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LINE & LENGTH.



TCA SRINIVASA RAGHAVAN

Another BRICS summit is over. China with its trade surpluses was clearly the overwhelming big daddy. It accounts for over 60 per cent of intra-BRICS trade and investment. Russia with its oil ran a close second. India trailed far behind with nine tail-enders.

Many people in India are full of admiration for China's economic success, like they were for Pakistan in the 1980s. But Pakistan went phut because it didn't have the political systems and institutions to sustain growth. China has the same problem. From 1950 to 1980 we admired and copied the USSR which also went phut in 1990.

That's why I always ask people who admire China if they would like to swap our political system and institutions with China's. No answer is forthcoming.

But let's leave aside the politics and sociology and examine the India-China comparisons from a purely economic lens. The starting point has to be the acknowledgement that neoclassical economics is founded on the idea of political liberties, which China doesn't permit. But we have a surfeit of these liberties.

Chinese GDP, meanwhile, is \$20 trillion. Ours is not even five. So the question has to be whether the absence of such liberties facilitates rapid growth in industrial output.

In China it does, but in the USSR it didn't. The West also didn't have full political liberties — of the sort we have had since 1950 — till about 50 years ago. You can check this out.

CAPITAL OR LABOUR

There can be no doubt whatsoever that political liberties and rapid economic

If Chinese political stability is ensured by massive force and widespread denial of political rights, Indian economic stability is ensured by suppressing economic freedoms. Which is preferable?



A tale of two systems

India-China comparisons don't make sense.
The two countries are chalk and cheese

growth are inversely related. When you expand one, the other contracts. The more you have of the former the slower will the latter be. Look at East Asia after 1990.

There are no exceptions to this rule because growth depends on giving primacy to capital. Strange as it may sound, this is Marx 101. And it's not just

China, all the 'Asian Tigers' were like that. This has been said by several Nobel winning economists as well.

Unconstrained optimisation means capital flows into China and flows out of India. Period. Our emphasis on liberties means capital gets short shrift.

All our laws favour labour because we are a rights-based society. And when we

try to correct the imbalance, as in 1991 or 2006 or 2019, there is protest. Just look at the number of trades unions and NGOs jumping up and down all the time and laying siege to the Supreme Court.

It must be asked why liberals object to a politically hard state, which is what we need for ever increasing investment and industrial output. You can't have one without the other. It doesn't work like that.

Also, when was the last time anyone compared Indian agricultural performance with China's? India achieved food self-sufficiency in the 1970s, so much so that the massive drought of 1979 went unnoticed by the world. China is nowhere near it.

In fact, food is one of China's biggest vulnerabilities alongside energy. It has enough of neither. All the world has to do is to reduce food and energy exports to China by 10 or 15 per cent and we will see how the paper tiger roars. India is quite safe that way.

We also have absolutely no idea of the efficiency of its capital use. The fact that the government's first priority is employment, Chinese industry is hugely subsidised. That has created what economists call a moral hazard problem: there is very little incentive to save on capital. Few people realise it but China has made the same mistakes as the old Soviet Union where efficiency is concerned.

APPLE OR ORANGE?

The point I am making is that when you compare two entirely different systems of governance you shouldn't just look at one part and draw large conclusions. The correct questions to ask must be about systemic stability: which countries have stable systems and which are resting on a pin?

If Chinese political stability is ensured by massive force and widespread denial of political rights, Indian economic stability is ensured by suppressing economic freedoms. Which is preferable?

What would happen if China allowed even a fraction of Indian political rights and India allowed a small degree of Chinese economic freedom? Neither is going to happen.

China has a lot of hugely subsidised economic competition. We have a lot of hugely subsidised political competition. You can choose between them.

That's why we should stop admiring what we don't have and start boasting about what we do and keep expanding those things. China has the economic brawn but not the political brain. And that is going to be its biggest long term liability.

Consider the following statements :

1. Vietnam has been one of the fastest growing economies in the world in the recent years.
2. Vietnam is led by a multi-party political system.
3. Vietnam's economic growth is linked to its integration with global supply chains and focus on exports.
4. For a long time Vietnam's low labour costs and stable exchange rates have attracted global manufacturers.
5. Vietnam has the most productive e-service sector in the Indo-Pacific region.

Which of the statements given above are correct ?

- (a) 2 and 4

1. A Tale of Two Systems

Source: Business Standard — TCA Srinivasa Raghavan, *Line & Length*

GS-2: Governance, India–China Relations, Comparative Political Systems

GS-3: Economic Development, Industrialisation, Investment

1. Context

- India and China represent **two different development models** shaped by their political systems, State capacity and economic priorities.
- Their strengths and vulnerabilities explain why **China's model cannot simply be replicated by India**.

2. China — Strengths & Vulnerabilities

Strengths

- **Strong State capacity:** Rapid mobilisation of resources and execution of large projects.
- **High capital formation:** Sustained investment in infrastructure and productive capacity.
- **Manufacturing scale:** Strong industrial base and global supply-chain integration.
- **Export competitiveness:** Large-scale production supports global market penetration.
- **Policy continuity:** Centralised decision-making enables long-term economic strategies.

Vulnerabilities

- **Political constraints:** Limited political freedoms and individual political rights.
- **External dependence:** Significant dependence on imported **energy and food**.
- **Resource-allocation risks:** State-directed investment can lead to inefficient capital allocation.
- **Market distortions:** Subsidies and State support can create overcapacity and competitive distortions.
- **Demographic pressures:** An ageing population and declining workforce can constrain long-term growth.

3. India — Strengths & Vulnerabilities

Strengths

- **Democratic institutions:** Political participation, accountability and constitutional checks.
- **Rights-based system:** Stronger protection of individual and labour rights.
- **Large domestic market:** Provides a substantial base for consumption and investment.
- **Food security:** Greater domestic food-production capacity provides resilience.
- **Demographic advantage:** A relatively young workforce provides potential for long-term growth.

- **Entrepreneurial ecosystem:** Expanding private sector, services and digital economy.

Vulnerabilities

- **Lower capital intensity:** Investment and capital formation remain below the level required for rapid industrial transformation.
- **Infrastructure gaps:** Logistics, urban infrastructure and power systems require continued expansion.
- **Productivity constraints:** Skill gaps and low productivity in several sectors limit competitiveness.
- **Employment challenge:** High growth has not always translated into sufficient quality employment.
- **Regulatory complexity:** Compliance and administrative barriers can discourage investment.
- **Human-capital gaps:** Education, health and skill deficiencies constrain productivity.

4. Core Lesson for India

- **China's strength:** Ability to mobilise **capital + State capacity + industrial policy** at scale.
- **India's strength:** Ability to combine **democracy + rights + markets + a large domestic economy**.
- India should therefore **learn from China's economic strengths without replicating its political system**.

5. Way Forward

- Strengthen **State capacity and policy implementation** within democratic institutions.
- Raise **investment, infrastructure and manufacturing capacity**.
- Combine labour-market flexibility with **worker protection and social security**.
- Improve skills, technology and productivity.
- Reduce regulatory barriers while maintaining **rule of law and accountability**.
- Convert India's demographic and domestic-market advantages into **employment-intensive industrial growth**.

India's urban-rural split: welfare benefits should not depend on it

A binary classification of areas as urban or rural doesn't reflect today's reality of urbanization but state schemes still go by it



T.C.A. ANANT

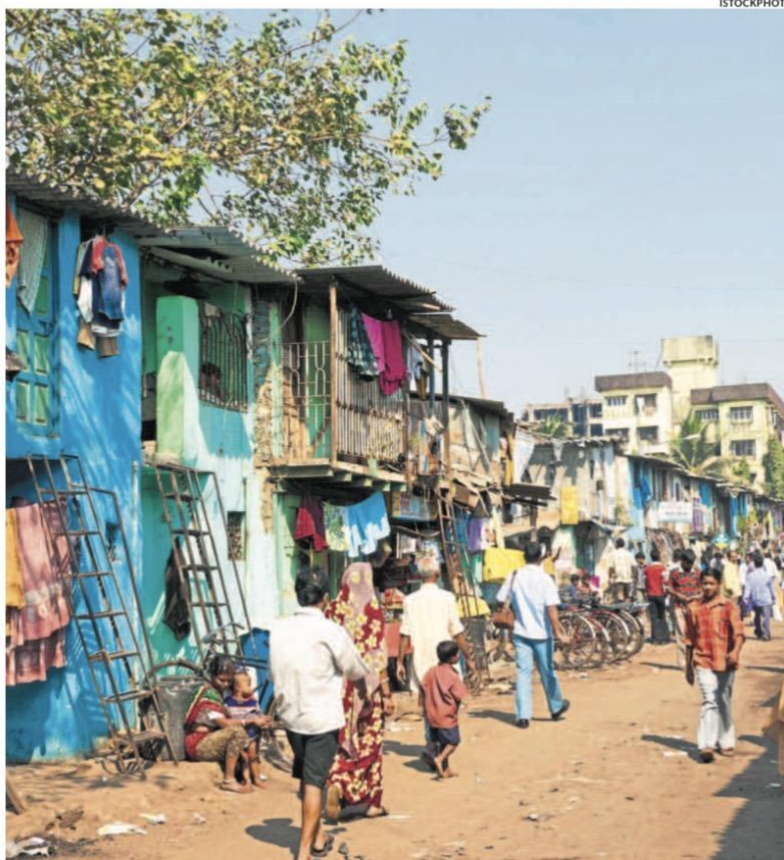
is a visiting professor at the Institute for Studies of Industrial Development and former chief statistician of India

India's governance of settlements rests on a binary. The 73rd and 74th Constitutional Amendments created two tiers of local government: panchayats for rural areas and urban local bodies for urban areas, with no third category. The default is 'rural' unless a government notification states otherwise. The Census sits uneasily within this binary because it recognizes something the Constitution does not: the Census town. Alongside places that are administratively urban (statutory towns), it identifies Census towns based on a statistical test: a settlement with at least 5,000 people, a density of at least 400 people per square kilometre, and at least 75% of the male main working population engaged outside agriculture. Everything else is rural. The Census identifies urban areas well before the state gets around to saying so.

That gap is the subject of a paper by V. Tandel, K. Hiranandani and M. Kapoor, 'What's in a Definition?: A Study on Implications and Suitability of Urban Definitions in India through its Employment Guarantee Programme.' A Census town, they show, remains rural for every purpose that matters to its residents: still governed by a panchayat, still taxed as rural land and still eligible for rural schemes. Conversion requires a discretionary state decision, and the authors document why it is often avoided—residents fearing higher taxes or lost entitlements, panchayats resisting loss of authority, builders preferring laxer land-use norms and states with their own political reasons for inaction. They test whether this reflects a simple fiscal motive—places staying rural, i.e., to keep drawing jobs guarantee funds—and find that the evidence does not support such a story. Their analysis points to misclassification and inefficiency, not rent-seeking.

The United Nations' *World Urbanization Prospects 2025* report reframes this problem in a way that is harder to set aside. Where the Indian system asks a binary question, the UN's 'Degree of Urbanization' methodology treats settlements as a continuum, classifying every square kilometre of a country as city, town or semi-dense area, or rural, using consistent and internationally comparable thresholds of population, density and contiguity. Applied to India, this suggests a much larger share of the country is already functionally urban than our administrative or Census definitions show. China has repeatedly widened its urban definition as its settlements changed; India's criteria have remained static, leading to 'hidden urbanization': settlements that function as towns but are recorded and governed as villages.

The implication is practical, not just conceptual. If functionally urban conditions are this widespread, the next Census is likely to record a sharp jump in India's measured urban population:



thanks to places that have already crossed the Census town threshold. That jump will reflect measurement catching up with a transformation already underway, not fresh migration or construction, and it will force us to confront on a much larger scale the governance question Tandel and her co-authors raised: what happens to a place and its people when its administrative status changes.

The deeper problem is that our welfare architecture is not designed to answer this question gracefully. Programmes are organized vertically by ministries, each defining beneficiaries in the vocabulary of its own jurisdiction: rural schemes are run by the ministry of rural development, anchored to rural local-body status, and a similar set are run by the ministry of housing and urban affairs, anchored to urban status, with different assumptions and funding formulas. A settlement's classification is therefore not just a label; it is the switch that determines which protections apply to the people living there.

Because rural and urban are treated as static categories rather than points on a moving continuum, the switch is treated as a one-off event, even though development makes it recurring. A village's economic character can change—through a new highway, an industrial corridor or construction activity—well before its governance. Reclassification, when it happens, is often abrupt: eligibility for rural schemes lapses the moment a panchayat becomes a 'nagar panchayat,' while the income security and services of genuine urban status arrive much slower, if at all. A casual-labour household does not become less vulnerable

because the settlement's legal status changes; it has simply exchanged agricultural vulnerability for non-agricultural vulnerability—and it is precisely this household that welfare schemes exist to protect.

This is not an argument for abandoning rural and urban categories or for adopting a single national definition—the UN treats harmonized measures such as the 'Degree of Urbanisation' as complementary to national definitions, not as a replacement. Tandel and her co-authors note that the US and UK already use different context-specific definitions of rurality across programmes.

What India needs instead is policy continuity: a mechanism that ensures a change in administrative classification does not by itself sever a household's access to the protections it relies on.

For this, existing beneficiaries could be grandfathered during a transition period after reclassification; poverty- or insecurity-linked eligibility could follow the household rather than reset at the jurisdictional boundary; and eligibility could be defined by the condition a programme addresses—income insecurity, unemployment, inadequate housing, lack of services, etc—rather than by the ministry or local body that governs the particular settlement.

The question we must address is not simply where to draw the line between village and town. It is what happens to the people standing on that line when the country finally redraws it—and whether India's welfare architecture can keep pace with a transition that, by the UN's numbers, is already well underway.

Q. 19 'भारत में स्मार्ट नगर स्मार्ट गाँवों के बिना जीवित नहीं रह सकते हैं।' ग्रामीण-नगरीय एकीकरण की पृष्ठभूमि में इस कथन पर चर्चा कीजिये।

Smart cities in India cannot sustain without smart villages. Discuss this statement in the backdrop of rural urban integration.

12½

2. India's Urban–Rural Divide: Welfare Should Be Need-Based

Source: The Hindu — T.C.A. Anand

GS-1: Urbanisation, Settlement Geography

GS-2: Governance, Local Government, Welfare Delivery

1. Context

- **Rapid urbanisation is weakening the traditional rural–urban distinction**, as peri-urban and transitional settlements increasingly combine rural and urban characteristics.
- The **UN Degree of Urbanisation (DEGURBA)** recognises urbanisation as a continuum based on population density and spatial contiguity.
- This raises the need to align **settlement classification, governance and welfare delivery** with changing socio-economic realities.

2. Existing Framework in India

- **73rd Constitutional Amendment:** Provides for Panchayati Raj Institutions as the framework for rural local governance.
- **74th Constitutional Amendment:** Provides for Municipalities as the framework for urban local governance.
- **Census classification:** Census towns are identified using population, density and occupational criteria.
- **Limitation:** Administrative classification may lag behind actual changes in **population, occupations, economic activity and infrastructure**.

3. Emerging Urbanisation Dynamics

- **Peri-urbanisation:** Villages located around expanding cities increasingly acquire urban characteristics through industrialisation, construction, commerce and improved connectivity.
- **Functional urbanisation:** Employment and economic linkages increasingly extend beyond municipal boundaries.

- **Classification–reality gap:** A settlement may function like an urban area while continuing to be administered through rural institutions.
- **Governance implications:** Such mismatch can affect infrastructure planning, service delivery and allocation of public resources.

4. Implications for Welfare Delivery

- **Rural–urban scheme divide:** Several welfare programmes are designed around separate rural and urban institutional frameworks.
- **Risk of discontinuity:** Reclassification may alter eligibility for existing schemes even though household-level vulnerability remains unchanged.
- **Need-based principle:** Poverty, unemployment, housing deprivation and lack of basic services are **not confined to either rural or urban areas**.
- **Equitable welfare:** Entitlements should therefore increasingly be determined by **socio-economic vulnerability rather than administrative location alone**.

5. Need for a Continuum-Based Approach

- **Beyond binary classification:** Recognise the spectrum of **rural → peri-urban → semi-urban → urban** settlements.
- **Multiple indicators:** Supplement administrative boundaries with population density, built-up characteristics, commuting patterns, economic activity and service access.
- **Better planning:** A more granular understanding of urbanisation can improve provision of **housing, transport, water, sanitation, healthcare and employment**.
- **Better targeting:** Accurate settlement-level data can reduce both **exclusion and duplication** in welfare programmes.

6. Governance & Policy Significance

- **Integrated rural–urban planning:** Planning should increasingly reflect functional economic regions rather than rigid administrative boundaries.
- **Institutional coordination:** Panchayats, Municipalities and higher levels of government need coordinated mechanisms for transitional settlements.
- **Continuity of public services:** Essential services should not be disrupted merely because administrative status changes.
- **Data-driven governance:** Harmonised definitions and databases across government programmes can improve targeting and resource allocation.
- **Inclusive urbanisation:** Urban growth should be translated into **productive employment, infrastructure and improved quality of life**.

7. Way Forward

- **Decouple welfare from settlement status:** Make household deprivation and vulnerability the primary basis for welfare eligibility.

- **Provide transition safeguards:** Protect existing beneficiaries during rural–urban reclassification.
- **Adopt dynamic classification:** Periodically update settlement categories in line with demographic and economic transformation.
- **Strengthen peri-urban governance:** Develop institutional arrangements specifically suited to rapidly transforming settlements.
- **Promote scheme convergence:** Ensure continuity of essential welfare and public services across rural–urban transitions.
- **Use improved methodologies:** Combine **UN DEGURBA-type spatial measures with India’s administrative and Census framework.**
- **Plan urbanisation proactively:** Treat urbanisation as a development opportunity requiring coordinated investment in infrastructure, human capital and employment.

How Trump has fuelled the resurgence of Brics



Sanjaya Baru

Sanjayovacha

This column is being written even as the New Delhi Brics Summit is still in progress. The likely language of the joint statement to be issued by Summit leaders has been revealed in the joint statement issued by Brics finance ministers at their meeting in Mumbai on September 10. Under the theme "Building for Resilience, Innovation, Cooperation and Sustainability", the statement categorically stated, "We continue to have serious concerns with the unilateral imposition of trade and finance-related actions, including the raising of tariffs and non-tariff measures, which distort trade and are inconsistent with World Trade Organisation rules." Reiterating support for an open, transparent, inclusive, non-discriminatory and rules-based multilateral trading system, the Brics finance ministers decided to explore the potential for cross-border payments in local currencies. President Donald Trump has breathed new life into Brics.

Brics began as Brics — Brazil, Russia, India and China — a group of 'emerging economies' as they were dubbed by the American firm Goldman Sachs, that coined the term. Russian President Vladimir Putin immediately picked up the formulation and took the first step. A meeting of Brics finance ministers met on the sidelines of the United Nations General Assembly in 2006. There was no proximate reason that year for such a gathering. India was in the

war in West Asia.

Then came the trans-Atlantic financial crisis of 2008-09. The United States took the initiative to convene a meeting of the Group of Twenty (G-20), an informal grouping of the finance ministers of 20 key economies formed in the aftermath of the Asian financial crisis of 1997-98, at the heads of government level. The initiative for a G-20 Summit meeting was taken by President Nicolas Sarkozy of France who convinced President George Bush that US convene a meeting to deal with the financial crisis.

The US toyed with the idea of expanding G-8 to G-9 by inviting China to the high table, recognising China's potential role to help it steer out of the financial crisis. Both Presidents Bush and Sarkozy felt the creation of a G-9 may upset other developing economies, especially India, and so decided to elevate the G-20 finance ministers' group into a heads-of-government group. While Brazil, China and India welcomed the idea they soon realised that the G-8 remained in place even as a G-20 was formed. Russia was invited to join G-7 in 1997 in the western hope that it would remain a suppliant. It was evicted in 2014 when it invaded Crimea.

It was President Putin who took the initiative to convene a Brics leaders' summit on the sidelines of a G20 meeting he was hosting in 2009. South Africa was invited to join at the second Brics summit in China and thus Brics

While he has openly targeted China and Russia, the US President has bad-mouthed the leaderships of Brazil, India and South Africa and targeted each one of the Brics economies

entirely on graduating out of the crisis and discovered that they would not be able to do so without China's help.

China's global relevance came to the fore when it became key to the resolution of the 2008-09 financial crisis. US treasury secretary Frank Paulson desperately reached out to his Chinese counterpart to make sure that China would not dump the large stock of US treasuries it was holding. China decided to play ball and help stabilise the dollar even as the euro was going through convulsions. The 2008-09 financial crisis marked the beginning of the decline of Europe and the rise of China in the global economy.

When Brics met in New Delhi in March 2012, the finance ministry, which remained the convening ministry for the group and was then headed by Pranab Mukherjee, came up with the idea of setting up a Brics bank that was named as the Brics New Development Bank (NDB). As soon as the idea of a fund-based institution was created the group realised that the national income of one member was more than the combined national income of the other four. China happily welcomed an Indian initiative proposing that NDB be located in China but offered to make its first chairman an Indian.

Those who today draw attention to China's so-called 'dominance' within

tional financial institutions with its dollar power. When the US found Japan emerging as the second biggest economy and Japanese exports into the US market threatened American firms it forced Japan, and along with it, Germany and others, to accept a depreciation of the US dollar against their currencies through what was called the Plaza Accord and signed at Hotel Plaza in New York in 1985.

In international relations money and weapons define power. Indeed, US is the dominant member of Nato, with a defence budget that exceeds the combined defence budget of all other Nato member countries. The US has used its money and muscle to assert its global dominance in the post-war era. When American allies like Japan and Germany were beginning to pose an economic challenge, the US used its power to keep them in line. Even today they remain occupied nations.

Quite understandably, therefore, China has come to dominate Brics. For this reason, India's interest in Brics began to flag until Donald Trump came along. Trump's unilateral economic sanctions and escalating trade war against all emerging economies has united Brics. While he has openly targeted China and Russia, he has bad-mouthed the leaderships of Brazil, India and South Africa and targeted each one of the Brics economies. In the newly expanded Brics he has been waging war against Iran. He has not spared other new members including Indonesia, Malaysia and Saudi Arabia.

The 18th Brics summit was convened in New Delhi against this background. A grouping that seemed to be losing momentum has suddenly found new life being breathed into it by the shared concerns of member nations in the face

Q10. “ब्रिक्स (BRICS) वैश्विक शासन में एक शक्तिशाली संतुलनकारी शक्ति के रूप में कार्य करता है, जो वैश्विक दक्षिण की आवाज़ और प्रभाव को सक्रिय रूप से प्रबल बनाता है।” ब्रिक्स (BRICS) की भूमिका को समझाइए कि वह स्वयं को अन्य समूहों के विकल्प के रूप में कैसे प्रस्तुत करता है ?

(उत्तर 150 शब्दों में दीजिए)

“BRICS acts as a powerful counterweight in global governance, actively amplifying the voice and influence of the Global South.” Explain the role of BRICS in projecting itself as an alternative to other groupings.

10

(Answer in 150 words)

3. How Trump Has Fuelled the Resurgence of BRICS

Source: Business Standard — Sanjaya Baru, *Sanjayavacha*

GS-2: International Relations — BRICS, Global Order, India–US Relations

1. Context

- **BRICS had appeared to be losing momentum**, but Donald Trump's return and his aggressive use of **tariffs, sanctions and unilateral economic measures** have given the grouping renewed relevance.

2. How Trump Revived BRICS

- **Tariffs & trade restrictions:** Pressure on India, Brazil, South Africa and other emerging economies created a shared economic concern.
- **Sanctions:** U.S. reliance on sanctions highlighted the vulnerability of countries dependent on Western financial systems.
- **Unilateralism:** Trump's preference for unilateral action strengthened the demand for **multilateral alternatives**.
- **Pressure on BRICS members:** Targeting several BRICS economies simultaneously encouraged greater intra-group solidarity.
- **China–U.S. rivalry:** Intensifying confrontation between the two largest economies has reinforced BRICS as a platform for emerging powers.

3. What BRICS Gains from This

- **Greater intra-BRICS trade:** Members have stronger incentives to expand trade among themselves.

- **Local-currency transactions:** Encourages efforts to reduce excessive dependence on the dollar.
- **Alternative institutions:** The **NDB** provides an additional source of development finance.
- **Collective bargaining power:** A larger grouping gives emerging economies greater leverage in global economic governance.
- **Multipolarity:** BRICS gains relevance as a vehicle for a **more distributed global power structure**.

4. Significance for India

- **Strategic autonomy:** Enables India to engage simultaneously with the U.S., China, Russia and the wider Global South.
- **Global South leadership:** Strengthens India's role in representing emerging-economy interests.
- **Economic resilience:** Diversified trade and financial partnerships can reduce vulnerability to unilateral economic pressure.
- **Reformed global governance:** Supports India's demand for greater representation in global institutions.

Chandrayaan-1 may have just detected oldest impact basin on Moon: Researchers

Anjali Marar
Bengaluru, September 14

FOR THE first time, planetary scientists have confirmed the existence of a hidden impact crater on the lunar surface using mineralogical data obtained from Chandrayaan-1 and it could predate the oldest known impact craters on the Moon.

A team of researchers from the Physical Research Laboratory (PRL), Ahmedabad, have identified the Australe Basin, which had remained untraced as this ancient basin had suffered erosion along its rims making it extremely difficult even for modern-day imaging techniques to detect.

Scientists believe there are approximately 300 impact basins present on the Moon. Of these, only 74 have been detected so far. Impact basins are formed over the lunar surface due to various violent space activities, like asteroid or meteorite hits. These are large craters, often several hundreds of kilo-

metres in diameters, and can have distinct outer rims. Due to the space hits, these craters are often found with remnants of volcanic activities.

This new study, published in the *The Planetary Science Journal*, has shed light on one such impact basin confirmed to be located along the southeastern hemisphere of the Moon. It has distinct morphology and gravity signatures and some unique mineralogical compositions.

PRL scientists are also of the opinion that this basin could well be older than the South Pole Aitken Basin which is the largest and the oldest known basin on the Moon (formed over 4 billion years ago).

Speaking with *The Indian Express*, Neha Panwar, planetary scientist and lead author of the study, said, "The volcanism inside the Australe Basin has a very unique mineralogy. Unlike the majority of basalt on the Moon that are high in calcium bearing, these basalts are relatively lower in calcium



The red ring represents the Australe Basin. PRL

and higher in magnesium."

Moreover, the Australe Basin was found to be in a province characterized by 248 small basalt ponds arranged in a circular pattern unlike several of the previously known impact basins that are classified for their smooth and vast hardened lava surfaces.

There were 11 scientific payloads onboard the Chandrayaan-1. Of these, six were contributions from international space agencies including

National Aeronautics Space Administration (NASA) and the European Space Agency.

The mineralogy of the Australe Basin was detected using data gathered by the Moon Mineralogy Mapper of NASA.

It is an imaging spectrometer that was designed to create mineralogical map of the lunar surface. It operates between 405 and 3000 nanometer wavelength range.

Scientists studied the absorption bands exhibited by some of the key lunar minerals, such as pyroxenes, olivine, and plagioclase.

The current study could offer detailed mineralogical insights of the region, particularly given the renewed interests shown by many countries with the proposed Moon Base mission by NASA and India's Chandrayaan-4, a lunar sample return mission.

"This study provides us with a framework to interpret the data from the landing missions in the broader geological context, by studying the regions that

could have contributed material to these landing sites. Such unique sites can be important targets for the future sample return missions," she said.

PRL scientists noted that even the Chandrayaan-3 landing site, now known as the Shiv Shakti point, possessed higher concentrations of magnesium. And that could be linked to some material originally from the South Pole Aitken Basin to have gotten transported to the Shiv Shakti point, located approximately 350 km apart.

"Interestingly, what we found was that the Australe region, too, has widespread Magnesium-bearing lithologies. Since the region lies close to the moon's South Polar region, it is likely that the material excavated by this impact would also have been deposited across the South Pole. With the future missions planned in the South Polar Region, it is important to understand how the regolith in these regions has evolved over billions of years," she explained.

4. Chandrayaan-1 May Have Detected the Moon's Oldest Impact Basin

Source: The Indian Express

GS-3: Space Technology, Lunar Science & Planetary Exploration

1. Context

- **Chandrayaan-1 data has helped identify the ancient Australe Basin**, potentially one of the Moon's oldest impact basins.

2. Chandrayaan Missions: Major Findings

- **Chandrayaan-1 (2008):**
 - Detected evidence of **water and hydroxyl molecules** on the lunar surface.
 - Its mineralogical data, including NASA's **Moon Mineralogy Mapper**, has now helped identify the Australe Basin.
- **Chandrayaan-2 (2019):**
 - Its **Orbiter continues lunar observations**, providing detailed data on surface composition, minerals and polar regions.
 - The data contributes to understanding lunar geology and identifying scientifically important regions.
- **Chandrayaan-3 (2023):**
 - Successfully demonstrated **soft landing and rover operations near the lunar South Pole**.
 - Rover-based analysis detected **sulphur** at the landing site and confirmed the presence of several other elements.

3. Australe Basin: What Has Been Discovered?

- **Ancient impact basin:** Located in the Moon's **southeastern hemisphere**, its distinct morphology and gravity signatures indicate a major ancient impact.
- **Potentially very old:** Researchers suggest it could be **older than the South Pole–Aitken Basin**, the largest known lunar impact basin.
- **Unique mineralogy:** Contains **low-calcium, magnesium-rich basalts**, providing clues about the Moon's volcanic and interior history.
- **Volcanic features:** The region contains around **248 small basalt ponds**, supporting its identification as an ancient impact basin.
- **Hidden geological record:** Subsequent impacts and volcanic activity had obscured the basin, making it difficult to identify through conventional surface imaging.

4. Scientific Relevance

- **Lunar evolution:** Helps reconstruct the Moon's early geological and volcanic history.
- **Impact history:** Provides evidence for understanding the intensity and chronology of ancient impacts in the Solar System.
- **South Polar science:** Its location near the lunar South Polar region makes the findings relevant to future exploration.
- **Sample-return targets:** Scientifically unusual regions such as this could provide valuable targets for future missions seeking representative lunar material.

5. Chandrayaan-4: Next Step

- **Approved:** Union Cabinet approved the mission in **September 2024**.
- **Planned launch:** **2027–28**.
- **Objective:** Collect lunar samples and **return them to Earth** for detailed laboratory analysis.
- **Relevance:** Returned samples can provide precise information on the Moon's **age, composition, geological evolution and impact history**, going beyond what remote sensing can establish.

India, Vietnam agree to deepen defence ties, co-produce military equipment

Shubhajit Roy
New Delhi, September 14

WITH AN eye on China's assertive behaviour in the Indo-Pacific region, India and Vietnam agreed to deepen defence and security cooperation, including thorough co-production of Indian defence equipment, after External Affairs Minister S Jaishankar met visiting Foreign Minister of Vietnam Le Hoai Trung on Monday.

Jaishankar, who co-chaired the 19th India-Vietnam Joint Commission Meeting (JCM) on trade, economic, scientific and technological cooperation with the Vietnamese minister, said: "Vietnam for us is a key partner in India's Act East Policy, in our Vision MAHASAGAR (Mutual and Holistic Advancement for Security and Growth Across Regions) in outlook of the Indo-Pacific. Vietnam is equally an important partner in the framework of our Comprehensive Strategic Partnership with ASEAN (Association of South-east Asian Nations)."

Defence and security cooperation is among the central pillars of the enhanced Comprehensive Strategic Partnership between India and Vietnam.

Bilateral defence engagement has also diversified to wider military-to-military dialogue and capacity building and training among all arms of the forces. In July 2023, India gifted an indigenously built missile corvette INS Kirpan to Vietnam. Earlier, 12 high-speed guard boats, built by Indian manufacturer Larsen & Toubro under a bilateral line of credit of USD 100 million, were handed over to Vietnam in June 2022. Two



External Affairs Minister S Jaishankar with Vietnamese counterpart Le Hoai Trung in New Delhi. PTI

more Lines of Credit of USD 120 million and USD 180 million have been signed between the Exim Bank of India and the Finance Ministry of Vietnam in July 2024, and are being undertaken currently.

According to the official statement on the bilateral talks: "They (India, Vietnam) identified the way forward on deepening ongoing defence and security collaboration, including through co-production of Indian defence items; expanding trade, investments and mutually beneficial supply chains; market access for Indian marine and agricultural products and pharmaceuticals; financial, port and air connectivity; opportunities in nuclear energy and space sector; heritage conservation; cooperation in standards for seafarers; capacity building and people-to-people ties."

The two ministers noted that discussions between the general secretary of the Communist Party of Vietnam and the President of Vietnam, To Lam, and

PM Modi, including during the former's State Visit to India in May 2026, provided "renewed impetus to the bilateral relationship".

Jaishankar said, "I am very glad to note that our bilateral ties have progressed significantly since the previous meeting of the Joint Commission, which was held three years ago. We have had two important State Visits from Vietnam in the meanwhile, most notably, the State Visit of General Secretary and President To Lam to India. And during this visit, our leaders elevated their relationship to an Enhanced Comprehensive Strategic Partnership. It is noteworthy that Vietnam is the first country in the region with which we have bilateral ties at that level."

It said that in a "productive and outcome-oriented discussion", the two ministers reviewed the full spectrum of bilateral relations under the India-Vietnam Enhanced Comprehensive Strategic Partnership. The MEA said it appreci-

ated the growing popularity of Yoga in Vietnam. They also agreed to observe next year as the Year of India-Vietnam Friendship to mark 55 years of diplomatic ties. They welcomed Vietnam's engagement under India's Indo-Pacific Oceans Initiatives (IPOI), it said.

"The two sides exchanged views on regional and global developments of mutual interest and reaffirmed their commitment to closer cooperation and coordination in regional and multilateral fora," the MEA said.

The ministers expressed satisfaction at upward and growing trajectory of bilateral relations and agreed to convene the next Joint Commission Meeting on a mutually convenient date.

According to the MEA, "Vietnam is a key pillar of India's Act East Policy. Rooted in deep civilisational linkages, the India-Vietnam Enhanced Comprehensive Strategic Partnership continues to grow from strength to strength across established and new areas of cooperation."

5. India–Vietnam Agree to Deepen Defence Ties, Co-produce Military Equipment

Source: The Indian Express

GS-2: International Relations — Act East Policy, ASEAN, Indo-Pacific, Defence Cooperation

1. Context

- India and Vietnam agreed to deepen **defence cooperation and co-production of Indian defence equipment** at the 19th India–Vietnam Joint Commission Meeting in New Delhi.

2. India–Vietnam Relations

- **Diplomatic relations:** Established in **1972**, with longstanding civilisational and political ties.
- **Strategic Partnership:** Established in **2007**.
- **Comprehensive Strategic Partnership:** Upgraded in **2016**.
- **Enhanced Comprehensive Strategic Partnership:** Upgraded in **May 2026**, reflecting the growing strategic importance of the relationship.
- **Core areas:** Defence, maritime security, trade, technology, connectivity and cooperation through ASEAN and Indo-Pacific mechanisms.
- Vietnam is an important partner for India's **Act East Policy** and **MAHASAGAR vision**.

3. Current Development: Defence Cooperation

- **Co-production of defence equipment:** The two countries have identified avenues for **co-producing Indian defence equipment**, moving beyond simple buyer–seller defence relations.
- **Defence-industrial cooperation:** The focus is shifting towards technology sharing, joint production and mutually beneficial defence supply chains.
- **Existing defence support:** India gifted Vietnam the indigenously built **INS Kirpan** in 2023 and supplied 12 high-speed guard boats under a \$100-million Line of Credit.
- **Defence financing:** Two additional Lines of Credit of **\$120 million and \$180 million** were signed in 2024 and are being implemented.
- **Technology cooperation:** Both sides are accelerating joint initiatives and defence technology sharing, with greater emphasis on defence-industrial collaboration.
- **Maritime security:** Cooperation is being strengthened in maritime security, maritime safety, hydrography and search-and-rescue.
- **ASEAN mechanism:** Both countries want greater coordination through **ADMM-Plus**, including its expert working groups. The next Defence Policy Dialogue is scheduled to be held in India alongside **Aero India 2027**.

4. Other Current Outcomes

- **Trade and investment:** Both sides agreed to expand trade and investment and develop more resilient supply chains.

- **Market access:** India will seek greater Vietnamese market access for **Indian marine, agricultural and pharmaceutical products**.
- **Connectivity:** Greater **air connectivity** is being pursued.
- **Strategic sectors:** Cooperation will also expand in **nuclear energy and space**.
- **Regional issues:** The two sides exchanged views on developments in the **South China Sea and West Asia** and reaffirmed closer regional and multilateral coordination.

5. Why This Development Matters for India

- **Defence manufacturing:** Provides an additional avenue for India's **Make in India and defence-export ambitions**.
- **Indo-Pacific:** Vietnam is strategically located along the South China Sea, making stronger defence ties important for India's wider maritime strategy.
- **China factor:** It strengthens India's strategic partnerships in Southeast Asia amid China's growing regional assertiveness.
- **ASEAN:** Defence cooperation deepens India's practical engagement with ASEAN beyond economic and diplomatic relations.
- **Strategic autonomy:** Co-production and technology partnerships allow India to build a wider network of defence partnerships rather than depend excessively on a few suppliers.

QUANTUM INFORMATION AND COMPUTING LAB AT RAMAN RESEARCH INSTITUTE

Scientists develop new way to tackle key quantum computing challenge

E. EXPLAINED

Single-shot fix

Amitabh Sinha
New Delhi, September 14

SCIENTISTS AT the Quantum Information and Computing (QuIC) laboratory at Raman Research Institute in Bengaluru have demonstrated a novel way to increase the stability of the quantum states that enable computation in a quantum computer that can potentially improve the reliability and integrity of these calculations.

Unlike traditional computers that encode electric states into 0s and 1s to store and process information, quantum computers make use of the very unique, but counter-intuitive, properties of the quantum world to carry out calculations.

One of these happens to be "quantum entanglement," a remarkable property of the quantum world in which two particles, after undergoing an interaction, get "linked" (or en-

tangled) together in such a way that they begin to behave like one single system. Measuring certain properties of one reveals information about corresponding properties of the other, irrespective of the distance between the two.

Scientists have used this, along with some other special properties like superposition—the ability of quantum particles to exist in multiple states at the

»CONTINUED ON PAGE 2

Raman Research Institute scientists found that a single, well-timed operation, not repeated fixes, can delay or prevent quantum entanglement from collapsing in this context. Timing itself becomes a new control tool, offering a simpler way to protect fragile quantum states used in computing, alongside existing error-correction methods.

Which one of the following is the context in which the term “qubit” is mentioned ?

- (a) Cloud Services
- (b) Quantum Computing
- (c) Visible Light Communication Technologies
- (d) Wireless Communication Technologies

6. Scientists Develop New Way to Tackle Quantum Computing Challenge

Source: The Indian Express

GS-3: Science & Technology — Quantum Technology

1. Context

- Researchers at the **Quantum Information and Computing Laboratory, Raman Research Institute, Bengaluru**, have demonstrated a new method to improve the **stability of quantum states**, addressing a major challenge in reliable quantum computing.

2. Quantum Computing: What Makes It Different?

- **Qubits:** Unlike classical bits, which represent 0 or 1, qubits can exploit **superposition** to exist in a combination of possible states.
- **Entanglement:** Two quantum particles can become strongly correlated, so that measuring one provides information about the other, even when separated.
- These properties give quantum computers their potential for solving certain problems much more efficiently than classical computers.

3. The Core Challenge: Fragility of Quantum States

- **Quantum states are extremely sensitive** to interactions with their surroundings.
- Such disturbances can destroy **entanglement and other quantum properties**, causing loss of information.
- This phenomenon is known as **decoherence** and is a major obstacle to reliable quantum computation.
- Conventional approaches therefore rely heavily on **quantum error correction and repeated control operations**.

4. What Is the New Finding?

- The RRI team demonstrated that a **single, carefully timed operation** can delay or prevent the collapse of quantum entanglement in the system studied.
- The method is described as a “**single-shot**” **approach**, because it does not depend on continuously repeating corrective operations.
- The crucial finding is that **the timing of the intervention itself can be used as a control tool** for preserving quantum states.
- The approach can potentially be used **alongside existing error-correction methods**, rather than replacing them.

5. Why Is This Important?

- **Improved stability:** Longer-lasting quantum states can make quantum computations more reliable.
- **Lower control complexity:** Reducing the need for repeated interventions could simplify the control of fragile quantum systems.
- **Better error management:** Preserving entanglement for longer can reduce the effects of decoherence on quantum calculations.
- **Practical quantum computers:** Solving the stability problem is essential for moving quantum computing from experimental systems towards more reliable, scalable machines.
- **Indian quantum research:** The work strengthens India’s research base in **quantum information science and quantum technology**.