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Indian Knowledge System

HISTORICAL PERSPECTIVES ON THE INDIAN KNOWLEDGE SYSTEM (IKS)

Indian Knowledge is deeply rooted in tradition, passed down through generations, forming a continuous legacy. This continuity is a hallmark of Indian civilization, making it the world's oldest surviving civilization. Over time, Indian Knowledge has evolved, integrating reforms to remain relevant while preserving its rich intellectual heritage.

The revival and adaptation of the Indian Knowledge System are vital for aligning its ancient wisdom with modern societal needs. It is crucial to integrate IKS into contemporary education to maintain this balance. The National Education Policy (NEP) 2020 has taken a significant step by providing a framework that encourages the inclusion of IKS in the curriculum. This initiative underscores the importance of a holistic and inclusive approach to learning, aiming to foster not just intellectual growth but also the spiritual and ethical development of individuals.

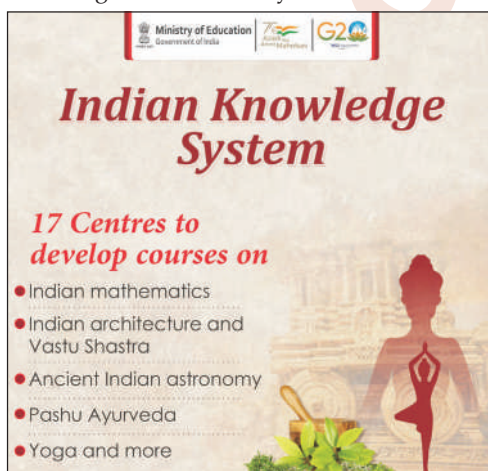In October 2020, the Ministry of Education established a dedicated division for Indian Knowledge Systems at AICTE (All India Council for Technical Education) in New Delhi. This was followed by the creation of centers across various institutes to further the study and application of IKS.

IKS is unique in its continuous flow of knowledge within the Indian subcontinent since ancient times. While the modern world has become interconnected, contributing to the exchange of ideas globally, Indian Knowledge remains distinctive. It focuses on the holistic development of individuals, preparing them for material success as well as spiritual fulfillment.

This integration of IKS into modern educational frameworks represents an important step toward preserving India's intellectual heritage while meeting the demands of a rapidly globalizing world. It ensures that ancient traditions are not only valued but also adapted for modern applications, paving the way for a more informed and balanced future.

DECOLONISATION OF THE MIND THROUGH THE INDIAN KNOWLEDGE SYSTEM

Decolonizing the mind, as conceptualized by Ngũgĩ wa Thiong'o, is the reclamation of cultural and intellectual sovereignty from colonial legacies. In India, the revival of the Indian Knowledge System (IKS) is integral to achieving this goal by fostering self-reliance and reinforcing national identity.

Indian Knowledge System

17 Centres to develop courses on
- Indian mathematics
- Indian architecture and Vastu Shastra
- Ancient Indian astronomy
- Pashu Ayurveda
- Yoga and more

1. India as a Knowledge Hub
- Historically known as *Gyan-Bhoomi* (land of knowledge), India has a rich intellectual heritage.
- Contributions to fields like astronomy, medicine (Ayurveda), philosophy, mathematics and literature reflect the depth of the IKS.

2. Role of IKS in Self-Reliance
- **Healthcare** : Ayurveda and other indigenous systems offer sustainable healthcare solutions.
- **Agriculture** : Traditional practices emphasize organic and ecological farming.
- **Science and Mathematics :** Contributions such as zero and calculus underpin modern scientific advancements.
- Aligns with the vision of Atmanirbhar Bharat (self-reliant India).

3. Role of IKS in National Identity
- Revives pride in India's cultural heritage, challenging Eurocentric narratives imposed during colonial rule.
- Promotes knowledge transfer through texts like the Vedas, Upanishads, and Upvedas, creating a structured intellectual tradition.

4. Contemporary Relevance of IKS
- Provides sustainable solutions to global challenges, such as climate change and ecological conservation.

- Enhances India's soft power globally by integrating IKS with modern education and innovation.

In Conclusion, The Indian Knowledge System is a transformative force for intellectual and cultural empowerment. Its revival not only fosters self-reliance but also re-establishes India's unique identity in the global arena, positioning it as a leader rooted in its civilizational ethos.

GURU-SHISHYA PARAMPARA : AN ETHICAL LEARNING FRAMEWORK

The Guru-Shishya Parampara is a cornerstone of Indian culture, rooted in the Vedic period, where the Guru imparts knowledge to the Shishya (disciple). This tradition is described in the Rig Veda, which identifies the Guru as the 'source and inspirer of self-knowledge' and emphasizes the Guru's role in dispelling ignorance. The term 'Guru' signifies 'one who removes darkness', while 'Shishya' means student and 'Parampara' indicates tradition. Together, the Guru-Shishya Parampara represents the ethical and intellectual bond between teacher and disciple, often compared to the relationship between a mother and her unborn child.

This system focuses on transmitting not only theoretical knowledge but also practical life skills, such as humility, discipline and self-control. Ethical learning within this framework aids individuals in differentiating between good and bad behaviour, fostering critical thinking and empathy while helping them address moral dilemmas.

Ethical Dimensions and Learning Principles

Ethical learning through the Guru-Shishya Parampara involves understanding moral principles and applying them in personal and professional contexts. It emphasizes decision-making, reflective thinking and societal responsibilities. This learning approach nurtures character development, encouraging the disciple to prioritize values and consider the broader consequences of their actions.

Roots in Vedic Education

The origins of this tradition trace back to the Vedic period (1500–500 BCE), during which education was primarily oral, conducted in ashramas and gurukulas under the guidance of Gurus. Education included both Vedic texts and essential life skills, ensuring a holistic development of the individual.

The process of learning, referred to as Shruti (hearing), relied heavily on direct interaction between the Guru and Shishya, with disciples learning through recitation and repetition.

Connection to Yoga Vasistha

The Yoga Vasistha is a revered Indian scripture, often considered a guide to self-realization. Known as the Maharamayana, Arsha Ramayana and Vasistharamayana. It conveys teachings through poetic narrations, dialogues and reflective writings. The text focuses on themes like the nature of reality, the mind and liberation, emphasizing ethical learning.

In the Yoga Vasistha, Sage Vasistha imparts wisdom to Prince Rama, addressing philosophical questions about life, suffering and the path to enlightenment. This scripture exemplifies how the Guru-Shishya Parampara fosters self-inquiry and spiritual growth alongside practical learning.
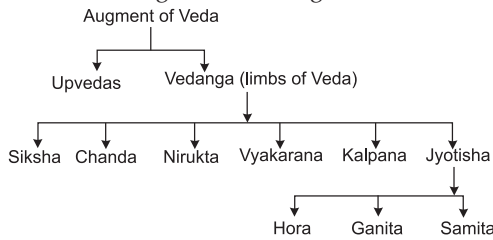
In Conclusion, The Guru-Shishya Parampara is a timeless ethical learning framework that integrates moral, intellectual and spiritual dimensions, ensuring holistic development. Its relevance persists in contemporary contexts, offering valuable lessons on ethics, self-discipline, and societal responsibility while nurturing individual potential.

SANSKRIT : THE CARRIER OF INDIAN KNOWLEDGE

A significant portion of Indian knowledge is encoded in Sanskrit, which serves as a critical medium for transmitting the teachings of the Vedas. Language, or Bhāṣā, plays a crucial role in carrying knowledge across generations. Compared to other mediums, Bhāṣā excels due to its vast vocabulary capable of expressing subtle nuances of meaning, including thoughts, emotions and complex concepts.

To overcome the inherent limitations of language in preserving such knowledge, ancient Vyākaraṇas (grammarians) undertook the monumental task of analyzing and codifying the structure and rules of Sanskrit. The Lakṣaṇa (grammatical framework) they created is so detailed and precise that it allows for the accurate recreation of texts over time, ensuring the transmission of knowledge without loss or distortion.

This continuum of commentary and linguistic preservation has played a pivotal role in making the Vedic corpus and associated wisdom available to this day.

The Role of Mnemonics in Preserving the Vedas

The Vedas form the core of Indian knowledge systems, reflecting ancient attempts to ensure their teachings remain intact for thousands of years. To achieve this, Vedic ancestors developed intricate mnemonic techniques that ensured every word's exact pronunciation and interpretability. These methods were critical in preserving the enormous Vedic texts without the risk of losing their meaning or structure.

Augment of Veda

- Upvedas
- Vedanga (limbs of Veda)
  - Siksha
  - Chanda
  - Nirukta
  - Vyakarana
  - Kalpana
  - Jyotisha
    - Hora
    - Ganita
    - Samita

Sanskrit, as a highly evolved variant of Bhāṣā, was specifically developed to safeguard these teachings. Its rich grammatical precision and expansive vocabulary were instrumental in encoding and transmitting knowledge across generations.

Knowledge and Language

The word Veda, derived from the root 'Vid' (to know), encapsulates the essence of knowledge. This connection highlights the inseparability of knowledge and language, as language is the primary medium for encoding, retaining, and sharing abstract concepts.

The term Bhāṣā is viewed as :

1. A means of communication encompassing words.

2. A system with spatial and temporal dynamism, adapting to changes over time and space.

3. A fluid entity accommodating numerous variants, with Sanskrit standing out as the most refined and systematic form.

This adaptability underscores the timeless relevance of Sanskrit as a tool for preserving and disseminating knowledge. The affixes of Veda found in texts like Ayurveda and Dhanurveda further reflect its integration across diverse domains of learning.

In Conclusion, The development of Sanskrit and its grammatical framework stands as a testament to the intellectual rigor of ancient Indian scholars. By ensuring the accurate transmission of Vedic knowledge, it not only safeguarded a treasure of wisdom but also paved the way for subsequent generations to access and build upon it. In essence, Sanskrit and Bhāṣā underscore the enduring legacy of Indian culture's commitment to preserving and sharing knowledge.

VEDIC MATHEMATICS AND METHODS OF MULTIPLICATION IN GAṆITASĀRASAṄGRAHA

Mathematics in ancient India developed as part of Sūtra literature, closely associated with the Vedas and Vedāṅgas. Among the six Vedāṅgas—Shiksha, Vyakarana, Chhandas, Nirukta, Kalpa, and Jyotish—mathematics is part of Kalpa, which deals with rituals and geometry.

The Śulbasūtras, dating back to the Vedic period, represent some of the earliest mathematical texts. These sūtras are practical manuals containing measurements, geometrical principles, and algorithms required for constructing Vedic altars (Yajnas). They highlight the mathematical precision used to ensure the proper design of altars, reflecting the integration of mathematics into religious practices.

Contributions of Mahāvīrācārya and the Gaṇitasārasaṅgraha

Mahāvīrācārya, a 9th-century Jain mathematician, significantly contributed to the field of mathematics. His seminal work, Gaṇitasārasaṅgraha, explores various mathematical concepts while distinctly separating astrology from mathematics. This differentiation underscores the scientific approach of ancient Indian mathematicians.

The Gaṇitasārasaṅgraha includes methods for performing multiplications and calculations that cater to individuals with varying intellectual capacities. It emphasizes flexibility, allowing learners to choose calculation methods suited to their understanding, a principle reflecting inclusivity in mathematical education.

Diverse Approaches to Multiplication

Ancient Indian scholars developed multiple methods for multiplication, emphasizing conceptual clarity and adaptability. This variety ensured that students of differing abilities and preferences could grasp and apply mathematical concepts effectively.

Legacy of Vedic Mathematics

The roots of Vedic mathematics can be traced back to texts like the Brāhmaṇas and Āraṇyakas, which introduced early mathematical ideas. Over time, scholars such as Āryabhaṭṭa, Bhāskarācārya and Śrīdhara expanded on these foundations, integrating advanced concepts into astronomy and other sciences.

The Śulbasūtras continue to be recognized as one of the oldest mathematical works in human history, illustrating how ancient Indians used mathematics to solve practical problems while contributing to the global understanding of geometry and arithmetic.

In Conclusion, The development of mathematics in ancient India was deeply intertwined with spirituality, science and daily life. Texts like the Gaṇitasārasaṅgraha demonstrate the ingenuity of ancient scholars in creating versatile, inclusive methods for mathematical learning. These contributions have left an enduring legacy, establishing India as a cradle of mathematical thought.

KONARK'S SUN TEMPLE : A GEO-HERITAGE MARVEL ON THE MAHANADI DELTA

The Sun Temple at Konark, situated on the eastern coast of India in Odisha, is a monumental marvel showing Indian architecture, engineering and artistic brilliance. Recognized as a UNESCO World Heritage Site, this 13th-century marvel is dedicated to Lord Surya, the sun god and symbolizes the grandeur of India's cultural heritage.

Historical and Architectural Significance

Built during the reign of King Narasimhadeva I of the Eastern Ganga dynasty, the Konark Sun Temple reflects the zenith of Kalinga architecture. The temple's design embodies the concept of Surya's celestial chariot, pulled by seven horses and adorned with twelve carved wheels, each representing a month of the year. This alignment with astronomical and calendar systems showcases the advanced knowledge of Indian architects and artisans.

The temple's intricate carvings and sculptures narrate tales from Hindu mythology, daily life, and celestial phenomena, with deep philosophical and cosmological meanings. The massive stone structure is a blend of functional, aesthetic and spiritual elements, making it a masterpiece of ancient Indian artistry.

Geological Aspects

The construction of the temple is also an engineering marvel, as it involved sourcing and transporting large quantities of chlorite, laterite, and other types of stone. These materials were meticulously selected for their durability and adaptability to the local climatic conditions. The Mahanadi Delta's proximity provided not only fertile land but also access to waterways that facilitated the transportation of these heavy materials.

The unique geological data of the area has revealed insights into the choice of materials and their interaction with the environment over centuries. The flora, fauna and climatic conditions around the region have played a role in the temple's deterioration, making its preservation a significant challenge for modern conservation efforts.

Current Challenges and Preservation Efforts

The Sun Temple has faced numerous challenges due to natural decay, salt-laden winds from the Bay of Bengal and human intervention. Portions of the temple have been lost over time, but significant efforts are being made to restore and preserve its remaining glory. Conservationists and archaeologists are employing advanced techniques to stabilize the structure and safeguard the intricate carvings.

Documentation and mapping of the temple site have been critical in understanding its historical and geological context. Tools and techniques used in modern conservation are aimed at mitigating the effects of erosion, climate change and other environmental factors.

In Conclusion, The Sun Temple at Konark stands as a timeless symbol of India's rich cultural and spiritual legacy. Its architectural and geological brilliance not only reflects the advanced knowledge of ancient Indian civilization but also serves as an inspiration for modern engineering and heritage conservation. As efforts to preserve this marvel continue, the Konark Sun Temple remains a beacon of India's artistic excellence and its commitment to safeguarding its historical treasures for future generations.

ECO-CONSCIOUSNESS THROUGH INDIAN PHILOSOPHY

Indian philosophy conceptualizes the environment not as inert but as a dynamic, interconnected system where humans coexist with other living beings. Rooted in ancient

scriptures, Indian traditions emphasize environmental preservation through moral guidelines, revering nature as sacred. This perspective fosters sustainable practices and guides modern societies towards harmony.

Philosophical Perspective

Indian philosophy stresses the interdependence of all life forms, promoting a holistic understanding of human and natural relationships. By prioritizing ecological balance, it views the environment as a benevolent habitat rather than an exploitable resource.

Historical Insights

India's ancient practices reflected eco-consciousness, integrating biodiversity conservation and sustainable resource management. Teachings from seers emphasized the sanctity of air, water, land and forests. Even modern issues, such as climate change, can draw solutions from this wisdom.

In Conclusion, As environmental crises intensify, Indian philosophical values remain relevant, offering a sustainable blueprint for balancing human progress with ecological preservation.

EMOTIONAL INTELLIGENCE IN PUBLIC ADMINISTRATION : A BUDDHIST APPROACH

Emotional Intelligence (EI) is a vital component in public administration, where decisions impact the lives of millions. EI enhances the ability to recognize, manage and respond to emotions effectively, ensuring balanced and empathetic governance. When combined with the principles of Buddhist philosophy, EI can further foster ethical and wise decision-making.

The Role of Emotional Intelligence in Public Administration

Public administration is inherently people-oriented. Administrators are not just decision-makers but also leaders who influence diverse groups and represent broader societal values. Emotional intelligence equips public administrators with the ability to :

- Recognize and understand their emotions and those of others.
- Cultivate self-awareness and empathy, essential for making balanced decisions.
- Improve communication, ensuring that decisions resonate with citizens' emotions and perspectives.

Effective emotional management is critical to promote accountability, cooperation and inclusivity in public systems.

Buddhist Philosophy and Emotional Intelligence

Buddhist teachings provide profound insights into understanding emotions and overcoming mental afflictions. According to the Abhidharma Samuccaya, emotions like ignorance, aversion and attachment are categorized as mental afflictions (klesha) that disrupt rational thinking. Buddhist principles advocate cultivating the following virtues to enhance emotional intelligence :

1. Mindfulness (Sati) : Being fully aware of one's emotions and their impact on decision-making.

2. Non-attachment (Alobha) : Overcoming biases and personal interests for the greater good.

3. Compassion (Karuna) : Developing empathy to address the needs of the populace effectively.

4. Patience (Kshanti) : Responding to challenges with calmness and understanding.

Buddhism emphasizes distinguishing between virtuous (kusala) and non-virtuous (akusala) states of mind, urging leaders to base their actions on ethical principles rather than impulsive emotions.

In Conclusion, Integrating emotional intelligence with the Buddhist approach offers a robust framework for public administration. It promotes mindfulness, ethical decision-making, and empathetic leadership, ensuring that governance serves as a tool for societal harmony and progress. By addressing emotions constructively, public administrators can create systems that resonate with the values of compassion and wisdom.

THE COOPERATIVE APPROACH TO JAN AUSHADHI KENDRAS

The Jan Aushadhi Scheme ensures easy access to high-quality, affordable medicines through Jan Aushadhi Kendras (JAKs). Under the Pradhan Mantri Bhartiya Jan Aushadhi Pariyojana (PMBJP), the scheme offers generic drugs at prices 50-90% cheaper than branded alternatives. Revamped in 2016, it aims to make healthcare affordable for all.

Key Highlights

1. **Evolution of the Scheme :** Launched in 2008; renamed as PMBJP in 2016. Focuses on reducing healthcare expenses by promoting generic medicines.

2. **Cost Efficiency :** Generic drugs are cheaper due to reduced patent and marketing costs. Prices are regulated under PMBJP.

3. **Integration with PACS :** Primary Agricultural Credit Societies (PACS) have been strengthened under the Sahkar se Samriddhi paradigm. PACS diversify into 25 activities like fertilizer distribution, dairy, seeds, LPG distribution, and more. Over 5200 PACS in Uttar Pradesh now operate as service centers.

4. **Expansion Efforts :** PACS-enabled Jan Aushadhi Kendras have grown significantly. Over 2000 PACS in India have entered MOUs with PMBJP, benefiting rural areas.

5. **Technology Support :** The Jan Aushadhi Sugam App allows users to find nearby Kendras and check medicine availability.

6. **Eligibility Criteria :** Individuals with backgrounds in Pharma/D. Pharma/B. Pharma or NGOs/public trusts are eligible to open JAKs.

Challenges

● **Demand-Supply Gaps :** Timely availability of medicines remains an issue.

● **Payment Delays :** Hindrances in ensuring smooth financial operations need to be resolved.

In Conclusion, The Jan Aushadhi Scheme, with cooperative integration, is a significant step toward affordable healthcare. However, addressing challenges like supply gaps and payment delays is crucial for the scheme's success.

FROM OUTSOURCING TO OUTPACING : INDIA'S LEADERSHIP IN GLOBAL CAPABILITY CENTRES (GCCs)

India has emerged as a global leader in Global Capability Centres (GCCs), hosting over 1,800 centers—more than half of the world's GCCs. Employing over 19 lakh people, the sector's market size reached $ 60 billion in 2022–23, showcasing an 11·4% annual growth rate.

GCCs are specialized entities that manage a wide range of operations, including analytics, technology support, product development and innovation. These centers contribute significantly to India's economy, yielding $ 3 in economic impact for every dollar invested and creating five times more jobs in local markets.

Factors Driving India's Leadership

1. **Business-Friendly Policies :** Initiatives like Ease of Doing Business, Make in India, and Digital India have created a conducive environment for GCC growth. SPICe+ and the Jan Vishwas Act have further simplified business operations, attracting international firms.

2. **Advanced Infrastructure :** Robust physical and digital infrastructure supports high-quality service delivery. A booming real estate sector accommodates the increasing GCC footprint.

3. **Abundant Skilled Workforce :** India's vast pool of highly skilled professionals ensures high productivity and innovation. Over 19 lakh people are currently employed in GCCs, enhancing India's reputation as a global talent hub.

4. **Competitive Edge :** India has outpaced competitors like Malaysia, Vietnam, and the Philippines due to its unique blend of infrastructure, talent and government support.

In Conclusion, India's dominance in the GCC sector has transformed it into a global innovation and service hub. By leveraging its skilled workforce and pro-business policies, India continues to set new benchmarks, cementing its position as a leader in the global outsourcing revolution.
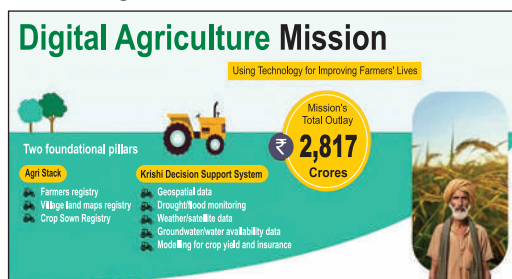
GIST

OF

KURUKSHETRA

ISRO'S ROLE IN RURAL DEVELOPMENT

The use of satellite data and space applications has significantly contributed to sustainable development in rural areas. Below are the key areas where ISRO has made an impact :

1. Agriculture and Food Security

- **Crop Monitoring :** Satellite imagery helps in monitoring crop health, estimating yields and identifying pest infestations.

- **Agri-Stack and Krishi Decision Support System (KDSS)** : These initiatives promote digital agriculture by integrating data for precision farming and better decision-making.

Digital Agriculture Mission
Using Technology for Improving Farmers' Lives

Mission's Total Outlay ₹ **2,817 Crores**

Two foundational pillars

Agri Stack
- Farmers registry
- Village land maps registry
- Crop Sown Registry

Krishi Decision Support System
- Geospatial data
- Drought/flood monitoring
- Weather/satellite data
- Groundwater/water availability data
- Modelling for crop yield and insurance

- **Horticulture and Aquaculture :** Remote sensing aids in identifying suitable zones for horticultural and aquacultural activities to improve productivity.

2. Water Resource Management

- **Mapping and Monitoring Water Bodies :** ISRO's satellites assist in tracking water bodies and reservoirs for effective management.

- **Irrigation Management :** Space-based solutions optimize water usage for agriculture through watershed mapping and irrigation planning.

3. Disaster Management and Preparedness

- **Flood Monitoring and Management :** ISRO provides real-time data for flood forecasting and damage mitigation.

- **Damage Assessment :** Satellite imagery aids in assessing crop losses and property damage post-disasters.

- **NADAMS (National Agricultural Drought Assessment and Monitoring System) :** Tracks drought conditions for timely interventions.

- **Early Warning Systems** : Space technology offers alerts for cyclones, tsunamis and landslides, reducing risks in vulnerable areas.

4. Rural Connectivity, Employment and Infrastructure

- **MGNREGA and Infrastructure Projects :** ISRO supports projects like road construction and rural connectivity through GIS-based planning.

- **BharatNet** :
  - **Objective :** To connect all Gram Panchayats with high-speed broadband.
  - **Implementation :** Phase 1 connected over 1 lakh villages; Phase 2 expands to more remote areas.

BharatNet
World's Largest Rural Broadband Project

5,84,747 kms - Optical Fibre Cable laid

Affordable high-speed internet connectivity

1.87 Lakh - Gram Panchayats benefitted

5. Healthcare and Education

- **Telemedicine and e-Sanjeevani :** ISRO's satellites enable remote consultations and medical assistance in underserved areas.

- **Tele-Education** : Enhances access to quality education for rural students through virtual classrooms.

6. Land and Property Management

- **DILRMP (Digital India Land Records Modernization Program)** : Improves transparency in land records.

DILRMP Portal

Records of Rights	Computerization of Land Records	Map Digitization	Modern Record Room	Survey Resurvey	Sub Registrar Office
ROR	CLR	Map digitization	MRR	Status	Physical Progress

- **SVAMITVA Scheme :** Uses drone mapping to provide property ownership records.
- **Bhuvan Panchayat :** Enables better planning and governance at the local level.

In Conclusion, ISRO's space technology has revolutionized rural development in India, fostering sustainable growth by addressing critical challenges. From agriculture to healthcare and education, ISRO's initiatives have laid the foundation for an inclusive and self-reliant rural India under programs like Antariksh Mein Atmanirbhar Bharat.

SPACE TECHNOLOGIES : TRANSFORMING RURAL INDIA

The Indian Space Research Organisation (ISRO) has been at the forefront of this mission, leveraging advanced space technologies to address critical challenges and promote sustainable development.

Key Contributions of ISRO in Rural Transformation

1. Agriculture and Food Security :
- **First Applications :** The journey began with the use of remote sensing to detect crop diseases like the coconut wilt in Kerala during the 1960s.
- **Crop Forecasting and Yield Estimation :**
  - ❏ The Mahalanobis National Crop Forecast Centre (MNCFC) collaborates with ISRO to improve crop forecasting and yield estimation.
  - ❏ Projects like FASAL (Forecasting Agricultural output using Space, Agro-meteorology, and Land-based Observations) enhance agricultural planning.
- **Geo-Advisories :** Provides farmers with actionable data to improve productivity and reduce risks.

2. Disaster Management and Preparedness :
- ISRO's space-based tools help monitor natural resources and manage disasters effectively.
- National Remote Sensing Centre (NRSC) and Space Application Centres aid in tracking disasters, offering early warnings and assisting in recovery efforts.

3. Water Resource Management :
- **Remote Sensing for Watershed Management :** Monitors water bodies and supports irrigation planning, ensuring efficient use of water resources.

4. Natural Resource Management
- ISRO supports the National Natural Resources Management System for optimal utilization of resources, ensuring sustainable growth in rural areas.

5. Rural Employment and Infrastructure :
- Space technologies support the implementation of various government schemes, enhancing rural connectivity and infrastructure planning.

6. Transforming Rural Lives :
- GeoMGNREGA is a software tool that uses space technology to create a Geographical Information System (GIS) for the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). It helps to monitor and report on the assets created under the program.
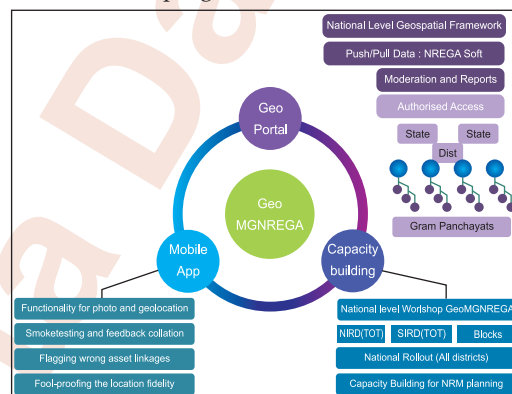
- SVAMITVA stands for Survey of Villages and Mapping with Improvised Technology in Village Areas. It's a scheme launched by the Ministry of Panchayati Raj (MoPR) to provide legal ownership cards to property owners in rural India. The scheme uses drone technology to map land parcels and create accurate land records.

Role of Government and Future Prospects

The government actively collaborates with ISRO to expand its reach and capacity. Programs like FASAL and initiatives through NRSC and Space Application Centres ensure the integration of advanced space technologies into various domains of national development.

In Conclusion, The applications of space-based technologies in rural India are shaping the country's development trajectory. From

empowering farmers to mitigating natural disasters, ISRO has revolutionized rural development, making Indian villages economically viable and sustainable units.

GEOSPATIAL DATA FOR RURAL RESOURCE MANAGEMENT

Through platforms like Bhuvan Panchayat, the National Database for Emergency Management (NDEM) and satellite technologies, ISRO aims to promote transparency, accountability, and sustainable rural governance.

Key Geospatial Initiatives

1. Bhuvan Panchayat (Version 4·0)

- **Objective :**
  - ❏ To empower Gram Panchayats with access to high-quality geospatial data.
  - ❏ Facilitate better planning, resource management and disaster response.
- **Features :**
  - ❏ Provides satellite imagery and geospatial analysis tools.
  - ❏ Enables integration of data for monitoring land use, water resources and urban development.
  - ❏ Real-time data sharing with a scale precision of 1:10,000, where one centimeter equals 100 meters on the map.
- **Implementation :** Developed by the National Remote Sensing Centre (NRSC) as a web-based platform under the Space-based Information Support for Decentralized Planning (SIS-DP) program.
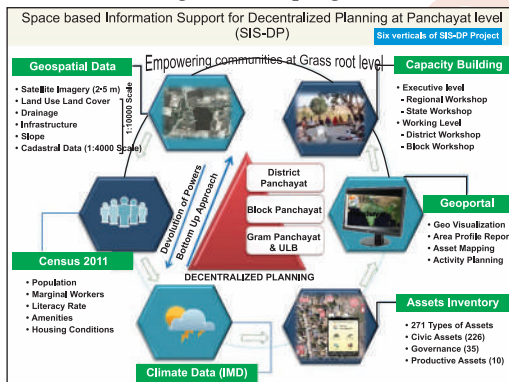
2. National Database for Emergency Management (NDEM)

- **Purpose :**
  - ❏ Supports disaster management through robust geospatial data.
  - ❏ Facilitates decision-making during emergencies by offering high-resolution satellite imagery and real-time information.
- **Applications :** Disaster mitigation, resource allocation and emergency response planning.

3. National Agricultural Drought Assessment and Monitoring System (NADAMS)

- **Role :**
  - ❏ Utilizes satellite data to assess drought conditions.
  - ❏ Guides agricultural planning and resource management in drought-prone areas.

4. Digitization of Land Records

- **Achievements :**
  - ❏ Over 95% of rural land records in India have been digitized under the Digital India Land Records Modernization Programme (DILRMP).
  - ❏ ISRO satellites like CartoSAT and ResourceSAT play a key role in land surveys and record digitization.
- **Significance :**
  - ❏ Enhances transparency in land ownership.
  - ❏ Facilitates better land management and development planning.
  - ❏ Reduces disputes related to land ownership and boundaries.

Importance of Geospatial Data in Rural Development

1. **Improved Governance :** Geospatial platforms like Bhuvan Panchayat empower local bodies to implement science-based solutions for planning and development. Promotes participatory decision-making by providing accurate, real-time data.

2. **Disaster Management :** Platforms like NDEM ensure readiness and resilience in dealing with natural disasters by offering real-time, actionable insights.

3. **Sustainable Development :** Geospatial data supports monitoring of natural resources, land use planning and agricultural productivity.

4. **Transparent Land Management :** Digitization of land records reduces corruption, streamlines processes and ensures clarity in property ownership.

ISRO Satellites Supporting Rural Resource Management

- **CartoSAT Series** : Provides high-resolution imagery for land surveys, urban planning and rural development.
- **ResourceSAT Series :** Supports agricultural monitoring, natural resource assessment and disaster management.

SPACE TECHNOLOGY: BRIDGING THE RURAL-URBAN GAP

Space technology, led by ISRO, serves as a critical tool for enhancing rural development and reducing the rural-urban divide.

Role of Space Technology

1. **Communication Connectivity :** Satellites like GSAT bridge the digital divide, enabling e-learning, telemedicine and e-governance in rural areas.

2. **Agricultural Applications :** Satellites such as RISAT provide real-time data for crop monitoring, soil analysis and weather prediction, aiding farmers in improving productivity.

3. **Disaster Management :** Remote sensing helps in early warning systems and efficient disaster response.

4. **Education and Literacy :** Satellite-based services facilitate digital education in rural areas, promoting societal progress.

5. **Environmental Monitoring :** Space technology assists in tracking deforestation, water resources and climate change.

In Conclusion, Space technology acts as a catalyst for rural development, ensuring inclusive growth and societal well-being. Its applications have transformed governance, agriculture and education, bridging the rural-urban divide effectively.

REIMAGINING THE FUTURE OF LEARNING : EDUCATING ON SPACE TECHNOLOGY

Space technology has become a transformative tool in addressing global challenges and driving innovation across sectors. From improving disaster management and enhancing climate resilience to revolutionizing agriculture and communication systems, its applications are shaping a sustainable future. As the global space economy expands at an unprecedented pace, there is a growing need to focus on education and capacity-building initiatives to prepare the workforce for the opportunities ahead.

Key Highlights

1. The Expanding Global Space Economy :

- The global space economy is projected to reach $ 1·8 trillion by 2035, reflecting a significant increase from $ 630 billion in 2023.
- India's space economy is expected to grow to $ 77 billion by 2030, with a CAGR of 26%, surpassing global GDP growth rates.

2. Space Technology and Sustainable Development :

- Space technology contributes to critical areas such as disaster risk reduction, climate monitoring, agriculture practices and service delivery improvements.
- It supports advancements in geospatial data, enabling better resource management, infrastructure planning and efficient service delivery.

3. Education as the Foundation :

- Integrating space technology into school curricula can inspire students to pursue innovative solutions and make informed career choices.
- Space-based tools like high-speed internet, electronic monitoring and remote learning systems can bridge educational gaps, especially in geographically diverse and underserved regions.

4. Preparing the Workforce for the Future :

- Investments in education and research are essential to meet the global demand for space-based solutions.
- The sector offers opportunities for innovation in areas like early warning systems, high-tech job creation and fostering a new generation of leaders equipped to tackle complex challenges.

Call to Action

To ensure leadership in the global space economy, nations must prioritize investments in education and research related to space technology. By empowering young minds with the knowledge and skills to innovate, we can not only address societal challenges but also secure sustainable economic growth. Space technology, when coupled with education, holds the potential to revolutionize industries and transform the future.

MOBILE APPS FOR FISHERMEN

Fishermen in India often face challenges such as crossing international maritime boundaries or navigating adverse weather conditions during their fishing routines. To address these issues and ensure their safety, ISRO and other organizations have developed innovative mobile

applications tailored to meet the needs of the fishing community.

The MapmyIndiaNavIC Message Receiver App

This app, developed using the Indian Regional Navigation Satellite System (NavIC), provides several features to enhance the safety and efficiency of fishermen :

- **Weather Alerts :** Warns fishermen against venturing out during adverse weather conditions, such as cyclones, tidal waves and high tides.
- **International Maritime Boundary Warnings :** Provides audiovisual alerts when fishermen approach or cross international maritime boundaries.
- **Fishing Zone Navigation :** Displays potential fishing zones for tuna and other species while offering waypoint navigation from the current location to the desired area.
- **Offline Functionality :** Operates completely offline, ensuring usability even in remote sea regions.
- **Emergency Messages :** Delivers weather-related emergency messages (*e.g.*, cyclones, high waves) in collaboration with INCOIS (Indian National Centre for Ocean Information Services).
- **Availability :** The app can be downloaded from the Google Play Store under the name MapmyIndiaNavIC.

Nabhmitra Network & App for Real-Time Tracking of Sub-20m Boats

- **Purpose :** Ensures real-time tracking of smaller fishing vessels, enhancing safety and monitoring for sub-20-meter boats.
- **Initiative :** Part of a national effort to support small-scale fishermen with efficient safety measures and communication tools.

Sagarmitra SAR Emergency Messaging App

This app is a vital tool for maritime safety, specifically designed for emergency situations :

- **Search and Rescue Assistance :** Facilitates rapid communication during emergencies at sea, ensuring timely intervention.
- **Real-Time Alerts :** Notifies authorities and relevant stakeholders in case of distress, improving search and rescue operations.

Impact on Fishermen

These applications collectively empower fishermen by :

- Enhancing safety with reliable weather alerts and boundary warnings.
- Supporting efficient fishing operations through navigation tools and fishing zone identification.
- Reducing risks associated with adverse weather and unintentional maritime boundary crossings.

By leveraging advanced satellite technology and innovative apps, India is ensuring the safety, productivity and sustainability of its fishing community.

SATELLITE-BASED EARLY WARNING SYSTEMS FOR DROUGHT AND FLOOD MANAGEMENT

Droughts and floods pose significant threats to agriculture, food security and rural livelihoods. Leveraging satellite technology for early warning systems offers transformative solutions to monitor, predict, and mitigate the impact of these disasters. By integrating scientific insights with community-based approaches, India can enhance resilience and promote sustainable agricultural practices.
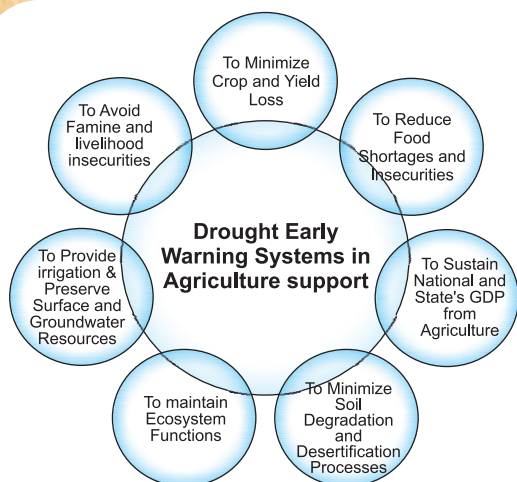
Understanding Droughts

Drought is defined as a prolonged period of inadequate water or moisture availability below normal levels. It is caused by factors such as :

- **Subnormal Rainfall :** Uneven or insufficient precipitation patterns.
- **Erratic Distribution :** Unequal rainfall spread across regions.
- **Higher Water Demand :** Increased water usage exceeding availability.

Key Impacts of Droughts :

1. **Crop Yields :** Droughts reduce soil moisture, inhibiting crop growth and productivity.
2. **Livelihoods :** Lower agricultural outputs lead to financial distress, forcing farmers into debt or migration.
3. **Livestock :** Scarcity of fodder and water weakens livestock health, reducing their productivity.
4. **Water Resources :** Over-reliance on groundwater for irrigation during droughts depletes resources, causing long-term sustainability issues.

Drought Early Warning Systems in Agriculture support
- To Minimize Crop and Yield Loss
- To Reduce Food Shortages and Insecurities
- To Avoid Famine and livelihood insecurities
- To Sustain National and State's GDP from Agriculture
- To Provide irrigation & Preserve Surface and Groundwater Resources
- To maintain Ecosystem Functions
- To Minimize Soil Degradation and Desertification Processes

Understanding Floods

Flooding results from excessive rainfall or overflowing rivers, leading to water stagnation in agricultural fields.

Key Impacts of Floods :

1. **Crops :** Floods destroy standing crops, degrade soil quality and reduce fertility.

2. **Infrastructure :** Damage to irrigation systems, roads and storage facilities disrupts agricultural operations.

3. **Food Security :** Loss of crops threatens food availability, further impacting rural economies.

Role of Satellite Technology in Management

Satellite-based early warning systems offer accurate and real-time data to monitor and predict droughts & floods. These systems support :

1. **Monitoring :** Continuous observation of rainfall patterns, soil moisture levels, and water availability.

2. **Risk Mitigation :** Timely alerts allow farmers to take preventive actions to minimize damage.

3. **Disaster Preparedness :** Integration of weather forecasts with agricultural advisories ensures informed decision-making.

4. **Sustainable Practices :** Facilitates the adoption of water-efficient and climate-resilient farming techniques.

Call to Action

To mitigate the adverse effects of droughts and floods, it is essential to adopt a multi-pronged strategy that includes :

- Expanding the reach of satellite-based early warning systems.
- Promoting collaborative efforts for disaster preparedness.
- Supporting rural communities with sustainable agricultural practices.

By aligning modern technology with traditional wisdom, India can safeguard its agricultural sector and rural livelihoods against climate-induced challenges.

KRISHI-DSS (DECISION SUPPORT SYSTEM)

Krishi-DSS (Decision Support System) is an indigenous geospatial platform developed to empower stakeholders in the agricultural sector by providing data-driven solutions for sustainable agricultural development. It integrates multiple data sources and advanced technologies to enable informed decision-making across various agricultural domains.

GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND FARMERS WELFARE

Digital Agriculture Mission

Encouraging the incorporation of cutting-edge technologies into Agriculture

- Artificial Intelligence
- Remote sensing
- BlockChain
- Robots
- Drones

Unlocking the Power of Data for Sustainable Agricultural Development

- **Comprehensive Data Integration :**
  - ❏ Combines satellite data, weather forecasts, soil health data, crop patterns and market trends to offer actionable insights.
  - ❏ Ensures precision farming by delivering location-specific recommendations.
- **Promotes Sustainability :**
  - ❏ Aids in efficient resource utilization like water, fertilizers and pesticides.
  - ❏ Helps mitigate climate change impacts by offering early warnings and adaptation strategies.
- **Boosts Agricultural Productivity :**
  - ❏ Enhances crop yield and profitability by suggesting best practices tailored to specific regions.

Indigenous Geospatial Platform for Informed Decision-Making in Agriculture

- **Self-Reliance in Agri-Tech :** Krishi-DSS is a product of Indian innovation, leveraging

ISRO's geospatial expertise and indigenous technologies.

- **Real-Time Monitoring :** Offers real-time data on weather, crop health, soil moisture and water availability.
- **Customizable and User-Friendly :** Designed for farmers, policymakers and agricultural scientists to access easy-to-understand geospatial data.

Connecting Stakeholders with Data-Driven Solutions

- **Farmers :** Provides recommendations on cropping patterns, irrigation schedules and pest management to optimize yields.
- **Government and Policymakers :** Enables effective planning of agricultural schemes and disaster management. Supports food security policies through better crop forecasting.
- **Research Institutions :** Facilitates agricultural innovation by providing extensive geospatial data for R&D.
- **Private Sector :** Offers insights for agribusinesses to enhance supply chain management and market access.

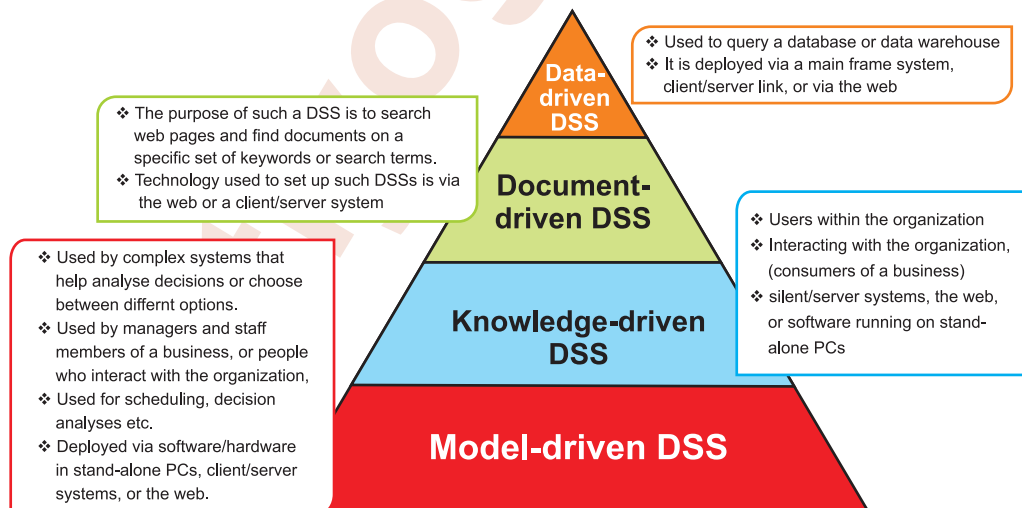## Applications of Krishi-DSS Towards Sustainable Agricultural Development

1. **Crop Health Monitoring :** Tracks crop conditions using satellite imagery to detect stress or disease at an early stage. Provides recommendations to farmers for timely intervention.
2. **Water Resource Management :** Monitors groundwater levels and helps optimize irrigation practices. Encourages the adoption of water-saving techniques such as drip irrigation.
3. **Weather and Disaster Preparedness :** Issues early warnings for extreme weather events like floods, droughts and cyclones. Reduces crop losses and ensures resilience against climate risks.
4. **Precision Agriculture :** Offers region-specific advice on seed selection, nutrient management and planting schedules. Minimizes wastage and enhances productivity.
5. **Market Intelligence :** Assists farmers in accessing market trends, prices and demand forecasts. Facilitates better decision-making for selling produce.

In Conclusion, Krishi-DSS is a transformative initiative that leverages the power of geospatial data and indigenous technology to drive sustainable agricultural development in India. By connecting stakeholders through a data-driven ecosystem, it ensures informed decision-making, enhances productivity, and promotes resource-efficient farming practices. This platform has the potential to revolutionize Indian agriculture, making it more resilient, inclusive and sustainable.

TYPES OF DSS

Data-driven DSS
- ❖ Used to query a database or data warehouse
- ❖ It is deployed via a main frame system, client/server link, or via the web

Document-driven DSS
- ❖ The purpose of such a DSS is to search web pages and find documents on a specific set of keywords or search terms.
- ❖ Technology used to set up such DSSs is via the web or a client/server system

Knowledge-driven DSS
- ❖ Users within the organization
- ❖ Interacting with the organization, (consumers of a business)
- ❖ silent/server systems, the web, or software running on stand-alone PCs

Model-driven DSS
- ❖ Used by complex systems that help analyse decisions or choose between differnt options.
- ❖ Used by managers and staff members of a business, or people who interact with the organization,
- ❖ Used for scheduling, decision analyses etc.
- ❖ Deployed via software/hardware in stand-alone PCs, client/server systems, or the web.

GIST
OF
DOWN TO EARTH

January 2025

PRESERVING A VOICE : DOCUMENTING THE KORKU LANGUAGE

The preservation of endangered tribal languages is crucial for safeguarding cultural heritage. Seema Prakash, a social worker, began her journey in Khalwa block, Madhya Pradesh, to address hunger and malnutrition as part of the Right to Food campaign. In the process, she discovered the significance of the Korku language, spoken by the Korku tribal community, in ensuring effective communication and promoting social welfare.

Efforts to Preserve and Promote the Korku Language

Challenges in Communication :

- The Korku language, predominantly spoken in Maharashtra and Madhya Pradesh, is among the nearly extinct languages, as per the People's Linguistic Survey of India.
- It has no script and is written in Devanagari or English, with distinct words that differ from Hindi.

Steps Taken by Seema Prakash and Spandan Samaj Seva Samiti

1. **Initial Breakthrough :** Prakash researched the Korku language to effectively communicate with the community, starting with the term for malnutrition, *shiti*. This effort highlighted the role of language in social welfare initiatives.
2. **Documenting the Language :** A dictionary of 500 Korku words was created, tracing the origins of words deeply rooted in nature. Names such as *Devda* (behind paddy) and *Jabu* (behind the jamun tree) reflect the tribe's connection to the soil.
3. **Cultural Preservation through Elders :** Elderly community members shared songs, stories and discussions, which were recorded and documented. Local residents like Sugandhi Vishwakarma contributed to the documentation efforts.

Incorporating Korku in Education

- Educational materials such as posters and paintings in Korku were developed and implemented across 100 anganwadis in Khalwa block.
- Financial support from the National Geographic Foundation facilitated this initiative.
- This effort improved learning outcomes and made education engaging for children.

Wider Recognition and Impact

- The District Institute of Education and Training initiated a pilot project based on this model.
- The Tribal Folk Art Academy at the state level began efforts to promote the Korku language.

In Conclusion, The documentation and promotion of the Korku language by Seema Prakash and Spandan Samaj Seva Samiti serve as a beacon for preserving endangered tribal languages. By integrating Korku into education, they not only safeguarded the community's cultural heritage but also empowered children through accessible learning. This initiative underscores the transformative power of language in social and educational development.

COMMONS IN CRISIS

The 2011 Supreme Court ruling on the protection of commons was a landmark decision aimed at safeguarding shared natural resources in India. However, its implementation has revealed systemic challenges, often exacerbating struggles for marginalized communities.

Key Issues

1. The Case of Rohar Jagir Village :

- The dispute began in 2003 over a 7·2 hectare pond encroached upon by residents.
- The 2011 Supreme Court ruling ordered eviction and restoration of commons nationwide but failed to bring significant change in the village.
- Encroachers remain in limbo; the pond is degraded and the fear of backlash prevents decisive action.

2. Implementation of the 2011 Supreme Court Judgement :

- The verdict mandated eviction from commons, with exceptions for socially deprived groups or public utilities.
- The case has been cited in over 460 high court rulings, prompting some states to amend laws or establish mechanisms to protect commons (*e.g.*, Public Land Protection Cells in Rajasthan, district-level cells in Madhya Pradesh and Assam).

3. Marginalized Communities and Systemic Inequities :

- An analysis of 1,630 cases citing the judgement revealed that :
  - Over 56% of encroachers identified were from Scheduled Castes, Scheduled Tribes, or landless communities.

- Evictions disproportionately affected nomadic and tribal groups, disrupting livelihoods.
- Courts often overlooked encroachers' rights, leading to high eviction rates (58%).

4. Challenges in Implementation :

- Governance lapses include :
  - Gram panchayats colluding with encroachers or exploiting commons for revenue generation (*e.g.*, sand mining in Kerala).
  - Stricter eviction policies post-verdict without adequate rehabilitation measures.
  - Lack of focus on ecological restoration or ensuring equitable community access.

Recommendations for Way Forward

- **Adopt Locally Relevant Solutions :** Consider social hierarchies and ecological dependencies for sustainable outcomes.
- **Ensure Accountability and Participation :** Establish transparent grievance mechanisms and participatory decision-making processes.
- **Strengthen Custodianship :** Empower local bodies with adequate resources and authority to protect commons.
- **Focus on Restoration :** Shift focus from evictions to ecological restoration and equitable resource access.

In Conclusion, The 2011 Supreme Court judgement was a crucial step towards protecting India's commons. However, its implementation has often failed to achieve its intent, disproportionately affecting marginalized groups. A participatory and restorative approach is essential to address these challenges effectively.

SCOPE FOR REDEMPTION : A SUSTAINABLE PATH FORWARD

Recent reports by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) emphasize the urgent need for comprehensive strategies to address interconnected environmental challenges. Despite global agreements to curb biodiversity loss since the 1992 Earth Summit, the planet continues to lose significant biodiversity. These reports—'Nexus Assessment' and 'Transformative Change Assessment'—provide scientific evidence and policy solutions to tackle this crisis.

Key Highlights

1. Nexus Assessment : This report identifies interlinkages between biodiversity, water, food, health and climate. It presents over 70 response options to optimize synergies across environmental crises.

- **Key Findings :**
  - Actions focusing on single issues often result in negative impacts on other nexus elements.
  - Delayed action on biodiversity can double the costs of intervention and lead to irreversible losses like species extinction.
- **Indirect Drivers :** These include overconsumption, waste generation, and population growth, which amplify direct drivers of biodiversity loss.

- **Economic Implications :**
  - Over 50% of global GDP depends on nature, yet short-term financial gains often take precedence over long-term environmental sustainability.
  - Delayed climate action could incur an additional $ 500 billion annually.
- **Policy Recommendations :**
  - Develop cross-sectoral approaches to manage biodiversity, water and climate holistically.
  - Prioritize systemic changes in governance, consumption patterns and incentives.

2. Transformative Change Assessment : This report delves into the root causes of biodiversity loss and outlines systemic changes needed for sustainability.

- **Root Causes Identified :** Human disconnection from nature. Inequitable distribution of power and wealth. Prioritization of short-term material gains.
- **Principles for Change :**
  - **Equity and Justice :** Address inequalities and empower marginalized communities.
  - **Pluralism and Inclusion :** Integrate diverse perspectives, including Indigenous knowledge.
  - **Adaptive Learning :** Promote flexible and responsive governance systems.

- **Case Study :** The Os Miñarzos Marine Reserve in Spain demonstrates how collaborative efforts among fishers, scientists, and governments can yield measurable biodiversity and economic benefits.

The Role of Indigenous Peoples and Local Communities (IPLCs)

Indigenous territories cover 20% of Earth's surface and house 80% of global biodiversity. Their traditional practices, such as community forestry in Nepal and tenure rights enforcement in Brazil, have proven effective in reducing deforestation and conserving ecosystems.

- **Challenges :** Land encroachment and pollution. Exclusion from decision-making processes.

- **Recommendations :** Secure land rights for IPLCs. Incorporate Indigenous knowledge into national and global policy frameworks.
- **Path Forward :** The reports emphasize that achieving biodiversity goals aligns with the UN Sustainable Development Goals (SDGs) and the Paris Agreement. System-wide changes in technology, governance, and societal values are crucial for a sustainable future.

In Conclusion, The IPBES reports underscore the urgency of integrated and inclusive strategies to combat biodiversity loss and environmental crises. By addressing root causes, promoting equity, and leveraging traditional knowledge, the global community can work towards a harmonious coexistence with nature.

A MAKE OR BREAK YEAR

2025 is positioned as a pivotal year for addressing a global polycrisis encompassing climate, ecology, economy and geopolitics. Key insights include :

1. Climate and Environmental Crisis

- **Critical Condition :** Earth's warming crossed the 1·5°C threshold in 2024, marking the 10th consecutive warmest year (WMO).
- **Drying Lands :** Over three-fourths of Earth's land has permanently dried since 1990 (UNCCD).
- **Extreme Events :** 12,000 disasters in 50 years have claimed over 2 million lives (IPBES).

2. Biodiversity Collapse :

- **Species Extinction :** Over 1 million species face extinction, including one-third of tree species (IUCN).
- **Rainforest Degradation :** Only 25% of tropical rainforests remain of high quality, threatening ecosystems.

- Biodiversity loss disrupts nature's biological rhythm and services essential for human survival.

3. Planetary Boundaries Breached

- Six boundaries have been transgressed, including climate change, biosphere integrity, and freshwater use.
- Only three—atmospheric aerosols, stratospheric ozone, and ocean acidification—remain within safe limits, but ocean acidification is nearing its threshold.

4. Call for Action

- **Nature's Revenge :** Human activities are pushing the planet to a tipping point, threatening survival.
- Urgent measures in governance, innovation, and policies are required to navigate the crises and stabilize ecosystems.

This year will be a test of global commitments, with nature's warning signals demanding radical shifts in behaviour and policy.

BURDEN OF POVERTY

1. Global Income Inequality

- The richest 10% capture 52% of global income, while the poorest 50% get only 8·5% (IMF).
- In India, the top 1% earns 23 times the national average, and the number of billionaires surged from 1 in 1991 to 162 in 2022.
- Wealth and income disparities are widening, with little indication of narrowing gaps.

2. Slowed Poverty Reduction

- Economic stagnation (2020–30) driven by low growth, COVID-19, inflation, conflicts and fragility.
- 133 million additional people fell into poverty ($ 3·65/day) in 2023 (UNDP), with numbers likely rising further.
- Over 50% of low-income countries face debt distress, dedicating 7·5% of budgets to external debt servicing, reducing welfare spending.

3. Climate Change and Poverty

- Climate change exacerbates poverty, with 1 in 5 people at risk of welfare losses from extreme weather.
- By 2030, extreme poverty is expected to drop marginally to 7·3% of the population, but absolute numbers may rise.

4. Future Strategies

- Increased social spending and progress on debt deals for poorer nations are essential.
- Greater focus on climate loss and damage compensation will help mitigate climate-related economic challenges.

  The world must address growing inequality, economic stagnation and climate impacts to combat the deepening burden of poverty effectively.

IMMIGRATION AND DEPOPULATION

1. Rising Immigration and Political Focus

- Immigration has become a key political agenda, despite immigrants making up only 3·6% of the global population (IOM).
- The number of international migrants has surged to 281 million in 2020, three times the 1970 figure.
- Declining populations in 61 countries (2022–2050) due to low fertility and high emigration have triggered incentives to boost growth.

2. Fertility Rates and Population Trends

- Two-thirds of the global population lives in areas with fertility below the replacement level (2·1 births per woman).
- In high-income countries, migration offsets population decline, becoming the key driver of growth in some regions.
- India and other low/middle-income countries will continue natural population growth due to excess births over deaths.

3. Economic Implications of Migration

- Population dynamics are geographically skewed, necessitating a new wave of migration to sustain the global workforce.
- Middle-income countries face an ageing population without sufficient income levels, while Africa's growing population lacks the skills to fill global workforce gaps.
- Migrants, comprising 184 million globally, form a vital workforce for developed nations.

4. Future of Immigration Policies

- Developed countries, facing ageing populations, will increasingly rely on migration for economic sustainability.
- Border control and selective migration policies will shape immigration to distinguish between eligible and ineligible migrants and manage illegal influx.
- Countries sealing borders today may need to reopen them out of economic necessity, not altruism.

  Immigration is emerging as a critical factor in addressing workforce challenges, economic sustainability and population dynamics globally.

PANDEMIC RISKS AND EMERGING PATHOGENS

1. Warning of a New Pandemic

- The UN Environment Programme (2024) warns of a pandemic by 2030, driven by zoonotic diseases linked to deforestation, urbanisation and unsustainable agriculture.
- Climate change accelerates pathogen spillover, with fatalities projected to be 12 times higher by 2050 than in 2020.

2. Emerging and Re-emerging Diseases (2024)

- **Mpox (Clade 1b) :** Originating in the Democratic Republic of Congo, it caused 50,000 cases and 1,000 deaths, spreading rapidly across Africa and globally. WHO declared it a public health emergency of international concern.
- **Vector-Borne Diseases in Latin America :** Brazil reported 6 million dengue cases, the highest ever. Diseases like chikungunya, zika, and oropouche fever are expanding into new regions due to climate-induced habitat changes. Dengue is spreading to Europe, with the invasive mosquito species Aedes albopictus now present in 13 EU countries.
- **H5N1 Influenza in North America :** Spread from poultry to dairy cows in 16 US states, infecting 65 people, raising concerns about potential mutations for human-to-human transmission.

3. Global Health Threats

- **Antimicrobial Resistance (AMR) :** Responsible for 4·95 million deaths annually. A UN political declaration in 2024 aims to reduce

AMR-related deaths by 10% annually by 2030.

- **Preparedness Gaps :** Despite the ongoing negotiation of the WHO's International Treaty on Pandemic Prevention, significant shortcomings in global collaboration remain.

4. Key Takeaway

The rising threat of zoonotic diseases, vector-borne illnesses and antimicrobial resistance highlights the urgent need for global coordination, climate action and robust pandemic preparedness to mitigate future health crises.

THE RISE OF THE SPACE ECONOMY

1. Growth and Projections

- The space economy is projected to grow at an annual rate of 9%, outpacing global GDP, and is expected to reach $ 1·8 trillion by 2035 (WEF and McKinsey).
- Key drivers include Earth observation, navigation technologies and private sector innovation.

2. Key Developments in 2024

- **Private Sector Leadership :** SpaceX's Starlink launched over 2,000 satellites in 2024, expanding its mega-constellation to 6,000 satellites in Low Earth Orbit (LEO). Space tourism saw growth with Blue Origin's New Shepard completing 28 commercial suborbital flights. The market could be worth $ 1·8-3·3 billion annually by 2035.
- **Scientific Advancements :** NASA's Juno captured the sharpest-ever images of Io, Jupiter's moon. China transported lunar samples from the moon's far side, a global first. India's Aditya L1 observatory completed its first halo orbit around the Sun-Earth Lagrange 1.

3. Future Missions and Partnerships

- **Planned space missions for 2025 :**
  - **NASA :** Galaxy studies, lunar exploration, and a joint mission with ISRO to measure Earth's changing ecosystems.
  - **ESA :** Exploring the Earth-Sun connection.
  - **China :** Tianwen-2 to collect samples from a near-Earth asteroid and study a comet.

4. Applications of Space Technology

- Enhanced satellite operations to provide critical inputs in agriculture, IT, insurance, and construction sectors, increasing accessibility and impact across diverse industries.

5. Key Takeaway

The space sector's rapid technological and economic expansion, driven by private players, international collaboration and scientific advancements, is transforming it into a pivotal domain for investment and innovation.

RISING GLOBAL TEMPERATURES AND THE URGENT NEED FOR CLIMATE ACTION

1. Temperature Trends and Warning

- November 2024 recorded 1·62°C above pre-industrial levels, marking the 16th month out of the last 17 to breach the 1·5°C threshold temporarily.
- Although this does not signify the long-term crossing of the 1·5°C guardrail, it highlights the rapidly closing window for limiting global warming to safer levels.

2. Call for Enhanced NDCs (Nationally Determined Contributions)

- The NDCs 3·0, due by February 2025, are critical for aligning with the Paris Agreement's 1·5°C goal.
- UNFCCC stresses the need to triple global renewable energy capacity and double energy efficiency by 2030 to meet the target.

3. Challenges and Gaps

- Current NDCs are insufficient, projected to reduce emissions by only 2·6% from 2019 levels by 2030, resulting in greenhouse gas emissions of 51·5 gigatonnes CO_2 equivalent.
- The required renewable energy capacity of 11·2 TW by 2030 faces a 34% shortfall, with national plans achieving only 7·4 TW.

4. Investment Needs

- Achieving renewable energy targets demands an annual addition of 1,044 GW and a cumulative investment of $ 31·5 trillion by 2030.
- Solar photovoltaic investments are on track, but other technologies and energy efficiency improvements require a sevenfold increase in funding.

5. Future of Renewables and Risks

- Renewables are expected to dominate global power generation by 2038, with China, Europe, and the US producing 57% of solar and wind energy by 2050.
- The shift to renewables will depend heavily on minerals like copper, lithium, nickel and iron ore, with risks from resource nationalism and geopolitical tensions disrupting supply chains and escalating costs.

6. Trade Conflicts & Policy Contradictions

- Measures like the EU's carbon border tax could hinder green transitions in developing countries, increase trade conflicts and contradict developed nations' commitments to support global climate efforts.

7. Key Takeaway

- The global response to climate change must urgently scale up commitments and investments in renewable energy and efficiency while addressing geopolitical & trade challenges to ensure a sustainable transition.

ARTIFICIAL INTELLIGENCE IN 2024 AND FUTURE TRENDS

1. AI's Growing Pervasiveness

- AI is integrated into diverse technologies, including ATMs, food delivery and stock trading.
- Nobel Prizes for Physics and Chemistry in 2024 recognized contributions to AI advancements.
- Global AI investment is projected to reach $ 200 billion by 2025, per Goldman Sachs.

2. Concerns and Challenges

- Risks include fraud, election tampering, and loss of control over AI systems due to its ability to 'lie' and 'deceive'.
- Over 30 AI-related lawsuits were filed in 2024, with copyright infringement for AI training being a major issue.
- The UN warned of AI-based weapons being deployed in conflicts in Ukraine and West Asia.

3. Global Governance and Regulation

- The UN General Assembly adopted the first global resolution on AI, highlighting its potential for achieving Sustainable Development Goals (SDGs) while emphasizing the need to safeguard human rights.
- Discussions on a potential global AI treaty are expected, but legal experts predict multiple failed attempts to create an international framework.

4. Policy Uncertainty in the US

- With Donald Trump taking office, the future of Biden's Executive Order on AI safety—focusing on privacy, equity, consumer protection and innovation—remains uncertain.
- Concerns exist about the removal of regulatory guardrails under the new administration.

5. AI Agents and Workforce Impact

- AI agents autonomously performing tasks could potentially double the workforce, according to PwC.
- Deloitte predicts that by 2025, 25% of enterprises may deploy Generative AI agents, increasing to 50% by 2027.

6. Energy Implications

- Data centers, the backbone of AI, consumed over 380 TWh of electricity in 2023, 1·4% of global consumption.
- This usage is projected to triple to 1,000 TWh by 2030, or 3% of global power consumption, with AI markets expected to double electricity use by 2025.

7. Key Takeaway

- AI continues to revolutionize industries but raises concerns about regulation, ethical usage and sustainability. The coming years will require a balance between innovation and addressing challenges related to governance, security and resource consumption.

KEY TREATIES AND GLOBAL EFFORTS IN 2025

1. Global Challenges and Opportunities

- The world grapples with conflicts, climate change, and inequalities, but 2025 offers hope through landmark treaties and agreements on health, plastics, chemicals, biodiversity and marine conservation.
- Sustainable Development Goals (SDGs) will undergo review at a high-level political forum, with the potential to reshape governance and restore planetary balance.

2. Major Treaties and Agreements

- **Global Pandemic Treaty (May 2025) :** To be finalized during the 78th WHO Health Assembly in Geneva. Focuses on prevention, equity, health systems, financing and governance to address weaknesses revealed by COVID-19.

- **Plastics Treaty :** Expected finalization after missing the 2024 deadline. Consensus exists on a framework, but disagreements persist over production limits *vs.* waste management.
- **UN Environment Assembly (UNEA-7) :** Scheduled for December 2025, under the theme "Advancing sustainable solutions for a resilient planet." The Open-ended Working Group will finalize proposals for managing chemicals and waste.

3. Environmental and Conservation Milestones

- **Minamata Convention Amendments (April 2025) :** Ban on mercury in cosmetics exceeding 1 ppm. Phase-out of mercury-added batteries, switches and relays by 2025 (except for R&D). COP-6 (November 2025) : Further discussions on mercury regulation.

- **UN Ocean Conference (June 2025) :** Focuses on SDG 14 (Ocean Protection), one of the least funded SDGs. Concludes with the adoption of commitments under the Nice Ocean Action Plan.
- **CITES COP-20 (November-December 2025) :** Celebrates 50 years of the Convention on International Trade in Endangered Species in Uzbekistan.
- **World Conservation Congress (October 2025) :** Hosted by Abu Dhabi and organized by the IUCN to discuss global conservation priorities.

4. Key Takeaway

- 2025 is a pivotal year for addressing global crises through collaborative governance, with a focus on sustainable development, environmental protection, and equitable health and conservation strategies.

GLOBAL TARGETS AND FRAMEWORKS TO ACHIEVE BY 2030

1. Kunming-Montreal Global Biodiversity Framework (2022)

- **23 Targets for 2030 :** Reduce threats to biodiversity. Promote sustainable use and benefit-sharing. Provide tools and solutions for implementation and mainstreaming.
- **4 Goals for 2050 :** A vision for a world living in harmony with nature.

2. 2030 Agenda for Sustainable Development (2015)

- 17 Sustainable Development Goals (SDGs) with 169 Targets.
- Focus on poverty eradication, health, education, inequality reduction, economic growth, climate action and ocean/forest preservation.

3. Convention on International Trade in Endangered Species (CITES) Strategic Vision (2021-2030)

- **1 Target :** Ensure all international trade in wild fauna and flora is legal, sustainable, and supports biodiversity conservation, contributing to the SDGs.

4. Montreal Protocol (1987)

- **1 Target :** Phase out hydrochlorofluorocarbons (HCFCs) by 2030 to protect the ozone layer.

5. Global Methane Pledge (2021)

- **1 Target :** Reduce global methane emissions by at least 30% below 2020 levels by 2030.

6. UN Convention to Combat Desertification (UNCCD)

- **1 Target :** Restore 1·5 billion hectares of degraded land to achieve land degradation neutrality by 2030.

7. WHO Nutrition Targets (Extended to 2030)

- **6 Targets :** Eliminate all forms of malnutrition. Achieve universal coverage of essential nutrition services.

Key Takeaway : These global frameworks and targets highlight collective efforts toward sustainability, biodiversity conservation, climate action, and human well-being, aiming to build a resilient and harmonious world by 2030.

INDIA'S GROUNDWATER RECOVERY : REALITY OR MISLEADING NUMBERS ?

Current Groundwater Status

- **Safe Assessment Units :** Increased from 63% (2017) to 73% (2023).

Concerns Over Methodology Changes

1. Introduction of the 2015 Methodology :

- Includes static in-storage resources (long-term, non-replenishable) along with dynamic resources.

- Incorporates additional recharge sources (*e.g.*, mountain streams, canals, ponds) despite unreliable data.

- Results in inflated estimates of groundwater availability, with recharge figures rising from 431·89 bcm (2017) to 449·08 bcm (2023).

2. Verification Removed :

- Discontinuation of on-ground validation (pre- and post-monsoon checks).
- Reassessment no longer mandated for significant fluctuations, risking underestimation of extraction rates.

Key Issues Identified

- **Inflated Recovery Figures :** Fundamental methodological changes give the illusion of improved groundwater health. Dependence on 'reasonable assumptions' rather than credible data.

- **Potential Over-Extraction :** Groundwater extraction rates may have surpassed critical thresholds. Lack of an effective mechanism to monitor sector-wise withdrawal.

Expert Warnings

- The apparent recovery may mask hidden damage to aquifers.
- Without accurate, on-ground verification, groundwater health cannot be reliably assessed.
- India risks long-term harm to groundwater resources if current assessment practices continue unaddressed.

CLIMATE SHAPES SPECIES

Impact of Climate on Evolution

- Evolution driven by changes in water availability, rainfall, temperature and humidity.
- Hominins evolved 6 million years ago due to climatic shifts.
- Unicellular organisms adapted to varying climates, while species in stable environments (*e.g.*, bacteria) remained unchanged.

Genetic and Physical Changes

- Evolution involves genetic and physical (phenotypic) changes.
- Physical adaptations, like jaw size, result from diet or locomotion changes.
- Gradual climatic changes over millennia influence species' traits.

Human Brain Evolution

- Climate challenges 2 million years ago led to tool-making, communication and increased brain size in *Homo* species.
- Fossils reveal significant brain growth compared to earlier ancestors.

Modern Adaptations

Populations evolve to survive extreme climates :

- Eskimos thrive in cold regions.
- Tibetans retain oxygen efficiently at high altitudes.
- Physical adaptations take approximately 500,000 years to appear.

New Species and Isolation

- Population isolation can lead to new human species over time.
- Denisovans adapted to high-altitude, low-oxygen environments, influencing Tibetan genetics.

Historical Climate-Driven Adaptations

- Climatic shifts in Europe led to ape extinction and Neanderthal adaptation to cold.
- *Homo sapiens* survived by migrating and adapting, while less adaptable species perished.

Future Prospects

- Technology and medicine increase human resilience to climate fluctuations.
- Humans are expected to adapt to future climate changes rather than face extinction.

SCARRED BY MINING - THE CRISIS OF NATURAL SPRINGS IN KASHMIR

Issue : Illegal riverbed mining in Kashmir is causing a drastic depletion of natural springs and rivers, threatening water availability, ecosystems and local livelihoods.

Key Highlights

1. Impact on Water Availability :

- The Sukh Nag stream and Arbal Nag spring in Budgam have nearly dried up due to illegal mining, disrupting water supplies for villages.

- A ₹ 30 crore water treatment plant in Dawlatpora is almost defunct due to the drying up of Arbal Nag.

2. Ecological Consequences :

- Mining alters river morphology, increases water turbidity and creates sinkholes.
- Local streams such as Doodh Ganga, Veshaw, and others, crucial for sustaining springs and the Jhelum river, face severe degradation.

- Loss of aquatic biodiversity and disrupted natural water regulation lead to heightened risks of floods, landslides and soil erosion.

3. Economic Toll :
- Agriculture relying on these water sources is under threat, with irrigation channels cut off.
- Wells now require drilling up to 20 meters, as opposed to 6 meters earlier.

4. Illegal Mining Practices :
- Despite regulations like the 2016 Minor Mineral Rules, heavy machinery is used to mine beyond permissible depths.
- Organised mafias exploit weak enforcement, often operating beyond legal hours without CCTV monitoring.

5. Role of Infrastructure Projects :
- Mining has surged due to material demands for projects like highway expansions, railway developments and urban infrastructure.

- From 2021-22 to 2022-23, mineral extraction increased from 0·47 million tonnes to 1·14 million tonnes.

6. Judicial Interventions :
- The National Green Tribunal (NGT) imposed penalties and revoked licences for environmental violations, including altering the flow of springs and using prohibited machinery.
- NGT investigations into the Sukh Nag mining revealed significant financial losses and ecological damage worth over ₹ 800 crore.

7. Call for Action :
- Experts and locals demand stricter enforcement, replenishment studies and sustainable alternatives to construction material extraction.

In Conclusion, Unregulated riverbed mining is devastating Kashmir's natural water resources, threatening ecosystems, public health and livelihoods. Urgent enforcement of environmental laws, stricter monitoring, and sustainable practices are essential to mitigate this crisis.

RETURN OF RAMBHOG : REVIVING AN AROMATIC PADDY VARIETY IN UTTAR PRADESH

Rambhog, a native paddy variety known for its sweet aroma and taste, is making a comeback in Uttar Pradesh's Terai region. Once forgotten, this indigenous rice is now a symbol of sustainable agriculture and economic growth for small and marginal farmers.

Key Highlights

1. Revival Efforts (2016 Onwards) :
- Farmers from 60 villages in Kanpur Dehat and Kanpur Nagar districts initiated Rambhog cultivation in 2016.
- Supported by the Shramik Bharti non-profit and agricultural scientists, efforts included :
  - ❏ Sourcing authentic seeds (2·5 kg from Rasulabad in Kanpur Dehat).
  - ❏ Reviving degraded soils using organic farming practices.

2. Economic and Environmental Benefits :
- **Higher Profits :** Farmers earn around ₹ 1 lakh per acre by cultivating Rambhog, despite its lower yield compared to hybrids.
- **Cost Savings :** Rambhog requires no chemical fertilizers, pesticides, or weedicides. Instead, farmers use :
  - ❏ **Homemade compost** (*e.g.*, Jeevamrutham, Daspatti Kadha, buttermilk).
  - ❏ Groundwater irrigation (₹ 1,600 for eight hours of pumping).

- **Resilient Crop :** Rambhog's tall stalks thrive without chemicals, unlike hybrid varieties that often collapse due to overgrowth from fertilizers.

3. Market Success :
- The rice is sold at ₹ 150-180 per kg under brands like Dhanika and Utsav Arth.
- Demand is high in urban areas like Delhi, Punjab and Kanpur.
- Farmer-producer companies like Ekta Nature Farming Producer Company have boosted marketing efforts.

4. Cultural and Historical Significance :
- Rambhog was a staple crop in the Terai region until hybrid varieties replaced it in the late 1990s.
- Hybrid crops were promoted by rice mills for higher yields, causing the near-extinction of Rambhog.

5. Challenges During Revival
- **Seed Shortage :** Finding genuine seeds required extensive searches across villages.
- **Degraded Soils :** Land degradation due to chemical farming necessitated soil rehabilitation using natural methods.

In Conclusion, The successful revival of Rambhog in Uttar Pradesh demonstrates the potential of indigenous crops to ensure eco-

nomic stability and ecological balance. It highlights the growing demand for sustainable and organic farming practices, offering a model for reviving other forgotten native crops.

BHOPAL GAS TRAGEDY AND ITS LONG-TERM IMPACT

The Bhopal Gas Tragedy occurred on the night of December 2, 1984, when 40 tonnes of methyl isocyanate (MIC) gas leaked from Union Carbide India Limited's (UCIL) pesticide plant. Over half a million people were exposed to the gas, leading to up to 30,000 deaths and long-term health consequences for survivors and subsequent generations.

Immediate Effects

- Widespread chaos and severe health conditions among residents, with symptoms like breathlessness, coughing and burning eyes.
- Families were separated during the escape; many suffered irreversible health damage or loss of loved ones.
- The tragedy resulted in a new disease classification termed 'Bhopal Gas Disease' with 40 symptoms, including respiratory issues, headaches, diabetes & chronic pain.

Long-Term Health Impact

- Survivors and their descendants continue to suffer severe health issues.
- Chronic ailments like high blood pressure, diabetes, and neurological issues.
- Children born to affected families experience delayed development and disabilities.

Studies Indicate

- Increased miscarriages, stillbirths and neonatal deaths.

- Decline in male births due to vulnerability of male fetuses to external stress.
- Higher cancer and employment disability risks among men born in 1985 within 100 km of Bhopal.

Environmental Impact

- Toxic waste from the plant and nearby solar evaporation ponds has contaminated soil and groundwater.
- Presence of 'forever chemicals' affecting 42 settlements around the factory.

Efforts for Management

- Supreme Court-appointed Oversight Committee monitors waste disposal.
- Toxic remnants include contaminated soil, mercury, and underground chemical waste.

Socio-Economic Implications

- Survivors face reduced quality of life, persistent health issues and inability to earn livelihoods.
- Study findings highlight a lack of mitigation through adequate health, disability and education services.

In Conclusion, The Bhopal Gas Tragedy remains the world's worst industrial disaster with enduring health, environmental and socio-economic impacts. It underscores the need for stronger industrial regulations and comprehensive disaster mitigation strategies.

ADDRESSING THE RISING THREAT OF CHEMICAL POLLUTION

The escalating environmental and public health challenges posed by synthetic chemicals, commonly referred to as 'novel entities', necessitate urgent attention. While chemical innovation drives industrial growth, it has also breached Earth's planetary boundaries, pushing the environment into uncharted territory.

1. Orcas Under Threat

- **Evolution and Predation :** Orcas, or killer whales, are apex predators with no natural enemies, tracing their origins to 50 million years ago.
- **Current Status :** These resilient predators are at risk due to human-released chemical contaminants.
- **Research Findings :** A 10 year study in the North Atlantic revealed high levels of Persistent Organic Pollutants (POPs) in orca blubber. POPs include polychlorinated
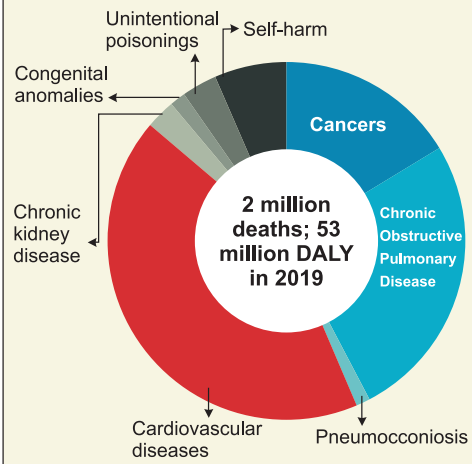
biphenyls (PCBs), banned decades ago but still found at dangerous levels. Orcas accumulate these toxins due to their position in the food chain, impacting immunity, reproduction and endocrine systems. These pollutants are passed from mothers to calves through milk.

2. Global Chemical Pollution

- **Chemical Ubiquity :** Persistent pollutants (*e.g.*, pesticides, industrial chemicals) travel through water, air, and food chains, persisting for decades. Apex species, including humans, are severely affected.
- **Industrial Growth :** The chemical industry has doubled production from 2000 to 2017 and is expected to double again by 2030. UNEP estimates 10 million tonnes of toxic chemicals are released annually, with 2 million being carcinogenic.
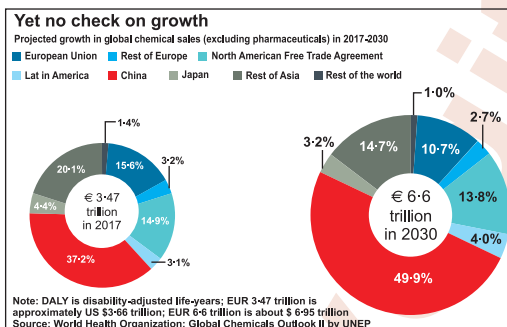
Mounting deaths

Total deaths attributable to chemicals by disease (data for 2019)

Labels on chart: Unintentional poisonings, Self-harm, Congenital anomalies, Cancers, Chronic kidney disease, Chronic Obstructive Pulmonary Disease, Cardiovascular diseases, Pneumocconiosis

Center: **2 million deaths; 53 million DALY in 2019**

DEADLY FLOW
As many as 81 rivers and tributaries of India have extremely high concentration of one or more trace and toxic heavy metals, says a study by Central Water Commission, released in August 2024. The heavy metals detected beyond safe limits included arsenic, cadmium, chromium, copper, iron, lead, mercury and nickel

Water quality monitoring stations where:
- Only 1 heavy metal found above limit (104)
- 2 heavy metals found above limit (28)
- 3 heavy metals found above limit (8)
- 4 heavy metals found above limit (1)
- Major Rivers
- Basins not covered
- State borders

source: "Status of Trace and Toxic Metals in Rivers of India (January to December 2022)", Central Water Commission August 2024

3. Persistent Chemicals in Ecosystems

- **'Forever Chemicals' :** Compounds like PFAS (Per- and Polyfluoroalkyl Substances) are found in water, food, soil and animals. PFAS are linked to severe health issues such as cancer, autoimmune diseases and kidney dysfunction.

Yet no check on growth
Projected growth in global chemical sales (excluding pharmaceuticals) in 2017-2030

Legend: European Union, Rest of Europe, North American Free Trade Agreement, Lat in America, China, Japan, Rest of Asia, Rest of the world

Left chart (€ 3·47 trillion in 2017): 1·4%, 15·6%, 3·2%, 20·1%, 4·4%, 14·9%, 37·2%, 3·1%

Right chart (€ 6·6 trillion in 2030): 1·0%, 2·7%, 10·7%, 14·7%, 3·2%, 13·8%, 4·0%, 49·9%

Note: DALY is disability-adjusted life-years; EUR 3·47 trillion is approximately US $3·66 trillion; EUR 6·6 trillion is about $ 6·95 trillion
Source: World Health Organization; Global Chemicals Outlook II by UNEP

- **Global Presence :** Pollutants like DDT and other pesticides banned decades ago still contaminate remote ecosystems, including ocean trenches and Himalayan glaciers.

4. Indian Context

- **Heavy Metal Contamination in Rivers :** A 2024 study by the Central Water Commission identified 81 Indian rivers with unsafe levels of heavy metals like arsenic, lead, and mercury. Such contamination stems from industrial, agricultural and mining activities.

Key Issues

1. Trade Secret Laws and Public Health Risks :

- Companies advocate for trade secret laws to protect intellectual property, relying on non-disclosure agreements (NDAs) to withhold crucial information.
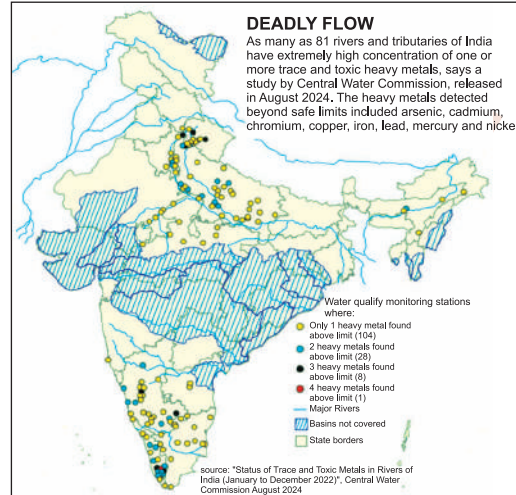
- Misuse of such protections can have dire consequences. For instance, during the Bhopal gas tragedy, Union Carbide Corporation's (UCC) refusal to disclose the chemical composition hindered effective medical treatment for victims.

- This issue is pertinent to India, the sixth-largest chemical producer globally, producing over 80,000 commercial products. However, the nation lacks a robust National Chemical Policy, pending since 2012, and comprehensive regulations like chemical inventories or mandatory registrations.

2. Breaching Planetary Boundaries :

- A 2022 study revealed that Earth's capacity to monitor and assess novel entities is inadequate, making it impossible to manage their environmental impact effectively.

- Chemicals affect various planetary boundaries, such as climate change, through the release of carbon dioxide during production.

- Challenges include bio-accumulation, bio-magnification, and the absence of toxicity thresholds for thousands of chemicals.

3. Complexities in Defining Boundaries :

- Persistence, mobility, and impact on Earth systems complicate the development of a unified threshold for chemical pollution.

- Scientists face limitations in collecting direct samples from industries, leading to delayed identification and response.

4. Global Regulatory Challenges :

- While frameworks like the Planetary Boundary concept highlight chemical pollution's risks, international agreements, such as the Global Plastics Treaty, struggle to enforce production reductions or stringent compliance.

- Resistance from nations and industries underscores the difficulty of balancing industrial needs with environmental preservation.

Recommendations

- **Improved Legislation :** Develop robust chemical safety laws akin to arms regulations, ensuring accountability for hazardous chemical use.
- **Global Cooperation :** Establish binding international treaties to curb chemical production, particularly of persistent and toxic substances.
- **Research and Monitoring :** Enhance global capacity for chemical assessment, focusing on their persistence, bio-accumulation and mobility.
- **Alternative Solutions :** Prioritize research on non-toxic and biodegradable materials for applications like medical use, where plastics remain indispensable.

In Conclusion, Chemical pollution poses a critical threat to environmental and human health, demanding comprehensive action. By addressing regulatory gaps, fostering international cooperation and advancing scientific research, nations can mitigate the adverse effects of chemical proliferation and ensure a sustainable future.

ONE NATION ONE SUBSCRIPTION (ONOS)

ONOS is an initiative to provide access to scholarly research articles in 13,000 journals for 18 million students and researchers in India. India will pay $ 715 million (₹ 6,000 crore) for a three-year subscription starting January 2025. It aims to reduce costs and streamline access through a common digital platform for 6,300 government institutions.

Advantages

1. **Cost Efficiency :** Centralized negotiation reduced costs compared to earlier individual subscriptions. Eliminates duplication and resource wastage.
2. **Wide Access :** Facilitates equitable access to research for students and researchers across institutions.

Concerns

1. **High Cost :** ONOS cost exceeds the earlier estimate of ₹ 1,500 crore per year spent on journal subscriptions.
2. **Missed Alternatives :** Many universities globally have shifted to open access models to promote free access to research and cut costs. Examples include Harvard, MIT and UC, which canceled deals with major publishers like Elsevier.
3. **Lack of Open Access Promotion :** ONOS does not emphasize green, gold, or diamond open access models. Researchers may face additional costs under the 'gold' model, such as Article Processing Charges (APC).
4. **Transparency Issues :** Details of the subscription deal remain unclear, raising concerns about double payments and safeguards for open access.

Global Context

- Developed nations prioritize open access over costly publisher agreements.
- Profit margins of scientific publishers remain extraordinarily high.
- Examples of rejection include :
  - **University of California :** Aimed for universal open access.
  - **MIT :** Advocated for equitable and open dissemination of research.

In Conclusion, While ONOS expands research access in India, its high cost, lack of transparency and missed opportunities for open access raise concerns about its effectiveness as a game changer.

GIST

OF

SCIENCE REPORTER

2025 : THE INTERNATIONAL YEAR OF QUANTUM SCIENCE AND TECHNOLOGY A NEW FRONTIER IN INNOVATION

The International Year of Quantum Science and Technology (IYQ2025) marks a significant milestone in the realm of innovation and scientific discovery. As we approach 2025, the focus shifts toward harnessing the transformative potential of quantum technology, which promises to reshape industries, enhance global security and deepen our understanding of the universe.
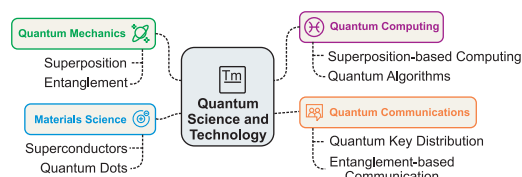
Quantum Science and Technology offer advanced tools such as quantum computing, cryptography and sensing that push the boundaries of traditional science. These technologies are at the forefront of innovation, driving advancements that were once thought to be purely theoretical. From revolutionizing healthcare through quantum imaging to enhancing cybersecurity with quantum encryption, IYQ2025 underscores the profound impact of quantum breakthroughs on various aspects of human life.

The era of quantum science presents a futuristic vision where complex problems are solved with unparalleled precision and new possibilities for sustainable development and exploration are explored. As we enter this transformative phase, quantum technology is poised to become a cornerstone of global progress and innovation.

THE REFLECTION OF QUANTUM

The reflection of quantum theory marks a significant shift in our understanding of the fundamental nature of energy and matter. The quantum model, initiated by Max Planck's groundbreaking work on black body radiation, revolutionized classical physics by introducing the concept that energy behaves both as a wave and a particle.

Unlike classical physics, which primarily focused on wave phenomena, quantum physics incorporates the dual nature of energy—both particulate and wave-like. This shift, driven by the idea of 'discretization', introduced the concept of quanta—distinct packets of energy that cannot be divided into smaller parts.

The introduction of quantum mechanics **addressed complex phenomena** that classical physics struggled to explain, such as the absorption and emission of light, atomic structure, and the behaviour of electrons. By considering energy in discrete units, quantum theory provided a deeper understanding of processes at microscopic levels, laying the foundation for advancements in fields such as quantum computing, quantum cryptography and quantum materials science.

Thus, quantum theory not only reshaped scientific thought but also opened the door to futuristic innovations that continue to challenge traditional boundaries of understanding.

BHARATIYA NIRDESHAK DRAVYAS (BNDs) REVOLUTIONISE INDIA'S QUALITY INFRASTRUCTURE

The Bharatiya Nirdeshak Dravyas (BNDs) are a pioneering initiative spearheaded by the Scientific Measurement Calibration Centre (SMCC) and the Council of Scientific and Industrial Research-National Institute of Science Communication and Policy Research (CSIR-NIScPR). These standardized reference materials are designed to provide a benchmark for precise and accurate measurement across various industries.

Significance of BNDs

Accurate measurement is crucial for maintaining high standards in fields ranging from healthcare to engineering and beyond.

BNDs act as certified reference materials that ensure consistency and reliability in testing and quality control processes. By establishing a uniform standard, BNDs enhance the credibility of Indian products and services in both domestic and international markets.

Impact on India's Economy

With the rapid growth of the 'Make in India' program, the need for quality infrastructure has never been more critical. BNDs enable industries to adopt cutting-edge technologies while maintaining strict quality parameters. This initiative promotes innovation while

ensuring that Indian products meet global standards of quality, thereby boosting competitiveness and export potential.

In Conclusion, The Bharatiya Nirdeshak Dravyas are set to revolutionize India's quality infrastructure by fostering a culture of precision and excellence. As industries continue to evolve, BNDs will play a crucial role in ensuring that Indian innovations are both reliable and globally recognized.

COP29 : STEPPED FORWARD YET MUCH MORE NEEDED

The 29th Conference of the Parties (COP29) to the United Nations Framework Convention on Climate Change (UNFCCC) was held from 11–22 November, 2024 in Baku, Azerbaijan. Marked as the second-largest COP after COP28 in Dubai, COP29 witnessed intense negotiations, particularly around climate finance, extending more than 35 hours past its scheduled conclusion. The conference officially ended on 24 November, 2024.

Key Outcomes of COP29

1. Climate Finance Commitment :
- A landmark agreement to increase annual climate finance for developing nations from $ 100 billion to $ 300 billion by 2035.
- The agreement aimed to address historical delays and meet the urgent financial needs of vulnerable countries.

2. High-Level Events and Thematic Days :
- Discussions focused on crucial issues such as mitigation, adaptation, renewable energy transitions, and loss and damage financing.
- Special emphasis was placed on enhancing partnerships for green technology and sustainable infrastructure.

3. Baku Climate Accord :
- The participating nations committed to revising their Nationally Determined Contributions (NDCs) to align with the goal of limiting global warming to 1·5°C above pre-industrial levels.
- A consensus was reached to phase down unabated fossil fuels, though more concrete deadlines were deferred to future summits.

Challenges Highlighted

- **Slow Progress on Loss and Damage Fund :** Despite pledges, the operationalization of the Loss and Damage Fund remained a contentious issue, with no concrete timeline established for its rollout.
- **Insufficient Measures for Immediate Action :** Critics noted that while financial commitments were increased, immediate measures to reduce emissions and accelerate green transitions were lacking.

In Conclusion, COP29 marked an important step forward in global climate governance, particularly through its enhanced financial commitments. However, significant gaps remain in addressing pressing climate challenges such as rapid emission reductions and the operationalization of support mechanisms. While progress was made, achieving climate justice and meeting the Paris Agreement goals will require sustained efforts and accountability in future COPs.

PURITY IN PERIL : IMPACT OF FOOD ADULTERATION ON PUBLIC HEALTH

The saying 'Health is Wealth' underscores the importance of consuming pure and nutritious food. However, food adulteration, a pressing issue, undermines this basic necessity by compromising food quality with harmful ingredients. This alarming trend has emerged as a significant public health concern in recent years.

Key Issues with Food Adulteration

1. Prevalence in India :
- Food adulteration is widespread, particularly in rural communities, semi-urban regions and urban slums.
- Consumers often unknowingly purchase inferior-quality products at fair retail prices.

2. Commonly Adulterated Items :
- Staples like milk, oil, grains and spices are frequently adulterated.
- Harmful substances such as chemicals, synthetic dyes and non-edible materials are commonly used.

3. Health Impacts :
- **Immediate Effects :** Foodborne illnesses, allergies and digestive issues.
- **Long-Term Effects :** Chronic diseases, including cancer, organ damage and developmental issues in children.

Efforts to Combat Food Adulteration

1. Government Initiatives :
- Implementation of the Food Safety and Standards Act (FSSAI) to regulate food quality.
- Awareness campaigns to educate consumers about detecting adulterated food.

2. Technological Solutions :

- Adoption of rapid testing kits for on-the-spot detection of adulterants.
- Encouraging research in food safety and quality assurance techniques.

3. Public Participation :

- Consumers are urged to report incidents of adulteration.
- Promoting the purchase of certified and labeled food products.

In Conclusion, Food adulteration poses a severe threat to public health and demands immediate attention. Tackling this issue requires a multi-pronged approach involving government regulations, technological advancements and public awareness. Ensuring food purity is not just about individual health but also about fostering a healthier society.

STRANGE HUNTING BEHAVIOUR IN BIRDS

Survival in the animal kingdom revolves around the ability to secure food, requiring a combination of skill, patience and endurance. Birds, like all animals, display fascinating behaviors and adaptations to meet their dietary needs. While most birds rely on nature-given anatomy and hunting instincts, some species exhibit **unconventional and peculiar hunting behaviours**, making them unique in the avian world.

Extraordinary Hunting Techniques in Birds

1. **Tool Usage :** Certain bird species, like crows and woodpecker finches, use tools such as twigs or leaves to extract insects from crevices.
2. **Deceptive Tactics :** Burrowing owls use dung to attract beetles, turning a simple bait into a strategic hunting tool.
3. **Cooperative Hunting :** Birds like pelicans hunt in groups, herding fish into shallow waters to make capture easier.
4. **Unique Prey Targeting :** Species such as **oxpeckers** feed on ticks and parasites found on large mammals, blending feeding with symbiosis.

Strange and Rare Hunting Behaviours

1. **Predatory Songbirds :** Shrikes, known as 'butcher birds', impale their prey on thorns or barbed wires, a method of food storage.
2. **Hunting in Flight :** Birds like swallows and martins capture insects mid-air with precision.
3. **Specialized Diets :** Some birds consume unusual items like rock salts for minerals or even animal excreta, as seen in extreme survival scenarios.

Adaptations Supporting Hunting

- **Anatomical Features :** Sharp talons, hooked beaks, and acute vision aid predatory birds like eagles and hawks.
- **Behavioural Traits :** Patience, stealth, and strategic positioning are critical to successful hunting in birds like herons and kingfishers.

In Conclusion, Birds exhibit an impressive range of hunting behaviours that reflect their adaptability and resourcefulness in the wild. From tool use to cooperative strategies, these behaviours highlight the incredible diversity of avian survival tactics. Understanding these unique behaviours deepens our appreciation for the complexities of nature.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH : EIGHT DECADES OF SUCCESS INSPIRED BY VISIONARY LEADERS

The Council of Scientific and Industrial Research (CSIR) stands as a pillar of Indian scientific innovation and excellence. Over eight decades, it has been instrumental in propelling India's progress in science and technology through groundbreaking contributions that touch diverse sectors.

Major Achievements

1. **Pioneering Innovations :**
- Developed the world's first baby food from buffalo milk.
- Created India's first parallel processing computer.
- Achieved the first complete genome sequencing of an Indian.
- Designed the first indigenous two-seater trainer aircraft.
2. **Expansive Research Network :** Boasts an extensive network of laboratories across the country, addressing issues ranging from health and agriculture to aerospace and environmental science.
3. **Technological Breakthroughs :** Spearheaded projects like green hydrogen production, advanced material research, and AI-driven solutions for societal needs.

Visionary Leadership

Guided by exemplary leaders, CSIR has continuously adapted to evolving challenges, fostering innovation and aligning its goals with national priorities like Make in India and Aatmanirbhar Bharat.

Impact on Society

1. **Economic Development :** Contributions to industries like pharmaceuticals, agriculture and energy.
2. **Global Recognition :** Positioned India as a leader in scientific research and innovation.
3. **Societal Upliftment :** Provided solutions to pressing societal challenges, including clean water, affordable medicines and sustainable energy.

In Conclusion, CSIR's legacy of innovation and dedication to excellence is a testament to its vital role in shaping India's scientific and industrial landscape. As it continues to evolve, its efforts remain a beacon of inspiration for future generations of scientists and innovators.

HANDFISH : GIVING UNDERWATER HIGH-FIVES TO ONE OF THE QUIRKIEST FISHES

Deep beneath the waters of southern Australia and Tasmania resides the handfish, a quirky and intriguing marine creature known for its unusual appearance and behaviour.

Key Characteristics

1. **Family :** Belongs to the Brachionichthyidae family.
2. **Size :** Ranges from a few centimeters to around **15 cm** in length.
3. **Unique Anatomy :** Named for their fin-like hands, which they use to 'walk' along the seabed instead of swimming. Possess a vibrant, camouflaged appearance to blend with their environment.

Habitat and Distribution

- Found exclusively in the waters of southern Australia and Tasmania.
- Prefer shallow, rocky areas and seagrass beds, which provide camouflage and hunting grounds.

Behaviour and Lifestyle

1. **Walking Fish :** Unlike most fish, handfish use their pectoral fins to 'walk' along the ocean floor.
2. **Solitary Creatures :** Tend to live alone and have a slow-paced lifestyle.

Conservation Status

- Several species of handfish are critically endangered due to :
  - ❑ Habitat loss.
  - ❑ Pollution.
  - ❑ Invasive species disrupting their ecosystems.
- Conservation efforts are in place to protect this unique marine species, including breeding programs and habitat restoration initiatives.

In Conclusion, The handfish exemplifies the diversity of life in Earth's oceans and underscores the need for preserving marine biodiversity. Protecting these fascinating creatures is crucial for maintaining the balance of our underwater ecosystems.