

Unlocking the Business Value of Quantum Computing

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Quantum computing is gradually transitioning from being a futuristic concept to slowly and steadily making its way to solving real-life problems. While it is still in the exploratory stages, in the future it is expected to have a very high impact by helping to solve problems that current computing power is not able to, and in the process, creating an industry worth US\$86 billion by 2040.¹

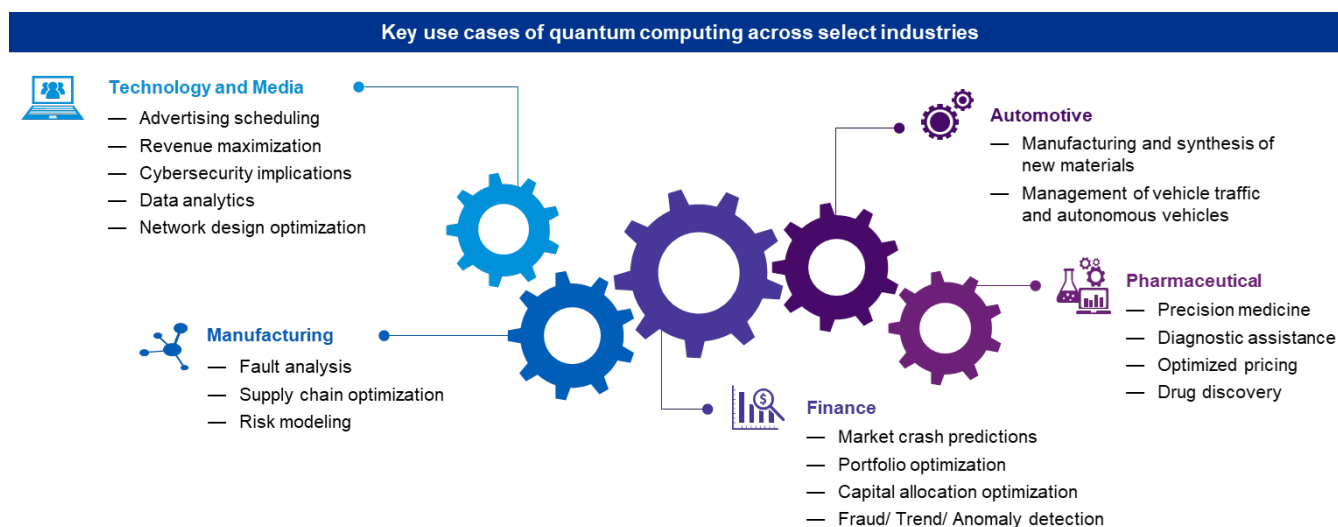
Looking at the promise and potential impact of quantum computing on the economy and business, several countries are funding research and development programs. Overall, there are 15 countries across the world with well-defined national initiatives in quantum technology, with approximately US\$23 billion of funding announced to date.² The UK government, in partnership with industry, has invested £1 billion to commercialize quantum innovations and attempt to secure the UK's status as a world leader in quantum science and technologies. Governments are not the only ones taking steps towards building a quantum future.

Technology firms are also investing millions of dollars in developing quantum computers, and equity funding for start-ups in quantum computing has risen by five-fold since 2015.³

With this hype around quantum computing, one cannot but wonder whether enterprises are exploring the associated risks and opportunities. Quantum computing, due to complex hardware and software requirements, is still a few years away from being commercially available. However, this has not discouraged enterprises from investing in or exploring it. IDC predicts that the number of organizations putting aside more than 17 percent of their annual IT budgets for quantum computing would rise to 19 percent by 2023.⁴

The interest in quantum computing can also be ascribed to its broad use for solving problems across industries (see Figure 1).

Figure 1: Quantum computing use cases across select industries



Source: KPMG analysis

¹ Growing Australia's Quantum Technology Industry, Australia's National Science Agency, May 2020.

² 15 Countries With National Quantum Initiatives, The Quantum Daily, April 2021.

³ What Is Quantum Computing? Definition, Industry Trends, & Benefits Explained, CB Insights, January 2021.

⁴ Quantum Computing Grows Its Following with Investments and Experiments on the Rise, According to IDC, IDC, May 2021.

In fact, it would not be wrong to say that what is seen today is the tip of the iceberg and in the future, with this technology maturing, there will be infinitely more and intriguing application areas for quantum computing. A report on the impact of quantum technologies on the EU's future policy, published by the European Union in 2018, underscored various

application areas for quantum computing over a 20-plus year timeframe. The report identified optimization, molecular simulations/quantum chemistry, material science, machine learning and pattern recognition as the application areas for quantum computing in the near future (see Figure 2).⁵

Figure 2: Expected implementation time scale for various quantum computing applications



Source: European Union, JRC Science for Policy Report, The Impact of Quantum Technologies on the EU's Future Policies, 2018.

What are the challenges in the adoption of quantum computing?



A fully mature quantum technology is expected to be unprecedentedly transformational. However, quantum technology is far from that stage and thus companies face significant challenges in the adoption of quantum computing. These are outlined below:

Continuous evolution of the quantum computing landscape

Although quantum technology is still at a nascent stage, it is evolving at a rapid pace. This has resulted in several new approaches towards the development of quantum technology. For example, there are several different approaches towards building a quantum computer depending on the type of qubit technology used at the hardware layer. It is then difficult to identify which specific technological approach will be able to withstand the pressure of time and prove its suitability for running commercial applications.

Lack of identification of business use cases

Although quantum computing offers tremendous potential, companies are still cautious in adopting it. In a survey conducted by KPMG in September 2021,⁶ only 56% of companies said they had undertaken any work to explore the risks of quantum technologies and the opportunities they may offer their business. That leaves 44% of companies having yet to take action regarding quantum technology. This cautious approach can be attributed to the challenges faced in identifying the right business problems that cannot be solved by classical computers and require quantum computing.

Shortage of skilled resources

Quantum computers are radically different from classical computers and require specialized skills that are in short supply. Development of quantum computing capabilities requires people who understand physics, mathematics, and computing. What is more, companies experimenting with quantum computing need employees who can provide an understanding of the business and therefore are able to identify the specific problems that require the maturity and ecosystem of quantum computing. A combination of such skills can be very difficult to find.

There is no denying that quantum computing delivers significant advantages over traditional computing, so what steps can businesses take to help ensure they overcome these challenges and realize the potential benefits?

⁵ The impact of quantum computing on the EU's Future Policies, JRC Science for Policy Report, 2018.

⁶ Based on a survey conducted by KPMG in the UK in September 2021 during a webinar on 'Future of Cyber in TMT's

The roadmap to realizing business value from quantum computing efforts

Adopting a nascent technology with immense future potential can be a tricky situation. KPMG has outlined some few steps that businesses can take to help realize the potential benefits from their quantum computing efforts.



Build an understanding of quantum computing within the organization and allocate it to a leader/team:

Quantum technology is no doubt an extremely complex technology to develop. However, using it to help solve business problems is not so difficult. Companies must overcome this initial hesitation and take the first steps to experiment with quantum computing. Along with this, it is important to identify the right people who can help champion the learning curve for quantum computing, its acceptance across relevant functional areas and its alignment to strategic objectives.



Identify suitable use cases and the associated value proposition:

Although quantum computing still might not be fully mature, some companies have started using it to solve problems within their business. For instance, companies across the utilities, automotive, finance and pharmaceutical industries are using it to help solve optimization-related business problems and have realized the benefits. As more progress is made within quantum technology, several new use cases will be developed and it will be essential for companies to identify those most relevant to their business. Making the right bets is expected to be an important factor in realizing the potential value of quantum computing.



Leverage the quantum ecosystem:

To help them be successful on this journey, companies should engage with the quantum technology ecosystem that consists of technology firms, start-ups, government, and academia. This ecosystem is expanding rapidly and can be extremely beneficial to companies. Engagement with the ecosystem can help companies identify relevant use cases, develop technical expertise and test solutions on actual quantum computers. The ecosystem can also assist companies to identify future disruptions in quantum technology development and, in the process, find relevant technology stacks that can help realize value from quantum computing projects.



Develop a long-term vision for adopting quantum computing:

Quantum computing as a technology is still in the preliminary stage and it will take a few years before it is available for general commercial use. However, companies should realize there is an upside to what quantum computing can deliver and develop a long-term vision for its adoption. There is an important need to take small steps to start experimenting with and take on quantum technology's steep learning curve. In the future, as quantum technology matures, companies that invested early in building relevant capabilities could have significant advantage over others.

Quantum technology is expected to bring massive disruption to various industries and windfall for companies that invest in building the right capabilities. A fast-follower strategy may not deliver the results it has in the past, so companies should start taking the initial steps now to be at the forefront on the road to quantum computing.



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