Science & Technology · GS - III

Evaluate the implications of semiconductor export controls for global technology supply chains and the pursuit of technological self-reliance.

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
15	~250 words

Answer Hint

Semiconductor geopolitics, export restrictions, supply-chain vulnerabilities, technological sovereignty, domestic manufacturing, strategic interdependence

Model Answer

Introduction

Semiconductors are critical inputs for artificial intelligence, telecommunications, defence and modern industries. Their strategic importance has made access to advanced chips and manufacturing technologies an instrument of geopolitical and economic competition.

Implications of Export Controls

1. **Strategic competition:** Restrictions on advanced chips and manufacturing equipment can limit the technological capabilities of rival countries, particularly in artificial intelligence and defence.
2. **Supply-chain disruptions:** Globally distributed production networks face uncertainty, higher compliance costs and potential shortages.
3. **Domestic capacity building:** Restrictions encourage governments to invest in indigenous semiconductor fabrication, research and chip-design capabilities.

4. **Technological fragmentation:** Competing technology ecosystems may emerge, reducing interoperability and increasing production costs.
5. **Strategic interdependence:** Countries controlling critical stages such as lithography, chip design and fabrication acquire significant geopolitical leverage.

India's Opportunities and Challenges

1. **Opportunities:** India's semiconductor initiatives, design talent and expanding electronics manufacturing base provide opportunities to strengthen its position in global supply chains.
2. **Challenges:** High capital requirements, technological complexity, dependence on imported equipment and shortages of specialised skills constrain self-reliance.

Way Forward

1. Strengthen semiconductor research, skilled workforce development and domestic manufacturing.
2. Diversify international partnerships while maintaining access to global technology networks.
3. Promote trusted supply chains through cooperation with technologically advanced partners.

Conclusion

Export controls highlight the strategic importance of semiconductor security. India must pursue technological self-reliance through domestic capacity building while preserving constructive international interdependence.

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