# Quantum in Financial Services:
The Future is Now

When it comes to using advanced technology to increase profit, reduce cost, and improve efficiency, financial institutions have often led the way. Today, many of those same companies are at the forefront of exploring how quantum computers can be used to drive competitive advantage.

The opportunities for better risk management, lower transaction costs and overhead, and better forecasting can add up to billions of dollars in potential gains per year for a firm. In fact, according to the Boston Consulting Group, quantum computing can unlock long-term value of $42B to $67B for financial institutions. In addition, lower energy consumption of quantum computers can advance sustainability agendas. It is no wonder the FinServ industry is moving quickly.
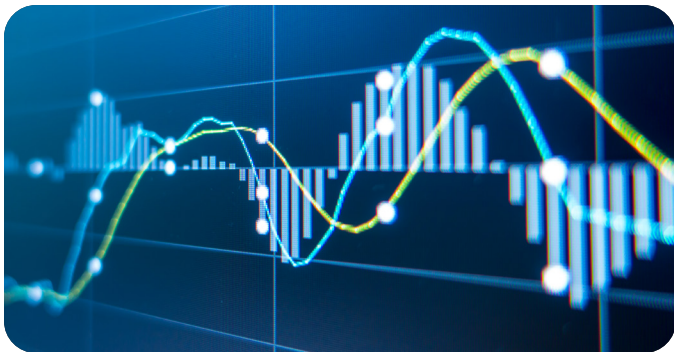
In a recent survey, 35% of large enterprises surveyed reported they were already experimenting with quantum computing—and within three years, 68% were considering quantum computing as a solution to a specific business problem. Companies in financial services and insurance were among the most aggressive in looking towards quantum computers to solve such problems. The top two reasons they cited were to increase efficiency and increase profitability.

In terms of use cases, optimization problems that have a large number of variables, and thus a huge number of potential combinations, stand out as the major driver of current quantum activity.

Optimization in Finance

Many problems in finance can be expressed as optimization problems. Complex optimization problems can be hard, or even impossible, for classical computers to solve. A good example is trying to optimize a diverse portfolio of financial assets to achieve the maximum reward with the lowest possible risk. This can be a feat of staggering complexity: for a portfolio of just eight assets in which transactions are performed every month for four years, the number of possible configurations is far greater than the number of atoms in the known universe.

Similar challenges exist in many areas of finance. Here are just a few optimization applications that are well-suited to a quantum-hybrid approach:

- **Portfolio allocation and optimization:** How can you efficiently generate optimal portfolios for higher returns, less volatility, and lower overhead?

- **Optimal trading trajectory:** How can you redefine behavioral clustering algorithms as quantum problems for better directional forecasting and risk management?

- **Optimal arbitrage opportunities:** How can you find the most profitable arbitrage opportunity among a given group of opportunities?

- **Credit scoring and optimal feature selection:** How can you improve the identification and management of risk and compliance?

- **Capital allocation optimization:** How can you maximize a portfolio's returns for a given level of risk, while taking into account constraints from modern portfolio theory?

- **Risk assessment and fraud detection:** With an overwhelming industry rate of false positives, how can you better assess and predict fraud to reduce costs?

Quantum Use Case Spotlight: Portfolio Optimization

Multiverse Computing, a leader in developing quantum computing-based solutions for the financial sector, recently demonstrated the power of using D-Wave's hybrid solver service in a pair of collaborations with two major European banks, BBVA and Bankia.

In their collaboration with BBVA, one of the largest financial institutions in the world, Multiverse set out to demonstrate that they could identify management strategies that yield the highest Sharpe ratio—a metric reflecting the rate of return at a given level of risk. For a large dataset, comprising 10^{382} possible portfolios, the hybrid quantum-classical approach identified a portfolio with a Sharpe ratio of 12.16 in just 171 seconds. For comparison, a ratio of eight is typically considered to be "a virtually risk-free investment."

> *"I've seen a real transition in published papers from 'toy', model-type problems, to real commercial products...I think we're really reaching that breaking point where quantum computing is becoming something the industry can derive value from."*
>
> **Sam Mugel**
> CTO, Multiverse Computing

With Bankia, a Spanish financial services company, Multiverse added an additional level of complexity to the problem. Short- and long-term capital gains are taxed at different rates, and many financial institutions apply a minimum holding period for assets in an investor's portfolio to reduce the tax burden. This new project added this as a new constraint.

The results offered a range of portfolio trajectories that delivered robust gains at every level of risk. In one of them, the D-Wave analysis identified a portfolio with 15% risk that yielded a 60% return on investment, whereas randomly selected portfolios at the same level of risk were entirely scattered along a continuum ranging from a 20% return to a 20% loss.
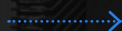
Access the detailed case story here.

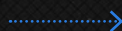## D-Wave Launch: The on-board to quantum computing program

If you are ready to get started but not sure how, the D-Wave Launch program has been designed to help enterprises at every step of their quantum journey, from problem discovery through production implementation.
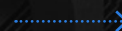
Identify the problem best suited to quantum → Get your team trained and start the development process → Move your application into test and ready for production → Get your application up and running to deliver benefit to your business

Sign Up Now To Get Started: www.dwavesys.com/d-wave-launch