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News analysis

Tech workers need new skills as Singapore gets set for quantum leap

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Singapore will soon build its own quantum computer, joining a handful of nations in doing so.

Quantum computing will herald a new computing age where new drugs and battery materials can be discovered much faster, and more accurate artificial intelligence (AI) models to detect fraud, software bugs, cancer cells and hate speech can be rolled out.

Nations that gain quantum advantage will have an edge in AI, biochemical and financial capabilities, among other things, bringing about significant economic gains in the digital future. Those that host quantum computers and have dabbled in this space include the United States, China, France, Finland, Germany, South Korea and Japan.

But the technology workforce needs to be upskilled to tap the benefits – a challenge not unique to Singapore.

Training is what Singapore hopes to provide, with Deputy Prime Minister Heng Swee Keat yesterday announcing the launch of the National Quantum Computing Hub and National Quantum Fabless Foundry at the Asia Tech x Singapore summit.

The hub, which will house Singapore's first quantum computer, will pool expertise from the Centre for Quantum Technologies at the National University of Singapore and other institutions. It will also be the place where companies and government agencies can test real-world applications to gain first-hand experience with the technology.

The foundry will develop the components needed to build quantum computers, with the aim of attracting businesses to set up shop here to establish an ecosystem of activities in the emerging field.

"Our investment in quantum computing and quantum engineering is part of our approach of trying to anticipate the future, and proactively shaping the future that we want," said Mr Heng yesterday.

The war chest in this quantum quest is at least $23.5 million. It will last until mid-2023, under Singapore's Research, Innovation and Enterprise 2020 plan.

Quantum computing is a branch of information science with developments dating back to the 1970s. It is similar to traditional computing, but operates at the far cooler temperature of nearly absolute zero (minus 273.15 deg C), where quantum objects (an electron or a particle of light) are manipulated to execute complex mathematical calculations out of reach of traditional computers.

A lot has progressed since, with quantum computers expected to outperform the world's best supercomputers as early as next year. The largest quantum computer can be more than 150 million times quicker than the fastest supercomputer and can solve in minutes a problem which would take a supercomputer 10,000 years.

Just what new skills are needed?

At the very least, technology workers will need to be more "quantum-literate", said Dr Alexander Ling, director of the National Research Foundation's Quantum Engineering Programme. This includes knowing what quantum computing can and cannot do.

Quantum computing – which works in similar ways to the human brain's neural network – is best suited for simulating drug molecules and understanding images and natural language. However, it is not suitable for processing and formatting a massive amount of data for analysis – a task for traditional supercomputers.

Software developers and data analysts need to understand this, and find ways to allow quantum computers to work with traditional computers.

"It is understanding the business problem and the underlying maths or model, and understanding how to manipulate the data to fix the problem," said Dr Scott Crowder, vice-president of IBM Quantum Adoption. "So, it is having the chemist (in a biomedical company) or data scientist at the bank understand quantum algorithms and being able to apply those to use cases and real-world problems."

The New York-based executive is in Singapore to attend the Asia Tech x Singapore summit, and he spoke to The Straits Times on the sidelines of the event.

In another example, quantum computers are good at uncovering patterns in data too complex for classical computers. So, banks can use quantum computers to detect fraudulent transactions, or even pinpoint a sweet spot at which investment portfolios can derive maximum gains with the least amount of risk.

Similarly, quantum computing can be a boost to AI models in understanding the context and nuances of human language. In this way, disinformation as well as toxic social media posts, videos and images online can be removed automatically.

The good news is that Singapore is not starting from scratch. The nation can level up from its current base of more than 200,000 tech professionals, and its education system can continue to keep pace with the latest tech advances. Plus, there is no need to acquire yet another programming language as what works today in software programming will still work in the quantum computing age.

As for hardware, it will be down to the Centre for Quantum Technologies and the upcoming National Quantum Fabless Foundry.

"Quantum computing in the physics department has been around for a long period of time... yes, we can always use more talented bright kids. They are in short supply, but it is not as big of a problem," said Dr Crowder.

It is not clear when Singapore's upcoming quantum computer can work its magic. But it is a space worth watching.

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