The American Journal of Engineering and Technology
ISSN 2689-0984 | Open Access

TYPE Original Research
PAGE NO. 124-126
DOI 10.37547/tajet/Volume07Issue06-13

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# Influence Of Quantum Calculations On The Industry Of Information Technologies

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**OPEN ACCESS**

SUBMITED 07 March 2025
ACCEPTED 04 May 2025
PUBLISHED 17 June 2025
VOLUME Vol.07 Issue06 2025

CITATION

Kalmuratov Maksetbay Tajimuratovich. (2025). Influence Of Quantum Calculations On The Industry Of Information Technologies. The American Journal of Engineering and Technology, 7(06), 124–126. https://doi.org/10.37547/tajet/Volume07Issue06-13



**Abstract:** Quantum calculations, based on the principles of quantum mechanics, can significantly change the information technology industry. Unlike classical computers, quantum computers use qubits that can be superposed, which allows them to significantly accelerate the solution of complex tasks such as optimization, big data processing, and cryptography. The article examines the impact of quantum computing on information processing, data security, and artificial intelligence, as well as the challenges facing the industry, including the problems of qubit stability and the need for retraining specialists. Quantum technologies have great potential, but for their mass application, it is necessary to overcome a number of technical and theoretical obstacles.

**Keywords:** Quantum computing, data processing, quantum cryptography, artificial intelligence, IT industry.

**Introduction:** Quantum computing is a new paradigm in the field of information processing that has the potential to radically change the existing principles of computational systems. Based on the principles of quantum mechanics, such as superposition and entanglement, quantum computers promise to bring breakthroughs in various areas of science and technology. While classical computers are limited in solving certain tasks, quantum devices can significantly accelerate computations, which may have a profound impact on the information technology (IT) industry. In this article, we will explore how quantum computing can transform the IT industry, including aspects of security, data processing, and the development of new technologies.

Quantum computing is based on the principles of quantum mechanics, which differ significantly from classical logic. Instead of conventional bits that can exist in one of two states (0 or 1), quantum computers use qubits—quantum bits. A qubit can exist not only in one of these states but also in a superposition of both, allowing it to represent multiple states simultaneously. This capability gives quantum computing a powerful advantage in parallel information processing. Another important aspect of quantum computing is the phenomenon of quantum entanglement, where the state of one qubit depends on the state of another, even when they are separated by large distances. Entanglement opens up new possibilities for data transmission and security.

One of the most promising areas of application for quantum computing in IT is the acceleration of solving complex problems. These may include tasks that require vast computational power, such as molecular simulations for the development of new materials and drugs, weather prediction, or complex optimization tasks [5, 167–169]. Quantum algorithms, such as Shor's algorithm and Grover's algorithm, can significantly speed up the solution of specific problems. For example, Shor's algorithm can factor large numbers into primes in polynomial time, which is significantly faster than classical algorithms. This has major implications for cryptography and big data analysis. With the advancement of Internet of Things (IoT) technologies, artificial intelligence (AI), and machine learning, the amount of data processed by modern systems is growing exponentially. Quantum computing may play a crucial role in the processing and analysis of this data. Quantum computers can efficiently perform tasks such as data searching and clustering, which are essential for enhancing performance in areas where big data analysis is critical. This will open new opportunities for business and science, enabling more accurate and faster computations.

One of the most widely discussed aspects of quantum computing in the context of IT is its impact on data security. Modern cryptographic systems based on algorithms such as RSA and ECC may become vulnerable to quantum attacks. Shor's algorithm, for instance, can efficiently decrypt encrypted data, posing a serious threat to many existing security methods. However, quantum computing also opens new horizons for creating more secure systems. Quantum cryptography uses the principles of quantum mechanics to establish secure communication channels that cannot be intercepted without detection. Quantum key distribution (QKD) protocols, such as the BB84 protocol, can provide a high level of security and ensure that no data is intercepted during transmission. Given the threat posed by quantum computing, research in the field of post-quantum cryptography is becoming increasingly important. These algorithms are being developed to be resistant to quantum attacks and may form the foundation of future information security systems.

Quantum computing could lead to significant advancements in the field of artificial intelligence and machine learning. Quantum machine learning algorithms, such as Grover's quantum algorithm for finding optimal solutions or quantum algorithms for data clustering, can accelerate the training of AI models and make them more efficient. In addition, quantum computing may enable the development of more complex and accurate models for data analysis and decision-making. This will result in improved prediction accuracy and faster machine learning processes [1, 189-190].

Despite the tremendous potential of quantum computing, there are numerous technical and theoretical challenges that must be overcome before it can be commercialized and widely adopted. Developing stable and scalable quantum computers remains one of the main obstacles. Quantum systems are extremely sensitive to external influences such as temperature and electromagnetic fields. This sensitivity leads to qubit decoherence, which makes it difficult to perform long-duration computations. There are several approaches to building quantum computers, including superconducting qubits, ion traps, and topological qubits, each with its own advantages and disadvantages. Significant progress in addressing these issues is expected in the coming decades. As quantum computing develops, there may be a growing need to retrain IT professionals, as they will need to learn new approaches and algorithms. Quantum technologies could also lead to major changes in the economy, impacting industries such as banking, finance, and pharmaceuticals. Quantum computing may become a crucial competitive advantage for companies, requiring substantial investment in infrastructure and research.

## CONCLUSION

Quantum computing promises to become an essential tool for the further development of information technology. It has the potential to significantly accelerate the solving of complex problems in data analysis, optimization, and cryptography. However, before quantum computers become widely accessible, a number of technical and theoretical challenges must be overcome. Nevertheless, as quantum technologies continue to evolve, the IT industry will undergo significant transformation, opening up new opportunities for both business and science.

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