8]

(b) A firm wishes to minimise its total cost $C = wL + rK$, subject to producing a target output level $\bar{Q}$ given by the production function $Q = L^2K^2$. Using the Lagrangian multiplier method, set up the constrained optimisation problem and derive the optimal (cost-minimising) input ratio K/L in terms of the factor prices w and r. [12]

Answer:

(a) The Marginal Physical Product (MPP) of a factor of production is one of the most fundamental concepts in production theory, describing how additional units of a single input translate into additional output. Separately, "returns to scale" describes how output responds when all inputs are increased together in the same proportion — a distinct concept, as emphasised in an earlier answer in this set. This part first defines MPP conceptually, then derives it for a specific production function, and finally uses that derivation to classify the function's returns to scale.

(i) Definition and Economic Significance of Marginal Physical Product

Definition: The Marginal Physical Product of a factor is the additional physical output produced by employing one more unit of that factor, holding all other factors constant. Formally, for a production function $Q = f(L, K)$, the MPP of labour is the partial derivative of output with respect to labour ($\partial Q/\partial L$), and similarly the MPP of capital is $\partial Q/\partial K$.

Economic Significance:

1. **Basis for factor demand: A profit-maximising firm operating in a competitive market hires a factor up to the point where the value of its marginal product (Price × MPP) equals the factor's price (wage rate for labour, rental rate for capital) — MPP is thus the direct analytical foundation of the firm's demand curve for inputs.**

2. **Reflects the Law of Diminishing Marginal Returns: In the short run, holding other factors fixed, MPP typically rises initially and then falls as more of a single variable factor is added to a fixed factor — this diminishing MPP is what underlies the conventionally upward-sloping short-run marginal cost curve.**
3. **Determines factor income shares (in competitive markets): Under perfect competition, each factor is paid according to its marginal product, connecting MPP directly to the theory of functional income distribution (wages, rent, profit).**

(ii) Deriving MPPL and MPPK for $Q = L^2K^2$

Given the production function: $Q = L^2K^2$

MPPL — Marginal Physical Product of Labour

Holding K constant, differentiate Q with respect to L:

$MPPL = \partial Q/\partial L = 2L \cdot K^2$

MPPK — Marginal Physical Product of Capital

Holding L constant, differentiate Q with respect to K:

$MPPK = \partial Q/\partial K = 2L^2 \cdot K$

(iii) Examining Returns to Scale

To test returns to scale, we scale both inputs by a common factor t (t > 1) and observe how output responds:

New output $= (tL)^2 \times (tK)^2 = t^2L^2 \times t^2K^2 = t^4 \times (L^2K^2) = t^4 \times Q$

Interpretation: When both inputs are scaled up by a factor t, output scales up by a factor of t^4 — a much larger proportional increase than the scaling factor itself.

Illustrative Example: Suppose we double both labour and capital (t = 2). Output rises by a factor of $2^4 = 16$ — i.e., output increases 16-fold in response to only a doubling of inputs, far more than proportionately.

Since output increases more than proportionately relative to the increase in inputs ($t^4 > t$ for any $t > 1$), this production function exhibits increasing returns to scale. Formally, this can also be verified by checking the sum of the exponents in the Cobb-Douglas-type function $Q = L^2K^2$: the exponents (2 + 2 = 4) sum to a value greater than 1, which is the standard test for increasing returns to scale in a Cobb-Douglas production function (sum = 1 implies CRS, as verified earlier in Q2(b)(ii) of the previous set; sum < 1 implies decreasing returns; sum > 1, as here, implies increasing returns).

Conclusion

This production function displays increasing returns to scale, meaning the firm becomes progressively more efficient as it expands its scale of operation — a pattern often associated with industries characterised by strong specialisation gains, network effects, or high fixed-cost/large-scale technologies (e.g., large-scale manufacturing, telecommunications infrastructure), where doubling plant size and workforce can more than double output due to gains from indivisibilities and specialisation that are not available at smaller scales.

(b) A firm seeking to produce a specified target level of output at the lowest possible cost faces a constrained optimisation problem: minimise total cost (a linear function of the two inputs) subject to the production function constraint that output must equal the target level. The Lagrangian multiplier method is the standard technique for solving this type of problem, and yields the well-known result that cost minimisation requires the firm to choose inputs such that the ratio of marginal products equals the ratio of factor prices.

Step 1: Setting Up the Constrained Optimisation Problem

Objective: Minimise total cost: $C = wL + rK$
where w is the wage rate (price of labour) and r is the rental rate of capital.

Constraint: Achieve a target output level $\bar{Q}$, given by the production function: $L^2K^2 = \bar{Q}$

Step 2: Forming the Lagrangian Function

$Z = wL + rK + \lambda(\bar{Q} - L^2K^2)$

where λ (the Lagrange multiplier) represents the shadow price of the output constraint — economically, it measures the marginal cost of producing one additional unit of output at the optimum.

Step 3: Deriving the First-Order Conditions

Taking partial derivatives of Z with respect to L, K, and λ, and setting each equal to zero:

$\partial Z/\partial L = w - \lambda(2LK^2) = 0 \rightarrow w = 2\lambda LK^2$ ... (Condition 1)

$\partial Z/\partial K = r - \lambda(2L^2K) = 0 \rightarrow r = 2\lambda L^2K$ ... (Condition 2)

$\partial Z/\partial \lambda = \bar{Q} - L^2K^2 = 0 \rightarrow L^2K^2 = \bar{Q}$ (recovers the original constraint) ... (Condition 3)

Step 4: Deriving the Optimal Input Ratio

Divide Condition 1 by Condition 2 to eliminate the Lagrange multiplier λ:

$w/r = (2\lambda LK^2) / (2\lambda L^2K)$

w/r = (LK²) / (L²K)

w/r = K/L

Therefore, the cost-minimising (optimal) capital-labour ratio is:

K/L = w/r

Step 5: Economic Interpretation of the Result

This result is a specific application of the general cost-minimisation rule: at the optimum, the Marginal Rate of Technical Substitution (MRTS) of labour for capital must equal the ratio of factor prices:

MRTS(L for K) = MPPL/MPPK = (2LK²)/(2L²K) = K/L

Setting this equal to the factor-price ratio w/r reproduces exactly the condition derived above: K/L = w/r.

Intuitive/Numerical Illustration: Suppose the wage rate w = ₹800 per unit of labour, and the rental rate of capital r = ₹400 per unit of capital. The optimal ratio is K/L = 800/400 = 2 — meaning the firm should employ twice as much capital as labour in its cost-minimising input combination. This makes clear economic sense: since labour is relatively more expensive than capital (w > r), the firm substitutes toward the relatively cheaper input (capital), using a capital-intensive combination. Conversely, if wages were to fall relative to the rental rate of capital (say, w = ₹300, r = ₹400), the optimal ratio K/L = 300/400 = 0.75 would fall correspondingly — the firm would shift toward a more labour-intensive combination, using less capital per unit of labour.

Note on the specific values of L and K: While K/L = w/r gives the optimal ratio, the specific levels of L and K required to produce the target output $\bar{Q}$ can be found by substituting this ratio back into the production constraint ($L^2K^2 = \bar{Q}$) — for instance, with K = (w/r)L, the constraint becomes $L^2 \times [(w/r)L]^2 = \bar{Q}$, i.e., $L^4(w/r)^2 = \bar{Q}$, which can be solved for the specific optimal L (and hence K) once numerical values of $\bar{Q}$, w, and r are supplied.

Conclusion

The Lagrangian method confirms the standard microeconomic result that cost-minimising firms equate the marginal rate of technical substitution between inputs to the ratio of their prices — here, yielding the clean result K/L = w/r for the specific production function $Q = L^2K^2$. This principle has direct real-world relevance: it explains why firms in economies with relatively high wage costs (e.g., advanced economies) tend to adopt more capital-intensive production techniques, while firms in labour-abundant, lower-wage economies (such as many labour-intensive manufacturing sectors in India) tend to optimally employ more labour-intensive techniques — a foundational insight for

understanding cross-country patterns of technology choice, industrial policy, and comparative advantage.

Q3. [Total: 20 marks]

Part (a): The following table gives Monthly Income (X) and Monthly Consumption Expenditure (Y), in Rs '000, for a sample of 10 households:

Household	1	2	3	4	5	6	7	8	9	10
Income (X)	20	25	30	35	40	45	50	55	60	65
Expenditure (Y)	18	21	24	27	29	32	35	37	40	42

(a) Estimate the linear regression equation $Y = a + bX$ by the method of Ordinary Least Squares (OLS). Compute the coefficient of determination (R^2) and interpret the estimated slope coefficient b as the Marginal Propensity to Consume (MPC). [12]

(b) If the estimated slope coefficient is $\hat{b} = 0.78$ with standard error $se(\hat{b}) = 0.09$, test at the 5% level of significance whether income has a statistically significant effect on consumption expenditure. (t-critical at 8 d.f., 5% level, two-tailed = 2.306) [8]

Answer:

(a) Ordinary Least Squares (OLS) regression estimates the linear relationship between income (X, the independent variable) and consumption expenditure (Y, the dependent variable) by finding the line $Y = a + bX$ that minimises the sum of squared deviations between actual and predicted values of Y. The estimated slope coefficient (b) has direct economic meaning in this context — it represents the Marginal Propensity to Consume (MPC), a central concept in Keynesian consumption theory.

Step 1: Compute the Means

Sum of X = 425; Mean of X ($\bar{X}$) = 425/10 = 42.5
Sum of Y = 305; Mean of Y ($\bar{Y}$) = 305/10 = 30.5

Step 2: Set Up the Deviation Table

Using deviations from the mean: $x = (X - \bar{X})$, $y = (Y - \bar{Y})$

Household	X	Y	x = X−42.5	y = Y−30.5	xy	x^2	y^2
1	20	18	−22.5	−12.5	281.25	506.25	156.25
2	25	21	−17.5	−9.5	166.25	306.25	90.25
3	30	24	−12.5	−6.5	81.25	156.25	42.25
4	35	27	−7.5	−3.5	26.25	56.25	12.25
5	40	29	−2.5	−1.5	3.75	6.25	2.25
6	45	32	2.5	1.5	3.75	6.25	2.25
7	50	35	7.5	4.5	33.75	56.25	20.25
8	55	37	12.5	6.5	81.25	156.25	42.25
9	60	40	17.5	9.5	166.25	306.25	90.25
10	65	42	22.5	11.5	258.75	506.25	132.25
Total					1102.5	2062.5	590.5

Step 3: Compute the Slope Coefficient (b)

$b = \Sigma xy / \Sigma x^2 = 1102.5 / 2062.5$

$b = 0.5345$ (approx. 0.53)

Step 4: Compute the Intercept (a)

$a = \bar{Y} - b \cdot \bar{X} = 30.5 - (0.5345 \times 42.5) = 30.5 - 22.72$

$a = 7.78$ (approx.)

Step 5: The Estimated Regression Equation

$\hat{Y} = 7.78 + 0.535\ X$

Step 6: Compute the Coefficient of Determination (R^2)

$R^2 = (\Sigma xy)^2 / (\Sigma x^2 \times \Sigma y^2)$

$R^2 = (1102.5)^2 / (2062.5 \times 590.5)$

$R^2 = 1,215,506.25 / 1,217,906.25$

R^2 = 0.998 (approx.)

Interpretation of the Slope Coefficient (b) as the Marginal Propensity to Consume

The estimated slope coefficient, b = 0.535, means that for every ₹1,000 increase in monthly household income, monthly consumption expenditure is estimated to rise by ₹535. In Keynesian terms, this is the Marginal Propensity to Consume (MPC) = 0.535 — out of every additional rupee of income, approximately 53.5 paise is spent on consumption, while the remaining 46.5 paise is saved (Marginal Propensity to Save, MPS = 1 − 0.535 = 0.465). This estimate is economically plausible, satisfying the theoretical requirement that 0 < MPC < 1.

The intercept, a = 7.78, represents estimated autonomous consumption — the level of consumption expenditure (₹7,780) that would occur even at zero income, reflecting dissaving/borrowing to sustain a minimum subsistence level of consumption, consistent with the standard Keynesian consumption function.

Interpretation of R^2

R^2 = 0.998 indicates that 99.8% of the variation in household consumption expenditure is explained by variation in household income, with only about 0.2% of the variation attributable to other unmeasured factors or random disturbance. This is an extremely strong goodness of fit, reflecting the near-perfectly linear relationship visible in the sample data, and indicates income is an overwhelmingly dominant explanatory factor for consumption in this sample.

Conclusion

The estimated regression confirms a strong, economically sensible positive relationship between income and consumption, with an MPC of 0.535 consistent with Keynesian theory, and an exceptionally high R^2 of 0.998 indicating income alone explains almost all the variation in household consumption expenditure within this sample.

(b) Having estimated the slope coefficient, we now test whether income has a statistically significant effect on consumption expenditure — that is, whether the estimated relationship reflects a genuine underlying association rather than merely arising by chance in this particular sample. (Note: this part of the question supplies its own values for the estimated slope and standard error — $\hat{b}$ = 0.78, se($\hat{b}$) = 0.09 — for the purpose of this hypothesis test, which we use directly as instructed below.)

Step 1: State the Hypotheses

- **Null Hypothesis (H_0): b = 0 (Income has no significant effect on consumption expenditure)**
- **Alternative Hypothesis (H_1): b ≠ 0 (Income has a significant effect on consumption expenditure)**

This is a two-tailed test, since we are testing for any significant relationship, positive or negative.

Step 2: Compute the t-statistic

$t = \hat{b} / se(\hat{b}) = 0.78 / 0.09$

$t = 8.667$ (approx.)

Step 3: Determine Degrees of Freedom and Critical Value

Degrees of freedom = $n - 2 = 10 - 2 = 8$ (consistent with the value given in the question)

Critical value at 5% level of significance, two-tailed, 8 d.f.: t-critical = 2.306

Step 4: Decision Rule and Comparison

Decision rule: Reject H_0 if |t-calculated| > t-critical

|t-calculated| = 8.667 > t-critical = 2.306

Step 5: Conclusion of the Test

Since the calculated t-statistic (8.667) far exceeds the critical value (2.306), we reject the null hypothesis at the 5% level of significance.

Conclusion

There is strong statistical evidence that income has a statistically significant effect on consumption expenditure. The t-value of 8.667 is well beyond the critical threshold, meaning this result would in fact be significant even at much stricter significance levels (e.g., 1%), and the probability of observing such a large t-statistic purely by chance if the true population slope were actually zero is negligible. This confirms that the positive relationship between income and consumption is a genuine, reliable feature of the underlying data-generating process rather than a sample-specific coincidence — supporting the economic validity of using this regression to estimate the Marginal Propensity to Consume for policy or forecasting purposes.

Q4. [Total: 20 marks]

(a) In a regression model with n = 25 observations and k = 4 explanatory variables, the Total Sum of Squares (TSS) = 850 and the Residual Sum of Squares (RSS) = 150. (i) Compute the Explained Sum of Squares (ESS) and R^2. (ii) Conduct an F-test for the overall significance of the regression at the 5% level of significance, given F-critical (4, 20 d.f., 5%) = 2.87. [7]

(b) Solve the following system of national-income-determination equations for the equilibrium values of income (Y) and the interest rate (r) using the matrix inversion method: Y + 2000r = 1000 Y − 4000r = 600 [7]

(c) Distinguish between supervised and unsupervised machine learning, and explain how these approaches differ from traditional parametric statistical tests. Briefly compare AI/ML-based econometric modelling with traditional econometric methods. [6]

Answer:

(a) The F-test for overall significance evaluates whether the regression model, taken as a whole, explains a statistically significant proportion of the variation in the dependent variable — i.e., whether the explanatory variables jointly have genuine predictive power, as opposed to appearing to fit the data merely by chance.

(i) Computing ESS and R^2

Given: n = 25, k = 4 (explanatory variables), TSS = 850, RSS = 150

Explained Sum of Squares (ESS):

ESS = TSS − RSS = 850 − 150

ESS = 700

Coefficient of Determination (R^2):

R^2 = ESS / TSS = 700 / 850

R^2 = 0.8235 (approx. 82.35%)

Interpretation: Approximately 82.35% of the total variation in the dependent variable is explained jointly by the four explanatory variables included in the model, while the remaining 17.65% is attributable to factors outside the model or random disturbance — indicating a strong overall fit.

(ii) F-Test for Overall Significance

Hypotheses:

- **H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (none of the explanatory variables jointly explain any variation in Y — the regression has no explanatory power)**
- **H_1: At least one $\beta_i \neq 0$ (the regression, taken jointly, has genuine explanatory power)**

Test Statistic:

$F = [ESS / k] / [RSS / (n - k - 1)]$

Degrees of freedom: numerator = k = 4; denominator = n − k − 1 = 25 − 4 − 1 = 20 (consistent with the F-critical value given)

F = (700 / 4) / (150 / 20)

F = 175 / 7.5

F-calculated = 23.33

Decision Rule and Comparison

Decision rule: Reject H_0 if F-calculated > F-critical

F-calculated (23.33) > F-critical (2.87)

Conclusion

Since the calculated F-statistic (23.33) far exceeds the critical value (2.87) at the 5% level of significance with (4, 20) degrees of freedom, we reject the null hypothesis. This confirms that the regression model as a whole is statistically significant — the four explanatory variables, taken jointly, explain a genuinely significant proportion of the variation in the dependent variable, and this strong result ($R^2 = 0.82$, combined with a highly significant F-statistic) indicates the model has substantial and reliable explanatory power rather than being a chance artefact of this particular sample.

(b) This is a system of two linear equations in two unknowns (Y and r), representing a simplified national-income-determination model. As with the IS-LM system solved earlier, we express this in matrix form and solve using Cramer's Rule (equivalent to matrix inversion), then verify the result by direct substitution.

Step 1: Express the System in Matrix Form

Given:
Y + 2000r = 1000
Y − 4000r = 600

In matrix form, A·X = B:

A = [1 2000] X = [Y] B = [1000]
[1 −4000] [r] [600]

Step 2: Compute the Determinant of A

D = (1 × −4000) − (2000 × 1) = −4000 − 2000

D = −6000

Since D ≠ 0, a unique solution exists.

Step 3: Solve for Y (replace column 1 with B)

A_Y = [1000 2000]
[600 −4000]

det(A_Y) = (1000 × −4000) − (2000 × 600) = −4,000,000 − 1,200,000 = −5,200,000

Y* = det(A_Y) / D = −5,200,000 / −6000

Y = 866.67*

Step 4: Solve for r (replace column 2 with B)

A_r = [1 1000]
[1 600]

det(A_r) = (1 × 600) − (1000 × 1) = 600 − 1000 = −400

r* = det(A_r) / D = −400 / −6000

r = 0.0667 (i.e., approximately 1/15)*

Step 5: Verification by Direct Substitution

Y = 1000 − 2000(0.0667) = 1000 − 133.33 = 866.67
Y = 600 + 4000(0.0667) = 600 + 266.67 = 866.67

Both equations are satisfied, confirming the solution.

Conclusion: The equilibrium level of income is Y* = 866.67, and the equilibrium interest rate is r* = 0.0667 (approximately 6.67%) — the unique pair of values at which both underlying equations of this income-determination system are simultaneously satisfied.

(c) As economic research increasingly incorporates machine learning (ML) alongside traditional econometric techniques, it is important to understand both the internal distinction between the two major categories of ML (supervised and unsupervised) and the broader distinction between the ML paradigm as a whole and classical parametric statistical inference — a distinction of growing relevance to central banks and regulators (including the RBI) using ML for tasks such as inflation nowcasting, credit risk modelling, and fraud detection.

Supervised Learning

Supervised learning involves training a model on a labelled dataset — one where both the input variables (features) and the correct output/target value are known — so the algorithm learns a mapping from inputs to outputs that can then be used to predict outcomes for new, unseen data. Common techniques include linear/logistic regression, decision trees, random forests, and neural networks used for classification or regression tasks.

Example: Training a credit-scoring model on historical loan data where both borrower characteristics (income, credit history, employment) and the actual loan outcome (defaulted or not) are known, so the model can then predict default probability for new loan applicants.

Unsupervised Learning

Unsupervised learning works with unlabelled data — only the input features are available, with no known "correct" output — and the algorithm instead seeks to discover inherent patterns, groupings, or structure within the data itself. Common techniques include clustering (e.g., k-means) and dimensionality reduction (e.g., Principal Component Analysis).

Example: Segmenting bank customers into distinct behavioural clusters based on their transaction patterns, without any predefined labels for what those clusters should represent, to inform targeted product design or fraud-monitoring strategies.

How ML Differs from Traditional Parametric Statistical Tests

1. **Objective — prediction vs inference: Traditional parametric methods (e.g., OLS regression, as used in Q3 above) are primarily oriented toward causal/structural inference — estimating specific parameters (like the MPC) with associated hypothesis tests (t-tests, F-tests) grounded in an assumed underlying data-generating process. ML methods are typically oriented toward out-of-sample predictive accuracy, often without any pretence of estimating an interpretable "true" structural parameter.**

2. **Functional form assumptions: Parametric statistical models require the researcher to specify a particular functional form in advance (e.g., linearity, as in Y = a + bX). Many ML methods (random forests, neural networks, gradient boosting) are non-parametric or semi-parametric, flexibly learning complex, non-linear relationships directly from the data without requiring the researcher to pre-specify the functional form.**

3. **Handling of high-dimensional data: ML techniques are generally far better suited to datasets with a very large number of variables (high-dimensionality) relative to the number of observations, using regularisation techniques (e.g., Lasso, Ridge — as noted in the multicollinearity remedies discussed earlier) to manage this, whereas classical OLS-based inference becomes unreliable or infeasible when the number of variables approaches or exceeds the number of observations.**

4. **Interpretability vs black-box trade-off: Classical econometric coefficients (like the b = 0.535 MPC estimated in Q3) have direct, transparent economic interpretation and statistical significance testing. Many powerful ML models (deep neural networks, ensemble methods) sacrifice this interpretability in exchange for superior predictive performance — a "black-box" trade-off of growing concern in regulatory contexts requiring explainability (e.g., credit decisions under fair-lending regulations).**

Comparing AI/ML-Based Econometric Modelling with Traditional Econometrics

Basis	Traditional Econometrics	AI/ML-Based Modelling
Primary goal	Causal inference, hypothesis testing, structural parameter estimation	Predictive accuracy, pattern recognition
Functional form	Pre-specified (e.g., linear)	Flexible, learned from data
Statistical inference	Well-developed (t-tests, F-tests, confidence intervals)	Less standardised; inference tools still developing
Data requirements	Works well with moderate sample sizes	Often requires large datasets for good performance
Interpretability	High (transparent coefficients)	Often lower (black-box models), though "explainable AI" tools are improving this

Basis	Traditional Econometrics	AI/ML-Based Modelling
Typical central-bank use case	Estimating policy elasticities (e.g., interest-rate pass-through), structural macro models	Nowcasting GDP/inflation from high-frequency/alternative data, fraud detection, credit risk scoring

Conclusion

Supervised and unsupervised learning represent two fundamentally different problem structures within machine learning — prediction from labelled data versus pattern discovery in unlabelled data — and both differ from traditional parametric econometrics in prioritising predictive flexibility and performance over structural interpretability and formal hypothesis testing. In practice, institutions like the RBI increasingly use both paradigms complementarily: traditional econometric models remain the preferred tool for policy-relevant causal inference and communicable, interpretable results (such as the MPC estimate obtained via OLS in Q3), while ML techniques are increasingly deployed for high-frequency nowcasting, anomaly/fraud detection, and prediction tasks where capturing complex non-linear patterns in large, high-dimensional datasets outweighs the need for a fully interpretable structural model.

SECTION B — INDIAN ECONOMY

Q5. [Total: 20 marks]

(a) What is a Financial Stability Report (FSR)? Discuss the key parameters it covers and explain how banks conduct stress tests as part of the financial stability assessment framework. [10]

(b) What is meant by a Financial Health Index? Discuss its key sub-parameters/components, defining each briefly. Also comment on how measures of financial stress fit into this broader financial-stability assessment. [10]

Answer:

(a) The Financial Stability Report (FSR) is a biannual (half-yearly) publication of the Reserve Bank of India, released on behalf of the Sub-Committee of the Financial Stability and Development Council (FSDC) — the apex inter-regulatory body bringing together the RBI, SEBI, IRDAI, and PFRDA. First published in 2010 (in the aftermath of the Global Financial Crisis), the FSR provides a comprehensive, system-wide assessment of the resilience of India's financial system, identifying both current and emerging risks to financial stability, and presenting the results of periodic stress tests conducted on banks and other financial institutions.

Key Parameters Covered by the FSR

1. **Macro-financial risk assessment: An overview of the global and domestic macroeconomic environment — growth, inflation, external sector conditions, and geopolitical risks — as the backdrop against which financial stability is assessed. The June 2026 edition, for instance, highlighted geopolitical fragmentation and rapid AI adoption as the two most significant forces reshaping the global financial system, alongside risks from elevated global public debt, fragile bond markets, and the growing role of leveraged non-bank financial intermediaries.**
2. **Banking sector health indicators:**
    - **Asset quality: Gross Non-Performing Assets (GNPA) ratio and Net NPA ratio of Scheduled Commercial Banks (SCBs) — the June 2026 FSR reported GNPA at a multi-decadal low of 1.8% as of March 2026, with the annual slippage ratio (fresh defaults) at 1.2% for FY 2025-26.**
    - **Capital adequacy: Capital to Risk-weighted Assets Ratio (CRAR) and Common Equity Tier-1 (CET1) ratio — reported at 17.7% and 15.3% respectively, both comfortably above the regulatory minimum and at multi-decade highs.**
    - **Profitability: Return on Assets (RoA), Return on Equity (RoE), and Net Interest Margin (NIM).**
    - **Liquidity: Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).**
3. **Non-Bank Financial Companies (NBFCs): Assessment of NBFC capital adequacy, asset quality, and — a growing area of focus — vulnerability arising from rising foreign currency borrowings, which help steady funding costs but raise exchange-rate exposure even where largely hedged.**
4. **Other segments of the financial system: Insurance companies (solvency ratios), mutual funds (liquidity risk, particularly in mid-cap/small-cap schemes with longer liquidation periods), pension funds, and financial markets (equity, debt, and forex market functioning).**
5. **Systemic risk and interconnectedness: Assessment of contagion risk arising from interlinkages between banks, NBFCs, and other financial entities — since distress in one segment (e.g., NBFCs relying heavily on bank funding) can transmit rapidly across the system.**
6. **Emerging/non-traditional risks: Cybersecurity threats, climate-related financial risks, and — increasingly — risks and opportunities from AI adoption in the financial sector.**

7. **Payment systems and regulatory initiatives: A review of recent RBI/FSDC regulatory measures aimed at strengthening resilience.**

How Banks Conduct Stress Tests

Stress testing is a forward-looking risk-management technique used to assess how resilient a bank's balance sheet would be under hypothetical, severely adverse economic scenarios — going beyond simple point-in-time ratios to a dynamic, scenario-based assessment.

1. **Scenario design: The RBI specifies a baseline scenario (reflecting the most likely macroeconomic trajectory) and one or more adverse/severe scenarios (e.g., a sharp GDP growth slowdown, a spike in interest rates, a sudden credit shock, or a severe market downturn).**

2. **Credit risk stress test: Banks project how their GNPA ratio, provisioning requirements, and consequently their capital position would evolve under each scenario. For example, the June 2026 FSR projected that under the baseline scenario, system-level GNPA would rise only marginally from 1.8% (March 2026) to about 1.9% (March 2028), whereas under adverse scenarios, GNPA could rise to 3.8%–4.1% — still indicating resilience, since banks' aggregate capital ratios were projected to remain comfortably above the regulatory minimum even in the severe-stress case.**

3. **Capital adequacy stress test: The impact of the assumed credit losses (and any associated market losses) on each bank's CRAR is computed, to check whether individual banks would breach the regulatory minimum capital requirement or need to draw upon capital conservation buffers under stress.**

4. **Liquidity risk stress test: Assesses whether banks can withstand a sudden, severe deposit withdrawal or funding-market disruption while maintaining adequate liquid asset buffers (via LCR-type metrics).**

5. **Sensitivity analysis: Examines the impact of a shock to a single risk factor in isolation (e.g., a sharp rise in interest rates affecting the mark-to-market value of a bank's bond portfolio, or a sudden equity market crash), holding other factors constant.**

6. **Bottom-up and top-down approaches: Individual banks conduct their own internal (bottom-up) stress tests as part of their risk management (and under RBI's ICAAP — Internal Capital Adequacy Assessment Process — requirements), while the RBI also conducts an independent, system-wide (top-down) macro stress test using its own models, ensuring an external, consistent check across the sector rather than relying solely on banks' self-assessments.**

7. **NBFC and other-institution stress testing: Similar exercises are extended to NBFCs (e.g., the June 2026 FSR's stress test covering 174 NBFCs, showing aggregate CRAR could dip from 22.8% to around 20.9% under severe credit stress) and to mutual funds and clearing corporations, assessing their resilience to redemption pressures and counterparty defaults respectively.**

Conclusion

The FSR functions as India's principal periodic health-check of the financial system, combining a wide-ranging set of quantitative indicators (asset quality, capital adequacy, profitability, liquidity) across banks, NBFCs, insurers, and markets, with forward-looking, scenario-based stress tests that go beyond current snapshot ratios to assess resilience under hypothetical adverse conditions — providing both regulators and market participants with an evidence-based, system-wide view of financial stability, and directly informing the RBI's macroprudential and regulatory policy responses.

(b) A Financial Health Index refers broadly to a composite indicator that aggregates multiple individual financial soundness metrics into a single summary measure, allowing regulators and analysts to track the overall condition of a financial institution or the financial system over time, rather than examining each individual ratio in isolation. In the Indian context, the RBI constructs and publishes such a composite measure — the Banking Stability Indicator (BSI) — as part of its Financial Stability Report, built on the internationally used CAMELS-type framework (Capital adequacy, Asset quality, Management/earnings efficiency, Liquidity, and Sensitivity to market risk) that underlies most financial soundness assessment frameworks globally, including the IMF's Financial Soundness Indicators.

Key Sub-Parameters/Components of a Financial Health Index

1. **Soundness (Capital Adequacy) Dimension: Captures a bank's capacity to absorb losses, typically measured through the Capital to Risk-weighted Assets Ratio (CRAR) and the Common Equity Tier-1 (CET1) ratio — higher and more stable capital buffers indicate a sounder institution, better able to withstand shocks without threatening depositors or requiring public bailout.**

2. **Asset Quality Dimension: Reflects the health of a bank's loan portfolio, measured via the Gross NPA ratio, Net NPA ratio, and the slippage ratio (the rate at which standard loans turn into fresh NPAs) — deteriorating asset quality is one of the earliest and most direct signals of financial distress, as seen historically in India's twin-balance-sheet crisis of the mid-2010s.**

3. **Profitability/Earnings Dimension: Assessed through Return on Assets (RoA), Return on Equity (RoE), and Net Interest Margin (NIM) — sustained, stable profitability allows banks to internally generate capital and absorb minor losses without needing external capital infusion, and weak profitability is often an early warning sign of underlying balance-sheet stress.**

4. **Liquidity Dimension: Measured via metrics such as the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR), and the extent of reliance on potentially volatile short-term wholesale funding — a bank can be technically solvent (adequate capital) yet still fail due to an inability to meet short-term obligations, making liquidity a distinct and essential dimension (as vividly illustrated by global bank failures triggered by liquidity runs even where solvency was not immediately in question).**

5. **Efficiency Dimension: Captures operational efficiency, typically through cost-to-income ratios — a measure of how effectively a bank converts its revenue-generating capacity into actual net income after operating costs.**

6. **Sensitivity to Market Risk: Assesses the vulnerability of a bank's balance sheet to movements in interest rates, exchange rates, and equity/bond prices — particularly relevant for assessing mark-to-market losses on investment portfolios under scenarios of rising interest rates.**

How Financial Stress Measures Fit into the Broader Financial-Stability Assessment

While a Financial Health Index (like the Banking Stability Indicator) is primarily a point-in-time, institution/system-level soundness measure, a Financial Stress Index (or Financial Conditions/Systemic Stress Index) serves a complementary but distinct purpose — capturing market-based, forward-looking signals of acute strain across financial markets in real time, rather than balance-sheet soundness per se. Such indices typically aggregate market indicators across several segments:

1. **Money market stress: Widening spreads between interbank lending rates and the policy rate, signalling counterparty distrust or liquidity hoarding.**

2. **Bond market stress: Sharp widening of corporate bond spreads over government securities, or heightened G-Sec yield volatility.**

3. **Equity market stress: Elevated volatility indices (e.g., India VIX) and sharp equity market drawdowns.**

4. **Foreign exchange market stress: Heightened exchange rate volatility and widening forward premia.**

5. **Banking sector stress: Market-based indicators such as bank equity price declines or rising CDS spreads on bank debt (where available), capturing market perception of bank distress even before it shows up in reported balance-sheet ratios.**

The Complementary Relationship:

- **The Financial Health Index/BSI reflects accumulated, backward-looking balance-sheet fundamentals (capital, asset quality, profitability) — it changes gradually and is reported periodically (e.g., alongside each half-yearly FSR).**
- **Financial stress indices are high-frequency, market-based, and forward-looking — they can spike suddenly in response to a shock (e.g., a global risk-off event, a sharp geopolitical escalation, or a sudden confidence crisis), often well before that stress is reflected in reported balance-sheet metrics like NPA ratios (which are typically reported with a lag and update quarterly at best).**
- **Used together, they provide early-warning capability alongside fundamental soundness assessment: a rising financial stress index combined with weakening fundamentals in the Financial Health Index would represent the most serious warning signal of impending systemic distress, whereas a temporary spike in market stress with fundamentally sound balance sheets (as the RBI's June 2026 FSR broadly described India's position — resilient fundamentals despite elevated global stress from geopolitical fragmentation) suggests the system is likely to weather the episode without lasting damage.**
- **This complementarity is precisely why the FSR combines both types of assessment — reporting core balance-sheet health indicators (Financial Health Index-type metrics: CRAR, GNPA, profitability) alongside an assessment of prevailing market conditions and stress tests under hypothetical adverse scenarios, giving a fuller, two-dimensional picture of financial stability than either measure could provide alone.**

Conclusion

A Financial Health Index provides a structured, multi-dimensional (CAMELS-style) summary of the fundamental soundness of banks and the financial system — spanning capital, asset quality, earnings, liquidity, and market-risk sensitivity — while financial stress indices capture the more volatile, high-frequency market signals of acute strain. Together, as reflected in the RBI's own approach in successive editions of the Financial Stability Report — most recently confirming continued balance-sheet resilience (GNPA at a multi-decadal low of 1.8%, CRAR at 17.7%) even amid elevated global stress from geopolitical fragmentation in mid-2026 — these complementary tools give regulators a comprehensive, both structural and real-time, basis for assessing and safeguarding financial stability.

Q6. [Total: 20 marks]

(a) Discuss the role of the services sector in the Indian economy. Highlight its recent contribution to GDP, employment and exports, citing relevant figures. [10]

(b) The discourse around India's demographic dividend has increasingly shifted focus from the quantity of jobs created to the quality of jobs. Discuss this shift and its implications for India's growth strategy. [10]

Answer:

(a) The services sector has emerged as the single largest and fastest-growing segment of the Indian economy over the past three decades, driving India's structural transformation away from a primarily agrarian economy toward a services-led growth model — a pattern that distinguishes India from the more typical agriculture-to-manufacturing-to-services trajectory followed by most other developing economies. Today, services are not merely a residual sector but the principal engine of GDP growth, a major (though not always high-quality) source of employment, and India's most successful global export vertical.

Contribution to GDP/GVA

1. **Share in GDP/GVA: As per the Economic Survey 2025-26, the services sector's share in India's GDP rose to 53.6% in H1 FY26, while its share in Gross Value Added (GVA) reached a historic high of 56.4% (FY26 First Advance Estimates) — meaning services now generate well over half of the entire economy's output.**
2. **Growth acceleration: The services sector is estimated to have grown by 9.1% in FY26, a sharp acceleration from 7.2% in FY25, comfortably outpacing overall GDP growth and reaffirming its role as the primary driver of India's expansion.**
3. **Key growth drivers within services: Financial services, real estate, and professional services have been particularly strong contributors to this acceleration, alongside continued strength in IT/ITeS.**
4. **Contribution to incremental growth: Over the medium term, the services sector is projected to contribute over two-thirds of India's incremental GDP growth, reflecting continued structural momentum toward services-led expansion, reinforced by rapid growth in newer sub-segments such as AI-enabled services, cloud computing, fintech, and cybersecurity.**
5. **Resilience: Services have functioned as a comparatively stable, low-volatility anchor for overall GDP, cushioning the economy against volatility in agriculture (weather-dependent) and manufacturing/industry (more exposed to global demand cycles and input-cost shocks).**

Contribution to Employment

1. **Volume of job creation: The services sector has consistently been the largest generator of new employment in the formal/organised economy — in FY25, the sector is estimated to have generated nearly three jobs for every one job created in manufacturing, underlining its outsized role in national employment expansion.**
2. **Sectoral employment share: While services contribute over half of GVA, their share of total employment remains somewhat lower than their output share — a pattern consistent with services (particularly IT and financial services) being relatively more capital/skill-intensive than labour-absorbing sectors like agriculture, meaning services' contribution to output has outpaced its contribution to broad-based employment generation, a nuance directly relevant to part (b) below.**
3. **Employment quality concerns: As explored further in part (b), a large share of services employment — particularly outside high-end IT/ITeS and financial services — remains informal, low-productivity, and lacking social security coverage, a structural concern despite the sector's strong aggregate output performance.**

Contribution to Exports

1. **Record services export performance: Services exports reached an all-time high of USD 387.5 billion in FY25, registering robust 13.6% year-on-year growth, and are estimated to have risen further to around USD 465–475 billion for FY26 — with services exports at USD 348.4 billion during April-January of FY26 alone, and accounting for about 10% of India's GDP in H1 FY26.**
2. **Global standing: India's share of world commercial services exports rose from 2% in 2005 to 4.3% in 2024, making it the world's seventh-largest services exporter, and India today commands roughly a 55% share of the global IT/business-services outsourcing market.**
3. **Offsetting the merchandise trade deficit: Services exports (together with remittances) have been critical in offsetting India's persistent merchandise trade deficit — the current account deficit remained moderate at just 0.8% of GDP in H1 FY26, substantially due to the strength of services exports and record remittance inflows (USD 135.4 billion in FY25, the highest globally).**
4. **Diversification of services exports: Beyond traditional IT/ITeS, growth has increasingly come from financial services, professional/business services, and knowledge-intensive segments — with newer verticals like education technology, health services, and financial analytics increasingly exported to markets in Southeast Asia, the Middle East, and Africa.**

5. **Policy support: Recent measures — including tax holidays until 2047 for foreign companies providing cloud services from India-based infrastructure, reforms to the Safe Harbour regime for IT services, and improved Advance Pricing Agreement mechanisms — reflect continued policy emphasis on consolidating India's services export competitiveness.**

Conclusion

The services sector today anchors the Indian economy on all three critical dimensions — contributing over half of national GVA and the majority of incremental growth, generating the largest share of new (though not always high-quality) employment, and serving as India's most successful and rapidly diversifying export vertical, crucial to external sector stability. However, as the Economic Survey 2025-26 itself cautions, services exports alone cannot deliver the full structural transformation India needs — underscoring the continued policy emphasis on complementing services-led growth with a revival of labour-intensive manufacturing, a theme directly connected to the quality-of-jobs.

(b) India's demographic dividend — the economic growth potential arising from a large working-age population relative to dependents — has long been treated as one of the country's foremost structural advantages, with the working-age share expected to remain favourable through roughly 2055, peaking around 2041. For much of the past two decades, policy discourse focused primarily on the quantity dimension — how many jobs the economy could generate to absorb the roughly 8-10 million new entrants joining the labour force annually. In recent years, however, the discourse has shifted decisively toward the quality of those jobs — their productivity, formality, wages, and social protection — reflecting growing recognition that job quantity alone is an inadequate, and potentially misleading, metric of whether the demographic dividend is actually being realised.

Why the Discourse Has Shifted

1. **Persistently high informality despite employment growth: Even as aggregate employment figures have improved, estimates suggest that roughly 90%+ of India's workforce remains informal or in the unorganised sector, with limited social protection, job security, or predictable incomes — meaning headline "jobs created" figures can mask a large underlying share of low-productivity, precarious work rather than durable, dividend-generating employment.**

2. **Rising graduate/educated unemployment ("qualification inflation"): Reports such as the State of Working India 2026 highlight that a substantial share of young graduates remain unemployed or underemployed, with only a small fraction securing regular, permanent salaried jobs shortly after graduation — indicating a growing mismatch between the type of jobs available and the aspirations/qualifications of an increasingly educated workforce, rather than a simple shortage of jobs per se.**

3. **Reverse migration to agriculture as a "quality" warning sign: A notable and concerning trend has been a substantial number of workers rejoining agriculture in recent years — not due to farm modernisation, but reflecting the failure of industry and services to absorb workers productively, including a documented multi-year contraction in manufacturing employment. This "reverse structural transformation" is a clear signal that job quantity metrics alone (e.g., overall employment/unemployment rates) can obscure a deterioration in job quality and productivity.**

4. **Growth of gig/platform work: The rapid expansion of gig and platform-based employment has added flexibility to the labour market, but typically without matching benefits, insurance, or predictable wages — exemplifying how new "jobs" can proliferate in headline counts while contributing comparatively little to durable income security or productivity growth.**

5. **Persistently low female labour force participation: Female LFPR remains well below male LFPR, and where women's employment does rise, it is frequently concentrated in unpaid family labour or low-productivity informal work — again illustrating that raw employment/participation numbers do not capture the productive, income-generating quality of work.**

6. **The manufacturing gap: With manufacturing's share of GDP still hovering around 15% — well below the levels achieved by China, Vietnam, or Bangladesh at comparable stages of development — India has not developed the labour-intensive, formal manufacturing base that historically absorbed large numbers of workers into stable, productivity-improving jobs elsewhere in Asia, reinforcing reliance on lower-productivity informal absorption instead.**

Implications for India's Growth Strategy

1. **Shift from employment-generation schemes to productivity-enhancing employment: Policy focus needs to move beyond simply counting jobs (or vacancies, as tracked via platforms like the National Career Service) toward explicitly targeting formal, socially-protected, productivity-enhancing employment — requiring complementary reforms in labour regulation, social security extension (e.g., to gig/platform workers), and ease of formalisation for small enterprises.**

2. **Reviving labour-intensive manufacturing: Given services' relatively capital/skill-intensive employment profile, a revival of labour-intensive manufacturing (textiles, leather, food processing, toys) is essential to absorb workers with lower formal skill levels at higher productivity than informal services or agriculture can offer — directly linked to schemes like PLI (Production Linked Incentive) aimed at building scaled, export-oriented manufacturing capacity.**

3. **Addressing the skills paradox: With reportedly only a small fraction of India's youth possessing formal vocational training, greater investment in skilling, vocational education (as envisaged under the National Education Policy's vocational-exposure targets), and better alignment between educational output and labour-market demand is essential to convert educational attainment into productive employment rather than qualification-inflation-driven underemployment.**

4. **Foundational education and health investments: Since early learning deficits (as repeatedly documented in ASER surveys) and health indicators (child stunting, maternal anaemia) constrain the effectiveness of later-stage skilling and vocational training, the quality-of-jobs debate increasingly connects backward to foundational human capital investment — recognising that a productive demographic dividend "begins in the primary classroom," not merely at the point of labour-market entry.**

5. **Raising female labour force participation meaningfully: Beyond simply counting women as "employed," policy must target quality female employment — addressing safety, childcare infrastructure, and workplace norms — to convert rising female educational attainment into genuinely productive labour force contribution.**

6. **Risk of a narrowing window: Since the demographic dividend is inherently time-bound (India's working-age share is expected to gradually decline after the 2041 peak), the shift in emphasis toward job quality reflects urgency — a large but underemployed or informally employed workforce risks converting what should be a demographic dividend into a demographic burden if productive absorption is not achieved within the available window.**

Conclusion

The shift in India's demographic-dividend discourse — from simply counting jobs created to scrutinising their productivity, formality, and security — reflects a maturing and more realistic understanding that raw employment numbers are an insufficient proxy for genuine economic dividend realisation. For India's growth strategy, this implies a more integrated policy approach: reviving labour-intensive manufacturing to complement services-led growth, extending social protection and formalisation to a still overwhelmingly informal workforce, strengthening foundational education and skilling, and closing gender gaps in labour force participation — together determining whether India's favourable demographic window translates into sustained, inclusive growth or remains, as some recent commentary has warned, "a promise deferred."

Q7. [Total: 20 marks]

(a) "Inflation in India has been tamed and is now well anchored." Discuss the recent evolution of the RBI's monetary policy framework and how it has responded to evolving inflation dynamics. [10]

(b) Discuss recent trends in India's monetary and fiscal policy, highlighting the coordination between the two in managing macroeconomic stability. [10]

Answer:

(a) India's transition to a rule-based, transparent monetary policy framework — Flexible Inflation Targeting (FIT) — has been one of the most consequential institutional reforms in Indian macroeconomic policy over the past decade. Introduced in 2016 and subject to statutory review every five years, the framework has now been reviewed twice, with the second review concluding in March 2026. The claim that inflation has been "tamed and well anchored" finds considerable support in recent data, but the framework's continued evolution — including a serious 2025-26 debate over its core design — shows that this anchoring has itself been actively managed and refined, not simply achieved by default.

The Institutional Framework

Under Section 45ZA of the RBI Act, 1934 (amended in May 2016), the Central Government, in consultation with the RBI, sets a CPI inflation target once every five years, along with an upper and lower tolerance band. A six-member Monetary Policy Committee (MPC) — three RBI members (including the Governor) and three government-nominated external members — is statutorily mandated to set the policy repo rate to keep CPI inflation within this band. If inflation breaches the tolerance band for three consecutive quarters, the RBI is required under Section 45ZN to submit a report to the government explaining the failure and proposing corrective action — a built-in accountability mechanism.

Evolution Across the Two Review Periods

1. **First Review Period (August 2016 – March 2021): The 4% target with a 2%–6% tolerance band was first notified in August 2016. RBI's own subsequent assessment found that average CPI inflation declined from 6.8% during the four years preceding FIT (2012-16) to around 4.9% since its adoption — strong evidence that a credible, rule-based numerical anchor materially improved inflation outcomes and expectations compared to India's earlier "multiple indicators approach."**

2. **First Review (March 2021): The government retained the 4% target and ±2% band for a further five years (April 2021–March 2026), a decision that allowed the MPC flexibility to prioritise growth support during the pandemic while retaining accountability — including a formal breach-explanation to the government in**

2022, when inflation exceeded the 6% upper band for five consecutive quarters (driven by the pandemic and the Russia-Ukraine war's commodity price shocks).

3. Second Review (2025-26) — A Genuine Design Debate: Ahead of the March 2026 statutory review, the RBI floated a discussion paper in August 2025 raising four fundamental questions: Should the 4% target continue? Should headline or core inflation be the target measure? Should the tolerance band be narrowed, widened, or replaced with a point target? RBI ultimately argued that since food and fuel constitute over 50% of India's consumption basket, and persistent food inflation can spill into core inflation via wages and rents, headline CPI remains the appropriate target — excluding volatile items risked undermining policy credibility. Following this review, on March 25, 2026, the government retained the 4% target with the 2%–6% band for a further five years (April 2026–March 2031) — the second consecutive retention of the original 2016 framework, reflecting confidence in its continued suitability even as the debate itself demonstrated the framework's institutional maturity and willingness to interrogate its own design.

Recent Inflation Dynamics and Policy Response

1. Sharp disinflation through 2025: Headline CPI inflation moderated to a nearly six-year low of 3.2% in April 2025, driven by a sustained decline in food prices (six consecutive months of decline at that point), before falling further to an eight-year low of 1.6% in July 2025 — reflecting a historically long, roughly nine-month streak of food price disinflation, aided by record wheat output, robust kharif arrivals, and softer crude oil prices.

2. GST rate rationalisation (September 2025): The GST rationalisation effective September 22, 2025, directly lowered consumer prices across roughly 11.4% of the CPI basket, contributing a further structural disinflationary impulse.

3. Responsive rate-cutting cycle: As inflation fell well below target, the MPC — under Governor Sanjay Malhotra (who assumed office in December 2024) — began a rate-cutting cycle: repo rate was cut from 6.50% in February 2025 (the first cut in nearly two years) progressively to 6.25% → 6.00% → 5.50%, before a further cut to 5.25% in February 2026, amounting to a cumulative 125 basis points of easing since February 2025, alongside a shift toward a "neutral" policy stance.

4. Recent stabilisation within target: By early-to-mid 2026, CPI inflation had moved back up modestly — to around 3.2% in February 2026 and roughly 3.5% by April 2026 — comfortably within the 2%-6% band and close to the 4% medium-term target, with the RBI signalling in May 2026 that it stood ready to act if inflation pressures were to become persistent, particularly from any renewed oil-price shocks.

Assessing the "Tamed and Anchored" Claim

The evidence broadly supports the claim: average inflation has fallen substantially since FIT's adoption, inflation has remained within the tolerance band roughly two-thirds to three-fourths of the time across the two review periods, and inflation expectations (as reflected in surveys) have declined alongside actual outcomes — hallmarks of genuine anchoring rather than a temporary lull. However, "anchored" should not be read as "permanently resolved": the framework has had to actively accommodate exogenous shocks (pandemic, geopolitical conflict-driven commodity spikes), the CPI base year (2012) is now dated and may overstate food's weight in current consumption patterns, and the RBI itself flagged (in the 2026 review) that risks to renewed inflation persist, particularly from global oil price volatility.

Conclusion

The evolution of RBI's monetary policy framework — from ad hoc multiple-indicator management to a transparent, statutorily accountable, twice-reviewed inflation-targeting regime — reflects a deliberate institutional maturation that has materially improved India's inflation outcomes and credibility. The retention of the 4% target with a 2%-6% band through 2031, following a genuine and transparent design debate in 2025-26, indicates the framework is not merely inherited but continuously re-validated — supporting the view that inflation is currently well anchored, while the framework's built-in flexibility (evidenced by its responsive rate-cutting cycle through 2025-26) shows it remains capable of adapting quickly should inflation dynamics shift again.

(b) Monetary and fiscal policy in India have historically operated through formally separate institutions — the RBI's MPC for monetary policy, and the Finance Ministry for fiscal policy — but effective macroeconomic stabilisation requires the two to work in a broadly complementary, if not always explicitly coordinated, direction. Recent trends (2025-26) illustrate both instruments moving in a mutually reinforcing manner: monetary easing alongside continued fiscal consolidation, together supporting growth while preserving macroeconomic stability.

Recent Trends in Monetary Policy

As discussed in part (a), the RBI pursued a substantial easing cycle through 2025-26 — cumulative repo rate cuts of 125 basis points (from 6.50% to 5.25%) between February 2025 and February 2026, moving from a withdrawal-of-accommodation stance to a neutral stance, supported by sharply disinflationary conditions (CPI falling to an eight-year low of 1.6% in July 2025). This easing was reinforced by liquidity management measures — adjustments to the Cash Reserve Ratio and open market operations — aimed at ensuring effective monetary transmission (e.g., over ₹50 lakh crore of outstanding floating-rate loans linked to the External Benchmark Lending Rate saw EMI reductions following the February 2026 rate cut).

Recent Trends in Fiscal Policy

1. **Continued fiscal consolidation: The fiscal deficit has been on a steady declining glide path — from a COVID-era peak of about 9.2% of GDP (2020-21) down to an estimated 4.8% of GDP in 2025-26, with a budgeted 4.4% for 2026-27 — reflecting sustained consolidation even while supporting growth-oriented capital expenditure (capex reached nearly 60% of the budgeted level by November 2025, reflecting strong execution).**
2. **Shift to a debt-to-GDP fiscal anchor: As discussed earlier, the government formally shifted its medium-term fiscal anchor from the annual fiscal deficit target to a medium-term debt-to-GDP ratio (targeting 50±1% by 2031) effective FY 2026-27, providing greater operational flexibility while maintaining a credible consolidation trajectory.**
3. **Tax buoyancy supporting consolidation without demand compression: Strong tax buoyancy and restrained revenue expenditure growth have allowed the government to sustain capital expenditure momentum while still meeting fiscal deficit targets — avoiding the need for demand-compressing austerity even as consolidation continues.**
4. **GST rationalisation (September 2025): Beyond its disinflationary effect (noted in part (a)), GST rate rationalisation also reflects a fiscal policy tool being used with direct macro-stabilisation implications — simplifying the tax structure while supporting consumption demand through lower effective prices on a significant share of the CPI basket.**

Coordination Between Monetary and Fiscal Policy

1. **Complementary, mutually reinforcing stance in 2025-26: With inflation running well below target and the fiscal deficit on a credible consolidation path, both monetary policy (rate cuts, neutral stance) and fiscal policy (sustained capex, tax rationalisation, restrained revenue expenditure) moved in a growth-supportive but not inflationary direction simultaneously — monetary easing did not have to contend with fiscal profligacy that might have offset its disinflationary gains, illustrating effective (if institutionally informal) coordination.**
2. **The FSDC as the institutional coordination mechanism: The Financial Stability and Development Council (FSDC), chaired by the Finance Minister and including the RBI Governor and heads of SEBI, IRDAI, and PFRDA, provides the principal institutional forum for coordinating monetary, fiscal, and financial-regulatory policy, particularly on matters of systemic financial stability (as reflected in the biannual Financial Stability Report discussed in Q5(a)).**

3. **Consumption-tax policy directly supporting the inflation-growth trade-off: The GST rationalisation exemplifies how fiscal policy tools can be deployed in a manner that directly assists the monetary authority's inflation objective (by lowering measured CPI) while simultaneously supporting aggregate demand — a genuinely complementary use of the two instruments rather than a source of tension.**

4. **PFCE and rural demand recovery reinforcing the growth mandate: Private Final Consumption Expenditure rose to 61.5% of GDP (the highest since FY12), growing 7.5% in H1 FY26, supported by low inflation (a monetary policy outcome) and rising real incomes/favourable rural demand (partly a fiscal/agricultural-policy outcome) — illustrating how the combined effect of low inflation and supportive real income growth has reinforced consumption-led growth.**

5. **Debt-anchor and monetary policy interaction: The Centre's shift to a debt-to-GDP fiscal anchor (rather than a rigid annual deficit ceiling) provides fiscal policy with greater flexibility to respond to shocks without abrupt tightening — reducing the risk of fiscal policy working at cross-purposes with monetary policy during a downturn, since fiscal space to support demand is preserved as long as the medium-term debt trajectory remains credible.**

6. **Points of tension/coordination challenges: Despite this broadly complementary picture, tensions can arise — for instance, large government borrowing programs (elevated G-Sec and State Government Securities supply) have kept long-end bond yields elevated even as short-term rates fell amid RBI easing (noted in the FSR), illustrating that fiscal financing needs can partially offset the transmission of monetary easing to the long end of the yield curve — a reminder that coordination, while broadly effective, is not automatic or friction-free.**

Conclusion

Recent trends show India's monetary and fiscal authorities moving in a broadly complementary direction: sustained monetary easing (125 bps of rate cuts, a shift to neutral stance) alongside credible fiscal consolidation (declining fiscal deficit, a new debt-to-GDP anchor, and growth-supportive capital expenditure) — together underpinning strong consumption-led growth without reigniting inflationary pressure. While formal coordination mechanisms like the FSDC exist primarily for financial-stability matters rather than routine macro policy-mix decisions, the observed alignment between disinflationary monetary policy and disciplined-but-growth-supportive fiscal policy through 2025-26 illustrates that India's two principal macroeconomic policy arms have, in practice, worked in a mutually reinforcing rather than conflicting manner — a pattern essential to sustaining the "well anchored" inflation environment discussed in part (a) while supporting continued robust growth.

Q8. [Total: 20 marks]

(a) Discuss the recent role of the Government of India and the RBI in managing emerging geopolitical risks to the Indian economy, with reference to the key challenges highlighted in the latest Economic Survey. [10]

(b) Write short notes on: (i) the Unified Lending Interface (ULI) and MuleHunter.AI as recent RBI digital/fintech initiatives; and (ii) the shift from input-based subsidies to outcome-based support measures in Indian agriculture. [10]

Answer:

(a) India's macroeconomic management in 2025-26 has taken place against a backdrop the Economic Survey itself describes as a shift from "hyper-globalisation" toward a more fragmented, security-driven, and geopolitically aligned trade system — marked by rising trade policy uncertainty, retaliatory tariffs, and strategic decoupling. The Survey characterises the likely near-term global environment not as a return to stability, but as one of "managed disorder," where minor shocks can escalate rapidly given a thinner margin of safety, requiring more active government and central-bank intervention to stabilise expectations. Against this backdrop, both the Government of India and the RBI have adopted a combination of buffer-building, institutional reform, and active monitoring to manage these risks.

Key Geopolitical Challenges Highlighted

1. **The West Asia conflict and elevated energy prices: Both the RBI's Annual Report 2025-26 and Financial Stability Report identified the West Asia conflict (which escalated further in early 2026) as the single most prominent near-term risk, driving elevated energy and commodity prices with direct pass-through to India's import bill, inflation, and growth outlook.**

2. **Global trade fragmentation and tariff uncertainty: The Survey noted that trade policy uncertainty and geopolitical-economic uncertainty indices reached multi-decade highs around April 2025, reflecting unpredictable US trade policy and rising "friend-shoring" at the expense of "near-shoring" — India's exporters face a less predictable external demand and tariff environment than in the pre-2025 period.**

3. **Volatile capital flows and exchange rate pressure: The RBI flagged risks of a sharp correction in global (particularly US) equity markets triggering foreign portfolio outflows, heightened exchange rate volatility, and tighter domestic financial conditions — the rupee depreciated by about 4.75% during 2025, reflecting falling terms of trade from tariff effects and slower capital inflows.**

4. **Geoeconomic fragmentation and supply chain disruption: Widening fragmentation of global trade and financial networks along geopolitical lines was highlighted as a structural, not merely cyclical, risk to India's external sector and corporate earnings/loan portfolios.**

5. **Weather-related disruptions: Alongside geopolitical risks, climate-related agricultural disruptions were flagged as a compounding risk to inflation and rural incomes.**

Government of India's Response

1. **Fiscal buffers — Economic Stabilisation Fund (ESF): The government created a dedicated fiscal buffer — the Economic Stabilisation Fund — specifically to safeguard public finances against global economic shocks, commodity price volatility, and geopolitical disruptions, reflecting a deliberate institutional response to the recognised "thinner margin of safety" in the global environment.**

2. **Continued fiscal consolidation as a stability anchor: As discussed in Q7(b), sustained fiscal consolidation (deficit declining toward 4.4% of GDP for 2026-27, and the new debt-to-GDP anchor) was explicitly framed by the RBI as one of the key factors strengthening India's resilience to external shocks, by preserving fiscal space to respond if conditions worsen.**

3. **Export diversification and trade strategy: Given the Survey's own caution that services exports alone cannot drive full economic transformation, government policy has emphasised building manufacturing export capacity (via schemes like PLI) alongside continued services strength, to reduce dependence on any single external demand channel amid trade fragmentation.**

4. **Process and regulatory reform ("deregulation and smart regulation"): The Survey highlighted state-level deregulation initiatives and broader ease-of-doing-business reforms as central to strengthening India's capacity to "reinvent" its governance machinery from a "regulation and control" to an "enabling" posture — improving the economy's underlying resilience and adaptability to external shocks rather than relying solely on reactive crisis management.**

RBI's Response

1. **Proactive liquidity management: Throughout FY26, the RBI maintained adequate systemic liquidity — including CRR cuts and durable liquidity injection via Open Market Operation purchases (representing a liquidity surplus of roughly ₹1.89 lakh crore) — ensuring effective monetary transmission even amid external volatility, with broad money growth accelerating from around 9% to over 12%.**

2. **Monetary easing to support growth amid external headwinds: As discussed in Q7(a)/(b), the RBI's cumulative 125 basis point rate cut cycle through 2025-26 partly reflected a deliberate effort to cushion domestic demand against the drag from external uncertainty, even as global central banks broadly eased in tandem (75-100 bps cuts across major advanced economies).**

3. **Reserve buffer maintenance: Foreign exchange reserves were maintained at robust levels (around USD 701.4 billion as of January 2026, providing roughly 11 months of import cover and covering over 94% of external debt) — a direct buffer against capital-flow volatility and currency pressure arising from geopolitical shocks.**

4. **Regulatory streamlining and institutional strengthening: The RBI consolidated over 9,000 circulars into 238 Master Directions and introduced a landmark, consultative framework for regulation-making (May 2025), alongside the FREE-AI framework for responsible AI adoption in the financial sector — reflecting recognition (as the Survey notes) that the quality of financial-sector regulation is itself a critical determinant of economic resilience in an uncertain global era.**

5. **Financial Stability Report monitoring: As discussed in Q5(a), the RBI's biannual FSR has explicitly tracked geopolitical fragmentation and AI-driven disruption as top-tier systemic risks, using stress testing to confirm that banks and NBFCs retain adequate capital buffers even under severe adverse geopolitical/macro scenarios.**

6. **Exchange rate and market stabilisation: The RBI has signalled readiness to manage disorderly currency movements and has emphasised that despite near-term external risks, India's sound macroeconomic fundamentals (moderate CAD, strong reserves, fiscal consolidation) provide adequate buffers to absorb shocks without systemic disruption.**

Conclusion

The Government and RBI's response to emerging geopolitical risks in 2025-26 reflects a coordinated, buffer-building strategy rather than reactive crisis management — combining fiscal stabilisation instruments (the ESF, continued deficit consolidation), export and regulatory diversification on the government side, with proactive liquidity management, robust reserve buffers, and institutional regulatory strengthening on the RBI side. As the Economic Survey's own framing suggests, in a world of "managed disorder" where systemic collapse is unlikely but volatility and required active intervention are the norm, India's approach has been to build layered resilience — fiscal, monetary, financial-regulatory, and structural — rather than assume any single shock-absorption mechanism will suffice.

(b) The ULI is conceived by the RBI (via the RBI Innovation Hub) as the "third pillar" of India's digital public infrastructure trinity, alongside the JAM (Jan Dhan-Aadhaar-Mobile) framework and UPI — just as UPI standardised digital payments, ULI aims to standardise digital credit delivery, tackling India's substantial unmet credit demand, particularly for farmers and MSMEs.

- **Origins: Rooted in a September 2022 pilot digitising Kisan Credit Card (KCC) loans below ₹1.6 lakh, formally unveiled as the "Public Tech Platform for Frictionless Credit" (PTPFC) on August 10, 2023.**
- **Core design: ULI provides lenders consent-based digital access to both financial and non-financial borrower data — including land records, GST returns, Aadhaar e-KYC, and satellite imagery — through standardised, "plug-and-play" APIs, drastically reducing paperwork and credit-appraisal time, particularly for small and rural borrowers with limited formal credit history.**
- **Recent scale-up: As of December 2025, 64 lenders (41 banks, 23 NBFCs) were onboarded, up from 36 a year earlier, with over 136 data services supporting 12 distinct loan journeys — reflecting the platform's transition from pilot to live, scaling digital infrastructure.**
- **Focus areas: Primarily targeted at agriculture (digital KCC loans) and MSMEs, which face an estimated multi-lakh-crore credit gap despite contributing significantly to GDP.**
- **Governance considerations: The RBI has clarified that consent management and grievance redress remain the responsibility of individual lenders, and observers have flagged data-governance and interest-rate transparency as areas requiring continued regulatory attention as the platform scales, to ensure inclusive rather than merely faster credit access.**

MuleHunter.AI

MuleHunter.AI is an RBI-supported machine learning framework designed to identify and curb the use of "mule bank accounts" — accounts used to launder proceeds from digital payment frauds and financial crimes, typically by routing stolen or fraudulently obtained funds through unwitting or complicit account holders before final withdrawal.

- **Function: Uses AI/ML pattern-recognition techniques to flag suspicious transaction behaviours characteristic of mule-account activity (e.g., unusual fund routing patterns, rapid pass-through transactions) that would be difficult to detect through traditional rule-based fraud monitoring alone.**

- **Significance: Reflects the RBI's broader emphasis on using AI/ML to strengthen supervisory and fraud-detection capacity in an era of rapidly growing digital payment volumes (UPI, IMPS), where fraud typologies are becoming increasingly sophisticated and fast-moving — directly complementing the RBI's FREE-AI framework for responsible AI adoption in financial services.**

(ii) Shift from Input-Based Subsidies to Outcome-Based Support in Indian Agriculture [5 marks]

The Traditional Input-Subsidy Model and Its Problems

India's agricultural subsidy architecture has historically centred on input subsidies — most prominently, the fertiliser subsidy (particularly on urea, sold to farmers at a fraction of its actual cost, e.g., a 45 kg bag costing the government around ₹2,200 but sold to farmers for around ₹242) — alongside subsidised power and irrigation. While instrumental to the Green Revolution's success, this model has generated well-documented distortions:

1. **Nutrient imbalance: Because urea remains outside the Nutrient-Based Subsidy (NBS) framework and is kept artificially cheap by statute while phosphatic/potassic fertilisers face different pricing, farmers over-apply nitrogen relative to phosphorus and potassium — India's NPK ratio often exceeds 8:3:1 against an ideal ratio of roughly 4:2:1, damaging soil health.**

2. **Fiscal unsustainability: Between 2014-15 and 2024-25, fertiliser consumption rose by only about 20%, while subsidy expenditure rose by roughly 120% — driven largely by import dependence and global price volatility rather than genuine farmer benefit, with the fertiliser subsidy bill reaching ₹1.71 lakh crore for 2026-27 (and a higher revised estimate of ₹1.86 lakh crore for 2025-26).**

3. **Poor targeting: Input subsidies are consumption-linked and largely untargeted, disproportionately benefiting larger farmers who use more inputs, while offering limited direct income security to smaller and marginal farmers (who constitute over 85% of India's farming households).**

4. **Environmental costs: Distorted, subsidy-driven overuse of chemical inputs contributes to soil degradation, groundwater depletion (via subsidised power for irrigation), and reduced long-run agricultural sustainability.**

The Shift Toward Outcome/Income-Based Support

1. **Direct Benefit Transfer (DBT) and income-support schemes: Rather than subsidising the price of specific inputs, policy is increasingly oriented toward direct cash transfers linked to farmer identity and landholding — building on the success of PM-KISAN, which already provides direct income support to over 10 crore farmer families using digitised land records (under the Digital India Land Records Modernisation Programme), Aadhaar, and bank account linkages.**

2. **Proposed fertiliser subsidy reform: Under discussion (e.g., ICRIER's 2026 work, and various policy proposals), a soil-linked DBT model would replace or supplement blanket input price subsidies with direct transfers tied to landholding/cropped area and soil-health data — for instance, proposals under which a majority (around 70%) of a farmer's entitlement could be transferred directly, allowing farmers to purchase fertiliser at market-linked prices while retaining flexibility over input choices based on actual crop and soil needs rather than distorted relative prices.**

3. **Linking support to sustainable practices: Emerging proposals emphasise conditional support tied to outcomes — such as incentivising adoption of drip/micro-irrigation, nano-fertilisers, precision farming, and Soil Health Card-based balanced nutrient application — shifting the subsidy's purpose from simply lowering input cost to actively promoting sustainable agricultural outcomes.**

4. **Digital targeting infrastructure (AgriStack, DBT 2.0): The reform is being enabled by strengthening digital land-record and farmer-identification systems, integrating land records, crop-sown data, fertiliser sales data, and satellite imagery to accurately identify actual cultivators (including tenant farmers, historically excluded from ownership-based targeting).**

5. **Implementation challenges: Policy analysts caution that the shift must be phased, predictable, and accompanied by adequate compensation, given risks of exclusion — incomplete land records in several states, and the risk that tenant farmers/sharecroppers could be left out if eligibility is based purely on land ownership rather than actual cultivation — meaning DBT-based reform must build a credible income-support architecture (spanning ownership records, tenancy declarations, and crop surveys) before withdrawing existing input subsidies, to avoid destabilising farm incomes during the transition.**

Conclusion

This shift reflects a broader philosophical evolution in Indian agricultural policy — from subsidising the inputs farmers consume (with attendant price distortions, fiscal strain, and environmental costs) toward directly supporting farmer incomes and outcomes (soil health, sustainable practices, and genuine welfare), building on digital public infrastructure already proven through PM-KISAN. However, given the scale, political sensitivity (echoing the 2020-21 farm law protests), and targeting complexity involved — particularly the risk of excluding tenant cultivators — this transition is expected to proceed gradually and in a carefully sequenced manner rather than through an abrupt withdrawal of existing input-subsidy architecture.