Delivery Associates

New Mexico Technology Council: Quantum Overview and Workforce Findings

March 2024

Objectives

Explore QIST Workforce Dynamics:
Overview of need, skills, and market trends

Broaden Quantum Inclusivity:
Assess current qualifications and skills

Opportunities for Additional Analysis:
Outline future analysis

Agenda

1. Welcome + Introductions
2. Summary of Findings + Our Approach
3. QIST Workforce Findings
4. Next Steps

01 Welcome + Introductions

Overview of Delivery Associates and Elevate Quantum

Introducing the Delivery Associates Team

Katie Barnum
Delivery Leader

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Delivery Leader

Tobias Knight
Delivery Leader

Tim Ponciano
Project Leader

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Project Leader

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Associate Director

Delivery Associates (DA) focuses on helping public and social sector organizations to deliver better outcomes at scale. Our mission is to improve the effectiveness and accountability of our partners to the people they serve.

DA partners with governments, nonprofits, and philanthropies to deliver better results through better implementation

We frame our work around 5 key questions

What are you going to do?

- Clear priorities
- Specific, measurable goals
- Shared alignment & buy-in between partners

How are you going to do it?

- Robust approach for portfolio development and management
- Practical, adaptable implementation plans

How will you know if you're on track?

- Strong data systems
- Clear visualizations
- Routines and 'stocktakes' with senior leaders

If not, how will you fix it?

- Problem solving, early and often
- Continuous improvement
- Impactful communications

How can we help?

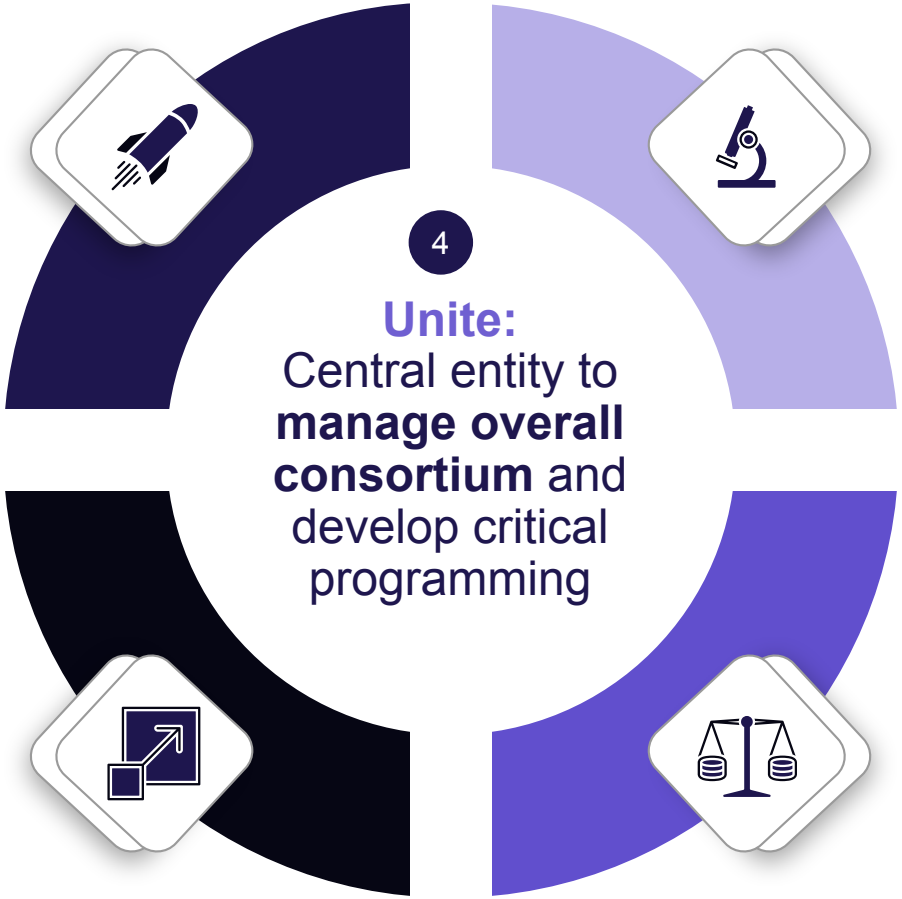
- Laser focus on your goals and priorities
- Deep understanding of how institutions work
- Ideas and insights from comparable work
- Capacity building for sustainable success
- Flexible digital and data solutions

DA supported the Elevate Quantum Consortium's application for $75M through the entire lifecycle of the EDA Tech Hubs grant

Elevate Quantum (EQ) is developing a highly integrated ecosystem, across four key projects, that will accelerate the Mountain West's quantum journey

1 **Create:** An **open-access commercial quantum fab/lab** providing outreach and access to hardware, software, compute, and expertise

3 **Include:** An **industry-informed, accessible, skilled, and inclusive quantum innovation and education ecosystem** that prioritizes activated diversity and equity within the QIT workforce

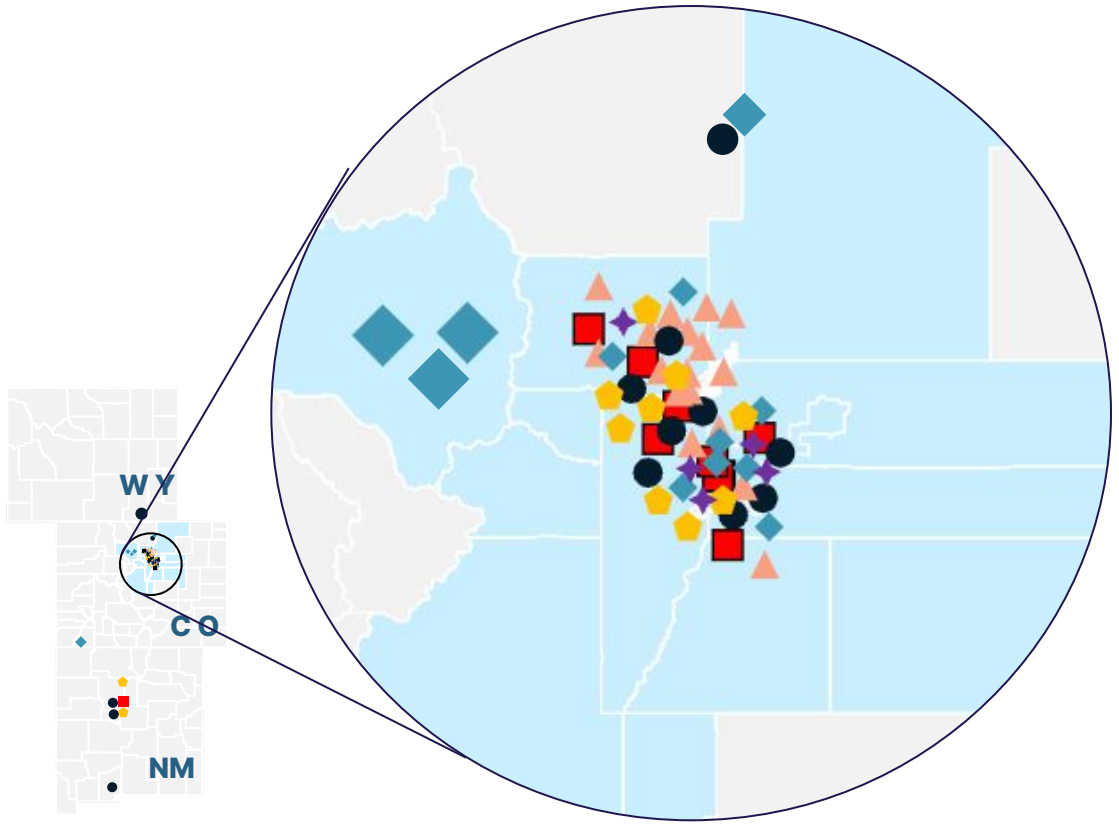


4 **Unite:** Central entity to **manage overall consortium** and develop critical programming

2a **Accelerate (Launch):** A E2E set of **accelerator programs from TTO, studio, and accelerator** designed to commercialize technology and form new successful quantum businesses in CO

2b **Accelerate (Scale):** A program to facilitate scaleups by offering **loan guarantees and multi-dimensional support** to grow partners

EQ is a consortium of 85+ organizations across CO, NM, and WY committed to helping build the region's quantum future



Entity Type

- Labor/Workforce Org.
- Industry/Firm
- Econ Dev / Capital
- K-12 STEM Partner
- Optional Entity
- State/Local Government
- Higher Education
- EQC Hub Geography
- Other Colorado Counties
- State Boundary

*Located outside of highlighted map geography

Labor/Workforce Org.

- Access Mode Accelerator
- ActivateWork
- Colorado AeroLab
- Colorado Equitable Economic Mobility Initiative (CEEMI)
- Economic Development Association for Black Communities
- GeekPack*
- Latino Leadership Institute
- National Center for Women & Information Technology (NCWIT)
- Womanium*

Industry/Firms

- Atom Computing
- Colorado Technology Association
- FormFactor, Inc. (NASDAQ: FORM)
- Icarus Quantum
- Infleqtion / ColdQuanta
- KM Labs
- Lockheed Martin*
- LongPath
- Maybell Quantum
- Mesa Quantum Systems
- Octave Photonics
- PMG Quantum Advisors
- Quantinuum
- Resilient Entanglement
- StratConGlobal*
- Vescent
- Xairos

Econ Dev / Capital

- America's Frontier Fund*
- BuffGold Ventures
- Caruso Ventures
- Colorado TechHubNow!
- Colorado Thrives
- Decisive Point*
- Denver Angels
- Denver Economic Development & Opportunity
- Endeavor Colorado
- Foundry
- Mark IV Capital*
- Matchstick Ventures
- Techstars
- Quantonation*
- Rockies Venture Club
- The Boulder Economic Council
- Colorado Startups

State/Local Government

- Governor of Colorado
- The North Central New Mexico Economic Development District - (political subdivision of NM EPSCoR State)*
- New Mexico Economic Development Department - (political subdivision of NM EPSCoR State)*
- City of Boulder Mayor

Additional Entities

- Los Alamos National Lab*

Additional Entities Continued

- Sandia National Laboratory*
- Colorado Photonics Industry Association
- New Mexico EPSCoR Office*
- Manufacturer's Edge
- National Institute of Standard and Technology - NIST Boulder Laboratory
- National Renewable Energy Laboratory

Higher Education

- Aspen Center for Physics*
- Central New Mexico Community College*
- Colorado Community College System
- Colorado School of Mines
- Fort Lewis College*
- Front Range Community College
- New Mexico State University*
- Telluride Science*
- Anschutz Medical Campus
- University of Colorado, Boulder
- University of Colorado, Denver
- University of Denver
- University of Wyoming*

K-12 STEM Partner

- Cherry Creek Innovation Campus
- Clear Creek School District RE-1
- East Grand School District #2
- St. Vrain Valley School District
- West Grand School District 1-JT

New Mexico’s current engagement in EQ

Create - New Mexico

- Led by UNM, Sandia, and LANL, put forward a component project to establish a QIS deployment facility in Albuquerque
- Aims to bring at least 5 quantum companies to NM to kickstart the quantum economy
- Exploring ways to leverage the space for community engagement events, startup support, and more

Include

- Sandia is helping lead the INCLUDE pillar
- Led by CNM and Sandia, with partners across NM, putting forward a component project to establish hands-on technician training at CNM
- Identifying ways to work with the broader community, including with partners like Explora and CS Alliance, to help introduce QIS in new venues

To support the work and success of the Elevate Quantum initiative, the State of New Mexico has committed to pursuing State funding for a 50% match for these two initiatives in the form of $10 million in state funds upon awarding of Phase 2 funding to the consortium.

02 Summary of Findings + Our Approach

Key Insights

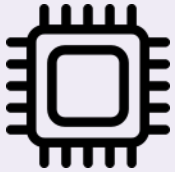
Developing a quantum-ready workforce requires the expansion of educational and upskilling pathways

Today's emphasis on higher education narrows the quantum workforce pool

77K
Workforce gap by 2034

80%
of Jobs require non-Quantum Skills

76%
of Jobs require a Bachelor's or Less



60%
of jobs postings are hardware-centric

Building the quantum future: strategies to strengthen workforce diversity and skills

1

Upskill graduates with quantum-relevant knowledge

Though there is only one qualified candidate for every three quantum jobs, there are **82K graduates in adjacent fields that can be reskilled** to meet current demand.

2

Expand pathways to broaden access to quantum

There are **only ~6 U.S. universities with QIT training labs and 3 of them are in CO**. These are essential for ensuring the workforce advances with the industry.

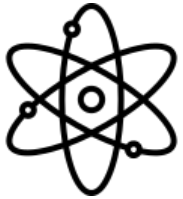
3

Engage historically underserved communities

After just one one-week of a virtual summer camp, middle schoolers demonstrated a **32% increase in interest in pursuing a career in quantum.**

Source: Lightcast, Quantum Computing Report, Expert Interviews

We assessed current QIST requirements and emerging trends to define the quantum workforce, identify supply, and forecast demand



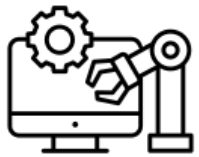
Quantum Workforce

What: Defining the QIST workforce: skills, occupations, wages, etc.

How: Conducting QIST expert interviews, desk research, and aggregation of peer-reviewed reports

Why: The QIST workforce is nascent and is compiled of members from multi-disciplinary backgrounds

1. Defining market trends
2. Assessing QIST wage and on-the-job training incentives



Quantum Demand

What: Quantifying the Mountain West's QIST workforce needs in a 10-year time horizon

How: Utilizing Lightcast, a workforce and market analysis platform, expert interviews, desk research

Why: Driven and guided by industry-informed needs

1. Segmenting demand by QIST domain
2. Generataring Industry informed education and skills requirements

Quantum Supply

What: Identifying sources of qualified candidates and defining the future workforce

How: Leveraging Lightcast, state and federal data sources, desk research, and peer-reviewed reports

Why: QIST's market adoption hinges on the ability to build required hardware to enable widespread software applications

1. Quantifying current and future supply
2. Identifying current QIST pathways

03 Workforce Analysis

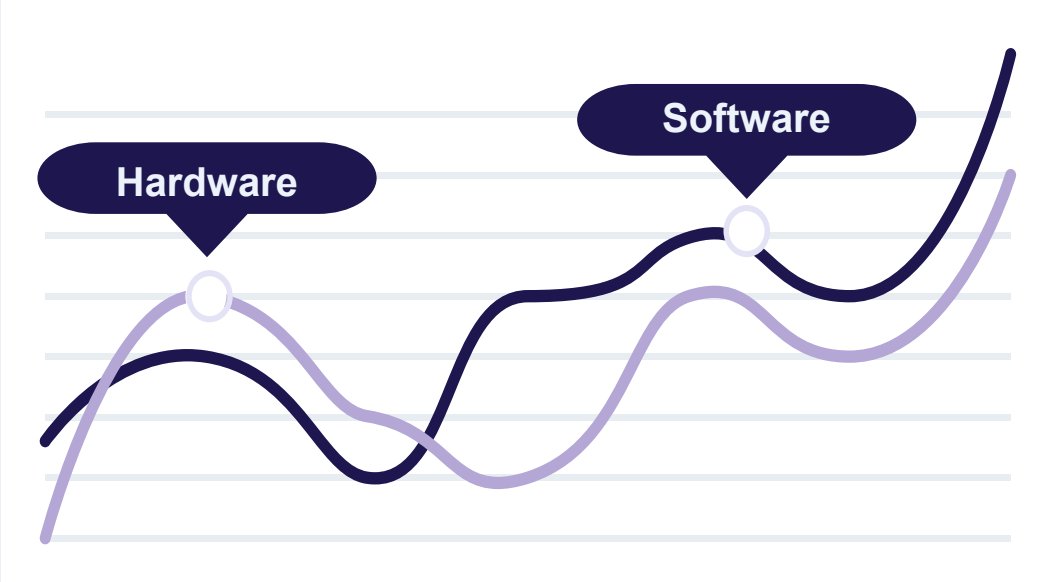
Data Deep Dive

Hardware will continue to drive growth until the industry hits inflection point, the "*Quantum Advantage,*" when software will accelerate long-term adoption

Quantum Over the Next Decade

- **Today**: Hardware makes up the largest portion (46%) of the jobs in QIST, signaling the industry's focus to advance quantum computing's capabilities and tackling complex tasks.
- **Quantum in 5-10 Years:** Quantum has reached a technical milestone and threshold. The industry is one step closer to the "Quantum Advantage", shifting the workforce to predominantly software.
- **Quantum 10+ Years:** Quantum has entered the application phase and the quantum workforce has matriculated into industry positions (e.g. healthcare, defense, IT, finance, etc.).

Quantum Worker Skill Demand



**Please note that this graph is notional only.

Source: Lightcast, Quantum Computing Report, Expert Interviews

Equipping the workforce with essential skills is key to realizing the quantum advantage

~60% of job openings require experimental-focused skills, signaling a gap for hardware-focused skills, which, have lower barriers to entry

Top 10 QIST Employer Desired Skills

- Systems Engineering
- C++
- Software Engineering
- Electrical Engineering
- Python
- Java
- Linux
- Systems Integration
- Software Development
- Automation

Top 10 QIST Employer Desired Occupations

- Software Developers
- Software QA Analysts and Testers
- Mechanical Engineers
- Electronics Engineers
- Electrical Engineers
- Computer Network Engineers
- Network and Computer Systems Administrators
- Computer Hardware Engineers
- Architectural and Engineering Manager
- Electrical and Electronic Engineering Technicians

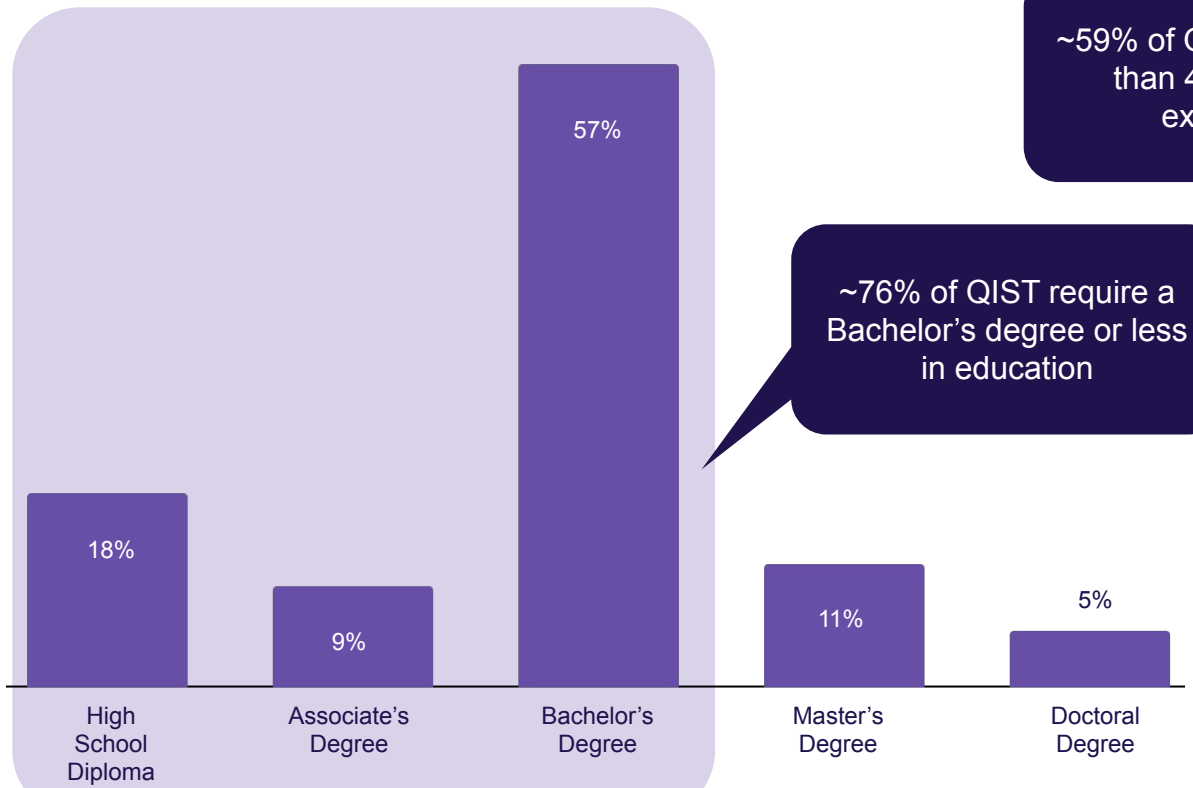
Hardware-related occupations are more distributed making up almost 60% of the most desired occupations

Note: Analysis based on ~200 US companies related to quantum information science. See Appendix 1 for inventory of current landscape

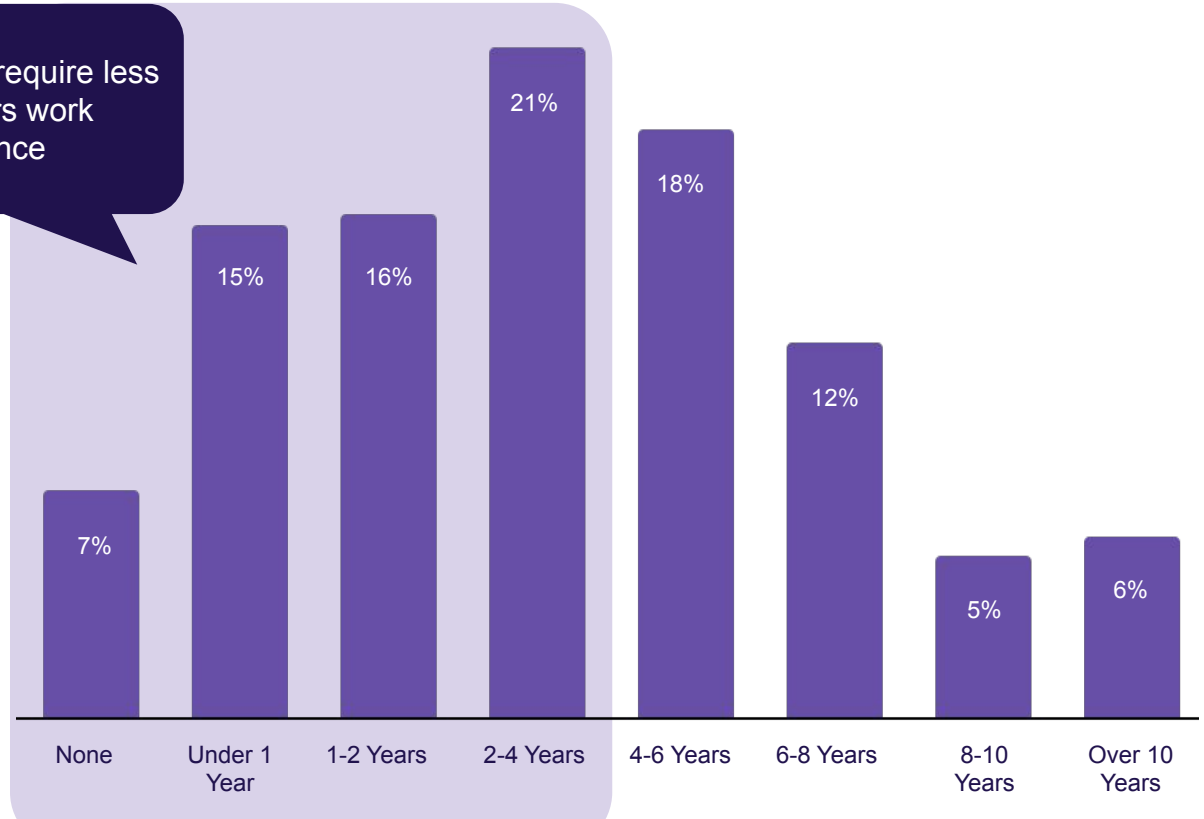
Source: Lightcast, Quantum Computing Report, Expert Interviews

Positions in quantum are more accessible than perceived, advanced degrees and extensive work experience are not required

Education Required



Work Experience Required

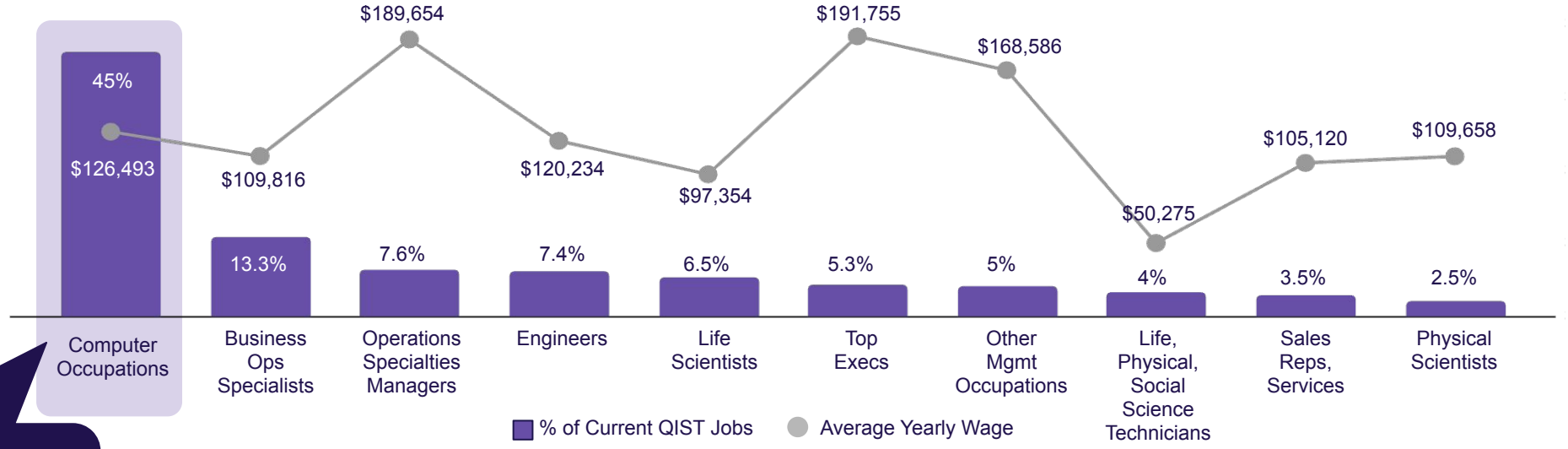


Note: Based on ~50K job posting from 2018-2023.

Source: Lightcast, Quantum Computing Report, Expert Interviews

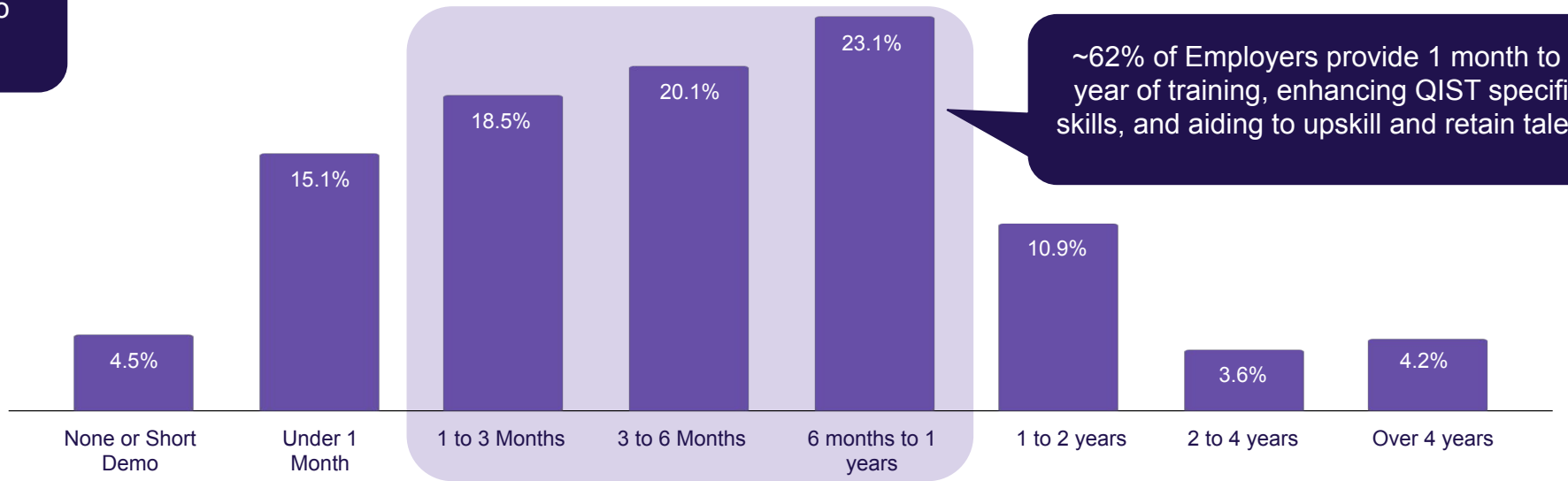
Market signals high demand for talent with competitive salaries and training programs

Occupation



Most common occupation provides an avg salary of $126K, compared to USA's average salary of $59K

On-the-job Training Provided

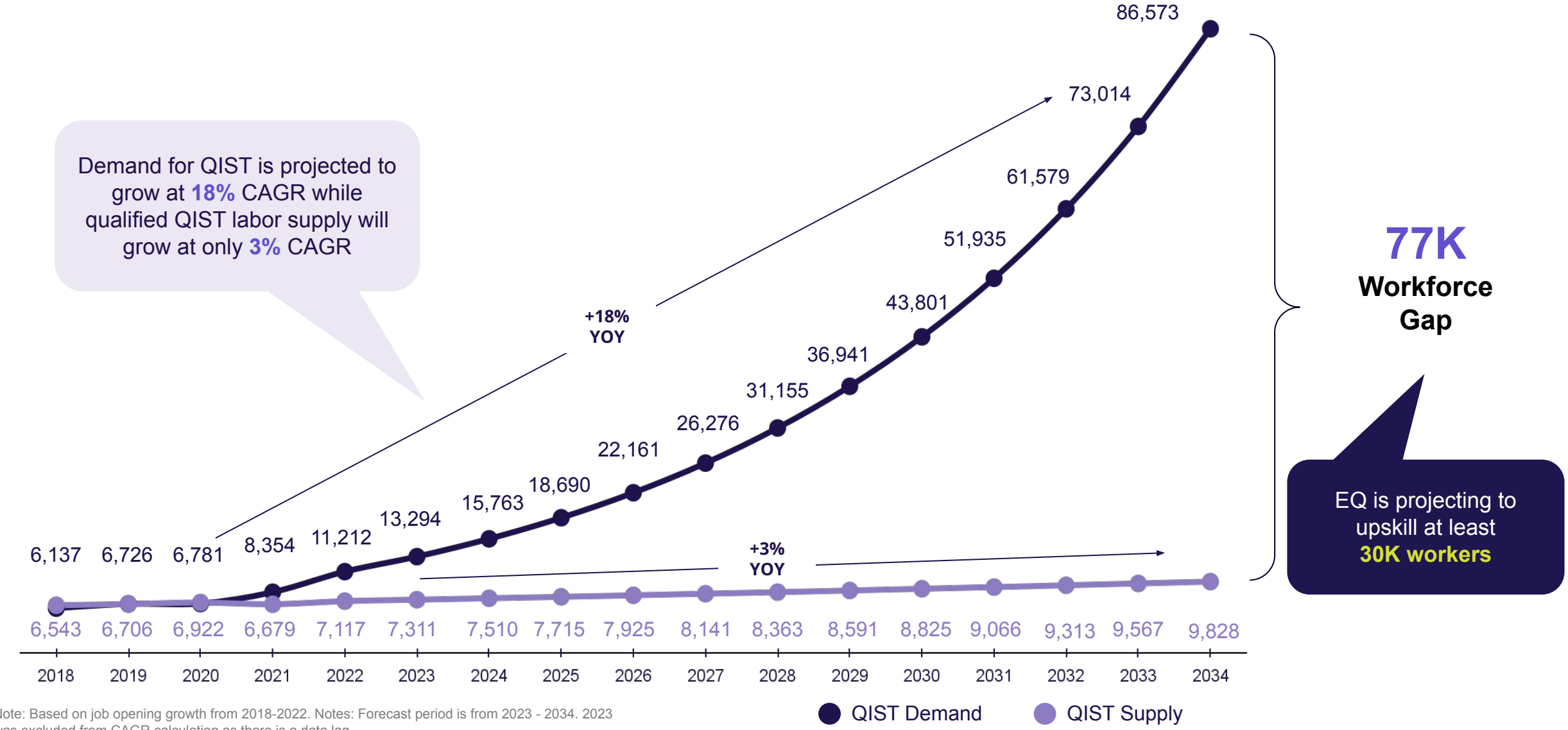


~62% of Employers provide 1 month to 1 year of training, enhancing QIST specific skills, and aiding to upskill and retain talent.

1. Based on Bureau of Labor Statistics (BLS) SOC Occupation Codes

Source: Lightcast, Quantum Computing Report, Expert Interviews

The quantum talent pipeline in the Mtn West falls short of industry demand but can be strengthened by upskilling and expanding education pathways



Note: Based on job opening growth from 2018-2022. Notes: Forecast period is from 2023 - 2034. 2023 was excluded from CAGR calculation as there is a data lag.

Source: Lightcast, Quantum Computing Report, Expert Interviews

04 Next Steps

What Happens Next

Uncovering further opportunities in the QIST workforce through detailed analysis

INDUSTRY

- Spans and layers analysis to define the optimal proportion of hardware and software workforce members to reach technical milestones
- Benchmark findings across regions

EMPLOYERS

- Estimated cost or investment of training a technician and upskilling to a technologist
- Workforce demands segmented by QIST specilitality (e.g., Qubit modality)

WORKFORCE

- Heatmap of MSAs, identifying the most impactful communities to implement programming
- Persona mapping of Hardware-centric roles

Thank you.