basic roots consulting

MAKING BUSINESSES BETTER

BRC BYTES

Quantum Leap: Unveiling the Next Era of Computational Power

A Basic Roots Consulting Deck

Quantum Computing
Summary

1
- Computing Power Revolution
- How a classical computer operates?
- Classical Computers are fine, Why Quantum Computer ?

2
- Future of Classical Computers
- Real time impact of Quantum Computers

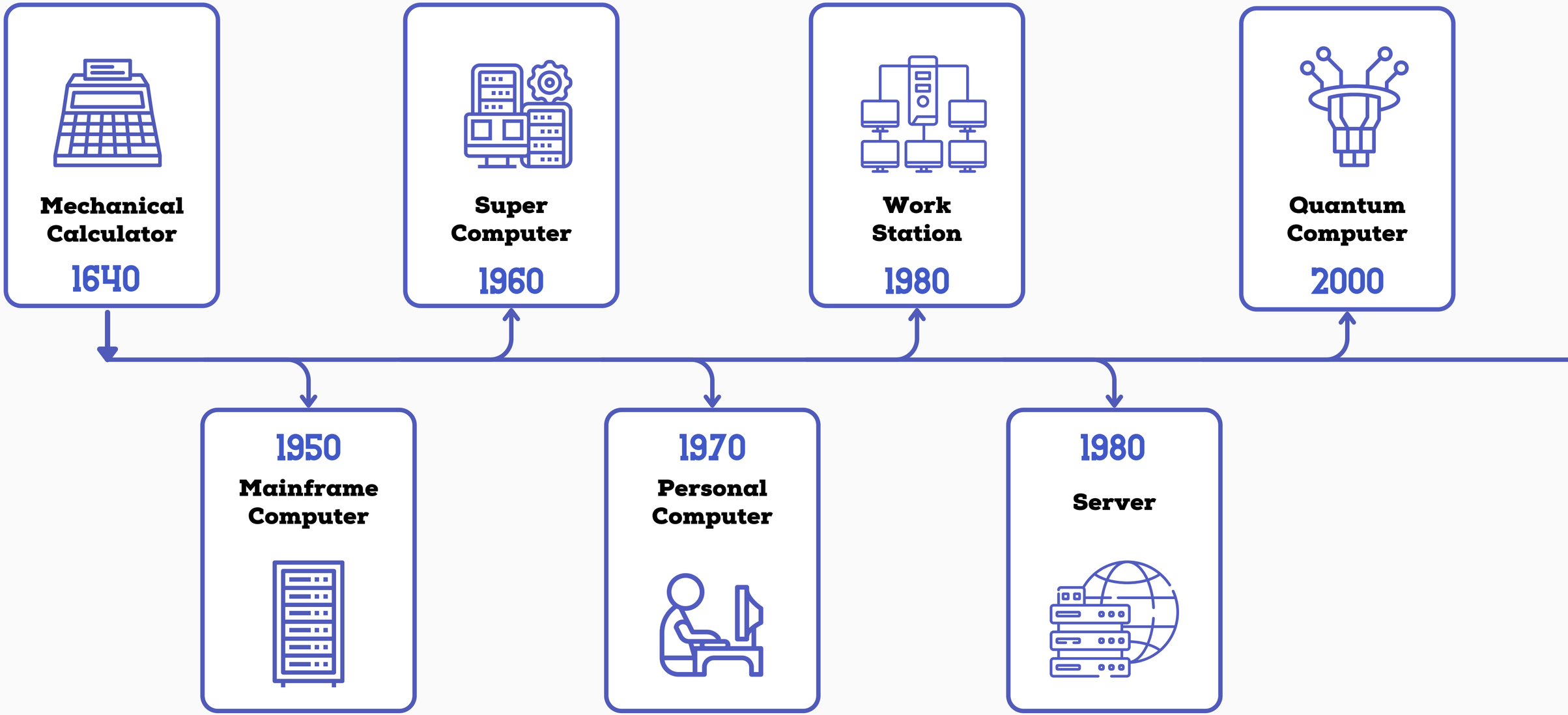
3
- Quantum Technology Market Classification
- Among Tech Giants, Where are opportunities for startups ?
- Quantum Technology Market Potential
- Global Quantum Technology Startups

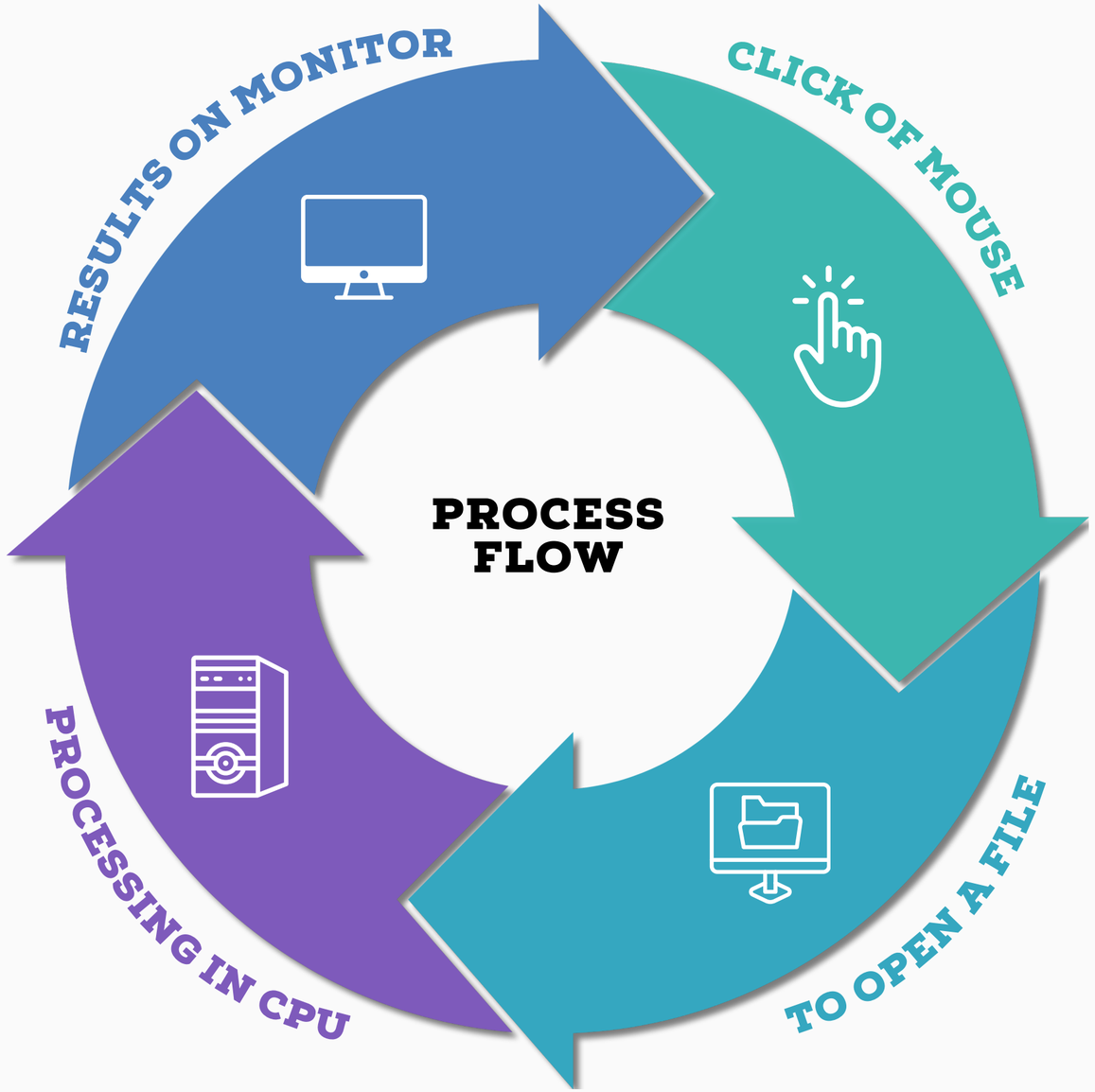
4
- Investment fueled in Quantum Technology Startups
- Startups bagging biggest deals

5
- Quantum Technology Landscape in India
- Quantum Technology Startups in India

6
- Applications of Quantum Computing
- How we will access a Quantum Computer ?
- Quantum Technology Impact across Industries

The Revolution in Computing Power





That's how a classical computer operates....

INPUT

Inputting information through devices like keyboard, Mouse etc.

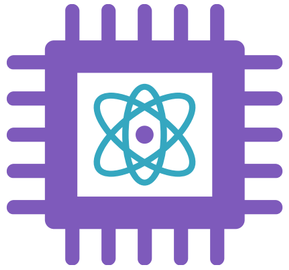
PROCESSING

Once the input is received, the command to open the file is converted into computer's language, which is a series of binary code (010111) for processing.

OUTPUT

After processing, the output is generated and displayed on the monitor.

Classical Computers are working fine, why Quantum Computer ?



In 2019

Google's quantum processor - **Sycamore**

"Performed a specific calculation in 200 seconds that would have taken the most powerful classical supercomputer approximately 10,000 years to complete."

The Quantum Power

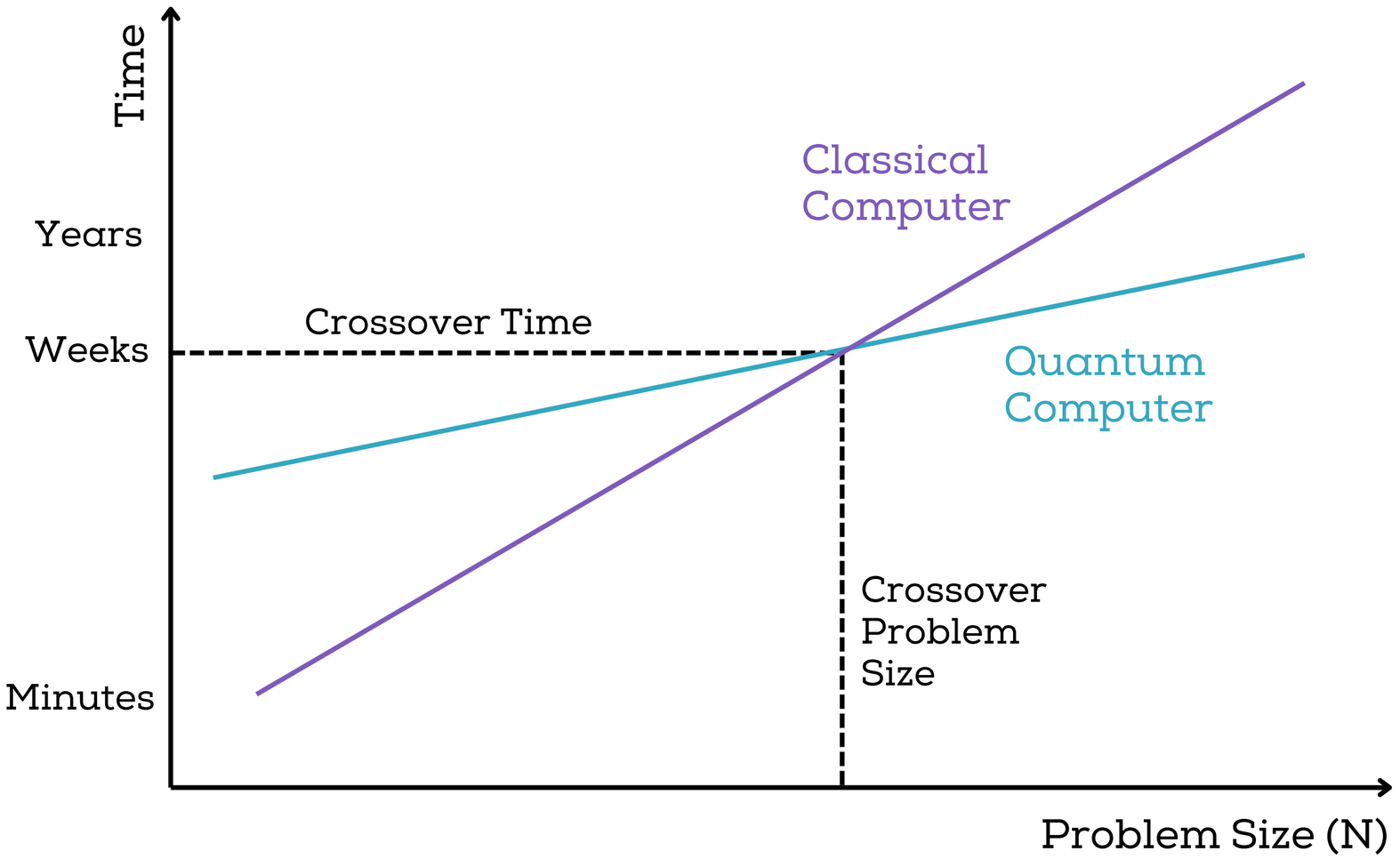
Maximized Efficiency

Saves Time

Superior Optimization

Enhanced Security

Then will a Classical Computer become obsolete in future ?



"For day to day tasks & operations"

A Classical Computer

"For Complex Problems that can take years for a classical computer to solve"

A Quantum Computer

Source: Observer Research Foundation

Let’s see one real time Optimization case

Objective: To optimize the airfoil shapes of aeroplane wings by addressing various types of constraints.

Addressing These **Mathematical Constraints**

- Particular Strength Requirement
- Minimizing Compliance
- Volume Reduction
- Adjusting Material Density

For a **Classical Computer** Would Have Taken a Lot of Time

Whereas a **Quantum Computer** gave an Optimal shape

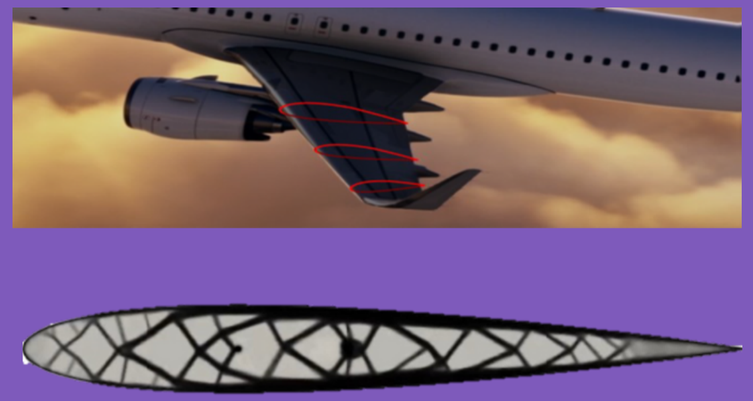
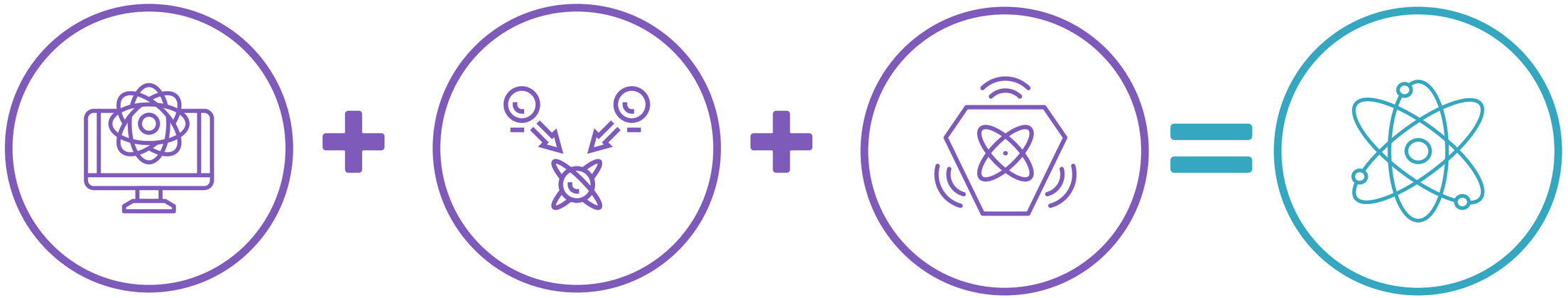


Fig- The design obtained by **Quantum Optimization**

Source: Airfoil Case Study by BosonQ Psi

The Quantum Technology Sector is made up of three subfields



Quantum Computing + **Quantum Communication** + **Quantum Sensing** = **Quantum Technology**

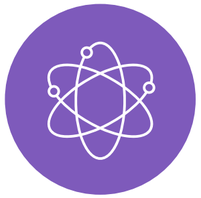
Quantum Computing	Quantum Communication	Quantum Sensing	Quantum Technology
Focused On	Focused On	Focused On	Together Called as
Quantum Hardware Development	**Securing Communication Between Two Channels**	**Precision Measurement Device Innovations**	**Quantum Technology**

Source: Mckinsey Digital - Quantum Technology Monitor

What are the Tech Giants doing in this field ?

Building Hardware for Scaling Quantum Power

Addressing Challenges



Qubit Coherence

High Error Rate

Qubit Scalability

Developing Algorithms

Google

Build a 53 Qubit Quantum Processor - **Sycamore**

IBM

Plans to enhance the quality & speed of **quantum circuits**

amazon

Through its **AWS Braket service**, provides access to quantum hardware

Where is the opportunity for startups ?

Quantum Technology Software Development

Focusing on

"Improving and Developing More Practical Applications of Quantum Technology"

Opportunities

Integration Platforms

Quantum Simulators

Quantum Security

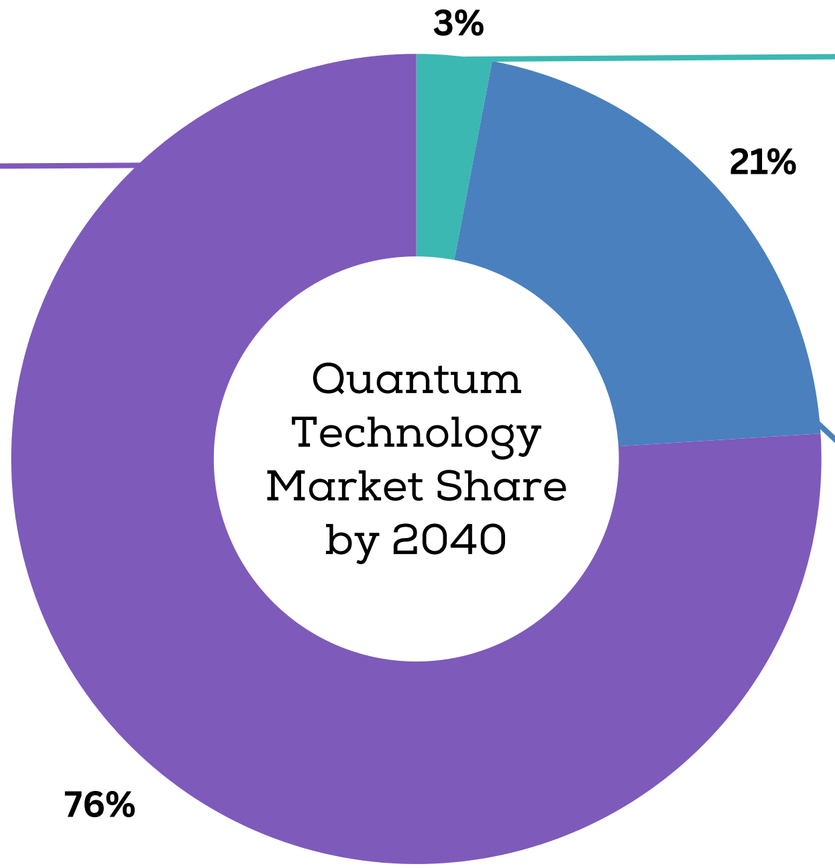
Quantum Training

The Quantum Technology market shows huge potential

USD 899M
Market Size as on 2023

USD 173 Billion
Estimated Market Size by 2040

USD 42B
Total Government Investment Announced



Quantum Computing

USD 45B - USD 131B
Estimated Market Size by 2040

USD 6.7B
Invested as of Dec 2023

261
Start-ups as of Dec 2023

Quantum Sensing

USD 1B - USD 6B
Estimated Market Size by 2040

USD 0.7B
Invested as of Dec 2023

48
Start-ups as of Dec 2023

Quantum Communication

USD 24B - USD 36B
Estimated Market Size by 2040

USD 1.2B
Invested as of Dec 2023

96
Start-ups as of Dec 2023

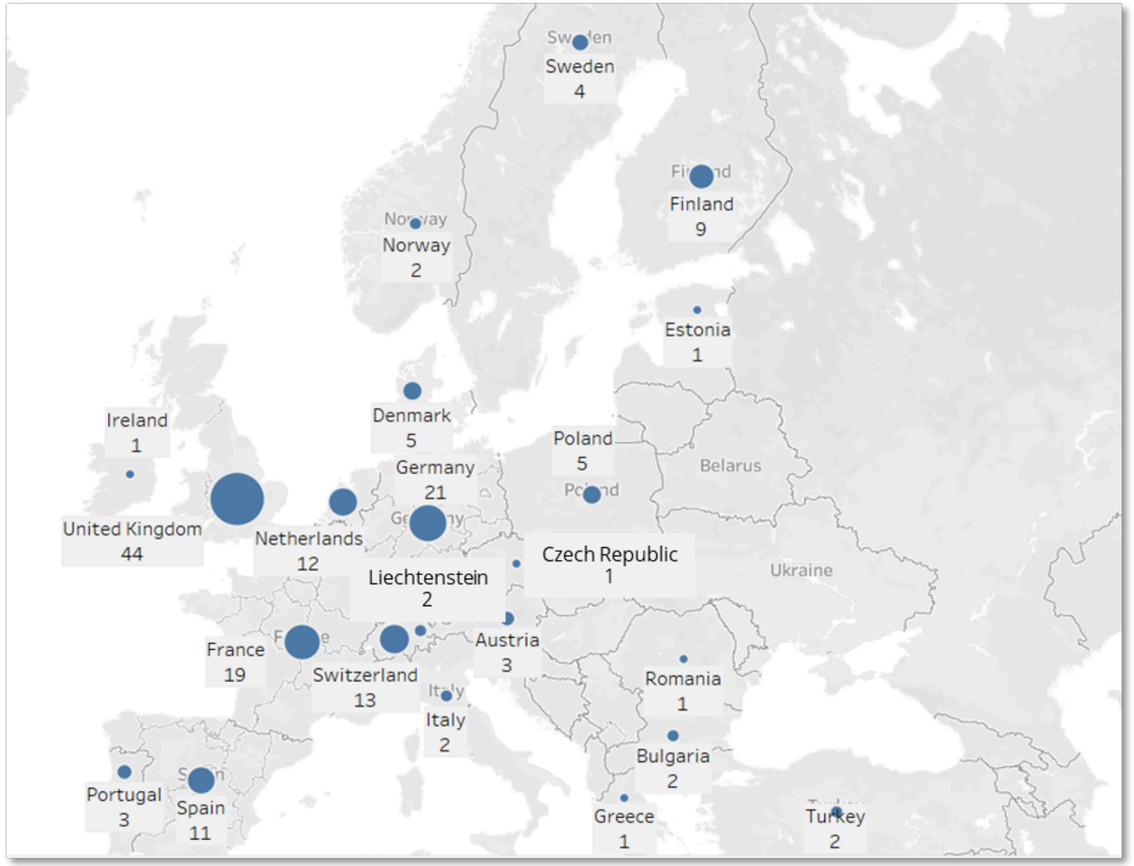
Source: Mckinsey Digital - Quantum Technology Monitor

Quantum Technology startups stage around the World

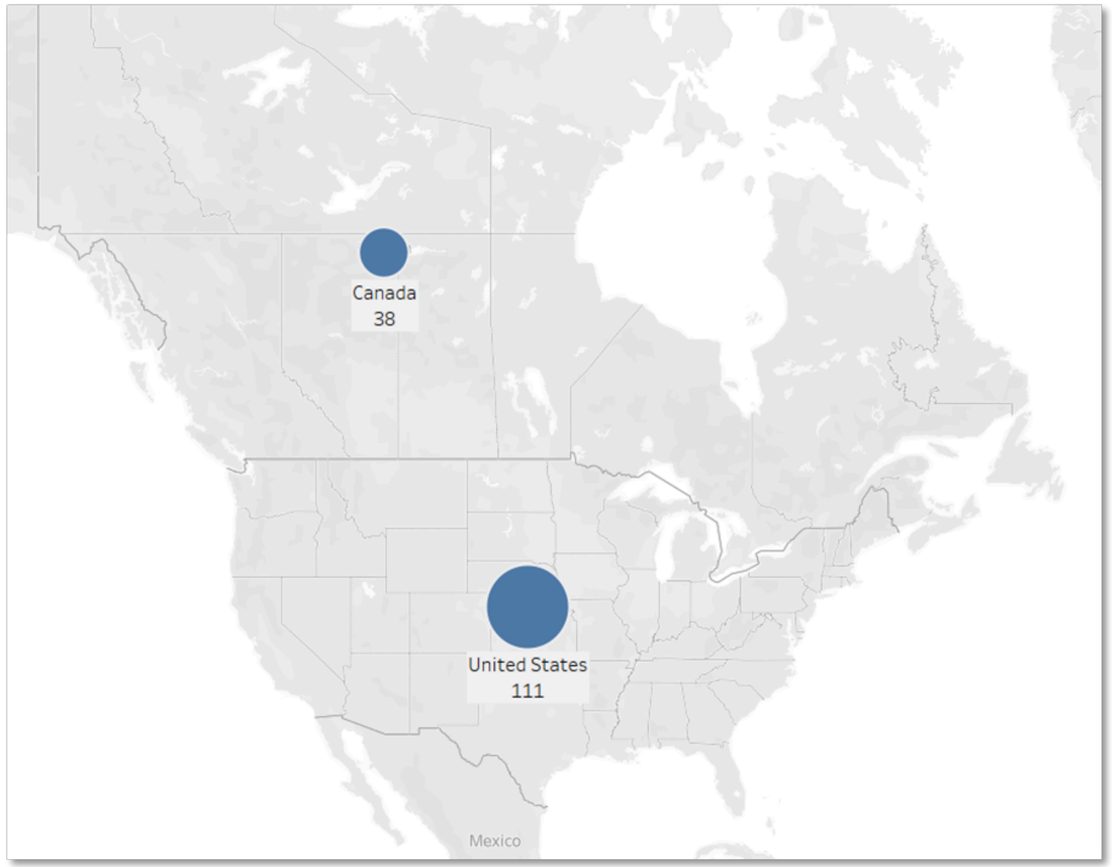
Startup		Fund Raised	Company Stage	Total Investors	Key Investors	Country
rigetti	Rigetti Computing	$198 Million	Series C	47	Bessemer Ventures, Seabed VC	USA
PsiQuantum	PsiQuantum	$680 Million	Series E	24	BlackRock, Redpoint Ventures	USA
IONQ	IonQ	$84 Million	Public	24	Cambium Capital, Google Ventures.	USA
D-Wave The Quantum Computing Company	D-Wave Systems	$256 Million	Series F	26	NEC, PSP Investments	Canada
atom computing	Atom Computing	$81 Million	Series B	15	Third Point Ventures, Prime Movers Lab	USA
QUANDELA	Quandela	$70.8 Million	Series C	8	Credit Mutual Innovation, Omnes Capital	France
OQC	Quantum Circuits Ltd.	$150 Million	Series B	11	SBI Investment, HiJoJo Partners	UK

Source: Tracxn Technologies

And there is a Quantum Race in Each Continent



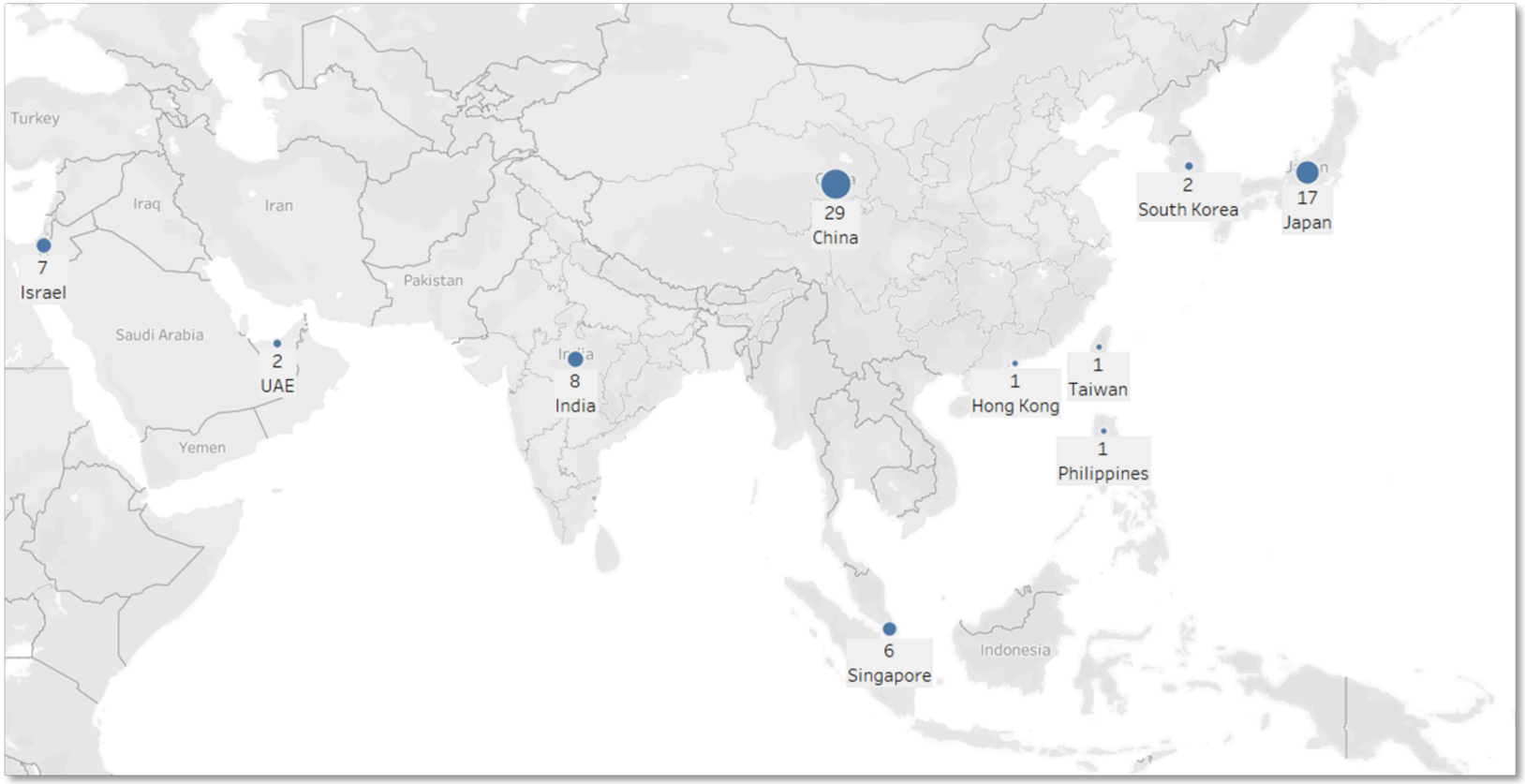
European Countries



North American Countries

Source: Mckinsey Digital - Quantum Technology Monitor

And there is a Quantum Race in Each Continent



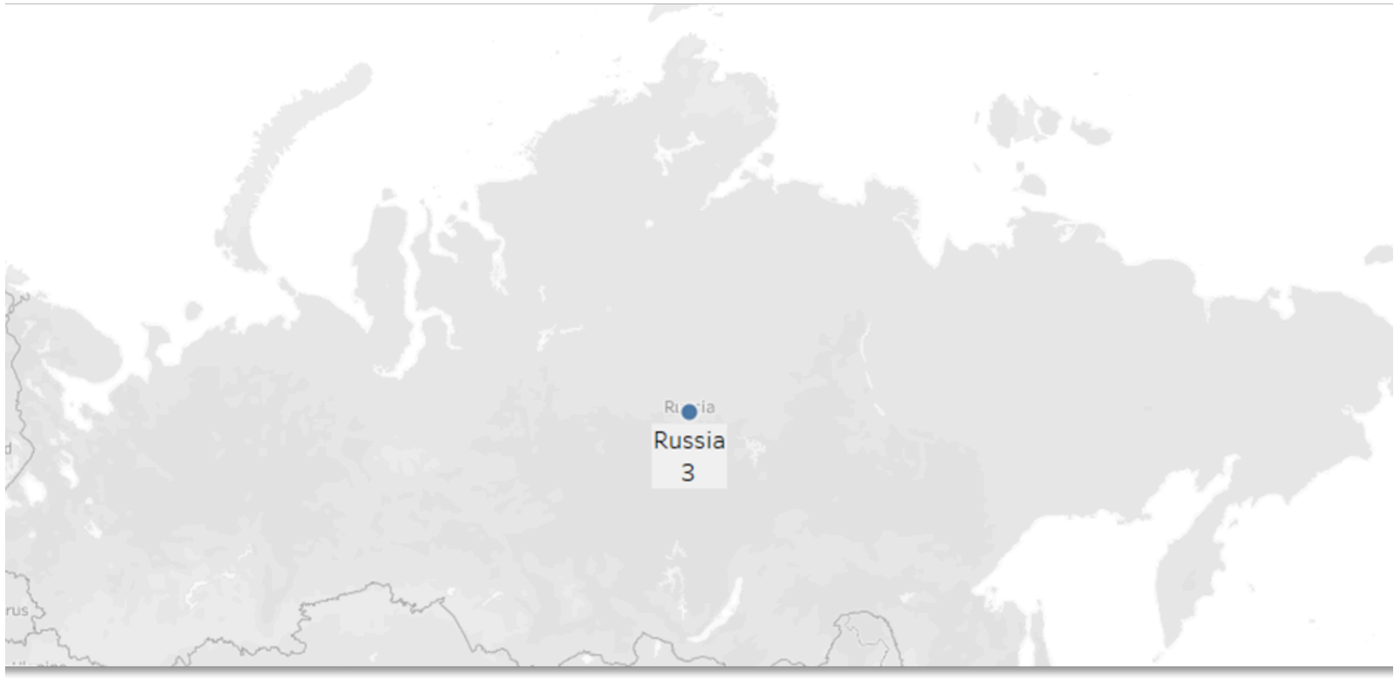
Asian Countries

South American Countries

Source: Mckinsey Digital - Quantum Technology Monitor

And there is a Quantum Race in Each Continent

Australia



Russia

Source: Mckinsey Digital - Quantum Technology Monitor

Now let’s look on Investors fueling investment in this sector

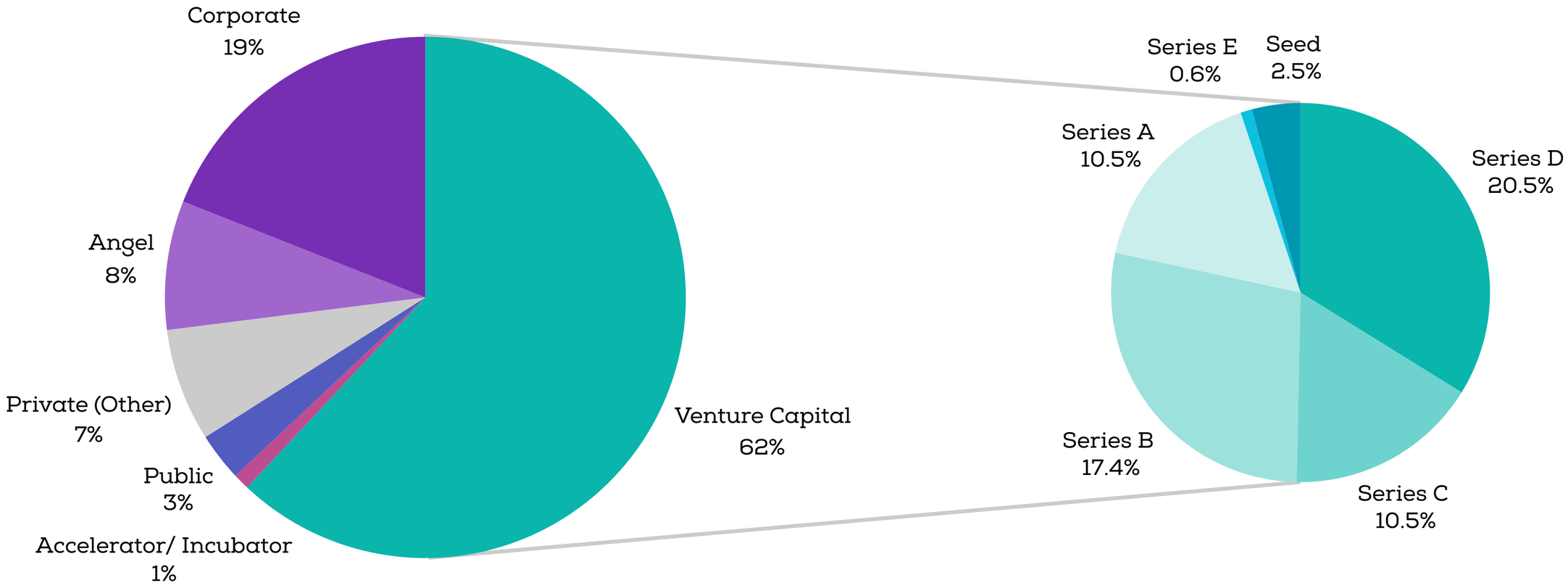


Fig - Quantum technology investments by investor type with split of venture capital investments by deal type 2001 – 2023 (% of investment value)

Source: Mckinsey Digital - Quantum Technology Monitor

So who got the biggest deals ?

Quantum Computing Quantum Communication Quantum Sensing

Ranking	Company	Country	Technology	Segement	Deal Size ($ Million)	Deal Type
1st	Pasqal	France		Hardware Manufacturing	103	Series B
2nd	Photonic	Canada		Hardware Manufacturing	100	Series D
3rd	OQC	UK		Application Software	100	Series B
4th	Q-CTRL	Australia		System Software	52	Series B
5th	Quantum Motion	UK		Hardware Manufacturing	51	Series B
6th	Silicon Quantum Computing	Australia		Hardware Manufacturing	50	Series A
7th	Xpanceo	UAE		Hardware Manufacturing	40	Seed
8th	Quandela	France		Hardware Manufacturing	39	Series A
9th	Oxford Ionics	UK		Hardware Manufacturing	36	Series A
10th	Nvision Imaging Technologies	Germany		Application Software	30	Series A

Source: Mckinsey Digital - Quantum Technology Monitor

And where does India stands ?

Figures, 2023

USD 1.75 Billion
Public Investment

USD 2.4 Million
Public Investment

60
Research Labs for QT

0.2%
of QT Related Patents Granted

QT Related Startups

Policies & News

- **National Quantum Mission (2023)**: Develop 5–1000 qubit computers in 8 years.
- **October 2023:** Samsung and IISc-Bengaluru quantum tech collaboration.
- **September 2023:** IIT Bombay and CQE partnership for talent pool.
- **June 2023:** BosonQ Psi and Tech Mahindra partnership for quantum tech.
- **March 2023:** First QC-based telecom network by Centre for Development of Telematics.

Source: Mckinsey Digital - Quantum Technology Monitor

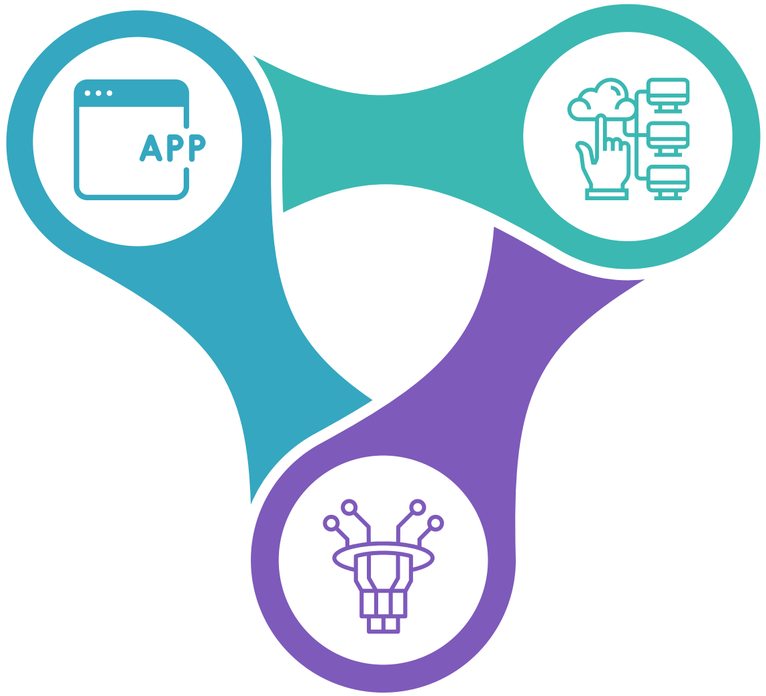
Quantum Technology startups stage in India

Startup		Fund Raised	Company Stage	Total Investors	Key Investors
Q→NU	QNu Labs	$13.5 Million	Seed	70	Speciale Invest, Tenacity Ventures, Venture Catalysts, Waao Partners
BosonQ Psi Enabling Simulations with Quantum Paradigm	BosonQ Psi	$525 K	Seed	12	3 to 1 Capital, O2 Angels Network
QπAI	QpiAI	$11.3 Million	Seed	1	SIDBI, Your Nest, We Founder Circle
bit labs	Qbit Labs	Undisclosed	Undisclosed	1	FalconX
QUANTICA COMPUTACAO	Quantica Computacao	Unfunded	Unfunded	N/A	N/A
KRYTOTECH	KryoTech	Unfunded	Unfunded	N/A	N/A
SQ Super Quantum	SuperQ Technologies	Unfunded	Unfunded	N/A	N/A

Source: Tracxn

And how human beings will access a Quantum Computer ?

"Quantum Computing as a Service"



Web Application

Defining the parameters on the application in our classical computer.

Provider's CPU & GPU

Classical data gets converted to quantum data & vice versa.

Quantum Computer

Quantum computer performs the operation & gives back the result.

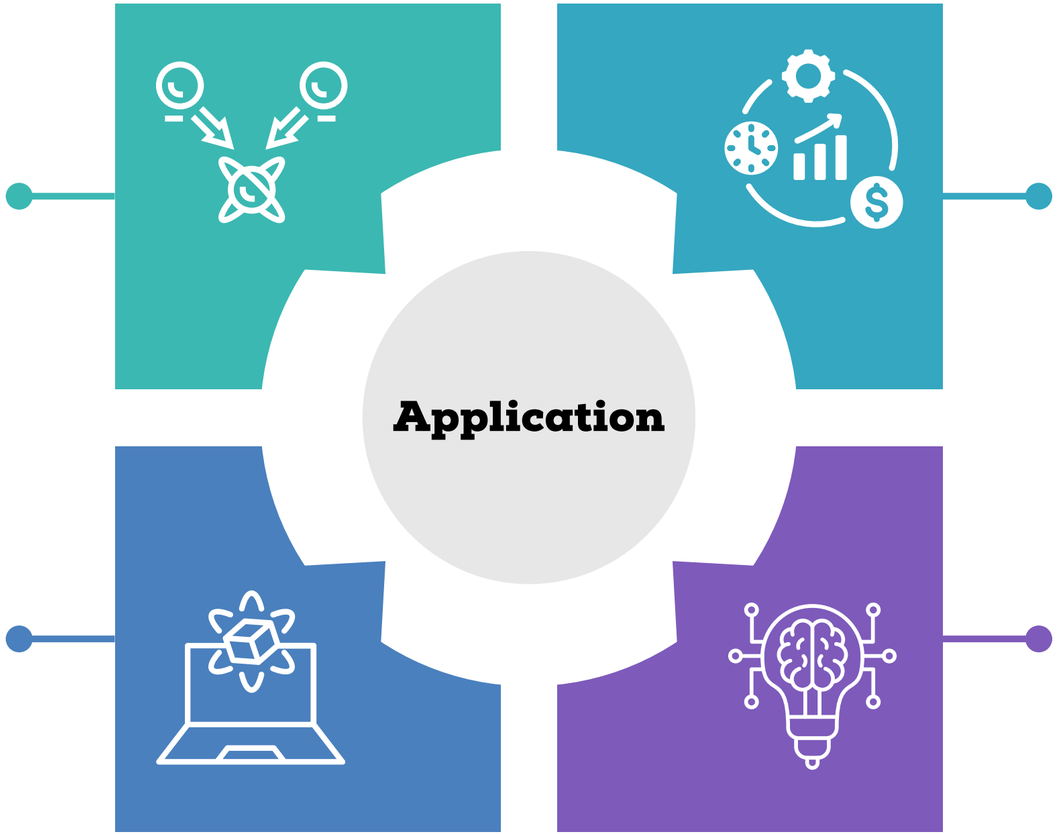
Applications of Quantum Computing

01 Cryptography

Breaking traditional encryption methods and developing quantum-resistant encryption.

02 Optimization

Enhancing solutions in logistics, finance, and operations.



03 Simulation

Simulating molecular structures for drug discovery and materials science.

04 Machine Learning

Accelerating data processing and algorithm performance for artificial intelligence.

And the impact Quantum Technlogy will have on Industries

Industry	Oil & Gas	Automotive & Assembly	Aerospace & Defence	Semi conductors	Medtech	Media & Gaming	Insurance	Public Sector
Monitoring	Seismic monitoring, Pipeline monitoring for predictive maintenance	Production-line optimization (eg, positioning) and quality assurance.		Production-optimization, Battery-life improvement & predictive Maintenance			Weather predictions for climate models	Volcano prediction, Seismic disturbances, Weather predictions.
Imaging					Cardiovascular irregularities, Brain abnormalities	Gaming interfaces, BCI		
Navigation		Precise atomic clocks for high accuracy GPS navigation	Precise atomic clocks for high accuracy GPS navigation					
Identification	Identification of natural resources	Faulty part identification in production		Faulty-part detection in microelectronics				

Source: Mckinsey Digital - Quantum Technology Monitor

Thank You

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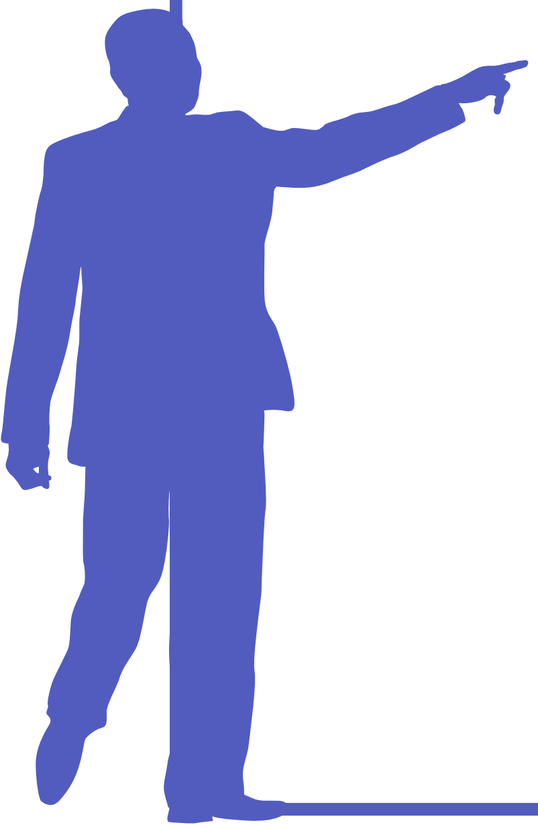
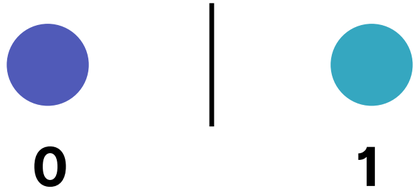
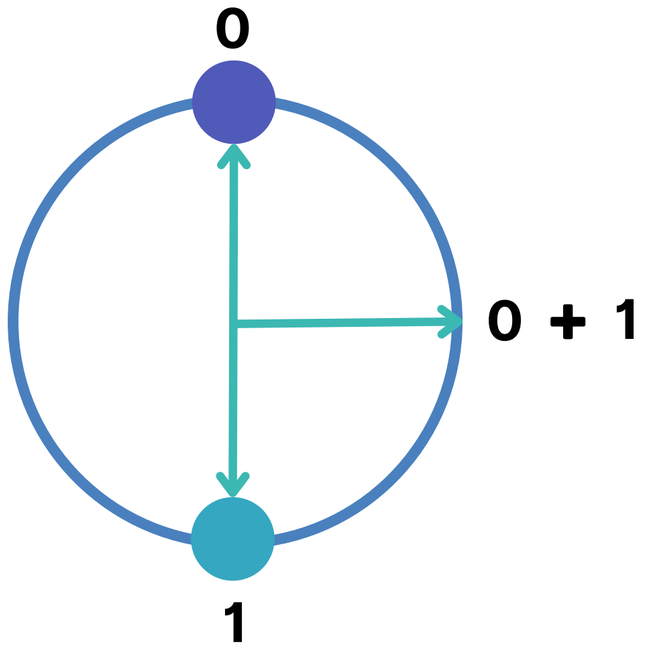
Appendix Ahead

Let’s look at the fundamentals of a Quantum Computer





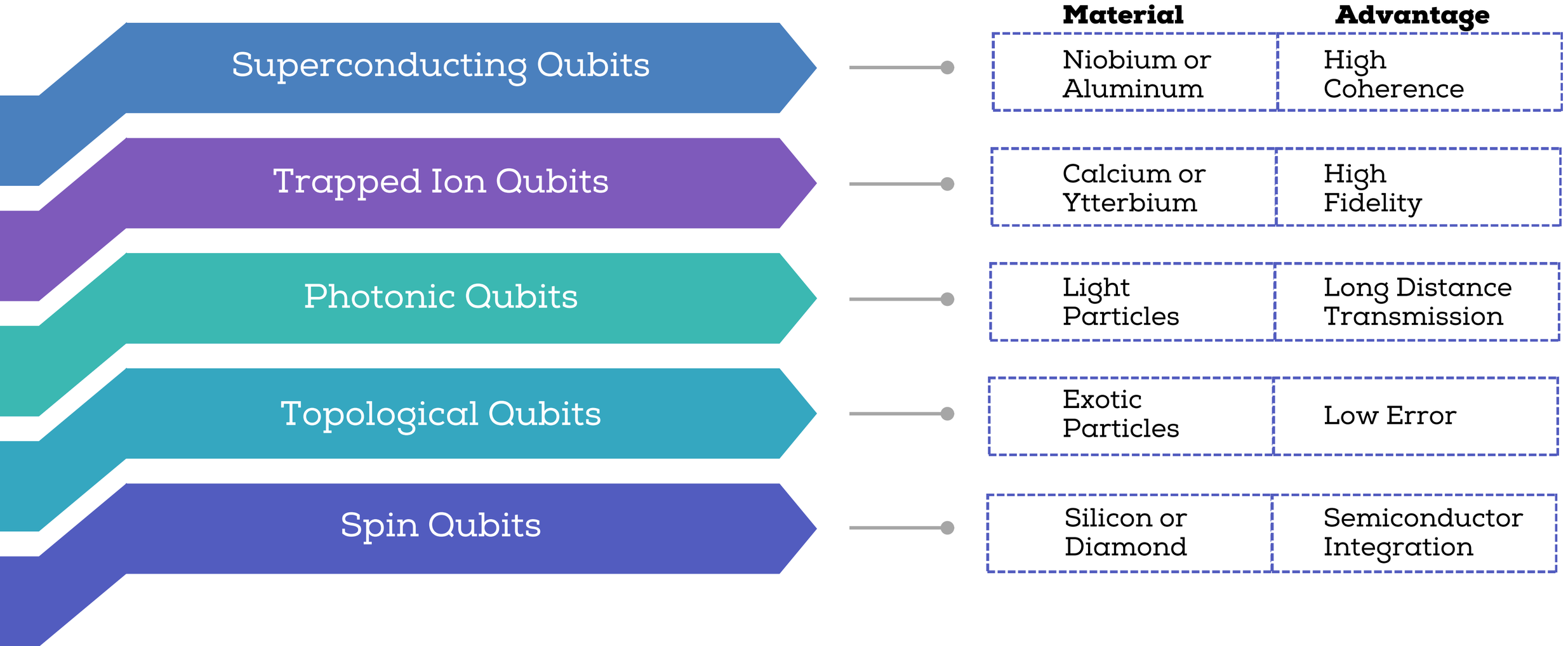
Classical Bits
(Binary)
Either 0 or 1



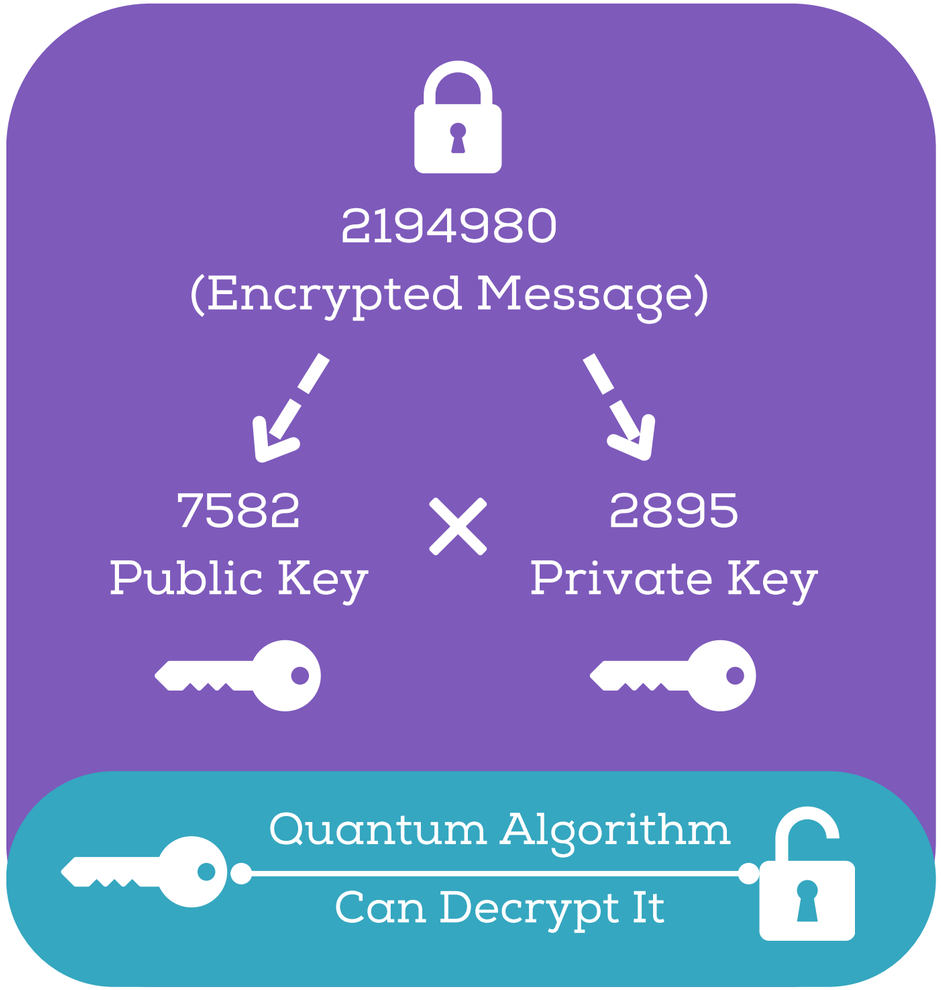
Quantum Bits
(Qubits)
Either 0 or 1
or
Both 0 and 1 at the same time

Classical Bits vs Quantum Bits

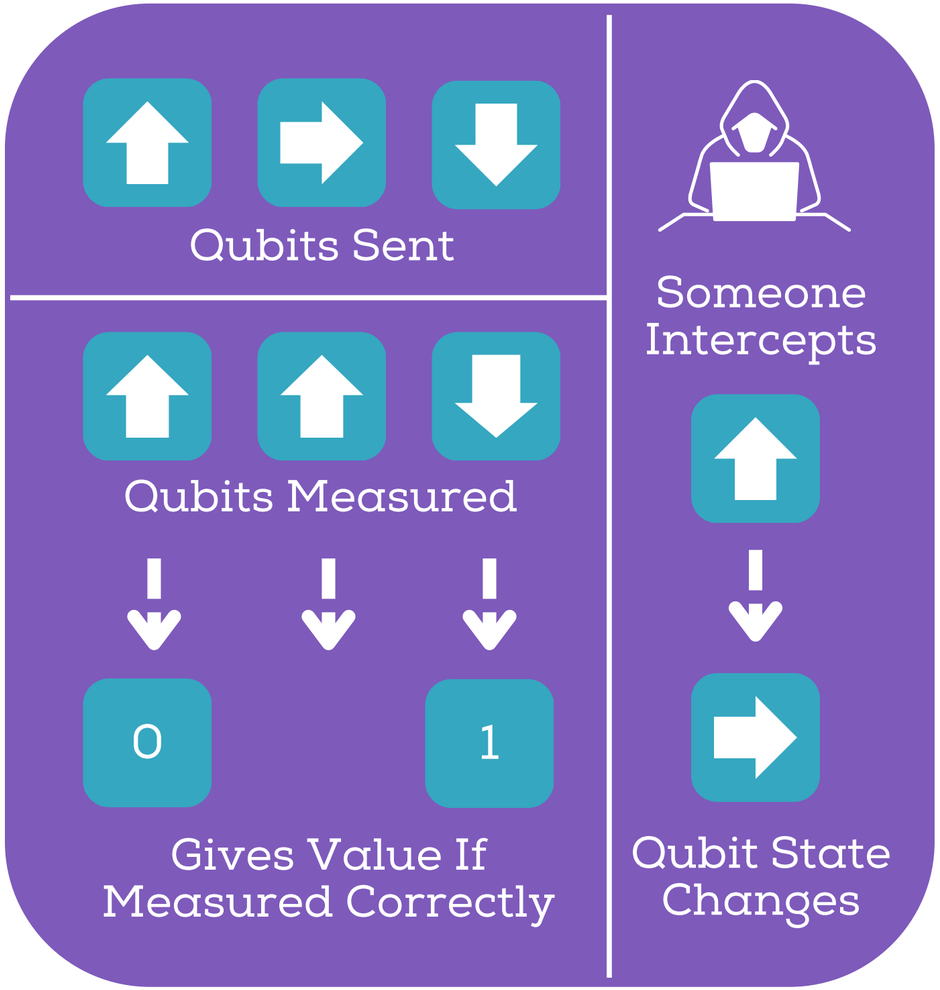
Classical bits manufacturing is limited to just one material, silicon, while quantum bits (qubits) can be made from various materials, each giving significant advantage.



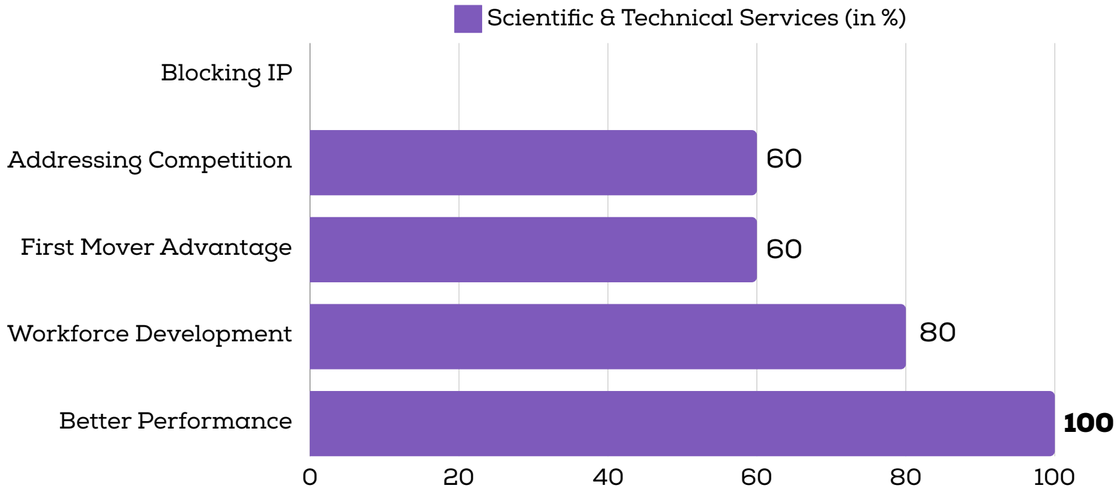
Breaking the classical encryption

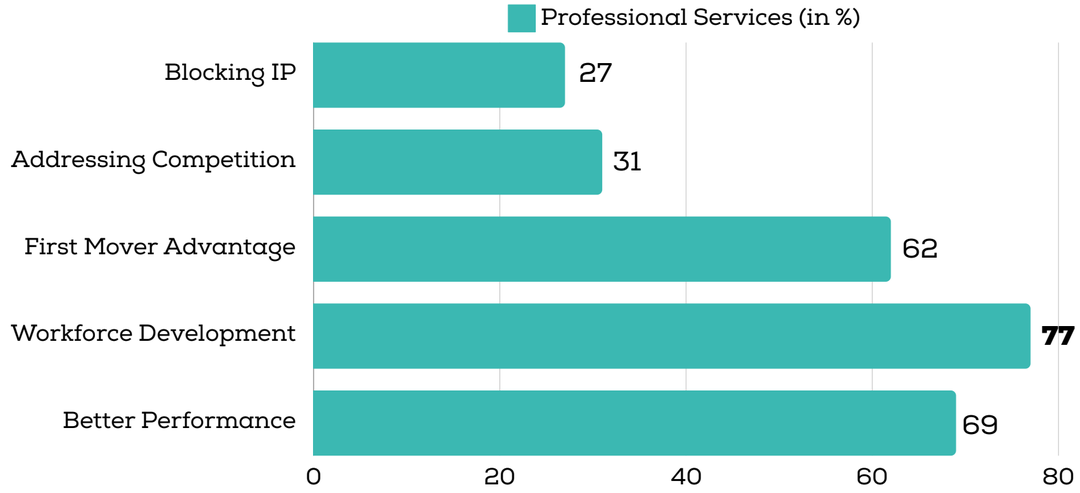


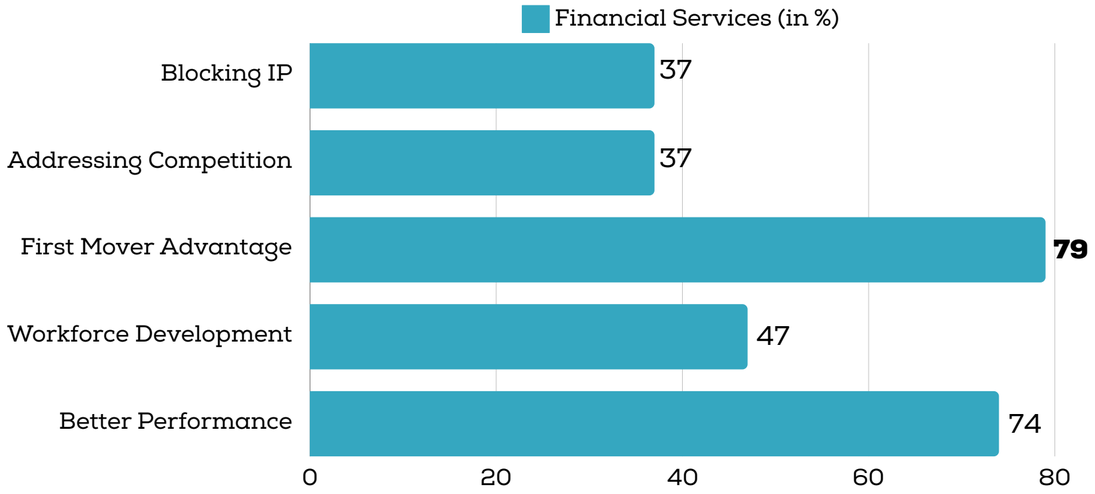
Securing it with Quantum Cryptography

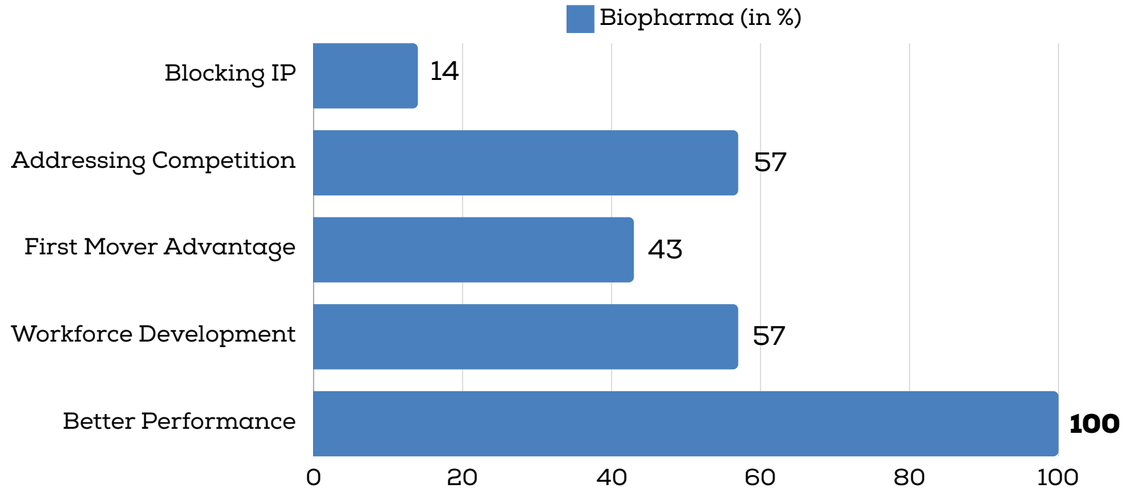


Reasons to explore Quantum Technology Sector









Source: Statista