

● POLITY

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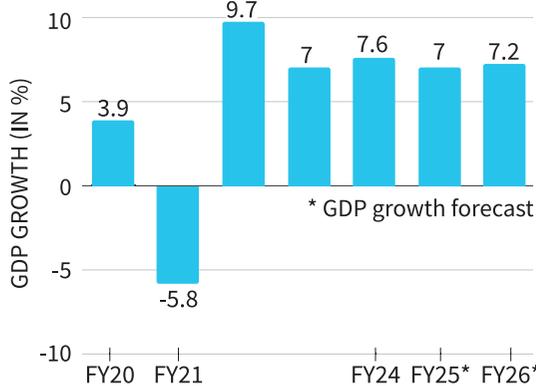
POLITY AND GOVERNANCE

ADB Projects India's GDP Growth In 2024-25 At 7%

CONTEXT: The Asian Development Bank (ADB) expects the Indian economy to remain strong over the next two years, with GDP growth projected at 7% in 2024-25 and 7.2% in 2025-26.

Projected slowdown

India's GDP growth is forecast by the Asian Development Bank to slow to 7% this year before improving to 7.2% in 2025-26



BACKGROUND: The Asian Development Bank (ADB) is issuing an economic outlook for India. They predict continued strong growth, but at a slightly slower pace than the previous year. This growth is expected to be driven by public and private investment, along with a revival in rural consumption. Inflation is also expected to moderate, due to factors like a normal monsoon and falling food prices. However, there are some downside risks, such as global economic conditions and potential weather shocks in India.

INDIA'S ECONOMIC OUTLOOK ACCORDING TO ADB (APRIL 2024)

Growth Forecast

- ADB projects India's GDP growth to be 7% in 2024-25, slowing slightly from 7.6% in 2023-24 but rising to 7.2% in 2025-26.
- This growth will be driven by public and private sector investments alongside a revival in rural consumption.

Inflation

- Retail inflation is expected to ease to 4.6% in 2024 and 4.5% in 2025-26, with food inflation dropping to 5.7% if farm output returns to normal.
- A normal monsoon this year is expected to aid agricultural production and contribute to lower food prices.

Global Factors

- A potential downside risk is a "higher for longer" interest rate regime in the US, which could impact Asian economies, including India, due to its reliance on imported goods.
- Rising global oil prices and tighter financial conditions could also pose challenges.

Domestic Factors

- Underperformance in agriculture due to weather shocks could affect both economic growth and inflation.

Upside Potential

- Faster-than-expected foreign direct investment (FDI), particularly in manufacturing, could boost output and productivity.
- Stronger global growth than anticipated could lead to increased exports and higher overall growth.

Other Considerations

- Rising incomes and improving consumer confidence in urban areas are expected to drive up demand.
- Increased imports to meet domestic demand may lead to a moderate widening of the Current Account Deficit.

CONCLUSION: The ADB paints a cautiously optimistic picture of the Indian economy over the next two years. While growth is expected to moderate slightly, it will remain robust thanks to continued investment and a revival in rural consumption. Lower inflation, fuelled by a normal monsoon and potentially stronger global growth, will further support economic activity. However, India remains susceptible to external factors like US interest rates and global oil prices, and domestic challenges like weather disruptions in agriculture. By capitalizing on potential upsides like increased FDI, India can solidify its position as a major growth engine in Asia.

INTERNATIONAL RELATIONS

Sound And Stable Ties In Region's Interest: China

CONTEXT: Prime Minister Narendra Modi's comments about tensions on the border with China and his hope for a restoration of peace and normalcy in relations between the two countries have been met with reactions from both India and China.



BACKGROUND: Tensions exist between India and China, particularly along the Line of Actual Control (LAC), a disputed border. This standoff has been ongoing since April 2020.

Prime Minister Narendra Modi has previously avoided publicly commenting on the situation.

RECENT DEVELOPMENTS:

In an Interview, PM Modi called for a resolution to the LAC standoff and a return to normalcy in relations between the two countries.

China's Foreign Ministry responded by calling for cooperation but downplaying the significance of the border issue in the overall relationship.

POSSIBLE REASONS FOR THE SHIFT:

- **Upcoming Indian general election:** PM Modi might be seeking to address the issue with China as a priority for a potential third term.
- **Changing global dynamics:** Renewed talks between China and other world powers (US and Europe) might be influencing India's approach.
- **Previous tough talk by other Indian officials:** Statements by External Affairs Minister, Defence Minister, and home Minister criticizing China's actions might have pressured PM Modi to address the situation.

POSSIBLE INTERPRETATIONS OF PM MODI'S COMMENTS:

- A signal to China for potential re-engagement and restoration of relations.
- A softening of India's stance, especially regarding the Quad grouping.

CHINA'S RESPONSE:

- China acknowledges India's message and emphasizes the importance of stable relations.
- Downplays the border issue as the sole factor in the relationship.
- Calls for continued communication, trust-building, dialogue, and cooperation.

ANALYSIS:

- CHINA has still not responded at the highest political level which is commensurate with Indian political intent.
- It has continued with its policy of labelling territories in Arunachal in Chinese local languages.
- There is no indication that it intends to move away from salami slicing policy or negotiation regarding Aksai chin.

ADDITIONAL POINTS TO CONSIDER:

- Recent changes in China's foreign policy, including renewed talks with the US and Europe, might be influencing India's approach.
- Statements from other Indian officials have been more critical of China, suggesting a range of views within the Indian government.

CONCLUSION: The situation is complex and evolving. Prime Minister Modi's comments mark a potential turning point, but it remains to be seen if both countries can find a way to de-escalate tensions and improve relations.

POLITY AND GOVERNANCE

No Shortage Of Capital Funds Due To Consolidated Budget Of 3 Services'

CONTEXT: The Indian Air Force (IAF) assures there will be sufficient funds for them despite the consolidation of capital allocation for all military services in the 2024-25 defense budget.



BACKGROUND:

Before February 2024:

- The Indian defense budget allocated capital funds separately for each military service (Army, Navy, Air Force).
- This system might have led to:
 - Difficulty in efficiently utilizing the entire capital budget.
 - Lack of flexibility in addressing urgent needs across different services.

Changes in the February 2024 Budget:

- The government consolidated the capital allocation for all three services.
- This means funds are grouped based on similar expenditure categories like aircraft, vehicles, etc., instead of being divided by service.
- **The Ministry of Defence (MoD) expects this to:**
 - Improve decision-making around capital expenditure.
 - Enable re-allocation of funds between services based on emerging priorities.
 - Ensure better overall utilization of the capital budget.

Indian Air Force's (IAF) Response:

- The IAF assures no funding shortage despite consolidation.
- Pre-allocated funds for 2024-25 remain available.
- A 10-year Integrated Capability Development Programme is being finalized for future procurements.

Additional Information:

- Total defense budget for 2024-25 is ₹6.2 lakh crore.
- ₹1.72 lakh crore allocated for capital expenditure (new procurements).
- Consolidation only affects capital allocation; other categories (salaries, pensions) remain separate.

CONCLUSION: The Indian Air Force (IAF) has expressed confidence that the consolidation of capital funds in the 2024-25

defense budget will not lead to a shortage of their service. While this new approach aims to improve efficiency and flexibility in military spending, it remains to be seen how it will impact resource allocation across the Army, Navy, and Air Force in the long term. The 10-year Integrated Capability Development Programme currently under development should provide a clearer picture of future procurement strategies under this new budgetary system.

POLITY AND GOVERNANCE

Finality And Justice

CONTEXT: The Supreme Court of India overturned its own decision in a high-stakes arbitration case, highlighting the tension between finality in legal judgments and ensuring justice.



BACKGROUND TO THE DMRC DISPUTE:

The Supreme Court's recent decision in the DMRC dispute highlights the complex interplay between finality in legal judgments and achieving justice.

Parties Involved:

- **Delhi Metro Rail Corporation (DMRC):** A government agency responsible for metro operations in Delhi.
- **Delhi Airport Metro Express Private Ltd. (DAMEPL):** A private company that received the contract to build, maintain, and operate a metro line connecting Delhi Airport to the city center.

Dispute:

- **DAMEPL** terminated the contract in 2012 citing the DMRC's alleged failure to address certain issues.
- **DAMEPL** sought arbitration and a tribunal ruled in their Favor in 2017, awarding them ₹7,687 crore.

LEGAL BATTLES:

- The DMRC challenged the award in the Delhi High Court.
- A single judge upheld the award, but a division bench set it aside.
- The Supreme Court, in a two-judge bench decision in 2021, restored the award.
- DMRC filed a curative petition, an extraordinary remedy for gross miscarriage of justice.

The Curative Petition:

- The DMRC then used the extraordinary curative petition process, citing a potential miscarriage of justice.

- This rare remedy is used to address situations where previous judgments cause severe injustice.

Supreme Court's Final Verdict:

- Using its curative powers, the Supreme Court overturned its 2021 decision.
- The court ruled that the earlier two-judge bench made an error in disregarding the importance of a safety certificate issued by the Commissioner of Metro Rail Safety (CMRS).
- This certificate, obtained jointly by DMRC and DAMEPL, was seen as crucial evidence by the Delhi High Court.

CURATIVE PETITION is an extraordinary remedy available in the Indian judicial system. It allows a party to challenge a final judgment of the Supreme Court itself.

- **Extremely rare:** Curative petitions are used in very few cases, typically only when a final judgement results in a gross miscarriage of justice.
- **Grounds for filing:** There are two main grounds for filing a curative petition:
 - To prevent abuse of process (e.g., the other party lied or manipulated the court)
 - To prevent a gross miscarriage of justice (e.g., a clear mistake was made in the judgement)
- **High bar for success:** The Supreme Court sets a very high bar for curative petitions. This means it's difficult to get them accepted and even harder to win.
- **Limited grounds for challenging judgements:** Under Indian arbitration law, arbitration awards can only be challenged on a limited basis. The DMRC case highlights the tension between respecting arbitration awards and ensuring justice through curative petitions.

Why is it significant in the DMRC case?

The DMRC case is significant because the Supreme Court used its curative powers to overturn its own previous judgment. This highlights the importance of curative petitions as a safeguard against situations where final judgments cause severe injustice. However, it's important to remember that curative petitions are a last resort and very rarely successful.

CONCLUSION: The Supreme Court's decision in the DMRC dispute showcases the ongoing struggle to balance finality in judgements with achieving justice. While the curative petition process offers a vital safeguard against gross miscarriage of justice, its rarity underscores the importance of careful consideration at each stage of the legal process.

This case serves as a reminder for arbitrators and judges to meticulously evaluate both facts and law to ensure fair outcomes and minimize the need for such extraordinary measures. Ultimately, a well-functioning legal system should strive for both finality and justice, and the DMRC dispute highlights the ongoing efforts to achieve this balance



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INTERNATIONAL RELATIONS

Lindy Cameron, U.K. Cyber Security Czar, To Be Next High Commissioner To India

CONTEXT: Lindy Cameron, a UK cybersecurity expert with experience in Afghanistan and trade, is the first woman appointed British High Commissioner to India, taking the role at a key time for India-UK relations.



LINDY CAMERON APPOINTED FIRST FEMALE BRITISH HIGH COMMISSIONER TO INDIA

- **Appointment and Background:**
 - Lindy Cameron, head of the U.K. National Cyber Security Centre, is the new British High Commissioner to India.
 - She replaces Alex Ellis, who completed his three-year term.
 - Ms. Cameron's experience includes:
 - Director General of the U.K.'s Northern Ireland Office.
 - Director-level roles in West Asia, North Africa, and Afghanistan for the Department for International Development.
 - Leading a provincial reconstruction team in Helmand, Afghanistan (2009-2010).
- **Significance of the Appointment:**
 - Ms. Cameron is the first woman to hold this position.
 - Her appointment comes during a crucial time for India-UK relations.
 - Upcoming general elections in both India and the UK.
 - Resetting of bilateral relations, marked by External Affairs Minister S. Jaishankar's visit to London (November 2023).
 - U.K.'s increasing defense presence in the Indo-Pacific.
- **Key Responsibility - Free Trade Agreement Talks:**
 - Ms. Cameron's role will involve overseeing the ongoing free trade agreement (FTA) negotiations between India and the UK.
 - The 14th round of talks was suspended due to Indian elections.
 - Negotiations are expected to resume after the elections and potentially before the UK's general election.

CONCLUSION: Lindy Cameron's appointment as the first female British High Commissioner to India signifies a significant moment in India-UK relations. Her diverse experience in cybersecurity, international development, and conflict resolution positions her well to navigate the upcoming general elections in both countries and oversee critical matters like the ongoing free trade agreement

negotiations. With the UK increasing its defense presence in the Indo-Pacific, Cameron's leadership is likely to play a key role in shaping the future trajectory of this important bilateral relationship.

ECONOMICS AND DEVELOPMENT

India Needs A Simpler Tariff Policy To Boost Manufacturing: ADB

CONTEXT: The Asian Development Bank (ADB) urges India to simplify trade policies and better integrate into global manufacturing networks to achieve its ambitious growth goals.



BACKGROUND: The Asian Development Bank (ADB) is a regional development financial institution established in 1966, headquartered in Manila, Philippines. Its primary purpose is to promote economic development in Asia through loans, technical assistance, grants, and investments.



INDIA'S GROWTH AMBITIONS AND INTEGRATION CHALLENGES

India's Growth Strategy:

- The Asian Development Bank (ADB) report focuses on India's ambitious goal of achieving \$2 trillion in exports by 2030.
- This strategy relies heavily on a significant increase in goods exports.

The Role of Manufacturing:

- The ADB emphasizes the critical role of the manufacturing sector in achieving sustainable medium-term growth.
- While India is a major player in services and knowledge-intensive sectors, a robust manufacturing sector is crucial for long-term economic success.

Challenges with Global Value Chains (GVCs):

- The report highlights India's limited integration into GVCs.
- GVCs involve fragmented production processes spread across different countries, with each specializing in stages where they have a comparative advantage.
- Historically, India hasn't participated extensively in these highly integrated networks.

Reasons for Limited GVC Integration (based on external sources):

- **Complex tariff structure:** India's tariff policies can be cumbersome for businesses, making it difficult to import components needed for manufacturing within GVCs.
- **Inadequate trade and logistics infrastructure:** Deficiencies in transportation networks and logistics can hinder efficient participation in GVCs, where timely movement of goods is crucial.

Potential Benefits of Deeper Integration:

- **Increased trade competitiveness:** Participating in GVCs allows India to leverage its comparative advantages in specific production stages, leading to more competitive exports.
- **Stronger regional ties:** As India's manufacturing sector grows within GVCs, it can foster stronger economic linkages with neighboring South Asian countries, which also tend to have limited trade integration.

ADB's Recommendations:

- The report recommends simplifying India's tariff policy to streamline trade processes.
- Continued efforts to improve trade and logistics infrastructure are seen as vital for efficient participation in GVCs.

CONCLUSION: the ADB report identifies India's limited GVC integration as a hurdle to achieving its ambitious export goals and highlights the need for trade policy reforms and infrastructure improvements to unlock the full potential of the manufacturing sector.

ECONOMICS AND DEVELOPMENT

'India To Face Most Impact If High U.S. Interest Rates Persist'

CONTEXT: The Asian Development Bank (ADB) warns that India could be the most impacted economy in Asia if the US Federal Reserve maintains high-interest rates for a longer period.

Higher for longer

India could face significant economic pressure if the EU and the U.S. delay cutting interest rates beyond 2024

- ADB expects currency depreciation will provide some gains for India due to increased export competitiveness

- Positive effects of depreciation could turn negative in 2025, 2026 once monetary easing begins in U.S. and EU

- It sees growth at 7% in FY25, before recovering to 7.2% in FY26



BACKGROUND: The ADB warns high U.S. interest rates for an extended period could hurt Asian economies. Weaker currencies due to a stronger dollar would increase import costs and inflation, especially for India due to its import reliance and sensitivity to exchange rates.

POTENTIAL IMPACT OF HIGH U.S. INTEREST RATES ON ASIAN ECONOMIES

The Asian Development Bank (ADB) conducted a simulation to understand the potential consequences of the U.S. Federal Reserve and the European Central Bank maintaining high interest rates for a longer period than anticipated (referred to as "higher for longer"). This scenario is particularly relevant because recent U.S. inflation figures exceeded expectations, raising concerns about the need for continued high interest rates.

Key Concerns:

- **Currency depreciation in emerging economies:** A "higher for longer" scenario would likely lead to a stronger U.S. dollar and euro compared to regional currencies. This depreciation could negatively affect emerging economies in Asia.
- **Increased imported inflation:** Weaker regional currencies due to a stronger dollar would make imports more expensive, potentially pushing up inflation across developing Asia.
- **Slower economic growth:** Higher interest rates can dampen economic activity, potentially leading to slower growth in emerging economies.

India's Vulnerability:

The ADB's simulation suggests that India might be the most impacted economy in Asia due to several factors:

- **Higher sensitivity to exchange rates:** India's inflation is more susceptible to fluctuations in exchange rates compared to other developing Asian economies.
- **Greater reliance on imports:** India depends more heavily on imported goods, making it more vulnerable to price increases caused by a weaker currency.

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Potential Benefits and Risks:

- **Short-term export boost:** A weaker rupee due to currency depreciation could initially benefit Indian exports by making them more competitive in the global market.
- **Geopolitical tensions and shipping disruptions:** Ongoing conflicts in West Asia and disruptions in shipping routes could further increase inflation through higher shipping costs.

CONCLUSION: The ADB's analysis highlights the potential challenges for India if the U.S. Federal Reserve maintains high interest rates for a longer period. The combination of higher inflation and potentially slower growth could pose significant risks to the Indian economy.

SCIENCE AND TECHNOLOGY

Apple Changes Hacking Alert Wording After India 'Pressure'

CONTEXT: Apple, Inc. now refers to "state-backed attackers" as "mercenary" hackers in customer email alerts and has updated its website support documentation accordingly.

BACKGROUND: Apple, Inc. is now referring to "state-backed attackers" as "mercenary" hackers in its communications to affected customers, including in support documents. This shift follows reports of the Indian government's pressure on Apple to provide deniability for hacking political leaders, journalists, and activists using spyware like Pegasus.

**HIGHLIGHTS**

- **Change in Notifications:** Apple made an update that redirects attention away from individual nation-states regarding hacking attempts, after reports of new notifications in 92 countries.
- **Contradictory Claims:** In November, Apple and the Centre claimed users in 150 countries received hacking alerts, but reports indicate only Indian users were notified.
- **No Recent Alerts:** Despite reports of fresh alerts, individuals who had previously received notifications in India reported not receiving any new alerts.
- **Political Pressure:** Senior Modi administration officials allegedly pressured Apple to minimize the political impact of hacking alerts in November.
- **Pegasus Spyware Traces:** Notable individuals, including a Congress party member and a news portal editor, found traces of Pegasus spyware on their phones after receiving November alerts.

ENVIRONMENT

A BATTLE TO SAVE LADAKH, AND ALL OF HUMANITY

CONTEXT: Sonam Wangchuk, a Ramon Magsaysay award winner and climate activist, addressed a crowd in Leh, Ladakh, urging global attention to regional climate change challenges.

BACKGROUND: Ladakh, located between India's neighbors, Pakistan and China, is home to 97% indigenous tribes who rely on farming and animal rearing. The region faces challenges from border disputes and climate change effects such as floods, drought, and landslides. Melting Himalayan glaciers also impact water sources for major rivers, affecting residents both upstream and downstream.

Infrastructure Boom

- **Launch of NMSHE:** The National Mission for Sustaining the Himalayan Ecosystem (NMSHE) was established in 2008 to assess and monitor climate change impacts on the Himalayan region.
- **Development in Ladakh:** After becoming a Union Territory, Ladakh saw rapid infrastructure development, including major projects like bridges, roads, tunnels, and solar projects.
- **Large-Scale Projects:** Notable projects include the Zojila tunnel, Kargil-Zaskar National Highway, and a large-scale solar energy project in the Changthang region.
- **Industrial Policy:** Ladakh's 2023 Industrial Land Allotment Policy aims to attract investment and promote Ladakh as a prime destination for industrial growth.
- **Role of BRO and NHIDCL:** The Border Roads Organisation and National Highways & Infrastructure Development Corporation Ltd. lead various infrastructure projects in climate-sensitive regions.
- **Climate Change Concerns:** Infrastructure projects in regions like Ladakh, Uttarakhand, and Andaman & Nicobar Islands face challenges from climate change-related disasters.

**A Region That Has Seen Disasters**

- **Government Actions Questioned:** Government bodies rapidly sanction and execute projects in the Himalayas without heeding warnings from past disasters in the region.
- **Frequent Disasters:** Since 2010, multiple disasters in the Himalayas, including Kedarnath floods (2013) and Joshimath collapse (2023), have caused loss of lives and property.
- **Uttarakhand's Infrastructure Projects:** Despite geologist and ecologist warnings, Uttarakhand has continued large-scale

infrastructure projects since its formation in 2000.

- Ignoring Expert Recommendations: Authorities disregard expert committee suggestions, such as limiting pilgrim numbers and avoiding hydroelectric projects in para-glacial zones.
- Human Cost: Environmental destruction results in tragic consequences for poor migrant workers, residents, tourists, and pilgrims, while developers often avoid accountability.

Climate change activists are frustrated by the lack of action on their recommendations, even after court appeals and expert committees. Multi-crore projects in the mountains often overlook risk assessment and safety measures. To preserve the Himalayan ecosystem and protect its people, urgent and collective action is needed. Wangchuk's fight extends beyond Ladakh to encompass all of humanity and its future generations.

SCIENCE AND TECHNOLOGY

ISRO'S 'Zero Orbital Debris' Milestone

CONTEXT: ISRO's PSLV-C58/XPoSat mission has left minimal debris in orbit, transforming the last rocket stage into an experimental module and ensuring safe re-entry.

BACKGROUND: ISRO transformed the last stage of the Polar Satellite Launch Vehicle (PSLV) into an orbital station, POEM-3, before de-orbiting it to re-enter Earth's atmosphere. This move ensured that the stage didn't float in orbit indefinitely and safely burned up upon re-entry. ISRO also passivated the stage by dumping its fuel to prevent potential explosions and debris.

POEM: Innovative Use of Spent Rocket Stage

- Inexpensive Space Platform: Developed by the Vikram Sarabhai Space Centre, POEM reuses the fourth stage of a PSLV rocket as an orbital platform for experiments.
- PSLV-C53 Mission: In June 2022, POEM orbited the earth on the PSLV-C53 mission to conduct in-orbit scientific experiments with various payloads.
- Power and Control: POEM is powered by solar panels and a lithium-ion battery, and utilizes an advanced navigation and guidance system for stability.
- Reusing Rocket Stage: ISRO first demonstrated reusing a spent fourth stage in the PSLV C-44 mission in 2019, using it to carry a student payload.
- Communication: POEM's telecommand system allows it to communicate with the ground station for operational commands and data transfer.



POEM-3 Completes Successful Space Mission

- PSLV C-58 Mission: Launched on January 1, the PSLV C-58 mission successfully deployed the XPoSat satellite into a 650 km orbit.
- POEM-3 in Lower Orbit: The fourth stage, known as POEM-3, was lowered to a 350 km orbit and experienced more atmospheric drag.
- Nine Payloads: POEM-3 carried nine payloads from various sources, including start-ups and institutes, which completed their experiments within 25 days.
- Mission Achievements: POEM-3 demonstrated the functionality of payloads and fuel cells, while data from experiments was collected for further analysis.
- Successful Re-entry: POEM-3 prepared for re-entry for two months and was tracked by ISRO, concluding with a successful re-entry on March 21.

Space Debris: A Growing Threat to Orbit

- Space Debris in LEO: Debris from spacecraft, rockets, defunct satellites, and explosive tests in low earth orbit (LEO) poses risks due to high-speed movement.
- LEO Extent: Low earth orbit ranges from 100 to 2,000 km above the earth, housing satellites for intelligence, communication, and navigation.
- Rise in Space Activity: In 2022, 2,533 objects were placed in space across 179 launches, according to ISRO's report, increasing the debris risk.
- Debris in GEO: Though less extensive, space debris also exists in geosynchronous orbit (GEO) 36,000 km above the earth, with over 7,000 satellites.
- Tracking Debris: The U.S. Space Command monitors space debris over 10 cm in LEO and 0.3-1 m in GEO, tracking millions of debris pieces.

A recent incident on March 8 saw space debris damaging a house in Florida, highlighting the growing risk as more satellites and anti-satellite tests increase debris in low Earth orbit (LEO). By 2030, around 60,000 objects over 10 cm in size could populate LEO, potentially causing cascading collisions and unusable orbits. Currently, no international laws govern LEO debris, with most spacefaring nations following U.N.-endorsed IADC guidelines for space debris mitigation.

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SCIENCE AND TECHNOLOGY

Crafted At Home, Nexcar19 Takes India To Next Level In Cancer Care

CONTEXT: CAR T cell therapy modifies a patient's T cells to combat cancer. Dr. Purwar returned to India in 2013 and found CAR-T research lacking.

BACKGROUND: In 2015, Alka Dwivedi joined IIT Bombay's Professor Rahul Purwar to develop affordable CAR-T cell therapy in India, aiming to offer patient-focused cancer treatment. Inspired by the need to close the gap in CAR-T research, they worked on making the therapy accessible to Indians. Collaborating with haemato-oncologists from Tata Memorial Hospital, their team advanced clinical trials for NexCAR19, potentially revolutionizing cancer treatment in India.

CAR-T Cell Therapy and Innovations

- **T-Cell Collection and Modification:** T-cells are collected via leukapheresis, then genetically modified in the lab to express chimeric antigen receptors (CARs).
- **Viral Vectors for CAR Delivery:** CAR genes are delivered to T-cells using vectors, such as lentiviral vectors, as seen in NexCAR19.
- **CAR-T Cell Infusion:** Re-engineered T-cells are multiplied and infused back into the patient after chemotherapy, enhancing immune response against cancer cells.
- **CAR Components:** The exterior of CAR binds to targeted antigens, while the internal part transmits signals for immune response activation.
- **Humanized CAR-T Therapies:** NexCAR19 features a humanized CAR by incorporating human proteins into mouse antibodies, potentially reducing toxicity.



Journey to Develop Novel Cancer Therapy

- **Challenges in Development:** Researchers faced multiple challenges while trying to develop an unexplored therapy in India, encountering both failures and successes.
- **Collaboration with NCI:** The team sought expertise from the National Cancer Institute (NCI) and brought Dr. Nirali Shah on board for the clinical trial phase.
- **Guidance from NCI:** During an AACR conference, the team met NCI researchers who helped them troubleshoot and provided insights on their protocol challenges.
- **Implementation of Suggestions:** Upon returning to India, the team applied the NCI's recommendations, resulting in successful in vitro and in vivo outcomes.

- **Effective Therapy Design:** The collaboration with NCI significantly impacted the development process, leading to the design of an effective therapy.

Milestones in Developing India's CAR-T Therapy

- **Clinical Trial Approval:** The team sought approval from the Central Drugs Standard Control Organization (CDSCO) for conducting the CAR-T therapy clinical trial.
- **First Patient Treatment:** On June 4, 2021, the first patient at Tata Memorial Hospital received successful CAR-T therapy, marking a significant achievement.
- **Positive Outcomes:** The therapy's success in the laboratory translated to positive patient results, indicating a major advancement in cancer treatment.
- **CDSCO Approval:** In October 2023, CDSCO approved CAR-T cell therapy for treating relapsed or refractory B-lymphomas and B-Acute Lymphoblastic Leukemia.
- **Made-in-India Product:** The team's perseverance led to the creation of a locally developed CAR-T cell therapy, overcoming various challenges along the way.

Challenges and Considerations for CAR-T Therapy

- **Varying Efficacy and Side Effects:** CAR-T therapy's success varies between individuals and may cause side effects like cytokine release syndrome and neurotoxicity.
- **Potential Complications:** While neurotoxicity was absent in early trials, low blood cell counts and infections are other possible side effects requiring careful monitoring.
- **Managing Side Effects:** Dr. Shah emphasizes the importance of managing inflammation-related side effects and possible immunocompromised patients requiring intensive care.
- **Healthcare Access Concerns:** Access to primary healthcare in India is limited, with cancer treatment mainly in metro areas, necessitating proximity to hospitals for side effect management.
- **Adaptation Across Countries:** Dr. Shah stresses the need to consider clinical parameters and regional differences when adopting CAR-T therapy from one country to another.

Dr. Purwar's vision of affordable cancer treatment led to NexCAR19, a CAR-T cell therapy priced at ₹40-45 lakh, much lower than its U.S. equivalent. Despite the relatively high cost, efforts are underway to reduce it further through manufacturing scale-up and improved purchasing power. Additionally, NexCAR19's low toxicity lessens hospitalisation expenses for patients.



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