 **Bestlink College of the Philippines**

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**Bachelor of Science in Computer Engineering Department**

**Narrative Report**

**The Future is Now: A Narrative on Emerging Technologies**

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1. **Executive Summary**

A report regarding quantum computing stated that quantum computing has opened the way for interesting innovations through improved computing capabilities not available on classical computers. According to this report, one of the important uses of qubit features such as superposition and entanglements is evident in how quantum computers can solve long-problem computation issues faster and more effectively than ever. This will change almost everything from cryptography, logistics and material science, pharmaceuticals, and artificial intelligence radically. However, much remains to be solved, such as steady qubits, error correction, and scalable quantum systems.

This report underlines the fact that quantum computing is in the developmental stage and recent breakthroughs bring it closer to practical application. It points out that the advances indeed are bringing the field closer to real-world problems that cannot be solved by classical computers and stresses that public and private investments are important enough to foster advancement, build up a workforce with quantum expertise, and bring it closer to practical application.

**II. Introduction**

**A. Context**

According to Team (2024), Quantum computing uses subatomic particles, such as electrons or photons. Quantum bits, or qubits, allow these particles to exist in more than one state (i.e., 1 and 0) at the same time. As accurate as the law is no longer today, it has inspired decades and exponential growth in processing power, benefiting fields from computing to telecommunications.

**B. Scope**

This report will give a thorough summary of the quickly developing topic of quantum computing. In particular, the paper will start by analyzing classical and quantum computing generally, outlining the key distinctions between the two, and introducing quantum computing's transformative potential. As mentioned by Roundy (2023), the tech has potential uses in supply chains, financial modeling, and other areas. Organizations that use the power of quantum computing could help humanity solve some of the world's biggest problems and make breakthroughs in critical areas, from drug research to global agriculture and beyond. The purpose of this report is to offer foundational knowledge on quantum computing, explain the mechanics behind it, point out the current challenges, contextualize its impact in relation to broader technological trends, and give potential applications and societal implications of quantum computing while taking an objective look at this new invention.

**III. Key Emerging Technologies**

Quantum computing is a technology that uses high-performance computers to address issues at the atomic and subatomic levels. It has the potential to revolutionize cybersecurity, as quantum computers can break many of the encryption algorithms currently used to protect sensitive information. It can also be used in machine learning to solve real-world problems.

**IV. Impacts of Emerging Technologies**

**A. Economic Impacts**

Based on Das (2024) The economic implications of quantum computing are vast. According to reports by McKinsey and Deloitte, quantum computing could generate billions of dollars in value across industries by enabling breakthroughs in drug discovery, materials science, cryptography, and more. Industries like finance, healthcare, energy, and telecommunications stand to benefit immensely.

**B. Social Impacts**

As indicated byNelson (n.d.),Quantum computing will be used for a variety of innovations and calculations across all industries that were not possible with previous computers.Quantum computers have the potential to benefit society in various ways, including making smarter investment decisions, developing drugs and vaccines faster, and revolutionizing transportation. However, one disadvantage of quantum computing is that it could break current cryptography.

**C. Environmental Impacts**

Quantum computing could bring about step changes throughout the economy that would have a huge impact on carbon abatement and carbon removal, including by helping to solve persistent sustainability problems such as curbing methane produced by agriculture, making the production of cement emissions-free, improving electric batteries for vehicles, developing significantly better renewable solar technology, finding a faster way to bring down the cost of hydrogen to make it a viable alternative to fossil fuels, and using green ammonia as a fuel and a fertilizer.

**V. Trends and Innovations**

**A. Current Trends**

The future of technology is created by major trends transforming industries and daily life: the dawn of artificial intelligence ethics and governance. AI is increasingly woven into various sectors; therefore, issues relating to bias, privacy, and accountability are manifested today, and this calls for an initiatory framework in the development of AI that supports responsible AI deployment, focusing on topics such as fairness, transparency, and data privacy. Perhaps the largest trend is decentralized finance (DeFi), changing the financial sector by illuminating alternative paths for mainstream banking systems. It uses blockchain technology to conduct peer-to-peer transactions, lending, and investments without intermediaries; this provides wider access and control to finance but raises some concerns related to security and regulation. Quantum computing has elevated the limit of computational power and can promise to change fields such as cryptography, materials science, and artificial intelligence. Sustainable tech initiatives are finally driving innovation toward ecologically friendly solutions, including renewable energy, green computing, and carbon-neutral goals in the quest to provide essential components in developing such technologies. Together, these reflect a greater trend toward ethical, inclusive, and sustainable technological growth.

**B. Innovations on the Horizon**

The speculative technologies may bring tremendous benefits as well as massive disruptions. Quantum computing might transform cryptography and artificial intelligence together while AI can make machines reason like humans and greatly shift the face of knowledge-based work, raising many questions on ethical grounds. While genetic engineering promises tailored treatment and the possibility of avoiding future disorders from arising altogether, it raises issues about the ethics of human enhancement. BCIs raise grave questions about privacy and cognitive autonomy, even though they may lead to "thought-machine interfaces" and revolutionize communication and treatment. Third, blockchain technology will pose regulatory problems even if it may democratize finance and governance and bring greater transparency. All these innovations promise important impacts on society.

**VI. Challenges and Concerns**

**A. Ethical Dilemmas**

Quantum computing raises unique ethical questions because it may affect sensitive fields like cryptography, data security, and artificial intelligence. For example, it may break the current encryption standards. This will put the highest levels of highly sensitive data at considerable risk and pose grave dangers to privacy and national security. The questions based on ethics are who owns the quantum technology and how one would go about using it or holding back its power. Even though that is the case, the given quantum inequalities may be accentuated if the technology only proves accessible to a few - perhaps the rich nations or corporations - thereby giving rise to unnecessary technological divides

**B. Regulatory Challenges**

The factor that emerges is the kind of convergence of various technologies, where interconnected fields of artificial intelligence, machine learning, and big data amplify each other's progress. Progress in one area oftentimes tends to fuel growth in others. Thus, it's speeding along with technological innovation. Second, there's been an enormous surge of investment into R&D by governments and companies like Google, Amazon, and Tesla. The investments are enormous and provide for critical breakthroughs in still other crucial areas, including AI, cybersecurity, and biotechnology-all of which push the pace of technological change. Additionally, potential risks from unanticipated consequences of quantum computing include amplifying the development of uncontrollable algorithms in AI, for instance. These paradoxes would require the proper governance frameworks in place, as well as international cooperation, to responsibly and equitably develop quantum technology.

**C. Public Perception and Mistrust**

Public distrust is a considerable factor in the acceptance of new technologies like quantum computing. Privacy, security, and misuse are all fears. They worry that their private and financial information will come into public view because quantum computers will decrypt codes. Given that quantum technology is extremely complex, it may be hard to grasp and even give causes for uncertainty and fear. Mistrust will mostly arise from the fact that only a few tech giants or governments control most quantum resources, mainly on monopoly concerns or equal distribution. The three key ingredients for building public trust and responsible technology development would be transparent communication, ethical guidelines, and inclusive policies.

**VII. Future Perspectives**

**A. Predictions for the Next Decade**

From the point of view of Ecanorea (2024), it will become a fundamental tool for scientific research, making it easier to solve problems that were previously impossible. Researchers are making continuous progress in increasing the coherence times of qubits, reducing error rates, and developing new quantum algorithms. Improvements in qubits and error correction are critical to this achievement. Qubits are still fragile and prone to errors, which severely limits the scale and precision of quantum calculations. The next decade is expected to be filled with developments both in quality and quantity of qubits. Improved error correction and progress on coherence, connectivity, and fault tolerance can yield hundreds or thousands of usable "logical" qubits, overcoming the current scalability challenges.

**B. The Role of Collaboration**

Based on *AWS*. (n.d.-b). Amazon Web Services, quantum computing can improve research and development, supply-chain optimization, and production. For example, you could apply quantum computing to decrease manufacturing process–related costs and shorten cycle times by optimizing elements such as path planning in complex processes. Collaboration is essential in the advancement of quantum computing because it's based on knowledge across physics, computer science, engineering, and even aspects of ethics and law. The challenges are broadly numerous-quantum computing presents with hardware limitations, error correction, algorithm development, and system scaling, at a level of complexity that's never been seen before. Bringing together different knowledge, talent, and resources through collaboration makes possible innovations no single organization can do on its own.

**VIII. Conclusion**

**A. Summary of Insights**

Quantum computing harnesses the principles of quantum mechanics, such as superposition and entanglement, to process information in ways that traditional computers cannot. Unlike classical bits, which represent either a 0 or a 1, quantum bits (qubits) can exist in multiple states simultaneously, thanks to superposition. This enables quantum computers to solve complex problems much faster than classical ones by exploring many solutions at once. Additionally, quantum entanglement allows qubits to be linked in such a way that the state of one qubit instantly affects the state of another, regardless of distance, offering the potential for highly efficient data processing. While quantum computing is still in its early stages, it holds promise for breakthroughs in fields like cryptography, optimization, material science, and drug discovery. However, challenges such as error correction, qubit coherence, and scalability remain significant hurdles that researchers are actively working to overcome.

**B. Vision for the Future**

Quantum computing has the potential to genuinely disrupt the fields of industry, research, and technology by radically altering the way that these fields are seen. Quantum computing has the potential to dominate the next several decades by addressing issues that were thought to be beyond human capabilities in a short amount of time, speeding up scientific research, and opening new possibilities not yet conceivable with a traditional computer system. Quantum computing may significantly revolutionize drug discovery, materials science, and genomics; it may be possible to simulate molecular interactions at the quantum level for significant contributions in terms of treatments for particularly challenging diseases like Alzheimer's and cancer. In logistics, finance, and the energy sector, quantum computing will optimize complex processes, reduce costs, and minimize environmental impacts through optimal resource management and refined supply chain operations.

**IX. Appendices**

**A. Glossary of Terms**

Quantum computing relies on key concepts such as qubits, which can exist in multiple states due to superposition, and entanglement, where qubits influence each other over distances. Quantum gates manipulate qubits, forming quantum circuits that solve problems faster than classical computers. However, quantum systems face challenges like decoherence, which can corrupt data, but quantum error correction methods help address this. Quantum supremacy is achieved when a quantum computer outperforms classical ones, and quantum algorithms like Shor’s and Grover’s offer significant speedups. Other concepts include quantum entropy (measuring uncertainty), quantum interference (optimizing algorithms), and quantum annealing (solving optimization problems). Quantum simulation models complex systems, and quantum cryptography enables secure communications. These principles hold promise for advancements in various fields.

**B. Case Studies**

* Artificial intelligence.
* Better batteries.
* Cleaner fertilization.
* Drug development.
* Electronic materials discovery.
* Financial modeling.
* Solar capture.
* Traffic optimization.

**X. References**

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