# GeoPolitics of Technology

Technology is no longer a neutral business enabler; it is the hard infrastructure of power. Control over semiconductors, energy systems, minerals, compute infrastructure, cyber capabilities, space assets, and defense platforms increasingly determines national sovereignty, corporate survivability, and strategic autonomy. This course reframes technology as **material capability embedded in contested geopolitical systems**, deliberately avoiding a narrow focus on software, platforms, or regulation.

Designed for second-year MBA/PGDM students, the course equips future leaders to think and act in a fragmented, multipolar world shaped by techno-nationalism, export controls, cyber conflict, and alliance realignment -- particularly in the context of **India's 2047 strategic horizon and evolving India - EU industrial convergence**.

## Course Objectives

By the end of the course, students will be able to:

- Identify technological chokepoints that shape geopolitical power
- Understand how states and corporations co-evolve around critical technologies
- Anticipate and respond to geopolitical shocks affecting technology-intensive businesses
- Make strategic decisions under uncertainty using structured simulations
- Communicate complex geopolitical–technology arguments with clarity and rigor

## Pedagogical Structure

The course is organized into **four pillars**, each comprising:

- Two **technology deep-dive sessions**
- One **players & politics session**
- One **Matrix Game** aligned to that pillar – *See Annexure A to know what is this game*

This is supplemented by an introductory framing session, a live-case "slack" session, an external speaker, and a final synthesis session. 20 sessions, 30 hours, 3 credits.

# Session Plan

### Session 1 – Introduction - *The Geopolitical CEO*

This opening session confronts students with a world undergoing a tectonic shift -- driven not by movements of the earth's plates, but by technological forces reshaping the foundations of global power. Institutions that once stabilized globalization, such as the UN, WTO, and the post-GATT trade regime, are weakening, while a growing number of regional and interest-based groupings -- such as the G7, BRICS, G20, RCEP, CPTPP, QUAD, and AfCFTA -- are emerging along new strategic fault lines. What appears on the surface as political fragmentation is presented as the consequence of deeper technological stresses involving semiconductors, energy systems, digital infrastructure, and military capabilities.

Students are introduced to a strategic environment in which **efficiency and innovation alone no longer guarantee advantage**. Instead, resilience, strategic autonomy, and control over critical technologies increasingly determine national power and corporate survival. Core concepts include techno-nationalism, supply-chain weaponization, the return of industrial policy, and the structural limits of globalization as it evolved over the past three decades. The session reframes the modern executive as a geopolitical actor and introduces the Matrix Game methodology that will be used throughout the course to simulate decision-making in this fractured, technology-driven global landscape.

**References :**


- World Economic Forum – *Global Risks Report 2025* https://www.weforum.org/publications/global-risks-report-2025/
- Navigating the New Geopolitics of Tech


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## Pillar I – The Silicon Foundation

### Session 2 – Tech I – *Lithography, Logic, and Manufacturing Power*

This session examines why semiconductors sit at the base of all modern technological power. Students explore lithography -- especially EUV -- as the decisive manufacturing chokepoint, and understand how logic nodes translate into economic, military, and AI advantage. The discussion focuses on why semiconductor leadership is difficult to replicate and why time, capital, and ecosystem depth matter more than intent.

**References:**

- ASML – *EUV Lithography Explained*
  https://www.asml.com/en/products/euv-lithography-systems
- CSIS – *Mapping the Global Semiconductor Supply Chain*
  https://www.csis.org/analysis/mapping-semiconductor-supply-chain-critical-role-indo-pacific-region

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## Session 3 – Tech II – *Advanced Packaging and Memory*

As chips have become smaller and faster, the main limits to performance are no longer inside the chip itself, but in how chips are assembled and how quickly they can move data. This session explains why modern computing power -- especially for AI -- now depends on advanced packaging techniques that connect multiple chips together, and on high-speed memory systems that can feed data fast enough to keep processors busy. Students will learn how technologies such as chip stacking and high-bandwidth memory shape real-world performance, and why these less visible components have become critical "bottlenecks" in scaling AI and advanced computing.

**References:**

- TSMC – *3DFabric Advanced Packaging Overview*
  *3DFabric | TSMC*
- Beyond Moore's Law: Why Advanced Packaging Matters | SemiWiki
- The Status of Moore's Law: It's Complicated - IEEE Spectrum

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## Session 4 – Players & Politics – *The Silicon Axis: US–Taiwan–Europe–India*

This session maps the geopolitical landscape of the semiconductor industry. Students analyze the interdependence between the US, Taiwan, Europe, and East Asia, with particular attention to Europe's gatekeeping role through equipment and materials. India's semiconductor ambitions are examined alongside the strategic implications of an emerging India–EU industrial partnership.

**References:**

- Government of India – *India Semiconductor Mission*
  https://www.ism.gov.in/
- European Commission – *European Chips Act Explained*
  https://digital-strategy.ec.europa.eu/en/policies/european-chips-act

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### Session 5 – Matrix Game I – *The Silicon Fracture*

In this simulation, participants confront an abrupt escalation in export controls affecting lithography, packaging, and advanced chips. Teams representing states and firms must decide whether to relocate manufacturing, enforce IP controls, or realign alliances. The game reinforces the idea that semiconductor power is structural, slow-moving, and politically constrained.

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## Pillar II – The Energy–Mineral Floor

### Session 6 – Tech I – *Critical Minerals and Refining Chemistry*

This session explains why access to raw materials alone is not enough to support modern energy systems and advanced manufacturing. Students explore the role of rare earth elements and battery minerals in electrification and clean energy, and learn why the most critical capability lies in the complex chemical processes required to refine and process these materials into usable forms. The discussion shows how control over refining and processing capacity -- rather than mining alone -- creates long-term strategic advantage and has become a significant source of geopolitical leverage.

**References:**


- International Energy Agency – *The Role of Critical Minerals in Clean Energy Transitions* https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions
- *Rare Earths Statistics and Information | U.S. Geological Survey*
- Rare Earth Supply Chain: Importance, Challenges, and Opportunities
- Rare earth elements: Sector allocations and supply chain considerations - ScienceDirect


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### Session 7 – Tech II – *Energy Systems for Industrial-Scale Compute*

As artificial intelligence and large data centers expand, the limiting factor is no longer software or hardware alone, but the availability of reliable and continuous electricity. This session examines how power requirements, grid capacity, and the need for steady baseload generation shape where large-scale computing can operate. Students will explore why major technology firms are increasingly focused on energy infrastructure -- including nuclear power and small modular reactors -- as long-term solutions, and how access to dependable energy is becoming a decisive factor in digital and AI competitiveness.

**References:**

- What are Small Modular Reactors (SMRs)? | IAEA
- Information Library - World Nuclear Association
- Gartner Says Electricity Demand for Data Centers to Grow 16% in 2025 and Double by 2030
- In focus: Data centres – an energy-hungry challenge - Energy

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### Session 8 – Players & Politics – *Resource Power and Energy Diplomacy*

This session examines how states weaponize energy and mineral dependencies. China's dominance in refining, Russia's energy leverage, Europe's green reindustrialization, and India's overseas mineral strategy are analyzed as competing responses to resource insecurity. The session emphasizes long-term structural leverage rather than short-term price shocks.

**References:**

- Ministry of Mines (India) – *National Critical Minerals Mission*
  https://www.pmindia.gov.in/en/news_updates/cabinet-approves-national-critical-mineral-mission/
- IRENA – *Geopolitics of the Energy Transition*
  *Geopolitics of the energy transition: Energy security*

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### Session 9 – Matrix Game II – *The Energy Chokepoint*

Participants face a cascading disruption across mineral refining and energy supply chains. Decisions must balance industrial continuity, alliance obligations, and strategic stockpiling. The game illustrates how energy and materials impose hard limits on economic and technological ambition.

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## Pillar III – Sovereign Compute and Cyber Power

### Session 10 – Tech I – *Compute Density and National AI Infrastructure*

This session explains why computing power itself has become a strategic resource, similar to energy or industrial capacity. Students explore how large numbers of specialized processors (GPUs) are physically clustered together, connected by extremely high-speed networks, and operated as national or sovereign AI infrastructure. The discussion shows why advanced AI systems depend less on clever algorithms alone and more on access to large, concentrated pools of computing power, making physical infrastructure, location, and control over compute a central determinant of AI capability and competitiveness.

**References:**

- NVIDIA – *AI Supercomputing Architecture Overview*
  *MGX Platform for Modular Server Design | NVIDIA*
- Stanford HAI – *AI Index Report 2025*
  *The 2025 AI Index Report | Stanford HAI*

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## Session 11 – Tech II – *Cyber Infrastructure: Attack and Defense*

This session explains cyber conflict by focusing on the physical and operational systems that make digital activity possible, rather than on individual acts of hacking. Students examine how data centers, undersea cables, satellites, industrial control systems, and embedded software can be disrupted, defended, or controlled during geopolitical confrontation. The discussion highlights how cyber attacks and cyber defenses are used to apply pressure, signal intent, and gain advantage without open warfare, making them central tools in modern "gray-zone" conflict.

**References:**

- Homepage - NCS Guide 2025
- NATO CCDCOE – *Cyber Power and National Security*
  *CCDCOE*
- CISA – *Critical Infrastructure Security & Resilience*
  *Critical Infrastructure Security and Resilience | Cybersecurity and Infrastructure Security Agency CISA*

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## Session 12 – Players & Politics – *DPI, Cyber Power, and Global Alignment*

This session explores how large-scale digital infrastructure -- such as payment systems, identity platforms, and data networks -- can shape geopolitical influence and international partnerships. Students examine India Stack as a model for building national digital systems that reduce dependence on global technology platforms, and compare this with Europe's efforts to retain control over its digital and industrial base. The session also looks at how investment from the

Gulf and the export of digital infrastructure are influencing alliances across the Global South, which is increasingly becoming a competitive arena for technology-driven alignment.

**References:**

- India Stack – *Digital Public Infrastructure Overview* *India Stack*
- Carnegie Endowment – *Digital Public Infrastructure and the Global South*
- The Future of Digital Public Infrastructure: A Thesis for Rapid Global Adoption | Carnegie Endowment for International Peace

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### Session 13 – Matrix Game III – *The Compute Blackout*

A coordinated cyber and infrastructure disruption restricts access to compute and financial rails. Teams must decide whether to escalate, decouple, or negotiate. The game reinforces the fragility of digital power when physical infrastructure is contested.

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## Pillar IV – Software-Defined Security & Strategic Conflict

### Session 14 – Tech I – *Autonomous Systems, Precision Strike & Cyber Ops*

Earlier sessions treat cyber power as infrastructure coercion; this pillar examines cyber operations integrated with kinetic and autonomous warfare. This session examines how modern warfare is being reshaped by the integration of physical systems and digital intelligence. Students explore the use of autonomous drones, precision-guided munitions, and AI-driven targeting systems, alongside offensive and defensive cyber operations that disrupt sensors, communications, and command systems. The focus is on how sensor fusion and real-time data processing compress decision cycles, allowing forces to detect, decide, and strike faster than adversaries. Military effectiveness is shown to depend less on sheer force and more on coordination between physical platforms and cyber capabilities.

**References:**

- Transforming the Multidomain Battlefield with AI: Object Detection, Predictive Analysis, and Autonomous Systems (Military Review) — https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2024-OLE/Multidomain-Battlefield-AI/
- Are Drones a Maneuver Force? The Evolving Role of Unmanned Vehicles on the

Battlefield (Military Review) — https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2025-OLE/Are-Drones-a-Maneuver-Force/
- Dilemmas in the policy debate on autonomous weapon systems | SIPRI

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## Session 15 – Tech II – *Space, Satellites, and Network Resilience*

This session focuses on the infrastructure that enables modern, technology-driven warfare. Students analyze satellite constellations, especially low-Earth orbit (LEO) systems, as well as subsea cables, terrestrial networks, and backup architectures that carry data, positioning, and communications. The discussion highlights orbital chokepoints, network redundancy, and the vulnerability of both space-based and ground-based systems to kinetic and cyber attacks. Space is treated not as a separate battlefield, but as an extension of terrestrial power that underpins navigation, targeting, communication, and economic activity.

**References:**

- ISRO – *Space Vision 2047*
- India outlines space vision: Own station by 2035, on Moon by 2040, a developed nation in sector by 2047 - The Tribune
- NASA – *LEO Economy and Commercial Space Strategy* https://www.nasa.gov/leo-economy/

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## Session 16 – Players & Politics – *Defense Indigenization and Strategic Autonomy*

This session explores how countries seek greater independence in defense technology in response to geopolitical uncertainty and shifting alliances. Students examine India's iDEX initiative and Europe's renewed focus on defense innovation as efforts to reduce reliance on foreign suppliers and legacy systems. The discussion highlights a shift away from large, slow-moving weapons platforms toward software-driven, modular, and upgradeable systems, where control over code, integration, and supply chains increasingly determines strategic autonomy.

**References:**

- Ministry of Defence (India) – *iDEX Framework* https://idex.gov.in/
- European Defence Agency – *EU Defence Innovation Landscape*

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- [Discover the EDA activities]

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### Session 17 – Matrix Game IV – *The Networked Battlefield*

A regional conflict escalates through a combination of autonomous drone swarms, precision strikes, cyber intrusions, and attacks on satellite and communication networks. Civilian infrastructure, defense command systems, and commercial space assets are simultaneously targeted. States and firms must decide how to defend networks, maintain operational continuity, and respond to escalation without triggering uncontrolled conflict.

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## Synthesis & Closure

### Session 18 – Slack / Live Case

Students apply course frameworks to a real-time geopolitical technology event, developing rapid analysis and strategic recommendations under uncertainty.

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### Session 19 – External Speaker

A capstone session with a senior strategist from government, defense, or global technology leadership, linking classroom concepts to real-world decision-making.

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### Session 20 – Conclusion

### *The Executive Resilience Playbook (2027–2032)*

The final session synthesizes insights across all four pillars, translating them into a strategic playbook for executives operating in a volatile, technology-driven geopolitical environment.

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## Evaluation Scheme

- **Matrix Games (Team-Based): 30%**

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- **Two Individual Term Papers: 70%**
  Presented as **two YouTube-style video podcasts**
  - Mid-term Podcast: 25%
  - Final Podcast: 45%

# Annexure: The Matrix Game

A Matrix Game is a structured strategic simulation in which outcomes are driven by logic, argument, and plausibility rather than by fixed rulebooks or predefined move sets. Participants propose actions on behalf of their assigned actors and must justify those actions through clear, causal reasoning -- explaining *why* the action should work in the real world. An Umpire evaluates the strength of the argument, weighs counter-arguments from other players, and assigns probabilities of success. A dice roll then introduces uncertainty, reflecting the role of chance, friction, and incomplete information in real geopolitical decision-making. If the argument is sound and the roll goes in its favor, the action succeeds.

### 1. Core Structure & Process

- **The Setup:** Each team receives a **Scenario** (the crisis), a **Brief** (Assets, Objectives, Constraints), and a **Map** of the technical/geopolitical theater.
- **The Turn Sequence:**
    1. **Action:** A team proposes a move with **three supporting reasons**.
    2. **Counter:** Opponents provide reasons why the move might fail.
    3. **Adjudication:** The Umpire weighs "Pros" vs. "Cons" to set a success probability (e.g., 4+ on a 6-sided die).
    4. **Outcome:** A die roll determines if the world state permanently updates.

### 2. 5-Team Example: "The Silicon Fracture"

*Teams: US, India, Nvidia, SpaceX, ASML - All examples are illustrative and do not represent actual institutional positions.*

- **Round 1 (Survival): Nvidia** moves R&D to India; **US** threatens IP revocation. *Result: Success (Roll 5).* R&D moves, but friction rises.
- **Round 2 (Infrastructure): India** attempts a lithography plant with **ASML**; **ASML** cites labor shortages. *Result: Failure (Roll 3).* The plant is delayed.
- **Round 3 (Dominance): US** tries to nationalize **Nvidia** clusters; **India/Nvidia** mount a joint legal defense. *Result: Success (Roll 6).* Nationalization fails; an Indo-Nvidia pole emerges.

### 3. The Hybrid "Centaur" Umpire – *different from the traditional format*

- **LLM Role:** Acts as the **Engine of Logic**, processing trade laws and tech specs to provide an instant, data-driven "Probability Score."
- **Human Role (Professor):** Acts as the **Engine of Context**, overriding or fine-tuning the AI’s score based on subtle political nuances or course-specific lessons.

### 4. Remote Play: Meet + WhatsApp – *different from the traditional format*

- **The Private Backchannel (WhatsApp):** Each team uses a private group for internal strategy and secret "diplomatic cables" to other teams.
- **The Public Stage (Google Meet):** Used as the plenary for formal arguments, screen-sharing the "Live Map," and rolling the die.
- **Visualization:** A shared Google Slide or Miro board tracks asset movements and territory changes in real-time.