Science & Technology · GS - III

Assess the implications of strategic export controls on advanced semiconductor technologies for global technology supply chains and international security.

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
15	~250 words

Answer Hint

Export controls, dual-use technology, semiconductor supply chains, technological interdependence, national security, technological decoupling

Model Answer

Introduction

Advanced semiconductors are critical inputs for artificial intelligence, telecommunications, defence systems and advanced computing. Consequently, their export has become an important instrument of national security and strategic competition.

Strategic and Security Implications

1. **Restricting military applications:** Export controls can prevent advanced chips and manufacturing technologies from being diverted towards military modernisation or surveillance capabilities.
2. **Protecting technological advantages:** Restrictions on high-end processors and semiconductor equipment can help countries preserve strategic advantages in critical technologies.
3. **Regulating sensitive transfers:** Restrictions on re-exports, intermediaries and end users seek to prevent circumvention through third countries.

Impact on Global Supply Chains

1. **Fragmentation:** Restrictions can encourage competing technology ecosystems, increasing costs and reducing interoperability.
2. **Supply-chain uncertainty:** Semiconductor manufacturers face regulatory complexity, market disruptions and investment uncertainty.
3. **Indigenous innovation:** Restrictions may encourage affected countries to develop domestic semiconductor manufacturing and alternative technologies.
4. **Third-country pressures:** Southeast Asian trading hubs may face greater scrutiny over transshipment and compliance with export-control regulations.

Way Forward

1. Strengthen multilateral coordination and transparent end-use verification.
2. Distinguish genuinely sensitive technologies from ordinary commercial products.
3. Maintain predictable regulations to minimise unintended disruption to legitimate trade.
4. Promote resilient and diversified semiconductor supply chains.

Conclusion

Strategic export controls can address legitimate security concerns, but excessive restrictions risk fragmenting global technology networks. A coordinated, proportionate and transparent framework is essential to balance national security with technological cooperation.

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