Techno-nationalism: Geo-economics Implications

The impact of techno-nationalism on the economy and security

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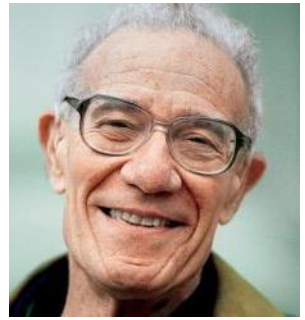
Technology's Role as the Fundamental Driver of Economic Development

- Robert Solow: Nobel Prize 1987
  Technology Drives of Economic Growth
  - Developed first exogenous models of economic growth



- Paul Romer: Nobel Prize 2019
  Endogenous Technological Change
  - Increasing human capital and global integration increases growth
  - "Endogenous Technological Change" was published in 1990 and provided a model showing how technological change was driven by the allocation of resources to knowledge creation. It showed that over time, more and more of societies resources should be dedicated to knowledge creation.

Semiconductors have been the main driver of technology advancement

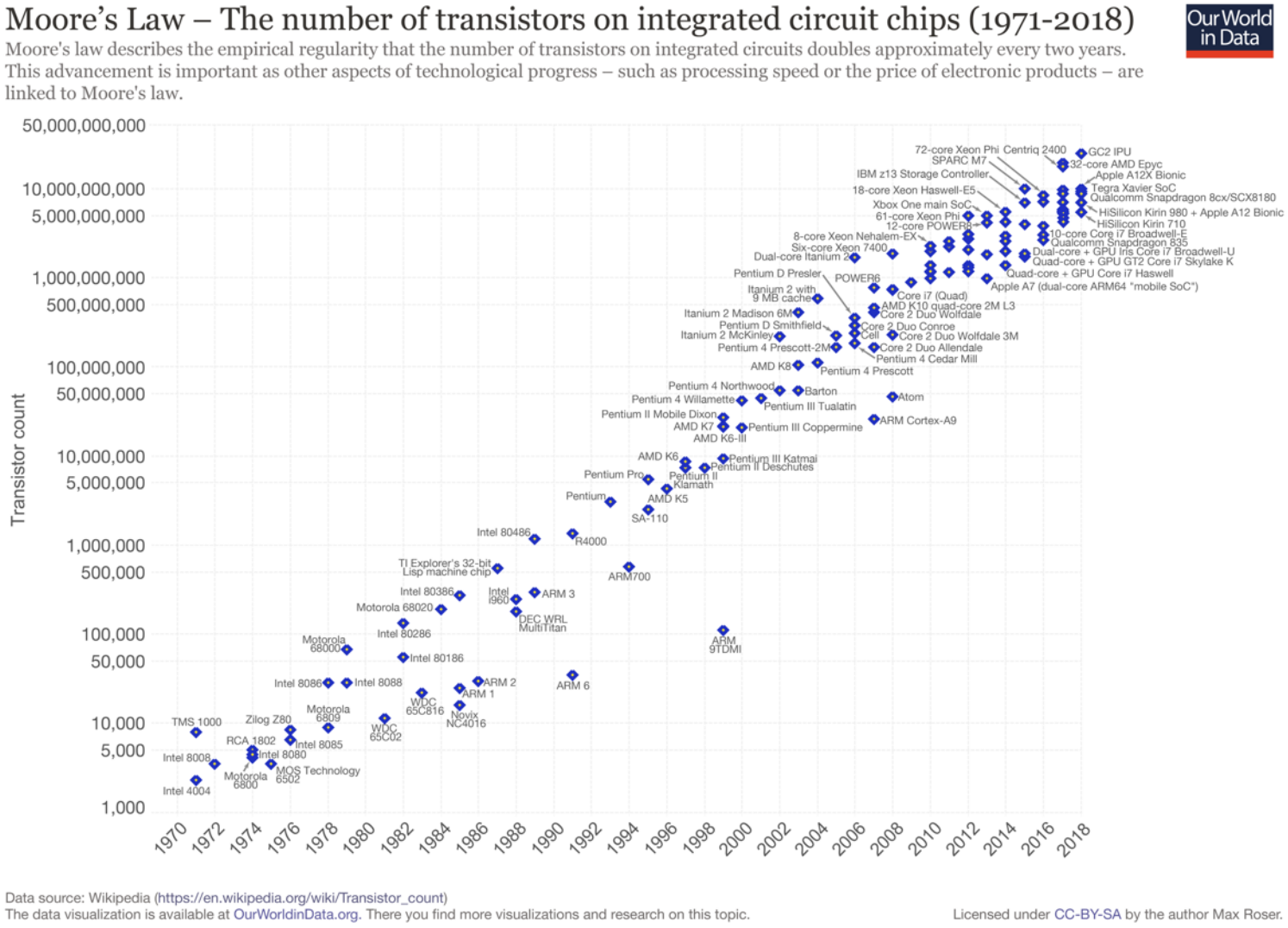
Moore's Law:

Transistor count doubles every 24 months

Result:

10,000,000 x improvement over 50 years

Driver of all other technology advances



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Semiconductors: Leading the Techno-Nationalism Trend

- Only three companies are at the cutting edge: TSMC, Samsung, Intel
  - Japan committed to creating a 4th competitor, Rapidus
- Huge investments by all leading economies -> heavy industrial/competitive policy,
  - Rivaling cold war policies of industrial development and containment
  - Huge Direct Gov't Semiconductor Investments: USA, Europe, China, India, Japan, etc.
- End of Moore's Law: It is slowing, but still going strong. Forecasts of "end of Moore's Law" have been wrong for decades
- Recent Semiconductor Progression: Driven by ASML Lithography technology
  - Deep UV Lithography – up to ~10 nanometer
  - Extreme UV Lithography – up to ~1 nanometer
  - High NA EUV Lithography – below ~1 nanometer
- Many other semiconductor advancements are under development:
  - Advanced packaging, materials, power, etc.
  - Optical Computing: chip interconnects and optical logic processing
  - Neuromorphic Computing: device-level neural tech, including memristors
  - Quantum Computing

What Digital Technologies are Driving Development?

Technology	Description	
1. Semiconductors	Foundational technology driving all others	**Current Technologies**
2. Broadband Communications	Mobile networks (5G), undersea cables, satellite networks, etc.	
3. Smartphones/devices	Low-cost personal devices for broad public internet access	
4. Digital Identification	Critical for deploying personal digital services	
5. Digital Payments	Critical for enabling digital commerce	
6. Cloud Computing	Enables data storage and processing without physical infrastructure	
7. Internet of Things (IoT)	Low-cost sensors that collect data from everyday life	
8. Artificial Intelligence	Traditional AI and generational AI (LLMs, etc.) built on big data and massive computing	
9. Robotics/Drones	Using intelligent systems to power autonomous machines	
10. Cybersecurity	Improving the privacy and security of users	
11. Space Technology	Using satellite and drone imagery for planning and analysis tasks	
12. Genetics	Genetic sequencing and editing for health and agriculture	**Emerging Technologies**
13. Quantum	Quantum computing, comms, encryption, etc.	
14. VR/AR	Virtual and Augmented Reality	
15. Human-Computer Interfaces	New computing interfaces, including direct brain connections like Neuralink	
15. Artificial General Intelligence	AI systems that can perform like humans	

Genetic Technology Example

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Genetic Sequencing – Exponential Improvement

- Gene sequencing technology is on a steep exponential improvement curve (steeper than Moore's Law)
- The Carlson Curve shows a doubling of performance every 12 months, compared to 24 months with semiconductors

Potential for Low-cost Sequencing

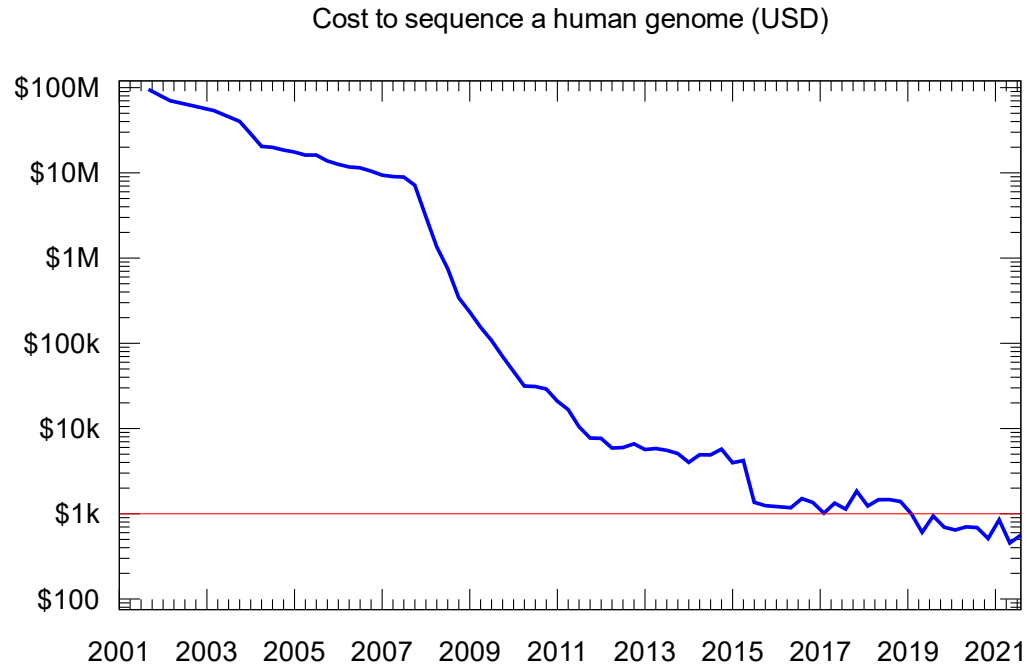
- Low-cost sequencing will enable rapid improvements in healthcare and agriculture
- Healthcare: Sequencing will enable improved diagnosis and treatment of diseases. For example, new cancer treatments will be based on identifying the specific mutations in a tumor instead of using common treatments for broad classes of cancers.
- Agriculture: Sequencing will enable improved plant breeding and improved diagnosis and treatment of plant diseases and pests.

Advanced Technologies

- Crispr Gene Editing, Synthetic Biology, Epigenetics, Protein engineering, etc.

Carlson Curve:

Cost to sequence a human genome halves every 12 months
100,000 x improvement in 17 years



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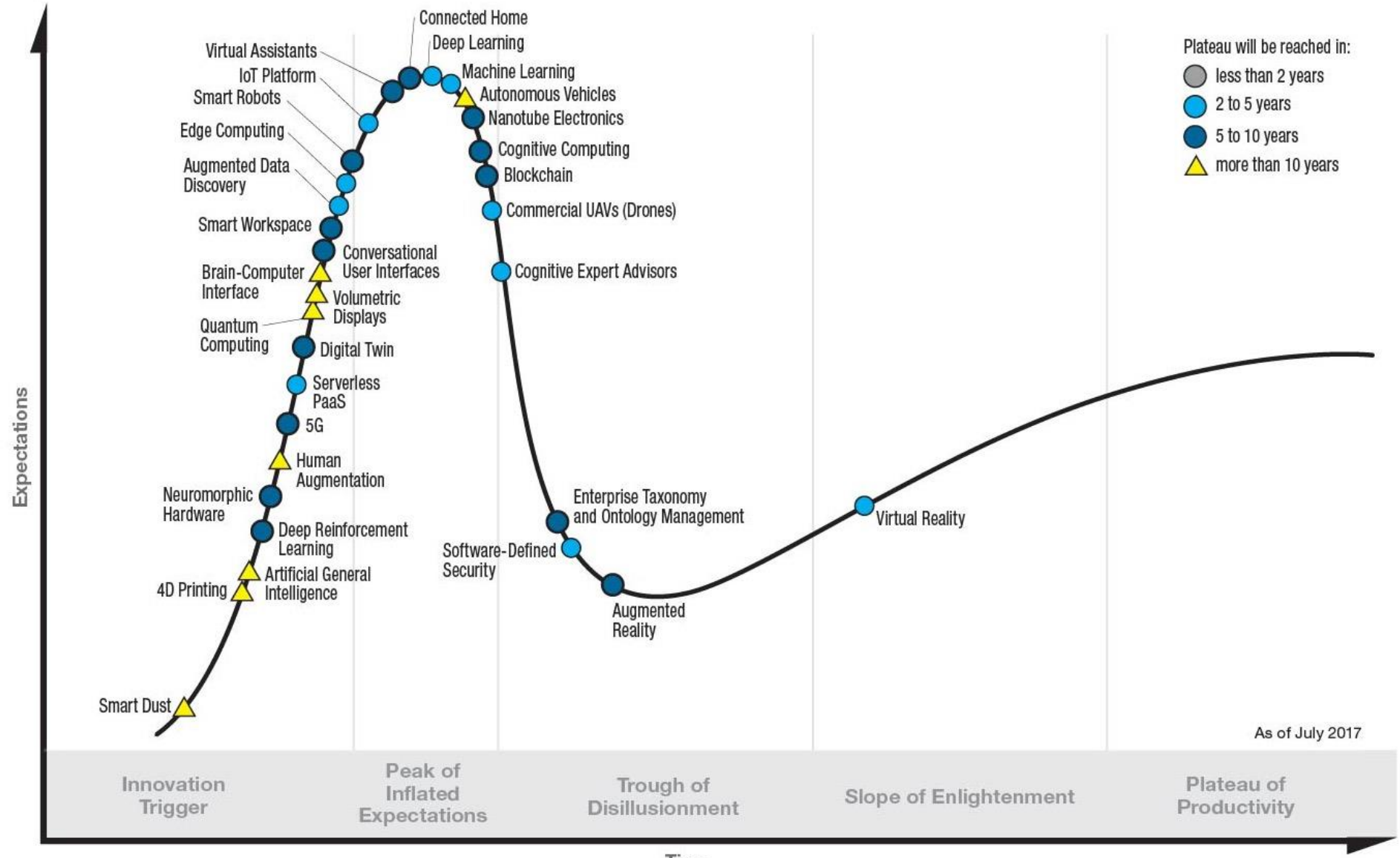
Hype Cycles: Standard Gartner Hype Cycle



National Tech Strategy Examples

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Korea

- Started journey from complete devastation following Korean War
- Heavy government involvement: Universities, Tech Startups, National Champions,
- Focus on external markets due to small domestic market
- Heavy focus on advanced technologies and human capital

India

- Major battleground country for global tech platforms – largest consumer market
- Gov't tech stack: Aadhaar, UPI
  - Government provides basic services that enable robust
- Reliance Jio as national champion driving low-cost, high speed mobile network
- Strong tech startup ecosystem
- Strong coupling with leading US tech platforms (Microsoft, Google, Amazon, etc.)

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National Policy Levers for Digital Technologies

- **Human Capital**: This is the most important, but requires very long-term perspective and must be done carefully to avoid career mismatch for grads
- **Policy:** Social/employment protection, cyber-security, data privacy, anti-monopoly, digital public infrastructure, education, R&D funding
- **R&D Infrastructure:** Universities are key, but also international partnerships and potential leverage of security/military funds
- **Universities:** Balance between large-scale education objectives versus developing leading institutions in specific areas
- **Tech Startups:** These require a complex ecosystem: universities, incubators, accelerators, VC's, gov't support, etc.
- **Platforms:** Need to balance opportunities to partner with global leaders against desire for local competitors
- **National Tech Leaders**: Local market dynamics offset against competition in global markets

ADB Program: PRIMESTEP

Supporting Indonesia's Tech Ecosystem

- University Science and Technology Parks
  - Support advanced research and development facilities in four university Science and Technology Parks
- Increase research and innovation
  - Improve technology transfer and commercialization of research and development,
  - Create an enabling environment for academia-industry collaborations on research
- Strengthen the startup incubation ecosystems
  - Improve startup ecosystem economic value chain

Thank You!

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