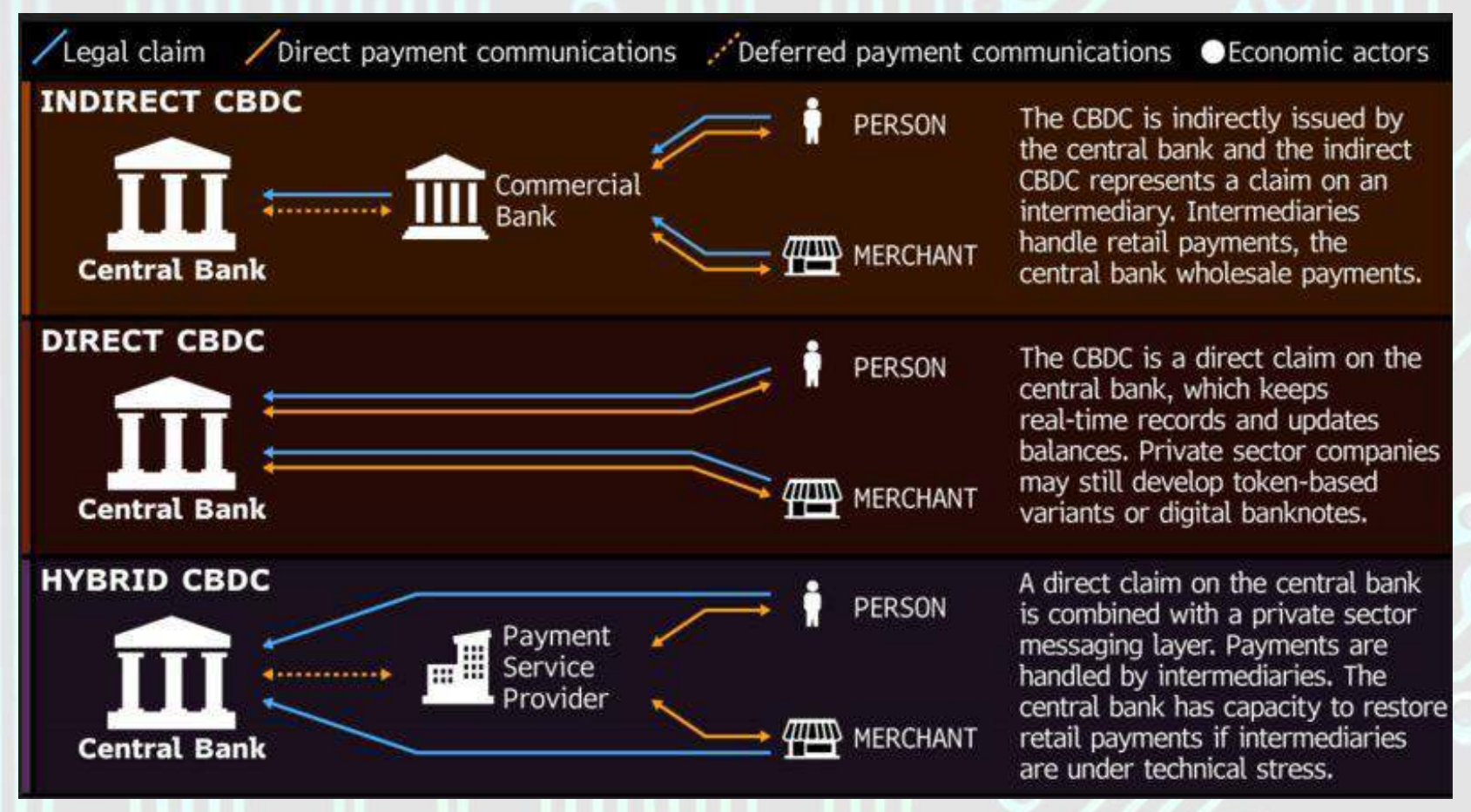
Central-Bank-Digital-Currency Blockchains; US Economic Influence Threatened – Requires Quantum Network Development & Deployment

Background

Central Bank Digital Currency (CBDC) systems use blockchain technology to secure financial transactions. CBDC bypasses the SWIFT system, which is influenced by worldwide US Dollar (USD) usage, thereby **undermining US soft-power controls**. Digitally secured Information and Communications Infrastructures (ICI) encryption, transmission and reception architectures will soon be vulnerable to quantum penetration.

What is Blockchain? Blockchain is a digital transaction ledger that stores records as blocks across computers in a P2P (peer-to-peer) network.[9]

What are Quantum Networks? Modular quantum computers linked together using qubits to transmit information via fiber-optic or free-space networks using switches and repeaters.



The CBDC is indirectly issued by the central bank and the indirect CBDC represents a claim on an intermediary. Intermediaries handle retail payments, the central bank wholesale payments.

The CBDC is a direct claim on the central bank, which keeps real-time records and updates balances. Private sector companies may still develop token-based variants or digital banknotes.

A direct claim on the central bank is combined with a private sector messaging layer. Payments are handled by intermediaries. The central bank has capacity to restore retail payments if intermediaries are under technical stress.

Fig. 2: CBDC Distribution Structures[2]

Significance

CBDC Threat: Digital currencies will diminish value of USD as "the" global currency, **reducing diplomatic bargaining power.**

Centralized CBDC security challenges

- Diminished anonymity and immutability
- Market manipulation

Decentralized CBDC security challenges

- Anonymity and nonregulatory oversight

Quantum Potential: Classical binary bits have two states: |0⟩ or |1⟩ to program information; quantum computing uses qubits which can be |0⟩, |1⟩, or *both*. This duality **increases the processing power** of a machine to perform faster, more complex operations and break classical encryption algorithms.

****Quantum Computing Disqualifies Blockchain Immutability****

QUESTION: How to secure future US power in a quantum era?

Opportunity Analysis

Leverage public-private partnerships to:

- Modernize and reinforce SWIFT capabilities
- **Develop and deploy a Quantum Internet (QI)**
  - Realize Quantum-Money[10], hybrid quantum-blockchains
  - Exploit CBDC and blockchains of corrupt entities

QI Development Challenges

Winning the near-peer state competition for "first-to-capture" Quantum Internet capabilities requires **prioritizing funding** to advance Technology Readiness Levels currently limited by:

- **Quantum teleportation and data retention optimization**
  - Topological materials for error-correction
- Rare Earth Resources -> supply chain surety

Imperfect Cloning: Post quantum (PQ) vulnerability threatening the security of quantum networks and quantum-blockchains

Horizon Threat

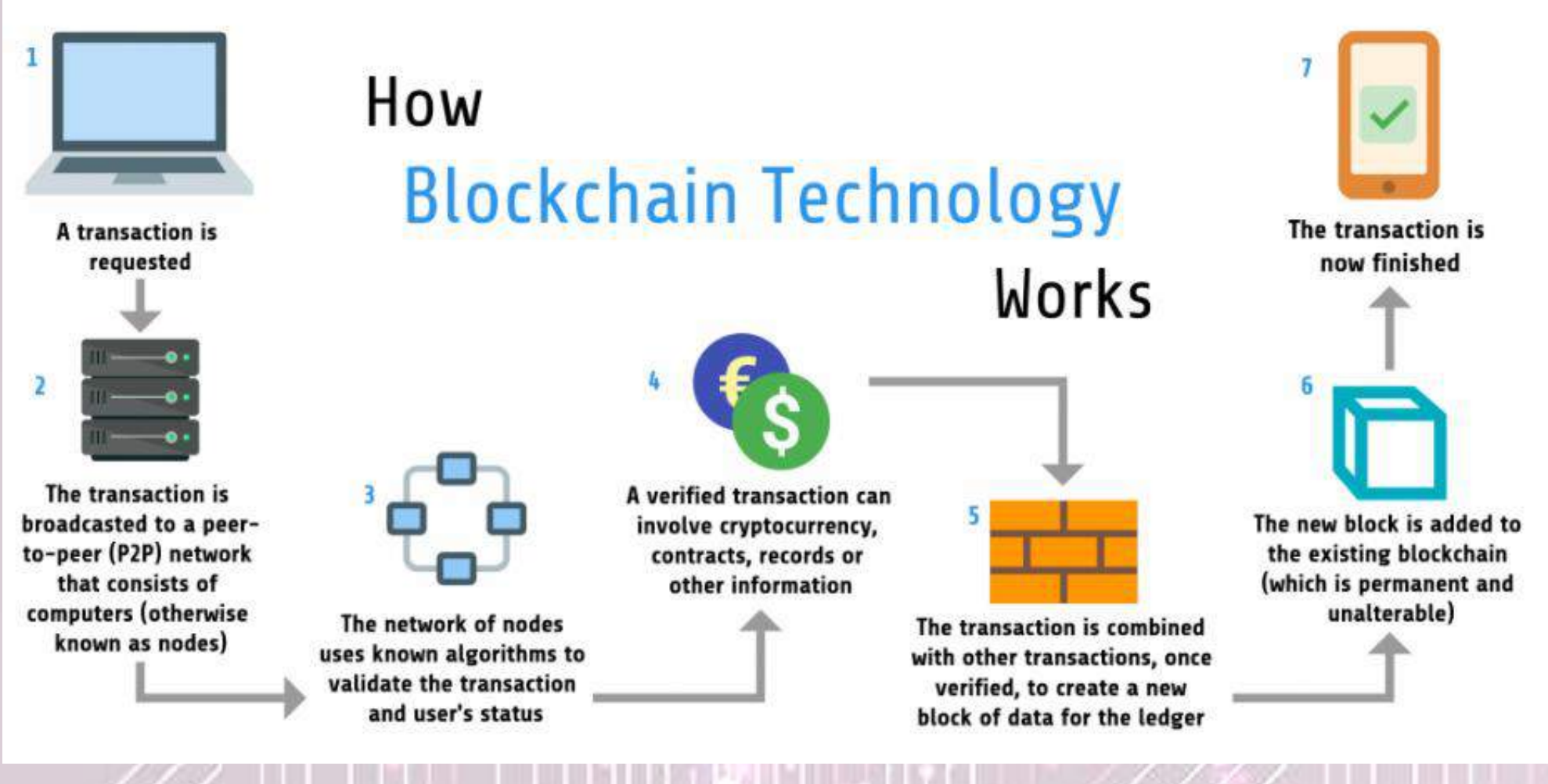
Quantum Supremacy will **Control** future data and financial **Security Strategies.**

Figure 1: Quantum qubit breaking blockchain encryption[1]

Research Methodology

Investigated quantum technology (QT) priorities, development status, and technology readiness levels using CBDC as a case-analysis for practical application implications. Considered post quantum (PQ) environments. Identified key QT actors for joint-resilience strategies. Utilized the following resources:

- Academic journal publications
- Subject Matter Expert (SME) interviews
- Open-source tools and news articles



1 A transaction is requested

2 The transaction is broadcasted to a peer-to-peer (P2P) network that consists of computers (otherwise known as nodes)

3 The network of nodes uses known algorithms to validate the transaction and user's status

4 A verified transaction can involve cryptocurrency, contracts, records or other information

5 The transaction is combined with other transactions, once verified, to create a new block of data for the ledger

6 The new block is added to the existing blockchain (which is permanent and unalterable)

7 The transaction is now finished

Fig. 3: Blockchain Architecture[3]

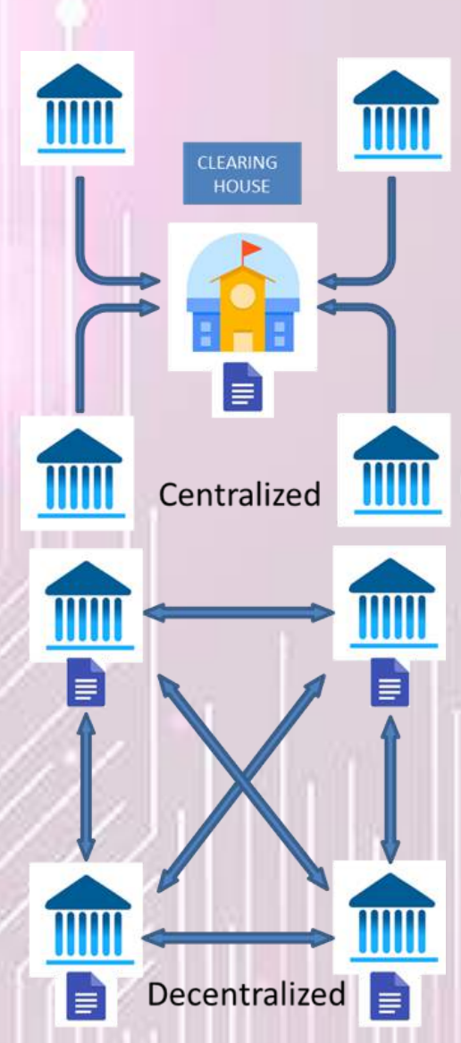


Fig. 4: Blockchain Ledger Distribution[4]

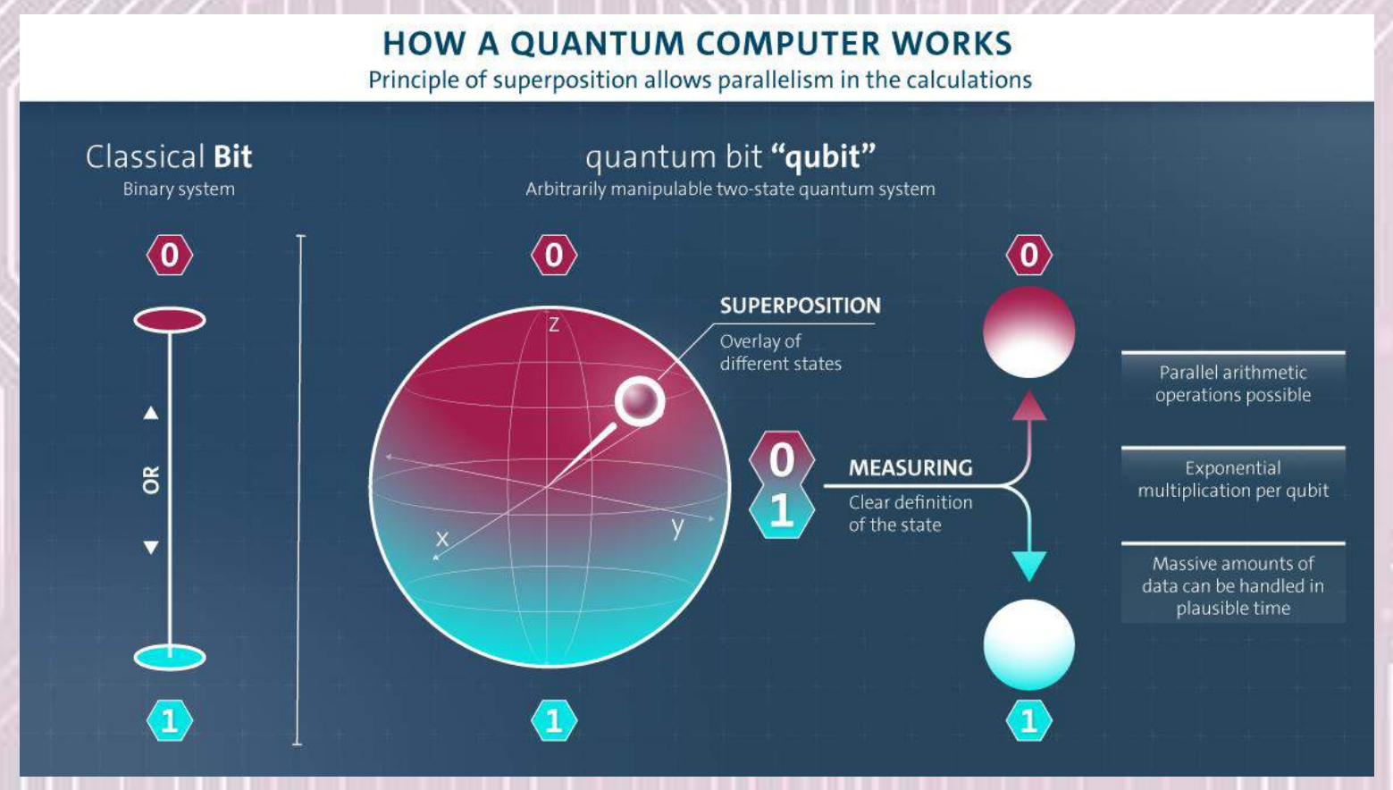
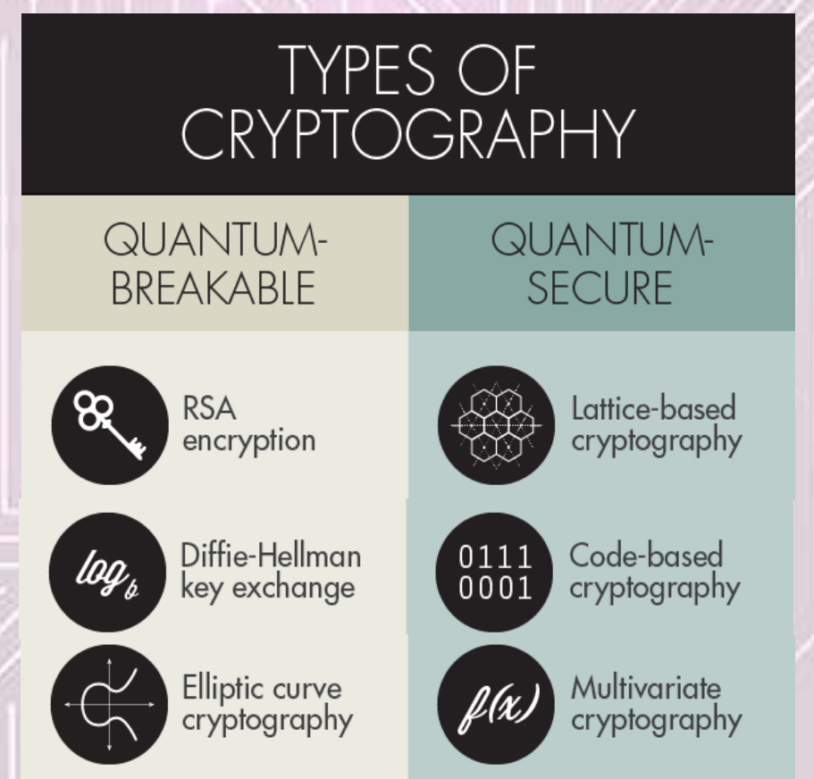

HOW A QUANTUM COMPUTER WORKS
Principle of superposition allows parallelism in the calculations
Classical Bit
Binary system
quantum bit "qubit"
Arbitrarily manipulable two-state quantum system
0
OR
1
Z
x
y
SUPERPOSITION
Overlay of different states
MEASURING
Clear definition of the state
Parallel arithmetic operations possible
Exponential multiplication per qubit
Massive amounts of data can be handled in plausible time

Fig. 5: Quantum Computing Qubits[5]


TYPES OF CRYPTOGRAPHY

QUANTUM-BREAKABLE	QUANTUM-SECURE
RSA encryption	Lattice-based cryptography
Diffie-Hellman key exchange	Code-based cryptography
Elliptic curve cryptography	Multivariate cryptography

Fig. 6: Cryptography Comparison[6]

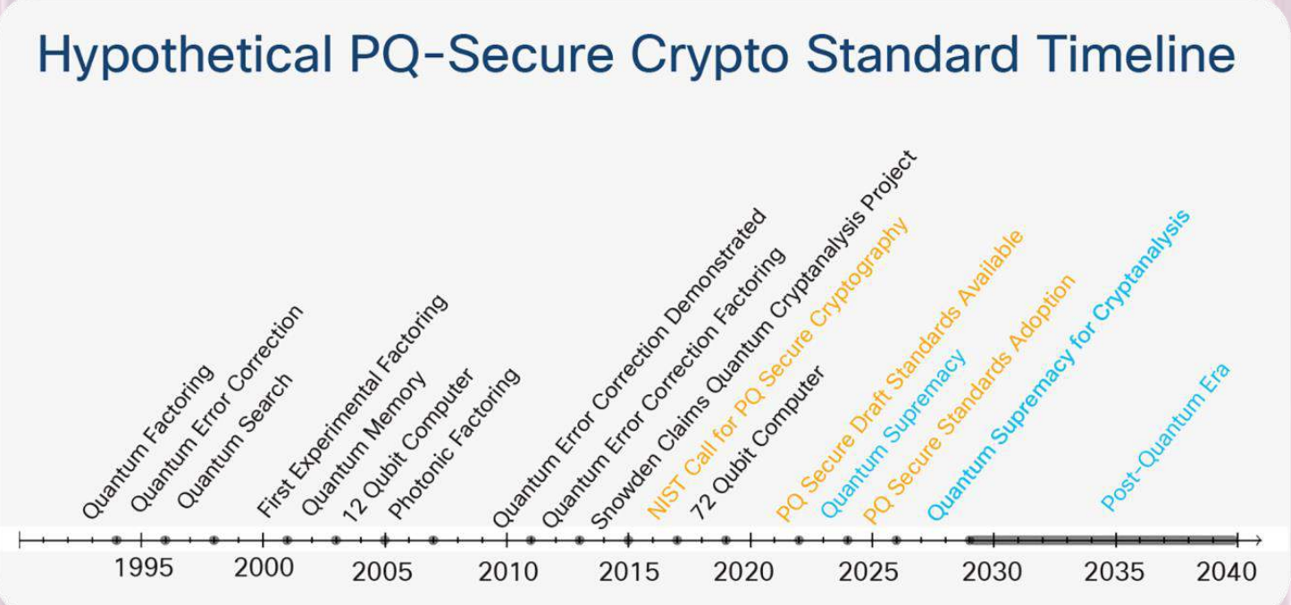


Fig. 7: Development Timeline for Post Quantum Era[7]

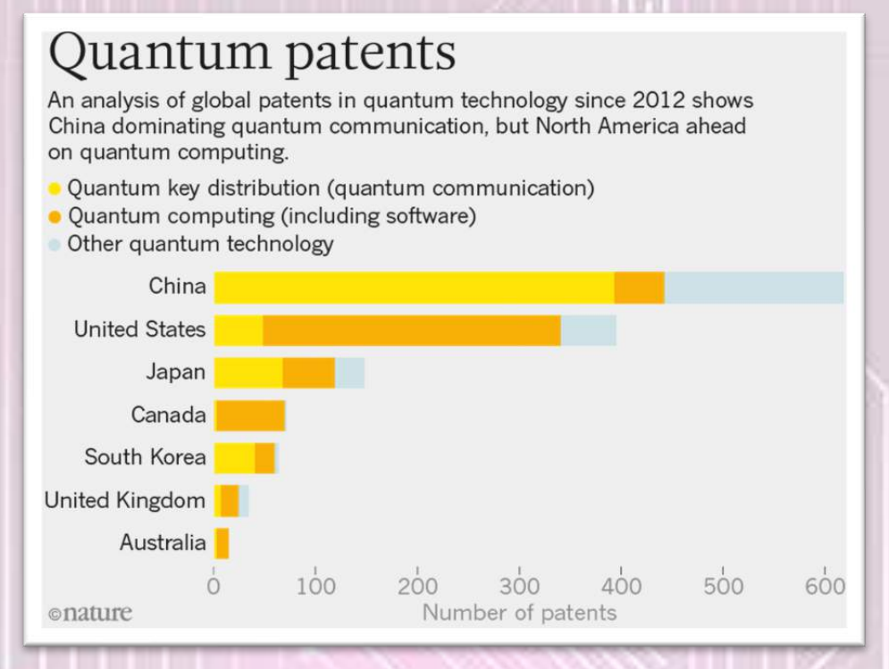


Fig. 8: Quantum Computing & Communication Patent Trends[8]

Resilience Strategies

1) Mobilize public-private consortiums and allied coalitions to:
   - Advance quantum technologies
   - **Standardize advanced encryption algorithms**
     - Research PQ hard problems
2) **Develop hybrid classical-quantum systems**
3) Establish international CBDC norms and requirements

Future Research

Investigate how Quantum Game Theory affects the intersection of quantum-driven Artificial Intelligence and state security strategies.

Acknowledgements

Research conducted under the advisement of Dr. Jeannie Johnson and Professor Briana Bowen.

Sources Link

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