

The Hindu Important News Articles & Editorial For UPSC CSE

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—It's about quality—

2024 के मध्य में, चेन्नई के एक अस्पताल में 30 वर्षीय व्यक्ति, जिसे अत्यंत दुर्लभ बॉम्बे ब्लड ग्रुप था, का किडनी ट्रांसप्लांट किया गया।

Cross-blood transplant performed on a patient with Bombay blood

His mother donated her kidney, though she did not have the Bombay blood group. And doctors in Chennai, who had performed cross-blood transplants for close to two decades, were willing to cross the Rubicon and pulled off what not long ago might have looked like a sheer miracle

Ramya Kannan

It was in his blood that the 30-year-old male should create history. Literally. In mid-2024, the patient underwent a kidney transplant. Though he was relatively young for a transplant, that's not where he stands unique. He had the extremely rare Bombay blood group, which prevented him from receiving organs or even blood transfusions from anyone who didn't have the same blood group running through their veins. But then that's exactly what he did: his mother donated her kidney, though she did not have the Bombay blood group. Doctors at MIOT International in Chennai, who had performed cross-blood transplants for close to two decades, were willing to cross the Rubicon into a sector with no precedence whatsoever: no one had attempted a cross-blood match on a Bombay group patient ever before.

A sheer miracle

In a recent paper published in the peer-reviewed journal *Kidney International Reports*, the team that worked on the transplant – Rajan Ravichandran, Yashwanth Raj T., and Kanakaraj Arumugam – chronicled for posterity how a team of doctors in Chennai pulled off what not long ago might have been put down as a sheer miracle. "It was impossible for Bombay blood group patients to receive blood or organs from another blood group, until it was not," senior nephrologist Dr. Ravichandran explained.

The story he believes begins nearly two decades ago, when he was trained in Japan to perform cross-blood transplants, referring to the transplantation performed when donors and recipients have different blood types. In 2010, he and his team at MIOT Hospitals used a kidney from a donor with B blood group on a recipient with O blood group, successfully. Using a special procedure called double filtration plasmapheresis (DFPP) developed by the Japanese, the team had the patient discharged in a week and back at his software job in three months' time.

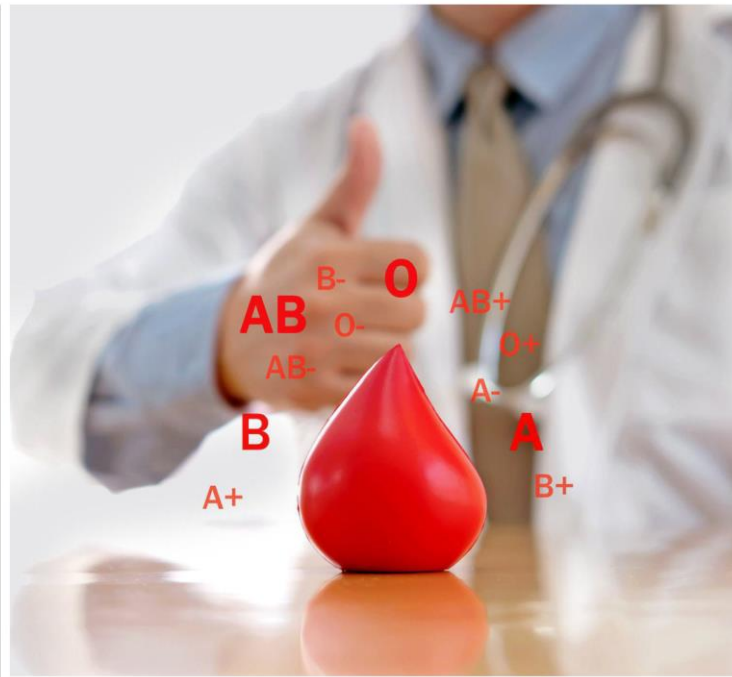
"The most essential requirement in transplantation is a blood group match – ideally, the patient's own blood group, or in the event it is not available, any group for which his blood does not carry antibodies," Dr. Ravichandran explained. Antibodies are used by the body to detect and neutralise foreign bodies, while antigens are proteins or carbohydrates found on the surface of red blood cells, white blood cells, and platelets, and they determine blood type.

Antibodies are used by the body to detect and neutralise foreign bodies, while antigens are proteins or carbohydrates found on the surface of red blood cells, white blood cells, and platelets, and they determine blood type.

The Bombay blood group

The Bombay, a.k.a. HH, blood group is a rare blood group first discovered in Mumbai in 1952 by Y.M. Bhende. The key differences between the Bombay blood group and the common ABO blood groups lie in the presence (or absence) of the H antigen, which is the fundamental building block for the ABO blood group system.

In normal individuals, the H antigen serves as the base structure for building A and B antigens. In Bombay blood group individuals, the gene responsible for producing the H antigen is mutated or absent, so neither A nor B antigens can be formed.



The Bombay, a.k.a. HH, blood group is a rare blood group first discovered in Mumbai in 1952 by Y.M. Bhende. Representative image. GETTY IMAGES/ISTOCKPHOTO

Therefore, these people cannot receive blood transfusions from any ABO group, including type O, which has the H antigen. They can only receive blood from another Bombay blood group donor. Its prevalence is about 0.0004% (one in 4 million) of the total human population. While it drops to one in a million in the European population and one in 10,000 in Mumbai, the act of finding a donor is still daunting.

Clinical challenges

It was daunting for this index patient as well. The issue was not to find a donor for a kidney; his mother was eager to donate hers; the nub was that his body would reject it outright because they had differing blood groups. "We decided that it was time to use the principles of cross-blood matching that we use for the ABO type here as well. We assumed it was a similar situation and decided to use the Japanese technique of DFPP," Dr. Ravichandran said.

"Once you identify the Bombay blood group, you know he has anti-H antibodies. Firstly, we measure anti-A and anti-B antibodies in the blood as we do in the case of ABO cross-blood matches. Here, additionally, you have to measure the levels for anti-H antibodies too, and titrate the levels. The next step is to give a monoclonal antibody injection to the patient to deplete B cells that produce antibodies," he said.

As the authors detailed in the paper,

In normal individuals, the H antigen serves as the base structure for building A and B antigens. In Bombay blood group individuals, the gene responsible for producing the H antigen is mutated or absent, so neither A nor B antigens can be formed. Therefore they cannot receive transfusions from any ABO group

the clinical challenges in such a scenario, even among those with rich cross-blood transplant experience in ABO, include determining a safe anti-H antibody titre cut-off, sufficient enough to stop the body from rejecting the organ from the donor.

Notably, there is no precedence for this, so one had to, again, assume a safe level of antibody concentration. There is a high risk of hyper-acute rejection as anti-H antibodies are more potent than anti-A or anti-B antibodies.

"After determining the titre (levels) of antibodies, we started plasmapheresis, which again removes the antibodies in the blood, lowering the chances of rejection. This was combined with immunosuppressive IVIG [intravenous immunoglobulin] to further suppress antibodies, thereby preventing hyperacute rejection of the organ."

Every alternate day, the team measured the level of antibodies in the patient. "Normally for anti-A and anti-B,

we consider a 1-in-16 concentration of antibody to be an ideal safe point to start transplant. It starts at 1-in-256, we then bring it down, lower the antibodies present. In anti-H there just is no cut off, so we made a few assumptions," he said.

A new hope

At what was assumed to be a safe, no-rejection antibody titre, the transplant surgery was performed. The team scoured the State for units of Bombay blood group units, just in case the patient might need it during transplant surgery, since cross-blood transfusion is not possible. However, he did not need it. The surgery was a breeze, and there were no complications during or after surgery, the team said.

While there is no published literature regarding accommodation of anti-H antibodies by the graft, as it had not been tested before, in this patient the doctors seemed to have achieved a no-rejection antibody titre status, and there was no rejection. The first two weeks, which are also crucial to decide if the organ will be rejected, also passed without incident, the doctors said.

Six months later, the patient is well and able to resume his pre-transplant activities, grateful at how the impossible became possible for him – and hopefully, for others in the Bombay blood group as well, if they are ever to require a transplant.

(ramya.kannan@thehindu.co.in)

- यह बॉम्बे ब्लड ग्रुप वाले मरीज पर किया गया पहला क्रॉस-ब्लड ट्रांसप्लांट था।

बॉम्बे ब्लड ग्रुप को समझना

- बॉम्बे ब्लड ग्रुप (HH ब्लड ग्रुप) की खोज 1952 में मुंबई में हुई थी।
- सामान्य ABO ब्लड ग्रुप के विपरीत, बॉम्बे ब्लड ग्रुप के व्यक्तियों में H एंटीजन नहीं होता, जो A या B एंटीजन बनने के लिए आवश्यक होता है।
- इस ब्लड ग्रुप वाले लोग किसी भी ABO ग्रुप (यहां तक कि O ग्रुप) से रक्त या अंग नहीं ले सकते।
- यह दुर्लभ ब्लड ग्रुप वैश्विक स्तर पर 40 लाख में से 1 व्यक्ति में पाया जाता है, जबकि मुंबई में इसकी अधिकता 10,000 में से 1 व्यक्ति में होती है।

बॉम्बे ब्लड ग्रुप के लिए ट्रांसप्लांट प्रक्रिया की चुनौतियाँ

- **डोनर की दुर्लभता:** बॉम्बे ब्लड ग्रुप वाले व्यक्ति केवल उसी ब्लड ग्रुप वाले दाता से ही रक्त या अंग प्राप्त कर सकते हैं।
- **अस्वीकृति (Rejection) का उच्च जोखिम:** H एंटीजन की अनुपस्थिति के कारण, शरीर में एंटी-H एंटीबॉडी बनती हैं, जो किसी भी असंगत (incompatible) दाता अंग पर तीव्र हमला कर सकती हैं।
- **पहले से कोई उदाहरण नहीं:** इससे पहले कभी भी बॉम्बे ब्लड ग्रुप के मरीज पर क्रॉस-ब्लड ट्रांसप्लांट नहीं हुआ था, जिससे सुरक्षित एंटीबॉडी स्तर निर्धारित करना कठिन था।
- **जटिल एंटीबॉडी निष्कासन:** आमतौर पर ABO-असंगत ट्रांसप्लांट में उपयोग की जाने वाली प्लाज्मा फ़ेरेसिस तकनीक को विशेष रूप से एंटी-H एंटीबॉडी हटाने के लिए अनुकूलित करना पड़ा।
- **आपातकालीन रक्त आपूर्ति की समस्या:** सर्जरी के दौरान जटिलताओं की स्थिति में बॉम्बे ब्लड ग्रुप के रक्त की व्यवस्था करना अत्यंत कठिन होता है।

Page 07 : Prelims Fact

- ➔ जनवरी 2025, जनवरी 2024 की तुलना में 0.09°C अधिक गर्म थी, जिससे यह अब तक की सबसे गर्म जनवरी बन गई।

जनवरी 2025 ने गर्मी का रिकॉर्ड तोड़ा

- ➔ इस वर्ष की जनवरी, औद्योगिक क्रांति से पहले के समय की तुलना में 1.75°C अधिक गर्म रही।
- ➔ यह पिछले 19 महीनों में से 18वां महीना था जब वैश्विक तापमान 1.5°C या उससे अधिक दर्ज किया गया।

बढ़ते तापमान का मुख्य कारण

- ➔ इस रिकॉर्ड तोड़ गर्मी का मुख्य कारण कोयला, तेल और प्राकृतिक गैस के जलने से ग्रीनहाउस गैसों का बढ़ता स्तर है।
- ➔ प्राकृतिक कारण जैसे एल नीनो और ला नीना भी वैश्विक तापमान को प्रभावित करते हैं।

अप्रत्याशित तापमान प्रवृत्तियाँ

- ➔ एल नीनो, जो जून 2024 में समाप्त हुआ, ने पिछले वर्ष की रिकॉर्ड गर्मी में योगदान दिया।
- ➔ ला नीना, जो जनवरी 2025 में शुरू हुई, आमतौर पर ग्रह को ठंडा करती है, लेकिन इस बार इसने गर्मी को धीमा नहीं किया।
- ➔ कुछ विशेषज्ञों का अनुमान है कि 2025, 2024 से भी अधिक गर्म हो सकता है, भले ही पहले कम तापमान की भविष्यवाणी की गई थी।



The Palisades Fire burns through a beach front property, in California on January 8, 2025. AP

Is global warming accelerating?

Associated Press

The world warmed to yet another monthly heat record in January, despite an abnormally chilly US, a cooling La Nina, and predictions of a slightly less hot 2025, according to the European climate service Copernicus.

The surprising January heat record coincides with a new study by a climate science heavyweight, former top NASA scientist James Hansen, and others arguing that global warming is accelerating. It's a claim that's dividing the research community.

January 2025 globally was 0.09 degrees C warmer than January 2024, the previous hottest January, and was 1.75 C warmer than it was before industrial times, Copernicus calculated. It was the 18th month of the last 19 that the world hit or passed 1.5 C above pre-industrial times. Scientists won't regard the limit as breached until global temperatures stay above it for 20 years.

By far the biggest driver of record heat is greenhouse gas buildup from the burning of coal, oil, and natural gas, but the natural contributions to temperature change have not been acting as expected, said Samantha Burgess, strategic lead for climate for the European weather agency.

The big natural factor in global temperatures is usually the natural cycle of changes in the equatorial Pacific Ocean waters. When the central Pacific is especially warm, it's an El Nino and global temperatures tend to spike. Last year was a substantial El Nino, though it ended last June, and the year was the hottest on record.

El Nino's cooler flip side, a La Nina, tends to dampen the effects of global warming, making record temperatures less likely. A La Nina started in January after brewing for months. Just last month,

It was the 18th month of the last 19 that the world hit 1.5 C above pre-industrial times. Scientists won't regard the limit as breached until temperatures stay above it for 20 years

climate scientists were predicting that 2025 wouldn't be as hot as 2024 or 2023, with the La Nina a major reason.

But Hansen, the former NASA scientist now at Columbia University, said 2025 could break 2024's records. In a study in the journal *Environment: Science and Policy for Sustainable Development*, Hansen and colleagues said the last 15 years have warmed at about twice the rate of the previous 40 years.

"I'm confident that this higher rate will continue for at least several years," Hansen said in an interview.

There's been a noticeable temperature rise even when taking out El Nino variations and expected climate change since 2020, Hansen said. He noted recent shipping regulations that have resulted in reduced sulphur pollution, which reflects some sunlight away from the earth and effectively reduces warming. And that will continue, he said.

University of Michigan environment dean Jonathan Overpeck, who wasn't part of the Hansen study. "There seems little doubt that global warming and the impacts of climate change are accelerating."

But Princeton's Gabe Vecchi and University of Pennsylvania's Michael Mann said they disagree. Vecchi said there's not enough data to show that this isn't random chance. Mann said that temperature increases are still within what climate models forecast.

- ▶ पृथ्वी पर खनिजों की विविधता बहुत अधिक है, जो आमतौर पर भूविज्ञान के अध्ययन में कल्पना से भी परे होती है।

THE SCIENCE QUIZ

Please send in your answers to science@thehindu.co.in

There are more minerals on earth than are dreamt of in our geology

Vasudevan Mukunth

QUESTION 1

Tanzanite is a strikingly blue variety of calcium aluminium hydroxyl sorosilicate crystals. Its colour is the result of small amounts of X present in the crystal — in the same way that some tunicates display a vivid blue colour thanks to metalloproteins called vanabins. Name X.

QUESTION 2

Zirconium and Y are very rarely found in the same natural compounds because the processes that create and accumulate them are very different. This is what makes the mineral painite very hard to find. Most of the currently known deposits of the mineral occur in Myanmar.

Name Y.

QUESTION 3

In pure form, this mineral has the chemical formula NaAlSi₃O₈. It's tough, dense, and doesn't weather easily. Its green form is highly valued in China. It's formed only in the subduction zones of continents, where rock is transformed to contain new minerals under very high pressure. Name the mineral.

QUESTION 4

When angular, hard-edged rock fragments become cemented together by powdery rock, you have breccia. Name the mineral found in the Dhofar 280 meteorite that crashed in Oman in 2000 later identified as lunar breccia.

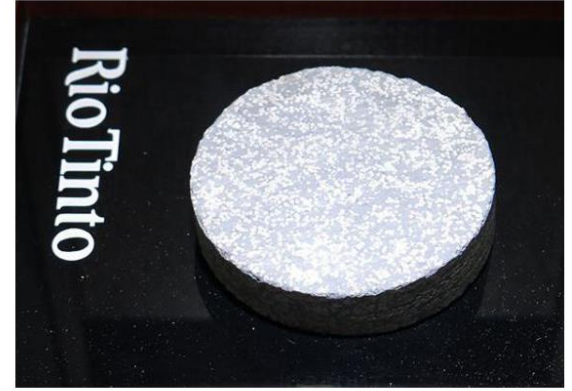
QUESTION 5

Ekanite is one of the very few minerals

on the earth that are naturally radioactive. It occurs mostly in Sri Lanka. It's hard to find because, in a process called Z, the radioactivity slowly but progressively degrades the crystal structure. Name Z.

Answers to January 30 quiz:

1. First computer virus that 'escaped' to other networks – **Ans: Elk Cloner**
 2. First virus for the IBM Personal Computer – **Ans: Brain**
 3. Code that mutates its algorithm when it runs – **Ans: Polymorphic code**
 4. Code that rewrites itself to perform new functions – **Ans: Metamorphic code**
 5. Worm believed to have disrupted Iran's nuclear programme – **Ans: Stuxnet**
- Visual: **John von Neumann**
First contact: ViswanadhaRao Batchu | K.N. Viswanathan | Dalbeer Singh | Ashish Nair | Joe V.R.



Visual: Name this mineral, thus far found only in Serbia. Its chemical formula is very similar to that of kryptonite as described in the 2006 film *Superman Returns*. DUNGDUNG (CC BY-SA 4.0)

टंज़नाइट

- ▶ एक नीला कैल्शियम एल्युमिनियम हाइड्रॉक्सिल सोरोसिलिकेट, जो केवल तंज़ानिया में पाया जाता है।
- ▶ इसकी नीली रंगत क्रिस्टल संरचना में वेनेडियम (X) की उपस्थिति के कारण होती है।
- ▶ यह गहनों में उपयोग किया जाता है और इसकी दुर्लभता एवं प्लिओक्रोइज़्म (अलग-अलग रोशनी में विभिन्न रंग दिखाने की क्षमता) के कारण अत्यधिक मूल्यवान है।

पेनाइट

- ▶ एक दुर्लभ बोरेट खनिज, जिसे पहली बार म्यांमार में खोजा गया था, जिसमें ज़िरकोनियम और बोरॉन (Y) होते हैं।
- ▶ यह एक समय पृथ्वी का सबसे दुर्लभ खनिज माना जाता था, क्योंकि यह अत्यंत दुर्लभ है।
- ▶ इसका रंग गहरा भूरा से लाल-भूरा होता है और यह अत्यधिक मांग में रहता है।

जेडाइट

- ▶ एक पाइरोक्सीन खनिज जिसका रासायनिक सूत्र NaAlSi₂O₆ है।
- ▶ इसकी हरी किस्में चीनी संस्कृति में "इंपीरियल जेड" के रूप में अत्यधिक मूल्यवान मानी जाती हैं।
- ▶ यह सबडकशन ज़ोन (उच्च दबाव और तापमान वाले स्थान) में बनता है, जिससे यह भूवैज्ञानिक रूप से दुर्लभ हो जाता है।

लूनर ब्रेचिया (धोफार 280 उल्कापिंड)

- यह एक प्रकार की चट्टान है, जो खंडित चंद्र सामग्री के एक साथ जुड़ने से बनी होती है।
- धोफार 280 उल्कापिंड, जिसे 2000 में ओमान में खोजा गया था, लूनर ब्रेचिया से युक्त है, जो इसके चंद्रमा से आने का संकेत देता है।
- इसका अध्ययन चंद्रमा की भूविज्ञान और प्रभाव इतिहास को समझने के लिए किया जाता है।

एकेनाइट

- एक रेडियोधर्मी खनिज, जो मुख्य रूप से श्रीलंका में पाया जाता है।
- इसकी क्रिस्टल संरचना स्वयं-रेडिएशन क्षति (मेटामिक्टाइज़ेशन (Z)) के कारण धीरे-धीरे नष्ट हो जाती है।
- इसमें यूरेनियम और थोरियम होते हैं, जिससे यह एक दुर्लभ रेडियोधर्मी सिलिकेट खनिज बन जाता है।

➔ वित्त वर्ष 2025-26 के केंद्रीय बजट में विज्ञान और प्रौद्योगिकी के लिए महत्वपूर्ण धन आवंटित किया गया है, जिसमें निजी क्षेत्र के अनुसंधान एवं विकास (R&D), जैव प्रौद्योगिकी, परमाणु ऊर्जा और कृत्रिम बुद्धिमत्ता (AI) पर विशेष ध्यान दिया गया है।

What has the Budget offered scientists?

The Union Budget for 2025-26 provided an overall and possibly unprecedented thrust on research and innovation, especially in the private sector. The Budget's support for private sector research is expected to accelerate advancements in areas such as gene-editing, personalised medicine, and sustainable agriculture

FULL CONTEXT

T.V. Padma

What does India's 2025-26 Union Budget spell for India's research ecosystem? The author asked seven scientists and science administrators. Their replies are presented below, edited for clarity. [Read the full version online here.](#)
[bit.ly/scientistsbudget](#)

Abhay Karandikar, Secretary, Department of Science & Technology: The Budget provides an overall and possibly unprecedented thrust on research and innovation by setting aside ₹20,000 crore for the Department of Science & Technology (DST), and towards research in the private sector, including corporates and startups. There is a focused attempt to bring together academia, the private sector, and startups to work on national missions.

The dedicated fund of ₹20,000 crore is part of the ₹1 lakh crore corpus fund announced in the Budget of July 2024 to boost private sector R&D, especially in the deep-tech and sunrise sectors. The DST will be the nodal ministry driving this fund. This will be a major step towards creating strategic autonomy in some key technology sectors. The National Geospatial Mission has been allocated ₹100 crore for FY 2025-2026 to develop foundational geospatial infrastructure and data. The mission will help implement the National Geospatial Policy 2022, with the goal of expanding the access and use of geospatial data and making India a world leader in the geospatial sector.

The Finance Minister has announced several initiatives to boost science, and innovation in the country including the Nuclear Energy Mission, clean tech initiatives, Atal Tinkering Labs etc.

Rajesh Gokhale, Secretary, Department of Biotechnology (DBT): The Union Budget demonstrates a commitment to advancing India's biotechnology sector, which aligns closely with the DBT's objectives. The ₹3,416.64 crore allocation reflects a significant increase of 51.45% from the previous year's allocation.

Recently, the government also approved the 'Bio-RIDE' scheme to foster innovation, promote bio-entrepreneurship, and strengthen India's position as a global leader in biomanufacturing and biotechnology.

The Budget's support for private sector research is expected to accelerate advancements in areas such as gene-editing, personalised medicine, and sustainable agriculture. The proposal for a light-touch regulatory framework based on principles and trust is a progressive step. Aligned with the government's 'BioE3 Policy' for fostering high-performance biomufacturing, the National Manufacturing Mission (NMM) announced in the Budget aims to accelerate technology development and commercialisation.

The National Mission on High Yielding Seeds will focus on strengthening the research ecosystem and developing high-yielding, pest resistant, and climate-resilient seeds. Similarly, some of DBT's initiatives contribute to self-reliance programmes, such as the mission on minor oil seeds. Another is a mission programme on 'Characterisation of Genetic Resources', to sequence/sequence and characterise available germplasm resources of pulses.



ISTOCKPHOTO

N. Kalaisevi, Director-General, Council of Scientific and Industrial Research (CSIR):

The Budget reinforces science, technology, and innovation (STI) as key enablers of national progress, aligning with CSIR's vision of advancing self-reliance and global competitiveness. The Budget's focus on public-private partnerships, industry collaboration, and technology-driven entrepreneurship will accelerate innovation in manufacturing, healthcare, and sustainability.

For agriculture and rural prosperity, CSIR's Aroma and Floriculture Missions align with the Agri-Hub initiative, promoting value-added farming and boosting farmer incomes. Similarly, CSIR's Millets Mission supports self-reliance in the farming of pulses and oilseeds, ensuring nutritional security and climate-resilient farming. The CSIR Cotton Mission aligns with the National Cotton Mission, strengthening India's position in global textile markets.

The Indigenous Manufacturing and Smart Packaging Missions find synergy with the NMM, driving innovation-led industrial growth. The Green Hydrogen Mission, spearheaded by CSIR, supports the clean energy transition.

For youth-skilling, CSIR's Jigyasa Programme complements Atal Tinkering Labs, fostering STEM education and research exposure. The Seaweed Mission and Learn & Earn Program empowers women entrepreneurs, supporting economic inclusion. Additionally, CSIR's Footwear for Healthcare and India Footwear Sizing Program align with the leather sector's initiatives. This Budget cements CSIR's pivotal role in nation-building and reinforces STI as the foundation for a self-reliant, inclusive, and globally competitive India.

K.S. Parthasarathy, former Secretary, Atomic Energy Regulatory Board: The Central government's ambitious

programme to enhance the share of nuclear power to 100 GW by 2047 and to invest heavily to support associated R&D is challenging to all stakeholders.

Accepting private sector participation in the nuclear sector adds a new dimension to the programme. Success in the project to develop and install Small Modular Reactors (SMRs) is essential in India's energy transition. As per the International Atomic Energy Agency (IAEA), SMRs are nuclear reactors with a power generating capacity of 300 MWe equivalent or less.

The Atomic Energy Regulatory Board (AERB) has implemented measures to regulate the safety of VVER Russian reactors, pressurised heavy water reactors of 700 MWe etc, all of which include first of its kind technologies.

AERB's reports to the IAEA Convention of Nuclear Safety reveal how openly and transparently it has been fulfilling its mandate. AERB staff updates its knowledge and expertise in safety-related disciplines associated with new technologies. It has linkages with the U.S. Nuclear Regulatory Commission and the French regulatory agency among others, and exchanges its experience regularly.

C.P. Rajendran, National Institute of Advanced Studies, Bengaluru:

The Budget infuses significant funding for science and technology and for the DBT, whereas the allocation for the Department of Scientific and Industrial Research is nominal.

The importance of curiosity-driven science doesn't seem to be a major priority. Much of the funding appears directed towards mission-mode programmes such as nuclear energy, AI, private sector initiatives, etc. The government also plans to amend the Nuclear Liability and Damage Act 2010 that makes operators liable for nuclear damage. This will have serious ramifications. Many experts have raised concerns about SMRs.

The Finance Minister also announced

the expansion of the Small Industries Development Bank of India Fund for Startups with an additional ₹10,000 crore corpus to enhance the "deep-tech ecosystem" in startups focused on AI, biotech, and space technology. India had over 3,600 deep-tech startups in 2023. In that year, they raised \$850 million, reflecting a 77% decrease from 2022 due to investors' lack of confidence regarding investment returns.

Curiosity-driven research is propelled by scientists' curiosity regarding specific research questions. What I observe is a growing corporatisation of science driven solely by immediate utility. Another critical issue is the rigid bureaucracy surrounding funding, which has created significant problems over the years.

Tapasya Srivastava, University of Delhi, South Campus:

The Budget meets the increasing needs of health research and biomedical devices, given that the Economic Survey recognised the physical and mental harms of ultra-processed food leading to non-communicable diseases.

The percentage increase from the Revised Estimate of 2024-2025 to Budget Estimate of 2025-2026 for Central universities (4.3%) is about half of that given to IITs (8.4%), which is disappointing given the number of students and the overhauling with respect to the National Education Policy (NEP) that universities are going through. These changes require unprecedented support from the government, which is not evident looking at these numbers.

It would have been more meaningful if the Prime Minister's Research Fellowship became an interim research fellowship of a reasonable amount that replaces the abysmally low ₹8,000 non-NET UGC. The PMRF is competitive and, therefore, ends up mostly in labs with sufficient funding.

The AI bandwagon is something that all governments seem to want to rush into. The allocation has come into the Centre of Excellence in AI education and one hopes the Centre sets benchmarks for adoption in a way that truly benefits Indian society, beyond buzzwords.

With a significant number of youth struggling with mental health issues, overall health decline, reduced attention span and consumerism, the unprecedented advantage of a steady government to implement value-based learning and life skills in school education to bring about generational change appears to have been lost.

Soumitro Banerjee, IISER, Kolkata:

The scientific community of India is dismayed to see the low financial allocation to sectors crucial for scientific development. The NEP 2020, adopted by the same government, recommended the expenditure on education be 6% of the GDP, which requires at least 10% of the Union Budget to be spent on education.

But since 2020, there has been no attempt to meet this target. This year the allocation is only 2.54%. This implies that through NEP-2020, the government is trying to change the structure and content of education without improving its quality. The direction of change is clear from the five-fold increased outlay for 'Indian Knowledge Systems'.

Basic science research has taken a backseat as the funding for IISc and the IISERs has been reduced. The UGC, which funds all universities, saw a drastic reduction in its budget last year (from ₹5,360 crore to ₹2,500 crore). Despite some increase this year (33% BE to BE), it is far below the pre-2024 figure.

T.V. Padma is a science journalist.

THE GIST

▼ The dedicated fund of ₹20,000 crore is part of the ₹1 lakh crore corpus fund announced in the Budget of July 2024 to boost private sector R&D, especially in the deep-tech and sunrise sectors.

▼ The importance of curiosity-driven science doesn't seem to be a major priority. Much of the funding appears directed towards mission-mode programmes such as nuclear energy, AI, private sector initiatives, etc.

▼ Basic science research has taken a backseat as the funding for IISc and the IISERs has been reduced.

➔ हालांकि, मूलभूत अनुसंधान (बेसिक रिसर्च) में घटते निवेश, कठोर नौकरशाही और विज्ञान के व्यापारीकरण को लेकर चिंताएँ बनी हुई हैं।

अनुसंधान और नवाचार को बढ़ावा

- विज्ञान और प्रौद्योगिकी विभाग (DST) और निजी क्षेत्र के अनुसंधान, विशेष रूप से स्टार्टअप के लिए ₹20,000 करोड़ का आवंटन किया गया है।
- DST इस फंड की देखरेख करेगा, जो ₹1 लाख करोड़ के अनुसंधान एवं विकास कोष का हिस्सा है, जिसका उद्देश्य डीपटेक और नवोदित (सनराइज़) क्षेत्रों को मजबूत करना है।
- राष्ट्रीय भू-स्थानिक मिशन (National Geospatial Mission) को ₹100 करोड़ मिले हैं, जो राष्ट्रीय भू-स्थानिक नीति 2022 (National Geospatial Policy 2022) को समर्थन देगा।
- **अन्य प्रमुख पहलें:**
 - परमाणु ऊर्जा मिशन
 - स्वच्छ तकनीक (क्लीन टेक) कार्यक्रम
 - अटल टिकरिंग लैब्स (Atal Tinkering Labs)

जैव प्रौद्योगिकी (Biotechnology) में प्रगति

- जैव प्रौद्योगिकी विभाग (DBT) को ₹3,446.64 करोड़ का आवंटन, जो पिछले वर्ष की तुलना में 51.45% की वृद्धि है।
- 'Bio-RIDE' योजना हाल ही में स्वीकृत हुई है, जिसका उद्देश्य बायो-एंटरप्रेन्योरशिप और बायोमैनुफैक्चरिंग को बढ़ावा देना है।
- बजट में निजी क्षेत्र के अनुसंधान को समर्थन मिलने से जीन-संपादन (Gene-Editing), व्यक्तिगत चिकित्सा (Personalized Medicine) और सतत कृषि (Sustainable Agriculture) में तेजी आएगी।
- राष्ट्रीय उच्च उपज वाले बीज मिशन (National Mission on High Yielding Seeds) जलवायु-प्रतिरोधी और कीट-रोधी बीजों के विकास पर ध्यान केंद्रित करेगा।

वैज्ञानिक और औद्योगिक अनुसंधान को समर्थन

- विज्ञान, प्रौद्योगिकी और नवाचार (STI) को राष्ट्रीय विकास का केंद्र बिंदु बनाया गया है।
- सार्वजनिक-निजी भागीदारी (Public-Private Partnerships) और उद्योग सहयोग विनिर्माण, स्वास्थ्य देखभाल और स्थिरता में नवाचार को बढ़ावा देंगे।
- प्रमुख मिशन:
 - अरोमा (Aroma) और पुष्पकृषि (Floriculture) मिशन से कृषि को बढ़ावा मिलेगा।
 - मिलेट्स मिशन (Millets Mission) से दलहन और तिलहन में आत्मनिर्भरता बढ़ेगी।
 - ग्रीन हाइड्रोजन मिशन भारत के स्वच्छ ऊर्जा लक्ष्यों (Clean Energy Goals) के अनुरूप है।
 - युवाओं के कौशल विकास, उद्यमिता और सतत कृषि के लिए विशेष योजनाएँ लागू की गई हैं।

परमाणु ऊर्जा और निजी क्षेत्र की भागीदारी

- बजट 2047 तक भारत की परमाणु ऊर्जा क्षमता को 100 GWe तक बढ़ाने के लक्ष्य का समर्थन करता है।

- ▶ परमाणु ऊर्जा में निजी क्षेत्र की भागीदारी नई चुनौतियाँ और अवसर लाती है।
- ▶ स्मॉल मॉड्यूलर रिएक्टर (SMRs) की सफलता भारत के ऊर्जा परिवर्तन (Energy Transition) के लिए महत्वपूर्ण है।
- ▶ परमाणु ऊर्जा नियामक बोर्ड (AERB) वैश्विक सहयोग के माध्यम से परमाणु सुरक्षा सुनिश्चित करेगा।

मूलभूत विज्ञान (Basic Science) के लिए घटती निधि पर चिंता

- ▶ विज्ञान और प्रौद्योगिकी को अधिक धनराशि आवंटित की गई है, लेकिन मूलभूत अनुसंधान (Basic Research) को सीमित समर्थन मिला है।
- ▶ बजट मुख्य रूप से परमाणु ऊर्जा और AI जैसे मिशन-मोड (Mission-Mode) परियोजनाओं पर केंद्रित है।
- ▶ परमाणु दायित्व और क्षति अधिनियम 2010 (Nuclear Liability and Damage Act 2010) में संशोधन को लेकर भी चिंताएँ हैं।
- ▶ डीपटेक स्टार्टअप इकोसिस्टम को ₹10,000 करोड़ का कोष मिला है, लेकिन निवेशकों में विश्वास अभी भी कम है।
- ▶ अनुसंधान निधि प्राप्त करने में नौकरशाही बाधाएँ बनी हुई हैं।

शिक्षा और स्वास्थ्य अनुसंधान

- ▶ स्वास्थ्य अनुसंधान में वृद्धि हुई है, विशेष रूप से बायोमेडिकल उपकरण (Biomedical Devices) और पोषण (Nutrition) क्षेत्र में।
- ▶ केंद्रीय विश्वविद्यालयों के बजट में केवल 4.3% की वृद्धि हुई, जबकि IITs के बजट में 8.4% की वृद्धि हुई, जबकि केंद्रीय विश्वविद्यालयों में अधिक छात्र नामांकित होते हैं।
- ▶ युवा शोधकर्ताओं को पर्याप्त समर्थन देने के लिए अनुसंधान छात्रवृत्ति (Research Fellowships) की समीक्षा आवश्यक है।
- ▶ AI अनुसंधान के लिए धन आवंटित किया गया है, लेकिन इसके भारतीय समाज के लिए वास्तविक लाभों पर संदेह बना हुआ है।
- ▶ मानसिक स्वास्थ्य और मूल्य-आधारित शिक्षा (Value-Based Learning) को बढ़ावा देने के लिए कोई ठोस कदम नहीं उठाए गए।

शिक्षा और वैज्ञानिक विकास में चुनौतियाँ

- ▶ राष्ट्रीय शिक्षा नीति (NEP-2020) ने शिक्षा पर GDP का 6% खर्च करने की सिफारिश की थी, लेकिन बजट में केवल 2.54% आवंटित किया गया है।
- ▶ IISc और IISER जैसे संस्थानों के लिए निधि में कटौती की गई है।
- ▶ पिछले वर्ष यूजीसी (UGC) के बजट में भारी कटौती हुई थी, और इस वर्ष कुछ वृद्धि हुई है, लेकिन यह अभी भी 2024 से पहले के स्तर से कम है।
- ▶ 'भारतीय ज्ञान प्रणाली' (Indian Knowledge Systems) के लिए बजट में पाँच गुना वृद्धि हुई है, जो शैक्षिक प्राथमिकताओं में बदलाव को दर्शाता है।

निष्कर्ष

- कुल मिलाकर, बजट में अनुप्रयोग-आधारित अनुसंधान (Applied Research) और औद्योगिक सहयोग (Industrial Collaboration) को मजबूत किया गया है, लेकिन मूलभूत अनुसंधान (Basic Research) और शिक्षा को पर्याप्त समर्थन नहीं मिला है।

UPSC Mains PYQ : 2014

Ques : भारतीय विश्वविद्यालयों में वैज्ञानिक अनुसंधान कम हो रहा है, क्योंकि विज्ञान में करियर हमारे व्यवसाय संचालन, इंजीनियरिंग या प्रशासन जितना आकर्षक नहीं है, और विश्वविद्यालय उपभोक्ता उन्मुख होते जा रहे हैं। आलोचनात्मक टिप्पणी करें। (200 words/12.5m)



In News : PM-VIKAS SCHEME

- ▶ प्रधानमंत्री विरासत का संवर्धन (PM VIKAS) अल्पसंख्यक कार्य मंत्रालय की एक प्रमुख पहल है, जो पाँच पूर्ववर्ती योजनाओं को एकीकृत करती है।

Launch of Integrated Scheme

By Combining Five (5) existing schemes of MoMA viz. Seekho aur Kamao, USTTAD, Hamari Dharohar, Nai Roshni and Nai Manzil

Guidelines for PM VIKAS

(Pradhan Mantri Virasat Ka Samvardhan)



अल्पसंख्यक कार्य मंत्रालय
MINISTRY OF
MINORITY AFFAIRS

सत्यमेव जयते

उद्देश्य:

- ▶ इस योजना का लक्ष्य अल्पसंख्यक समुदायों के कारीगरों और शिल्पकारों को कौशल विकास, बाज़ार से जोड़ने और वित्तीय सहायता प्रदान कर उन्हें सशक्त बनाना है।

मुख्य विशेषताएँ:

- ▶ **मंत्रालय:** इस योजना को अल्पसंख्यक कार्य मंत्रालय द्वारा लागू किया गया है।
- ▶ **लाभार्थी समुदाय:** यह मुस्लिम, ईसाई, सिख, बौद्ध, जैन और पारसी समुदायों पर केंद्रित है।
- ▶ **कौशल विकास:** पारंपरिक कला, शिल्प और आधुनिक कौशल में उन्नयन और उद्यमिता प्रशिक्षण प्रदान किया जाता है।
- ▶ **वित्तीय सहायता:** विभिन्न सरकारी योजनाओं के तहत रियायती ऋण (सब्सिडी वाले लोन) के माध्यम से आर्थिक सहायता दी जाती है।

Daily News Analysis

- ➔ **बाज़ार से जोड़ना:** प्रदर्शनियों और डिजिटल प्लेटफार्मों के माध्यम से राष्ट्रीय और अंतर्राष्ट्रीय बाज़ारों तक पहुंच को बढ़ावा दिया जाता है।
- ➔ **अन्य योजनाओं से समन्वय:** यह योजना पीएम विश्वकर्मा योजना, सीखो और कमाओ, नई मंज़िल, नई रोशनी, हमारी धरोहर और USTTAD योजना को एकीकृत करती है।
- ➔ **डिजिटल सशक्तिकरण:** ई-कॉमर्स और डिजिटल मार्केटिंग कौशल को अपनाने के लिए प्रोत्साहित किया जाता है।
- ➔ **रोजगार सृजन:** इस योजना का उद्देश्य स्थायी आजीविका के अवसरों का निर्माण करना और भारत की समृद्ध विरासत को संरक्षित करना है।



India as a bridge between the Global North and South

In his address in January 2025, in Bhubaneswar, Odisha, while addressing the 18th Pravasi Bharatiya Divas convention, the Prime Minister, Narendra Modi, said, 'Today's India not only firmly asserts its own point but also strongly amplifies the voice of the Global South'. Similarly, when India held the 3rd Voice of Global South Summit 2024, last August, Mr. Modi said that India aspires to lead the required reforms to take developing countries into a new, more inclusive structure of global governance.

What has influenced India's renewed enthusiasm to champion the cause of the developing world? And, how can the country influence change to become an effective global development partner?

Unlike the Non-Alignment Movement (NAM), India's motivation does not appear to be based on decolonisation or strong criticism of the West. Rather, as India attempts to increase its presence in the Global South, it is simultaneously deepening its relationships with traditional partners such as the United States and Europe. The high-level visit of Jake Sullivan, the former U.S. National Security Adviser, in January, reflects this. Mr. Modi's visit to Poland, in August 2024, also shows India's attempt to create new alliances.

The China factor argument

The cynical answer often circles back to India trying to counter China's growing global dominance. Trends of foreign direct investments in Africa indicate that India appears to be in a race with China, mainly focusing on countries which already have a significant Chinese presence. Further, industrialised countries are thought to be strategically partnering with India to contain China's rising international footprint. The Quad partnership, an on-going dialogue between Japan, India, Australia and the U.S., for a free and fair Indo-Pacific, is seen as one such attempt. However, the India-China competition does not give the full picture.

India is trying to create an individual identity as an emerging power in its own right to forward



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its own strategic trade, defence, and geopolitical interests. Global South countries are disillusioned with present economic paradigms, burdened with debt and conditionalities. They are not looking for another China or a new western institution. India can fill this gap while being a bridge between the Global North and Global South. To be successful, India needs to back up its rhetoric with the right strategies.

Steps that India must take

The first is for India to double-down on its call for an alternate paradigm of development cooperation that is not solely top-down, dictated by the Global North. India often lays emphasis on equal partnerships with other developing countries, trying to set itself apart from traditional powers. In practice, it signals otherwise by putting forward strategies with an India-first approach.

The newly announced 'Global Development Compact' aimed at facilitating growth in the Global South, was described as rooted in Indian experiences and strategies. India's development story as an emerging power and being the world's largest democracy makes it unique. However, it does not hold all the policy answers. It would merit India to not only assert itself as a provider of knowledge but also be open to learning from other Global South countries to address its domestic challenges. Countries are bound to be more receptive toward a country that views them as partners. Otherwise, India may also be perceived as a big brother imposing traditional donor and recipient relationships.

Second, New Delhi has laid stress on a more human-centric approach to tackle developmental challenges. This has been defined at international fora towards promoting behavioural change via Mission LiFE ('Lifestyle For Environment'), which encourages low consumption lifestyles. While important, the need is to rebrand human-centric development in order to focus on building human resource and capacity, especially to tackle future sustainability challenges. Skill India or schemes that mainstream women into entrepreneurship,

will be attractive for countries in the Global South which are also seeking to grow their domestic industry. India's capacity building strategy has tended to revolve around the Indian Technical and Economic Cooperation (ITEC) programme, which implements sector-specific short-term activities. It would be more effective for longer term engagement to assist countries in creating their own institutional capacity to create a better workforce. India can leverage its experiences with micro, small and medium enterprises to foster exchanges. A focus on digital infrastructure, climate and energy solutions as well as water and food security are key areas for cooperation.

The goal ahead

Lastly, India has called for more inclusive global governance. The nation demonstrated this intent by championing the addition of the African Union into the G-20 (in 2023) during India's presidency. India should not be content with facilitating changes in established international institutions but also learn to build domestic capacity. As India aspires to become a stronger global development player, it must establish norms, standards and systems to work with partner countries. Initially, it is beneficial to use existing institutional channels of partners such as the United Nations or Germany and France that are more experienced in development cooperation. However, the long-term goal should be for India to create its own robust domestic systems for international cooperation. Trilateral partnerships and increased engagement with new partners need to be seen as a learning by doing process, where India imbibes its experiences to scale up India-led global initiatives.

India aspires to be the 'Voice' of the Global South, but it also must 'listen' to be a good leader. When India spearheaded NAM, the country showed the world that there is a new, third option for developing countries. India should not miss out on an opportunity to do the same thing now.

The views expressed are personal

GS Paper 02 : International Relations

UPSC Mains Practice Question: ग्लोबल साउथ में भारत की उभरती भूमिका और एक प्रभावी वैश्विक विकास भागीदार बनने के लिए इसे अपनाई जाने वाली प्रमुख रणनीतियों पर चर्चा करें।

(250 Words /15 marks)

Context :

- ▶ जनवरी 2025 में 18वें प्रवासी भारतीय दिवस पर प्रधानमंत्री नरेंद्र मोदी ने समावेशी शासन और विकास सहयोग के माध्यम से ग्लोबल साउथ की आवाज़ को सशक्त करने के भारत के संकल्प को दोहराया।

ग्लोबल साउथ में भारत की बढ़ती रुचि

- ▶ भारत विकासशील देशों की चिंताओं को उजागर कर एक अधिक समावेशी वैश्विक शासन प्रणाली बनाने की दिशा में काम कर रहा है।
- ▶ पहले के केवल उपनिवेशवाद विरोधी आंदोलनों के बजाय, भारत अब अमेरिका और यूरोपीय देशों जैसे पारंपरिक साझेदारों के साथ अपने संबंध मज़बूत कर रहा है।
- ▶ उच्च-स्तरीय राजनयिक यात्राएँ यह दर्शाती हैं कि भारत नए गठजोड़ बना रहा है और रणनीतिक रिश्तों को संतुलित रख रहा है।

रणनीतिक विचार और वैश्विक स्थिति

- ▶ कुछ विश्लेषकों का मानना है कि ग्लोबल साउथ में भारत की बढ़ती भूमिका एक प्रमुख वैश्विक शक्ति के प्रभाव को संतुलित करने का प्रयास हो सकती है।
- ▶ अफ्रीकी देशों में भारत और अन्य प्रमुख शक्तियों के बढ़ते निवेश प्रतिस्पर्धा को दर्शाते हैं।
- ▶ कई औद्योगिक राष्ट्र भारत के साथ रणनीतिक गठबंधन कर रहे हैं ताकि वैश्विक शक्ति संतुलन बनाए रखा जा सके।
- ▶ हालाँकि, भारत सिर्फ प्रतिस्पर्धा करने के बजाय खुद को एक स्वतंत्र उभरती हुई शक्ति के रूप में स्थापित करना चाहता है, जिसमें उसके अपने रणनीतिक और आर्थिक हित शामिल हैं।

ग्लोबल साउथ की चिंताओं का समाधान

- ▶ कई विकासशील देश आर्थिक संकट, ऋण बोझ और शर्तों से बंधी सहायता जैसी समस्याओं से जूझ रहे हैं।
- ▶ ये देश ऐसी विकल्पी साझेदारियों की तलाश में हैं, जो उनकी निर्भरता को न दोहराएँ।
- ▶ भारत इन देशों और विकसित राष्ट्रों के बीच एक सेतु की भूमिका निभा सकता है, लेकिन इसके लिए प्रभावी रणनीतियों को अपनाना आवश्यक है।

भारत के लिए सफलता के प्रमुख कदम

1. विकास सहयोग का पुनर्परिभाषित करना

- ▶ भारत को ऐसा विकास मॉडल अपनाना चाहिए, जो केवल विकसित देशों की शर्तों पर आधारित न हो।
- ▶ हाल ही में शुरू किया गया "ग्लोबल डेवलपमेंट कॉम्पैक्ट" भारत के अनुभवों पर आधारित विकास रणनीतियों को बढ़ावा देता है।

- ▶ भारत को अन्य विकासशील देशों से भी सीखने की आवश्यकता है ताकि घरेलू और वैश्विक चुनौतियों का प्रभावी समाधान निकाला जा सके।
- ▶ एक संतुलित दृष्टिकोण अपनाने से छोटे देशों पर प्रभुत्व जमाने की धारणा को रोका जा सकता है।

2. मानव-केंद्रित दृष्टिकोण अपनाना

- ▶ भारत मिशन LIFE जैसी पहलों के माध्यम से सतत विकास और जिम्मेदार उपभोग को बढ़ावा दे रहा है।
- ▶ कौशल प्रशिक्षण और उद्यमिता पर अधिक ध्यान देने की आवश्यकता है।
- ▶ भारतीय तकनीकी और आर्थिक सहयोग (ITEC) कार्यक्रम ने पारंपरिक रूप से अल्पकालिक प्रशिक्षण प्रदान किया है।
- ▶ दीर्घकालिक प्रभाव बढ़ाने के लिए, भारत को संस्थागत क्षमता निर्माण पर ध्यान देना चाहिए ताकि अन्य देशों में कुशल कार्यबल विकसित किया जा सके।
- ▶ डिजिटल अवसंरचना, जलवायु अनुकूलन, ऊर्जा समाधान, जल और खाद्य सुरक्षा में सहयोग भारत की वैश्विक विकास भूमिका को मजबूत कर सकता है।

3. समावेशी वैश्विक शासन का निर्माण

- ▶ भारत ने अफ्रीकी संघ को G-20 में शामिल करने की पुरजोर वकालत की है।
- ▶ मौजूदा वैश्विक संस्थानों को प्रभावित करने के साथ-साथ, भारत को अपने अंतर्राष्ट्रीय सहयोग की क्षमता भी बढ़ानी होगी।
- ▶ प्रारंभिक चरण में, भारत संयुक्त राष्ट्र और यूरोपीय देशों जैसे अनुभवी विकास भागीदारों के साथ सहयोग कर सकता है।
- ▶ दीर्घकालिक रूप से, भारत को स्वतंत्र विकास साझेदारी तंत्र विकसित करना चाहिए।
- ▶ त्रिपक्षीय सहयोग और निरंतर जुड़ाव से भारत अपने वैश्विक पहलों को और मजबूत कर सकता है।

आगे की राह

- ▶ ग्लोबल साउथ की आवाज़ बनने के लिए भारत को सक्रिय रूप से संवाद और सहयोग करना होगा।
- ▶ भारत ने पहले भी एक प्रमुख वैश्विक आंदोलन का नेतृत्व कर विकासशील देशों को एक वैकल्पिक मार्ग दिखाया था।
- ▶ अब उसके पास एक नए, समावेशी और सतत विकास मॉडल को स्थापित करने का अवसर है, जो विश्वभर के लिए एक मार्गदर्शक बन सकता है।