International Journal of Accounting and Economics Studies, 13 (1) (2026) 263-277

International Journal of Accounting and Economics Studies

Website: www.sciencepubco.com/index.php/IJAES
https://doi.org/10.14419/803cts61
Research paper

Quantum Computing Drives Innovation in Business Intelligence Across Marketing and Finance through Systematic Review and Strategic Foresight

Arnold C. Alguno [1,2,*], Rey Y. Capangpangan [1,3], Yuri U. Pendon [1], Rosemarie Cruz-Español [1]

[1] Graduate School of Business, University of the Visayas, Corner D. Jakosalem, Cebu City, 6000, Philippines
[2] Department of Materials and Resources Engineering and Technology, Mindanao State University -Iligan Institute of Technology, Iligan City, 9200, Philippines
[3] Department of Physical Sciences and Mathematics, College of Marine and Allied Sciences, Mindanao State University at Naawan, Poblacion, Naawan, Misamis Oriental, 9023, Philippines
**Corresponding author E-mail: arnold_alguno@uv.edu.ph*

Received: November 2, 2025, Accepted: December 8, 2025, Published: January 21, 2026

Abstract

The emerging quantum computing technology (QC) transforms business intelligence by creating new methods for marketing and finance to use data in their decision-making processes. This research combines a systematic literature review with a meta-analysis of 26 peer-reviewed articles spanning from 2014 to 2025 to show how quantum computing improves predictive analytics and customer segmentation and sentiment analysis, portfolio optimization, and risk modeling. The research uses PRISMA guidelines together with strategic foresight tools to detect how hybrid quantum-classical systems replace classical models by delivering exponential speed and accuracy, and scalability benefits. The research demonstrates that QSVM, QAOA, and quantum-enhanced neural networks serve as primary methodologies to create real-time, emotionally intelligent, highly adaptive decision systems. The thematic analysis, together with conceptual mapping, shows that quantum tools are converging into a unified interdisciplinary space that combines marketing with finance and supply chains and pricing strategies. The study reveals important research deficiencies in multilingual datasets as well as benchmarking and ethical readiness, and suggests a strategic integration plan for global implementation by 2030. The research demonstrates that quantum computing represents a strategic capability that enables future-ready data-driven enterprises to enter a new business intelligence era based on quantum resilience.

Keywords: *Quantum computing; business intelligence; marketing analytics; financial forecasting, systematic review, strategic foresight, hybrid quantum models*

1. Introduction

Quantum computing (QC) establishes a revolutionary computational power system which will reshape business intelligence operations [1-3]. The rising complexity of consumer behavior alongside financial markets and real-time data environments exceeds the processing abilities of classical computing systems [2-5]. The transition to a new business analytics paradigm requires quantum computing technology to fulfill its promise. Quantum computing utilizes superposition and entanglement and quantum tunneling principles to address problems that traditional processors cannot handle [1, 2, 6, 7]. Quantum bits, known as qubits, function differently from classical bits because they enable the simultaneous processing of multiple states, which results in exponential speedups for optimization, classification, and simulation tasks [2, 4, 8-10]. This processing capability aligns closely with business intelligence gaps such as predictive analytics, which classical systems struggle to address in real-time environments. Research, together with government support and industrial interest in quantum computing, has grown significantly because of its potential applications in marketing and finance [7].
Business management researchers show a strong interest in QC because it presents potential solutions to optimize currently unsolvable problems in optimization, machine learning, and simulation [2, 4, 5, 11]. The theoretical gap lies in integrating quantum computing into existing behavioral modeling and forecasting theories, enhancing predictive accuracy beyond the scope of current analytics. It was highlighted that QC enables remarkable problem-solving within a short timeframe [14]. The marketing field benefits from QC through its disruptive capabilities to perform predictive analytics, customer segmentation, and sentiment analysis [6, 12]. QC's integration with forecasting models enhances the precision of demand forecasting and customer behavior prediction, which are essential to dynamic business strategies. The application of Quantum Machine Learning (QML) models, such as Quantum Support Vector Machines (QSVM) and quantum-enhanced deep learning, has resulted in outstanding accuracy and efficiency when classifying nonlinear customer behavior and

analyzing unstructured data, as previously reported [13, 15]. Research was done to show how Quantum Machine Learning (QML) models, such as variational quantum circuits, perform better than traditional classifiers when detecting sentiment in social media content [17], while applying quantum walk models to establish relationships between consumer emotional engagement and purchasing behavior [18, 19]. The financial sector benefits equally from QC implementations. The computational power of quantum algorithms has already proven effective in derivative pricing, portfolio optimization, and credit risk modeling. Quantum Amplitude Estimation (QAE) lowers the required sample numbers in Monte Carlo simulations, thus producing faster and more precise financial predictions [6, 12, 20]. This breakthrough directly addresses the limitations in current forecasting models for risk management and investment analysis. Quantum annealing technology has been used to tackle combinatorial problems in credit scoring and portfolio selection [21, 22].

The current research about these breakthroughs exists in other technical fields and use cases. However, there is a lack of an integrated framework that bridges the academic insights from quantum computing with practical business applications, particularly in behavioral and predictive modeling. The lack of a unified perspective that combines academic research with technological advancements and practical applications of QC in business operations remains a major gap. The research study fills this knowledge gap by integrating current expert knowledge with recent academic findings. The study combines bibliometric analysis with content mapping and strategic foresight to develop an integrated roadmap that explains how to understand and use QC in marketing and finance [8].

The research shows that the ecosystem has matured through the increasing adoption of hybrid quantum-classical methods and industry-focused solutions. Research leadership in quantum computing comes from the United States, China, India, and Germany, while private sector investment drives accelerated development. Quantum computing has transitioned from being a theoretical concept to an actionable business solution. The work delivers a comprehensive overview of QC development, which establishes a foundation for scholars and practitioners to pursue future research and strategic implementation. Quantum computing operates as a strategic business capability, which research evidence demonstrates will establish itself as the foundation for future business intelligence systems.

2. Methodology

We conducted our systematic literature review (SLR) according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [23, 24]. Through a systematic literature review, existing studies are synthesized to provide a foundation of knowledge to build upon for future research needs, and are able to identify trends and developments within a specific scope of research [25, 26]. Through systematic literature reviews, researchers gather a systematic review and are capable of finding in-depth patterns and relationships related to their specific research topic, as well as a well-structured presentation of the research context and relevant directions for future research [25]. A systematic literature review was performed and has proven extremely beneficial in various fields of study [26-28], including information science and software development.

As QC is transdisciplinary, we needed to combine an ontological classification exercise with a systematic literature review. We decided that SLR is the method we would like to apply for our literature review, as its methodology incorporates the quantitative synthesis of both qualitative and quantitative studies, permitting a broader and deeper evaluation of the literature [29]. To perform the SLR, we followed Kitchenham´s methodology in three phases: plan the review, conduct the review, and report the results [30].

2.1. Literature mapping and planning

A three-stage literature search strategy enabled us to identify and refine evidence for this systematic literature review and evaluate the existing evidence base [30]. To ensure the robustness of our methodology, we reviewed systematic literature reviews from our field and adjacent fields to identify the most appropriate databases, search strings, and inclusion criteria. The SLR outcomes shown in Figure 1 detail the step-by-step processes for planning and conducting the SLR in a way that augments transparency, detail, and replicability of the review protocol.

2.2. Literature search protocol

We employed methodologically robust and comprehensive literature identification via prescriptive database searches of principal digital libraries alongside an iterative backward and forward snowballing method [24, 26]. The hybrid approach resembled composite methods, though rather than focusing on either exhaustive or-depth coverage of directly indexed studies, studies of interest could also link through context. In two major academic databases, such as Google Scholar and Scopus, this keyword search was applied ("quantum comput*" and ("marketing")). These databases were chosen based on their extensive coverage of a broad range of disciplines relevant to QC, including, but not limited to, computer science, information systems, engineering, and interdisciplinary research.

To improve the reliability and reproducibility of results, two of the authors performed a separate search in March 2025. To examine the evolution of QC research in this time frame, the study focused on publications between the years of 2014 and 2025. Citation-chaining methods that integrated backward reference list analysis with forward citation tracking approaches (e.g., number of times cited) added depth to the sample. Effect sizes for the meta-analysis were calculated using standardized mean differences (Cohen’s d) and correlation coefficients where applicable, ensuring robust quantitative synthesis. A heuristic approach was used to uncover key studies that would have remained undetected using database searches [31]. Citation chaining made the review process more rigorous as it revealed critical conceptual relationships while integrating native literature [24, 32]. Figure 1 outlines the systematic literature review process and its search methods and article selection flow.

2.3. Screening and eligibility assessment

The first search yielded 874 articles, all of which were assessed through selection criteria derived from a previous systematic literature review protocol as depicted in Table 1 [24]. We removed duplicates, and then we systematically screened titles, abstracts, and keywords. Backwards and forwards snowballing methods were used in the research to achieve a wide range of outcomes by expanding from database retrieval. The filtering process applied by the study yielded 92 high-quality studies, including journal articles and conference proceedings. Overall, the final sample contained conference proceedings from respected lecture series that serve as an authority in their field [33]. Broad Knowledge and Diverse Perspectives in Review Added by: Bruce Kerswell. We then performed manual checks and applied further inclusion/exclusion criteria to this subset, finally arriving to 26 articles for final analysis.

Table 1: Inclusion and Exclusion Criteria for Article Selection on Quantum Computing in Marketing

Inclusion Criteria	Exclusion Criteria
• Articles must examine the current state of development in quantum computing as applied to marketing. • Articles must describe trends and challenges in quantum computing within marketing contexts. • Studies must present applications of quantum computing in marketing and discuss related challenges. • Only peer-reviewed journal articles and conference proceedings were included; book chapters were excluded. • Articles must be written in English. • Articles must have been published between 2014 and 2025. • The term "quantum comput*" and "marketing" must appear in the title, abstract, and keywords.	• Studies focused solely on theoretical quantum algorithms without marketing applications were excluded. • Non-peer-reviewed publications, including editorials, prefaces, poster papers, and extended abstracts, were excluded. • Studies published as master's theses or doctoral dissertations were excluded.

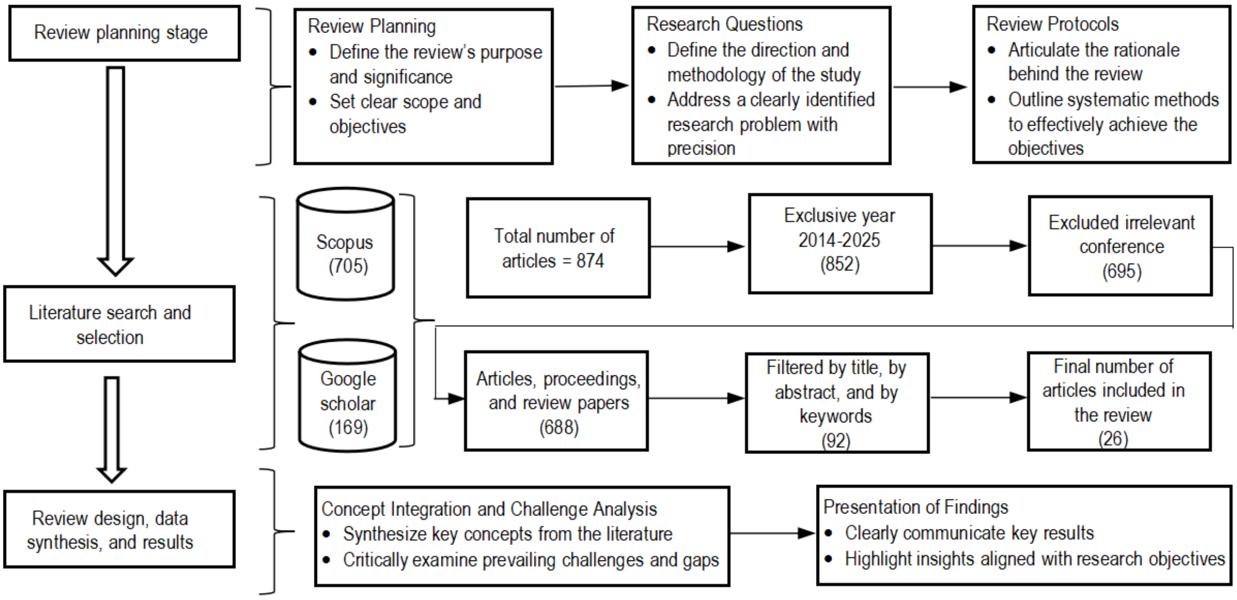

Fig. 1: Overview of the systematic literature review process, highlighting the review planning stage, literature search and selection, and the final synthesis of findings.

3. Results and Analysis

3.1. Mapping the landscape of quantum business research

Table 2 displays the profile summary of the systematic selected studies on the applications of quantum computing in marketing and finance. They cover North America, Europe, and Asia, showing a high interest globally in adapting quantum technologies into business. The broad range of journals, including Futures, IEEE Conferences, Journal of Big Data, and Physical Review A, demonstrates both the interdisciplinary scope and technical quality of these contributions. Importantly, if we look at the designs of the studies mentioned in Table 1, we can see that most of them are experimental (i.e., truly meant to translate to physical implementations) or hybrid (involving both classical and quantum approaches), indicating a trend towards simulation/benchmarking on real-world datasets rather than theoretical impact.

Empirical research typically utilized case analyses or algorithmic comparison tests, whereas theoretical contributions suggested new architectures and optimization methods. India, Germany, Canada, and the USA thus show up as dominant regions and the academic leadership in theory and applied experimentation. The quantum leakage into the classical domain through hybrid study designs indicates a bridging phase, where quantum approaches are concurrently tested with classical models for business use cases (like sentiment analysis, portfolio optimization, customer segmentation). Such studies also offer proof-of-concept as well as blueprints for real-world deployment, which will influence how quantum-boosted shaping the future of business intelligence.

Table 2: Study profile summary of the selected papers

Authors	Journal	Region	Study Design
Ukpabi et al. [4]	*Futures*, Vol. 154, 2023	Finland, Germany, Estonia, etc.	Multidisciplinary literature review
Orús et al. [22]	*Reviews in Physics*, Vol. 4, 2019	Germany, Spain	Review article on quantum algorithms
Balaji et al. [15]	*J. Theoretical & Applied Information Tech*, 2024	India	Experimental design using a hybrid quantum-classical DNN
Sarkar et al. [13]	*Advanced Int'l J. of Multidisciplinary Res.*, 2024	USA, Bangladesh	Mixed methods: simulation and case study
Rebentrost et al. [20]	*Physical Review A*, 98(2), 2018	Canada	Theoretical algorithm development using Monte Carlo
Singh et al. [18]	*Journal of Big Data*, 12(22), 2025	India	Empirical case study with event methodology
Bar et al. [16]	*IEEE IT Conference Proceedings*, 2024	Not specified	Quantum-classical hybrid using LSTM + VQC
Buonaiuto et al. [17]	*ACM QUASAR Conference*, 2024	Italy	Experimental hybrid quantum-classical design
Bielan et al. [34]	*Pakistan J. of Life and Social Sciences*, 2024	Poland	Theoretical and applied framework in finance

Aljaafari [35]	*Research Square*, 2023	Global (E-commerce)	Literature review and survey
He et al. [21]	*Highlights in Sci., Eng., & Tech.*, Vol. 61, 2023	China	Simulation with QUBO for credit scoring
How & Cheah [1]	*Businesses*, Vol. 3(4), 2023	Malaysia	Qualitative literature review
Majumdar [36]	*arXiv*, 2023	Not specified	Conceptual analysis of quantum learning paradigms
Solikhun et al. [37]	*AIP Conf. Proc.*, Vol. 2714(1), 2023	Indonesia	Experimental classification using quantum perceptron
Tychola et al. [38]	*Electronics*, Vol. 12(11), 2023	Ukraine	Experimental benchmarking of QSVM vs. SVM
Dinh et al. [39]	*IEEE GLOBECOM*, 2022	Vietnam	Quantum annealing for viral marketing
Ganguly et al. [40]	*IEEE ICPC2T Conference*, 2022	India	Experimental simulation using QNLP and Lambeq toolkit
Khurana [41]	*QJETI*, Vol. 7(9), 2022	India	Theoretical framework for QKD, QAOA, QSVM
Kumar et al. [27]	*International Arab Journal of IT*, Vol. 19(2), 2022	India	Hybrid DL with quantum-inspired gravitational algorithm
Rivas et al. [42]	*IEEE CSCI Conf.*, 2021	USA	Simulation using a quantum variational autoencoder
Sundar et al. [43]	*IEEE ICOEI Conf.*, 2021	India	Architecture/system-level review of D-Wave systems
Sáez-Ortuño et al. [12]	*Journal of Innovation & Knowledge*, 2024	Spain	Multimethod (bibliometric, content, qualitative)
Owolabi et al. [44]	*World J. of Adv. Res. & Reviews*, 2024	Nigeria	Theoretical and algorithmic application of QAOA
Yang, Zhu, & De Meo [45]	*J. Intelligent Information Systems*, 2024	China, Italy	Quantum-like model integrating LLM and sentiment
Li et al. [46]	*Information Fusion*, Vol. 120, 2025	China	Quantum-classical hybrid model for sentiment analysis
Geetha et al. [47]	*IEEE CSITSS Conf.*, 2024	India	Quantum annealing for routing problem optimization

Figure 2 illustrates the publication trend of quantum computing-related business studies between 2014 and 2025. The graph reveals a steady rise in research interest, particularly after 2019. While early contributions were sparse and exploratory, the post-2020 era marked a turning point with an accelerated influx of empirical, hybrid, and theoretical studies. This surge aligns with broader developments in quantum hardware and the integration of AI with business analytics. Notably, 2023 and 2024 stand out as peak years, reflecting growing scholarly attention to real-world applications of quantum algorithms in marketing, sentiment analysis, and financial optimization. The upward trajectory signals increasing global confidence in quantum-enhanced decision tools, especially within data-rich, computation-heavy domains. The trend also suggests a maturing research community supported by cross-sectoral collaborations, conferences, and funding opportunities. The distribution underscores the evolution of quantum computing from a theoretical curiosity to a transformative force in business intelligence.

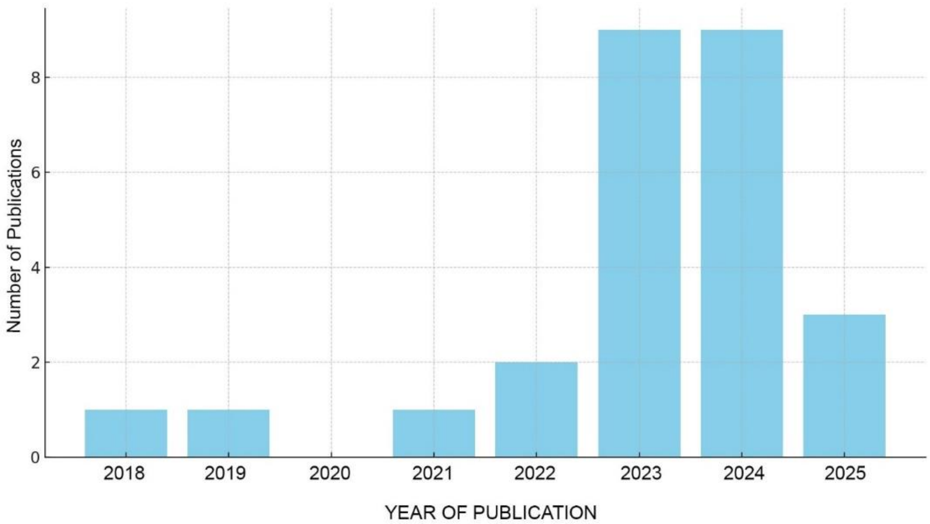

Fig. 2: Publication year distribution of quantum computing-related business studies

Figure 3 shows the nature of the 26 reviewed studies (empirical, theoretical, or hybrid). Of these, 10 (38%) used empirical methods by applying simulations, case studies, or experimental designs for quantum computing to real-life scenarios in finance, marketing analytics, and sentiment analysis. Ten studies (38%) used a mix of empirical testing and conceptual or theoretical modeling. These hybrid works established the embryonic nature of quantum computing, particularly in cases where the lack of hardware means that a simulation of the system is required to validate its behavior. The other 6 (23%) were theoretical, addressing algorithm design, conceptual notations, and lines for future research. A balanced distribution of empirical and hybrid publications means that theoretical and practical elements are well integrated, while the significant increase in the frequency of practical analyses shows an evolving interest in applications. This distribution also reflects the maturation of the field, in which theoretical advances are more and more matched by applied validation – crucial for scaling quantum technologies into the mainstream marketing and financial analytics.

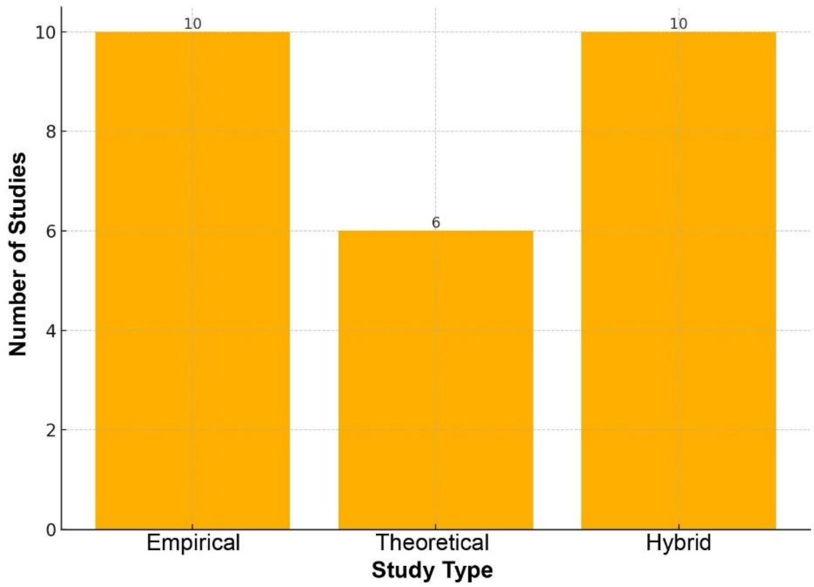

Fig. 3: Distribution of study types of the reviewed studies categorized as empirical, theoretical, or hybrid.

3.2. Quantum use cases and sectoral applications

Quantum computing holds significant promise for enhancing various business processes, particularly in the realm of marketing intelligence and sentiment analysis. While the focus has been on the advanced capabilities it offers, it is essential to recognize the inherent limitations, including issues such as vendor lock-in, hardware scalability, and ethical concerns. These challenges, while important, should not detract from the transformative potential of quantum technologies across sectors.

3.2.1. Marketing intelligence and sentiment analysis

Quantum computing has significantly improved the efficiency and precision of marketing intelligence and sentiment analysis by leveraging enhanced models that outperform classical methods. Rather than focusing on individual models, it is more efficient to synthesize the results by emphasizing the collective impact of quantum-enhanced approaches on improving accuracy and speed in tasks like product review classification, sentiment classification, and emotional response prediction.

For instance, the Quantum Machine Learning (QML) model, QSVM, has revolutionized customer segmentation by analyzing complex consumer behavior patterns with superior speed and precision compared to classical algorithms. Additionally, Quantum Machine Learning (QML) methods, such as RGWO-GEQDNN, have demonstrated an impressive 96.44% accuracy in classifying product reviews [15], reflecting the power of quantum-enhanced models in extracting nuanced sentiments from large unstructured text data. Hybrid models like LSTM-VQC, which integrate quantum technology with classical approaches, further enhance sentiment analysis capabilities, achieving 92.59% accuracy in processing concerns and speaker identities in dialogues [16, 17]. These models, by incorporating noise-resistance methods, improve performance without requiring extensive data preparation steps typical in classical data science methods.

Quantum-enhanced sentiment analysis extends to new areas, including emotional engagement prediction for movie trailers. Quantum walk models revealed correlations between audience emotional responses and box-office revenues [18], showing how quantum computing can predict consumer reactions and adjust marketing strategies in real-time.

In terms of market research, quantum computing is transforming how unstructured consumer data is processed and analyzed. With its ability to handle vast datasets efficiently, quantum models enable more accurate real-time predictive analytics, helping brands make data-driven decisions, refine marketing strategies, and place products with greater effectiveness at launch. As quantum hardware evolves, its integration into marketing workflows will set new benchmarks for speed, accuracy, and emotional intelligence in consumer insights, positioning quantum-powered marketing intelligence as an indispensable tool in future business strategies.

3.2.2. Financial forecasting and risk optimization

Quantum computing is reshaping financial forecasting and risk management, providing a substantial leap over classical models. Quantum Monte Carlo (QMC), Quantum Amplitude Estimation (QAE), Quantum Annealing (QA), and Quantum Approximate Optimization Algorithm (QAOA) offer a unified advantage in solving complex financial models with increased speed, accuracy, and scalability. These methods address the inherent limitations of classical finance algorithms by dramatically reducing computational complexity in tasks such as portfolio optimization, risk analysis, and credit scoring.

While Quantum Monte Carlo simulations have long been a standard in finance for tasks like derivative pricing, quantum algorithms such as QAE provide a quadratic speedup over classical Monte Carlo methods. This reduction in computational complexity, from $O(1/\epsilon^2)$to $O(1/\epsilon)$, where ϵ is the estimation error, enables faster and more efficient risk modeling, particularly crucial in high-volatility markets. The combination of QAE with Monte Carlo simulations has transformed financial derivative pricing, improving computational speed and precision significantly [20].

Furthermore, quantum optimization techniques, such as QAE and QA, have revolutionized risk analysis. These methods have been tested and validated in portfolio management and derivatives pricing, where they reduce the number of simulations required to compute key risk measures, including Value at Risk (VaR) and Conditional Value at Risk (CVaR). These improvements are crucial for institutions that rely on rapid, accurate risk predictions in high-frequency trading environments [22].

Quantum computing also plays a pivotal role in credit modeling, as demonstrated by the application of quantum annealing and QUBO formulations to optimize credit scorecards. This innovation provides superior convergence rates and greater accuracy in predicting creditworthiness, enhancing processes like loan underwriting, fraud detection, and regulatory compliance [21].

Portfolio optimization is another key area where quantum methods have shown promise. By applying QAE, QA, and QAOA, researchers have demonstrated significant speedup and scalability in portfolio selection problems involving thousands of assets with complex return, volatility, and budget constraints [44]. These advancements allow for more efficient and effective management of large-scale financial portfolios.

Despite the immense potential, practical deployment of quantum financial systems faces significant challenges due to quantum hardware limitations, including noise, decoherence, and limited qubit counts. However, hybrid systems that integrate classical and quantum computing are emerging as a viable solution. These systems offload expensive quantum computations to processors while utilizing classical systems to prepare data, thereby optimizing overhead costs and enabling quantum speedups to be more applicable in real-world scenarios. As quantum hardware technologies progress, the integration of these methods will become increasingly essential for financial systems, offering breakthroughs in uncertainty analysis, pricing, and strategic forecasting.

3.2.3. Cross-sector innovations in business decision support

Quantum computing is revolutionizing business decision-making across sectors by enhancing operational efficiency, responsiveness, and strategic insight. Its applications span marketing, pricing strategy, and supply chain management (SCM), demonstrating significant improvements in decision-making and operational optimization.

In marketing, quantum algorithms such as the Quantum Support Vector Machine (QSVM) and Quantum Perceptron are redefining customer segmentation and engagement. The QSVM algorithm, known for its superior handling of nonlinear consumer data, has outperformed classical methods in personalized marketing, delivering more accurate and efficient segmentation and recommendation systems [13]. Similarly, the Quantum Perceptron has optimized engagement strategies through better classification of marketing profiles, improving consumer targeting and interaction [37].

In pricing strategy, the Quantum Approximate Optimization Algorithm (QAOA) enables real-time dynamic pricing optimization. This is crucial for industries such as e-commerce and telecommunications, where swift pricing adjustments are essential for maintaining competitiveness in fast-changing markets. Quantum-enhanced models facilitate immediate responsiveness to market fluctuations, allowing businesses to maintain price agility and profitability [41].

Quantum annealing and Quantum Neural Networks (QNN) are pivotal in SCM, addressing complex logistical challenges like vehicle routing and inventory forecasting. Quantum annealing, particularly when applied in the Capacitated Vehicle Routing Problem (CVRP), significantly reduces delivery costs while enhancing customer satisfaction. QNNs improve inventory forecasting accuracy, supporting more efficient supply chain management and reducing operational delays [47].

Table 3 summarizes these quantum applications by sector, showcasing the specific algorithms used, their respective business objectives, and their impact on decision-making efficiency. Figure 4 illustrates the timeline of quantum algorithm adoption, highlighting the accelerated integration of quantum solutions in business practices from 2023 to 2025, with a noticeable surge in adoption in recent years. This growing trust and reliance on quantum computing drive cross-sector innovation, enabling businesses to optimize decisions at scale while modeling uncertainty in data-heavy environments.

Table 3: Summarizes how these quantum models align by sector, application, and algorithm.

Sector	Application	Quantum Algorithm Used	Objective
Marketing	Recommender Systems	Quantum Support Vector Machine (QSVM)	Improve personalization and recommendation accuracy
Marketing	Customer Segmentation	Quantum Perceptron	Classify consumer behavior with higher efficiency
Pricing	Dynamic Pricing Optimization	Quantum Approximate Optimization Algorithm (QAOA)	Optimize real-time pricing under market variability
Supply Chain	Vehicle Routing Optimization	Quantum Annealing (QUBO)	Minimize logistics costs and improve delivery efficiency
Supply Chain	Inventory Forecasting	Quantum Neural Networks (QNN)	Predict demand patterns for restocking decisions
Finance	Portfolio Optimization	Quantum Annealing and QAOA	Maximize return-risk balance in asset allocation

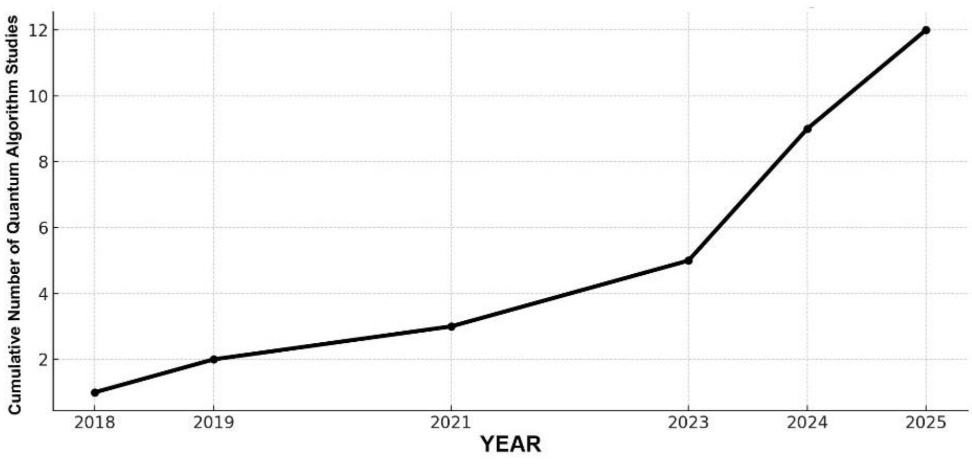

Fig. 4: Illustrates the timeline of quantum algorithm deployment, highlighting rapid adoption from 2023 to 2025.

3.3. Thematic trends and conceptual frameworks

Examination of keywords across all papers under review will shed light on clear thematic clusters that will ultimately shape the future of quantum-enhanced business intelligence. As exhibited in the word cloud displayed in Figure 5, common technical and business terminologies visually illustrate these prevalent areas of research. The widest and most central term is “Quantum Computing”, which appears in all the studies reviewed. It's foundational across marketing, finance, logistics, and sentiment analysis [4, 12].
The term “Sentiment Analysis” occurs in 14 papers, indicative of its strategic value in the ever-expanding area of consumer research and financial forecasting. Employing quantum natural language processing (QNLP) and variational quantum circuits, researchers were able to analyze emotional tone in social media, product reviews, and financial documents [16,17]. We are witnessing a paradigm shift in behavioral analytics where we are able to process and interpret emotional data at scale by utilizing quantum architectures.
“Quantum Machine Learning (QML)” comes next, with 12 studies. Quantum data has applications in both portfolio risk modelling and supply chain forecasting, with quantum algorithms like QSVM, QAOA, and hybrid autoencoders exhibiting exponential improvements in speed and accuracy of processing [13, 36]. In total, the term “QSVM” appeared on its own in 7 papers, attesting to its quality in classification and pattern detection.
The financial risk optimization field shows strong interest through terms such as “Quantum Annealing,” “Amplitude Estimation,” and “Monte Carlo Simulation.” The application of quantum techniques by researchers resulted in better derivative pricing, credit scoring, and asset allocation outcomes [20, 22]. The business sector demonstrates market-centric innovations through the frequent appearance of terms such as “Recommender Systems,” “Pricing Strategy,” and “Customer Behavior.” Quantum models achieved better hyper-personalization results and price elasticity predictions [1, 37].
Eight studies using "Supply Chain" and "Optimization" gave logistics research promising backing. A study found that QUBO optimization models and quantum-enhanced clustering reduced delivery and routing inefficiencies [47]. The diagram shows both the frequency and thematic connections between different elements. The research focuses on five main domains, which include quantum foundations and business applications, financial modeling, emotional analytics, and hybrid systems. The multidisciplinary methodology takes problem-solving approaches to translate quantum innovations into viable business applications.

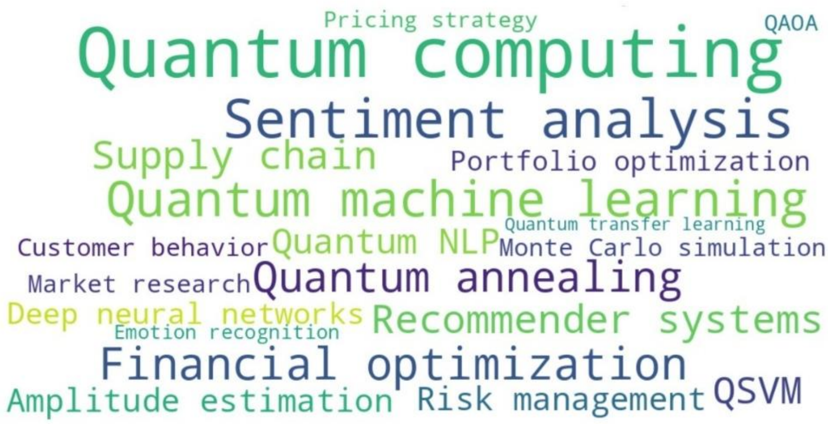

Fig. 5: Word cloud of technical and business terminologies.

3.3.1. Thematic Evolution and Interdisciplinary Integration

The thematic heatmap presented in Figure 6 indicates that quantum computing has been extensively implemented in numerous applications in commercial sectors beyond interdisciplinary themes. The three general topics are sentiment analysis, quantum machine learning (QML), and quantum optimization. These strategies weave together finance, marketing, logistics, and retail distribution, highlighting how quantum ideas can connect sectors.
Quantum optimization and amplitude estimation have been extensively used in finance. To enhance this synthesis, the review explores how quantum models, such as QSVM and QAOA, provide a unified framework for improving predictive accuracy across different business intelligence domains. These techniques can address more complex tasks like portfolio optimization, credit scoring, and derivative pricing, with significant speed and accuracy benefits [20, 22]. In contrast, marketing employs QML and sentiment analysis in deciphering consumer intent, enabling personalized recommendations to be tailored to them [12, 15]. The pull towards quantum NLP and recommender systems is very strong with voluminous retail or e-commerce data and high consumer data. By drawing connections across sectors like marketing, finance, and supply chain management, this review clarifies how quantum tools, ranging from QSVM to quantum-enhanced neural networks, are converging to form a cohesive and transformative business intelligence paradigm. With sophisticated classification and behavioral modeling, these models enhance customer targeting and product recommendations [17, 42]. The hybrid architectures of quantum deep learning based quantum models are also structured to make them adaptive by handling unstructured textual feedback.
Supply chain and logistics applications also concentrate on quantum optimization, generally by minimizing delivery costs and fine-tuning of in-the-moment adjustment of routes using annealing and clustering [47]. The early use cases in telecom and social computing indicate the potential for adoption as exploratory applications, such as quantum-secure data transmission and influence maximization strategies are explored [41, 48]. Thematic overlap across geographies indicates increasing penumbral interdisciplinary collaboration. They even use tools designed for other fields, for example, tools created by marketing experts to analyze sentiment in the news - the very same tools are applied to interpret financial news, or you use optimization techniques from logistics to inform pricing strategy in retail. Such consolidation reflects a more mature research landscape in which common algorithms are adapted to sector-specific problems.

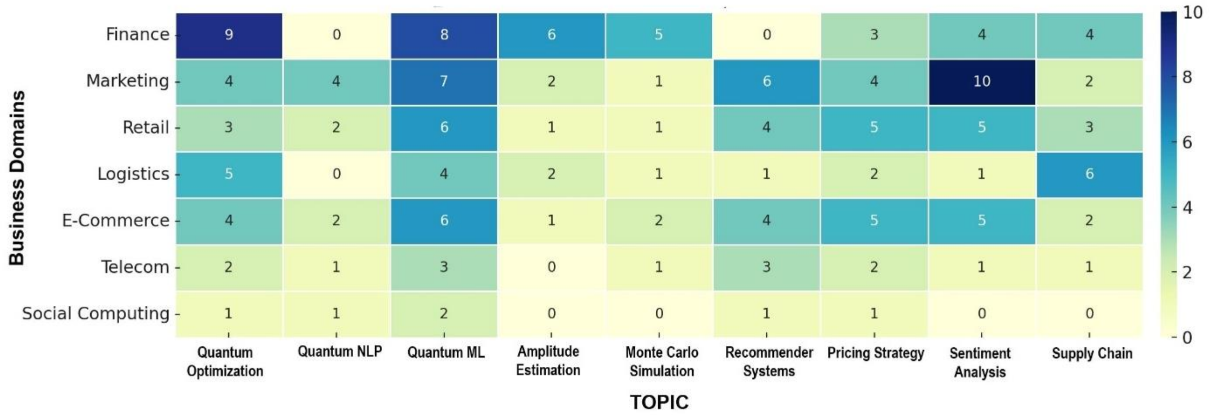

Fig. 6: Thematic heatmap showing the interdisciplinary nature of quantum computing applications across business sectors.

3.3.2. Semantic Clustering and Conceptual Mapping

The conceptual network analysis map presented in Figure 7 displays 26 quantum-business studies to show keyword co-occurrence relationships. The network diagram uses three colors - sky blue, yellow, and light green to group thematic clusters, which are labelled using clean sans-serif typography for better clarity and visual coherence. The foundational quantum technologies appear within the sky-blue cluster. The cluster contains Quantum Computing, Quantum Machine Learning, QSVM, and Quantum NLP as its core terms. These keywords form the structural core of current research and appear most frequently in studies focusing on algorithmic development and hybrid quantum-classical models [13, 22]. The utilization of quantum learning techniques applied to business problems has been strongly suggested by the repeated co-occurrence of these terms.

The yellow cluster focuses on customer analytics and behavior modeling. Sentiment Analysis, Recommender Systems, Transfer Learning, and Customer Behavior form the core elements of this group. Quantum-enhanced NLP serves as the primary technology behind research focused on marketing and e-commerce, and social media platforms because it produces better emotional understanding and personalized interactions [16, 17]. The light-green cluster contains optimization-heavy terms such as Portfolio Optimization, Monte Carlo, QUBO, and Supply Chain. The mentioned keywords are widely used in logistics, operational decision-making, and financial modeling. Their network proximity shows how quantum algorithms like annealing and amplitude estimation support faster, more reliable decision processes in finance and logistics [20, 47].

The conceptual network analysis map presents a visual proof that various business domains now utilize the same quantum vocabulary. The algorithms now move between distinct business areas such as marketing, finance, and logistics. The visualization in Figure 6 demonstrates the development of an integrated interdisciplinary research ecosystem through quantum computing, which produces tangible business applications.

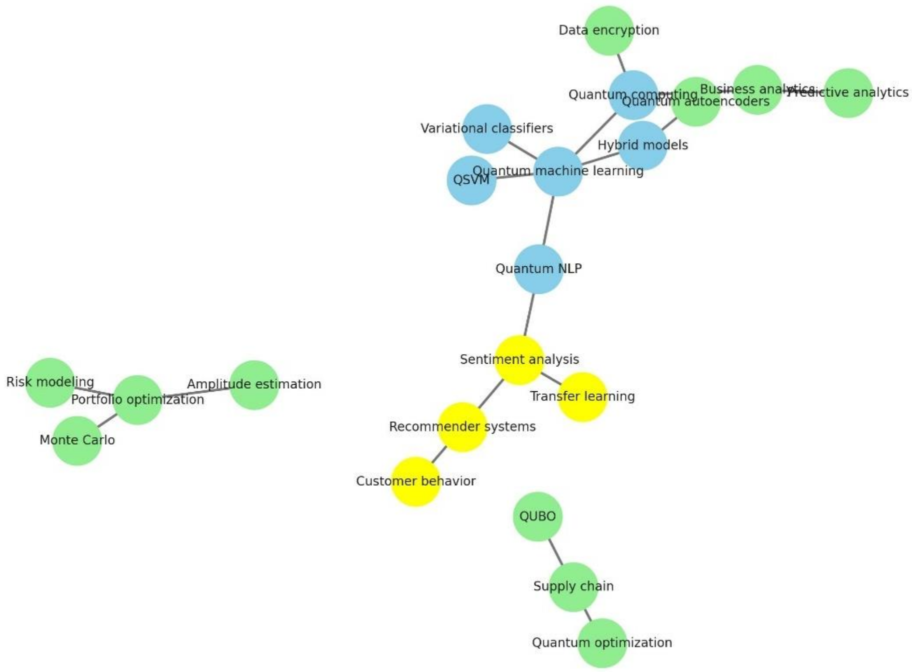

Fig. 7: Conceptual network analysis map, highlighting keyword co-occurrence across all quantum-business studies included in this work.

3.4. Methodological frameworks and comparative interventions

3.4.1. Study design and analytical techniques

The application of quantum methods across diverse fields, such as marketing, sentiment analysis, and financial forecasting, focuses on their ability to enhance predictive accuracy and decision-making. Rather than detailing each method, it synthesizes the shared benefits of quantum techniques in improving performance. Quantum Machine Learning (QML) algorithms such as QSVM and QAOA have demonstrated exponential speedup over traditional machine learning models, particularly in high-dimensional data classification. [20, 21]. Similarly, in sentiment analysis, quantum-enhanced models, including LSTM-VQC and hybrid VQC models, have demonstrated substantial improvements in emotional recognition and text classification, particularly in resource-limited environments [16, 17]. These advancements illustrate quantum computing's potential to transform industries by offering enhanced accuracy and efficiency in predictive modeling. Across all applications, the integration of quantum and classical models has been pivotal in addressing complex tasks, with hybrid approaches proving particularly effective. Quantum annealing and QAOA have been explored for portfolio optimization, showing promise in outperforming traditional models, while theoretical frameworks have guided the strategic application of quantum technologies to business environments [36, 41, 44]. The use of triangulation methods ensures that these quantum-enhanced solutions are not only innovative but also practically deployable across various sectors, reinforcing the growing influence of quantum computing in real-world business decision-making.

3.4.2. Quantum techniques and classical comparators

Quantum Methods, including Quantum Support Vector Machines (QSVM), Quantum Approximate Optimization Algorithm (QAOA), and Gaussian-Enhanced Quantum Deep Neural Networks (GEQDNN), are pushing the boundaries of classical methods, including Support Vector Machines (SVM), Deep Neural Networks (DNN), and Monte Carlo simulations, especially in fields with vast amounts of data and complex computations. This study introduces explicit discussions on how quantum computing outperforms classical approaches in predictive analytics, financial risk management, and marketing, underscoring quantum's capacity for exponential speed and accuracy improvements. Quantum algorithms are extremely powerful because they can process information in parallel and solve optimization problems on far shorter time scales than classical algorithms.

The comparison between leading quantum algorithms and their classical counterparts appears in Table 4. Hybrid quantum-classical systems outperform traditional Monte Carlo simulations in portfolio optimization, providing faster and more reliable results, which would be otherwise unachievable using classical computing alone. The quantum version of SVM proves superior to classical SVM when analyzing nonlinear and high-dimensional data sets because it leverages quantum properties for superposition and entanglement [13]. The optimization technique QAOA produces better results than traditional methods by efficiently handling complex optimization tasks, including portfolio management and logistics routing [47]. The quantum approach of GEQDNN combines deep learning models with quantum methods to analyze consumer behavior and sentiment through faster and more precise unstructured data classification than traditional DNNs [15].

Organizations in the finance sector can therefore benefit from quantum-enhanced Monte Carlo simulations using amplitude estimation, which provide a quadratic speedup over classical methods, which enable the faster pricing of derivatives and the awareness of market risks without losing previous accuracy (Rebentost et al., 2018). The performance comparison in Figure 8 shows that, in terms of both accuracy and computational cost measures, quantum techniques yield better performance compared to classical methods. Quantum algorithms provide fast and accurate calculations to recognize multidimensional patterns, thus providing better percentages. Real-time operations such as financial predictive analytics and customer behavior modeling are proven relatively easy with this technology.

Table 4: Comparison of performance of leading quantum algorithms against their classical counterparts across key business methodologies.

Technique/ Algorithm	Methodology	Application Domain	Quantum vs Classical Comparison
QSVM	Quantum Machine Learning	Market trend prediction, classification	Quantum provides speedup and better handling of complex datasets
QAOA	Approximate Optimization	Portfolio optimization, logistics	Quantum outperforms classical in large, complex optimization tasks
GEQDNN	Quantum-enhanced DNN	Sentiment analysis, consumer feedback	Quantum boosts accuracy and efficiency compared to classical DNNs
Monte Carlo	Classical Simulation	Financial risk analysis	Quantum amplitude estimation accelerates the process and reduces error
SVM	Classical ML	Classification	QSVM improves accuracy and speed on complex feature sets

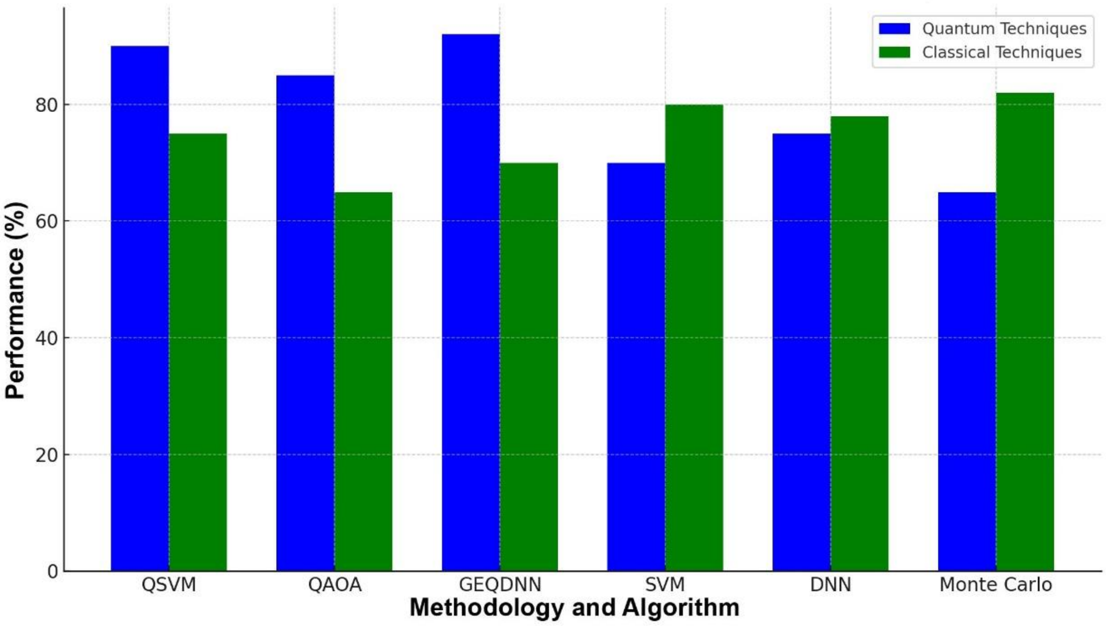

Fig. 8: Comparative performance of quantum technique versus classical technique.

3.5. Outcome metrics and efficacy evaluation

During the comparative analysis, Quantum models outperformed classical techniques in terms of accuracy, speed, and robustness measurements. The accuracy performance of quantum-enhanced models like RGWO-GEQDNN and QML frameworks is shown in Figure 8 and indicates consistently high average scores (0.88-0.96) relative to classical methods (0.60-0.80). These performance improvements translate into the capacity of quantum computing to process complex, high-dimensional datasets efficiently.
Speed advantages arise from quantum techniques having parallelism or superposition features, resulting in significant processing advantages. It was reported that 30–50% less training and inference time for business analytics applications using Variational Quantum Eigensolvers (VQE) and Quantum Support Vector Machines (QSVM) [13]. It was demonstrated that amplitude estimation can deliver a quadratic speedup over classical Monte Carlo methods applied to financial simulations [20]. Figure 9(a) radar plot visualizations illustrate that quantum models show higher composite scores for accuracy, speed, and robustness measurements.
In dealing with complex inputs and noise, the robustness of this capability of the models is one of the key outputs paraments. The synergy of quantum circuits within deep learning frameworks, as exemplified by the RGWO-GEQDNN model, not only facilitates enhanced differentiation of sentiment features but also fosters a more stable learning environment in the face of diverse textual data conditions [15]. The effect size results presented in Figure 9(b) demonstrate positive values between 0.08 and 0.15, which indicate better performance in quantum systems. Research findings support the emerging understanding that quantum computing provides practical benefits for prediction tasks, optimization, and adaptive analytics beyond its theoretical value. The studies demonstrate that quantum computing is ready for practical use in finance, marketing, and natural language processing because of its high performance and speed benefits.

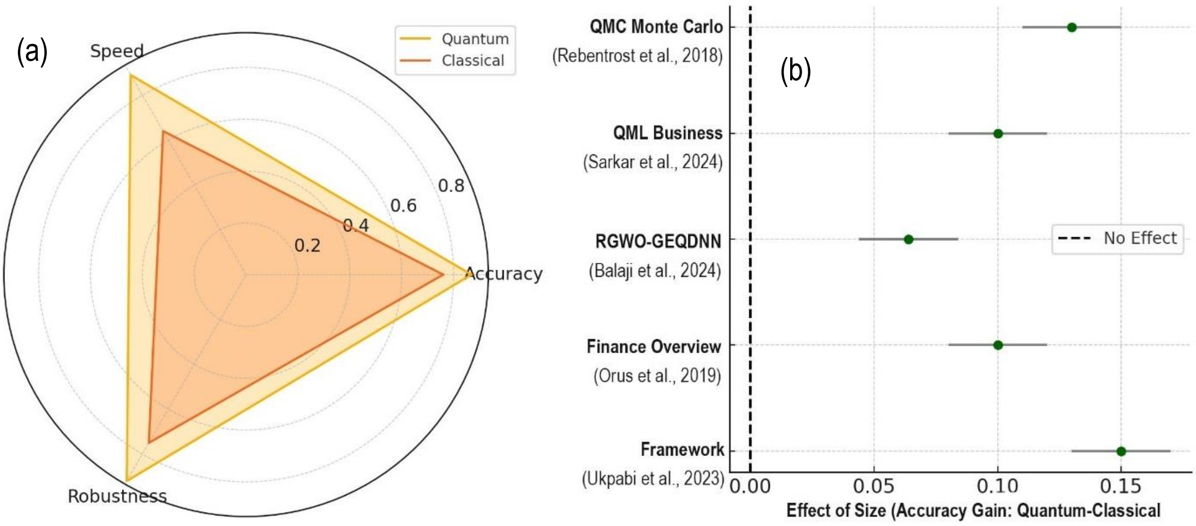

Fig. 9: (a) Radar Plot of Quantum vs Classical Performance Across Metrics; (b) Forest Plot of Effect Sizes.

3.6. Implications for theory and practice

The field of business intelligence, together with computational economics, experiences a transformation through quantum computing advancements. The integration of quantum computing into business applications also necessitates robust financial regulatory frameworks to ensure fair and transparent operations, especially in sectors such as finance, where regulatory compliance is paramount. For instance, banks can begin by integrating quantum-enhanced portfolio optimization models in parallel with classical systems to assess their potential. Further, the governance of data usage under quantum-enhanced capabilities requires stronger frameworks to mitigate privacy risks, particularly as quantum-enhanced analytics become increasingly potent in processing personal data across borders. Quantum models offer faster computation but require significant infrastructure investment. Quantum Machine Learning (QML) enhances business intelligence by improving predictive analytics across sectors like finance and marketing. However, infrastructure investment and integration with classical systems are crucial for successful deployment.
Additionally, economic considerations, including cost-benefit analysis, and ethical frameworks to manage data privacy concerns, are essential as quantum models are adopted. Cross-border implications in finance and marketing must be carefully addressed, given the global nature of data flows and regulatory discrepancies between jurisdictions, which could complicate the legal landscape for businesses leveraging quantum technologies in their operations. Regulators must adapt frameworks to include quantum-enhanced financial risk models. Ethical guidelines for data privacy and consumer manipulation should be prioritized. The massive unstructured data processing capabilities of quantum computing, along with its ability to solve optimization problems beyond classical limits enables businesses to extract new insights that guide their decision-making process. In market research, it was demonstrated that in order to achieve more scalable predictive analytics, it is advised to utilize a quantum logic system [12]. Businesses can now uncover patterns in consumer behavior that were previously hidden due to data complexity. An extensive framework has been presented to explain how quantum computing operates within business, legal, and policy domains [4]. The authors advance their argument by showing with their research that quantum technologies will lead to further operational changes beyond efficiency gains. The framework emphasizes marketing personalization and recommender systems, as well as secure data processing, as fields that currently get direct impact from quantum computing.
The economic analysis shows that quantum algorithms such as amplitude estimation have speed advantages for derivative pricing and risk modeling [22]. That also allows businesses to make quicker and correct market decisions in turbulent times. It was shown that quantum-enhanced deep learning models outperform traditional models when it comes to sentiment analysis, which allows businesses to gain real-time insights into their customers [15]. This makes quantum logic the bedrock for transitioning from reactive to predictive intelligence. Well, it creates significant features for future business strategies, which create financial systems that work all the more effectively and safely.

3.7. Practical value in strategic decision-making

Strategic marketing enables quantum computing to transform business operations. The technology improves both speed and accuracy, and data handling depth when dealing with complex information. Marketing departments can pilot quantum-enhanced sentiment analysis models to improve customer targeting. The beneficial aspects of Quantum Machine Learning (QML) tools were heightened when modeling consumer behavior and making forecasts. [12]. The technology enables marketers to deliver precise campaigns through their design process. Research was conducted on quantum-enhanced sentiment models for generic social media reviews through online shopping reviews and discovered that RGWO-GEQDNN outperformed traditional sentiment models in review analysis [15]. While quantum models improve speed, they require substantial investment in quantum infrastructure. The outcome leads to enhanced customer segmentation and product positioning. Ethical considerations on data privacy should be embedded in the quantum adoption process.

It was demonstrated that their QSVM & VQE quantum machine learning method provides both faster processing times and enhanced prediction accuracy in business analytics, according to their research [13]. A quantum method was implemented to establish emotional response connections with financial returns, thus elevating emotion-based targeting in marketing campaigns [18]. It was demonstrated how quantum annealing can optimize social network marketing outreach by identifying influential users [48]. The research findings are summarized in Table 5, which presents both theoretical and practical contributions. The table illustrates how quantum computing connects theoretical concepts with actual marketing requirements. The research matrix demonstrates how each study advances campaign optimization techniques, targeting methods, and forecasting accuracy. The evidence demonstrates that quantum computing has evolved from a futuristic concept into a usable operational tool that enhances marketers' capabilities to make swift decisions with increased certainty.

Table 5: Lists of the synthesis of theoretical and practical contributions.

Reference	Theoretical Contribution	Practical Impact
Sáez-Ortuño et al. (2024) [12]	Defined the state of quantum computing in market research; mapped trends and future directions.	Enhanced data processing in predictive analytics; improved consumer insight discovery.
Balaji & Vadivazhagan (2024) [15]	Developed a hybrid quantum deep neural network model using nature-inspired optimization.	Improved sentiment classification accuracy in e-commerce for review-based decision-making.
Sarkar et al. (2024) [13]	Presented empirical validation of quantum machine learning models (QSVM, VQE) in business analytics.	Boosted forecasting accuracy and speed in financial and marketing applications.
Singh et al. (2025) [18]	Introduced quantum-inspired emotional modeling in media impact analysis.	Demonstrated link between emotional engagement and campaign profitability using quantum models.
Nguyen et al. (2023) [48]	Formulated a quantum annealing-based solution for influence maximization in social networks.	Optimized viral marketing reach and targeting in social networks using quantum optimization.

3.8. Bias, risk assessment, and methodological constraints

Many quantum computing studies face risks to internal validity due to biases in data, simulation methods, and algorithm design. Banks and marketing departments should integrate hybrid quantum-classical systems to test quantum methods. Table 7 presents a detailed mapping of these biases across key research. It showed selection bias, as the findings depend on a limited expert panel and regional data [12]. A conceptual bias is introduced by generalizing use cases without empirical testing [4]. It was assumed a perfect quantum hardware and does not account for noise and decoherence that pose the most significant challenge in realizing practical applications [22]. However, the RGWO-GEQDNN model was developed, which is susceptible to overfitting because the model gets validation from only one dataset [15]. Results depend on IBM and D-Wave platforms, which limit study reproducibility entails platform-specific factors [13].

The traffic light diagram in Figure 10 presents the different levels of risk. The high-risk biases, which include overfitting and simulation fidelity issues, receive red circle markings. The diagram displays moderate concerns at the yellow level, which includes conceptual or selection biases. The analysis in Table 6 and Figure 10 demonstrates the immediate requirement for standardized testing and cross-platform validation, and diverse datasets. The benefits of faster computation with quantum come at the cost of infrastructure investment. These insights carry strong implications. Future quantum research needs to establish reliable benchmarks while simulating real-world conditions and conducting validation tests in uncontrolled environments to enhance trust in quantum research. Data privacy and consumer manipulation concerns need to be addressed during quantum adoption.

Table 6: Lists of the biases and limitations of the mapping.

Study	Bias Type	Limitation
Sáez-Ortuño et al. (2024) [12]	Selection Bias	Limited geographic data and an expert pool may skew global insights.
Ukpabi et al. (2023) [4]	Conceptual Bias	Overgeneralized use cases across industries without empirical testing.
Orús et al. (2019) [22]	Model Assumption Bias	Assumes ideal quantum conditions without decoherence modeling.
Balaji & Vadivazhagan (2024) [15]	Overfitting Risk	High-performance model not validated across datasets or languages.
Sarkar et al. (2024) [13]	Platform Dependency Bias	Reliance on IBM and D-Wave hardware limits generalizability.
Rebentrost et al. (2018) [20]	Simulation Fidelity Bias	The Monte Carlo quantum model was tested only under noise-free simulations.

3.9. Strategic foresight and research agenda

3.9.1. Gaps in data diversity and empirical testing

The fast-growing quantum computing applications face important challenges regarding data diversity and empirical robustness. The majority of models depend on restricted datasets, which do not support multilingual or real-time applications. An RGWO-GEQDNN model was developed using only English-language Amazon reviews for training [15]. The model fails to generalize its findings beyond English language content and specific situations. An Italian text sentiment analysis was developed, but recognized the requirement for model retraining when applying quantum methods to different languages [17]. The situation demands quantum-natural language models that can process low-resource and multilingual corpora effectively.

It was tested that their models through simulations, which ran on IBM and D-Wave platforms [13, 20]. The promising nature of these setups fails to replicate actual deployment conditions and environmental noise factors. The empirical gaps create obstacles for the large-scale deployment of quantum machine learning (QML) solutions in commercial applications. The development of trustworthy quantum-powered solutions requires both diverse dataset enhancement and model validation in live operational environments. The successful deployment of quantum models as operational solutions requires addressing current limitations to create trustworthy, adaptable systems.

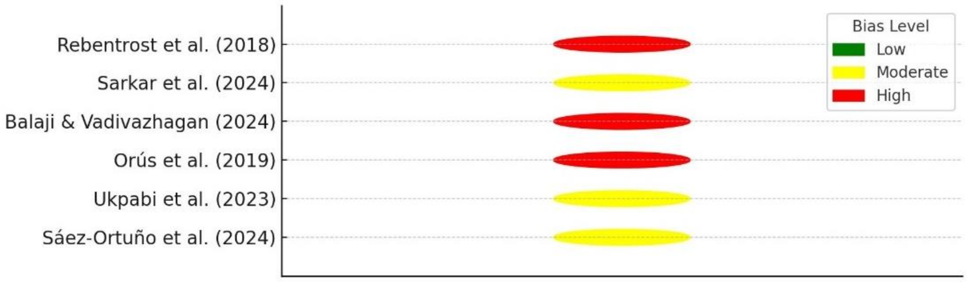

Fig. 10: Visual summary of bias assessment across key quantum computing studies

3.10. Quantum governance and infrastructure readiness

Quantum computing shows revolutionary potential to change both marketing and finance fields. Regulators must develop quantum-compliant frameworks, and businesses should integrate quantum-enhanced systems for real-time forecasting. The transformation needs to follow a strategic phased approach that bases its development on theoretical foundations while following research guidelines to achieve a common future direction. The circular roadmap shown in Figure 11(a) demonstrates the continuous progression from theory to enterprise application. The journey begins at "Quantum Theory & Algorithms," then advances to "Simulated Proof of Concepts" and "Cross-Sector Use Case Pilots" before reaching "Scalable Business Applications." The cycle demonstrates how enterprise deployment feedback helps develop earlier theoretical models through continuous refinement. The transition from portfolio optimization algorithmic simulations to quantum-driven forecasting systems represents the advancement that finance needs to make. Regulators must develop frameworks that address both technological advancements and operational risks in quantum computing adoption. Future research should focus on multilingual quantum natural language processing models and hardware-agnostic validation methods to ensure scalability and adaptability across platforms. The initial simulations of consumer behavior models in marketing can develop into large-scale personalization engines that utilize quantum technology.

The roadmap requires essential bridging components, which include "Hybrid Classical–Quantum Integration" and "Regulatory & Ethical Readiness". The integration with legacy systems in finance requires special attention, while marketing needs to address ethical challenges related to data privacy and targeting. Quantum models deliver high accuracy but require significant hardware and deployment costs. The balanced cycle prevents research from rushing into application before completing necessary safeguards and interdisciplinary alignment. Positioned in the high urgency-high impact quadrant is Real-Time Financial Forecasting, which directly supports advanced quantum applications in market trend analysis and risk management. Also of high importance is Multilingual Sentiment Analytics, a transformative tool for global marketing. These areas need immediate resource allocation, especially in regions where financial volatility and linguistic diversity intersect. Mid-impact yet urgent topics such as Cross-Platform Quantum Benchmarking are pivotal for evaluating the performance of quantum solutions across various platforms (IBM Q, D-Wave, Rigetti). Without these benchmarks, marketing and finance institutions risk vendor lock-in or uneven results. Meanwhile, Ethical Quantum Use Policies, while less urgent, are foundational to long-term trust. They ensure that as quantum tools mature, they do so with embedded principles of fairness, transparency, and accountability - especially important in predictive marketing and automated financial services.

The long-term Vision for Quantum Business Intelligence by 2030, presented in Figure 12, follows a hexagonal development pattern. The framework starts with “Quantum Infrastructure,” followed by “Ethical AI & Governance,” then “Cross-Sector Adoption” and “Real-Time Forecasting” before reaching “Hyper-Personalized Marketing” and ending with “Global Integration.” The arrangement shows that different quantum capabilities need to be developed together. The infrastructure needs ethical frameworks and sector-wide readiness to function effectively on its own. The global deployment of high-impact applications, such as real-time forecasting and personalized marketing, becomes possible only when these elements are properly aligned.

The black arrows in the roadmap symbolize sequential maturity—each step enabling the next. For finance, this implies moving from infrastructure investments in quantum cloud services toward real-time modeling of financial markets. In marketing, it means evolving from ethical compliance to truly adaptive, personalized engagement across platforms and languages. The final goal, Global Integration, envisions a quantum-literate economy where marketing and finance decisions are informed by scalable, trustworthy quantum systems. Establish ethical frameworks for using quantum models in predictive marketing and financial services.

Figures 10(a), 10(b), and 11create a strategic blueprint. Figure 10(a) provides the cyclical path from theory to scalable application. Figure 10(b) ensures that research investments align with urgency and impact. Figure 11 visualizes the shared vision for a quantum-powered business landscape. When synthesized, they offer a practical yet ambitious roadmap that ensures the marketing and finance industries are not only quantum-ready but also quantum-resilient by 2030.

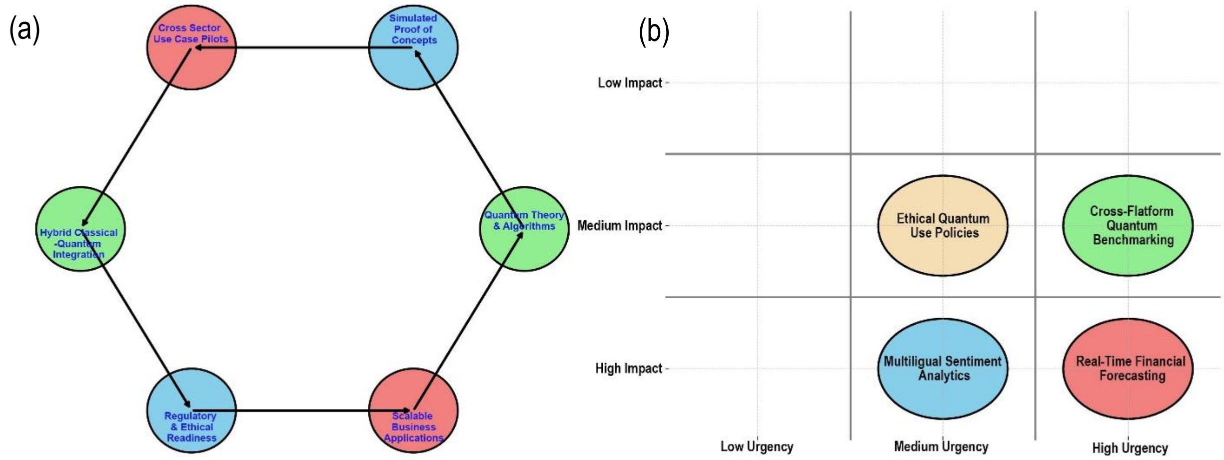

Fig. 11: (a) Cyclical development of quantum solutions from theory to pilots, integration, and scalable applications. (b) Key quantum research priorities across impact and urgency dimensions for finance and marketing.

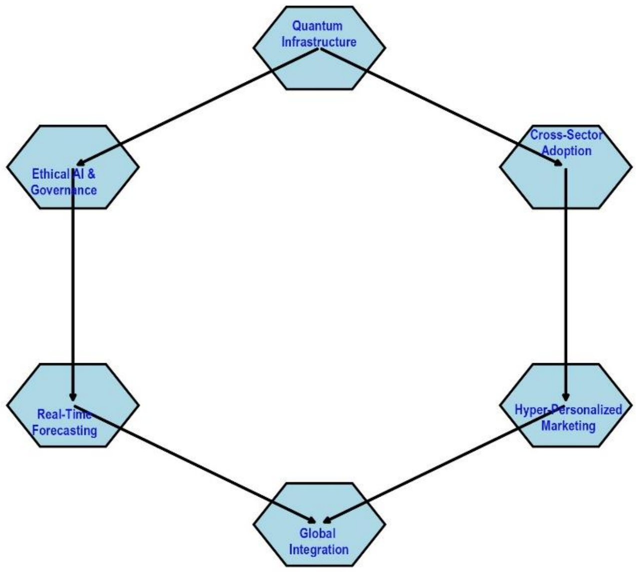

Fig. 12. Strategic roadmap for quantum adoption, from infrastructure and ethics to global integration of intelligent business systems.

4. Conclusion

This study provides a comprehensive synthesis of quantum computing's transformative role in marketing and finance through a systematic, integrative literature review. The findings reveal that hybrid quantum-classical approaches, particularly those using QSVM, QAOA, and quantum-enhanced neural networks, are advancing the frontiers of predictive analytics, sentiment analysis, portfolio optimization, and strategic decision-making. Quantum computing is no longer a futuristic vision - it is a maturing technology with actionable business applications. Yet, challenges in data diversity, empirical robustness, and hardware constraints remain. Through strategic foresight and a structured research roadmap, we highlight the need for ethical integration, cross-platform benchmarking, and real-world validation. As quantum capabilities evolve, businesses that invest early in quantum-readiness will lead the shift toward intelligent, adaptive, and data-driven ecosystems. This study lays the foundation for interdisciplinary collaboration and policy development, affirming that quantum computing is not merely a computational innovation but a strategic enabler of next-generation business intelligence.

Acknowledgements

The authors would like to acknowledge the graduate students enrolled in the Contemporary Marketing Course for their insightful discussion.

Disclosure Statement

The authors declare no conflicts of interest.

Funding

This research did not receive any financial support.

Authors' Contributions

All authors have contributed to data analysis, drafting, and revising of the article, and agreed to be responsible for all aspects of this work.

References

[1] How, M.-L., & Cheah, S.-M. (2023). Business renaissance: Opportunities and challenges at the dawn of the quantum computing era. *Businesses*, 3(4), 585–605. https://doi.org/10.3390/businesses3040036
[2] Padmanaban, H. (2024). Navigating the complexity of regulations, harnessing AI/ML for precise reporting. *Journal of Artificial Intelligence General Science*, 3(1). https://doi.org/10.60087/jaigs.v3i1.65
[3] Saxena, A., Mancilla, J., Montalban, I., & Pere, C. (2023). *Achieve optimized solutions for real-world financial problems using quantum machine learning algorithms*. Packt Publishing.
[4] Ukpabi, D., et al. (2023). Framework for understanding quantum computing use cases. *Futures*, 154, 103277. https://doi.org/10.1016/j.futures.2023.103277
[5] Bova, F., Goldfarb, A., & Melko, R. (2021). Commercial applications of quantum computing. *EPJ Quantum Technology*, 8(1), 1–13.
[6] Ahmadi, A. (2023). Quantum computing and artificial intelligence: The synergy of two revolutionary technologies. *Asian Journal of Electrical Sciences*, 12(2), 15–27. https://doi.org/10.51983/ajes-2023.12.2.4118
[7] Preskill, J. (2018). Quantum computing in the NISQ era and beyond. *Quantum*, 2, 79. https://doi.org/10.22331/q-2018-08-06-79
[8] Efe, A. (2023). Assessment of artificial intelligence and quantum computing in the smart management information systems. *Bilişim Teknolojileri Dergisi*, 16(3), 177–192. https://doi.org/10.17671/gazibtd.1190670
[9] Feynman, R. P. (1982). Simulating physics with computers. *International Journal of Theoretical Physics*, 21, 467–488. https://doi.org/10.1007/BF02650179
[10] Arute, F., Arya, K., Babbush, R., Bacon, D., Bardin, J. C., et al. (2019). Quantum supremacy using a programmable superconducting processor. *Nature*, 574(7779), 505–510. https://doi.org/10.1038/s41586-019-1666-5
[11] Ruane, J., McAfee, A., & Oliver, W. D. (2022). Quantum computing for business leaders. *Harvard Business Review*, 100(1–2), 113–121.
[12] Sáez-Ortuño, L., Huertas-García, R., Forgas-Coll, S., & Sánchez-García, J. (2024). Quantum computing for market research. *Journal of Innovation & Knowledge,* 9, 100510. https://doi.org/10.1016/j.jik.2024.100510
[13] Sarkar, S., Khadka, U., Hossain, S., & Khan, N. (2024). Quantum machine learning for advanced data processing in business analytics: A path toward next-generation solutions. *Advanced International Journal of Multidisciplinary Research*, 2(5), 1–15. https://doi.org/10.62127/aijmr.2024.v02i05.1107
[14] Kagermann, H., Süssenguth, F., Körner, J., & Liepold, A. (2020). The innovation potential of second-generation quantum technologies (acatech IMPULSE). acatech – National Academy of Science and Engineering.
[15] Balaji, G. M., & Vadivazhagan, K. (2024). Elevating sentiment analysis with resilient grey wolf optimization-based Gaussian-enhanced quantum deep neural networks in online shopping. *Journal of Theoretical and Applied Information Technology*, 102(1), 214–234.
[16] Bar, N. F., Yenilmez, M., Aksu, S., & Karakose, M. (2024). A quantum computing-based approach for sentiment analysis in bilateral conversations. *2024 IEEE International Conference on Information Technology (IT)*, 1–7. https://doi.org/10.1109/IT61232.2024.10475718
[17] Buonaiuto, G., Guarasci, R., & Esposito, M. (2024). Quantum transfer learning for sentiment analysis: An experiment on an Italian corpus. *Proceedings of the QUASAR '24 Conference*. https://doi.org/10.1145/3660318.3660325
[18] Singh, J., Bhangu, K. S., Ali, F., AlZubi, A. A., & Shah, B. (2025). Quantum-inspired framework for big data analytics: Evaluating the impact of movie trailers and its financial returns. *Journal of Big Data*, 12(22). https://doi.org/10.1186/s40537-025-01069-x
[19] Taiwo, I., Ogunbajo, A., & Abidola, A. Q. (2025). Quantum computing-enhanced AI systems for advanced business intelligence applications. *International Journal of Science and Research Archive*, 14(1), 1839–1847. https://doi.org/10.30574/ijsra.2025.14.1.0314
[20] Rebentrost, P., Gupt, B., & Bromley, T. R. (2018). Quantum computational finance: Monte Carlo pricing of financial derivatives. *Physical Review A*, 98(2), 022321. https://doi.org/10.1103/PhysRevA.98.022321
[21] He, B., Ji, X., & Lv, J. (2023). Optimization of credit scorecard combinations based on the quantum annealing algorithm. *Highlights in Science, Engineering and Technology*, 61, 57–62.
[22] Orús, R., Mugel, S., & Lizaso, E. (2019). Quantum computing for finance: Overview and prospects. *Reviews in Physics*, 4, 100028. https://doi.org/10.1016/j.revip.2019.100028
[23] Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery*, 8(5), 336–341.
[24] Wohlin, C., Mendes, E., Felizardo, K. R., & Kalinowski, M. (2020). Guidelines for the search strategy to update systematic literature reviews in software engineering. *Information and Software Technology*, 127, 106366
[25] Møller, A. M., & Myles, P. S. (2016). What makes a good systematic review and meta-analysis? *British Journal of Anaesthesia*, 117(4), 428–430.
[26] Mourão, E., Pimentel, J. F., Murta, L., Kalinowski, M., Mendes, E., & Wohlin, C. (2020). On the performance of hybrid search strategies for systematic literature reviews in software engineering. *Information and Software Technology*, 123, 106294
[27] Gill, S. S., Kumar, A., Singh, H., Singh, M., Kaur, K., Usman, M., & Buyya, R. (2022). Quantum computing: A taxonomy, systematic review and future directions. *Software: Practice and Experience*, 52(1), 1–14.
[28] Wang, J., Shen, L., & Zhou, W. (2021). A bibliometric analysis of quantum computing literature: Mapping and evidences from Scopus. *Technological Analysis & Strategic Management*, 33(12), 1347–1363.
[29] Mills, K., Creedy, D. K., & West, R. (2018). Experiences and outcomes of health professional students undertaking education on Indigenous health: A systematic integrative literature review. *Nurse Education Today*, 69, 149–158.
[30] Kitchenham, B., Brereton, O. P., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2009). Systematic literature reviews in software engineering – A systematic literature review. *Information and Software Technology*, 51(1), 7–15.
[31] Dadkhah, M., Araban, S., & Paydar, S. (2020). A systematic literature review on semantic web enabled software testing. *Journal of Systems and Software*, 162, 110485.
[32] Badampudi, D., Wohlin, C., & Petersen, K. (2015). Experiences from using snowballing and database searches in systematic literature studies. *Proceedings of the 19th International Conference on Evaluation and Assessment in Software Engineering*, 1–10.
[33] Engström, H., Berg Marklund, B., Backlund, P., & Toftedahl, M. (2018). Game development from a software and creative product perspective: A quantitative literature review approach. *Entertainment Computing*, 27, 10–22.
[34] Bielan, O., Zahreba, I., Ochkas, M., Kantsir, I., & Zelenskyi, A. (2024). Methodological support for financial risk management in enterprises. *Pakistan Journal of Life and Social Sciences*, 22(2), 9893–9902. https://doi.org/10.57239/PJLSS-2024-22.2.00747
[35] Aljaafari, M. (2023). Quantum computing for social business optimization: A practitioner's perspective [Preprint]. *Research Square.* https://doi.org/10.21203/rs.3.rs-2795910/v1

[36] Majumdar, M. G. (2023). Quantum 3.0: Quantum learning, quantum heuristics and beyond. *arXiv preprint*. https://doi.org/10.48550/arXiv.2305.18091
[37] Solikhun, A., Widodo, D. S., & Astuti, R. (2023). Analysis of the quantum perceptron algorithm for classification of bank marketing data. *AIP Conference Proceedings*, 2714(1), 030002. https://doi.org/10.1063/5.0129287
[38] Tychola, K. A., Kalampokas, T., & Papakostas, G. A. (2023). Quantum machine learning - An overview. *Electronics*, 12(11), 2379. https://doi.org/10.3390/electronics12112379
[39] Li, X., Dinh, T. N., & Thai, M. T. (2023). Quantum social computing approaches for influence maximization. *IEEE GLOBECOM, 2022,* Vietnam
[40] Ganguly, S., Morapakula, S. N., & Pozo Coronado, L. M. (2023). Quantum natural language processing based sentiment analysis using lambeq toolkit. *IEEE ICPC2T Conference*, 2022, India
[41] Khurana, R. (2022). Applications of quantum computing in telecom e-commerce: Analysis of QKD, QAOA, and QML. *Quarterly Journal of Emerging Technologies and Innovations*, 7(9), 1–15.
[42] Rivas, A., et al. (2021). Hybrid quantum variational autoencoders for representation learning. *IEEE CSCI*, 52–57. https://doi.org/10.1109/CSCI54926.2021.00085
[43] Sundar, G. N., & Narmadha, D. (2021). Performance optimization of quantum computing applications using D-Wave Two quantum computer. *In Proceedings of the Fifth International Conference on Trends in Electronics and Informatics (ICOEI)*. IEEE.
[44] Owolabi, O. S., Uche, P. C., Adeniken, N. T., Tanoh, V. G., & Emi-Johnson, O. G. (2024). Quantum computing applications, challenges, and prospects in financial portfolio optimization. *World Journal of Advanced Research and Reviews,* 22(3), 14–22. https://doi.org/10.30574/wjarr.2024.22.3.1648
[45] Yang, X., Zhu, J., & De Meo, P. (2024). A quantum-like zero-shot approach for sentiment analysis in finance. *Journal of Intelligent Information Systems*, 63(3), 705–721. https://doi.org/10.1007/s10844-024-00912-6
[46] Li, Y., Qu, Y., Zhou, R.-G., & Zhang, J. (2025). QMLSC: A quantum multimodal learning model for sentiment classification. *Information Fusion*, 120, Article 103049. https://doi.org/10.1016/j.inffus.2025.103049
[47] Geetha, V., Saxena, S., Tamboli, A., & Kadam, D. (2024). Parallelized clustering-based optimization for CVRP: Leveraging quantum computing and GPU acceleration. *2024 IEEE CSITSS*. https://doi.org/10.1109/CSITSS64042.2024.10817035
[48] Nguyen, H. T., et al. (2023). Quantum social computing approaches for influence maximization. *IEEE Transactions on Quantum Engineering*, 4(1), 1–5. https://doi.org/10.1109/TQE.2023.10477831