

# Quantum Computing: A Concept and Business Perspective

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## Abstract

Quantum computing is a new phenomenon today. Quantum computing is a computing process that involves quantum mechanics, computer science, and information theories. The investors, companies, policymakers, and people's expectations from quantum computing are that it would solve many business issues that are not quite easy to handle and beyond the capacities of current supercomputers. For the managers, there could be certain steps to follow. For example, managers could try to find out the existing quantum ecosystem and check the situation with information providers. They could try to understand the requirements of the business that align with quantum applications. To understand these issues we have conducted an open-ended survey with Quantum professionals. Our findings suggest that quantum business is essential for managers to understand complex scientific concepts. By considering the interconnectedness of systems, exploring multiple options and scenarios, and embracing uncertainty, managers can create a more agile and effective decision-making process.

## Keywords

Quantum Technology, Quantum business, Business challenges, Business transformation, Qualitative Research, Open-ended survey,

## 1. Introduction

The field of software engineering and information science has been abuzz with exciting advancements in quantum computing [1, 2]. This innovative technology has piqued the interest of computer scientists, engineers, and physicists who are keen to explore its vast potential [3]. By harnessing the principles of quantum mechanics, quantum computing can perform intricate calculations at an unparalleled pace, process enormous amounts of data, and transmit information simultaneously. These capabilities make quantum computing a game-changer that is set to revolutionize the current IT landscape and inspire innovation across diverse industries [4, 2].

Quantum computing is a different level of computational mechanism that is essential for today's business world. Quantum computing combines information technology with a combination of computer science [5].

This on going study addresses the following questions:

**RQ1:** What is the impact of quantum business on management practices and decision-making?

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**RQ2:** What are the current challenges and issues managers might face in the field of quantum business?

## **2. Background**

Quantum information technology is a field that relies on the principles of quantum physics to develop hardware and protocols capable of harnessing the full potential of quantum physical phenomena [6, 7]. It uses the properties of quantum entanglement, interference, and true randomness to deliver significant advantages over traditional computing and information technologies [7].

The realization that information is not just an abstract concept but physical and quantum physical at that, paved the way for the development of quantum tech. Quantum physics, which describes the behavior of atoms and molecules, was first observed during physical experimentation in the early 1900s [7].

Quantum communication is a fundamental aspect of quantum tech that involves the development of hardware and protocols capable of utilizing the true randomness offered by quantum physical objects such as photons and electrons [6]. On the other hand, quantum computation is a field that studies the development of hardware capable of controlling the quantum physical features of quantum superposition and quantum entanglement. The beginning of the era of quantum tech can be traced back to two significant events that occurred in the twentieth century [8].

## **3. Research approach**

To successfully collect data from a large number of respondents working on quantum computing technology, an open-ended survey questionnaire is undoubtedly the most relevant method Schluter et al. [9]. We have developed an open-ended survey questionnaire to collect data from quantum computing professionals- through Linked In and various quantum computing groups in social media. We have employed directed content analysis, a technique used to validate and enhance a theoretical framework, to analyze the data we have collected [10]. As a part of this process, we have utilized Holsti's content analysis method to classify various factors reported by our survey participants [11].

The factors have been grouped into four broad categories and further divided into subcategories. This approach allows us to gain a deeper understanding of the data and identify key insights that can inform our future research and decision-making processes.

## **4. Results**

### **4.1. Managers' perspective on the concept of quantum uncertainty and probability in risk assessment**

Incorporating the concept of quantum uncertainty and probability into risk assessment is a complex task for managers. However, there are some strategies they can use to address

this challenge. First, managers can apply mathematical models such as Bayesian networks or decision trees that allow them to model and quantify uncertainty. Second, they can use simulations and scenario analysis to generate a range of possible outcomes and evaluate the likelihood of each scenario.

A professional stated that,

*"managers can seek the help of experts in quantum computing and data analytics to develop customized solutions that suit their specific needs".*

#### **4.2. Managers' decision-making and navigating uncertain business environments with quantum computing**

Quantum computing can help managers optimize business processes, such as supply chain management, resource allocation, and scheduling, by solving complex optimization problems more efficiently.

A professional stated that

*"...quantum computing can assist in the development of more accurate predictive models, which can help managers anticipate future trends and outcomes more accurately. Overall, quantum computing can be a valuable tool for managers in navigating the uncertain and rapidly changing business environment of today".*

#### **4.3. Improving decision-making through collective intelligence, collaboration and interconnectedness**

The principles of quantum concepts have the potential to impact collaboration and interconnectedness among teams and departments within an organization in several ways, ultimately improving decision-making through collective intelligence. One way is through the concept of entanglement, which refers to the interconnectedness of quantum particles at a distance. In a business context, this could mean that different departments and teams become more interconnected and interdependent, leading to a greater exchange of information and knowledge sharing.

A company professional stated that

*"This technology can lead to more informed decision-making as a result of the collective intelligence of the organization and that will impact the decision-making process hugely".*

#### **4.4. Creative ways to align conflicting interests and foster cooperation in teams or departments**

Quantum interference can be applied to resolve conflicts within teams or departments by finding creative ways to align conflicting interests and foster cooperation. Quantum interference occurs when two or more quantum particles interact and have a greater impact on the outcome than they would individually. In a business context, this could mean that by aligning the interests of conflicting teams or departments, the outcome could be greater than the sum of its parts.

## 5. Conclusions

The prospect of quantum computing can bring huge opportunities for business, IT, and various sectors. This technology can create a new horizon for the business. The understanding that comes here is quantum business and management should be well-understood and well-defined. The quantum computing and quantum business and management phase is still in the experimental phase. By considering the interconnectedness of systems, exploring multiple options and scenarios, and embracing uncertainty, managers can create a more agile and effective decision-making process.

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