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QUANTUM COMPUTING: A VIEW FROM THE TRENCHES

Research note | October 2021

Executive Summary

An August '21, Classiq commissioned a survey of over 500 managers that are familiar with quantum technologies. The survey revealed that quantum computing is perhaps closer than conventional wisdom, and that there is genuine excitement amongst the people in 'the quantum computing trenches' about the organizational benefits of quantum.

The survey also reveals two major roadblocks to quantum deployment: the lack of qualified manpower, and the availability of development environments that can address next-generation quantum computers.

Key findings include:

- Only 1.4% don't think quantum computing is a necessity or is important to advance technology performance.
- "Better development platform" is the most cited answer when asked the most important component to the evolution of quantum computing
- More than 60% say quantum computing will be a big trend in the next 5-10 years, second only to virtual and augmented reality
- 95.7% believe that quantum computing can bring performance breakthroughs
- There is tremendous interest in quantum computing training. Nearly 95% of respondents said they would like to be trained in quantum. 95.7% (Q24) think high schools and universities should offer more quantum computing training.
- 89.8% believe IT departments should have a budget specifically for quantum computing technologies, and 61.9% (Q20) report that their company already allocated a budget for quantum computing. The survey also reveals which industries are already budgeting for quantum computing projects.

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Methodology and Sampling Error

A national online survey of 509 US Managers+, was commissioned by Classiq and conducted by Propeller Insights, an LA-based market research firm, between July 26th and August 12th, 2021.
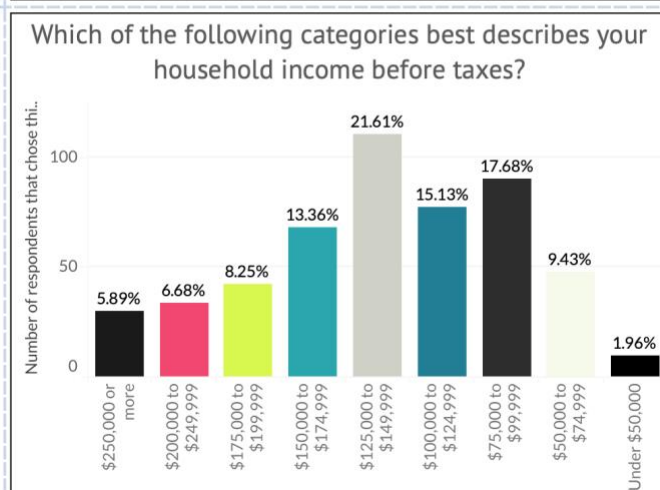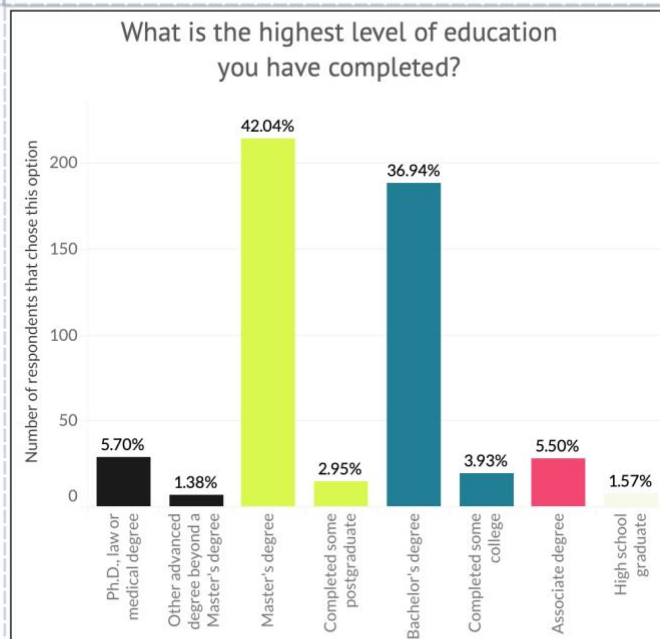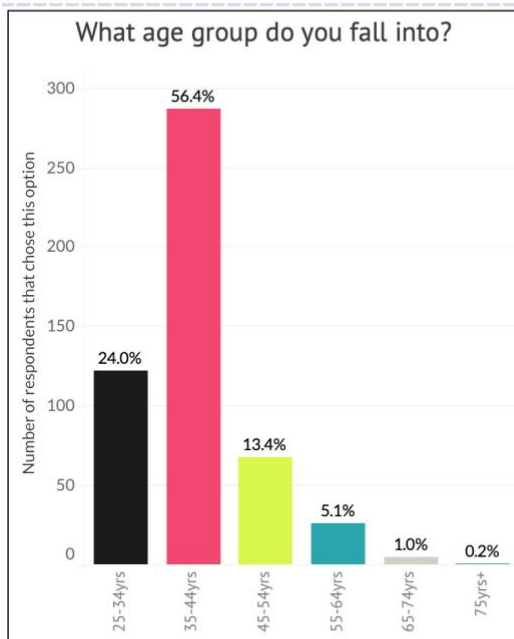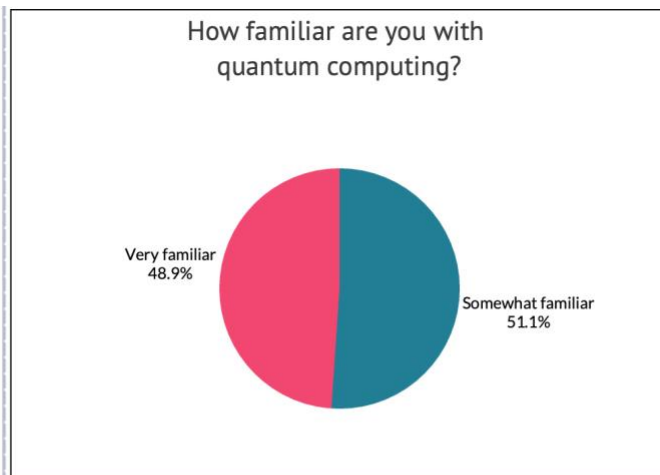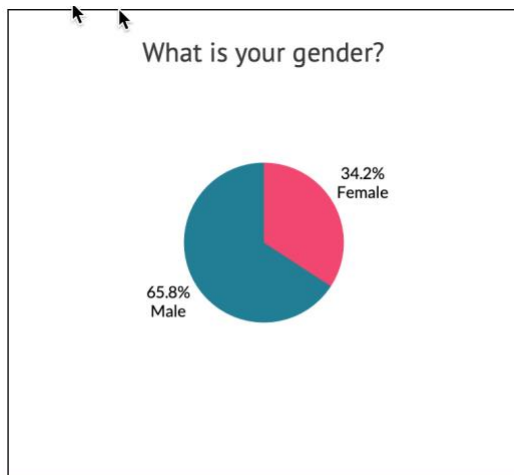
Respondents opted into an online database where they were targeted based on demographics. To further confirm qualifications, respondents were asked to verify their information in the survey itself, including title and industry.

As a qualification question, respondents were asked "how familiar are you with quantum computing?" Only those that responded "very familiar" or "somewhat familiar" were included in the analysis and constitute the 509 samples. Those that responded, "I've never heard of it", "I've heard of it, but I'm unfamiliar" or "I'm vaguely familiar" were excluded from continuing the survey. Also excluded are respondents under 18 years of age.
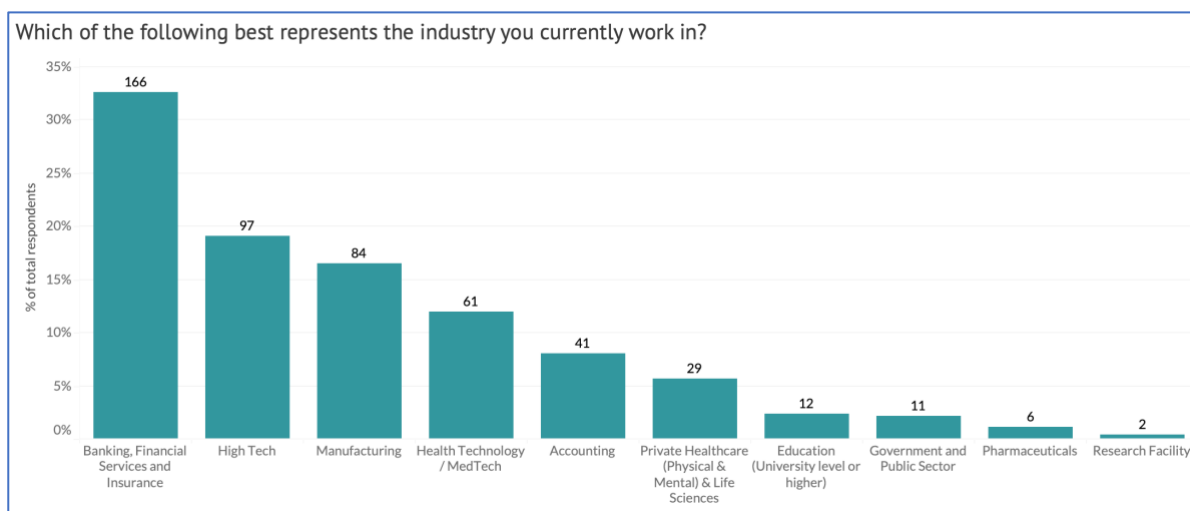
The survey was conducted with the maximum margin of sampling error of +/- 4 percentage points at a 95 percent level of confidence. This means that all other things being equal, if the identical survey were repeated, its confidence intervals would contain the true value of parameters 95 times out of 100. Subsets of the data have a larger margin of error than the whole data set. As a rule, we do not rely on the validity of very small subsets of the data especially sets smaller than 50-75 respondents.
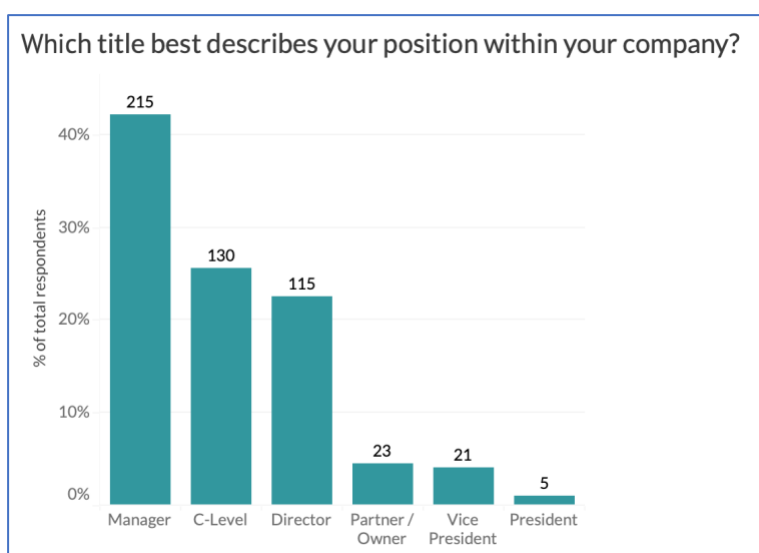
Demographics and Other Attributes

The survey demographics including gender, age, education, US state of residence and household income are summarized in the chart below

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What is your gender?

- 34.2% Female
- 65.8% Male

How familiar are you with quantum computing?

- Very familiar 48.9%
- Somewhat familiar 51.1%

What age group do you fall into?

Number of respondents that chose this option

- 25-34yrs: 24.0%
- 35-44yrs: 56.4%
- 45-54yrs: 13.4%
- 55-64yrs: 5.1%
- 65-74yrs: 1.0%
- 75yrs+: 0.2%

What is the highest level of education you have completed?

Number of respondents that chose this option

- Ph.D, law or medical degree: 5.70%
- Other advanced degree beyond a Master's degree: 1.38%
- Master's degree: 42.04%
- Completed some postgraduate: 2.95%
- Bachelor's degree: 36.94%
- Completed some college: 3.93%
- Associate degree: 5.50%
- High school graduate: 1.57%

In which state do you currently reside?

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Which of the following categories best describes your household income before taxes?

Number of respondents that chose thi..

- $250,000 or more: 5.89%
- $200,000 to $249,999: 6.68%
- $175,000 to $199,999: 8.25%
- $150,000 to $174,999: 13.36%
- $125,000 to $149,999: 21.61%
- $100,000 to $124,999: 15.13%
- $75,000 to $99,999: 17.68%
- $50,000 to $74,999: 9.43%
- Under $50,000: 1.96%

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The survey covered a variety of industries:

Which of the following best represents the industry you currently work in?

Survey participants hold a wide range of managerial roles:

Which title best describes your position within your company?

A word-cloud describing the exact job title is:

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In contrast with other surveys that focused on C-level strategy positions, this survey captured the opinions of many that do the actual work:
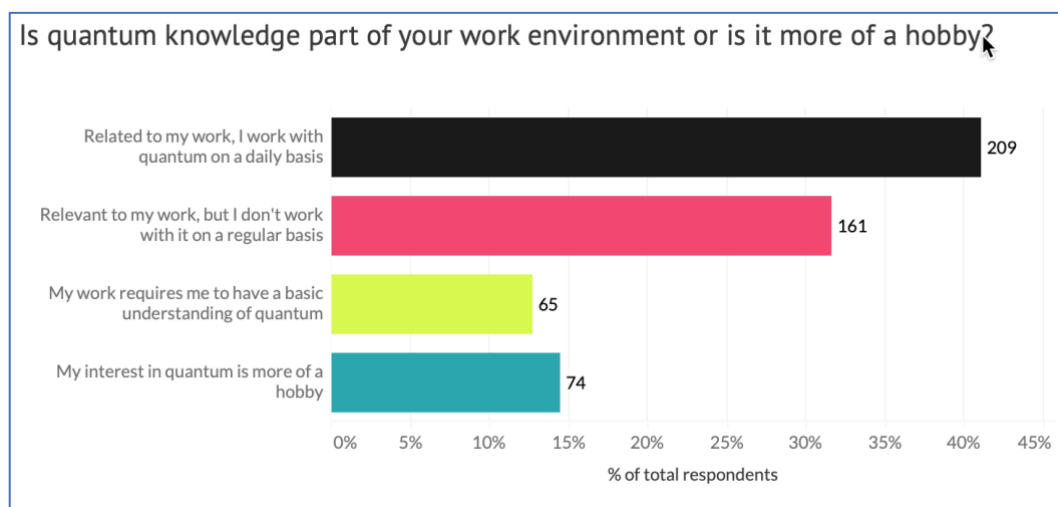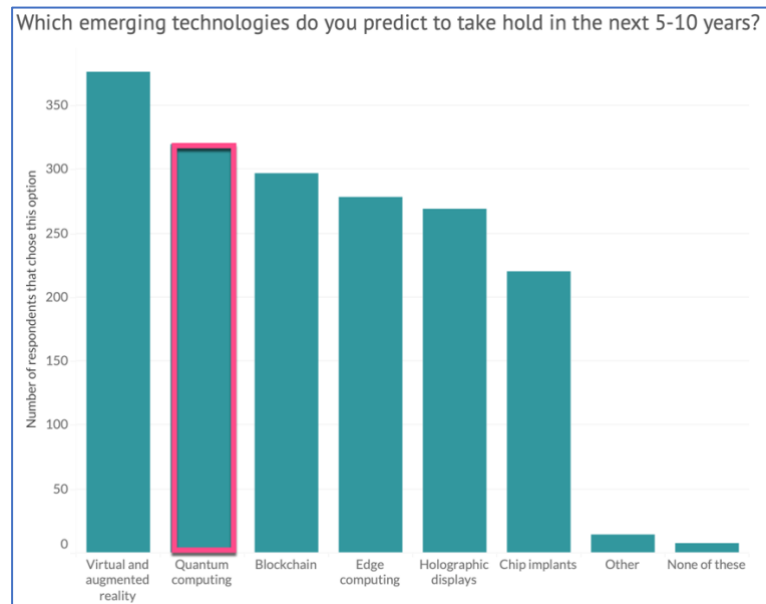

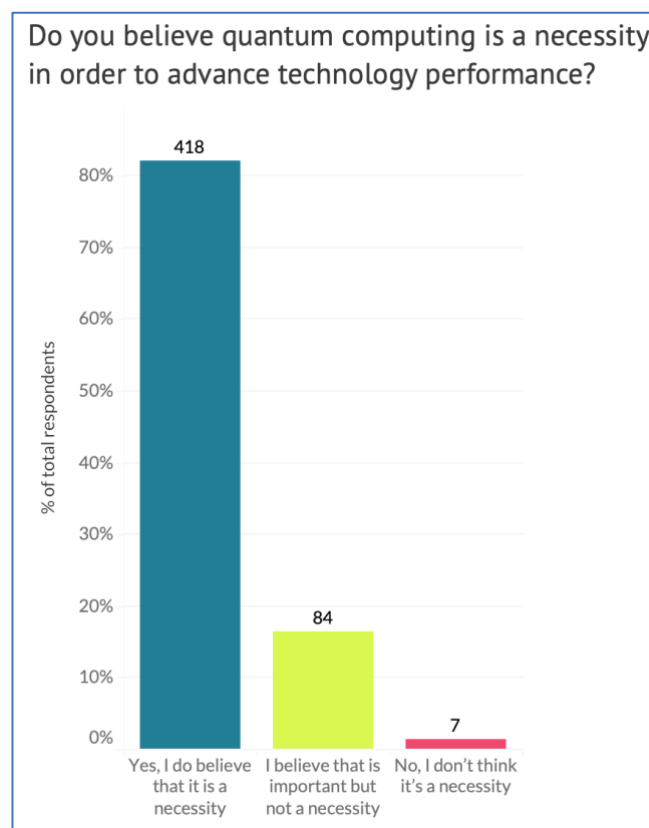Over 40 percent of respondents report that they work with quantum daily.
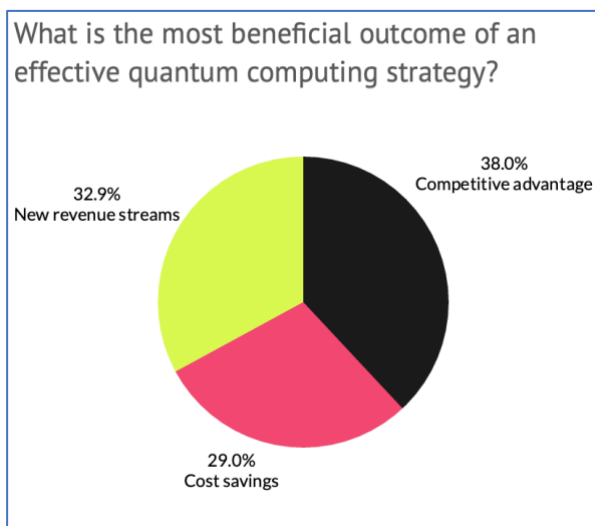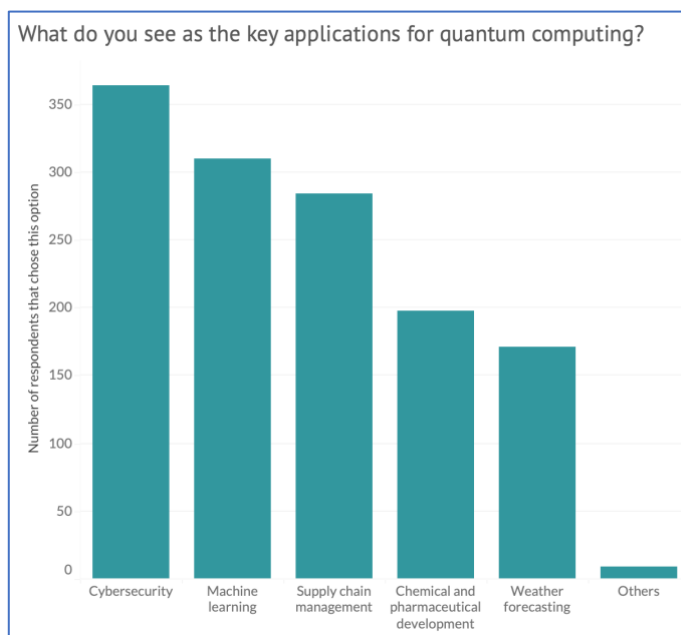
The Quantum Opportunity

We asked a series of questions centered on the opportunity of quantum: how organizations would benefit from quantum computing and in what fields.

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Which emerging technologies do you predict to take hold in the next 5-10 years?
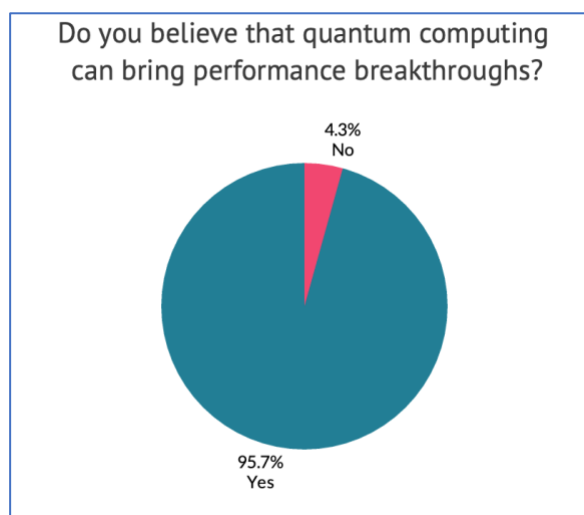
It is not surprising that this cohort believes in quantum computing and predicts it will go mainstream in the coming years.

Do you believe quantum computing is a necessity in order to advance technology performance?

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What do you see as the key applications for quantum computing?

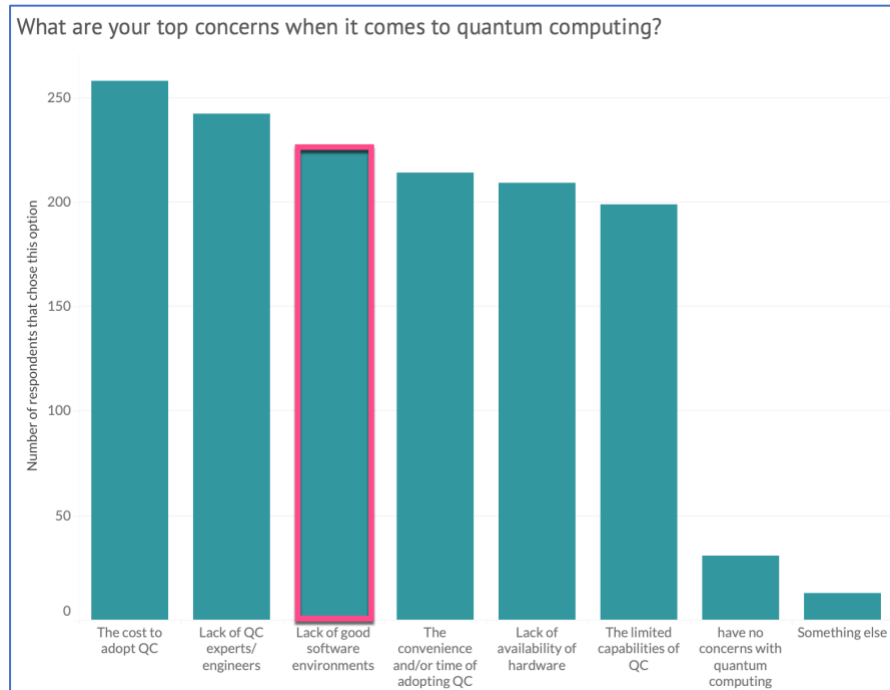**What is the most beneficial outcome of an effective quantum computing strategy?**

Responses are quite evenly distributed between cost savings, new revenue streams and competitive advantages.

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Quantum Roadblocks

The next set of questions focused on the roadblocks: what needs to be solved so that quantum computing becomes mainstream.


There is no dominant concern. In this question, respondents were asked to mark all the items they were worried about. Cost, availability and 'the limited capabilities of quantum computing' are what one would expect at this nascent stage of the market. The hope is that all of these are resolved concurrently: better hardware that is more accessible and more cost-effective. Another key point is the lack of experts and engineers that understand quantum computing. This might be solved in one of two ways:

- Educational programs – whether through academic institutions or offered by corporations – that will train the next generation of quantum-capable software engineers.
- Better software environments that would make it easy – or at least easier – to program quantum computing without requiring a Ph.D. in quantum information sciences.

Which of the below is the most important component to the evolution of quantum computing?
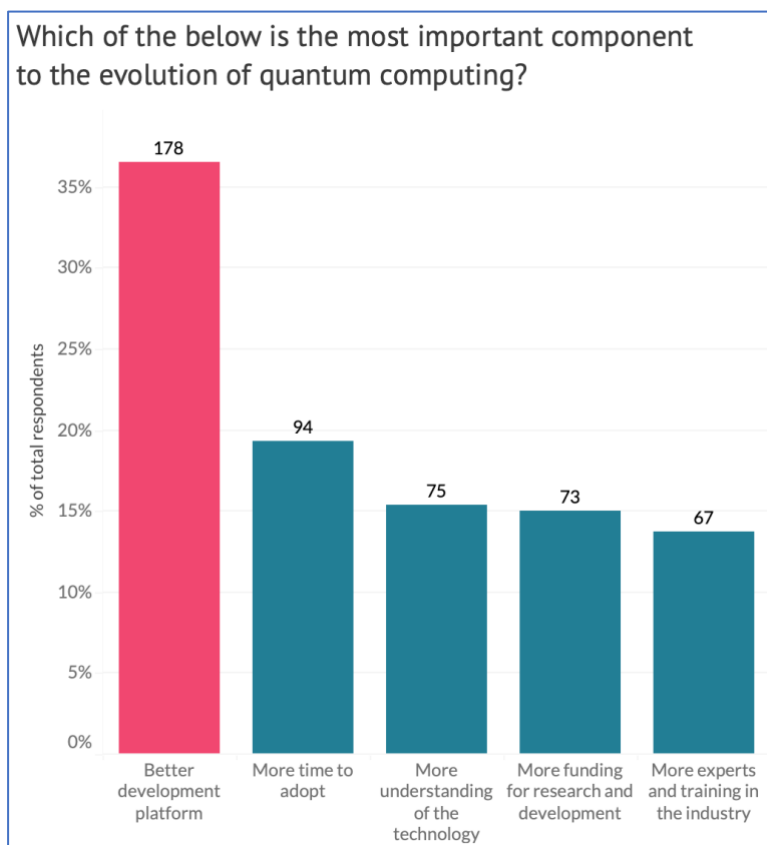
This question did not provide the option to select multiple answers and inquired about the most important component to help the evolution of quantum computing. In this case, we do see a better development platform as a dominant item.
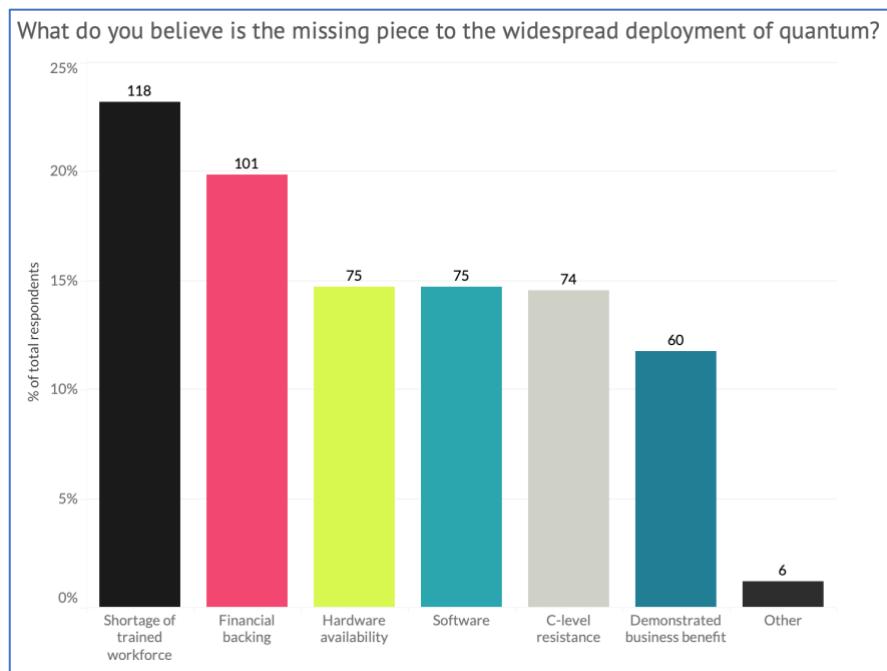
How important do you think portability (the ability to move quantum code developed on one type of quantum computer to another type) is when it comes to quantum software?
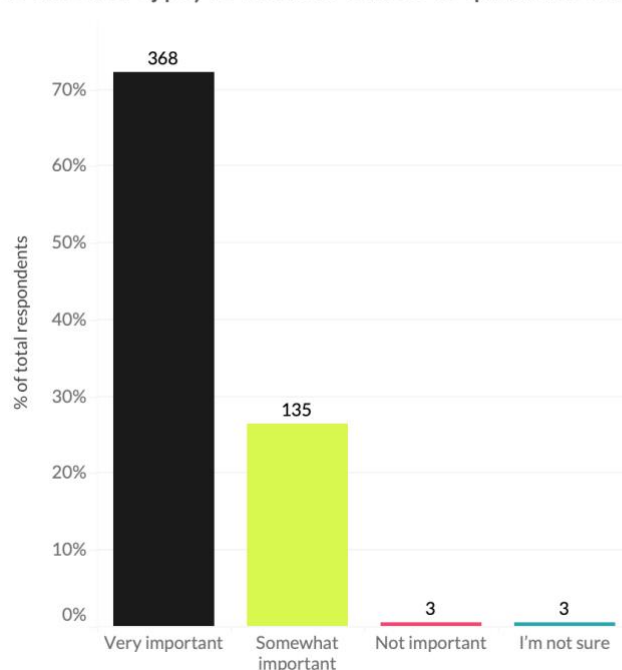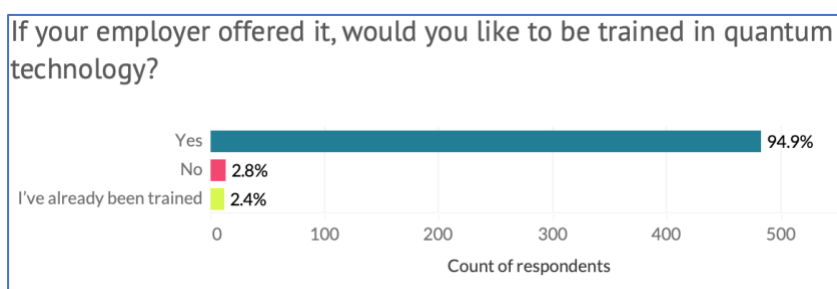
One important attribute of an advanced software platform is the ability to transition software from one quantum computer to another. This is understandable. Today, it is unclear who the winners will be in the hardware race and organizations may be reluctant to commit to one particular hardware architecture without a way to easily port it to another when necessary.

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The Workforce Issue

The shortage of engineers and scientists that can program quantum computers comes up very often. It is also evident in the next question:

What do you believe is the missing piece to the widespread deployment of quantum?

	Shortage of trained workforce	Financial backing	Hardware availability	Software	C-level resistance	Demonstrated business benefit	Other
Count	118	101	75	75	74	60	6

Even though nearly half of respondents describe themselves as 'very familiar' with quantum computers, there is an overwhelming desire for additional education:


If your employer offered it, would you like to be trained in quantum technology?

Yes	94.9%
No	2.8%
I've already been trained	2.4%

Count of respondents

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They are also looking for high-schools and universities to help fill the need:

Do you think high schools and universities should offer more quantum training?

4.3%
No

95.7%
Yes

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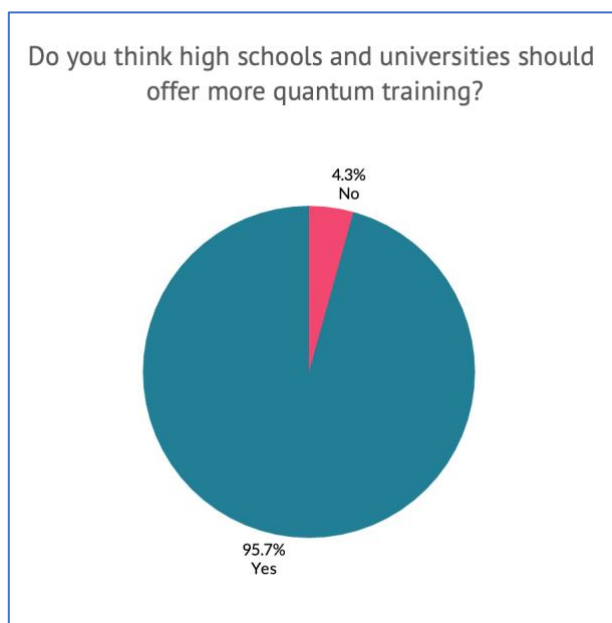
Quantum Computing Budgets

Because of the quantum opportunity and despite the roadblocks, we were curious to understand whether organizations are budgeting for quantum computing projects. This is summarized in the following graphs
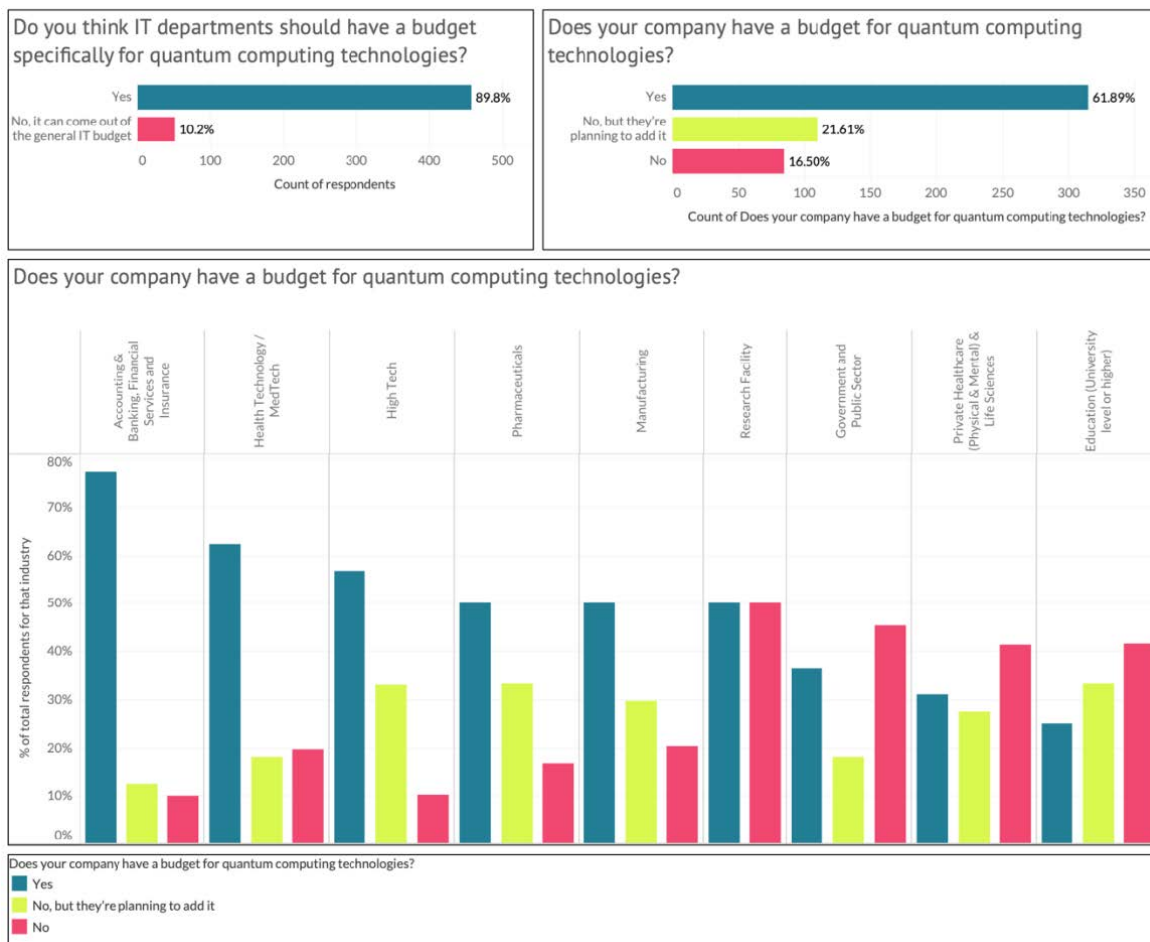
Nearly 90% believe that IT departments should have quantum computing budgets, and over 83% indicate that their company either has a budget or is planning to add it.

The industries that lead in terms of having quantum budgets are accounting and finance, health and pharma, and high technology. Educational facilities, private healthcare organizations and government organizations are behind.

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Summary

The benefits of quantum computing appear to be both significant and around the corner. Organizations are taking notice and are budgeting for quantum projects. While there are roadblocks – notably trained personnel and effective development environments – they appear to be surmountable.

Forward-looking organizations cannot afford to ignore quantum computing and need to chart a coherent strategy to take advantage of this new method of computing, or risk being left at a significant competitive disadvantage.

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REVOLUTIONIZING THE DEVELOPMENT OF QUANTUM SOFTWARE

In this research note, we reviewed the results of a survey conducted in August 2021. We believe that the adoption of quantum computing is accelerating, and are developing a unique software platform to help expedite the design and deployment of sophisticated quantum circuits.

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