Science & Technology · GS - III

Examine how technology export controls are reshaping global semiconductor supply chains and creating new challenges for strategic autonomy.

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
15	~250 words

Answer Hint

Semiconductor geopolitics, dual-use technology, export licensing, technology denial, supply-chain fragmentation, end-user verification, strategic autonomy

Model Answer

Advanced semiconductors are critical to artificial intelligence, telecommunications, defence systems and high-performance computing. Their strategic importance has increasingly transformed technology trade into an instrument of geopolitical and national-security policy.

Changing global technology landscape

1. **Strategic competition:** Major powers use export controls to restrict access to advanced chips, semiconductor manufacturing equipment and associated technologies.
2. **Dual-use concerns:** High-performance computing chips can support civilian AI applications as well as military research, surveillance and advanced weapons development.
3. **Supply-chain fragmentation:** Restrictions encourage countries to diversify suppliers, develop domestic manufacturing capabilities and establish technology partnerships.
4. **Transshipment risks:** Intermediaries and third-country entities can conceal the actual destination of controlled products, complicating enforcement.

Challenges for India

India remains dependent on international suppliers for advanced semiconductor manufacturing equipment and high-end chips. Fragmentation can increase procurement costs, delay technology access and expose domestic industries to geopolitical disruptions. At the same time, trusted technology partnerships create opportunities for investment and capability development.

Policy priorities

1. Strengthen domestic semiconductor design, fabrication, packaging and testing capabilities.
2. Develop robust end-user verification, customs monitoring and export-control compliance mechanisms.
3. Diversify international technology partnerships rather than depending on a limited supplier base.
4. Invest in research, skilled manpower and indigenous computing capabilities.

India's Semiconductor Mission and participation in international technology partnerships can support these objectives.

Conclusion: Strategic autonomy does not require technological isolation. It requires the domestic capacity and diversified partnerships necessary to withstand external restrictions while participating in global innovation networks.

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