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'Bio-fortified potatoes to hit Indian market soon'

A.M. Jigeesh
NEW DELHI

Bio-fortified potatoes, with added iron content, will soon be available in Indian markets, said Simon Heck, Director-General of the Peru-based International Potato Center (CIP), in an interview with *The Hindu*. Bio-fortified sweet potatoes, with vitamin A added using technology deve-

Simon Heck

loped by the CIP, are already available in Karnataka, Assam, West Bengal, and Odisha. The CIP, an apex

research body of international research institutions working on tubular crops, will take efforts to make the seeds of bio-fortified sweet potato available to more farmers, said Dr. Heck, currently in India for the establishment of the CIP South Asia regional centre in Agra.

The focus is on iron fortification in potatoes. "We have already shared the

germ plasm with the Indian Council of Agricultural Research's Central Potato Institute in Shimla. The first variety has been released in Peru", he said.

"Now it is under the evaluation of the ICAR, and it needs to be adapted to the Indian growing conditions," Dr. Heck added.

CONTINUED ON

The 'right to repair' must include 'right to remember'

In May 2025, the Indian government took a significant step toward promoting sustainable electronics. It accepted a report proposing a Repairability Index for mobile phones and appliances, ranking products based on ease of repair, spare part access, and software support. New e-waste policies now include minimum payments to incentivise formal recycling. These are timely moves.

But as India takes steps toward making repair a consumer right, we must also treat it as a cultural and intellectual resource – a form of knowledge that deserves preservation and support. India's digital and Artificial Intelligence (AI) policy landscape is evolving rapidly. Initiatives such as Digital Public Infrastructure (DPI) and the National Strategy on Artificial Intelligence (NSAI) emphasise innovation, data-driven governance and economic efficiency. Yet, the systems that quietly sustain everyday life – especially the informal repair and maintenance economy – remain largely invisible in digital and policy frameworks.

In an age of cloud backups and algorithmic processing, it is easy to forget the value of knowledge that cannot be codified. Much of India's repair expertise lives in muscle memory, quiet observation, and years of hands-on improvisation. This tacit knowledge is vital to India's material resilience. From mobile fixers in Delhi's Karol Bagh to appliance technicians in Chennai's Ritchie Street, repairers keep devices working well past their planned obsolescence. "If we don't fix it, who will?" says a mobile repairer in Ritchie Street. "People throw things out. But we see what can be made new." Their tools may be modest and their workshops discreet, but their work reflects deep ingenuity. They restore devices not by consulting manuals, but by diagnosing faults through sensory cues, reusing components, and adapting creatively to constraints. Yet, this ecosystem is gradually eroding. As product designs become less repairable and consumer habits shift toward disposability, informal repairers find themselves increasingly locked out of markets, of skilling programmes, and of policy attention. What risks being lost is not only economic opportunity but also a vast, undocumented reservoir of knowledge that has long supported India's technological resilience.

Why tacit knowledge matters
"I learnt by watching my uncle," says an appliance repairer in Bhopal. "He never explained with words. He just showed me once, and expected me to try. That's how we pass it on." Tacit knowledge refers to forms of skill and intuition that are difficult to formalise. In India's repair economy, this expertise is typically passed down through mentorship, observation, and repetition – not through formal training or certification. It is inherently adaptive and

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> As India invests in AI infrastructure and digital public goods, it must align these ambitions with the ground realities of repair and an established culture of innovation and frugality

context-sensitive, qualities that structured digital systems, including AI, often struggle to replicate. As AI advances, it increasingly draws on insights shaped by this kind of labour. However, mechanisms to acknowledge or equitably involve the contributors of this knowledge are still evolving. The result is a growing imbalance: AI systems continue to improve, while the communities enabling that learning often remain unrecognised. Globally, the Right to Repair movement has gained momentum. The European Union recently introduced rules requiring manufacturers to provide access to spare parts and repair documentation. In India, the Department of Consumer Affairs launched a Right to Repair framework in 2022, followed by a national portal in 2023 covering electronics, automobiles, and farm equipment. Meanwhile, the United Nations Sustainable Development Goal 12 promotes repair as part of responsible consumption. India now has the opportunity to lead by recognising repair not just as a service but also as a form of knowledge work.

The blind spot in India's digital policy
In 2021-22, India generated over 1.6 million tonnes of e-waste, becoming the world's third-largest producer. The E-Waste (Management) Rules, 2022 introduced Extended Producer Responsibility (EPR) – a principle that makes manufacturers responsible for post-use product management. However, while these rules encourage recycling, they make only a passing mention of repair as a preventive strategy. National skilling programmes such as the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) focus on short-term certifications for formal industrial roles. Repair work, which requires improvisation, diagnostic skill and creative reuse does not easily fit this framework. Similarly, the National Education Policy (NEP) 2020 celebrates Indian knowledge traditions and experiential learning but offers little guidance on how to support or transmit hands-on repair expertise. Campaigns such as Mission LiFE (LiFEStyle For Environment) promote repair and reuse, but complementary efforts are needed to support the workers who make such sustainability practices possible. While policies now champion circularity, they risk leaving behind the very workforce whose skills make it real.

As sustainability becomes a national priority, policymakers and technologists are reconsidering how we design, discard, and extend the life of everyday products. One emerging idea in research is 'unmaking' – the process of taking apart, repairing or repurposing devices after their first use, revealing design flaws and opportunities for reuse. Breakdowns and repairs are not failures; they are feedback loops and sources of practical insight. A discarded circuit board can become a teaching tool. A salvaged phone part can restore someone's access to work or school.

A broken appliance can be repaired and reused. Informal repairers perform this work daily. Their labour sits at the centre of the circular economy, where reuse is not an afterthought but a design principle. Recognising them as stewards of sustainability – not marginal figures – can reshape how we think about environmental and digital innovation alike.

AI-enabled solutions for repair justice
India's culture of *jugaad* and frugality long pre-dates today's tech-forward policies. Repairers have always adapted across devices and decades, with minimal support. As the country invests in AI infrastructure and digital public goods, it must align these ambitions with the ground realities of repair. Most modern gadgets are built for compactness and control, not repair. According to a 2023 iFixit global report, only 23% of smartphones sold in Asia are easily repairable due to design constraints. To change this, design norms and procurement policies must include repairability from the start. To make technology genuinely sustainable, public policy must consider not only how products are manufactured and used but also how they break down, are repaired, and find new life. A shift toward designing for "unmaking", where disassembly and repair are anticipated from the outset, should inform both hardware standards and AI-integrated systems.

This transition will require coordinated institutional action. The Ministry of Electronics and Information Technology can embed repairability criteria into AI and procurement policies. The Department of Consumer Affairs could expand the Right to Repair framework to include product classification and community involvement. Platforms such as e-Shram, under the Ministry of Labour and Employment, can formally recognise informal repairers and connect them to social protection and skill-building schemes. The Ministry of Skill Development and Entrepreneurship can consider training programmes to account for the tacit, diagnostic nature of repair work, which does not conform to standardised industrial templates. To support this, decision trees can help codify typical repair pathways, while Large Language Models can capture, summarise, and translate tacit repair narratives into structured, shareable knowledge, enabling broader learning without stripping local context or expertise.

Supporting this ecosystem is not merely a question of intellectual property or technical efficiency. It is about valuing the quiet, embodied labour that sustains our digital and material lives – an essential step toward a just, repair-ready technological future. As philosopher Michael Polanyi observed, "We know more than we can tell." By choosing to remember what cannot be digitised, we preserve the human wisdom essential to a meaningful technological future.

Another slip up by India in the trade pact with the U.K.

The India-United Kingdom Comprehensive Economic and Trade Agreement (CETA) raises several questions regarding India's commitments in the CETA's intellectual property chapter (Chapter 13). A problematic article in this chapter is Article 13.6, "Understandings Regarding TRIPS and Public Health Measures", in particular its first paragraph: "The Parties recognise the preferable and optimal route to promote and ensure access to medicines is through voluntary mechanisms, such as voluntary licensing which may include technology transfer on mutually agreed terms" (http://bit.ly/46zLEzj).

India's agreeing to this provision would result in dilution of its position on two critical issues. First, India consistently backed the use of compulsory licensing as opposed to voluntary licensing, to address high prices of patented medicines. Second, India argued that advanced countries must transfer technologies to developing countries on "favourable terms", for their industrialisation, and also for reducing their carbon footprints.

Issue of pricing
High prices of patented medicines are a serious anomaly of the patent system, due to excessive rent-seeking by patentees. Compulsory licensing of patented medicines can vastly improve the affordability of high-priced medicines by facilitating the production of such medicines. This was experienced following the grant of compulsory licence to Natco Pharma in 2012 for producing an anti-cancer medicine, sorafenib tosylate. The price came down to less than ₹8,800 for a month's treatment, from the ₹2,80,428 charged by the owner of the patent on the medicine, Bayer Corporation (http://bit.ly/4lVTc4l).

For remedying such instances of excessive rent-seeking, India's law-makers included compulsory licensing as a key safeguard while amending the Patents Act to make it compatible with the World Trade Organization's (WTO) Agreement on Trade Related Aspects of

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> There is a dilution of India's backing of the more effective compulsory licensing to address the high prices of patented medicines

Intellectual Property Rights (TRIPS). Both Houses of the Parliament unanimously adopted this legislation after a Joint Parliamentary Committee had carefully considered its provisions (http://bit.ly/4l7Z1uh).

Grant of compulsory licence
India's TRIPS-consistent Patents Act allows grant of compulsory licence to anyone interested in producing a patented product in India, three years after the grant of a patent. This licence can be granted if: reasonable requirements of the public with respect to the patented invention are not satisfied; or the patented invention is not available to the public at reasonably affordable price, or the patented invention is not "worked" in the territory of India, implying, it has not been commercially exploited in the country (http://bit.ly/4lTSBjI).

Patent rules monitor "working" requirement and, accordingly, patentees must submit the working status of their inventions. They had to do so annually until this requirement was diluted through India's FTA with the European Free Trade Association, with India agreeing that the periodicity of reporting "shall not be less than 3 years" (http://bit.ly/4o4NCxU). This dilution, has now been reinforced through the CETA, and it takes away an important ground for issuing compulsory licences.

By backing voluntary licensing to address the problem of access to medicines, India has, de facto, given up its position as a strong votary of compulsory licensing in the WTO. A coalition of developing countries, including India earned the right to issue compulsory licences through the Doha Declaration on the TRIPS Agreement and Public Health in 2001, despite strident opposition from advanced countries. The Declaration emphasised, "each Member has the right to grant compulsory licences and the freedom to determine the grounds upon which such licences are granted" (http://bit.ly/3IUwjiW).

Voluntary licences cannot ensure access to affordable medicines due to the weak bargaining position of domestic companies in developing

countries *vis-à-vis* dominant pharmaceutical corporations. Médecins Sans Frontières (MSF), a medical humanitarian organisation, observed that using the terms of voluntary licences, pharmaceutical corporations can set various limitations, including to control the supply of active pharmaceutical ingredients, besides imposing restrictions on licensees. Therefore, options for getting affordable access are compromised when voluntary licences are used (http://bit.ly/3U0j6aQ). The MSF's observations were proven when Cipla produced the anti-COVID drug, remdesivir, in India under a voluntary licence from Gilead Sciences, the owner of the patent on the medicine. The price of remdesivir fixed by Cipla for India was, in purchasing power terms, higher than that Gilead had charged in the United States.

India's demand will be affected
The CETA undermines India's demand for technology transfer "on favourable terms" in several multilateral forums. This demand was first made through the United Nations General Assembly Resolution on the New International Economic Order (NIEO) in 1974. A key aspect of the NIEO was the call for facilitated technology transfer from advanced to developing countries to promote the industrialisation efforts of the developing countries (http://bit.ly/41ejRRl). However, despite their best efforts, little progress was seen regarding technology transfer.

The disappointment of developing countries was reflected in India's Fourth Biennial Update Report to the United Nations Framework Convention on Climate Change in 2024: "Despite substantial national efforts and investments, barriers like slow international technology transfer and intellectual property rights (IPR) hinder the rapid adoption of [climate friendly] technologies" (http://bit.ly/3HlTlfU).

As India has compromised its long-held position that technology transfer to developing countries must be on "favourable terms", its demand for climate-friendly technologies from advanced countries could lose its sting.

On the track towards belonging

Sarabjit Arjan Singh

former general manager, Indian Railway, and former member of Central Administrative Tribunal

The completion of the the Udhampur, Srinagar, Baramulla rail link project, or the Jammu-Baramulla line, nearly four decades in the making, marks not only a historic engineering achievement in one of the most formidable terrains on the planet, but also the quiet fulfilment of a long-standing promise between the Indian state and the people of Jammu and Kashmir. Spanning 272 kilometres through the Pir Panjal and Himalayan ranges, this railway line is more than steel and concrete; it is a bridge of belonging.

Mobility equates to opportunity. The railway line connects places such as Sopore, Anantnag, Qazigund, and Banihal to the national economy. It brings markets closer, education within reach, and jobs within possibility. Each train narrows not just physical distance but also psychological gaps. This railway line fosters the sentiment that national integration is not merely about symbolism but practical access, investment, and shared development. In a region long marked by conflict, this railway line offers a quieter story – one of shared work, patience, and steady progress. It won't resolve every issue, but it shifts the conversation towards connection and common purpose.The train carries the message that Kashmir is not peripheral to India, but central to its journey forward.

Audacity and achievement
This milestone would not have been possible without the undaunted spirit of India's railway engineers. From the snow-bound tunnels of Pir Panjal to the vertiginous heights of the Chenab bridge, these professionals and workers toiled through some of the harshest natural conditions imaginable. They worked through deep winters, unpredictable landslides, and security concerns. Their courage and commitment deserve the gratitude of a nation.

The Indian Railways has a proud tradition of such resolve. In the 19th century, railway engineers built a railway through the treacherous Western Ghats and delivered the Bhor Ghat section that connects Mumbai with the Deccan. During the Assam rail-link project of 1948, when newly independent India faced a logistical crisis in connecting the Northeast, the legendary railway engineer Sardar Karnil Singh (later Chairman of the Railway Board) and his team built 200 kilometres of line in record time, including more than 300 bridges.

The Jammu-Baramulla line now joins this lineage of audacity and achievement. It is a reminder that while governments may change and priorities may shift, the railway engineer – anonymous and often unsung – continues to be one of the Republic's most enduring architects. Their work does not merely connect places; it connects lives, aspirations, and identities. It is they who transform maps into meanings and blueprints into belonging.

The symbolism of the Jammu-Baramulla line lies not only in what it connects but also in what it overcomes. The project navigated not only geotechnical obstacles and climatic extremities, but also long periods of political uncertainty and civil unrest. Each completed tunnel and bridge, therefore, is an engineering feat and also a marker of perseverance and institutional commitment in the face of adversity.

Strategic importance
The line's strategic importance is also worth underlining. By linking Kashmir's northernmost railhead with the rest of India's railway grid, it brings unparalleled logistical advantages for civilian mobility, trade, and even emergency response. The line also reduces dependence on the single Srinagar-Jammu national highway, which is vulnerable to landslides and closures during winter. In doing so, it enhances the resilience of Kashmir's

connectivity and helps ensure the regular flow of essentials such as food, fuel, and medicine.

For students and patients who earlier endured long road journeys over mountainous passes, the railway offers comfort, affordability, and dignity. It reduces both the cost and the emotional toll of separation, making it easier for families to stay connected. In time, it will also make the region more attractive to investors and institutions, opening the doors for industrial parks, skill development centres, and agro-logistics hubs to be developed in and around stations such as Anantnag, Awantipora, and Baramulla.

Culturally too, the railway becomes a conduit for exchange. As trains bring people to and from the Valley, they also carry stories, memories, and understanding. The rail journey is a slow but steady social equaliser, allowing a common experience to emerge across geographies. For many in the Valley who had never travelled far beyond their districts, it opens a new window to the rest of the country – and vice versa.

The future now depends on how we build around this backbone. The completion of the Jammu-Baramulla line must be followed by careful planning of last-mile linkages, station area development, and service frequency enhancement. Local entrepreneurs, women's groups, and artisans must be enabled to benefit from the access that this line provides. Government agencies and private players must together create ecosystems around these stations, so they become not just halts, but hubs of rural transformation.

This project is a testament to what democratic development looks like in action – patient, deliberate, and deeply transformational. The tracks may be made of steel, but the promise they carry is one of trust. And that may be the most powerful foundation on which to build the future of Jammu and Kashmir.

> More than a feat of engineering, completion of the line is a reaffirmation of a social contract between the people of Kashmir and the Indian Union

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A step forward, but not far enough

There are lacunae in the calculation of welfare cess in the Gig Workers Ordinance

Mohan Mani

While the Karnataka Platform Based Gig Workers (Social Security and Welfare) Ordinance, 2025, is a step forward towards basic social security cover, there are serious lacunae related to calculation of the welfare cess.

The welfare ordinance specifies 'payout' as the basis parameter for calculation of the welfare cess. 'Payout' is defined as the 'final payment made by the aggregator/platform to the gig worker...'. It goes on to define the 'welfare fee' as ranging from 1% and 5% of the payout per transaction to the gig worker. This formulation raises a series of issues. First, the range of 1-5% is likely to tend towards the lower bound of 1%. For instance, while the Construction Workers Welfare Cess provided for 1-2% cess, across States, the actual cess collected was 1% of construction cost.

Second, at the lower bound, this is a clear dilution of the provisions of cess under the Social Security Code of the Centre. The Code defines cess as 1-2% of turnover with a maximum cap of 5% of payment to workers. That means that a cess of 1% on turnover is the minimum. The 'payout', as defined in the Karnataka Bill, being the payment from the platform to the gig worker, is a part of and therefore less than the turnover of the platform. A cess of 1% on payout is therefore necessarily less than 1% cess on turnover of the platform and contravenes the Social Security Code.

We could test this rate of cess against the financial results of Zomato. The company had an Adjusted Revenue of

₹7,790 crore, while the 'delivery and related charges' was ₹3,900 crore (Annual Report 2024). Therefore, even a 2% cess on payout would barely equal 1% of company turnover, the minimum provision for platform cess under the Code.

The trend among food delivery platforms is towards diversification into merchandising and own production. There is every possibility that in such situations, the payout as a ratio to turnover might decline further, with even the cess rate at 2% payout being less than 1% cess on turnover. From Zomato's example, we can calculate that at 5% cess on the payout, the additional cost to be borne by the customer on a purchase value of ₹100 is barely around 50 paise. Surely the customer would not grudge this additional cost for social security cover to the platform worker. The employer contribution from Zomato at this cess rate would still be less than a third of what garment manufacturers in the State contribute towards Employees' State Insurance and Employees' Provident Fund cover per worker.

There is a further issue related to the ride-hail sector of platform work. With the entry of Namma Yatri in Bengaluru, the operations for the sector for autorickshaws has moved from a 'commission' model to a 'subscription' model. In essence, Namma Yatri does not

charge a commission on its rides, passing on the entire payment by customers to the driver. Instead, the driver pays a fixed subscription to Namma Yatri that allows her/him to be onboarded with the platform for a fixed duration. This benefits the driver, as the per ride subscription cost generally works out much less than the per ride commission. Uber and Ola have followed this model introduced by Namma Yatri, for autorickshaw operations in Bengaluru. The payout in this model from the platform to the driver is zero. How will the Bill account for this? Will this mean that platform-based autorickshaw drivers will be excluded from it?

A possible workaround could be that for all platform operations following a subscription model, the cess payment could be built into the customer fee, charging, say, 2% of the full transaction amount. The financial portal for this model of platform work could be designed to transfer the cess amount of each transaction to the Payment and Welfare Fee Verification System that forms part of the Bill. The quantum of payment at 2% is not so much as to inconvenience the customers taking a ride on these autorickshaws. The platforms in this case are unlikely to object, as they are merely called on to serve as intermediaries for the cess transaction.

The platform sector is complex and a one-size-fits-all approach will only end in chaos. Cess rates will need to be calibrated to fit the average employment conditions in each sector, ensuring that some minimum standards of social security can be guaranteed.

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How does the World Bank classify countries by income?

The World Bank's income groups are widely used in global data. This article explains how they are defined and updated

Bertha Rohenkohl
Pablo Arriagada

When people talk about countries as 'rich' or 'poor', they can mean many different things. But for researchers and policymakers, it helps to have a way to compare countries by income using clear criteria. One widely used approach is the World Bank's income classification system, which places countries into four groups: low, lower-middle, upper-middle, and high-income countries.

Every year, the World Bank assigns each country to an income group based on its gross national income (GNI) per capita. GNI per capita is a measure of the average income of a country's residents, including income that is earned abroad. Since countries report GNI in their local currencies, the World Bank converts these figures into U.S. dollars using exchange rates. It then places countries in one of four income groups based on specific thresholds. **Maps 1** and **2** show how countries were classified by income in 2014 and 2024.

The income thresholds that separate groups were first set in the late 1980s when this classification system was introduced. At that time, these were aligned with the World Bank's policies for lending money to countries. The Bank used average incomes to determine which countries were eligible for concessional loans.

This threshold for receiving such loans became the boundary between low-income and middle-income countries. The Bank then added two more thresholds to allow for further distinctions. These were chosen based on the distribution of country incomes at the time, rather than on lending rules.

Today, the thresholds are no longer linked to the Bank's operations, but they have been updated yearly to account for inflation. This

adjustment is based on a measure of global inflation.

This means that the classification is *absolute*. Countries are put into groups according to predetermined thresholds, and a country's placement depends only on its GNI per capita, not on how it stacks up relative to other countries. The thresholds for the latest income groups are (in U.S. dollars): low income: $1,135 or less; lower-middle income: $1,136 to $4,495; upper-middle income: $4,496 to $13,935; high income: More than $13,935.

If a country's GNI per capita crosses a threshold, it moves into a new income group in the following update. Because GNI per capita changes over time, and thresholds are revised annually, countries can move between income groups over time. These movements may reflect real changes in income, shifts in exchange rates, or updates to population data.

In the long run, most countries have moved up the income ladder as their economies have grown. However, countries can also move down – and some have, particularly in periods of war and economic crisis. Two examples are Syria and Yemen, which went from low-middle income to low income in 2017.

When we hear that there are four income groups, we might imagine that the world's population is evenly divided across them, with around 25% of people living in each. But this isn't the case. Again, these groups are defined based on *absolute* thresholds, not relative cut-offs that change based on other countries' progress.

In 2004, 37% of the population lived in low-income countries. Today, that share has fallen to less than 10%. In the same period, the share of upper-middle income countries increased from less than 10% to 35%. You can see this change in **Charts 3, 4 and 5**.

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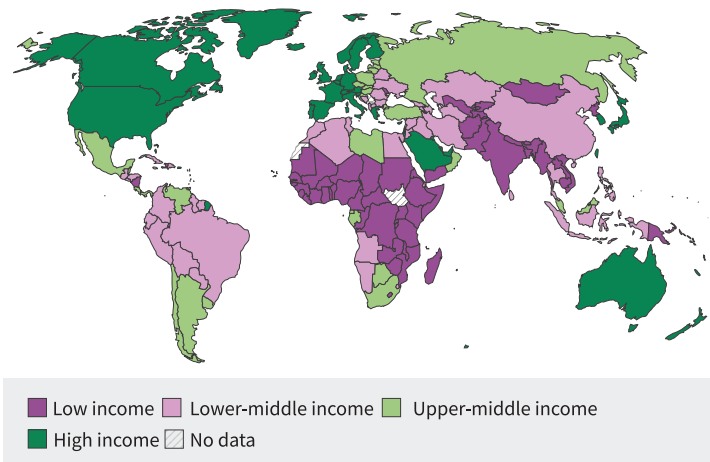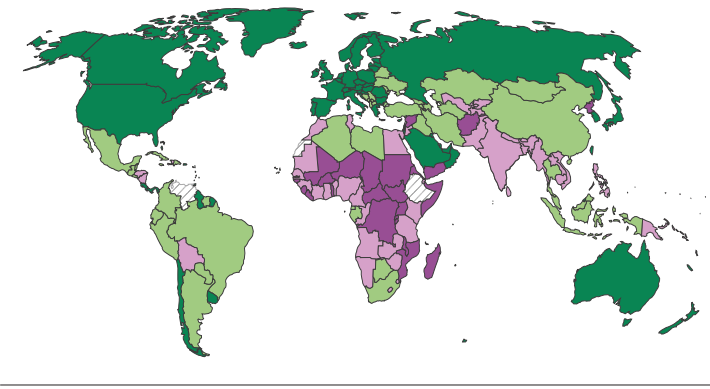
Income thresholds

The data for the charts were sourced from Our World in Data's story titled "How does the World Bank classify countries by income?"
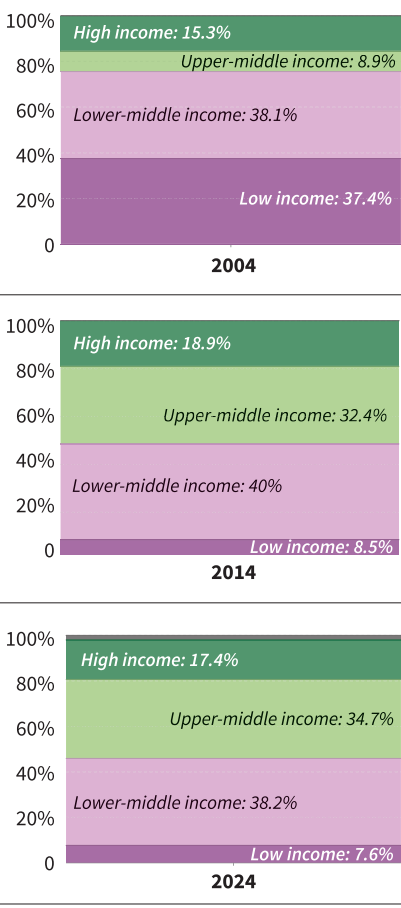
Map 1: Countries classified by income in 2014

Map 2: Countries classified by income in 2024

Low income   Lower-middle income   Upper-middle income   High income   No data

Charts 3, 4 and 5: Share of population by income group in 2004, 2014 and 2024

2004
High income: 15.3%
Upper-middle income: 8.9%
Lower-middle income: 38.1%
Low income: 37.4%

2014
High income: 18.9%
Upper-middle income: 32.4%
Lower-middle income: 40%
Low income: 8.5%

2024
High income: 17.4%
Upper-middle income: 34.7%
Lower-middle income: 38.2%
Low income: 7.6%

Text&Context

Why were the Malegaon blast accused freed?

What did a Special National Investigation Agency Court rule with respect to the 2008 Malegaon bomb blast case? What were the casualties of the blasts? Why were confessional statements recorded under the Maharashtra Control of Organised Crime Act rendered inadmissible?

Aaratrika Bhaumik

The story so far:

On July 31, a Special National Investigation Agency (NIA) Court acquitted all seven accused in the 2008 Malegaon bomb blast case, including Bharatiya Janata Party (BJP) leader and former MP Pragya Singh Thakur and serving Army Lieutenant Colonel Prasad Purohit. Special Judge A.K. Lahoti observed that although the occurrence of the bomb blast was indisputable, the prosecution had failed to produce credible and admissible evidence establishing the accused's involvement in the crime.

What was the Malegaon blast case?

On September 29, 2008, during the holy month of Ramzan, a powerful bomb blast ripped through Malegaon, a communally sensitive town in Maharashtra. Around 9:35 p.m., an explosive device concealed in an LML Freedom motorcycle detonated near the Shakeel Goods Transport Company. The explosion killed six people, injured 95 others, and caused significant damage to surrounding property. An FIR was promptly registered and the investigation was initially undertaken by the Nashik Rural Police and Mumbai's Anti-Terrorism Squad (ATS). In 2011, the case was transferred to the NIA. Of the 14 individuals arrested in connection with the blast, charges against seven were eventually dropped. The remaining seven, Pragya Singh Thakur, Colonel Prasad Shrikant Purohit, Ramesh Upadhyay, Sameer Kulkarni, Ajay Rahirkar, Sudhakar Dwivedi, and Sudhakar Chaturvedi, were put on trial. They were prosecuted under various provisions of the Indian Penal Code, 1860, along with charges under the Unlawful Activities (Prevention) Act (UAPA), 1967, and the Explosive Substances Act, 1908.

According to the ATS, conspiracy meetings had taken place across various

Procedural anomalies: Sameer Kulkarni leaving the sessions court in Mumbai, on July 31. PTI

locations allegedly under Ms. Thakur's leadership. However, several witnesses, including serving Army officers, later retracted their statements in court, alleging that their earlier testimonies had been coerced. Many of the accused also claimed that their confessions were extracted under torture. The case also attracted widespread attention following the resignation of NIA special public prosecutor Rohini Salian, who alleged that she had been instructed to "go soft" on the accused and that the agency was deliberately weakening the case against the so-called "Hindu terror" network.

Why were the accused acquitted?

The court held that Ms. Thakur was not in "conscious possession" of the LML Freedom motorcycle in which the explosive device was allegedly planted. The Judge further observed that there was neither eyewitness testimony nor circumstantial evidence to suggest that

Ms. Thakur had handed over the motorcycle to the co-accused or was involved in assembling the explosive device. Instead, he noted that the explosive could have been hung, placed, or kept near the motorcycle, rather than fitted inside it. Judge Lahoti observed that the forensic expert who examined the motorcycle, on which the explosive device was allegedly planted, had admitted that it was merely his "guesswork" that led him to conclude the bomb was placed in the vehicle's boot. No scientific test had been conducted to verify the placement of the explosive. Accordingly, the Judge held that in the absence of any primary forensic analysis, the expert's testimony failed to inspire confidence. The ATS further alleged that the explosive used in the blast was RDX, claiming it had been procured by Colonel Purohit during his posting in Jammu & Kashmir. However, the court found no evidence establishing the source of the

explosive or how it was procured or transported.

However, Judge Lahoti rejected Mr. Purohit's claim that his association with fringe organisations like Abhinav Bharat was part of his official duties as an intelligence officer. He noted that documentary evidence clearly established Mr. Purohit's role as a trustee of the Abhinav Bharat Trust. However, there was no material on record to suggest that his superiors had authorised him to join the trust or to collect and utilise its funds.

Moreover, the ATS, which initially investigated the blast, based its case primarily on the accused having participated in conspiracy meetings related to execution of the attack. Its key evidence comprised confessional statements recorded under the Maharashtra Control of Organised Crime Act (MCOCA), 1999. However, these confessions were rendered inadmissible after MCOCA was dropped from the case in 2016, when the NIA took over the investigation and flagged procedural lapses. The court concurred, noting that the sanction to invoke MCOCA had been granted without "application of judicial mind." Judge Lahoti noted that Additional Chief Secretary of the Home Department, Mumbai, Chitkala Zutshi, had failed to consult the investigating officer before granting sanction under the UAPA. As a result, the statutory presumptions under the Act, such as the reverse burden of proof, could not be invoked against the accused, the court held.

What happens next?

Advocate Shahid Nadeem, representing Nisar Ahmed Haji Sayyed Bilal, who lost his son in the blast, told the media that the case reflected "significant failures" on the part of the NIA. He added that the victims' families intend to explore legal remedies by filing an independent appeal in the Bombay High Court. Meanwhile, political pressure is mounting on the Maharashtra government to file its own appeal, as it did following the acquittals in the 2006 Mumbai train blasts case.

THE GIST

▼ On September 29, 2008, during the holy month of Ramzan, a powerful bomb blast ripped through Malegaon, a communally sensitive town in Maharashtra. The explosion killed six people, and injured 95 others.

▼ The court held that Ms. Thakur was not in "conscious possession" of the LML Freedom motorcycle in which the explosive device was allegedly planted.

▼ Advocate Shahid Nadeem, representing Nisar Ahmed Haji Sayyed Bilal, who lost his son in the blast, told the media that the case reflected "significant failures" on the part of the NIA.

How will railway to Sairang help in regional connectivity?

How will it boost the Act East policy? What is the status of projects to link the northeast with Southeast Asia?

Rahul Karmakar

The story so far:

The Indian Railways recently commissioned the new 51.38 km track to Sairang, 18 km short of Mizoram's capital Aizawl. It raises hopes for India's ambitious Act East Policy which envisages rail and road links with Southeast Asia.

When did the Mizoram project start?

Mizoram had 1.5 km of metre gauge railway track connecting Bairabi in the State's Kolasib district to Assam's Silchar before the gauge conversion project, sanctioned in 2000, was undertaken. The extension of this project to Sairang, which entailed laying a 51.38 km track, began in 2008-09, but the progress was slow due to inclement weather, a difficult and landslide-prone terrain, manpower shortage, and issues with transporting construction materials. The project was

part of the Indian Railways' plan in the early 2010s to connect all the northeastern State capitals to the country's rail network, although the Sairang railway station is 18 km short of Mizoram's capital, Aizawl. The Bairabi-Sairang section, which received safety clearance in June 2025 and awaits formal inauguration, has 48 tunnels with a total length of 12.85 km and 142 bridges. The project cost more than ₹5,020 crore and the lives of 18 workers when the bridge with the tallest pier collapsed during construction in August 2023.

What is its significance?

Landlocked Mizoram's fastest access to the rest of the country is through air travel. The Aizawl-Silchar highway, also via Sairang, is the second-fastest option that consumes at least five hours. Trains, including a proposed Rajdhani Express, from the Sairang railhead will slash this travel time to 1.5 hours and the cost of

transportation considerably. Railway officials say the biggest gain for the State will be in tourism, trade, and transportation of goods, reducing the dependence on trucks to a large extent. They said the Sairang railhead is strategic vis-a-vis the Act East Policy, envisaging rail and road connectivity to improve trade with the Association of Southeast Asian Nations (ASEAN) and other East Asian countries, deepen diplomatic engagements, and build stronger security cooperation. Sairang is also expected to be vital for transhipment of goods from the India-funded Sittwe Port in Myanmar.

What is the Act East Policy?

The Act East Policy, announced by Prime Minister Narendra Modi in 2014, was a more ambitious version of the Look East Policy initiated during the Congress government in 1991 with the key objective of transforming the northeastern region into India's gateway to the ASEAN bloc.

Official data show that the Centre increased the budgetary allocations for the region by 300% from ₹36,108 crore during the 2014-15 fiscal to more than ₹1,00,000 crore during 2024-25. More than 10,000 km of highways and 800 km of railway tracks were built, eight new airports established, and several inland waterway projects undertaken during this period. Vital to linking Southeast Asia by rail are the 82.5 km Dimapur-Zubza (near Kohima) project in Nagaland, the Imphal-Moreh plan in Manipur, and the Asian Highway 1 from Assam to Moreh via Kohima and Imphal. While the Nagaland project is on track, the ethnic conflict in Manipur has affected the proposed railway line between Imphal and Moreh.

The connectivity projects to link the northeast with Southeast Asia have not progressed beyond India's borders due to the unrest in India's neighbourhood. The Act East Policy ran into the civil war in Myanmar following a military coup in February 2021, followed by the fall of the Sheikh Hasina government in Bangladesh in August 2024. The Agartala-Akhaura railway project, which would have provided Tripura faster access to Kolkata through Bangladesh and connectivity to the Chittagong Port, has been stalled. The biggest setback has been the delay of the ₹2,904 crore Kaladan Multi-Modal Transit Transport Project in Myanmar, which would have reduced the distance between Mizoram and Kolkata by 1,000 km.

THE GIST

▼ The project was part of the Indian Railways' plan in the early 2010s to connect all the northeastern State capitals to the country's rail network, although the Sairang railway station is 18 km short of Mizoram's capital, Aizawl.

▼ The Act East Policy, announced by Prime Minister Narendra Modi in 2014, had the key objective of transforming the northeastern region into India's gateway to the ASEAN bloc.

▼ The connectivity projects to link the northeast with Southeast Asia have not progressed beyond India's borders due to the unrest in India's neighbourhood.

New rules: Bitcoin, Ethereum and the stablecoin USDT are promoted at a cryptocurrency store in Hong Kong on July 29. AFP

Why is Hong Kong regulating and licensing stablecoins?

Stablecoins are a class of cryptocurrencies, with their values linked to assets. Hong Kong is preparing the implementation of a regulatory regime for those issuing stablecoins, prompting enthusiasm in the fintech sector while authorities push for a more cautious approach

Sahana Venugopal

The story so far:

Hong Kong is taking a decisive step forward in regulating certain types of cryptocurrencies, as it prepares to enforce the Stablecoins Ordinance from August 1. The new regulations come amidst an explosion of interest in stablecoins and their promising applications in both personal finance and international business. While crypto users who support official regulation are excited, the authorities have advised caution.

What is the new stablecoin licensing system in Hong Kong?
The Hong Kong Monetary Authority announced that the Stablecoins Ordinance will come into effect from August 1 this year. This means it will be illegal for people to "offer any unlicensed fiat-referenced stablecoin (FRS) to a retail investor, or actively market the issue of unlicensed FRS to the public of Hong Kong," according to Eddie Yue, Chief Executive of the Hong Kong Monetary Authority (HKMA).

Furthermore, companies that want to legally issue stablecoins to users in Hong Kong will have to obtain a licence from the Monetary Authority as well as meet set requirements when it comes to managing reserve assets and redemption, asset stabilisation, and processing user requests. In addition to this, they will have to comply with the applicable regulations that prevent money laundering and terrorist financing, thus making sure that their assets are properly disclosed and audited.

The HKMA warned that the regulations are not a red carpet for interested parties to begin issuing stablecoins, and that in the beginning it would "at most grant a handful of stablecoin issuer licences. In other words, a large number of applicants will be disappointed," per Mr. Yue in an official statement.

What are stablecoins?
Stablecoins are a class of cryptocurrencies, with their values linked to assets. Unlike better known cryptocurrency coins such as Bitcoin (BTC) and Ether (ETH) or even tokens such as Shiba Inu (SHIB), whose values can wildly rise and fall due to investor sentiments and other factors, stablecoins are designed to maintain relatively steady prices. Hence, their name.

This so-called stability is achieved through the process of "pegging" the stablecoin to an asset such as fiat currency (like U.S. Dollars, EU Euros, Hong Kong Dollars, etc.), a commodity (like gold), other cryptocurrencies (such as Bitcoin), by regulating their value via computer algorithms, or by mixing multiple strategies. While the price of Bitcoin might rise or fall in the coming years, a USD-pegged stablecoin should ideally remain around $1.

Stablecoins are different from CBDCs, or Central Bank Digital Currencies, which are digital currencies officially issued and controlled by a government's central bank. Meanwhile, stablecoins can be privately issued and can also be pegged to foreign currencies.

Why do stablecoins require regulation?
Stablecoins play an important role both within and outside the crypto ecosystem, even if they might not balloon in price like Bitcoin. Crypto investors often use stablecoins to facilitate easy trading on crypto exchanges. Others around the world have used stablecoins to maintain the value of their savings when their native currencies are depreciating, or to save money on cross-border transactions. Argentina, Turkey, and even Taliban-occupied Afghanistan are some places where stablecoins are not just for trading, but a way to make daily life possible.

The numbers tell a compelling story as well. Tether (USDT), the fourth largest cryptocurrency by market capitalisation and the largest stablecoin, per CoinMarketCap, has a circulating supply of 163.75 billion USDT. Meanwhile, more than $250 billion worth of stablecoins are estimated to be in circulation worldwide.

Naturally, more governments are concerned about whether the highly engineered use of stablecoins could one day affect the value of the original fiat currencies or commodities backing them up. Furthermore, what is the guarantee that every stablecoin pegged to the dollar, euro, pound, or peso is actually backed up by its issuer? Currently, it is largely up to stablecoin users to audit their issuers' reserves and make sure that their stablecoins are adequately backed. When a stablecoin issuer suddenly adds millions of dollars in assets, it naturally raises questions about where the money to back this is coming from, or whether it really exists. This is where regulation comes in.

Do stablecoins exhibit volatility despite being pegged to currencies?
Despite their name and their backing, stablecoins can also exhibit volatility. In response to both technical factors and world events, stablecoins sometimes come unpegged and their prices may rise or fall beyond the usual range, with sudden drops triggering panic amongst investors. For example, USDT, which is pegged to the U.S. Dollar, has in the past fallen to prices as low as around $0.92.

Stablecoins have also collapsed entirely. In May 2022, Terra's cryptocurrency LUNA and its linked algorithmic stablecoin UST both lost most of their value in a matter of hours. Panicking investors who no longer trusted these assets quickly sold them off to minimise losses, and the prices fell close to zero. Billions of dollars were wiped from the crypto sector and the ensuing liquidity crunch triggered asset freezes across global crypto exchanges and fintech platforms.

Have other countries started to regulate stablecoins?
U.S. President Donald Trump in July signed the GENIUS Act that is designed to regulate stablecoins and protect the U.S. dollar, much to the joy of his pro-crypto supporters.

As per the White House, the GENIUS Act requires 100% reserve backing with liquid assets like U.S. dollars or short-term Treasuries for stablecoins. Those issuing this asset will also have to make monthly, public disclosures of the composition of their reserves, apart from complying with marketing rules.

Other countries that have started to regulate stablecoins include Japan and Singapore, per *AFP*, while multiple other jurisdictions have more generic regulations that cover stablecoins along with other cryptocurrencies.

Though the Chinese government heavily restricts crypto-related activities in its jurisdiction, some of the country's tech giants hope that Hong Kong's upcoming regulatory regime will provide an outlet for their own stablecoin ventures.

'Bio-fortified potatoes to hit Indian market soon'

Dr. Heck said India has the strongest momentum for potato production and farmers wanted better varieties of potato that grew well with fewer agro-chemical input and they also wanted to be part of the market chain, including food processing. He expressed hope that the centre will help farmers access better quality seeds and provide them better exposure to markets.

The CIP believes that the location chosen for the new centre near Agra, in the heart of the potato belt of India, is ideal as the Indo-Gangetic plains is the largest potato-producing area in the world.

Dr. Heck said the Uttar Pradesh government had made available the land and handed it over to the National Horticulture Board, which invited the CIP to establish the centre. The agreement between the CIP and the Union Agriculture Ministry, signed in the last week of July, was set up following the demand from the Government of India in recognition of the potential for economic growth from the thriving potato sector.

"It may be noted that international companies, especially potato firms from Europe and North America, are increasingly investing in potato production in India," he said.

Part of market chain
"What they [farmers] needed is access to potato seed of the right quality, of the right variety, and at the right time of the year. There are constraints. They do not have enough potato seeds or they come too late for planting or they are not of good quality. We need to build the capacity for companies to multiply potato seeds. That will be a major contribution of the CIP," he said. The CIP was working with private companies and public research institutes to make sure that farmers throughout India would have access to good quality planting material, right from the initial breeding of new varieties, through multiplication every year, in the right locations.

He said the CIP would also ensure that the vulnerable parts of society had access to nutritious potato. There were number of opportunities along the road; one was to work with the government, with public sector food procurement, for school feeding programmes, such as mid-day meals. This would give children access to nutritious potato through the programmes, more specifically and consistently, he said. Another one was to breed potato that was more nutritious, he added.

Philippines President to visit India as two sides look to deepen maritime ties

Kallol Bhattacherjee
NEW DELHI

In a move aimed at deepening maritime cooperation with the Southeast Asian region, India will host Philippines President Ferdinand Romualdez Marcos Jr. from August 4 to 8. This will be the first visit by President Marcos Jr., son of the former President Ferdinand Marcos, who visited India in 1976.

The External Affairs Ministry said the visit would formally begin with the ceremonial reception at the Rashtrapati Bhavan which would be followed by a visit by President Marcos Jr. to the memorial of Mahatma Gandhi at Rajghat.

Mr. Marcos Jr. will hold delegation-level talks with Prime Minister Narendra Modi with the two sides signing multiple agreements and MoUs. On August 7, he will visit Bengaluru.

Bilateral brief: External Affairs Minister Jaishankar with Philippine Secretary of Foreign Affairs Enrique A. Manalo in March 2025. PTI

The visit is being viewed as the culmination of sustained political-level dialogue even as they strengthened maritime cooperation as both Philippines and India are strong proponents of freedom of navigation in the South China Sea.

Mr. Modi had met Mr. Marcos Jr. on the sidelines of 21st ASEAN-India Summit and the 19th East Asia Summit in Vientiane, Lao PDR in October 2024. They had also met on the sidelines of the 20th ASEAN-India Summit in Jakarta in September 2023. Earlier, Mr. Modi had congratulated President Marcos Jr. after his electoral victory in 2022.

External Affairs Minister S. Jaishankar had met Secretary of Foreign Affairs of the Philippines Enrique A. Manalo on March 18, 2025 when Mr. Manalo participated in the Raisina Dialogue in New Delhi. The Ministers also met in Vientiane, on July 25, 2024, on the sidelines of the ASEAN-India Foreign Ministers' meeting. Mr. Jaishankar had visited the Philippines from March 25-27, 2025. He met Secretary Manalo and the Secretary of National Defence of the Philippines, Teodoro Gilbert, and called on President Marcos Jr. during the visit.

The upcoming five-day visit is drawing attention as it starts soon after several Indian Navy destroyers reached the Port of Manila on August 1 to conduct joint patrol of the West Philippine Sea with the Philippine Navy. Armed Forces of Philippines Chief General Romeo Brawner Jr. told local media that the presence of the Indian destroyers was a "clear demonstration" of mutual resolve to guard the maritime domain.

Govt. may push for passage of key sports Bill in LS amid deadlock over debate on SIR

The Hindu Bureau
NEW DELHI

The government is likely to push for the passage of a key sports Bill in the Lok Sabha on Monday, amid a deadlock in Parliament over the Opposition demand for a discussion on the special intensive revision of the electoral rolls in poll-bound Bihar, which the government has refused to accede to.

The Lower House has listed the National Sports Governance Bill, which envisages greater transparency in the functioning of sports bodies, for consideration and passage.

Resolution in RS

The Rajya Sabha has listed for passage on Monday a resolution from Union Home Minister Amit Shah on the extension of President's Rule in Manipur by another six months with effect from August 13.

Opposition MPs protesting in the Well as Lok Sabha Speaker Om Birla conducts the proceedings in the House. SANSAD TV/PTI

Other than a two-day discussion on the Pahalgam terror attack and Operation Sindoor in both the Houses, no significant business was transacted so far in the Monsoon Session of Parliament. Rajya Sabha Chairman Jagdeep Dhankhar's resignation on the very first day of the session added to the chaos.

Government sources, however, claim that if the Opposition does not pause its protests, it will get the National Sports Governance Bill passed in the din. Another Bill listed for consideration and passage in the Lok Sabha is the National Anti-Doping (Amendment) Bill.

The government's legislative agenda include the Readjustment of Representation of Scheduled Tribes in Assembly Constituencies of the State of Goa Bill, 2024, the Merchant Shipping Bill, 2024 and the Indian Ports Bill, 2025.

BEIJING

China, Russia start three-day joint naval drills in Sea of Japan

AP

China and Russia began joint naval drills in the Sea of Japan on Sunday as they seek to reinforce their ties and counterbalance what they see as a U.S.-led global order. The "Joint Sea-2025" exercises kicked off in waters near the Russian port of Vladivostok and would last for three days, China's Defence Ministry said on Sunday. AFP

Pakistan backs Iran's nuclear programme for peace purposes

Press Trust of India
ISLAMABAD

Pakistan and Iran are aiming to achieve the target of $10 billion in annual trade

Pakistan on Sunday supported Iran's right to develop nuclear capability for peaceful purposes, as the two sides signed several agreements to expand cooperation in multiple fields.

Iranian President Masoud Pezeshkian, who arrived in Islamabad on Saturday met Prime Minister Shehbaz Sharif at his official residence. At a joint press conference following their meeting, Mr. Sharif emphasised that Iran has the right to the peaceful use of nuclear energy, which has been at the centre of the ongoing tensions with Israel.

Mr. Sharif said the two sides have signed several MoUs and made commitments and hoped that they would be transformed into agreements. He said Pakistan and Iran are aiming to achieve the target of $10 billion in annual trade.

'Anything that moves, NISAR will see with unprecedented fidelity'

A conversation with Karen St. Germain, director of the Earth Science Division at NASA's Science Mission Directorate, on the 'extraordinary new capability' NISAR represents for ISRO and NASA; a satellite that has been 11 years in the making has implications for the study of other planets too

INTERVIEW

Karen St. Germain

Vasudevan Mukunth
Kunal Shankar

On July 31, ISRO launched the NASA-ISRO Synthetic Aperture Radar (NISAR) satellite, a flagship earth observation mission jointly developed by the two space agencies. It's the first satellite to use radars of two frequencies to monitor the earth's surface. NISAR will enhance climate resilience, agricultural monitoring, and disaster response. To discuss the milestone, **Vasudevan Mukunth** and **Kunal Shankar** spoke to **Karen St. Germain**, director of the Earth Science Division at the Science Mission Directorate at NASA, to understand the mission's science goals. To watch the full interview, visit *newsth.live/nisarscience*.

Vasudevan Mukunth: Karen, thank you so much for joining us today. Can you give us a few examples of scientific studies that are possible with NISAR, but haven't been possible so far with the existing crop of earth observation satellites?

Karen St. Germain: Absolutely, and it's great to be with you. The way to think about NISAR is that it will see anything that has structure to it that moves, that changes its position at a scale of less than a centimetre over an area about half of a tennis court. When I say anything that has structure: it could be forest, it could be buildings, it could be glaciers, mountains, land. Anything that moves, we'll see at an unprecedented level of fidelity.

What that means is we will be able to see the slight bulging that happens before a volcano erupts. We'll be able to see the land becoming unstable before a landslide. We'll be able to see building shifts after an earthquake or any other sort of event. When a forest gets cut down, we'll be able to see that. Anything that changes, we'll be able to see, and that's an extraordinary new capability for us.

Kunal Shankar: After the launch, NISAR will start its 90-day commissioning phase. In this phase, do you foresee any challenges with calibration, especially with cross-band calibration?

Karen St. Germain: There are a number of different aspects to the calibration. Largely the ISRO team will focus on calibrating the S-band radar and the NASA team will focus on calibrating the L-band radar. They don't really get cross-calibrated, but each one will look at its own special targets.

Now, what do I mean by a target? It's something we call a corner reflector and it is exactly what it sounds like. It's a corner, just like the corner of a room. And it has a special feature, which is that when a pulse of energy hits it from any direction, it reflects back in exactly the same direction. So we use these targets to calibrate independently each of the instruments. And then the only other thing we really have to pay special attention to is the alignment, the pointing. Are they pointing in the same place on the ground? And for that, we'll use the data itself. So the data itself will identify features and we'll align those features from each radar.

Kunal Shankar: Speaking of costs, there's a lot of interest about the commercial aspect and the applications aspect of NISAR. Could you just tell us a bit about the kind of interest that it has generated?

Karen St. Germain: Actually, let me take a step back and talk about earth observation data in general because understanding the earth – the surface, the atmosphere, and the changes large and small that can have impacts on communities and businesses, that's become an enormous area of interest. In fact, NASA's been collecting data on the earth system for more than 60 years now. And we find that about three quarters of our Fortune 100 companies are drawing something out of that earth observation archive. We also find that about 75% of our users, and we have more than 5 million users, are coming from .com addresses. So we are talking about agriculture producers, the insurance industry, the finance industry, the transportation industry. And that's before you even get to things like disaster response. So we have a tremendous interest in general.

For NISAR specifically, we know that NISAR will produce data that can directly benefit agriculture, also risk assessment – everything from natural hazards like earthquakes and volcanoes, which are both issues in the US but also things like wildfire risk because NISAR will be able to characterise how much fuel is in our wildlands. So that's dry fuel that is burnable. There are all these application areas. One of the things that we do that we're really excited about is any time we launch a new mission, we have an Early Adopters program. These are people out there who anticipate what NISAR might do for them in their business. We don't require that they tell us a lot about what they intend to do. But right now for NISAR, we have at least 200 of these Early Adopters. Once the data start to roll out and the excitement builds, we expect it to take off from there.

Vasudevan Mukunth: Can you say why NISAR took 11 years to build? Were there any particularly difficult engineering challenges that you had to overcome first?

Karen St. Germain: Yeah, absolutely. First, it's an enormously complex system, with many dozens of subassemblies that had to be designed. Of course, to make these two radars work together and operate through a single reflector, there's a lot of design work that had to happen up front. So it was challenging to begin with. And then we had a couple of other particular challenges. This one happened right as I was starting my job: COVID hit. So think about an integrated engineering team already separated by time zones and distance and now having to work through a global pandemic. A lot of this work also had to happen in person. We had people who had to travel at the height of COVID, and had to leave their families. Remember that the waves of COVID hit differently in the US and India. We had people on both teams sometimes come down with COVID when they were in the opposite country, so we had to take care of one another's teams. Then we had to develop entirely new protocols for how people could work together in a space and remain healthy. That was a big one.

More recently, this reflector is enormous, it's about a 40-foot deployable reflector. And when we were in India integrating and we were testing in the thermal vacuum, we saw some data that worried us. We were really afraid that there may be too much of a thermal load on that reflector before it gets deployed, and it might overheat. If it did that, it could challenge the structural integrity. Of course, when you've got a deployable antenna, if it doesn't stay taut, it doesn't reflect the way you want it to. So we ended up de-mating that reflector, bringing it back home, applying a reflective coating so the sun couldn't cause it to overheat, on the struts (not on the reflector surface itself). Then we had to ship it back and reintegrate. So we had a couple of technical challenges, which we expect when you're doing something as difficult as this.

Vasudevan Mukunth: Both the L-band and the S-band radars use the same reflector. Since S-band has a shorter wavelength than the L-band, does this create any trade-offs in either L-band or S-band performance?

Karen St. Germain: It doesn't. And the reason for that is because this is a synthetic aperture radar. It creates its spatial resolution as it moves along. Each radar is taking snapshots as it moves along. You know, to get this kind of centimeter level fidelity and the kind of spatial resolution we're achieving, if you were to use a solid antenna, it would have to be five miles long. Just like when you're talking about a camera, if you want to be able to get high fidelity, you need a big lens. Same idea. But we can't deploy an antenna that big. So what we do is we build up image after image after image to get that resolution. And because of this technique, it's actually independent of wavelength. It works the same for S- and for L-bands. The only thing that's a little different is because the antenna feeds for the L-band and the S-band can't physically occupy the same space, they have to be next to each other and that means there's a slight difference in the way their pulses reflect off the antenna. There's that positioning difference, and that we can correct for.

Vasudevan Mukunth: Could you tell us a little bit more about that slight difference?

Karen St. Germain: It's the way a reflector works. You would ideally want to put the feed at the focal point of the reflector. But when you have two feeds, you can't do that. So they're slightly offset. That means they illuminate the reflector just slightly differently. The alignment is just a little bit different. The team optimised the design to minimize that difference and to make it so that they could correct it in post-processing.

Kunal Shankar: How do NASA and JPL's radar systems for planetary exploration feed into and evolve from their earth observation systems?
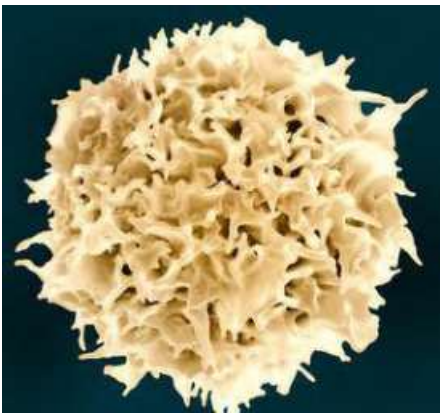
Karen St. Germain: Once you have expertise in a technology, you can use it in many, many ways.

And this is often the case in NASA between earth science and planetary science. One of us will develop a new technology or advance a new technology and then it can be used very broadly. So absolutely! And we love that kind of interplay. I love seeing earth science technologies make it into planetary missions.

That's one aspect. The other thing is what we learn from NISAR on earth can inform what we understand about other planets. There are lots of ways that we interact across disciplines.

One of the things that NISAR is going to tell us about is what's going on underneath the crust of the surface because we'll be able to see these very small motions that you and I don't experience daily, right? We can't sense these. But NISAR will, and it will allow us to advance our models about how the interior of planets work. And those kinds of models are the same models we use when we try to understand how a planet like Mars works.

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Karen St. Germain Join FREE Whatsapp Channel chat.whatsapp.com/HDvqPnxvwWb3Agy98nVaIQ
ILLUSTRATION: SOUMYADIP SINHA

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A view of NISAR before the chamber door was closed ahead of its thermal vacuum testing at the Jet Propulsion Laboratory, California, January 4, 2022. NASA

A colourised scanning electron micrograph of a T cell. NIAID

Scientists use AI-designed proteins to generate immune cells

Rahul Karmakar

A team of Harvard scientists has used artificial intelligence (AI), in the form of AI-designed proteins, to generate large numbers of immune cells and enhance immunity against diseases ranging from cancer to viral infections, a new research paper published in *Cell* said.

The scientists engineered a synthetic activator of a key cellular pathway called Notch signalling, which plays a crucial role in cellular differentiation and is essential for transforming human immune progenitors into T cells. Notch signalling is a cell-to-cell communication system vital for various developmental processes and tissue homeostasis in multicellular organisms. Homeostasis is the body's way of keeping everything balanced and stable, despite what is happening around it.

"In response to viral infections or cancer, the body requires a higher production of T cells to mount an effective immune defence. However, this process depends on the activation of the Notch signalling pathway, for which no effective molecular activators have been available," Rubul Mout from Assam, the principal scientist of the study, said.

Associated with the Harvard Stem Cell Institute and the Stem Cell & Regenerative Biology Program at Boston Children's Hospital, he is one of 24 scientists involved in the collaborative effort. They include George Daley, the Dean of Harvard Medical School, and Nobel laureate David Baker.

The body needs more T cells to deal with viral infections or cancer. This process depends on activation of Notch signalling pathways, for which no molecular activators have been available

Improved method

According to the study, an earlier method of activating Notch signalling in laboratory settings by immobilising Notch ligands on tissue culture dishes is not applicable for therapeutic use in humans. The quest for a viable, soluble activator of Notch signalling that could work in vivo (inside a living body) made the team develop a library of custom-designed soluble Notch agonists and systematically test their ability to activate the Notch pathway and support T cell development and function.

AI-driven protein design technologies, an innovation that contributed to Dr. Baker receiving the 2024 Nobel Prize in Chemistry along with Demis Hassabis and John Jumper, were used to address the challenge.

Using the agonists, the researchers demonstrated the large-scale generation of T cells in a laboratory bioreactor, an important advancement given the growing demand for T cell production in hospitals worldwide for Chimeric Antigen Receptor (CAR) T cell-based cancer immunotherapies.

Furthermore, when the agonists were injected into mice during vaccination, the animals displayed significantly improved T cell responses, indicating an enhanced immune response. The treatment resulted in increased production of memory T cells, which are crucial for the long-term impact of vaccines. "Being able to activate Notch signalling opens up tremendous opportunities in immunotherapy, vaccine development, and immune cell regeneration," Dr. Mout said.

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