"An Overview of Impact of Quantum Computation in Digital Business"

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Abstract

This paper is a study about the Quantum Computation in digital Business.Quantum Computing is one of the important emerging-technology in the digital world. Today's technology is changing at a faster pace, bring change and rapid progress, causing an advance technological change in the digital world. It is important to stay with current emerging technology trends for the growth of the digital business. Quantum Computers can solve problems rapidly when compared to Binary Computers. Quantum-Computing breakthrough will be a big success in digital world. It brings changes in the new digital world. Two changes can be seen simultaneously in the new digital world. First one is, it puts an end to the present infrastructure. Public network will be secured and digital privacy will be maintained. Second one is more important, where the Quantum Computers uses the power of algorithm in solving the problem. Where the Binary Computers fails to do so. Quantum computers hold the promise to reshape our world. This study aims to analyse the impact of Quantum Computing in the digital business using conceptual study. This study is purely based on the secondary data from various websites, journals and digital books. The findings of this study states that Quantum Computing will be used in the digital businesses in optimizing the better investment strategies, improved encryption, Advanced Cryptography, Aid in Aviation, Used in Analysing the enormous amount of data, Forecasting the weather and many more. Tremendous levels of investment are being made, scientific and mathematical talent are being devoted to Quantum computing research and development.

KEYWORDS: Quantum Computing, Classical Computer, Cryptography, Algorithm, Cyber Attacks, Encryption, Qubits, Superposition.

INTRODUCTION:

Digital Technology ischanging at a faster pace. It enables drastic change and growth in the Digital World. Technologies have lot more evolved after the outbreak of COVID-19 Some of the emerging top 9 trending technologies in the digital world in 2022 are Cyber Security,Machine Learning, Internet of Things,EdgeComputing, Block Chain, Artificial Intelligence, Quantum Computing, Virtual Reality and Augmented Reality,5G and Robotic Process Automation (RPA). One of the top trending technologies is 'Quantum Computing'. Peter Shor a mathematician in the year 1994 introduced Quantum-Computing.Using this Computer large prime numbers can be factorised which will reduce the time, that is in a few days, but billions of years may be taken when we use convention computer which are transistor based. This was an enormous breakthrough in the field of computing, because prime for present information security infrastructure and encryption, prime factorization plays a fundamental foundation.Afterseven years, Scientists from IBMrevealed successfully in their beginning stage that algorithm can be used in the Quantum Machine and the

very small one is known as albeit. It proved that Peter Shor's algorithm can be built and used for Quantum Computing.

I. OBJECTIVE OF THE STUDY:

1. To understand the concept of Quantum Computing.
2. To know the trending technologies in the digital world.
3. To analyse the impact of Quantum Computing in Digital Business.
4. To ensure nation-wide investment in quantum research and technology

II. SCOPE OF THE STUDY:

This study is focused to examine the impact of Quantum Computation in digital businessaround the world, how quantum computation helps to solve the problems that beyond reach to classical computers and also some of the areas which excels and help the business for future days.

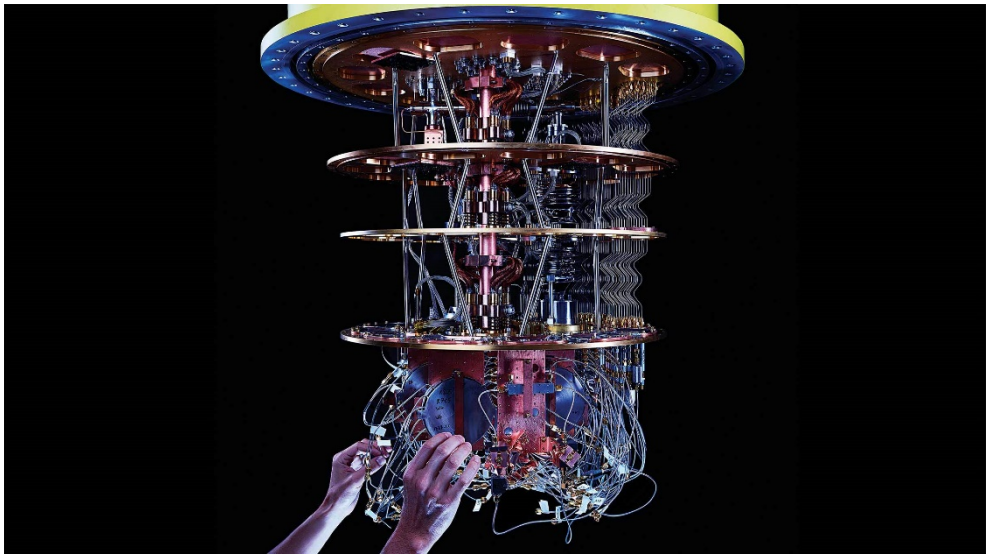
III. LITERATURE REVIEW:

1. According to **Prashant (2007)**-In his research paper, he has studied on the basics of Quantum Computing. Later concluded saying that,during the twentieth century Scientific development has been influenced by the Quantum theory which is the one of the most effective theories. The future is definitely promising. He has expressed his new line of thought. According to him we should make effective use of quantum effects, it must be applied to modern technology this is not merely for observation but it must be put into practice. If we follow this Quantum Computing will have a bright future.
2. **McKinsey & Company(2021)** They studied on the emerging ecosystem and industry use cases. Later they believed that in future 2030there will be a combination of Quantum and Convention computing. This model of operation is called as hybrid. To use this model one has to be well-versed in the technique. Using this hybrid model there will be advancement in technology and more research will be done which will be benefitted in the field of technology and business.
3. According to **Riccardo Silvestri (2020)**In his Master's Thesis hestudied on Business value of quantum computers analysing its business potentials and identifying needed capabilities for the healthcare industries. Quantum computers bring not only a new computing paradigm but also will inspire new ways of thinking (Microsoft quantum team 2018). The promise of extraordinary computing power in quantum machine is to find solutions to problems today are unbridgeable. And concluded saying that the impact that quantum computing has on the health care sector as a whole, from an application as well as business perspective. There is a call for looking at problems and reformulate their structure so that potentially they can become solvable cases in the quantum domain.
4. **Accenture Company (2016)** They studied about the best utilisation of quantum computing and came to the conclusion that for a successful

business the leaders must be able adopt this new technology they should study well about the utilisation of quantumcomputing in business. For this they must prepare themselves to make use of quantum computer.

5. **Quantum Technology and Application Consortium (2021)**In this research they studied on Industry Quantum Computing Applications, according to this study they believed they can overcome the limitation that have been faced by the scientist in building the quantum computers. Where they can optimize the computing in simulation, machine learning problem. They have created a ecosystem where various sectors are currently working together. In the present state their technology has application level. Where business can apply in their business. For example, investors, software developers, funding programmer, system integrators, policy maker and suppliers.

IV. QUALITIES OF QUANTUM COMPUTING



Source:Quantum computing for Business Leaders by Jonathan Ruane, Andrew McAfee, and William D. Oliver from the Magazine (Jan-Feb 2022)

- Quantum Computers are quantum mechanics-based computers and used in high speed.
- Information's are stored in Qubits.
- There are a continuous and infinite number of possible states.
- Calculations are done in probabilistic and for same input there are multiple possible outputs.
- Data processing is done by Quantum logic at parallel instances.
- In Quantum Computing linear algebra is used for operations.
- Circuit behaviour is described by Quantum mechanics.
- Superposition State can be seen in Quantum Computing.

SUPERPOSITION STATE-The fundamental unit of Computation in Quantum computing is Qubit. A qubit can be represented 0,1 or both simultaneously this phenomenon is called "Superposition".Photons or electrons are the sub-atomic particles of qubits, which are used in Quantum Computers, these scientific and engineering challenges are

generated and managed by qubits. Quantum bits have some special properties which havemore processing power when compared to binary bits. In Superposition State simultaneously quantum computer can perform through a vast number using several qubits and giving a potential outcome. The Quantum Computer's secret power lies in its ability to generate and calculate quantum bits.

V. RESEARCH METHODOLOGY:

This study aims to analyse the impact of Quantum Computation in the Digital Business using conceptual study. This paper attempt to study about the Quantum Computation in the Digital Business. This study is purely based on the secondary data from various websites, articles, journals and digital books.

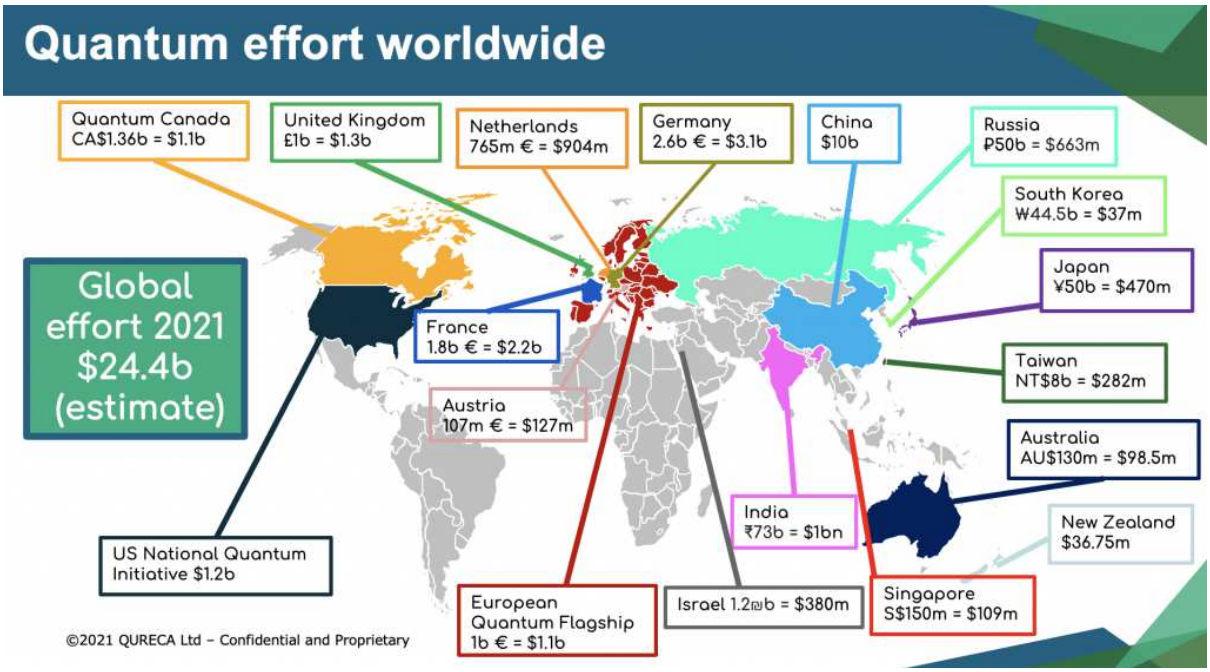
VI. IMPACT OF QUANTUM COMPUTING IN DIGITAL BUSINESS:

Quantum computing promises to help the digital business and solve problems which are not possible for the Conventional Computers. Following is Some of the areas where Quantum Computing excels.

- **Advanced Cryptography:** - The Classical Computers unable to break encryption which uses very big prime number factorisation integers (300+). While Quantum Computers can crack traditional encryption in a shorter period of time. Hence securing strong safeguard of business's digital asset and life.
- **Aid in Aviation:-** Quantum Computing technology helps in much more complicated computer modelling like aeronautic. It helps in the scheduling and routing of aircrafts which has abundant commercial benefits for cost and time. Companies like Lockheed Martin and Airbus are actively doing research and investing in the space technology to take benefit of the computing power.
- **Data Analysis:** - Quantum computing and mechanics helps to solve problems on a large scale. Topological systems are especially useful for analysing the connections in complex networks. Such analysis can be done by Quantum Computing. For example, Global interconnections of the internet, Internal wiring of the brain. NASA is also looking for analysing the large amount of data they collect regarding space.
- **Forecasting:** - Predicting and forecasting of weather needs computation of large and complex data sets. More inputs are required to compute actual weather. Quantum computers are able to handle many factors and Predict weather accurately. In US weather affects the GDP approximately by 30%.Through accurate forecasting it will be able to have more economic benefits.
- **Pattern Matching:** - Patterns can be used to predict future patterns which are very valuable. These pattern matching can be used in the traffic conditions, where it can compute and inform drivers about traffic condition in advance about 45 minutes. Currently Volkswagen in using this pattern matching currently for solving traffic problem.
- **Medical Research:**- Companies like Pharmaceutical are using Quantum Computing in discovery of new medicine and marketing the drugs. Using Quantum Computers Companies are saving time and billions of dollars which they were spending earlier to introduce new drug to the market.
- **Self-Driving Cars:-**Technology companies like Apple, Microsoft and Google and automobile companies like Tesla are planning to develop car without drivers. They are aiming to improve living standardsof the people. Not only

that they are aiming at lessen traffic problem and pollution. CurrentlyGoogle, Volkswagenand Tesla companies are using quantum computers in transportation and also in developing batteries and self-driving vehicles.

VII. NATION-WIDE INVESTMENT IN QUANTUM RESEARCH AND TECHNOLOGY:



Source:"Quantum computing for Business Leaders"(Jan-Feb 2022)by Andrew McAfee,William D. Oliver andJonathan Ruanefrom the Magazine.

Around the world quantum initiatives is continuously rising. Nation-wide investments in quantum research and technology reaching almost $25 billion. This funding is leading to fantastic research and innovation.

VIII. LIMITATIONS OF QUANTUM COMPUTERS:

- Expensive and specialized infrastructure is required for Quantum Computers.
- Absolute zero temperatures should be maintained to operate.
- To prevent errors, it should be shielded from outside like radio magnetic fields, light and radio waves.

IX. CONCLUSION:

Building functional quantum computer is one of the most difficult works because qubits are not able to withstand for a very long duration, because temperature, vibration and other different environmental factors will result inlosing the mechanics of quantum computing which may bring errors. So, Scientist are trying to build suitable environment for qubits which help them to survive for long duration so that they can be used for commercial purpose. At present we are able to form 50-100

qubit. But scientistsare trying to make 1000 physical qubit which is very large which helps in digital security, increase in investment, motivate in innovation.

X. FINDINGS:

- Helps in analysing the large amount of data
- Aim to securing strong safeguard of business's digital asset and life.
- Identifying the similar pattern in data and predicting the future pattern.
- Helps in much more complicated computer modelling like aeronautic.
- Nation wide investment being made in quantum computing.
- Using quantum computers in transportation and also in developing batteries and self-driving vehicles.
- Useful for analysing the connections in complex networks.For example, Global interconnections of the internet, Internal wiring of the brain.

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