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No: 1521, Second Floor, H-Block, 5th Street, Anna Nagar, Chennai-40.

Ph: +91 8754543687, www.gurukulamias.in

Page 01 : GS 2 : International Relations

In a recent conversation with American podcaster Lex Fridman, Prime Minister Narendra Modi discussed India's diplomatic challenges with Pakistan and China while also drawing parallels between his leadership approach and that of former U.S. President Donald Trump.

- His remarks provide insight into India's foreign policy, particularly in the context of regional security, peace efforts, and global diplomacy.

Key Themes and Analysis

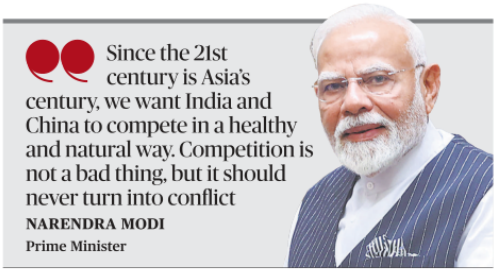
India-Pakistan Relations: Repeated Setbacks in Peace Initiatives

- Modi highlighted that India's attempts to foster peace with Pakistan, including inviting former Prime Minister Nawaz Sharif to his swearing-in ceremony in 2014, have not yielded the desired results. He emphasized that these efforts have been met with hostility and betrayal.
- A key factor in the breakdown of trust has been cross-border terrorism, including the Uri and Pulwama attacks. Pakistan's failure to act against terror outfits has further strained relations.
- Despite this, Modi expressed hope that wisdom will prevail in Pakistan's leadership, indicating that India remains open to peaceful negotiations if credible steps are taken.

India-China Relations: Advocating Dialogue Over Discord

- Modi stressed that diplomatic efforts have helped restore stability in India-China border areas, emphasizing that differences between neighbors should not escalate into disputes.
- He pointed out that competition between the two countries should not turn into conflict.
- Despite past tensions, China remains India's largest trading partner. However, border disputes such as those in Doklam and Galwan have led India to adopt a cautious approach.

Every peace move met with hostility by Pakistan: Modi



Press Trust of India
NEW DELHI

Noting that all of India's attempts to foster peace with Pakistan have been met with hostility and betrayal, Prime Minister Narendra Modi has expressed hope that wisdom will prevail on the leadership in Islamabad to improve bilateral relations.

In a three-hour conversation with American scientist and podcaster Lex Fridman, who released the episode on Sunday, Mr. Modi emphasised his similarities to U.S. President Donald Trump, noting that Mr. Trump seems to have a clearer road map for his second term.

With regard to China, he cited the return to normalcy on the border as evidence of the power of dialogue over discord and called for the neighbours to cooperate in the interest of global stability and prosperity.

Recalling his own swearing-in ceremony in 2014, Mr. Modi said he had specially invited his Pakistan counterpart Nawaz Sharif with the hope that the two countries could turn over a new leaf.

"This sent a clear message to the world about India's commitment to peace and harmony, but we didn't get the desired outcome... Yet, every noble attempt at fostering peace was met with hostility and betrayal. We sincerely hope that wisdom prevails upon them and they choose the path of peace."

Dialogue over discord

Despite past tensions with China, Mr. Modi said he favours dialogue over discord. "Differences are natural. When two neighbouring countries exist, occasional disagreements are bound to happen... but our effort is to ensure that these differences don't turn into disputes." He emphasised that stronger cooperation between the neighbours is also key to global stability and prosperity, drawing from historical examples. "Since the 21st century is Asia's century, we want India and China to compete in a healthy and natural way. Competition is not a bad thing, but it should never turn into conflict," he said.

Mr. Modi said he shares a bond of mutual trust with Mr. Trump and they connect well because they believe in putting their respective national interests above everything else.

ON GUJARAT RIOTS
» PAGE 4

- While India engages in diplomacy, it is also strengthening its defense capabilities and reducing economic dependence on China.

Modi-Trump Parallels: National Interest First

- Modi noted a shared leadership philosophy with Trump, highlighting that both prioritize national interests above global obligations. This aligns with India's evolving foreign policy, which is shifting from non-alignment towards strategic autonomy.
- Initiatives such as Atmanirbhar Bharat reflect this approach, emphasizing self-reliance while maintaining diplomatic engagement with global powers.

Conclusion: Implications for India's Foreign Policy

- India remains committed to peace with Pakistan but demands accountability on terrorism. With China, it seeks diplomatic engagement while preparing for potential security challenges. The broader foreign policy approach reflects strategic pragmatism, balancing cooperation with competition on the global stage.

UPSC Mains Practice Question

Ques: India has consistently attempted to engage Pakistan in peaceful dialogue, but such efforts have often been met with hostility. Critically examine the challenges in India-Pakistan relations and suggest a way forward. **(250 words)**

The Indian Space Research Organisation (ISRO) has received approval from the Central Government for the Chandrayaan-5 mission. This upcoming lunar exploration project will feature a significantly larger 250-kg rover, compared to the 25-kg rover used in Chandrayaan-3.

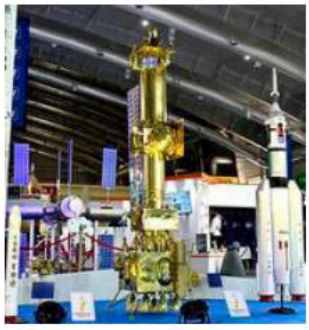
Chandrayaan-5 has received Centre's approval, will carry 250-kg rover, says ISRO chief

Press Trust of India
CHENNAI

The Centre recently accorded approval for the ambitious Chandrayaan-5 mission to study the moon, Indian Space Research Organisation Chairman V. Narayanan said on Sunday.

At an event to felicitate him for taking over as the Chairman of the Bengaluru-headquartered ISRO, Mr. Narayanan said that unlike the Chandrayaan-3 mission which carried the 25-kilogram rover 'Prayagyaan', the Chandrayaan-5 mission would carry a 250-kg rover to study the moon's surface.

The Chandrayaan mission consists of studying the lunar surface. Chandrayaan-1, successfully launched in 2008, took



A model of Chandrayaan-4.

chemical, mineralogical and photo-geologic mapping of the Moon.

The Chandrayaan-2 mission (2019) was 98% successful, but just two per cent of the Mission could not be achieved in the final stages.

Still, the onboard high-resolution camera on Chandrayaan-2 is sending hundreds of images, Narayanan, also the Secretary of Department of Space, said. Chandrayaan-3 Mission is a follow-on mission to Chandrayaan-2 to demonstrate end-to-end capability in safe landing and roving on the lunar surface.

Chandrayaan-3 success

ISRO successfully launched the Chandrayaan-3 mission with the Lander Vikram successfully 'soft-landing' on the South pole of the Moon on August 23,2023.

"Just three days back, we got the approval for Chandrayaan-5 Mission. We will be doing it in association with Japan," Narayanan said.

The Chandrayaan-4 Mission, expected to be launched in 2027, aims to bring samples collected from the moon.

- The announcement comes as ISRO continues its lunar exploration efforts, with Chandrayaan-4 planned for 2027 and aimed at bringing back lunar samples.

Key Themes and Analysis

1. Evolution of India's Lunar Missions

- **Chandrayaan-1 (2008):** India's first lunar mission that provided crucial data, including the discovery of water molecules on the Moon's surface.
- **Chandrayaan-2 (2019):** Aimed at landing on the Moon's South Pole but faced last-minute challenges, making the mission 98% successful.
- **Chandrayaan**-3 (2023): Successfully landed near the Moon's South Pole, making India the first country to do so. The rover 'Pragyan' explored the lunar surface.
- **Chandrayaan-4 (2027):** Planned as a sample-return mission, marking a major milestone in ISRO's capabilities.
- **Chandrayaan-5:** Approved recently, featuring a 250-kg rover in collaboration with Japan, indicating growing international cooperation in space exploration.

2. Chandrayaan-5 and its Significance

- **Advanced Rover:** A heavier 250-kg rover is expected to conduct more detailed scientific analysis compared to previous missions.
- **International Collaboration:** Working with Japan signifies India's growing participation in global space research and technology-sharing.
- **Boosting India's Space Program:** The success of Chandrayaan-3 has strengthened ISRO's global reputation, and the approval of Chandrayaan-5 reflects India's long-term space ambitions.

3. India's Expanding Space Diplomacy

- Collaboration with Japan on Chandrayaan-5 aligns with India's broader strategy of international cooperation in space exploration.
- India is a key player in the Artemis Accords, strengthening its position in global space governance.
- Recent partnerships with NASA, Russia, and European agencies highlight India's increasing role in space diplomacy.

Conclusion: Implications for India's Space Program

- The approval of Chandrayaan-5 underscores India's commitment to expanding its lunar exploration capabilities.
- The growing international collaborations indicate a shift towards more complex and ambitious space missions.
- Success in these missions will enhance India's leadership in space research, innovation, and technology.

Daily News Analysis

UPSC Mains Practice Question

Ques : India's lunar missions have significantly contributed to global space exploration. Discuss the importance of the Chandrayaan missions in India's space program and their implications for scientific research**.(250 words)**

The Supreme Court of India, in a 2014 judgment, upheld the principle of "linguistic secularism" and the organic evolution of language laws in the country.

- The issue has resurfaced amid debates over the language formula in the National Education Policy (NEP), with Tamil Nadu's Chief Minister M.K. Stalin accusing the Centre of imposing Hindi at the cost of regional languages like Tamil.

SC had favoured 'linguistic secularism' in 2014 order, said evolution of language was 'organic'

NEWS ANALYSIS

Krishnadas Rajagopal
NEW DELHI

The debate over the language formula in the National Education Policy rages, though the Supreme Court had favoured "linguistic secularism", or the acceptance of the legitimate aspirations of the speakers of different languages in India, in a 2014 judgment.

Tamil Nadu Chief Minister M.K. Stalin has accused the Centre of imposing Hindi through the National Education Policy at the cost of "totally destroying Tamil Nadu's progress in education".

The court in *U.P. Hindi Sahittya Sammelan vs State of U.P.* in September 2014 had observed that the mode of development or evolution of both law and language in the country was "organic". Indian language laws, the court said, were "not rigid but accommodative – the object being to secure linguistic secularism".

The judgment referred to Constitutional expert H.M. Seervai's commentary on the conflict which arose in the Constituent Assembly in 1949 over the question of Hindi as a "national language". A compromise proposed in the Munshi-Ayyangar formula led to the inclusion of Article 343 in the Constitution declaring Hindi in the Devanagari script as the official language of the Union.

'Official language'

"Though Hindi was selected as the official language, it could not be described as the national language, for, it was not the language generally spoken in all parts of India, and though spoken by the largest single group of people, that group did not constitute the majority of people in India. Besides, there were regional languages such as Bengali in Bengal, Tamil in Madras, and Marathi and Gujarati in the erstwhile State of Bombay which were spoken by large populations and it was claimed for those languages that they were more developed than Hindi. Hindi was therefore described as the official language," the judgment quoted from Mr. Seervai's commentary.

The court said Indian language laws were not rigid but accommodative. FILE PHOTO

Article 351 however imposes a "duty" on the Union government to promote the spread of the Hindi language. However, the Allahabad High Court, in its 1982 judgment in *Sunil K.R. Sahastrabudhey vs Director, IIT Kanpur*, observed that "although Hindi is the national language of India and Article 351 lays down a duty on the Union to promote the spread of Hindi language to develop it so that it may serve as a medium of expression for all the elements of the composite culture of India, there is no right conferred on any citizen to compel an institution to impart education in that particular language".

Besides, Article 29(1) of the Constitution recognised that "every section of the society which has a distinct language script or culture of its own" has the fundamental right to conserve the same.

"This is a right which is conferred on both majority and minority," the top court had underscored.

The Supreme court, while responding to whether a student or a parent or a citizen has a right to choose the medium of instruction at primary school level in *State of Karnataka vs Associated Management of Primary & Secondary Schools*, said the fundamental right to speech and expression under Article 19 included the freedom of a primary class student to choose the language of instruction. The court said the state cannot impose control over such a choice.

In this, the court had taken a leaf from the U.S. Supreme Court's conclusion in *Pierce v. Society of Sisters of Holy Names* in 1924 that "a child is not a mere creature of the State. Those who nurture him and direct his destiny have the right coupled with the high duty to recognise and prepare him for additional obligations".

Key Themes and Analysis

1. Constitutional Framework for Language Policy

- **Article 343:** Declares Hindi in Devanagari script as the official language of India, but not the national language.
- **Article 351:** Directs the Union to promote Hindi for national communication while respecting linguistic diversity.

- **Article 29(1):** Guarantees the right of every linguistic community, whether majority or minority, to conserve its language, script, or culture.
- **Supreme Court Judgment (2014):** Emphasized that Indian language laws are flexible and accommodative rather than rigid, ensuring linguistic secularism.

2. Supreme Court's Stand on Language and Education

- In State of Karnataka vs Associated Management of Primary & Secondary Schools, the SC held that a student's fundamental right to speech and expression under Article 19 includes the choice of the medium of instruction.
- The SC took cues from the U.S. Supreme Court's 1924 Pierce v. Society of Sisters judgment, which emphasized that a child is not merely a state subject but an individual whose learning preferences must be respected.
- The Allahabad High Court (1982) held that while the Union must promote Hindi, there is no constitutional obligation to impose it as the medium of instruction.

3. The National Education Policy (NEP) and Linguistic Concerns

- The NEP 2020 promotes a three-language formula, encouraging states to offer Hindi, English, and a regional language.
- Tamil Nadu, with its historic opposition to Hindi imposition (as seen in the anti-Hindi agitations of 1965), argues that the NEP threatens its linguistic autonomy.
- The Supreme Court's 2014 ruling supports the idea that language policy should be flexible and cater to regional linguistic aspirations rather than imposing uniformity.

Conclusion: Balancing Linguistic Diversity and National Integration

- India's language policy must maintain a delicate balance between national unity and regional linguistic aspirations.
- The SC's stance reinforces the right to language choice, aligning with India's pluralistic ethos.
- Future language policies must be inclusive and accommodative, ensuring that both Hindi and regional languages flourish without compulsion.

UPSC Mains Practice Question

Ques : Discuss the significance of linguistic secularism in India and analyze the role of the judiciary in upholding linguistic rights.**(250 words)**

Page 06: GS 2 :International Relations

India and New Zealand have resumed negotiations on a Free Trade Agreement (FTA) after a decade-long pause. The Comprehensive Economic Cooperation Agreement (CECA) talks, which began in 2010, had stalled in 2015 over tariff disparities and market access concerns.

India, New Zealand resume trade deal talks after decade

The FTA negotiations aim to achieve balanced outcomes that enhance supply chain integration and improve market access, says Commerce Ministry after a meeting between Goyal and McClay

Press Trust of India
NEW DELHI

After a gap of about 10 years, India and New Zealand on Sunday announced resumption of negotiations for a proposed free trade agreement (FTA) to boost economic ties.

India and New Zealand began negotiating the Comprehensive Economic Cooperation Agreement (CECA) in April 2010 to boost trade in goods, services, and investment. However, after 10 rounds of discussions, the talks stalled in February 2015.

"The two nations are pleased to announce the launch of negotiations for a comprehensive and mutually beneficial India-New Zealand Free Trade Agreement (FTA) negotiations," the Commerce Ministry said.

The announcement was made after a meeting of Commerce and Industry Minister Piyush Goyal and Todd McClay, New Zealand's Minister for Trade and Investment.

Prime Minister of New Zealand Christopher Luxon is here on a four-day visit from Sunday.

Deep dive: Commerce Minister Piyush Goyal with New Zealand Trade Minister Todd McClay in New Delhi on Sunday. ANI

"The India-New Zealand FTA negotiations aim to achieve balanced outcomes that enhance supply chain integration and improve market access," it said. "With bilateral trade continuing to grow steadily, surpassing USD 1 billion during April-January 2025, the FTA negotiations aim to unlock new avenues for businesses and consumers, fostering mutual growth and prosperity of our nations," Mr. Goyal said in a post on X.

According to think tank Global Trade Research Initiative (GTRI), a major challenge in the renewed talks will be the disparity in tariff structures.

Common ground

New Zealand's average import tariff is only 2.3%, with over half of its tariff lines already duty-free, meaning Indian goods already have substantial access to its market.

In contrast, India's average tariff stands at 17.8%, meaning it would have to make significant reductions, making a traditional FTA less attractive for India. "As talks resume, both countries will need to find common ground on these issues to move forward successfully," GTRI founder Ajay Srivastava said.

He said earlier New Zealand was demanding greater access to India's dairy market, which India resisted to protect its domestic dairy industry that supports millions of farmers.

Currently, India's dairy imports from New Zealand are minimal (around $0.57 million), and while India may consider limited imports of value-added dairy products, it remains firm against allowing raw dairy imports, he said. India was also reluctant to lower tariffs on New Zealand's dairy, meat, and wine exports, while New Zealand pushed for more favourable trade terms.

"Pressure from the U.S. to open India's dairy and agriculture sectors may also influence negotiations," Mr. Srivastava said, adding that another key issue was India's demand for easier movement of its skilled professionals and better access for its IT and services sector.

- The renewed discussions aim to enhance supply chain integration, trade in goods, services, and investment, addressing both nations' economic interests.

Key Themes and Analysis

India-New Zealand Trade Relations and FTA Negotiations

- Current trade volume between the two countries exceeded $1 billion between April 2024 and January 2025.
- The FTA aims to achieve balanced outcomes by improving market access and supply chain integration.
- **Major challenges in negotiation include:**
  - **Tariff disparity:** New Zealand's average tariff is 2.3 percent, with over 50 percent of imports already duty-free, whereas India's average tariff is 17.8 percent, making it difficult for India to offer deep tariff cuts.
  - **Dairy sector concerns:** New Zealand demands greater access to India's dairy market, but India is reluctant due to the potential impact on millions of farmers.
  - **Other sensitive sectors:** Meat and wine exports from New Zealand face high tariffs in India, while India seeks better access for its IT professionals in New Zealand.

Economic and Strategic Significance of the FTA

- Benefits for India include improved access to high-quality agricultural products, advanced technology, and foreign investment.
- Strengthening Indo-Pacific trade partnerships is a major strategic advantage, given New Zealand's position in the region.
- The agreement could serve as a model for future FTAs with developed economies.
- Benefits for New Zealand include greater access to India's large consumer base and the potential to expand exports, particularly in dairy, wine, and meat.
- Strengthening economic ties with India aligns with New Zealand's long-term trade and diplomatic goals.
- This discussion connects to GS Paper 2 (India's trade diplomacy) and GS Paper 3 (Economic implications of FTAs).

Geopolitical and Global Trade Dynamics

- Pressure from the United States may influence India's position on agricultural and dairy import policies.
- New Zealand, as part of the Five Eyes alliance, is looking to strengthen economic ties with India amidst changing global trade patterns.

- Cooperation between India and New Zealand could serve as a counterbalance to China's economic influence in the Indo-Pacific.

Conclusion: Balancing Trade Growth with Domestic Interests

- India must find a balance between protecting domestic industries, particularly dairy and agriculture, and expanding trade opportunities.
- A mutually beneficial FTA will require concessions on both sides, particularly regarding tariffs and the movement of professionals.
- The outcome of these talks could influence India's future trade negotiations with other developed economies.

UPSC Mains Practice Question

Ques : India's trade policy must balance economic growth with strategic geopolitical interests. Discuss in light of the India-New Zealand FTA negotiations.**(250 words)**

A recent study by IIT Delhi, published in Environmental Research Letters (November 2024), has found that air pollution and climate change will reduce India's solar power generation capacity. India, the fifth-largest solar power producer, aims to generate 50% of its electricity from non-fossil sources by 2030. However, declining air quality and rising temperatures could impact solar cell efficiency, leading to energy losses.

Air pollution will lower India's solar generation capacity: study

Solar cells perform best under bright sunlight. They also need lower ambient temperature and airflow over them for cooling. Any imbalance in these factors lowers solar cell performance. Researchers have found that solar radiation was the main factor affecting solar-cell efficiency, followed by temperature

Unnati Ashar

A study by researchers at IIT Delhi has found that air pollution and climate change will impair solar panel performance in India. It was published in *Environmental Research Letters* in November 2024.

According to the paper, India is the fifth-largest solar power producer worldwide. The country has set a target to produce 50% of its electric power from non-fossil fuel sources by 2030, and plans to install 500 GW of renewable energy capacity to this end by then. One-fifth of this capacity is expected to be in the form of solar power.

India also has plans to develop more solar parks and promote rooftop solar generation.

Solar power and climate

Like other forms of renewable energy sources , solar photovoltaic energy is at the mercy of weather and climate.

"Accurately assessing future renewable energy resources, particularly solar energy in India, where solar deployment is expanding rapidly, is crucial for ensuring a sustainable and resilient energy future," Sushovan Ghosh, lead author of the new study, then at the Centre for Atmospheric Sciences at IIT Delhi and now a researcher in the Earth Sciences Department of the Barcelona Supercomputing Centre, said.

The study is the first to examine how climate change will affect solar cell efficiency in India.

"Studies of this kind give impetus to the innovations towards mitigating greenhouse gases through the exploration of viable energy alternatives and, more importantly, improvements in photovoltaic cell design," T.V. Ramachandra, a faculty member at the Centre for Ecological Sciences of the Indian Institute of Science, Bengaluru, said. India has 300 sunny days a year but their quality is declining due to air pollution. "Solar radiation at the earth's surface is not stable over time but undergoes significant long-term variations, referred to as global dimming and brightening," Ghosh said.

"This variation depends on atmospheric variables such as clouds, aerosols or particulate matter, water vapour, and radiatively active gas molecules such as ozone. Clouds reflect and aerosols either scatter or absorb incoming solar radiation reaching the surface. Therefore, on a cloudy or hazy day, due to particulate matter pollution, less solar radiation will impinge on the solar panel and reduce solar generation."

Workers install solar panels at the Adani Group-owned Khavda Renewable Energy Park in Khavda, Gujarat. AFP

Data from CERES

The team's study used data from 1985 to 2014 to predict changes from 2041 to 2050, the middle of the current century. "Given that photovoltaic power plants generally have a lifespan of 20 to 25 years, analysing the 2040s aligns well with the operational lifetime of existing and planned installations," according to Ghosh. "Beyond this period, the analysis may lose practical relevance."

The team used global climate models, testing them against observations from NASA's Clouds and the Earth's Radiant Energy System (CERES) project and the India Meteorological Department. CERES uses instruments in space to measure radiation coming from the earth and thus understand the role of cloud cover in climate change.

The team studied two scenarios. The first included a moderate level of efforts to control air quality and mitigate climate change. The second had weak climate change efforts but strong air pollution control measures.

Air pollution blocks solar radiation from reaching solar panels, resulting in less power produced. Rising temperatures due to climate change also lower the efficiency of solar cells.

Temperature to blame

The models found that by mid-century, the efficiency of solar panels in India will drop by 2.3% in the second scenario but by a greater amount in the first scenario. Based on current solar power generation levels, this amounts to a loss of at least 840 gigawatt-hours of electricity every year. Losses from temperature were higher in the second scenario, which was expected because of weaker climate action.

> Studies of this kind give impetus to innovations that mitigate greenhouse gas emissions through the exploration of viable energy alternatives and, more importantly, improvements in photovoltaic cell design

"This study, based on radiation data from global climate models, provides vital insights into the likely impact of escalating air pollution on photovoltaic efficiency," Ramachandra, who wasn't involved in the study, said.

Solar cells perform best under bright sunlight. They also need lower ambient temperature and airflow over them for cooling. Any imbalance in these factors lowers solar cell performance.

The study found that solar radiation was the main factor affecting solar cell efficiency. Temperature came next, followed by ambient wind speed, although it was much less impactful.

Cut emissions either way

The study also reported that the temperature of solar cells is expected to rise by 2 degrees C by the mid-century due to higher ambient temperatures. "It is important to distinguish between ambient air temperature and cell temperature, as solar cells can heat up significantly beyond the surrounding air temperature due to solar exposure," Ghosh said.

The researchers also revealed that some parts of India's northeast as well as Kerala will develop higher solar power potential in time. "This is really interesting. ... This is because the cloud fractions are expected to decrease over these regions," Ghosh said.

According to the paper, the models can help the government and industry players better pick sites for future solar power projects and allocate resources accordingly.

According to Ghosh, the study underscores the need to curb climate change and improve air quality. He advocated cutting greenhouse gas emissions in particular, which would mitigate climate change as well as remove particulate matter in the way of sunlight headed for solar panels: "This will help us fully utilise the future solar energy potential and create a path toward building climate-resilient nations."

"At the individual level, public participation is crucial, through the adoption of electric vehicles and the use of public transport to reduce fossil fuel consumption. Tree planting and climate awareness efforts to enhance environmental sustainability are needed," Ghosh added.

"While India has introduced commendable policies, the key challenge lies in accelerating their effective implementation from the ground level to top governance structures."

(Unnati Ashar is a freelance science journalist. unnati_a@ymail.com)

THE GIST

India has 300 sunny days a year, but their quality is declining due to air pollution. 'Solar radiation at the earth's surface is not stable over time but undergoes significant long-term variations, referred to as global dimming and brightening'

Air quality variations depend on clouds, aerosols, particulate matter, water vapour and radiatively active gas molecules such as ozone. On a cloudy or hazy day, due to particulate matter, less solar radiation will impinge on the panel and affect generation

The study used data from 1985 to 2014 to predict changes from 2041 to 2050. 'Given that photovoltaic power plants generally have a lifespan of 20 to 25 years, analysing the 2040s aligns well with the operational lifetime of installations'

The research concluded that by mid-century, the efficiency of solar panels will drop by 2.3% owing to pollution. Based on current solar generation levels, this amounts to a loss of at least 840 gigawatt-hours of electricity every year

Key Themes and Analysis

Solar Power and Climate Change

- Solar panels require bright sunlight, lower temperatures, and airflow for optimal performance. Any imbalance in these factors reduces efficiency. Air pollution, including particulate matter and aerosols, blocks solar radiation, leading to global dimming, which affects solar power generation.
- Rising temperatures due to climate change further reduce efficiency by heating up solar cells beyond ambient temperature levels.

Study Findings on Solar Energy Efficiency

- The study used historical data (1985-2014) and projected solar efficiency changes from 2041-2050. It analyzed two scenarios:
  - Moderate climate action but weak air pollution control – leading to higher efficiency losses.
  - Strong air pollution control but weak climate change efforts – resulting in lower losses.
- The study concluded that by mid-century, solar panel efficiency in India will drop by 2.3%, leading to an annual loss of at least 840 gigawatt-hours of electricity.

Regional Impact and Site Selection for Solar Projects

- Northeast India and Kerala may develop higher solar potential due to reduced cloud cover in the future. The findings can help policymakers and industries choose better locations for solar projects and optimize investment in renewable energy.

Policy Recommendations and Mitigation Strategies

- **Cut greenhouse gas emissions:** Reducing emissions will improve air quality and increase solar radiation reaching the panels.
- **Enhance solar panel technology:** Research into high-efficiency solar cells and cooling mechanisms can offset losses.
- **Public participation:** Adoption of electric vehicles, public transport, and afforestation efforts can reduce fossil fuel usage and air pollution.
- **Implementation of policies**: India has introduced commendable renewable energy policies, but effective implementation at all levels remains a challenge.

Conclusion: Balancing Solar Energy Expansion and Environmental Sustainability

- While India is aggressively expanding its solar energy sector, air pollution and climate change pose major hurdles. A multi-pronged approach involving policy reforms, technological advancements,

and public participation is crucial for a climate-resilient solar energy future. Strengthening air quality regulations and investing in climate adaptation strategies will help maximize India's solar power potential.

UPSC Mains Practice Question

Ques: How does air pollution impact solar energy generation? Discuss India's strategies to mitigate the effects of climate change on renewable energy production.**(250 words)**

The challenges of public health education in India

The decision by the United States to withdraw from the World Health Organization (WHO) and drastically reduce the scale of the United States Agency for International Development (USAID) is one that has sent shock waves through the aid and public health world. This move has disrupted essential health-care services in many low- and middle-income countries. However, India has been largely unaffected, as international aid accounts for just 1% of its total health expenditure. Nevertheless, the cessation of such funding threatens to further shrink an already constrained public health development sector, which relies heavily on international support. More importantly, this development directly impacts the public health job market, reducing opportunities for thousands who are pursuing their Master of Public Health (MPH) and similar postgraduate courses.

Public health plays a critical role in shaping a nation's well-being and health-care delivery. The Constitution of India, through Article 47, underlines the state's responsibility to improve public health care. Public health is a specialised field that requires specific knowledge and skills to effectively address people's health needs. There is an urgent need for a dedicated workforce in India trained in public health, a fact that was very starkly realised during the COVID-19 pandemic. Beyond government systems, such a workforce is essential for civil society organisations, academic institutions, and research organisations engaged in public health.

The evolution of training and jobs in India

Though the surge in public health education in India is relatively recent, its history dates to the colonial era. In the early days, public health was largely embedded within medical teaching. This narrow approach persisted despite the establishment of the All India Institute of Hygiene and Public Health, Kolkata in 1932 and the subsequent inclusion of preventive and social medicine – later known as community medicine – as an essential part of medical education. Specialists in community medicine, well-trained in public health provided public health services and met human resource needs in this field. However, their numbers were limited, and they were often engaged in medical teaching. Many students pursued MPH courses abroad in countries such as Australia, the European Union, the United Kingdom and the U.S. Yet, the supply of public health professionals remained constrained. Recognising the growing need and demand, MPH institutions and teaching expanded in India.

The number of institutions offering MPH and related courses in India has grown rapidly. Currently, over 100 institutions offer master's level courses in public health, whereas in 2000, there was only one. This expansion coincided with the launch of the National Rural Health Mission (NRHM) in 2005, which opened public health system roles to non-medical public health specialists. A wide range of institutions, from social science faculties to community medicine departments within medical institutions, have begun offering MPH courses. However, after an initial surge in demand, government recruitment for public health specialists plateaued, while the number of schools, programmes, and graduates continued to rise. As a result, securing jobs has become increasingly difficult for graduates.

Dr. Vikash R. Keshri

is a senior public health and health policy expert and an Adjunct Senior Lecturer at the School of Population Health, University of New South Wales, Sydney, Australia

The key issue is the mismatch between supply and demand, with shrinking job opportunities and the dominance of the private sector

Compounding this issue are challenges such as the lack of standardised training, insufficient practical learning opportunities, faculty shortages, and varied curricula that inadequately prepare students for real-world public health challenges. In addition, institutions offering public health courses are unevenly distributed, with large and populous States such as Assam, Bihar and Jharkhand, and many smaller and hilly States, having none or only a limited number of seats.

Hurdles graduates face, issues in education

The foremost challenge is the mismatch between supply and demand, with limited and shrinking job opportunities for graduates. Today, entry-level positions in public health, such as research or programme assistants, attract a very high number of applications, with a significant proportion of candidates being eligible. The success rate remains exceptionally low, with only a few positions available. Moreover, the shrinking of public health roles and institutions within the public system has further limited job prospects. Efforts to establish public health management cadres in States have been hindered by multiple factors.

In recent times, the changing landscape of health care, marked by the growing dominance of the private sector in public health, further restricts employment opportunities. The private sector prioritises hospital and business management professionals over public health specialists. With limited opportunities in both the public and private sectors, the research and development sectors remain the primary employers for graduates. However, these sectors rely largely on foreign grants, and India is no longer one of the priority countries for such international funders. Similarly, the development sector is constrained by limited funding, which is expected to worsen further due to recent decisions in the U.S. The national research and health development funding remains in its early development and is significantly underfunded. Thus, the job scarcity for public health professionals continues and can exacerbate further.

Beyond job scarcity, there are concerns about the quality of MPH education. The rapid spread of public health schools has led to intense competition to attract students, often at the expense of compromising admission standards.

HEALTH & GOVERNANCE

Many students enrol in these courses without a clear understanding of the field or passion needed to thrive in this field. Further, public health faculty often lack adequate training and real-world experience. The absence of a standardised curriculum and clear outcome measures, despite the Health Ministry's model course framework further exacerbates concerns. In India, MPH courses are currently not mandatorily regulated by any regulatory body. Neither the National Medical Commission (NMC) nor umbrella organisations such as the University Grants Commission (UGC) oversee MPH training. In the absence of these quality measures, the overall quality of graduates is also impacted.

Approaches to consider

To address these challenges, a multi-pronged approach is required. The most urgent priority is to create public health jobs at all levels, from primary care to State and national health systems. In most developed countries with established public health education systems, governments are the largest employers of public health professionals. Similarly, establishing a dedicated public health cadre within State governments would be a significant step. This would not only create employment but also strengthen public health systems.

Next, a robust regulatory mechanism must be introduced by constituting a dedicated regulatory body or a specialised public health education division within existing regulatory agencies such as the NMC or UGC. This department, led by public health experts, should be responsible for setting curriculum standards and minimum training requirements while allowing room for institutional innovation, given that public health is a dynamic and evolving discipline. Moreover, public health training in all institutions must be closely integrated with practical learning opportunities within public health systems. There is a need to foster the growth of public health institutions in States where there are none or only a limited number. The emerging global situation calls for more national action and the building of local ecosystems for sustainable development in health.

The views expressed are personal

GS Paper 02 Governance & Social Justice

UPSC Mains Practice Question: Discuss the challenges in public health education in India. What policy measures are needed to improve training and job opportunities in this sector?

Context :

- Public health plays a crucial role in shaping a nation's healthcare system and overall well-being. The Indian Constitution, under Article 47, mandates the state to improve public health. However, challenges such as lack of standardized training, inadequate practical exposure, and limited job opportunities hinder the sector's growth.
- A recent development impacting public health education is the United States' decision to withdraw from the World Health Organization (WHO) and reduce USAID funding, affecting health programs in low- and middle-income countries. While India is not heavily reliant on international aid (which forms only 1% of its health expenditure), such funding cuts could further weaken an already fragile public health development sector and reduce job opportunities for public health graduates.

Evolution of Public Health Education in India

- Public health education in India has evolved significantly over the decades:
  - Historically, public health was embedded within medical education, with specialists trained in Preventive and Social Medicine (Community Medicine) playing key roles.
  - The All India Institute of Hygiene and Public Health, Kolkata (1932) was one of the first institutions offering specialized public health training.
  - Many Indian students pursued Master of Public Health (MPH) programs abroad due to limited domestic opportunities.
  - The demand for public health professionals increased after the launch of the National Rural Health Mission (NRHM) in 2005, leading to the expansion of MPH programs in India.
  - Currently, over 100 institutions offer MPH courses in India, compared to just one in 2000. Despite this expansion, government recruitment for public health specialists has remained stagnant, making it increasingly difficult for graduates to secure jobs.

Key Challenges in Public Health Education

1. Mismatch Between Supply and Demand

- The number of public health graduates has increased rapidly, but job opportunities have not kept pace.
- Entry-level positions (e.g., research/program assistants) attract a large number of applicants, making selection highly competitive.

- Government recruitment for public health professionals remains low despite a growing need.
- The public sector's shrinking role in healthcare limits employment options.

2. Limited Role of Government in Hiring Public Health Graduates

- Unlike developed countries where governments are the largest employers of public health professionals, India lacks a dedicated *public health management cadre* at the state level.
- Various efforts to institutionalize public health positions within state governments have been unsuccessful.

3. Rise of Private Sector and Limited Research Opportunities

- The private sector prioritizes hospital management professionals over public health specialists.
- Research and development (R&D) opportunities are limited, as they depend on foreign grants, which are now declining.
- India's domestic funding for public health research remains inadequate.

4. Quality Issues in MPH Education

- Rapid expansion of MPH courses has led to institutions competing for students, often compromising on admission standards.
- Many students enroll in MPH programs without a clear understanding of the field or required skills.
- Faculty often lack practical experience, limiting the effectiveness of training.
- The absence of a *standardized curriculum* results in inconsistencies in the quality of education.
- No regulatory body (such as NMC or UGC) oversees MPH training in India, affecting credibility and employability.

5. Uneven Distribution of Public Health Institutions

- Some large states (e.g., Bihar, Jharkhand, Assam) have very few or no public health institutions.
- This regional disparity limits access to quality education and employment opportunities.

Way Forward – Policy Recommendations

- **1.Establish a Dedicated Public Health Cadre**
  - The government should create a public health cadre at the state and national levels to strengthen healthcare delivery and provide employment to MPH graduates.
  - Strengthening the National Health Mission (NHM) and similar initiatives could generate more public health jobs.
- **2. Improve Regulation and Standardization of Public Health Education**
  - A dedicated regulatory body or a specialized division under NMC/UGC should oversee public health education.
  - The curriculum must be standardized to ensure consistency in training.
  - Public health courses should include practical exposure through internships with health organizations.
- **3. Expand and Strengthen Public Health Institutions in Underserved Regions**

- The government should establish more public health schools in states where they are currently lacking.
- Increased funding for state health research and public health policy studies can enhance career opportunities.

4. Increase Public Health Employment in the Private Sector

- Private hospitals and corporate entities should be encouraged to hire public health professionals for health planning and epidemiological research.
- Strengthening*public-private partnerships (PPP) in healthcare can create new job roles.

5. Enhance Research Funding and International Collaboration

- More national funding should be allocated for public health research and innovation.
- Strengthening collaborations with international health organizations and academic institutions can improve training quality.

Conclusion

Public health education in India has grown significantly, but a lack of standardization, job scarcity, and weak government hiring limit its impact. Strengthening regulatory mechanisms, establishing a public health cadre, and improving education quality are essential to making public health a viable career choice. A multi-pronged approach involving the government, private sector, and research institutions is required to ensure sustainable development in this field.