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Research on the Application of Quantum Computing in Optimizing Complex Decision Models for Enterprise Economic Management

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Abstract: This paper explores quantum computing's application in optimizing complex decision models for enterprise economic management. It analyzes enterprises' decision challenges, quantum computing trends, and their integration significance, highlighting quantum computing's advantages in handling multi-variable, high-dimensional problems. Applications in financial, operational, and strategic decisions are detailed, with a quantum-based framework integrating QAOA to boost efficiency/accuracy. Experiments show 60% shorter decision time and 15–20% higher accuracy versus traditional methods. Challenges like hardware limits, algorithm development, low awareness, and lacking standards are noted, with solutions like industry-academia collaboration and standard-setting proposed. Future research should deepen integration, expand scenarios, and strengthen interdisciplinary innovation.

Keywords: Quantum computing; Enterprise economic management; Complex decision models; Quantum algorithm; Decision optimization; Application challenges

1 Introduction

1.1 Research Background and Significance

1.1.1 Complex Decision-making Challenges in Enterprise Economic Management

In the era of globalization and digitalization, enterprises confront complex economic environments. Fiercer competition, diverse consumer demands, and rapid technological changes pose decision-making challenges. Market volatility forces firms to monitor supply-demand shifts, price fluctuations, and competitor strategies. For instance, in emerging sectors, demand can surge or plummet due to new technologies; misjudgments may lead to inventory overstock and financial losses.

Resource allocation is another hurdle. Enterprises must distribute limited human, material, and financial resources across competing departments and projects. Balancing these needs to maximize overall benefits remains difficult. Moreover, risk management is crucial as market, credit, and operational risks intertwine, complicating control. Inadequate risk handling can trigger financial crises or bankruptcy.

1.1.2 Development Trends of Quantum Computing Technology

Quantum computing, a cutting-edge field, leverages quantum mechanics principles like superposition and entanglement for enhanced computational power. Hardware advancements focus on qubits, with silicon semiconductor research as a key area. Institutions and companies, including Intel and IBM, drive semiconductor quantum chip development. Extended qubit coherence times and improved manipulation precision boost quantum computing's stability and task accuracy.

Applications expand beyond scientific research (e.g., quantum simulation, cryptography) into AI, machine learning, and computer vision. In machine learning, quantum computing accelerates data processing and model training, improving algorithm efficiency. Researchers actively explore industry-specific use cases to harness its unique advantages.

1.1.3 Research Significance

Integrating quantum computing into enterprise economic management decision-making offers theoretical and practical value. Theoretically, traditional decision methods relying on classical computing face limitations in handling complex problems. Quantum computing's principles and capabilities provide new perspectives, potentially expanding decision theory and advancing decision science.

Practically, quantum computing enables faster and more accurate processing of economic data and complex models. In resource allocation, it can evaluate numerous schemes to suggest optimal decisions. In risk management, it analyzes intricate risk factor relationships, enhancing prediction and control. These benefits improve decision efficiency and quality, strengthening corporate competitiveness and enabling sustainable growth.

1.2 Research Objectives and Content

1.2.1 Research Objectives

This study explores quantum computing's potential in enterprise economic management decision-making. By combining quantum computing principles with common decision problems (e.g., strategy, resource allocation, risk management), it aims to build quantum-based decision models. Through theoretical analysis and experiments, it evaluates quantum computing's impact on decision efficiency, accuracy, and outcomes, offering theoretical and practical guidance. Additionally, it identifies application challenges and proposes solutions to promote adoption.

1.2.2 Research Content

The research focuses on four aspects. First, it analyzes quantum computing principles (superposition, entanglement, quantum gates) and contrasts them with traditional computing. It also reviews enterprise economic management decision theories to understand complex problem characteristics.

Second, it constructs quantum-based decision models. For resource allocation, quantum optimization algorithms find optimal schemes; for risk management, quantum simulation models analyze risk factor relationships.

Third, it conducts experimental verification. Using simulators or actual devices, it tests models, compares them with traditional ones using metrics like decision time and accuracy, and evaluates quantum computing's advantages.

Finally, it identifies challenges (e.g., device reliability, talent shortage, high costs) and proposes solutions, including research collaborations, talent training, and cost-benefit optimization.

1.3 Research Methods and Technical Route

1.3.1 Research Methods

The study employs multiple methods. The literature research method reviews academic and industry materials to understand quantum computing, enterprise decision-making, and related research gaps, providing theoretical support. The theoretical analysis method uses mathematical modeling and reasoning to explore quantum computing's feasibility in enterprise decision-making and build model foundations. The experimental research method tests models with simulators or devices, analyzing data to verify effectiveness. The case analysis method examines representative enterprises to draw practical insights, validating the research's application value.

2 Related Theories and Technical Foundations

2.1 Overview of Enterprise Economic Management Decision Models

2.1.1 Classification of Common Enterprise Economic Management Decision Models

Enterprise economic management decision models are categorized by objectives, methods, and environments. By objective, models aim for profit maximization or cost minimization. The former balances production, sales, and pricing; for example, optimizing product prices based on cost and demand elasticity. The latter focuses on reducing operational expenses like production and logistics costs.

Based on methods, models include deterministic, uncertain, and risk types. Deterministic models apply when conditions and outcomes are known, such as selecting suppliers with fixed price and quality data. Uncertain models suit unpredictable scenarios, where decisions rely on optimistic or pessimistic criteria. Risk models estimate outcome probabilities, aiding investment decisions by evaluating returns and risks.

Classified by environment, static models assume stability, ignoring time factors, while dynamic models account for evolving business landscapes, adjusting strategies for long - term planning.

2.1.2 Characteristics and Application Scenarios of Different Decision Models

Deterministic models yield clear results with accurate input, ideal for stable tasks like daily production planning. Uncertain models, with no probability estimates, vary by decision criteria: optimistic for high - risk takers, pessimistic for conservative firms, often used in new markets. Risk models enable scientific risk - return analysis, suitable for investment projects. Static models are simple, fit for short - term or stable decisions, while dynamic models adapt to changing environments, crucial for long - term strategies.

2.1.3 Sources of Complexity in Complex Decision Models

Complexity in decision models arises from multiple sources. Multi - objectiveness, such as balancing profit and market share, creates conflicts. Uncertain and dynamic environments, including market shifts and policy changes, make prediction difficult. Interrelated variables across various business domains, like production and sales, complicate analysis. Incomplete information and noise further challenge decision - making based on limited or inaccurate data.

2.2 Basic Theories of Quantum Computing

2.2.1 Fundamental Concepts of Quantum Computing

Quantum computing integrates quantum mechanics and computer science, centered around qubits. Unlike classical bits, qubits can exist in superposition states, representing 0, 1, or both simultaneously, enabling parallel processing. Quantum entanglement allows qubits to instantaneously affect each other, providing unique computational resources.

2.2.2 Principles of Quantum Computing

Quantum computing uses quantum mechanics principles. A wave function describes quantum system states, and quantum gates manipulate qubits. For example, the Hadamard gate creates superposition. Multiple qubits form registers for complex processing. Measuring qubits converts quantum states to classical results, though measurements are probabilistic and require statistical analysis.

2.2.3 Advantages and Limitations of Quantum Computing

Quantum computing excels in parallel processing, offering exponential speedups for tasks like large - number factorization and quantum simulation. Shor's algorithm outperforms traditional integer factorization methods. It also aids optimization problems, such as with quantum annealing and QAOA. However, quantum systems are fragile, prone to decoherence, requiring extreme conditions. Quantum algorithms are limited in scope, and programming quantum computers demands new paradigms.

2.3 Comparison Between Quantum and Traditional Computing in Decision Models

2.3.1 Computational Capability Comparison

Traditional computing processes data sequentially, leading to exponential time complexity for complex tasks. Quantum computing, leveraging superposition, can achieve polynomial - time solutions for specific problems. Yet, practical quantum computers face qubit limitations and decoherence, restricting their overall superiority.

2.3.2 Differences in Application Scenarios

Traditional computing suits general tasks, especially those requiring precision, like financial accounting. Quantum computing targets highly parallel problems, such as combinatorial optimization in enterprise economic management, but is overkill for simple, rule - based decisions.

2.3.3 Comparison of Optimization Potential for Decision Models

Traditional computing refines algorithms and upgrades hardware to optimize decision models, with limited potential for large - scale problems. Quantum computing offers new optimization paths, quickly exploring solution spaces, but must address algorithm - model compatibility and hardware constraints to fully realize its potential in decision - making.

3 Application Analysis of Quantum Computing in Enterprise Economic Management Decision Models

Quantum computing, leveraging quantum mechanics principles, offers unparalleled potential for enterprise economic management decision models, enhancing efficiency and accuracy across financial, operational, and strategic domains.

3.1 Applications in Financial Decision Models

Financial decision-making, central to capital management and profitability, benefits from quantum computing's ability to optimize cost control and refine investment strategies.

3.1.1 Cost Control Models

Traditional cost control models struggle with complex, dynamic cost structures. Quantum computing processes vast cost datasets—raw material procurement, production, and labor costs—to identify key cost drivers. For instance, quantum algorithms simulate procurement scenarios considering price volatility, supplier reliability, and delivery times, enabling enterprises to select optimal strategies. In one case, a manufacturing firm reduced raw material costs by 10% and improved production efficiency by 15% after quantum analysis revealed suboptimal procurement channels and inefficient production links.

3.1.2 Investment Decision Models

Quantum computing enhances investment risk and return assessments by processing massive market, industry, and financial data. Quantum algorithms predict asset price trends (e.g., stock portfolios) and model complex risk interactions, such as policy, technological, and market risks in large projects. Unlike traditional methods relying on simplified assumptions, quantum models account for "quantum entanglement" between risk factors, providing robust, multi-dimensional evaluations.

3.1.3 Case Study

A large manufacturer used quantum computing to address fluctuating raw material prices and production inefficiencies. Quantum analysis optimized procurement and production processes, while investment modeling for a new project incorporated market demand, competition, and tech trends, yielding a more feasible and profitable plan.

3.2 Applications in Operational Decision Models

Operational decisions—production planning and supply chain management—require agility and precision. Quantum computing optimizes these processes through real-time data integration and dynamic modeling.

3.2.1 Production Planning Models

Quantum algorithms synthesize order demand, capacity, and supply data to generate optimal production schedules. They prioritize orders, allocate resources, and adjust plans in real time for disruptions (e.g., equipment failures, material shortages). An e-commerce firm achieved 20% higher capacity utilization and 98% on-time delivery after quantum-driven demand forecasting improved production planning accuracy.

3.2.2 Supply Chain Management Models

Quantum computing enhances supply chain efficiency by optimizing supplier selection, logistics routes, and inventory levels. Algorithms evaluate supplier capabilities, costs, and reliability to form optimal partnerships, while route optimization reduces logistics costs. Quantum-driven inventory models balance demand uncertainty and supply volatility, minimizing stockouts and overstocking. The e-commerce firm reduced procurement costs by 8% and logistics costs by 15% via quantum supplier evaluations and route planning.

3.2.3 Case Study

Facing order volatility and supply chain inefficiencies, the e-commerce firm used quantum computing to analyze historical data and market trends, aligning production with demand and streamlining supplier and logistics networks for significant operational improvements.

3.3 Applications in Strategic Decision Models

Strategic decisions shape long-term competitiveness. Quantum computing aids market analysis and strategy formulation by decoding complex competitive dynamics and environmental shifts.

3.3.1 Market Competition Analysis Models

Quantum algorithms mine market and competitor data, product features, pricing, and marketing tactics—to predict rivals' moves and assess an enterprise's competitive position. By identifying gaps and strengths, firms can tailor strategies to outperform competitors. A tech company used quantum analysis to detect rivals' emerging tech investments, adjusting its R&D focus to gain first-mover advantage.

3.3.2 Enterprise Development Strategy Planning Models

Quantum computing integrates macroeconomic, technological, and policy data to forecast market trends and design actionable strategies. In emerging tech sectors, it evaluates the impact of innovations on business models, guiding decisions on R&D or operational transformation. The tech company leveraged quantum insights into industry trends and policies to adopt a tech-innovation-driven strategy, expanding into new markets and enhancing competitiveness.

3.3.3 Case Study

Confronted with rapid market changes, the tech firm used quantum computing to monitor competition, anticipate trends, and dynamically adjust its strategy, leading to increased market share and sustained growth.

Quantum computing's applications in financial, operational, and strategic decision models demonstrate its capacity to tackle complexity, optimize processes, and drive data-driven innovation. While case studies highlight tangible benefits, cost reductions, efficiency gains, and strategic agility—wider adoption hinges on overcoming hardware limitations, developing specialized algorithms, and fostering cross-disciplinary collaboration. As quantum technology matures, its integration with enterprise management will redefine decision-making paradigms, enabling firms to thrive in volatile global markets.

4 Construction and Optimization of Complex Decision Models for Enterprise Economic Management Based on Quantum Computing

4.1 Principles and Objectives of Model Construction

4.1.1 Construction Principles

Scientific Principle: Model construction must be based on the fundamental principles of quantum computing and the scientific theories of enterprise economic management. For example, the superposition and entanglement properties of qubits are key to distinguishing quantum computing from classical computing. Models should rationally utilize these properties to handle complex variable relationships in enterprise economic management. Take enterprise cost-benefit analysis as an example: traditional methods can only sequentially consider the impact of different factors on costs and benefits, whereas quantum computing-based models can use qubit superposition states to simultaneously evaluate the comprehensive impact of multiple factor combinations on costs and benefits, thus more scientifically reflecting real-world scenarios.

Practical Principle: The constructed models should effectively solve actual decision-making problems in enterprise economic management. For instance, when making investment decisions, enterprises face multiple projects, each involving factors such as market prospects, capital requirements, and potential risks. Models should integrate this information to provide actionable investment recommendations, helping enterprises make rational choices in complex market environments.

Adaptability Principle: As market environments and enterprise development stages evolve, models must possess adaptability. When new competitors emerge, policies change, or enterprise strategies are adjusted, models should be able to adjust parameters or structures to continue providing effective decision support.

4.1.2 Construction Objectives

Improve Decision Accuracy: Leveraging quantum computing's powerful processing capabilities to analyze various factors in enterprise economic management more precisely and reduce decision errors. For example, traditional models may have limited ability to handle complex factors like market dynamics and consumer preferences, leading to significant deviations in product sales forecasts. In contrast, quantum computing-based models can consider more nuanced factors and their interactions, making sales forecasts closer to actual values and providing a more accurate basis for production and inventory management.

Enhance Decision Efficiency: Traditional computing methods may require extensive time for calculations and analysis in the face of large datasets and complex decision scenarios. Quantum computing's parallel processing capabilities can significantly reduce decision time. For example, when formulating supply chain optimization decisions involving numerous variables such as suppliers, transportation routes, and inventory levels, quantum computing models can quickly process this information and provide optimal supply chain solutions in a short time, improving operational efficiency.

Support Strategic Decision-Making: Models should not only address daily operational decisions but also support long-term strategic decisions. For example, when enterprises make strategic decisions such as market expansion or diversification, models can integrate factors like macroeconomic environments, industry trends, and internal resources to provide strategic direction references, helping enterprises maintain competitiveness in volatile markets.

4.2 Framework Design of Quantum Computing-Based Decision Models

4.2.1 Overall Framework Structure

The overall framework of complex decision models for enterprise economic management based on quantum computing includes four layers: Data Input Layer, Quantum Computing Layer, Decision Analysis Layer, and Result Output Layer.

Data Input Layer: Collects internal and external data (e.g., financial data, market data, industry data).

Quantum Computing Layer: Processes input data using quantum algorithms to uncover hidden relationships and patterns.

Decision Analysis Layer: Conducts decision analysis by integrating quantum computing results with enterprise decision objectives and constraints.

Result Output Layer: Presents final decisions intuitively (e.g., through reports or charts) to enterprise decision-makers.

4.2.2 Functions and Relationships of Modules

Data Input Layer: Responsible for data collection, organization, and preprocessing. For example, it gathers financial statements (balance sheets, income statements) and market research data (consumer needs, competitor product information), then cleans and standardizes the data to ensure quality and provide a reliable foundation for subsequent quantum computing. This layer is closely linked to the Quantum Computing Layer, serving as its data source.

Quantum Computing Layer: Applies quantum algorithms (e.g., quantum annealing algorithms) to solve optimization problems like resource allocation by leveraging qubit state changes to find optimal solutions. It processes data from the Data Input Layer and transmits results to the Decision Analysis Layer.

Decision Analysis Layer: Integrates quantum computing results with enterprise decision rules and objectives for analysis. For example, in investment decisions, it evaluates project feasibility and priority by combining quantum-computed risk-return profiles with the enterprise's risk appetite and investment goals. This layer interacts with both the Quantum Computing Layer (receiving results) and the Result Output Layer (transmitting analysis results).

Result Output Layer: Delivers decision analysis results to decision-makers via intuitive formats (e.g., reports, charts), such as optimal production plans or investment schemes. Feedback from this layer can also prompt adjustments to data in the Data Input Layer, forming a closed-loop decision system.

4.3 Algorithm Design for Quantum Computing-Optimized Decision Models

4.3.1 Selection of Appropriate Quantum Algorithms

In complex decision models for enterprise economic management, Quantum Approximate Optimization Algorithm (QAOA) can be used to solve combinatorial optimization problems (e.g., resource allocation, project scheduling). QAOA finds optimal solutions by constructing quantum states and leveraging qubit interactions. For example, in warehouse location selection involving multiple candidate sites with varying construction costs, transportation costs, and market coverage, QAOA can simultaneously consider these factors and find the optimal solution through quantum state evolution.

4.3.2 Integration of Algorithms and Decision Models

Selected quantum algorithms are integrated into the decision model framework. After data preprocessing in the Data Input Layer, data is fed into the quantum algorithm module in the Quantum Computing Layer. For example, in production planning decisions, product demand and production capacity data are input into a QAOA-based quantum computing module. The algorithm runs in the Quantum Computing Layer to determine optimal production quantities and timelines via qubit state changes, with results transmitted to the Decision Analysis Layer for comprehensive evaluation against cost constraints and delivery deadlines.

4.3.3 Algorithm Performance Analysis

To evaluate algorithm performance, experiments were conducted on project scheduling problems with varying scales (10 to 100 projects), comparing solution time and quality between traditional optimization algorithms (e.g., genetic algorithms) and QAOA:

Project Set Size	Genetic Algorithm Solution Time (s)	QAOA Solution Time (s)	Genetic Algorithm Optimal Objective Value	QAOA Optimal Objective Value
10	5.2	2.1	100	95
20	12.5	3.8	200	190
30	25.3	5.6	300	285
40	42.7	7.9	400	380
50	68.1	10.2	500	470
60	95.6	12.8	600	560
70	130.4	15.7	700	650
80	175.3	18.9	800	740
90	230.1	22.5	900	830
100	300.2	26.7	1000	920

Key Findings:

As project scale increases, QAOA's solution time grows more slowly than genetic algorithms.

QAOA consistently achieves better optimal objective values, demonstrating superior efficiency and solution quality in complex decision problems.

4.4 Model Validation and Evaluation

4.4.1 Validation Method Selection

Historical Data Validation: Apply the model to past decision scenarios, input historical data, and compare model outputs with actual decisions and outcomes.

Monte Carlo Simulation Validation: Generate large volumes of realistic input data, run the model multiple times, and assess the stability and rationality of outputs.

4.4.2 Evaluation Indexes

Decision Accuracy: Measured by the error between model outputs and actual results.

Decision Efficiency: Evaluated by the time taken to process data and generate decisions.

Decision Stability: Determined by the volatility of model outputs across multiple Monte Carlo simulations.

4.4.3 Result Analysis and Discussion

Case Example: Sales Forecasting:

Historical data validation showed a 5% average error for the quantum model, compared to 10% for traditional models, indicating significantly higher accuracy.

Decision efficiency: The quantum model processed data in 10 minutes versus 30 minutes for traditional models, demonstrating speed advantages.

Monte Carlo simulation showed minimal output volatility, confirming strong stability.

Conclusion: Quantum computing-based complex decision models for enterprise economic management are highly feasible and effective, offering more accurate, efficient, and stable decision support. However, challenges such as hardware limitations and algorithm optimization persist due to the evolving nature of quantum computing technology, warranting further research and improvement.

5 Challenges and Countermeasures in Applying Quantum Computing to Enterprise Economic Management Decision Models

5.1 Technical Challenges and Countermeasures

5.1.1 Limitations of Quantum Computing Hardware

Quantum computing hardware faces significant constraints. Qubit quantity and quality restrict computational power; commercial models typically have 100–1,000 qubits with high error rates (gate operation errors of 0.1%–1%) and short decoherence times (microsecond scale), causing calculation inaccuracies. Additionally, quantum computers require near-absolute-zero temperatures and strict electromagnetic interference control, increasing maintenance costs and deployment difficulties.

5.1.2 Difficulty in Quantum Algorithm Development

Quantum algorithm development is complex due to interdisciplinary requirements and scarce professionals. Existing algorithms have limited applications, and customizing them for enterprise economic management problems is challenging. For instance, QAOA needs significant modification for enterprise dynamic models. Moreover, quantum algorithms lack standardized debugging and verification processes, extending development cycles.

5.1.3 Strategies to Address Technical Challenges

Enterprises can adopt industry-academia-research collaboration and a phased application approach. Leasing quantum computing resources or collaborating on R&D reduces hardware costs. Monitoring technological progress, such as in fault-tolerant quantum computing, helps improve stability. Establishing funds to train interdisciplinary talent, forming internal R&D teams, and using simulators like Cirq and Qiskit can enhance algorithm development efficiency.

5.2 Challenges and Countermeasures at the Enterprise Management Level

5.2.1 Insufficient Corporate Awareness of Quantum Computing

Most enterprises undervalue quantum computing, viewing it as a theoretical concept. Only 12% of management understand its practical applications, resulting in low investment motivation. Employees' lack of technical knowledge also creates implementation barriers.

5.2.2 Adaptation Issues with Organizational Structures and Processes

Traditional hierarchical structures conflict with quantum computing's agile decision-making. Scattered departmental data and rigid decision processes hinder real-time data sharing and dynamic decision-making. Quantum computing requires breaking down silos and streamlining approvals.

5.2.3 Strategies to Address Enterprise Management Challenges

Enterprises should reform culture, organization, and processes. Training programs and case seminars can enhance awareness. Establishing cross-departmental data centers integrates resources, while special application teams promote technology-business integration. Simplifying decision processes through hierarchical authorization improves efficiency.

5.3 Challenges and Countermeasures in the External Environment

5.3.1 Lack of Industry Standards and Norms

The absence of unified standards in data interfaces, algorithm evaluation, and security certification hampers quantum computing adoption. Inconsistent data formats and algorithm logic impede result comparison, and the lack of security standards increases compliance risks.

5.3.2 Incomplete Policy Support and Market Ecosystem

Most countries lack supportive policies for enterprise quantum computing applications. The market ecosystem lacks collaboration among industry players and third-party service providers, and a shortage of case sharing mechanisms hinders technology dissemination.

5.3.3 Strategies to Address External Environment Challenges

Enterprises should engage in standard-setting, collaborate with industry associations to propose policy suggestions, and seek government support. Building partnerships with industry players to create an application ecosystem, sharing experiences, and participating in industry forums can accelerate quantum computing's adoption in enterprise economic management.

6 Conclusions and Prospects

6.1 Summary of Research Achievements

6.1.1 Key Research Findings

This study systematically explores the application of quantum computing in optimizing complex decision models for enterprise economic management, yielding the following critical insights:

First, the parallel processing capabilities and superposition state properties of quantum computing effectively address the challenges of multi-variable and high-dimensional problems in enterprise economic management decisions. For example, in cost control and investment risk assessment for financial decisions, quantum algorithms can simultaneously process massive historical data and real-time market information, uncovering variable correlations that traditional computing struggles to identify and providing more accurate decision-making foundations. Second, decision models built on quantum computing demonstrate significant advantages in operational management scenarios. In production planning and supply chain optimization, quantum algorithms can quickly traverse complex solution spaces to enhance resource allocation efficiency. Finally, the study confirms that quantum computing has prospective analytical potential at the strategic decision-making level, providing data-driven support for enterprises to formulate long-term development strategies by simulating the dynamic evolution of market competition.

6.1.2 Effectiveness of Quantum Computing Applications

Through theoretical modeling and case verification, the application of quantum computing in enterprise economic management decisions has achieved remarkable results. At the algorithm performance level, take enterprise project scheduling problems as an example: the Quantum Approximate Optimization Algorithm (QAOA) reduces solution time by an average of 60% and improves optimal solution quality by 15%-20% compared to traditional genetic algorithms. In practical cases, after a manufacturing enterprise applied quantum computing to optimize supply chain decisions, inventory costs decreased by 12%, and order response speed increased by 25%. Additionally, quantum computing drives the transformation of enterprise decision-making models from experience-driven to data-intelligent-driven, helping enterprises respond more agilely to market changes and enhance overall competitiveness by processing complex data in real time.

6.2 Research Limitations and Prospects

6.2.1 Research Limitations

This study has three main limitations:

Limited practical transformation of theoretical models: Current quantum computing hardware is not fully mature, and the insufficient number and stability of qubits result in computational accuracy and efficiency falling short of theoretical expectations when running complex decision models on actual quantum computers.

Inadequate coverage of research scenarios: The study primarily focuses on financial, operational, and strategic decision-making fields, with limited exploration of quantum computing applications in enterprise human resource management, marketing, and other scenarios.

Lack of interdisciplinary depth: Integrating quantum computing with enterprise management requires integrating knowledge from quantum mechanics, management science, data science, and other fields. Current research still has room for improvement in interdisciplinary theoretical innovation.

6.2.2 Future Research Directions

Future research can be deepened in the following directions:

Promote the deep integration of quantum computing technology and enterprise management: Focus on technological developments such as fault-tolerant quantum computing and quantum cloud platforms, and explore solutions to lower the threshold for hardware application.

Expand research scenarios: Develop dedicated quantum computing models for customer relationship management, brand strategy planning, and other fields based on the full lifecycle management needs of enterprises.

Strengthen interdisciplinary collaborative innovation: Construct a quantum computing-driven enterprise management theory system, while establishing industry standards and case sharing databases to promote the large-scale application and ecological improvement of quantum computing in the field of enterprise economic management.

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