



## EDITORIAL: INDIAN EXPRESS

**GENERAL STUDIES 3: SCIENCE & TECHNOLOGY**

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**TOPIC: AWARENESS IN THE FIELDS OF IT**

### THE SHIFT FROM ECONOMIC DOMINANCE TO TECHNOLOGICAL SUPREMACY

#### The Changing Narrative of Global Power

- In 1992, James Carville's famous slogan, "The economy, stupid," emphasized the importance of economic strength, encapsulating the global power dynamics at the time. However, the narrative of global dominance has evolved in the 21st century. Today, the real race is not about economic size or GDP figures but about technological prowess.
- The ability of nations to excel in frontier technologies like artificial intelligence (AI), quantum computing, genetic engineering, and clean-tech is now the primary determinant of global standing. These technologies are set to drive economic and geopolitical shifts, and countries' success or failure in adopting them will shape their future trajectory.

#### Frontier Technologies and Their Global Importance

##### The Rise of Disruptive Technologies

- Frontier technologies are defined as disruptive innovations with the potential to transform industries, economies, and societies. These technologies address large-scale challenges such as climate change, public health crises, and global economic restructuring. Examples of frontier technologies include AI, robotics, 3D printing, and the Internet of Things (IoT).
- These technologies are redefining manufacturing, agriculture, and trade, while also connecting informal and formal sectors in innovative ways. They are central to efforts aimed at improving government administration, the delivery of public services, and responding to environmental challenges.

##### Applications and Impact on Society

- These technologies offer unprecedented opportunities for societal advancements. For example, in South Korea, the smart city of Songdo is built around IoT to reduce traffic pollution, save energy and water, and create a cleaner environment. On a larger scale, frontier technologies can address climate hazards and air pollution, offering sustainable solutions to global environmental issues. They also have the potential to improve the efficiency and accessibility of essential services, contributing to the goals of the 2030 Agenda for Sustainable Development.



## The Technological Battleground: Quantum Computing as a Case Study

### The Race for Quantum Supremacy

- Quantum computing is one of the most significant frontier technologies, exemplifying the urgent need for nations to invest in and advance their technological capabilities. Google's breakthrough with its quantum chip, Willow, demonstrated the immense potential of quantum computing by solving problems in minutes that would take the fastest supercomputers septillions of years.
- This unprecedented pace of technological advancement underscores the global shift towards quantum supremacy. While the U.S. and China dominate the quantum space, India's progress has been relatively modest. Although initiatives like the National Mission on Quantum Technologies & Applications (launched in 2020 with a \$1 billion budget) have made some progress, India is still far behind global leaders.

### Risks of Delayed Entry into Quantum Technologies

- Quantum computing has wide-ranging applications in fields like AI, space exploration, and genomic research. If India continues to lag behind, it risks missing out on these critical opportunities. Competing in quantum technologies is essential not just for advancing scientific knowledge but also for ensuring national security, economic growth, and global influence. India's slow pace in this field could hinder its ability to influence global technology trends and secure a competitive edge in the coming decades.

### India's Current Standing and Challenges in Frontier Technologies

#### India's Modest Progress and Global Ranking

- India has made strides in areas such as supercomputing, with developments like the Param 8000 and AIRAWAT. However, its standing in the field of frontier technologies, especially quantum computing, remains modest compared to global leaders like the U.S. and China. India ranks 20th in the world in terms of quantum research paper citations and ninth in quantum patent contributions. In contrast, the U.S. and China together control over 85% of global quantum patents. This disparity reflects a need for substantial investments in research, development, and international collaboration to catch up in the global race for quantum supremacy.

#### Investment and Innovation Gaps

- India's challenges lie not only in research output but also in the lack of a robust innovation ecosystem. Despite having a rich intellectual capital, India struggles to convert this potential into groundbreaking technological advancements. To compete globally, India needs to ramp up investments in both AI and quantum infrastructure. This includes not only funding but also fostering collaboration between the public and private sectors to spur innovation and technological breakthroughs.





## Historical Lessons: The Role of Visionary Leadership

### Drawing from Global Historical Examples

- History shows that visionary leadership is essential for driving technological transformation. The United States under Franklin D. Roosevelt's New Deal, the Soviet Union's industrialization under Stalin, and China's reform period under Deng Xiaoping are prime examples of how strategic focus and resource allocation can transform nations. India, too, needs to leverage its current decade of strong leadership to push for a technological revolution. Investments in AI infrastructure and frontier tech should become a national priority, and public-private partnerships must be strengthened to accelerate progress in these areas.

### Building on Existing Strengths

- India's intellectual and technological potential is clear, as evidenced by achievements like Gukesh Dommaraju's chess triumph and its emerging IT sector. However, these strengths need to be harnessed for cutting-edge technologies. India must build on its existing capabilities to secure a strong presence in the global tech race.

## The Opportunity and the Road Ahead

### Harnessing India's Technological Potential

- The digital revolution of the 1980s and 1990s provided the foundation for India's IT industry to thrive. Now, a similar leap forward is possible in AI and quantum technologies. India must seize this window of opportunity by focusing on building a strong technological infrastructure, investing in research, and fostering collaboration between academia, industry, and the government. This is India's chance to join the ranks of global technology leaders and assert its position on the world stage.

### Commitment to Technological Transformation

- To make this leap, the Indian government and private enterprises must commit to a vision of technological transformation. By prioritizing frontier technologies and creating a conducive environment for innovation, India can secure a leading role in the global technological landscape. The time to act is now—delays could result in India missing out on the benefits of technological leadership.

## Conclusion: Seizing the Frontier Tech Opportunity

### A Critical Juncture for India

- India stands at a critical juncture in its pursuit of technological supremacy. While progress has been made in various technological sectors, the speed and scale of global advancements



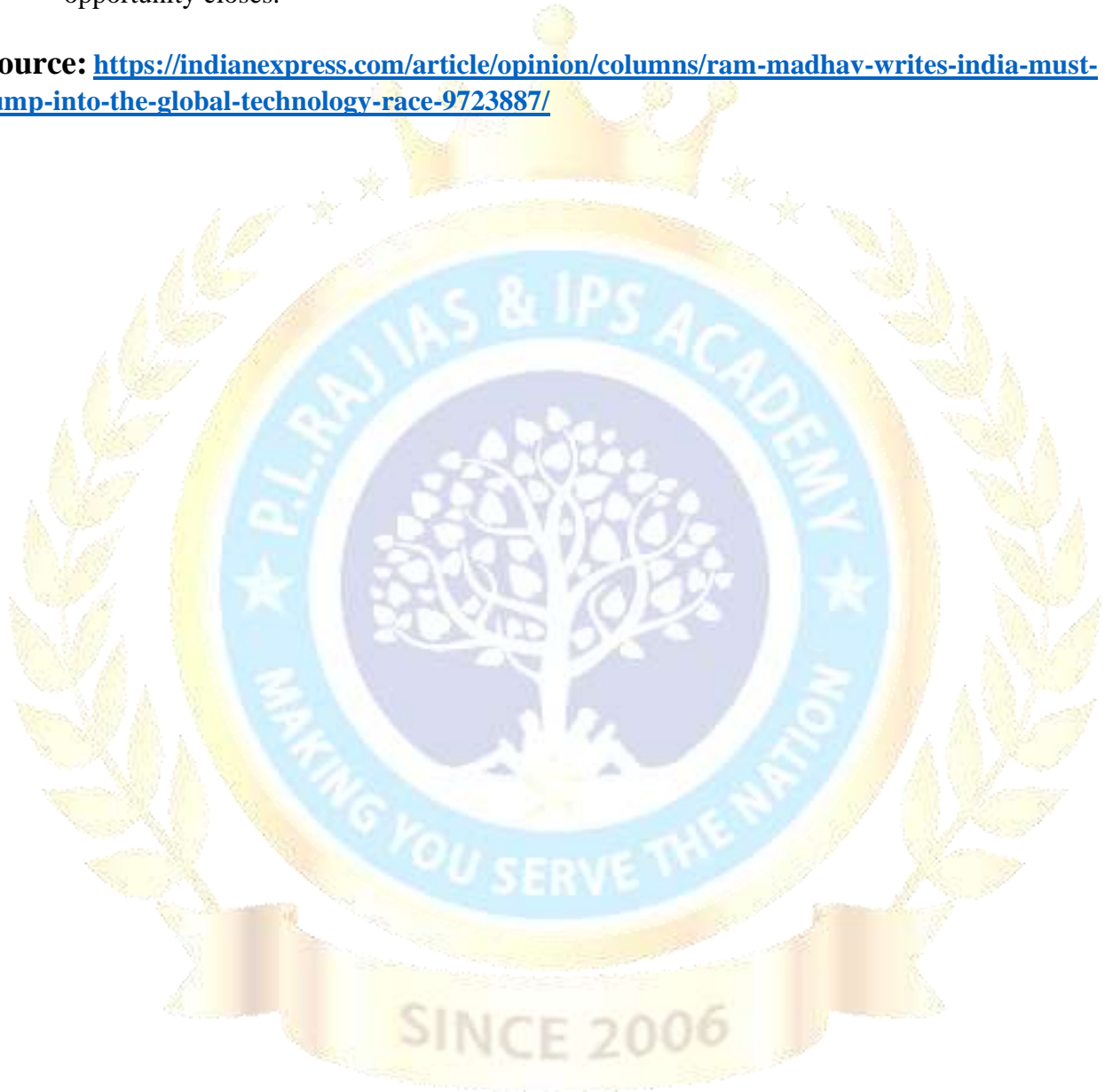
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necessitate a more aggressive approach. By prioritizing AI, quantum computing, and other frontier technologies, India has the potential to leapfrog into the ranks of global tech leaders.

- To do so, the country must build the necessary infrastructure, foster innovation, and ensure that both public and private sectors are aligned in their efforts. This is India's window to define its future trajectory on the global stage, and the time to act is now before this opportunity closes.

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