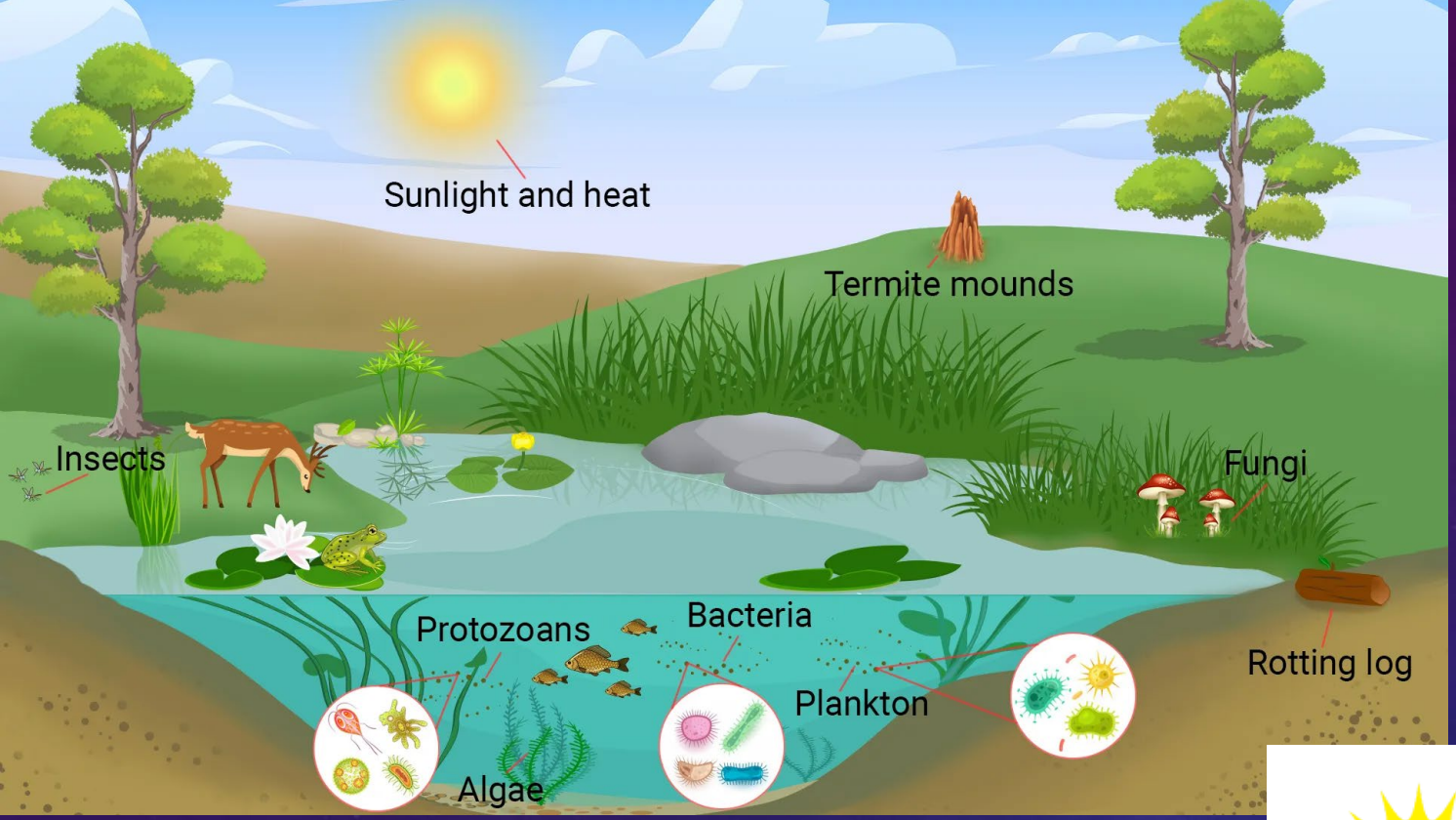
미국의 양자 생태계 현황

2025. 01. 09.

한-미 양자기술협력센터

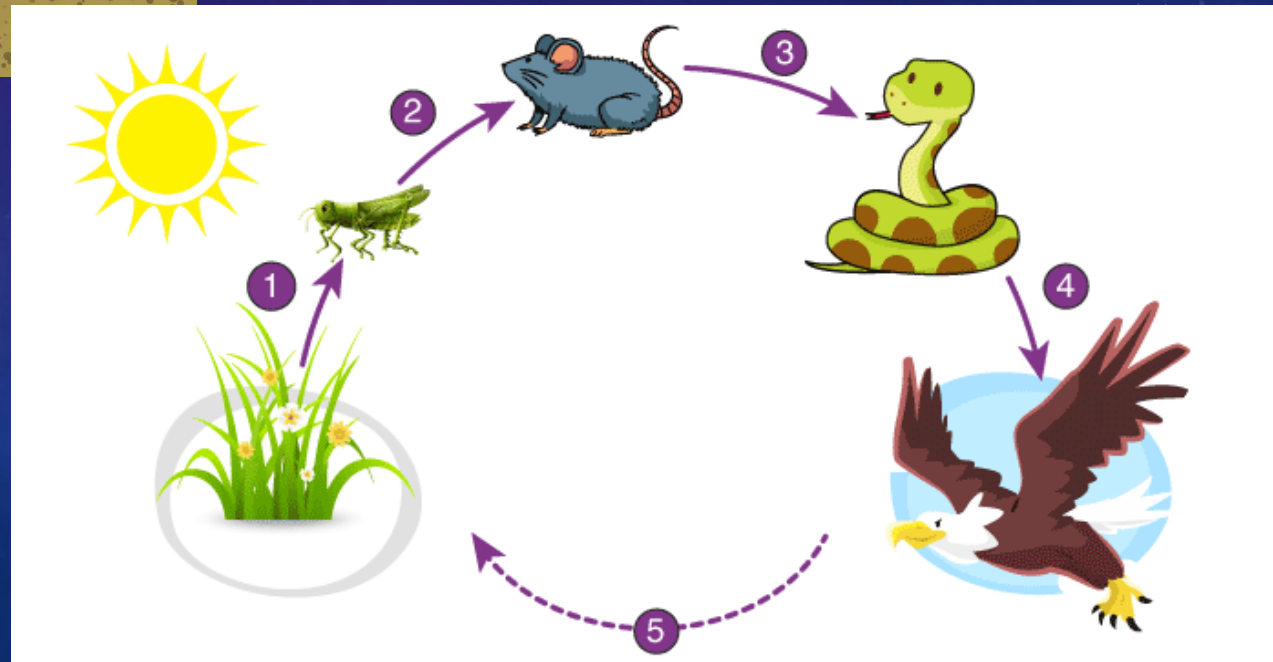
정윤채

Ecosystem

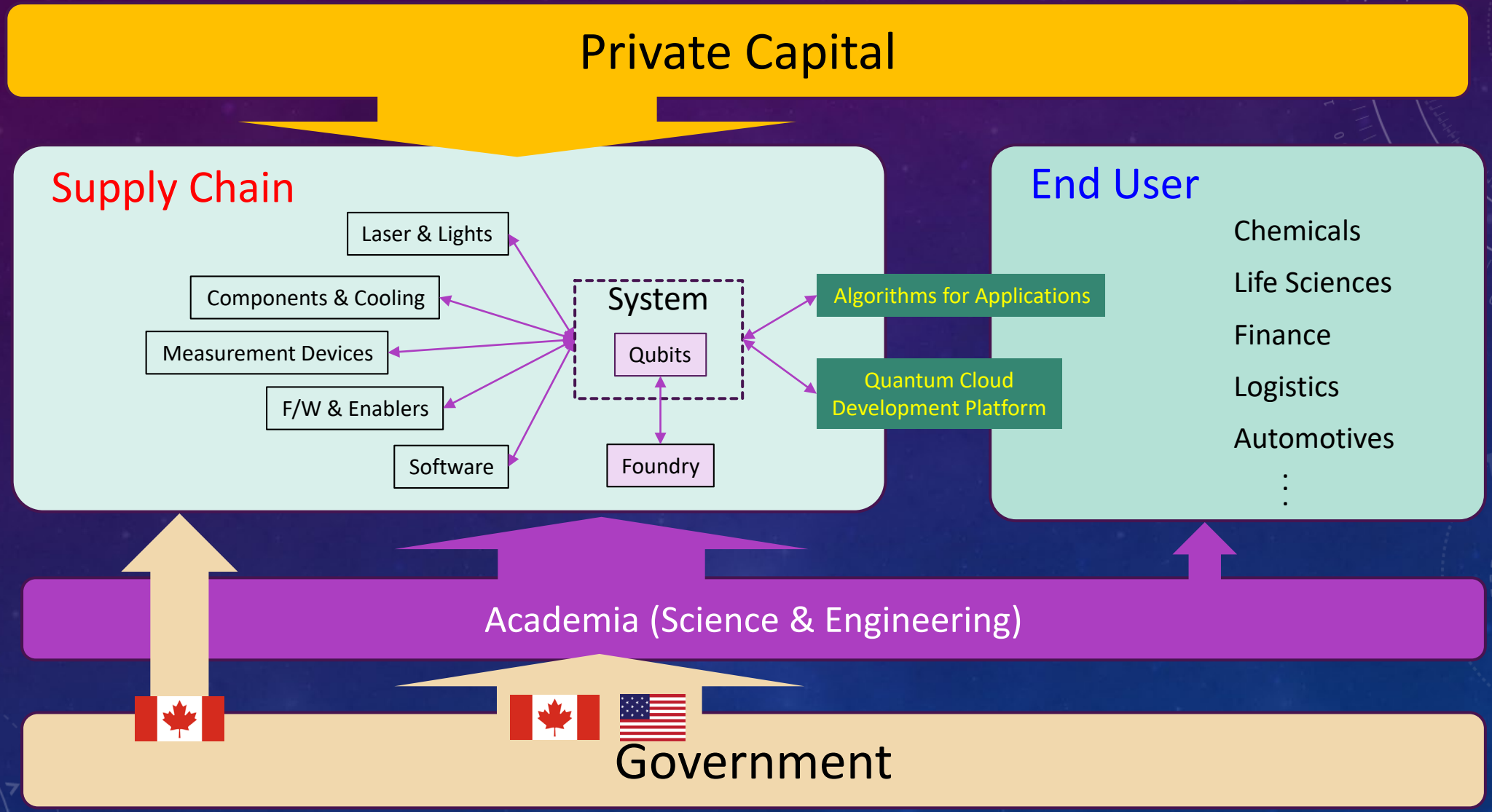


Ecosystem is “Interactive”

Food Chain

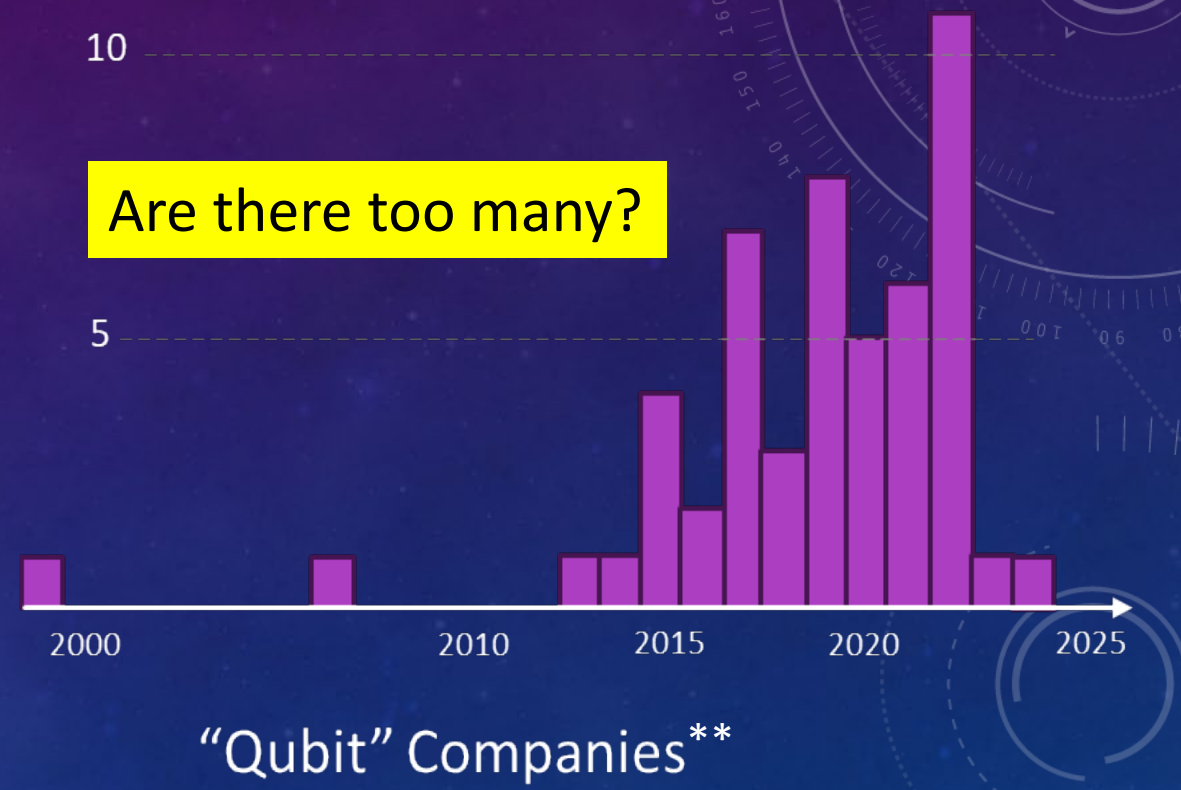


Quantum Ecosystem (computing)



Quantum Ecosystem – Investment & Qubits

Startup Investment*

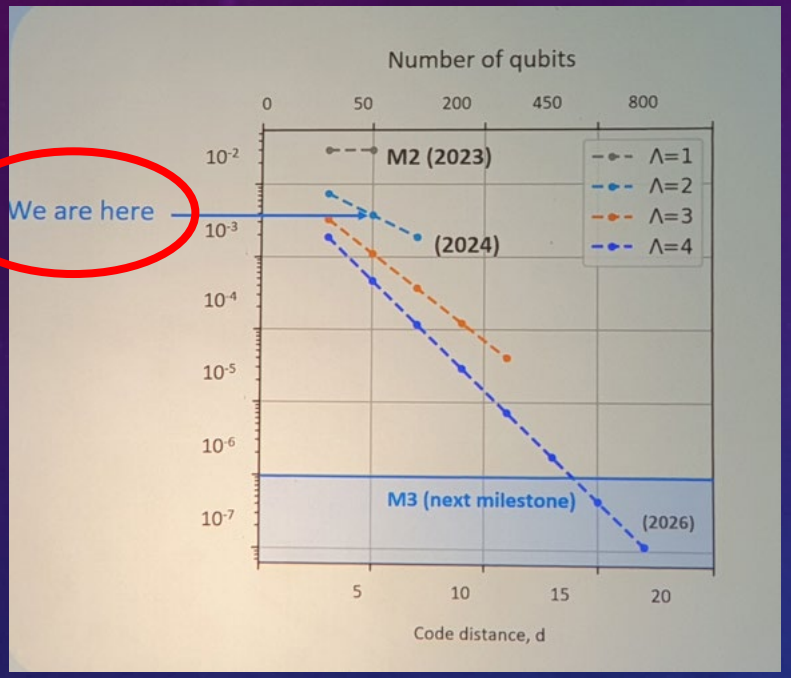


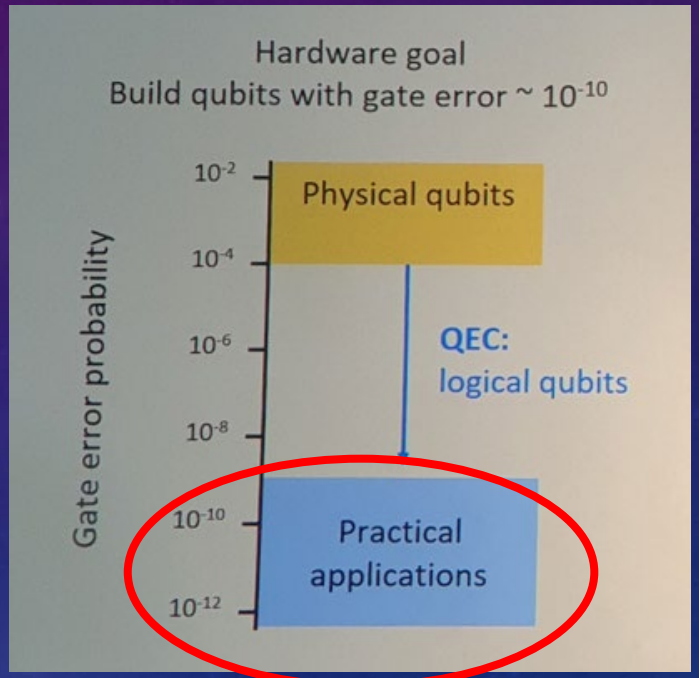
"Qubit" Companies**

* McKinsey Report 2024
** The Quantum Insider

Quantum Ecosystem – Qubits

Error Correction



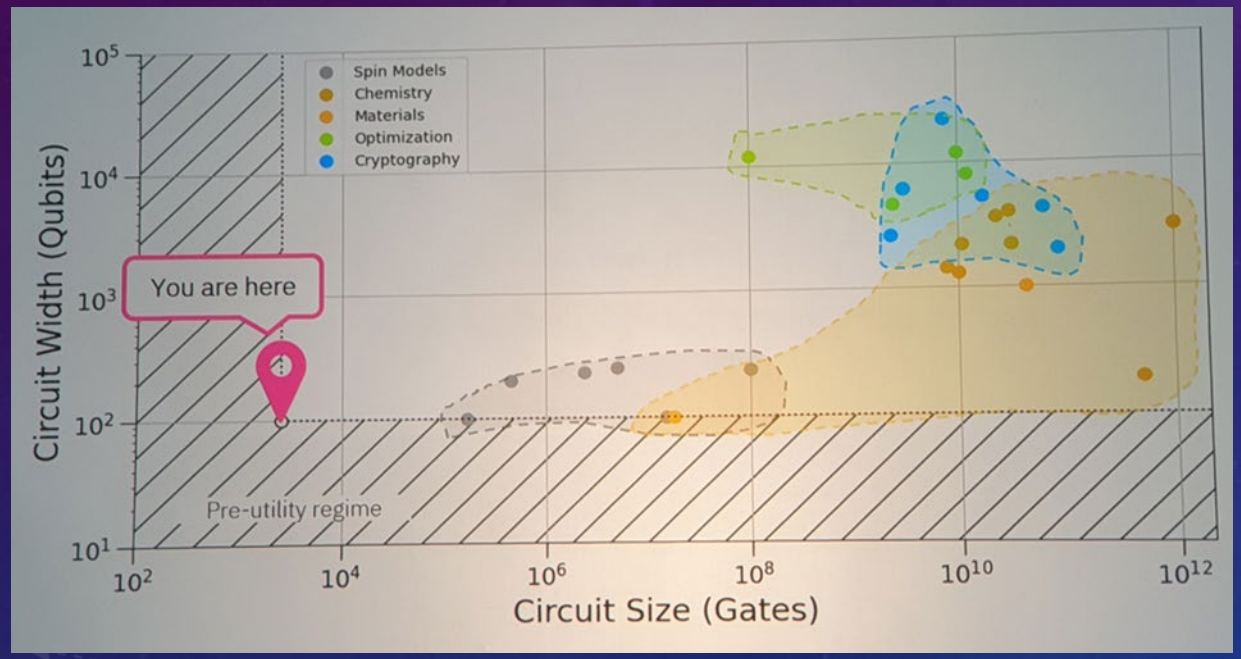


"Good progress, but further to go toward Practical Applications"

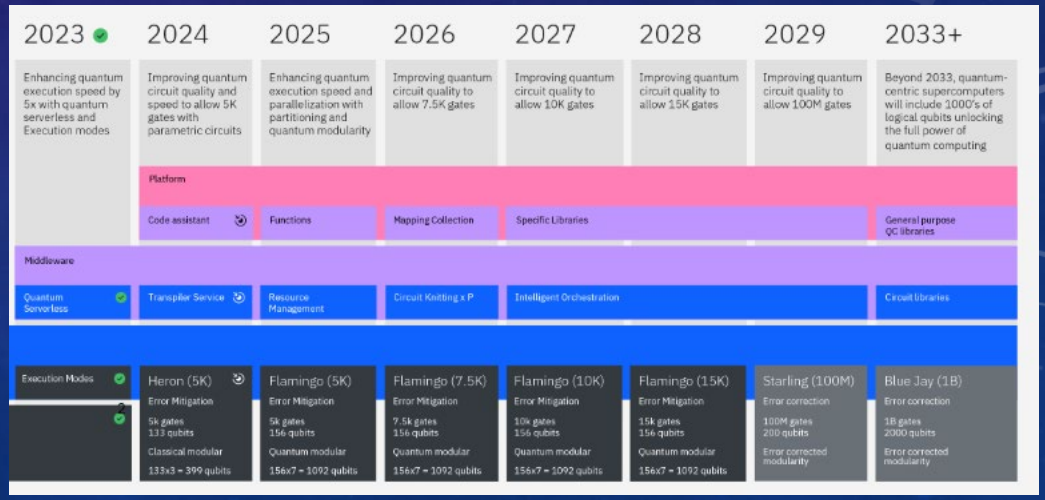
Quantum Ecosystem – Qubits

Scale-up : toward practical and useful applications

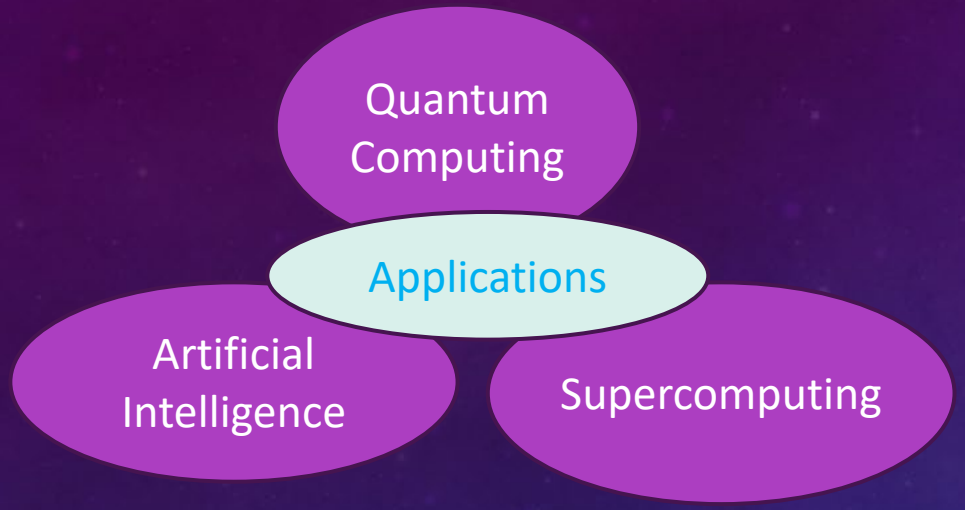
"More qubits, longer gates"



Roadmap announcement: 16 companies



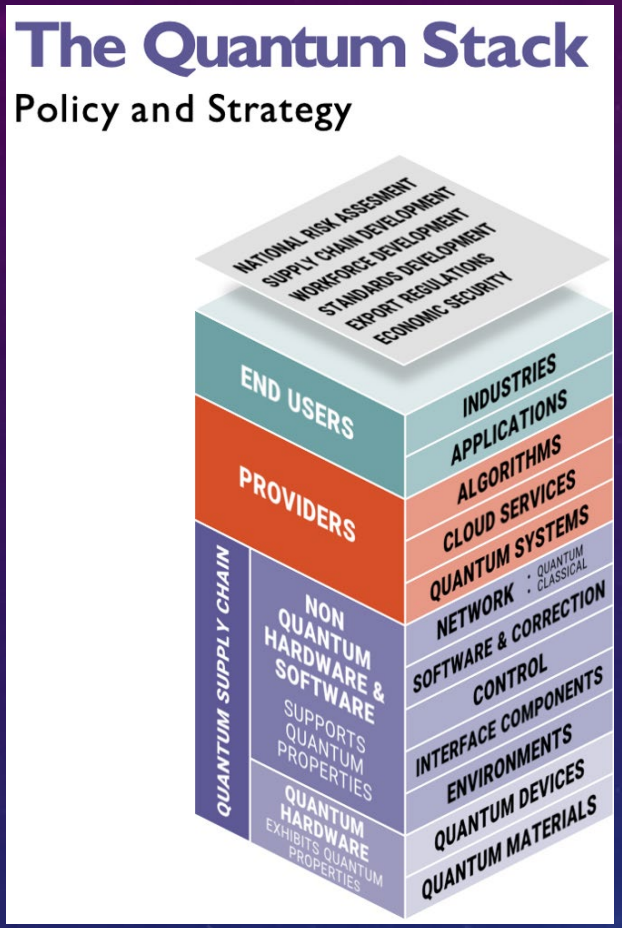
Quantum Ecosystem – Quantum Classical Hybrid



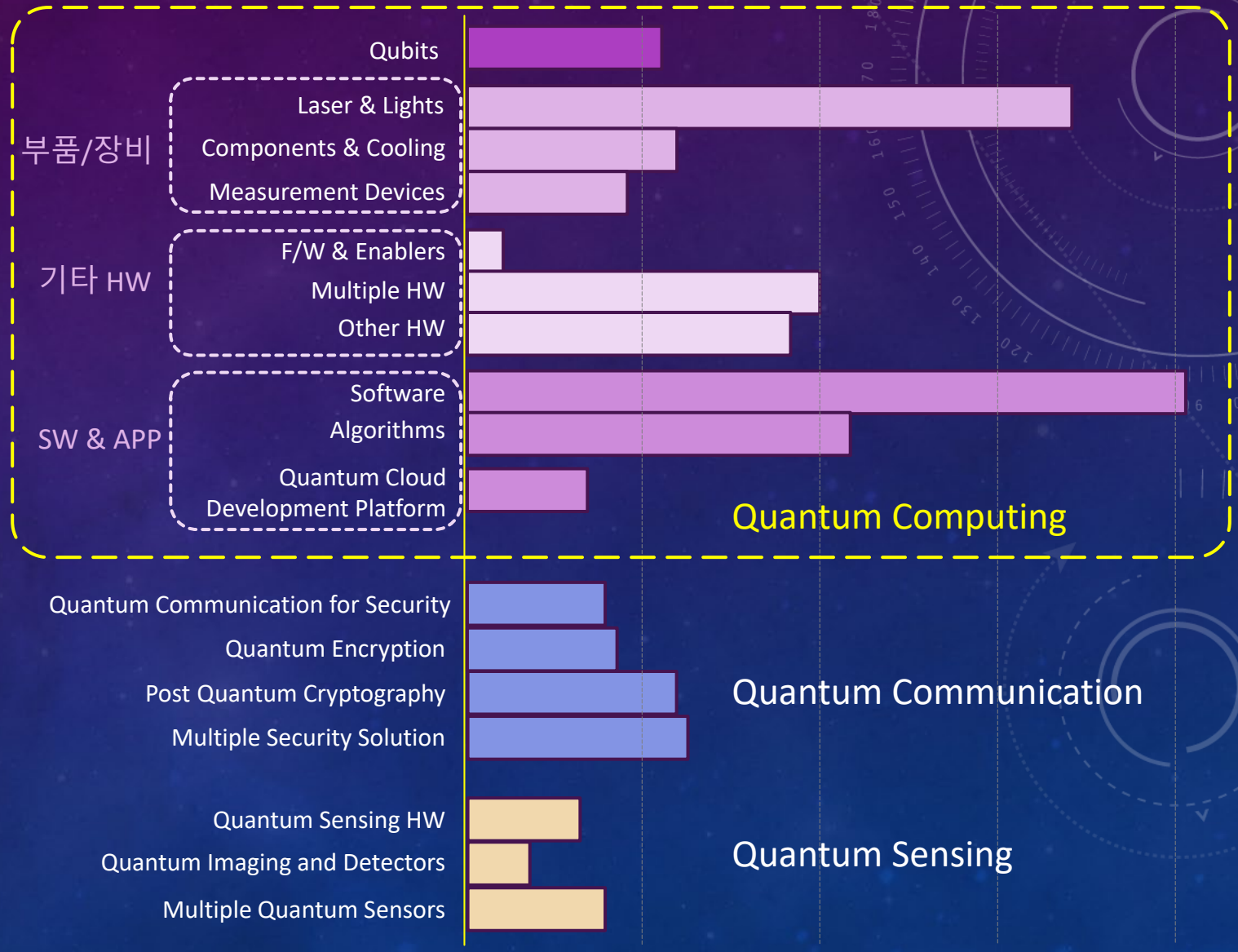
- Use SC/AI for QC HW design/error correction
- Use QC to enhance machine learning
- Use QC as an accelerator of SC

- Supercomputing centers are considering hybrid systems
- Major qubit companies are announcing their hybrid capabilities
- NVIDIA offers SW stacks for hybrid architecture (CUDA-Q)
- To explore Practical Applications even with NISQ

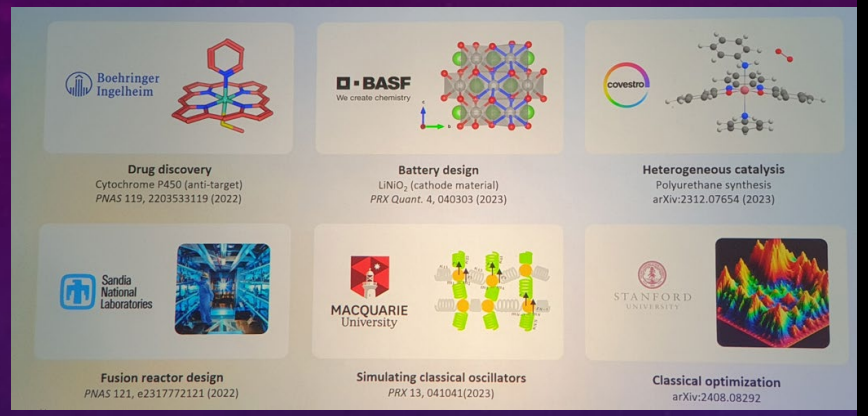
Quantum Ecosystem – Supply Chain



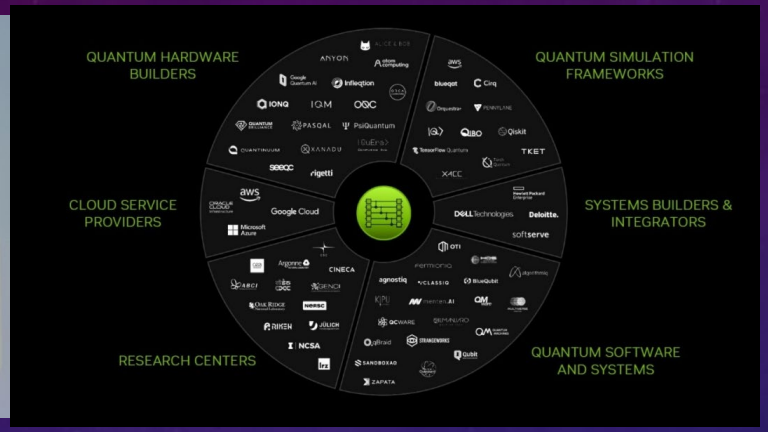
Supply Chain



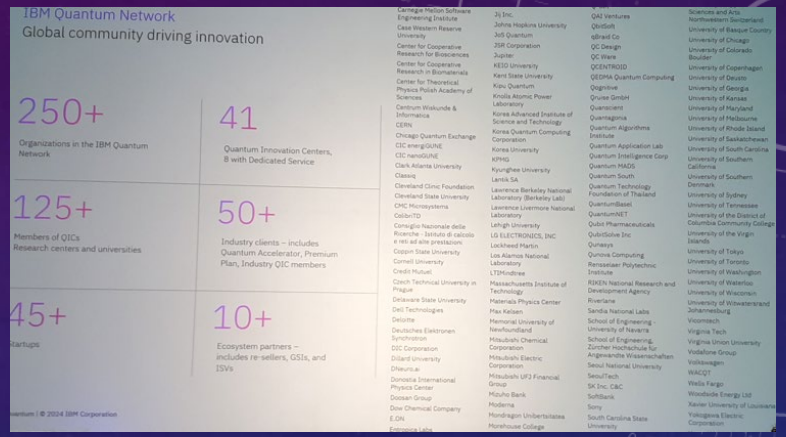
Quantum Ecosystem – Alliances and Partnership



Google



NVIDIA



IBM

Pasqal

Rigetty

And many more…

They claim their partnership as the ecosystem for "practical application"

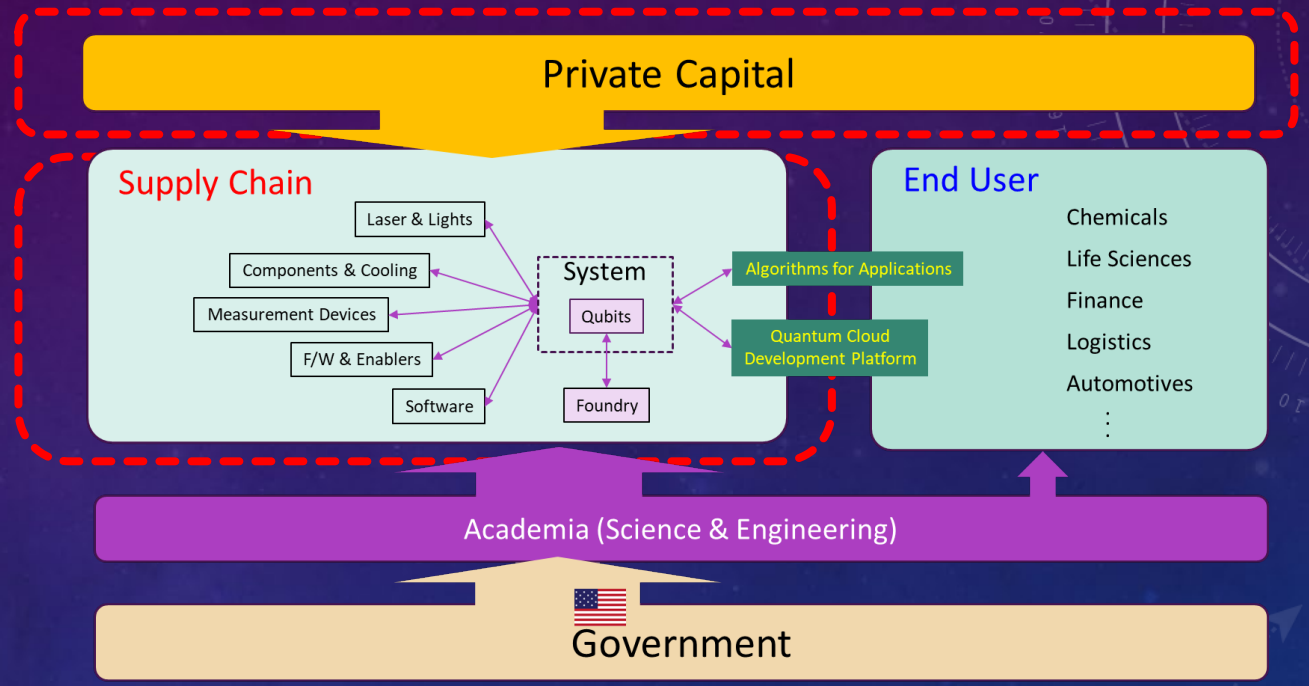
Quantum Ecosystem – US Government

DOT : Outbound Investment Control (‘24.10)

DOC : Export Control (‘24.09)

- DOS : QDG ('24.07)
- NQCO : MDQ (‘22.11)

Control



Promotion

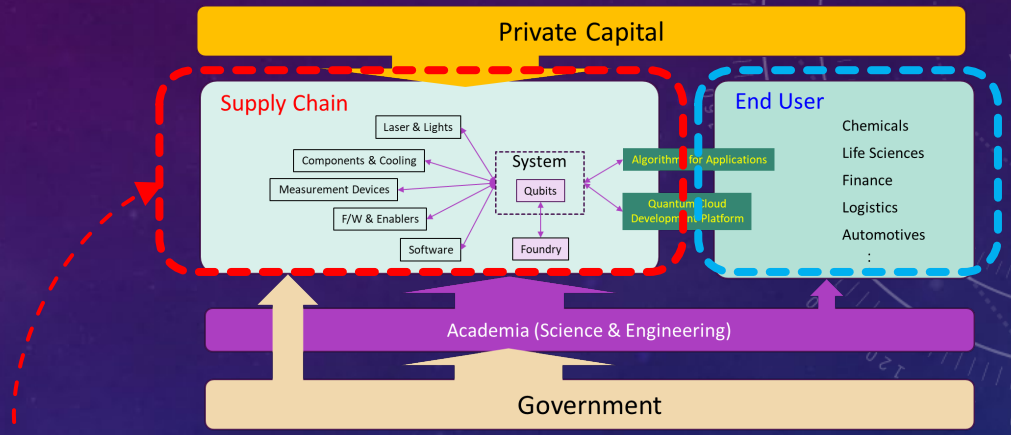
NQI Act Phase 2

- Name: Quantum Information Science, Engineering, and Technology
- Forster environment for industrial development
- Strengthen international cooperation with key partners

Quantum Ecosystem: What should we do?

McKinsey Report 2024

Good initiative,
now the strategy matters



Where is the current battlefield?

Where will be the future battlefield?

When is the “future”?

시사점

- 과학과 산업이 동시에 발전하고 있으며 속도가 매우 빠르게 진행
  - ➔ 경쟁은 과학 뿐 아니라 산업에서 가열되고 있음
  - ➔ 느리게 움직이면 공급망에 참여할 기회가 없을 우려

- 현재 보이는 모습이 전부가 아닐 수도 있음
  - ➔ 보이는 것이 아니라 보이지 않는 것에서 기회를 찾아야 함
  - ➔ Yet to come: 소형화, 대규모화, 다양한 응용

Mainframe vs. PC
Local storage vs. Datacenter
Voice phone vs. Smart phone

- 집중 투자 필요 분야
  - ➔ 미래 기술
  - ➔ 공급망 참여 가능 기술
  - ➔ 응용 기술
  - ➔ Quantum Literacy
  - ➔ Multidisciplinary Workforces
  - ➔ Startup Incubation

감사합니다