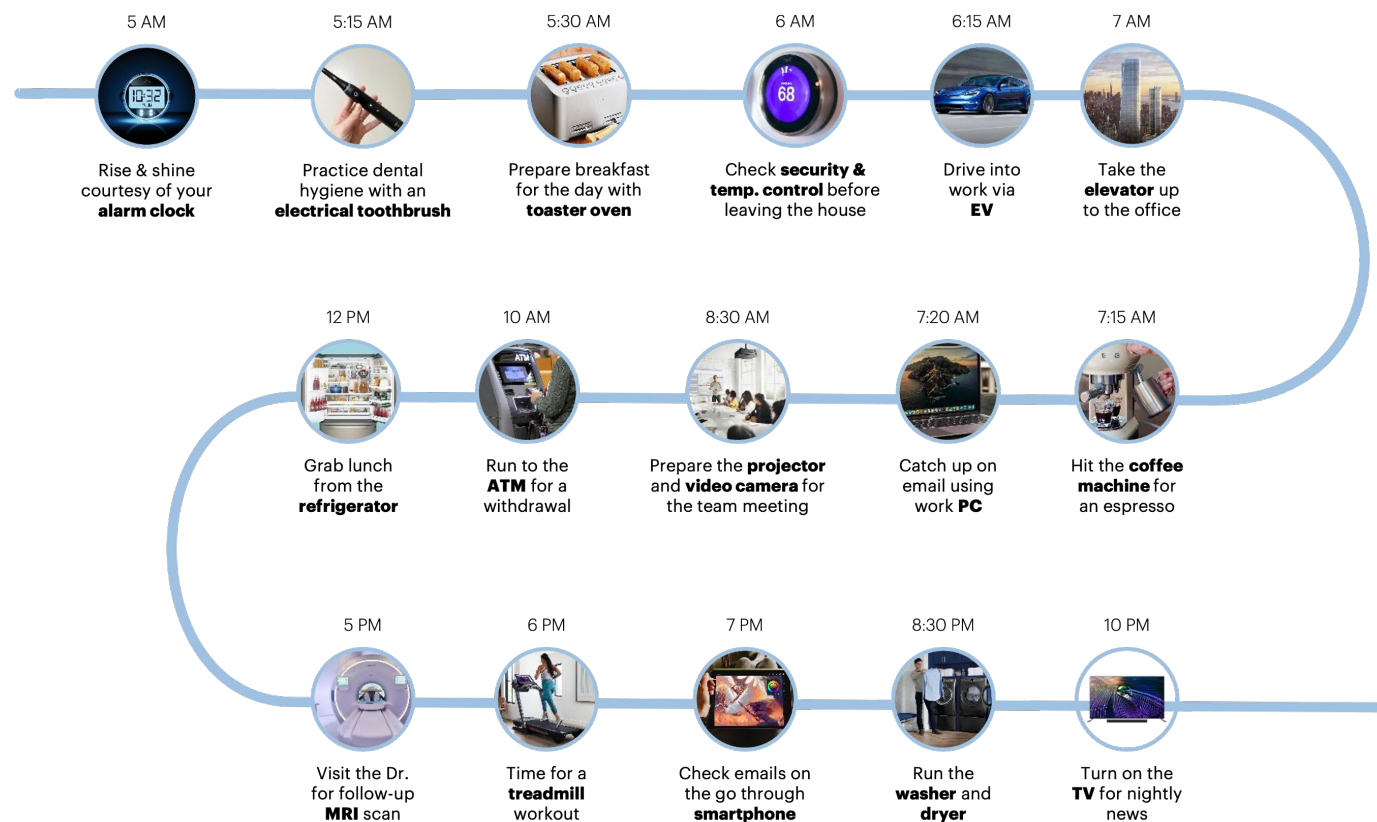# Hundreds of industries are feeling the pinch of the ongoing global chip shortage, because semiconductors are ubiquitous

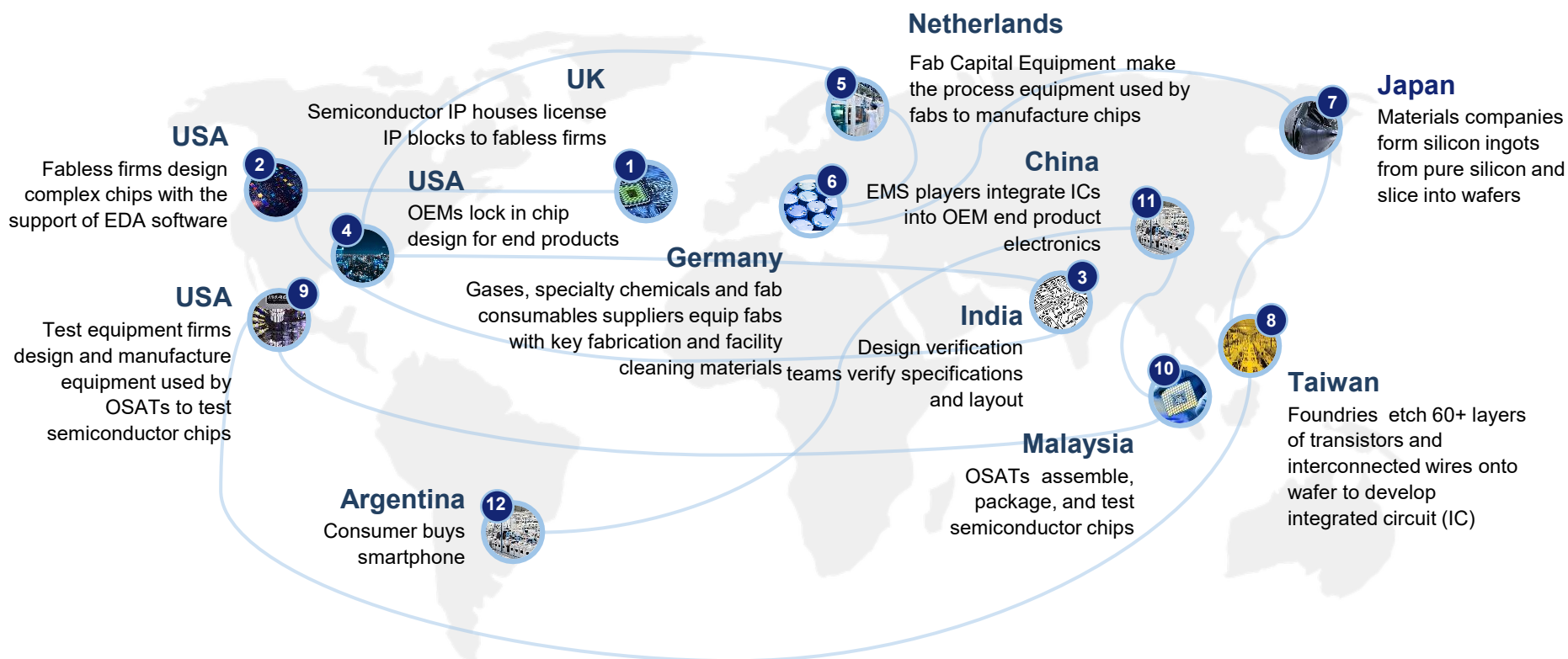Chips have become extremely pervasive in our daily lives

**5 AM** — Rise & shine courtesy of your **alarm clock**

**5:15 AM** — Practice dental hygiene with an **electrical toothbrush**

**5:30 AM** — Prepare breakfast for the day with **toaster oven**

**6 AM** — Check **security & temp. control** before leaving the house

**6:15 AM** — Drive into work via **EV**

**7 AM** — Take the **elevator** up to the office

**12 PM** — Grab lunch from the **refrigerator**

**10 AM** — Run to the **ATM** for a withdrawal

**8:30 AM** — Prepare the **projector** and **video camera** for the team meeting

**7:20 AM** — Catch up on email using work **PC**

**7:15 AM** — Hit the **coffee machine** for an espresso

**5 PM** — Visit the Dr. for follow-up **MRI** scan

**6 PM** — Time for a **treadmill** workout

**7 PM** — Check emails on the go through **smartphone**

**8:30 PM** — Run the **washer** and **dryer**

**10 PM** — Turn on the **TV** for nightly news

Supply chain fragility **pre-dated** the current COVID-induced chip shortage

Increasing complexity and costs have organically moved the industry towards **specialization**

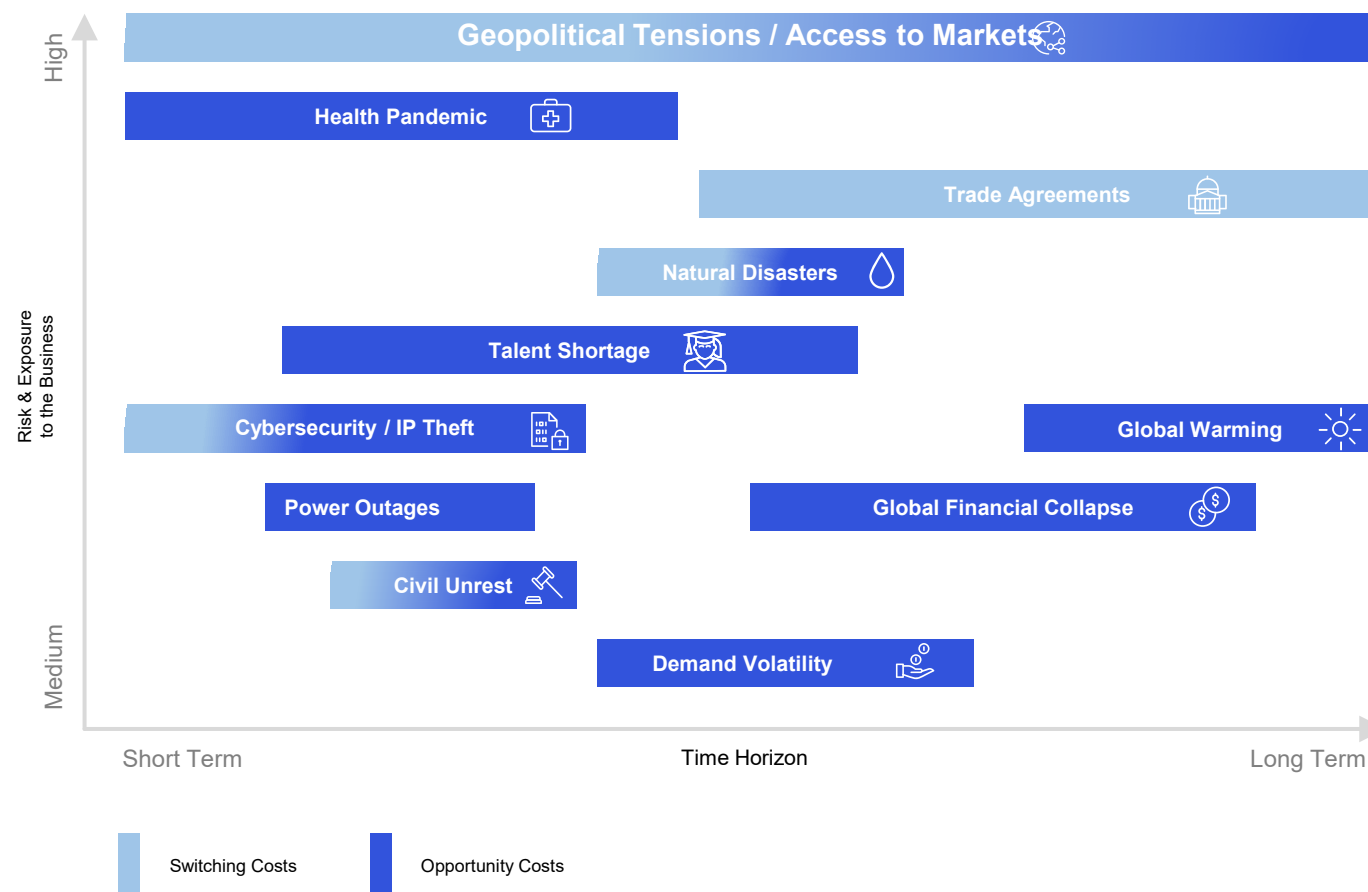Sustained semiconductor innovation requires closer **collaboration** among global ecosystem players

# The industry has evolved into a deeply complex, interconnected web of global partners working to produce one semiconductor chip

**Netherlands**
Fab Capital Equipment make the process equipment used by fabs to manufacture chips

**UK**
Semiconductor IP houses license IP blocks to fabless firms

**Japan**
Materials companies form silicon ingots from pure silicon and slice into wafers

**USA**
Fabless firms design complex chips with the support of EDA software

**USA**
OEMs lock in chip design for end products

**China**
EMS players integrate ICs into OEM end product electronics

**Germany**
Gases, specialty chemicals and fab consumables suppliers equip fabs with key fabrication and facility cleaning materials

**India**
Design verification teams verify specifications and layout

**USA**
Test equipment firms design and manufacture equipment used by OSATs to test semiconductor chips

**Taiwan**
Foundries etch 60+ layers of transistors and interconnected wires onto wafer to develop integrated circuit (IC)

**Malaysia**
OSATs assemble, package, and test semiconductor chips

**Argentina**
Consumer buys smartphone

Note: Above depicts one illustrative flow within the global semiconductor value chain

# Even the industry's leading semiconductor companies find themselves vulnerable to key short- and long-term risks

Risk & Exposure to the Business (vertical axis, High to Medium)

Time Horizon (horizontal axis, Short Term to Long Term)

- Geopolitical Tensions / Access to Markets
- Health Pandemic
- Trade Agreements
- Natural Disasters
- Talent Shortage
- Cybersecurity / IP Theft
- Global Warming
- Power Outages
- Global Financial Collapse
- Civil Unrest
- Demand Volatility

Legend:
- Switching Costs
- Opportunity Costs

## Key Callouts

**Cybersecurity & IP theft threat,** though commonly referenced in the media, poses **comparatively lower risk** due to immense effort required to **reverse-engineer design**

**Obstructed access to markets** as a result of geopolitical tensions emerges as the **highest-risk bottleneck** to the semiconductor value chain

Insufficient **talent supply threatens R&D and design leadership,** particularly as STEM talent flock to hyperscalers, startups, and finance