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Page 07 : GS 3 : Science & Tech : Awareness in various sc and tech fields

Indian researchers have developed a predictive model based on the Gompertz Model to estimate a newborn's birth weight using routine pregnancy scans.

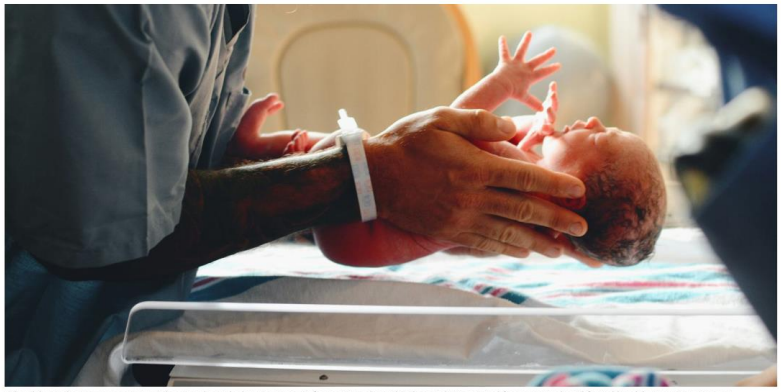
Model by Chennai, Pune team predicts birth weight from routine scans

Equipped with the model, the researchers are looking forward to applying it in the clinic. They have published the code for their prediction software online and plan to develop an easy and free online calculator for clinicians; they are also in the early stages of considering access requests from independent researchers

Sneha Khedkar

Researchers from the Institute of Mathematical Sciences (IMSc) and Seethapathy Clinic and Hospital, both in Chennai, and the Indian Institute of Science Education and Research (IISER), Pune, have developed a model that can predict a newborn's birth weight using routine scans during pregnancy.

Accurate information about birth weight is crucial for maternal and foetal health. Low weight can cause complications like preterm birth, while heavier babies are harder to deliver safely. Knowing foetal birth weight can help healthcare providers identify possible risks and plan interventions.



A health worker prepares to weigh a newborn baby. Accurate information about birth weight is crucial for maternal and foetal health. CHRISTIAN BOWEN

How much a foetus weighs

There is no method to determine foetal weight during a pregnancy, so doctors assess a baby's growth by measuring parameters like head and abdominal circumference during routine ultrasounds. Some mathematical formulae allow birth weight predictions based on these measurements, but they require late-term ultrasounds within a week before delivery.

"Often within the public sector, this last scan close to the delivery does not happen," said Uma Ram, a gynaecologist at Seethapathy Clinic and Hospital, Chennai. When computational biologists Leelavati Narlikar from IISER and Rahul Siddharthan from IMSc approached Ram with a grant for maternal and child health-related work, they decided to pursue this problem.

Their method was reported in the journal *European Journal of Obstetrics & Gynecology and Reproductive Biology: X* on October 3. It uses a mathematical model to calculate foetal growth parameters, allowing doctors to estimate birth weight without late-term ultrasounds.

The Gompertz model

"This is a very interesting and important study," said Tavpritesh Sethi, a computational biologist at the Indraprastha Institute of Information Technology, Delhi; he wasn't associated with the study. "If the model is validated across bigger settings, it essentially reduces the need for carrying out a lot of ultrasounds."

The team's investigation of a mathematical model for growth led them to the Gompertz formula. First described in the 19th century by English mathematician Benjamin Gompertz, the equation has been used to model cell population and tumour growth in biology research. Researchers have also used it to model foetal growth volume in collective data but not to measure individual birth weight.

The Gompertz model, which uses the formula, was originally developed to predict population growth in a constrained setting, Siddharthan said. The team tested it to predict foetal measurements since the uterus is a constrained environment and the formula estimates the right shape of growth, he added.

The team used measurements of foetal parameters like head and abdominal circumference from at least three routine scans of more than 750 pregnant women. They incorporated these data into the Gompertz formula to estimate foetal measurements at the time of birth.

Many women, many formulae

Next, "we tried to predict the birth weight of the baby at the time of delivery," the study's first author, Chandrani Kumari, said.

They used the actual and predicted foetal measurements to train a machine-learning model to predict birth weight.

To challenge their model, the researchers compared expected weights with birth weights reported in the records. They observed that their model predicted more than 70% of birth weights with an error margin of less than 10%.

Researchers from other countries have provided several other formulae to predict foetal weight at birth and during pregnancy based on ultrasound measurements. Despite not having late-term ultrasound measurements, the current model was comparable to these previously described models, indicating this method outperforms older ones.

The Gompertz formula has been used to model cell population and tumour growth. Researchers have also used it to model foetal growth volume in collective data

Next step: the clinic

The researchers next used their model to predict birth weights in a different group of 365 women. They obtained foetal measurements for this group from hospitals in Chennai, Pondicherry, Hyderabad, and Kochi. And again, they observed that recorded birth weights in this group were comparable to expected birth weights predicted by their model.

Equipped with a model to accurately predict birth weight, the team now looks forward to applying it in the clinic. The researchers have published the code for their prediction software online and plan to make an easy (and free) online calculator for clinicians.

Ultrasound machines also have software equipped with growth charts and formulae for doctors to estimate a foetus's weight. "In similar fashion, this formula could also be incorporated into that software," Ram said.

Gaps in the machine

But the study is not without limitations, according to Sethi and the researchers. The model still needs to incorporate the nutritional status of pregnant women, which may affect foetal growth, Sethi said. He also said the model must be validated in other populations across India, where the relationship between, say, a foetus's physical dimensions and weight might be different.

The researchers agreed testing the model with a more diverse cohort is important. Both groups they tested the model with were from South India. But change may be underway: the researchers are in the early stages of considering requests from independent researchers for access to their model.

Need for data

Narlikar added they also need to check whether the model works with geographically and ethnically diverse populations, but there is limited data to test the model on.

"One thing the community is lacking is ... that we don't have a lot of publicly available datasets," she said. "It would be a great thing if we had more of them."

Indeed, Narlikar and Siddharthan – both bioinformaticians – noted the lack of data sharing in healthcare, in part to maintain patient confidentiality. "We have done our best to anonymise the data and give only the basic information so that patients cannot be identified," Siddharthan said.

"We have made our data available. We very much hope that other groups will do the same thing."

(Sneha Khedkar is a biologist turned freelance science journalist. snehakhedkar30@gmail.com)

THE GIST

- Doctors assess the baby's growth using head and abdominal circumference during ultrasounds. Some formulae allow weight predictions based on these measurements, but they require late-term ultrasounds
- The team used foetal parameters from at least three routine scans of more than 750 pregnant women. They incorporated these data into the Gompertz formula to estimate measurements at the time of birth
- Researchers compared expected weights with birth weights reported in records. They found their model predicted more than 70% of birth weights with an error margin of less than 10%
- The model needs to incorporate the nutritional status of women and must be validated in other populations across India, where the relationship between a foetus's physical dimensions and weight might be different

What is the Gompertz Model?

- It is a mathematical model developed by English mathematician Benjamin Gompertz in the early 19th century.

- It was originally designed to model population growth in a constrained environment, such as a specific geographic region.
- The model uses an S-shaped (sigmoid) curve to represent growth patterns that start slowly, accelerate, and then slow again as they approach a plateau.

Applications:

- Biology: The Gompertz Model is used to study tumor growth and cell population dynamics, reflecting constrained growth in biological systems.
- Epidemiology: Applied in predicting the spread of infectious diseases like COVID-19, capturing how transmission rates slow with interventions.
- Ecology: Useful for modelling species population growth in habitats with limited resources, aiding conservation and ecosystem management.
- Healthcare: Recently adapted to predict foetal birth weight, helping identify potential risks associated with low or high birth weight.
- Aging Research: Employed to analyze mortality rates and lifespan patterns, contributing to studies on aging and longevity.

Recent Research and Significance

- Recent research has applied the Gompertz Model in predicting foetal birth weight using routine scans, as shown by researchers from IISER Pune and IMSc Chennai, offering a non-invasive alternative for maternal health.
- The model is used in tumor growth studies, allowing researchers to understand and predict cancer progression.
- Its predictive accuracy under constrained conditions makes it useful for biological systems, including population growth and cell dynamics.
- In healthcare, it supports early detection and intervention for conditions impacted by growth patterns, such as low or high birth weight risks.

Page 08 : GS 2 : International Relations

The article discusses the ongoing dispute between Indian and Sri Lankan fishermen in the Palk Bay region, emphasizing the need for dialogue to resolve fishing-related issues.

- It highlights a recent meeting where Indian officials urged for direct discussions between the fishermen of both countries to find a solution.

Analysis of the News

- India called for a meeting between fishermen from both India and Sri Lanka during the sixth meeting of the India-Sri Lanka Joint Working Group on Fisheries in Colombo. This initiative aims to address the ongoing and complex issue of fishing rights and practices in the Palk Bay, which has been a source of tension.
- Indian High Commissioner Santosh Jha and Sri Lankan President Anura Kumara Dissanayake stressed the importance of a long-term resolution that respects the needs of fishermen and promotes cooperation.

Focus on Sustainable Solutions:

- The discussions emphasized the need for a long-term resolution that considers the needs of fishermen and fosters cooperation between the two nations.
- Both parties acknowledged the necessity of finding a sustainable approach that respects the livelihoods of those involved.

Grassroots Calls for Negotiation:

- On October 25, fishermen from Rameswaram staged a demonstration demanding talks with their Sri Lankan counterparts. This grassroots movement reflects a growing desire for dialogue, which is crucial given the history of disputes.
- Additionally, representatives from the Northern Province of Sri Lanka had previously reached out to their Tamil Nadu counterparts,

Sharing resources

Fishermen from both sides of the Palk Bay must meet to resolve dispute

India rightly used the sixth meeting of the India-Sri Lanka Joint Working Group on Fisheries, in Colombo on October 29, as an opportunity to again call for a meeting between fishermen of both countries to resolve the vexed problem of fishing in the Palk Bay. In a meeting in Colombo between India's High Commissioner Santosh Jha and Sri Lankan President Anura Kumara Dissanayake, stress was laid on the "importance of a long-term resolution that respects the needs of fishermen ... and promotes cooperation". Mr. Dissanayake affirmed his commitment to protecting Sri Lanka's interests. Weeks earlier, when India's External Affairs Minister S. Jaishankar met the President, the subject had come up for discussion. The idea of talks between fishermen seems to have takers. On October 25, fishermen staged a demonstration in Rameswaram wanting talks. Nearly eight months ago, representatives of the fisherfolk from the Northern Province had appealed for negotiations with their Tamil Nadu counterparts, despite their complaints about 'destructive bottom trawling' by the other side. It is up to Sri Lanka to respond.

What is well known is the frequent arrest of Tamil Nadu's fishermen, especially from Ramanathapuram, on charges of transgressing the International Maritime Boundary Line. Many are released after India's intervention. According to Tamil Nadu Chief Minister M.K. Stalin, as on October 27, there were 30 incidents of arrests this year; 140 fishermen and 200 boats are with Sri Lanka. There were casualties on both sides, in June and August, in operations by Sri Lanka to nab Tamil Nadu's fishermen. However, what appears to be a new trend is the increasing detention of Indian fishermen and their boats, with lengthy sentences and fines on repeat offenders. This is why India's long-standing position, that the issue has humanitarian and livelihood angles, assumes significance. At the same time, marine ecosystem conservation is important. Once Sri Lanka's parliamentary poll is over in mid-November, Mr. Dissanayake should enable a conducive environment for the northern fishermen to arrive at an agreement – this would need political support. Likewise, India should again push for the deep-sea fishing project, launched in 2017, for Tamil Nadu's fishermen, apart from promoting alternative forms of fishing. New Delhi should also come up with suitable schemes to help fishermen in the Northern Province, who have still to recover from the civil war. Fishermen from both countries should explore the relevance of the broad contours of an understanding reached between them in 2010. The northern fishermen should also understand the need to give Tamil Nadu's fishermen a reasonable period of transition. A combination of measures by all stakeholders is what can resolve the Palk Bay dispute.

despite raising concerns about destructive fishing practices like bottom trawling.

Frequent Arrests of Fishermen:

- A well-documented issue is the frequent arrest of Tamil Nadu fishermen, particularly from the Ramanathapuram district, for allegedly crossing the International Maritime Boundary Line.
- As of October 27, there had been 30 reported incidents this year, resulting in the detention of approximately 140 fishermen and 200 fishing boats by Sri Lankan authorities. Many of these fishermen are released after diplomatic intervention from India.

Humanitarian and Environmental Considerations:

- India maintains that the dispute encompasses significant humanitarian and livelihood dimensions for the fishermen involved.
- Alongside these concerns, there is also a pressing need for marine ecosystem conservation, which must be factored into any discussions or agreements.

Political Context and Future Prospects:

- With Sri Lanka's parliamentary elections scheduled for mid-November, it is hoped that President Dissanayake will create a favorable environment for negotiations between northern fishermen and their Tamil Nadu counterparts. Political support will be crucial in facilitating these discussions and finding common ground.

Promotion of Fishing Initiatives:

- India should prioritize the promotion of the deep-sea fishing project launched in 2017, aimed at supporting Tamil Nadu's fishermen.
- Additionally, there is a need to develop alternative fishing schemes that can provide sustainable livelihoods.
- This support is particularly important for fishermen in the Northern Province of Sri Lanka, many of whom are still recovering from the impacts of the civil war.

Revisiting Past Agreements:

- It is essential for fishermen from both countries to explore and possibly revive the understanding established in 2010, which addressed various aspects of fishing rights and practices.
- Furthermore, it is important for northern fishermen to recognize and accommodate the need for a reasonable transition period for Tamil Nadu fishermen as negotiations progress.

Conclusion:

- Ultimately, a multifaceted approach involving all stakeholders is necessary to effectively resolve the Palk Bay dispute.
- By fostering dialogue, supporting sustainable fishing practices, and addressing the humanitarian needs of affected fishermen, both India and Sri Lanka can work towards a peaceful and cooperative resolution to this longstanding issue.

Page 08 : GS 3 : Economics : Effects Of Liberalization On The Economy, Changes In Industrial Policy and their effects on Industrial Growth

The October 25, 2024, incident where a Qatar Airways Boeing 787's landing gear sank into a collapsed ramp at Doha underscores the importance of runway safety concerns.

- Similar risks exist in Chennai Airport's expansion plans and the greenfield project at Parandur, where soil stability and structural integrity are critical issues that must not be overlooked.

Airports where pilots could fear to land

Captain A. (Mohan) Ranganathan

a former airline instructor pilot and aviation safety adviser. He is also a former member of the Civil Aviation Safety Advisory Council (CASAC), India

On October 25, 2024, there was an incident involving a Qatar Airways Boeing 787 that was operating as a scheduled flight from Colombo, Sri Lanka to Doha, Qatar. After landing and taxiing at slow speed to the assigned bay, the plane's right main landing gear sank into a ramp area, which in turn collapsed. As the plane's main landing gear wheels had sunk in deep, the right engine made contact with the ground and sustained damage. It is fortunate that the incident did not happen on the runway or on the taxi track when the plane would have been at a higher speed.

Social media posts indicate that a Japanese company contracted to build the airport at Doha – most of it is on reclaimed land – had suggested that the whole area would need to be concreted as the soil was not strong enough to handle the stress that would be induced by heavy aircraft movement. As the cost was prohibitive, a cheaper option was chosen. It is surprising that a cash-rich country would cut costs on an important infrastructure project that is one of the most important in the fast growing aviation scene.

Singapore's Changi airport, Hong Kong's new airport at Chek Lap Kok island, and Male airport (the Maldives) are built on reclaimed land and have been functioning and expanding rapidly. They have not encountered the kind of problem seen at Doha. However, it is certain that Qatar will leave no stone unturned in correcting any deficiency found in the airport operational area constructions.

Chennai airport's expansion

Why is this incident of interest to India? People may not be aware of the original expansion plan of Chennai airport that had been proposed in 2007. The design project was originally given to the firm, Larsen & Toubro (L&T), with the Airports Authority of India (AAI) involved in the requirements. Under the plan, a parallel runway to the existing main runway was to be constructed, and the old secondary runway was to be extended across the Adyar river (which flows near the airport area), with a bridge to connect the two runways. L&T carried out the soil testing for the bridge to be built across the river, which would hold the taxi track and the area assigned for the parallel runway. It appears that the firm found the soil for the area required for the parallel runway to be unsuitable, and the proposal for a parallel runway was dropped.

The AAI then proposed that the taxi track across the river be converted into the extended secondary runway and that L&T needed to do fresh soil testing for the expanded project. For reasons best known to L&T and the AAI, L&T dropped out of the project. Instead, the project was awarded to an unknown construction company, Consolidated Construction Consortium Limited (CCCL), which, at that stage, had no experience of building even a road bridge. The AAI claimed that the bridge construction design had been approved by IIT Madras. This writer has a letter from the Head of the Department of Structural Engineering, IIT Madras, stating that they had only validated the numbers given by the AAI.

In the expansion plans at Chennai airport and the greenfield project at Parandur, there are runway safety issues that cannot be brushed aside

Safety violations, unaddressed issues

In the Environment Clearance No. 10-140/2007-IA-III dt. 25/8/- 1, it was indicated by the AAI that the runway bridge, with a span of 200 metres by 415m and a structural grid of 20 mx10m, on a RCC column of 1.2m diameter and 1.4m high above a high floodline, would be constructed on the Adyar river. The flood level in earlier floods was 13m and so the bottom of the bridge should have been 14.4m above mean sea level. The pillars supporting the bridge across the Adyar were to be 1.2m in diameter, but the pillars constructed are 0.86m in diameter. The area that the bridge was to occupy was 200m x 417m but it was stretched to 617m. The most serious violation was the caveat that the bridge had to be built 1.4m higher than the flood level of the Adyar river in the earlier floods. But the bridge has been built four metres below the permitted level. During the catastrophic floods in Chennai in 2015, the gushing water flow in the Adyar river was blocked by this structure, resulting in an accelerated water flow through the lower portion of the secondary runway. This resulted in the Coast Guard hanger, private aircraft parked on the tarmac and also an Army bridge near the Indian Army's Officers Training Academy (which is next to the airport) being destroyed.

The floods in 2015 were blamed on the delayed opening of the sluice gates of Chembarambakkam lake (one of Chennai's water supply sources) which lies 14 kilometres west of the airport. Environmentalists say the water discharge from Chembarambakkam contributes only around 30% of the water flow in the Adyar river, with the rest from overflow from flooded waterbodies further west such as Mudichur, Sriperumbudur and Parandur (the planned site of Chennai's second airport) We have seen what Chennai and the surroundings went through during the deluges in 2021 and 2023. Weather pundits expect extreme weather events ahead.

This brings us back to Doha and its connection with Chennai airport. The AAI completed the Chennai runway extension more than 12 years ago and the AAI claims that it is designed for Airbus A380 operations. Recently, in a review of operations at Chennai airport, a Cabinet Minister in the Tamil Nadu government said that efforts are on to get Code F aircraft (much larger widebody aircraft such as the A380) to operate to Chennai. He said the AAI is working on this. To operate such aircraft, you need a runway and taxi track width of 60m. This would need even wider spacing from the existing main runway. The runways in Chennai are only 45m wide. If one applies the standards set by the International Civil Aviation Organization, no Code F plane can operate. Can the AAI explain why no widebody aircraft can operate on the secondary runway, even though it was completed 12 years ago?

A greenfield project

Now to the much proclaimed greenfield Parandur airport project. The plan here is for the acquisition of 4,000 acres of land for a new international airport which is an area rich in waterbodies. To have such an airport built to international standards, soil testing and concreting of the entire area will have to be done in order to operate large aircraft. Based on the experience of the dropped parallel runway project at the existing Chennai airport, are crores of tax-payers' money going to be sunk in a project which will destroy the many waterbodies at Parandur? If 4,000 acres of concrete – and for a depth of at least 4m – are to cover waterbodies, can one imagine where flood waters from those destroyed waterbodies would flow? We are in an era of climate change. Let us not forget that constructing an airport on reclaimed land that is situated in an area of waterbodies is a specialised subject, and the costs are prohibitive.

Readers may wonder why this writer has mentioned the depth of a concrete tarmac. Readers might be aware of hard landings of 2g or 3g. In simple terms, 'g' is the acceleration due to gravity. So, a 2g landing for an aircraft that weighs 400 tons is equivalent to the weight on its wheels of an impact of 800 tons. Apart from such an impact, if an aircraft lands when there is a strong crosswind, the wheels, rather than being straight, may be at 30°-45° angle to the runway. On touchdown, the aircraft's wheels straighten as the aircraft moves along the runway. The runway surface, apart from the impact of the aircraft, will also be subject to a twisting force. The Minister has talked about a plan for even larger planes landing at the existing Chennai airport. And Parandur airport is being planned in an area with waterbodies. One can imagine the huge twisting impact that an aircraft weighing 600 tons will have on a runway when landing in a crosswind. There has to be a professional in charge who has good knowledge on how to design a runway and operational area structures, and who also has knowledge of operational issues.

We have read reports of several bridges built in recent times across India collapsing like a pack of cards. Lives have been lost. We must not lose sight of the issue of safety.

Bengaluru has now established itself as the aviation gateway to the south, a position Chennai once held. Tamil Nadu has lost its premium gateway position because of procrastination, bad planning and design. The fact is also that inflated numbers projecting rising air passenger numbers in Tamil Nadu cannot conceal the truth. Passenger numbers have not even touched 40% of their original projections. It seems to be a case of fools rushing in where angels fear to tread.

Background

- The Chennai airport expansion, initially proposed in 2007, faced design and safety issues, including unsuitable soil for a parallel runway and violations in bridge construction standards, raising concerns about infrastructure reliability and potential flooding risks in future projects.

What are the specific challenges and risks pilots face when landing at these airports?

- Runway Integrity: Pilots may encounter challenges if the runway or taxiways have structural weaknesses or are poorly designed, such as in the case of Doha, where the ground beneath collapsed under the aircraft's weight.
- Crosswinds and Weather Conditions: Airports located near water bodies or in regions with extreme weather may present challenges during landing, such as turbulence from crosswinds or sudden weather changes, increasing the risk of hard landings or runway excursions.
- Ground Handling: The condition of the ground infrastructure, including taxiways and ramps, is critical. Pilots must be cautious of soft spots or areas not properly constructed to withstand aircraft weight, which can lead to accidents.
- Limited Runway Width and Length: Airports with insufficient runway dimensions may restrict landing and takeoff performance for larger aircraft, posing risks during adverse conditions where longer stopping distances are required.
- Inadequate Visual Aids: Poorly designed lighting and navigational aids can impair a pilot's ability to assess runway conditions, especially in low visibility scenarios.
- Safety Compliance: Non-compliance with international aviation standards during the design and construction phases may lead to operational hazards that pilots must navigate.

How do airport design and infrastructure impact aviation safety?

- Structural Reliability: The strength and reliability of runway surfaces directly affect safety. Insufficient ground support may lead to structural failures under heavy loads, as seen in the Doha incident.
- Drainage Systems: Effective drainage systems are vital for preventing water accumulation on runways, which can lead to hydroplaning and loss of control during landings.
- Environmental Considerations: The placement of airports in flood-prone areas without adequate flood management strategies can compromise safety during heavy rainfall, as experienced in Chennai.
- Design Standards: Compliance with International Civil Aviation Organization (ICAO) standards is crucial for ensuring that airports are capable of safely accommodating various aircraft types.

- Construction Quality: The choice of construction materials and techniques directly impacts the longevity and safety of airport infrastructure. Cost-cutting measures may lead to substandard designs.

What measures are being taken to enhance pilot training and operational procedures at these high-risk airports? (Way forward)

- Enhanced Simulation Training: Pilots receive advanced simulation training to handle specific challenges associated with landing at high-risk airports, including crosswind landings and emergencies on compromised runways.
- Regular Safety Audits: Conduct audits and inspections of airport facilities and infrastructure to ensure compliance with safety standards and identify potential hazards.
- Real-time Weather Updates: Implementation of systems that provide pilots with real-time updates on weather conditions and runway status, helping them make informed decisions during landings.
- Collaboration with Engineers: Continuous collaboration between pilots and airport engineers during the planning and construction phases to address potential safety issues upfront.
- Training on Emergency Protocols: Training programs that include scenarios specific to airports with known risks, ensuring pilots are prepared for emergencies related to runway or taxiway failures.

Page 10 : GS 2 : Governance : Governance, Transparency & Accountability, Citizens Charters

World Cities Day is celebrated annually on October 31, highlighting the growing urban population, now at 4.7 billion (57.5% of the total). This year's theme focuses on empowering youth to drive local sustainability initiatives in urban areas.

What are major challenges faced by Indian cities?

What is the theme for this year's World Cities Day? What led to India's rapid urbanisation? How big of a threat does climate change and rising inequality pose to urban growth?

Tikender Singh Panwar

The story so far:

October 31 is observed every year as World Cities Day. The world's urban population has reached an estimated 4.7 billion, or 57.5% of the world's total population, with projections to double by 2050. The theme for this year's World Cities Day is 'Youth Climate Changemakers: Catalysing Local Action for Urban Sustainability'.

What are challenges faced by cities?

The UN underscores that cities face unprecedented challenges, especially climate change. While strides have been made towards Sustainable Development Goals (SDGs), urban centres remain plagued by poverty, inequality, and environmental degradation. In the Global South, these challenges are intensified by rapid urbanisation, inadequate infrastructure, and limited resources. Cities here often suffer from housing shortages, poor access to clean water and sanitation, and increased vulnerability to climate-related events.

What about Indian urbanisation?

India's urbanisation trajectory differs from the cities in the Global North. In Western countries, urbanisation followed industrialisation, which created jobs that absorbed rural labour. Their urbanisation was sustained also because of massive economic transfers from colonies. Economist Utsa Patnaik has highlighted that India alone contributed over $45 trillion to England's economy during colonial rule. In contrast, India's urbanisation is largely driven by economic distress, resulting in "poverty-driven urbanisation," with both rural-to-urban and urban-to-urban migration. During the COVID-19 pandemic, the strain on urban planning became apparent, as reverse migration trends highlighted gaps in infrastructure.

What are urban challenges in India?

Without a 2021 Census, India lacks precise data on its urban population. World Bank estimates suggest around 40% of India's population live in urban areas, in around 9,000 statutory and census towns. The main challenges Indian cities face include inadequate spatial planning, climate change, massive migration, growing inequality and social segregation, and governance limitations.

Urban planning agencies have struggled due to two main issues. First, spatial and temporal plans are often outdated and fail to accommodate population growth. Since the 1980s, deindustrialisation has led to job losses in cities like Ahmedabad, Delhi, Surat, and Mumbai. Many workers displaced by this trend moved to peri-urban areas, where they live in overcrowded conditions. Currently, 40% of India's urban population resides in slums. Second, plans often focus on capital growth rather than people's needs, leading to a lack of local ownership and engagement in the planning process. Additionally, inequality is widening, with exclusive developments catering to the wealthy while millions lack basic housing. Similarly, climate change severely impacts Indian cities. Cities face severe pollution and are increasingly subject to urban flooding and "heat island effects." Among the 10 most polluted cities in India, eight are in the NCR region around Delhi.

Despite the 74th Constitutional Amendment, most Indian cities remain controlled by undemocratic bodies. Though cities have elected representatives, they rarely control urban planning, which is often outsourced to parastatals and private entities. For example, less than three of the 18 functions outlined in the 12th Schedule have been universally transferred to urban governments, and cities receive a mere 0.5% of the GDP in intergovernmental transfers. As we observe World Cities Day, these challenges highlight the need for comprehensive national interventions.

The writer is former deputy mayor, Shimla, and Member, Kerala Urban Commission.

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- The world's urban population has reached an estimated 4.7 billion, or 57.5% of the world's total population, with projections to double by 2050.
- India's urbanisation trajectory differs from the cities in the Global North. In Western countries, urbanisation followed industrialisation, which created jobs that absorbed rural labour.
- The main challenges Indian cities face include inadequate spatial planning, climate change, massive migration, growing inequality and social segregation, and governance limitations.

What is the theme for this year's World Cities Day?

- The theme for this year's World Cities Day is "Youth Climate Changemakers: Catalysing Local Action for Urban Sustainability."
- It emphasizes the vital role of young people in driving grassroots initiatives to address climate change and promote sustainable urban development.

What led to India's rapid urbanization?

- Economic Distress: Urbanization in India is largely driven by economic hardships in rural areas, leading to both rural-to-urban and urban-to-urban migration.
- COVID-19 Impact: The pandemic exposed the strain on urban infrastructure and highlighted the reverse migration trends, showcasing gaps in urban planning.
- Lack of Census Data: The absence of precise data from the 2021 Census limits understanding and planning for urban population growth, though estimates suggest around 40% of the population resides in urban areas.
- Job Losses from Deindustrialisation: Many cities have experienced deindustrialization since the 1980s, resulting in job losses that push displaced workers to peri-urban areas.
- Overcrowding in Slums: Approximately 40% of India's urban population lives in slums, exacerbating the challenges associated with rapid urban growth.

How big of a threat do climate change and rising inequality pose to urban growth?

- Climate Change: Indian cities face severe pollution, urban flooding, and heat island effects, which jeopardize urban sustainability and living conditions.
- Rising Inequality: Urban development often caters to wealthier populations, resulting in stark contrasts between exclusive developments and the significant number of urban residents lacking basic housing.
- Social Segregation: Increasing segregation along social and religious lines within urban settings worsens inequality and marginalizes vulnerable groups.
- Governance Limitations: Many urban areas are controlled by undemocratic bodies, limiting the effectiveness of governance and local engagement in urban planning.
- Inadequate Urban Planning: Outdated spatial and temporal planning does not address the needs of a growing urban population, further complicating the impact of climate change and social disparities.

Steps taken by the government:

- Smart Cities Mission: Launched in 2015, this initiative aims to promote sustainable and inclusive urban development by investing in infrastructure, smart technologies, and urban planning to improve the quality of life in cities and enhance urban resilience.
- Atal Mission for Rejuvenation and Urban Transformation (AMRUT): This mission focuses on providing basic services like water supply, sewage management, and urban transport in cities, promoting sustainable urban development and improving the quality of life for residents.
- Pradhan Mantri Awas Yojana (PMAY): This scheme aims to provide affordable housing for all by 2022, addressing the housing shortage and improving living conditions for low-income urban residents, thereby tackling issues related to slums and inadequate housing.

Way forward:

- Enhance Data-Driven Urban Planning: Need to conduct comprehensive and regular urban censuses to gather accurate demographic data, enabling evidence-based decision-making for urban policies and effective resource allocation.
- Strengthen Community Engagement: The government should foster participatory governance by involving local communities in urban planning and development processes.

In News : Global TB Report 2024

The Global TB Report 2024 has acknowledged the tremendous progress India has made in closing the gap of missed TB cases since 2015.

About Global TB Report:

- It is an annual report published by the World Health Organization (WHO).
- It provides a comprehensive and up-to-date assessment of the TB epidemic and of progress in prevention, diagnosis, and treatment of the disease at global, regional, and country levels.

Highlights of the 2024 Report:

- It shows 8.2 million people were newly diagnosed with TB in 2023, a figure that represents the highest number of TB cases recorded by the WHO since it began global TB monitoring in 1995.
- It also marks a significant increase from the 7.5 million new TB cases reported in 2022.
- Although the estimated number of 1.25 million TB deaths in 2023 is down from the 1.32 million recorded in 2022 and continues a declining trend from the height of the COVID-19 pandemic, that number still far surpasses the 320,000 COVID deaths officially reported to the WHO last year.

- The data show that 30 mostly low- and middle-income countries (LMICs) bear 87% of the global TB burden, with five countries—India (26%), Indonesia (10%), China (6.8%), the Philippines (6.8%), and Pakistan (6.3%)—combining for 56% of the burden.
- 55 percent of people who developed TB were men, 33 percent were women, and 12 percent were children and young adolescents.
- According to the report, a significant number of new TB cases are driven by five major risk factors: undernutrition, HIV infection, alcohol use disorders, smoking, and diabetes.
- In 2023, India was estimated to have had 27 lakh TB cases, of which 25.1 lakh persons were diagnosed and put on treatment.
- This has buoyed India's treatment coverage to 89 percent in 2023 from 72 percent in 2015, thereby bridging the gap of missing cases.
- It acknowledged a drop in India's TB incidence - from 237 per lakh population in 2015, to 195 per lakh population in 2023, accounting for a 17.7 percent decline.

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The BRICS summit boost to India-Iran ties

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At the 16th BRICS Summit hosted by Russia in Kazan (October 22-24, 2024), there were a few meetings on the sidelines which created a buzz. One such meeting was between India and Iran, both close civilisational friends and looking to strengthen a stagnating partnership. Iran, which is now embroiled in the war in Gaza, is looking for Indian support in de-escalating the crisis. India, too, has supported having a ceasefire and de-escalation at the earliest. Globally, India is being widely sought after to facilitate a peaceful resolution to the conflict as it enjoys trust and goodwill across both ends of the conflict, with Israel and Iran.

Much potential

The bilateral meeting between Prime Minister Narendra Modi and President of the Islamic Republic of Iran Masoud Pezeshkian was the first time that the leaders have met. During the meeting, they acknowledged the strong and untapped potential in the bilateral relationship. Mr. Pezeshkian appreciated India's growing role in the world and underlined its potential role in de-escalating the Gaza conflict. He also acknowledged the key role played by India in 2023 in Iran's entry into key multilateral organisations such as the Shanghai Cooperation Organisation (SCO) and BRICS. Both sides also discussed the possibilities of strengthening cooperation in key areas such as the Chabahar port and the International North-South Transport Corridor (INSTC).

Iran's importance for India, however, goes well beyond the Chabahar port and the connectivity options that it provides. Iran is vitally important due to its vast reserves of crude oil and natural gas. Its total oil reserves are estimated at 209 billion barrels and that of natural gas at 33,988 billion cubic metres, which at the end of 2021, accounted for 24% of the oil reserves of West Asia and 12% of the world. Despite crippling economic sanctions and the ongoing war in Gaza, Iran's crude production in May 2024 rose to 3.4 million barrels per day (bpd) while crude oil exports in March 2024 averaged 1.61 million bpd.

Energy cooperation and defence ties are just some of the possibilities that exist to strengthen a stagnating partnership

Options for a closer partnership

The Chabahar port has been the driving force of the bilateral relationship in recent times. In a deal signed on May 13 this year, India and Iran signed a 10-year contract for the operation of the port. Chabahar port also provides easy and short access to India's Kandla and Mumbai ports. As it is located outside the Strait of Hormuz, it insulates India's trade from any threat of closure of sea lanes due to conflicts in the Persian Gulf region. In addition, a railway link of 700 km between Chabahar and Zahedan city is being fast-tracked, to be connected later to the railway network of Iran. A further road link from Zahedan to Zaranj in Afghanistan could provide seamless connectivity for humanitarian aid from India to Afghanistan.

Energy supplies are the next big possibility. Before May 2019, Iran met almost 12% of India's crude oil needs. As bilateral ties take better shape, oil and gas imports could re-commence from Iran which could then open up a new range of possibilities to fulfil India's energy needs.

The ambitious Iran-Oman-India gas pipeline has been under discussion since 1993. In May 2022, Iran and Oman agreed to develop two undersea gas pipelines and an oil field along their maritime borders. If this materialises, extending these to India could be an option.

Close military cooperation with Iran is also a possibility. The two countries had signed a defence cooperation agreement in 2001 but nothing came of it, mainly due to western sanctions on Iran. In recent years, Iran has developed modern weapons platforms such as short and medium range ballistic missiles, hypersonic missiles, and armed drones. Iran is already supplying armed drones to Russia in its war with Ukraine. India too is looking to develop cheap and effective armed drones and could find an effective partner in Iran.

To combat the threat of terror groups operating from Pakistan, India and Iran could conduct joint counterterrorism exercises and develop intelligence-sharing mechanisms. On the naval front, port calls at Iranian ports and the development of logistical facilities in the Persian Gulf could prove extremely useful.

Aspects of Indian diplomacy

India and Iran can achieve a lot together. There is recognition that too much time has already been lost. India's ability to de-hyphenate ties and engage independently with nations that are adversarial to each other, such as Iran and Israel, could be useful in driving the ties. Also, India's decision to exercise strategic autonomy in issues of national interest, as seen in its engagement with Russia during the Ukraine war, is a useful precedent to invigorate ties with Iran.

However, many a time, stray and 'out of context' comments have threatened to apply the brakes on ties. A statement by Iran's Supreme Leader on September 16 this year, comparing the "sufferings" of Indian Muslims to the residents of Gaza, drawing sharp comments from India. Both countries have to realise that the bilateral relationship is far more important and precious to be derailed by such stray comments.

India, under Modi 3.0, is looking to strengthen India's outreach and strategic convergence in West Asia. Similarly, Iran is looking to consolidate its diplomatic gains of recent years and considers India to be an important partner. The meeting at the BRICS Summit may have just given the right impetus for both.

GS Paper 02 : International Relations

UPSC Mains Practice Question: Discuss the significance of the India-Iran relationship in the context of regional security and energy cooperation. How can India leverage its strategic autonomy to foster stronger ties with Iran amid geopolitical challenges? (150 words/10m)

Context :

- At the 16th BRICS Summit in Kazan, Russia, in October 2024, Indian Prime Minister Narendra Modi and Iranian President Masoud Pezeshkian held their first meeting, aiming to strengthen bilateral ties amid Iran's interest in India's support for de-escalating the Gaza conflict.
- They discussed enhancing cooperation in areas such as the Chabahar port, energy supplies, and counterterrorism.

Analysis of the News

- At the sideline of the 16th BRICS Summit Kazan, Russia, the Indian Prime Minister Narendra Modi and Iranian President Masoud Pezeshkian, held a meeting focusing on revitalizing their bilateral relationship. During their discussions, they acknowledged the strong potential and opportunities for deeper collaboration in various fields such as

Key Areas of Cooperation:

- The leaders discussed various avenues for enhancing cooperation, notably:
  - Chabahar Port: A critical infrastructure project for India-Iran relations.
  - International North-South Transport Corridor (INSTC): An important trade route connecting India to Central Asia and beyond.
  - The focus on these areas reflects a desire to strengthen trade and connectivity, which has been a cornerstone of their partnership.
- **Energy Resources:**
  - Energy Significance: Iran is vital to India due to its substantial reserves of crude oil and natural gas, with estimates showing Oil Reserves approximately 209 billion barrels and Natural Gas Reserves around 33,988 billion cubic meters.
  - Regional and Global Impact: As of the end of 2021, Iran's oil reserves accounted for 24% of West Asia's total oil reserves. These reserves represent 12% of global oil reserves.

Chabahar Port's Strategic Importance:

- Crucial Asset: The Chabahar port is crucial for India-Iran relations, with a 10-year operational contract signed in May 2024 enhancing its trade role.
- Secure Trade Route: The port's location outside the Strait of Hormuz offers India a trade route that mitigates risks from potential conflicts in the Persian Gulf.
- Connectivity Improvements: Plans are underway for a 700 km railway link between Chabahar and Zahedan to enhance connectivity.
- Humanitarian Aid Route: A road link from Zahedan to Zaranj in Afghanistan is being developed to facilitate Indian humanitarian aid.

Potential Energy Partnerships:

- Renewed Energy Imports: Before May 2019, Iran accounted for about 12% of India's crude oil imports, and improving bilateral relations could lead to renewed energy imports from Iran.

- Iran-Oman-India Gas Pipeline: The ongoing discussions regarding the ambitious Iran-Oman-India gas pipeline, which has been on the table since 1993, could provide a vital energy link if it comes to fruition.
- Agreements with Oman: In May 2022, agreements were made between Iran and Oman to develop two undersea gas pipelines and an oil field along their maritime borders, with potential extensions to India being explored.

Military Cooperation:

- Military Advancements: Iran has made significant advancements in its military technology, including the development of short and medium-range ballistic missiles, hypersonic missiles, and armed drones.
- Drone Technology Collaboration: Iran is already supplying drones to Russia for its military operations in Ukraine, presenting India with an opportunity to explore partnerships in drone technology, as India seeks to develop affordable and effective armed drones.

Diplomatic Dynamics:

- De-Hyphenation of Foreign Relations: India's strategy to de-hyphenate its foreign relations enables it to engage independently with countries on opposing sides, such as Iran and Israel, facilitating stronger ties with Iran.
- Strategic Autonomy: India's strategic autonomy, particularly demonstrated through its engagement with Russia during the Ukraine crisis, sets a precedent for invigorating relations with Iran.

Challenges and Future Outlook:

- Diplomatic Threats: While the future of India-Iran relations appears promising, insensitive remarks can jeopardize diplomatic efforts. For Example, Iran's Supreme Leader made a controversial comment on September 16, comparing the suffering of Indian Muslims to that in Gaza, which received strong criticism from India.
- Need for Prioritization: Both countries need to prioritize their bilateral relationship to avoid such remarks undermining progress and to foster a more robust and cooperative future.