EDITORIAL

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India's Growing Focus on Deep Tech Innovation

Introduction

- **Traditional Emphasis**: India's tech sector has primarily focused on **software development** and **consumer internet**.
- **Shift Towards Deep Tech**: Due to global challenges like **climate change** and **healthcare needs**, India is shifting its focus towards **deep tech**—technologies that rely on **scientific and engineering breakthroughs**.
- **Role of Startups**: Indian startups are increasingly leveraging advanced technologies like **AI, robotics, and biotechnology** to create innovative solutions.
- **Government Support**: Initiatives such as the **National Deep Tech Startup Policy** and increased funding for research have bolstered this shift.
- **India's Potential**: With a strong base in **STEM education** and a dynamic **startup ecosystem**, India is well-positioned to emerge as a global leader in deep tech.
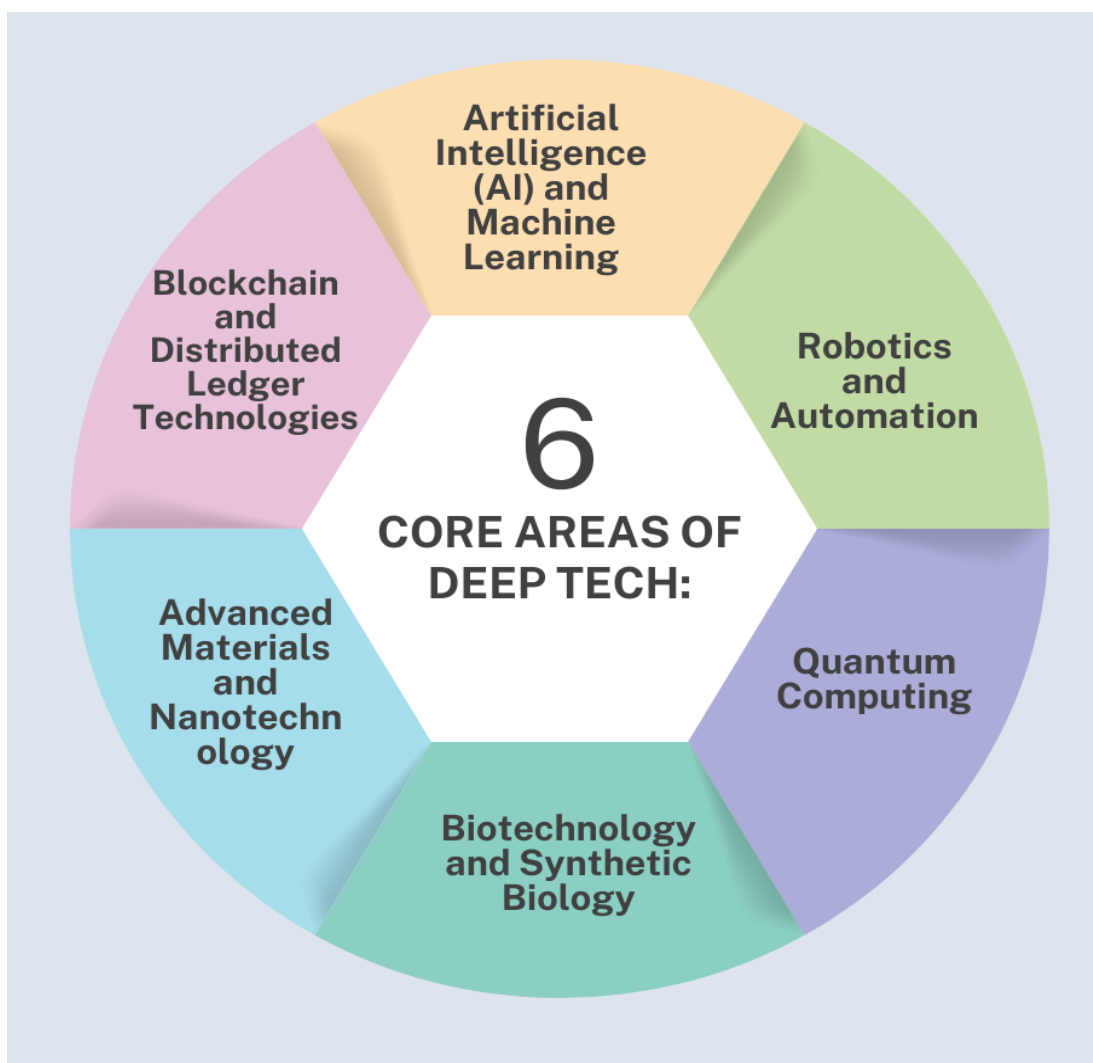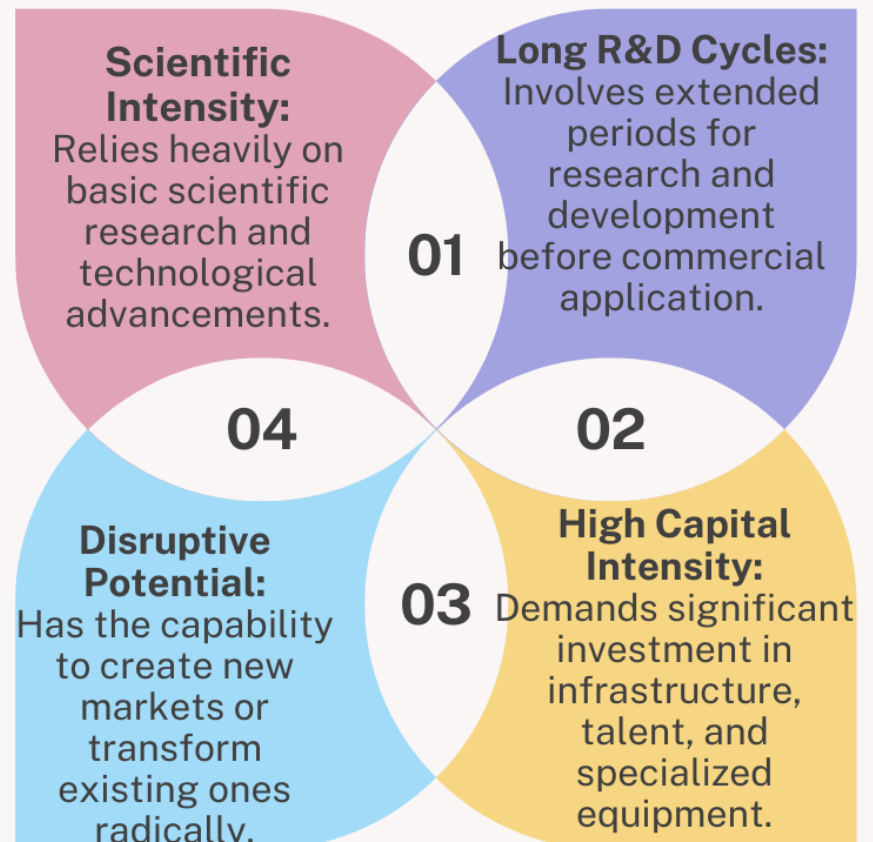
What is Deep Tech?

- **Definition**: **Deep tech** refers to startups that focus on applying **fundamental scientific discoveries** and **engineering innovations** to solve complex problems.
- **Difference from Conventional Tech**: Unlike conventional technology that aims at incremental improvements, deep tech focuses on **disruptive innovations** that require substantial **R&D** and investment.

India's Status in Deep Tech

- **Global Ranking**: India ranks **6th** among the top 9 global deep tech ecosystems with **3,600 startups**.
- **Funding**: In 2023, Indian deep tech startups attracted **USD 850 million** in investments.
- **AI Focus**:
  - **74%** of new deep tech startups in 2023 were focused on **AI**.
  - **86%** of funded startups centered around AI applications.
  - AI accounts for **41%** of all deep tech patents in India.

KEY CHARACTERISTICS OF DEEP TECH

01 — **Scientific Intensity:** Relies heavily on basic scientific research and technological advancements.

02 — **Long R&D Cycles:** Involves extended periods for research and development before commercial application.

03 — **High Capital Intensity:** Demands significant investment in infrastructure, talent, and specialized equipment.

04 — **Disruptive Potential:** Has the capability to create new markets or transform existing ones radically.

6 CORE AREAS OF DEEP TECH:
- Artificial Intelligence (AI) and Machine Learning
- Robotics and Automation
- Quantum Computing
- Biotechnology and Synthetic Biology
- Advanced Materials and Nanotechnology
- Blockchain and Distributed Ledger Technologies

Growth Drivers of Deep Tech in India

1. **Government Policy Push**:
   - **Supportive Policies**: Proactive policies like the **National Mission on Quantum Technologies** and the draft **National Deep Tech Start-up Policy 2023** aim to enhance technological capabilities.
   - **Key Initiatives**:
     - **National Mission on Quantum Technologies and Applications**: Allocated ₹8,000 crore for advancing quantum technologies.
     - **Anusandhan National Research Foundation**: A ₹1 lakh-crore corpus dedicated to multidisciplinary research.
   - **Impact**: These policies provide a favorable environment for deep tech innovations through funding and regulatory support.
2. **Surge in Venture Capital Investments**:

- o **Increased Investment Share**: Deep tech's share in global venture capital investments has doubled from **10% to 20%** over the past decade.
- o **2023 Funding Trends**: Globally, deep tech startups raised **USD 40 billion** despite economic uncertainties.
- o **Indian Scenario**: Startups like **Observe.AI** secured over **USD 214 million** for innovative AI solutions.

3. **Rising Demand for Indigenous Solutions**:
- o **Self-Reliance Initiatives**: India's drive for self-reliance in strategic sectors like **defense** and **space** fuels demand for homegrown deep tech.
- o **Examples**:
  - **Skyroot Aerospace**: Launched the **Vikram-S rocket** in 2022, reflecting indigenous innovation.
  - **ideaForge**: Developing drones for defense and homeland security needs.
- o **Impact**: This demand provides a ready market for deep tech innovations tailored to Indian needs.
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Deep-tech startups flourish

India's deep-tech startups, which deal in advanced technologies such as artificial intelligence (AI), blockchain, Internet of Things (IoT) and more, grew at a compound annual growth rate of 53% last year, said a report by the National Association of Software and Services Companies (Nasscom) last week. The country now has over 3,000 deep-tech startups, which have raised over $2.7 billion last year.
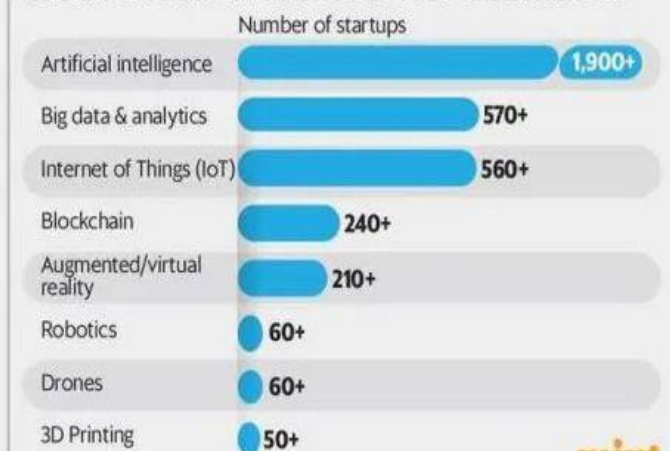
Total deep-tech startups in India: **3,000+**
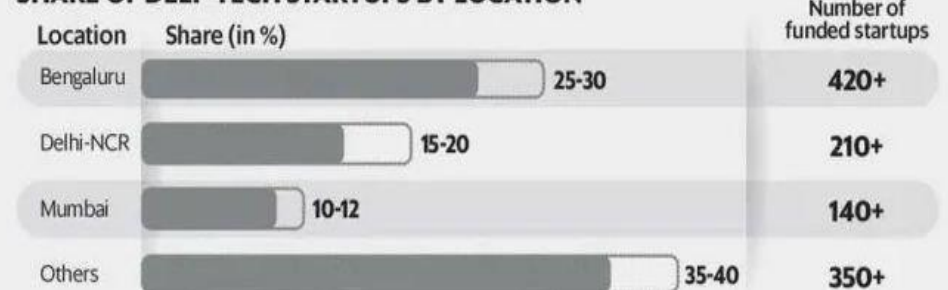
Share of deep-tech startups in India's startup ecosystem: **12%**

Total deep-tech startups added in 2021: **210+**

SHARE OF DEEP-TECH STARTUPS BY TECHNOLOGY
Number of startups
- Artificial intelligence: 1,900+
- Big data & analytics: 570+
- Internet of Things (IoT): 560+
- Blockchain: 240+
- Augmented/virtual reality: 210+
- Robotics: 60+
- Drones: 60+
- 3D Printing: 50+

SHARE OF DEEP-TECH STARTUPS BY LOCATION
Location	Share (in %)	Number of funded startups
Bengaluru	25-30	420+
Delhi-NCR	15-20	210+
Mumbai	10-12	140+
Others	35-40	350+

Source: Deep-Tech ecosystem report by Nasscom, Zinnov

4. **Robust STEM Talent Pool**:
- o **Strong STEM Foundation**: With over **1.5 million engineering graduates** annually, India has a vast pool of technical talent.
- o **Retaining Talent**: Focus is on channeling this talent into deep tech through industry-academia collaborations.

5. **Focus on Solving Grand Challenges**:
- o **Addressing Major Issues**: Startups are increasingly targeting grand challenges in **healthcare, climate change, and sustainable energy**.
- o **Examples**:
  - **Biocon and Syngene**: Leading in genomics and personalized medicine.
  - **Cell Propulsion**: Working on electric mobility solutions.
- o **Impact**: These efforts attract investments and position India as a global leader in problem-solving technologies.

Major Challenges in Deep Tech Development in India

1. **Long Gestation Periods**:
- o **Extended Development Times**: Innovations in deep tech often take years to commercialize, conflicting with typical **3-5 year investment cycles**.
- o **Funding Gaps**: This mismatch creates a funding gap, especially in capital-intensive sectors like **biotech** and **advanced materials**.

2. **Talent Shortage**:
- o **Lack of Specialized Skills**: Despite a large number of STEM graduates, there is a shortage of professionals with deep tech expertise.

- **Brain Drain**: Many skilled professionals migrate to global tech hubs, exacerbating the talent crunch.
3. **Regulatory Challenges**:
    - **Evolving Regulations**: Deep tech often operates in areas where regulations are unclear or rapidly changing, creating uncertainty.
    - **Example**: The drone sector faced shifting regulations between 2018 and 2021, affecting startups' operations.
4. **Market Readiness Issues**:
    - **Advanced Technology Adoption**: Many deep tech solutions are ahead of their time, resulting in low market readiness.
    - **Example**: Quantum computing solutions by startups like **BosonQ Psi** are technically advanced but face limited market demand.
5. **Infrastructure Deficiencies**:
    - **Need for Specialized Facilities**: Deep tech requires sophisticated infrastructure, which is currently inadequate in India.
    - **Current Scenario**: India holds less than **2%** of the world's computer infrastructure.
6. **Intellectual Property (IP) Challenges**:
    - **IP Protection**: Securing and defending intellectual property is a significant challenge due to high costs and slow processes.
    - **Global Position**: India ranks **40th** in innovation (WIPO 2023), indicating room for improvement.
7. **Funding Crunch**:
    - **Drop in Investments**: In 2023, funding for Indian deep tech startups fell by **77%** to **USD 850 million**.
    - **Investor Reluctance**: A reduced investor pool, down **60%** from June 2022, shows a preference for lower-risk ventures.

Measures to Accelerate Deep Tech Development in India

1. **Creating Deep Tech Clusters**:
    - **Specialized Hubs**: Develop deep tech clusters in key cities to foster collaboration between startups, research institutions, and industry partners.
    - **Examples**: Bengaluru for AI and robotics, Hyderabad for aerospace and defense.
2. **Establishing Deep Tech-Focused Venture Funds**:
    - **Long-Term Investment Funds**: Create government-backed funds with longer investment horizons (7-10 years) to support deep tech startups.
    - **Dedicated Allocation**: Use a portion of the **₹10,000 crore Fund of Funds** specifically for deep tech ventures.
3. **Implementing Regulatory Sandboxes**:
    - **Testing Environments**: Set up regulatory sandboxes for sectors like AI, biotechnology, and quantum computing to test innovations with relaxed rules.
4. **Launching Deep Tech Education Initiatives**:
    - **Specialized Courses**: Partner with top institutes to create curricula focused on deep tech fields and industry-sponsored PhD programs.
5. **Building Open Innovation Platforms**:
    - **Collaboration Platforms**: Develop platforms to connect startups, corporates, and academia in sectors like AI for healthcare, similar to the **Global South Covid-19 Digital Innovation Challenge**.
6. **Creating a Deep Tech Commercialization Fund**:

○ **Supporting Market Transition**: Fund the transition from lab research to market-ready products, focusing on areas like **advanced materials, biotechnology, and energy storage**.

7. **Forging Global Deep Tech Alliances**:
   ○ **Strategic Partnerships**: Establish deep tech partnerships with global innovation hubs like **Silicon Valley, Tel Aviv, and Singapore**.
   ○ **Bilateral Initiatives**: Develop **bilateral innovation funds, joint research programs, and talent exchange**initiatives.
   ○ **Example**: The **Indo-Israel Bilateral Workshop on Quantum Technologies (I2QT-2022)** represents a significant step in advancing quantum computing and cryptography.

Conclusion

India's deep tech ecosystem is poised for transformation, driven by its focus on addressing global challenges like climate change and healthcare. To realize its potential, India must adopt a comprehensive strategy involving innovation clusters, patient capital, supportive policies, strong IP frameworks, and talent development. With strategic government support and a strong STEM base, India can emerge as a global leader in deep tech, offering solutions to critical global issues and boosting its economic growth.

MAINS QUESTION

How does the concept of 'deep tech' differ from traditional technology innovation? Discuss its key characteristics and core areas of application. Why is deep tech considered crucial for future technological advancements?