GROUP 1

ECO723

FOUNDATIONS OF FINANCIAL RISK AND CLIMATE ECONOMICS

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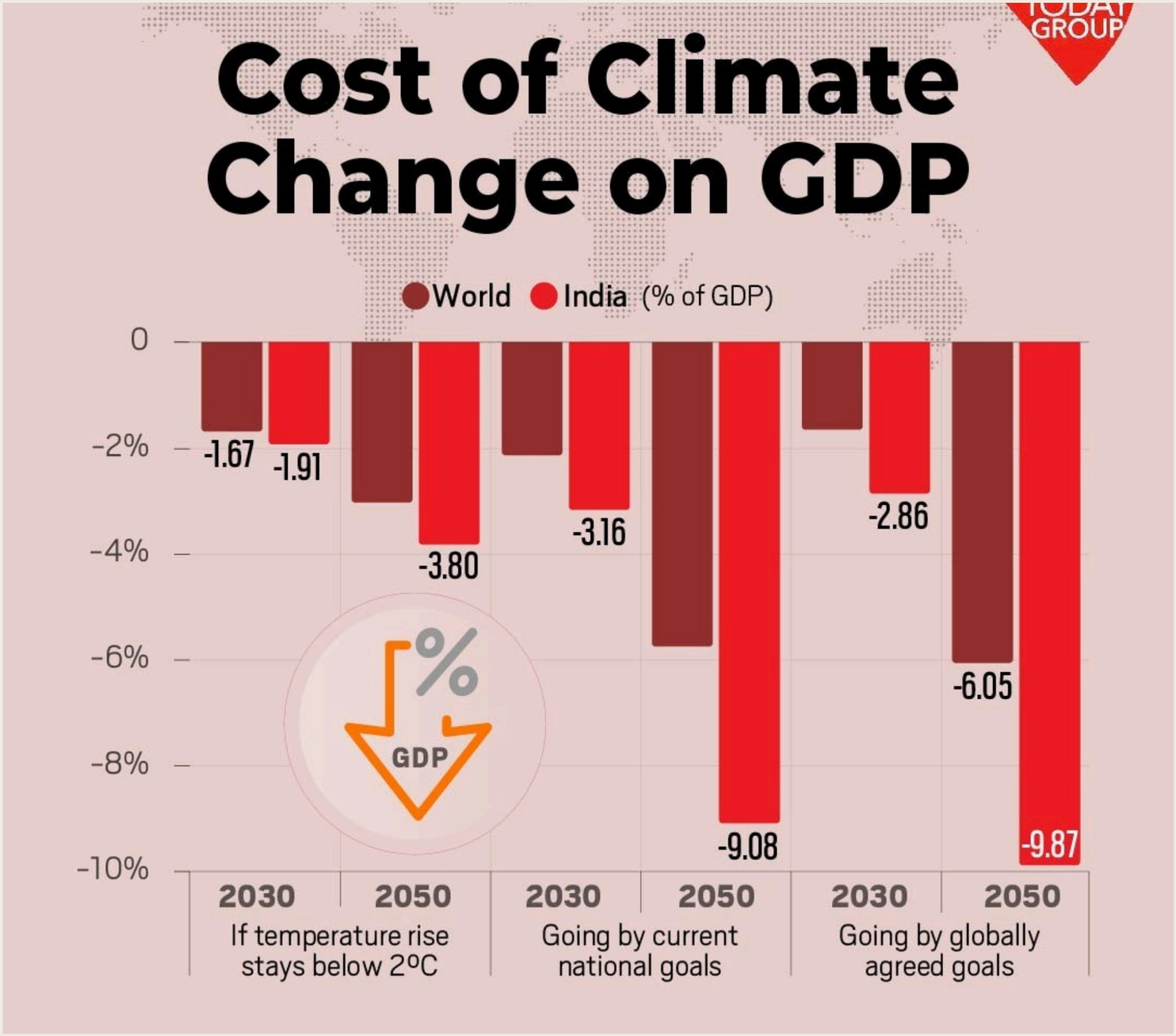
INDTRODUCTION

- Climate change introduces complex systemic risks that affect agriculture, energy systems, financial markets, and macroeconomic stability.
- Financial institutions, governments, and investors must now factor in climate shocks, long-term environmental degradation, and low-carbon transitions.
- Climate economics integrates risk modeling, investment planning, environmental constraints, and sustainability.
- The field links carbon emissions to GDP loss, supply chain disruptions, infrastructure risks, and insurance market volatility.

Example: A 20% drop in Indian maize production in 2023 due to heat stress led to regional food inflation and income shocks.


Cost of Climate Change on GDP
World
India
(% of GDP)
0
-2%
-4%
-6%
-8%
-10%
-1.67
-1.91
-3.80
-3.16
-9.08
-2.86
-6.05
-9.87
%
GDP
2030
2050
2030
2050
2030
2050
If temperature rise stays below 2°C
Going by current national goals
Going by globally agreed goals

ECONOMIC DISCOUNTING AND FUTURE PLANNING

- Climate policies must compare short-term investment with long-term environmental outcomes.
- Discounting reduces future costs to present-day values, shaping policy urgency.
- A high discount rate minimizes future damages; a low rate amplifies their present value.

Example: At 5% discount rate, ₹10,000 crore in damage 100 years from now is valued at only ₹1,000 crore today.

Choosing the right discount rate reflects how much we value future generations.

RAMSEY RULE

Formula: r = δ + ηg

δ = time preference (how impatient we are)
η = inequality aversion (value of equality across generations)
g = growth rate of consumption

Lower & means higher weight on future generations stronger climate action.
Used in cost-benefit analysis, carbon pricing, and fiscal planning.

Ramsey Formula: $r = \delta + \eta \cdot g$

r	Discount rate
δ	Pure rate of time preference
η	Elasticity of marginal utility of consumption
g	Growth rate of consumption

Example: Should we spend ₹1,000 crore today?

$\delta = 1\%$ $\eta = 2$

$g = 2\%$

$r = 1\% + (2 \times 2\%) = 5\%$

Interpretation:

- ₹10,000 crore 50 years later is worth only ₹870 crore today
- Spend up to ₹870 crore today to avoid that loss

INTERGENERATIONAL RESPONSIBILITY

ETHICAL FINANCE ASKS: SHOULD FUTURE GENERATIONS BEAR TODAY INACTION?

- Climate impacts are long-lasting biodiversity loss, and ecosystem collapse sea level rise collapse span centuries.
- Investments today (in renewables, flood control, agriculture have lifetime benefits.
- Financial fairness means integrating climate risk into long term public spending.
- Intergenerational planning tools must incorporate discount rates, risk tolerance, and social equity metrics.

FINANCIAL RISK VS CLIMATE-INDUCED ECONOMIC DISRUPTION

- Climate risks include physical risks (storms, droughts), transition risks (policy shifts), and liability risks (legal action).
- Traditional financial models fail to capture systemic climate volatility.

Example: 2023 droughts caused food supply shocks and inflation across South Asia.

- Stranded fossil fuel assets now pose a valuation challenge to banks.
- Financial forecasting must now include climate stress testing and exposure modeling for long-term economic planning.
- Climate-related economic shocks can undermine national credit ratings and increase sovereign borrowing costs.

SOCIAL COST OF CARBON (SCC) AND DECLINING DISCOUNT RATES

- SCC measures economic damage from 1 ton of CO2 and supports carbon pricing, taxation, and investment decisions.
- IAM-based SCC estimates range from $50 to $600/ton, depending on discount rates and risk assumptions.
- Embedding SCC in financial models encourages emissions reduction and sustainability-linked finance.
- Declining discount rates are used to reflect the increasing value of long-term environmental benefits.
- UK and France already apply declining rates in public project assessments.
- Example: Afforestation or long-term adaptation projects benefit more under declining rates.

GREEN INVESTMENT AND ENERGY COST COMPETITIVENESS

Lazard LCOE data shows renewables are now cost-competitive:

- Wind: S32-S62/MWh
- Solar PV: S46-$56/MWh
- Gas peaking: $165-S217/MWh
- Coal: S60-S143/MWh

- Green finance tools: green bonds, climate transition funds, sustainability-linked loans.
- India issued ₹3,200 crore in sovereign green bonds in 2023.
- The concept of "Greenium" reflects the premium investors are willing to pay for green assets due to lower perceived risk and higher demand

- Apple and Microsoft have issued green bonds for renewable energy and data center efficiency; Adani Green Energy is building large-scale solar capacity under sovereign green bond support

GREEN INVESTMESUSTAINABILITY FRAMEWORKS AND NATURAL CAPITAL LIMITSNT, GEOENGINEERING, AND ENERGY ECONOMICS

- Weak sustainability: assumes capital substitution (e.g., forests = tech).
- Strong sustainability: ecological thresholds cannot be breached.
- Heal favors strong models: not all ecosystem services are replaceable.

Example: no substitute exists for ocean acidification effects on marine life.

- Natural capital includes forests, wetlands, glaciers - providing services beyond market pricing.
- Heal warns against overreliance on substitution in economic forecasts.

Example: Himalayan glacier loss threatens water access for 18 people.
Valuation methods must go beyond GDP to include ecosystem health.

CLIMATE TIPPING POINTS AND POLICY ALIGNMENT

- Tipping points: ice sheet melt, Amazon forest dieback, methane release.
- Crossing one can trigger cascading effects across climate systems.
- 2023: S110B in insured global losses from climate disasters.
- Financial systems must hedge against low-probability, high-cost events.
- Delay amplifies long-term climate costs and market shocks.
- Example: Cyclone Amphan cost India ~S13B in 2020, exposing adaptation gaps.
- India: NAPCC, Hydrogen Mission, PLI for solar
- Global: Paris Agreement, EU Green Deal, UN SDGs
- Finance tools:
- Emission-linked bonds, ESG regulation, carbon pricing, restructured subsidies
- Sovereign green bonds now fund large public climate initiatives in India, UK, Germany, and Indonesia

ACTION DRIVERS AND MODEL LIMITATIONS

- Rising disaster costs and global economic disruptions demand proactive financing.
- Green bonds surpassed S500B in global issuance in 2023.
- Greenium incentivizes firms to adopt sustainable operations.
- Apple has invested billions in clean energy, achieving carbon neutrality across supply chains.
- Climate risk is now a core agenda item for central banks and financial regulators.
- However, IAMs rely on uncertain inputs and speculative assumptions.
- SCC varies with discounting and ethical preferences.
- Geoengineering is politically sensitive and poorly governed.
- Developing countries face data shortages, limiting financial planning.

Current tools underprice biodiversity loss and nonlinear climate events.

KEY TAKEAWAYS

- Climate change is a foundational risk to global financial systems.
- Economic models must evolve to reflect environmental limits, ethical responsibility, and ambiguity.
- Discounting, SCC, and IAMs are critical tools but must be applied with care.
- Renewables are now an economically rational investment.
- Coordinated climate finance and policy are essential to build equitable, resilient futures.
- Companies and countries leading in climate finance (e.g., Microsoft, Apple, Adani, EU, India) are shaping future-proof economic strategies.

Group Members

Rakesh Kumar Bairwa(210821)

Neeraj Kumar(230692)

Jatavath Balakoti(241080060)

RISHABH KATIYAR(220885)

DEEPAK CHAURASIA(220330)

THANK YOU