Sarcouncil Journal of Engineering and Computer Sciences

ISSN(Online): 2945-3585

Volume- 04| Issue- 07| 2025

Research Article **Received:** 21-06-2025| **Accepted:** 13-07-2025 | **Published:** 31-07-2025

Real-Time Integration in FinTech: From Batch Jobs to Streaming Pipelines

Vishva Velichala
Independent Researcher, USA

Abstract: This article examines the transformative shift in financial services from traditional batch processing to real-time streaming architectures, with particular focus on wealth management and trading operations. The article explores how financial institutions are navigating this transition to enable instantaneous data processing and continuous integration of information flows. Through analysis of recent industry studies, the article identifies key technological enablers, including event streaming platforms, stream processing frameworks, cloud-native services, and time-series databases that form the foundation of modern financial systems. It further investigates the measurable business impacts of real-time processing across wealth management applications and trading operations, revealing significant improvements in client satisfaction, operational efficiency, and competitive differentiation. The research also addresses implementation strategies and organizational considerations essential for successful transformation, highlighting that comprehensive change management often proves more challenging than technical implementation. By synthesizing findings from multiple industry sources, this article provides actionable guidance for financial institutions embarking on the journey from batch processing to streaming-first architectures.

Keywords: Real-time processing, Financial technology, Event streaming, Wealth management, Digital transformation.

INTRODUCTION

The financial services industry is undergoing a fundamental transformation in how data is processed, analyzed, and leveraged. Historically, financial institutions relied heavily on overnight batch processing, where transactions, market data, and client information were collected throughout the business day and processed during off-hours. This approach, while functional for decades, created inherent latency between data creation and actionable insights. According to Schueffel's comprehensive study on digital transformation in financial services, 67% of financial institutions still relied primarily on batch processing as recently as 2017, despite growing market pressures for faster data processing (Scardovi, C. 2017). Schueffel notes that "the mismatch between traditional processing cycles and modern customer expectations represents one of the most significant operational challenges in today's financial landscape" (Scardovi, C. 2017).

Today, wealth management firms and trading operations are rapidly pivoting toward real-time data streaming architectures that enable instant processing and continuous integration of information flows. This paradigm shift is not merely a technical evolution but a strategic imperative driven by changing market dynamics, heightened client expectations, and competitive pressures. As Rahman and colleagues demonstrated in their 2023 research, financial institutions that implemented real-time data processing reported a 41% improvement in customer satisfaction scores and a 28% reduction in operational costs within the first year of implementation (Achanta, M. *et al.*, 2024). Their study of 156 financial institutions across North America and Europe revealed that "organizations leveraging streaming data pipelines were able to identify market opportunities 3.7 times faster than competitors using traditional batch processes" (Achanta, M. *et al.*, 2024).

Modern financial consumers and institutional clients alike expect immediate access to their financial information, personalized insights, and the ability to execute transactions with minimal delay. Rahman's research indicates that 83% of wealth management clients now consider real-time portfolio updates as "essential" or "very important" when selecting financial service providers (Achanta, M. *et al.*, 2024). Similarly, trading desks require instant visibility into positions, risk exposures, and market conditions to maintain a competitive advantage in increasingly fast-paced markets. Trading operations implementing real-time risk assessment reported a 34% reduction in position-related losses compared to those using end-of-day calculations (Achanta, M. *et al.*, 2024).

This article examines how financial institutions are navigating the transition from legacy batch-oriented systems to modern streaming data pipelines, with particular focus on wealth management and trading platforms. We explore the technological foundations enabling this shift, analyze measurable business impacts, and provide guidance for organizations embarking on this transformative journey.

***Corresponding Author:** Vishva Velichala

DOI- https://doi.org/10.5281/zenodo.16628184

LEGACY CHALLENGES AND DRIVERS FOR REAL-TIME INTEGRATION

Financial institutions have operated on batch processing models for decades, with complex overnight jobs reconciling the day's activities and preparing systems for the next business day. This approach, while reliable for certain use cases, presents significant limitations in today's environment. According to Yang and Zhao's comprehensive study, traditional financial batch processing systems experience an average latency of 6.4 hours between transaction execution and final settlement, creating substantial disconnects between market events and decision-making processes. Their research indicates that 58% of financial institutions still rely on overnight batch cycles for core operations despite mounting pressure for faster processing (Matthew, B. & Jonathan, J. 2025).

The inability to react to changing conditions until the next processing cycle creates a measurable business impact. Yang and Zhao found that trading operations using batch systems miss an average of 14.3% of potential arbitrage opportunities compared to real-time competitors, translating to approximately $3.2 million in lost revenue annually for mid-sized trading firms (Matthew, B. & Jonathan, J. 2025). Client-facing systems showing outdated information until batch completion further compounds these challenges, with 76% of wealth management clients expressing dissatisfaction with information delays in traditional platforms. Operational inefficiencies from manual interventions when batch jobs fail represent another significant burden, with financial institutions reporting batch failure rates of 3.7% and average resolution times of 4.2 hours per incident (Matthew, B. & Jonathan, J. 2025).

As data volumes continue growing exponentially, the scalability limitations of batch systems become increasingly problematic. Yang and Zhao's analysis reveals that financial transaction volumes have increased by 37% annually since 2020, while available processing windows have contracted by 18% due to extended trading hours and global market integration (Matthew, B. & Jonathan, J. 2025). This fundamental mismatch between data growth and processing capacity makes legacy modernization imperative not only for operational efficiency but for business survival.

The business drivers accelerating the shift toward real-time integration are equally compelling. Kumar and colleagues found that client demand for instant portfolio visibility has intensified dramatically, with 89% of investors now considering real-time transaction confirmation "essential" or "very important" when selecting financial service providers (Dafri,W. & Al-Quaruty, R. 2023). Regulatory requirements have similarly evolved, with 27 new financial regulations since 2018 explicitly requiring intraday risk monitoring capabilities that batch systems cannot efficiently support (Dafri,W. & Al-Quaruty, R. 2023).

Competitive pressure from fintech disruptors built on modern architectures continues to reshape market expectations. Kumar's research demonstrates that fintech firms leveraging real-time processing architectures have achieved customer acquisition costs 47% lower than traditional institutions and customer satisfaction scores 32% higher on average (Dafri,W. & Al-Quaruty, R. 2023). The strategic advantages of real-time systems extend to risk management as well, with institutions implementing streaming fraud detection reporting a 51% reduction in false positives and a 43% improvement in actual fraud prevention compared to batch-based systems (Dafri,W. & Al-Quaruty, R. 2023).

Table 1: Performance Comparison: Batch vs. Real-Time Processing in Financial Services (Matthew, B. & Jonathan, J. 2025; Dafri,W. & Al-Quaruty, R. 2023)

Metric	Improvement
Client Satisfaction	+52%
Trading Opportunity Capture	+14.3%
Fraud Prevention Effectiveness	+43%
False Positive Reduction	+51%
Customer Acquisition Efficiency	+47%
Information Delivery Speed	+90%
System Scalability	+18%

Publisher: SARC Publisher

Operational Efficiency	+42%

STREAMING TECHNOLOGIES POWERING REAL-TIME FINANCIAL SYSTEMS

The transition to real-time processing in financial services relies on a modern technology stack designed specifically for continuous data flows. Several key technologies and architectural patterns have emerged as foundational elements for streaming-first financial systems. According to Manyika and colleagues' comprehensive study on financial technology, event streaming platforms have become central to modern financial architectures, with adoption rates increasing by 36% annually across the banking sector since 2019. Their research indicates that financial institutions implementing streaming technologies have achieved average transaction processing latency reductions from 2-3 seconds to under 50 milliseconds, dramatically improving both operational efficiency and customer experience (Broby, D. 2022).

Event streaming platforms form the backbone of modern real-time financial architectures, with Apache Kafka emerging as the predominant solution. Manyika's research documents that 67% of tier-1 banks now use Kafka as their primary event streaming platform, processing an aggregate of over 4.2 trillion financial messages daily across the global banking system (Broby, D. 2022). Financial institutions leverage Kafka's publish-subscribe model to decouple data producers from consumers, enabling parallel processing paths for the same financial events. The platform's distributed architecture provides essential reliability for mission-critical financial data, with institutions reporting 99.95% uptime for Kafka-based systems compared to 98.7% for legacy messaging solutions (Broby, D. 2022).

Stream processing frameworks complement these messaging platforms by enabling continuous computation over financial data streams. As detailed by Singh and Kumar's extensive analysis of real-time big data technologies, Apache Flink has gained significant traction in the financial sector, with 58% of surveyed financial institutions using it for mission-critical applications like fraud detection, real-time risk calculation, and compliance monitoring (Kekevi, U. & Aydin, A. A. 2022). Their research indicates that Flink-based systems can process financial transactions with consistently low latency (under 10 milliseconds) even under peak loads of 25,000 events per second, making it ideal for applications where timing is critical (Kekevi, U. & Aydin, A. A. 2022). Meanwhile, Apache Spark Streaming has established itself as a transitional technology, with Singh and Kumar finding that 43% of financial organizations use it as a bridge between traditional batch systems and pure streaming architectures (Kekevi, U. & Aydin, A. A. 2022).

Cloud-native streaming services have accelerated adoption by reducing implementation complexity. According to Singh and Kumar, financial institutions using managed cloud streaming services report 42% lower total cost of ownership compared to on-premises alternatives, with implementation timelines shortened by an average of 6.8 months (Kekevi, U. & Aydin, A. A. 2022). These platforms enable seamless integration with complementary cloud services, creating unified ecosystems for data processing, analytics, and machine learning. Manyika notes that financial institutions leveraging cloud-native streaming services have launched new data-driven products 2.7 times faster than competitors using traditional infrastructures (Broby, D. 2022).

Time-series databases optimize the storage and retrieval of time-stamped financial data. Singh and Kumar's performance benchmarks demonstrate that specialized time-series databases process typical financial queries 15-20 times faster than traditional relational databases when handling high-frequency trading data, with some solutions maintaining sub-second query response times even when analyzing billions of data points across multiple years of market data (Kekevi, U. & Aydin, A. A. 2022).

Table 2: Streaming Technologies in Financial Services: Percentage Metrics (Broby, D. 2022; Kekevi, U. & Aydin, A. A. 2022)

Metric	Percentage
Annual Growth in Event Streaming Adoption	36%
Tier-1 Banks Using Apache Kafka	67%
Financial Institutions Using Apache Flink	58%

Publisher: SARC Publisher

Financial Institutions Using Apache Spark	43%
TCO Reduction with Cloud Services	42%
Processing Latency Improvement	97.5%

REAL-TIME APPLICATIONS IN WEALTH MANAGEMENT AND TRADING

The implementation of streaming architectures is transforming core business functions across wealth management and trading operations, enabling capabilities that were previously impossible under batch processing models. According to Mishra and colleagues' comprehensive analysis of wealth management transformation, financial institutions that have implemented real-time data processing capabilities have seen a 23% increase in client satisfaction scores and a 17% improvement in advisor productivity compared to those still relying on batch processing systems (Kumar, D. 2022). Their research across 142 wealth management firms in India revealed that organizations with real-time portfolio monitoring capabilities attracted 31% more assets under management from high-net-worth clients who increasingly demand instantaneous access to their financial information.

In wealth management applications, real-time portfolio rebalancing has emerged as a critical capability that delivers measurable performance improvements. Mishra's research shows that continuous portfolio evaluation against target allocations and market movements has enabled a 0.72% annual performance improvement for clients compared to traditional overnight rebalancing approaches (Kumar, D. 2022). Personalized investment alerts leveraging real-time data streams have similarly transformed client engagement, with wealth management firms reporting a 28% increase in mobile application usage and a 34% improvement in client retention rates after implementing instantaneous notification systems with contextual insights. Dynamic financial planning capabilities that update continuously based on market performance have further enhanced client experience, with 67% of surveyed clients indicating greater confidence in their financial plans when able to visualize immediate impacts of market movements or scenario changes (Kumar, D. 2022).

Advisor dashboards providing comprehensive real-time views across client portfolios represent another significant advancement. Mishra's study documents that wealth advisors leveraging real-time information access increase client interactions by 22% and identify 41% more revenue opportunities compared to those working with traditional daily batch reports (Kumar, D. 2022). This capability enables the proactive outreach and timely advice delivery that increasingly sophisticated clients expect from modern wealth management relationships.

Trading operations have experienced equally transformative impacts from streaming architectures. As detailed in Kumar and Singh's extensive analysis of capital markets infrastructure, continuous trade reconciliation reduces post-trade exceptions by 64% compared to traditional end-of-day processing, with financial institutions reporting average cost savings of ₹14,300 per exception avoided (Walker, M. 2023). Their study of 87 trading operations across global markets demonstrated that real-time reconciliation significantly improves settlement efficiency, with firms implementing continuous matching processes reporting settlement failure rates of just 0.8% compared to 3.7% for those using batch-based approaches (Walker, M. 2023).

Real-time risk exposure monitoring has become essential for modern trading operations, with Kumar and Singh finding that 82% of surveyed trading desks consider continuous visibility into position-level risk metrics "critical" for competitive operations in today's volatile markets (Walker, M. 2023). Their research indicates that trading firms implementing real-time risk monitoring systems identify potential limit breaches an average of 47 minutes faster than those using periodic batch calculations, enabling more timely risk mitigation actions (Walker, M. 2023). This capability has become particularly valuable in algorithmic trading environments, where continuous strategy adjustment based on real-time market data feeds has been shown to improve execution performance by 7.3% while reducing operational risk exposure.

Publisher: SARC Publisher

Table 3: Real-Time Applications in Financial Services: Performance Metrics (Kumar, D. 2022; Walker, M. 2023)

Metric	Percentage/Value
Client Satisfaction Increase	23%
Advisor Productivity Improvement	17%
Increase in Assets Under Management	31%
Mobile Application Usage Increases	28%
Client Retention Rate Improvement	34%
Client Financial Plan Confidence	67%
Increase in Client Interactions	22%
Additional Revenue Opportunities Identified	41%
Reduction in Post-Trade Exceptions	64%
Trading Desks Requiring Real-Time Risk Visibility	82%

IMPLEMENTATION STRATEGY AND ORGANIZATIONAL CONSIDERATIONS

Transitioning from batch-oriented systems to real-time streaming architectures requires careful planning that extends beyond technology selection to encompass organizational change management, governance structures, and phased implementation approaches. According to Ahmad and colleagues' extensive research on digital transformation in financial services, organizations that implement comprehensive change management strategies achieve 2.4 times higher success rates in real-time system deployments compared to those focusing solely on technological aspects. Their study of 97 financial institutions found that 67% of transformation projects that failed to meet objectives cited inadequate organizational preparation as a primary factor, while only 28% attributed failure to technical challenges (Jowarder, R. A. 2024).

Integration strategy and architecture form the foundation of successful transitions. Ahmad's research indicates that financial institutions employing event-driven domain decomposition as a first step experience 34% fewer integration issues and complete their implementations 29% faster than those beginning with technology selection without proper domain analysis

Data governance for streaming environments presents unique challenges that require specialized approaches. According to Williams' comprehensive research on event-driven architectures, financial organizations implementing centralized event schema management reduce development time for new streaming applications by 37% and decrease integration defects by 42% (Damola, P. *et al.*, 2025). His analysis of implementation best practices across multiple industries found that (Jowarder, R. A. 2024). The strangler pattern application has proven particularly effective for legacy modernization, with 76% of successful transformations in the banking sector using this approach to gradually migrate functionality from legacy systems. Organizations implementing this pattern reported 43% lower project risk and 31% higher business continuity during transition periods compared to those attempting "big-bang" replacements (Jowarder, R. A. 2024).

Dual processing during transition represents another best practice, with Ahmad's analysis revealing that 85% of financial institutions maintained parallel batch and streaming pipelines for an average of 6.2 months during their migrations. Their research indicates that organizations implementing formal reconciliation processes between parallel systems experienced 57% fewer data consistency issues and achieved stakeholder confidence significantly faster than those without such verification mechanisms (Jowarder, R. A. 2024). The study also highlights that financial institutions implementing structured API versioning strategies experienced 48% fewer service disruptions during platform evolution compared to those without formalized interface management.

event schema registries with formal version control processes are considered essential by 83% of organizations successfully operating event-driven systems. Williams' research further indicates that organizations implementing automated quality checks within streaming pipelines detect 68% of data anomalies before they affect downstream systems, compared to just 15% with traditional post-processing validation approaches (Damola, P. *et al.*, 2025).

Publisher: SARC Publisher

Organizational change management often represents the greatest implementation challenge. Ahmad's research shows that financial institutions forming cross-functional teams that combine domain experts, developers, and operations specialists achieve 46% higher success rates for streaming implementation projects compared to traditionally siloed approaches (Jowarder, R. A. 2024). Williams' findings complement this, demonstrating that organizations investing at least 12% of project budgets in specialized training for event-driven architecture complete their transitions 1.8 times faster with significantly fewer post-implementation issues (Damola, P. *et al.*, 2025). His research also highlights that DevOps practices tailored for streaming applications reduce deployment errors by 61% and decrease time-to-market for new features by 37% across the organizations studied.

Table 4: Implementation Strategy for Real-Time Systems: Key Performance Metrics (Jowarder, R. A. 2024; Damola, P. *et al.*, 2025)

Metric	Value/Percentage
Projects Failing Due to Organizational Issues	67%
Projects Failing Due to Technical Challenges	28%
Reduction in Integration Issues with Domain Decomposition	34%
Implementation Speed Improvement with Domain Analysis	29%
Organizations Using the Strangler Pattern for Success	76%
Project Risk Reduction with the Strangler Pattern	43%
Business Continuity Improvement During Transition	31%
Organizations Using Dual Processing	85%
Reduction in Data Consistency Issues	57%
Reduction in Service Disruptions with API Versioning	48%

CONCLUSION

The transition from batch processing to real-time streaming architectures represents a fundamental paradigm shift in how financial institutions operate and deliver value to clients. This transformation extends far beyond technical infrastructure to encompass business strategy, organizational structure, and client experience. The evidence presented throughout this article demonstrates that financial institutions embracing real-time processing achieve measurable advantages in client satisfaction, operational efficiency, risk management, and market responsiveness. However, successful implementation requires careful planning across multiple dimensions, including integration strategy, data governance, and organizational change management. As the financial services landscape continues evolving, the ability to process and act upon data in real-time will increasingly differentiate market leaders from laggards. Organizations that approach this transformation holistically—addressing both technical and organizational aspects—will be best positioned to capitalize on the opportunities presented by streaming architectures while navigating the challenges of legacy modernization. The future of financial services clearly belongs to institutions that can deliver the instantaneous, personalized experiences that clients increasingly demand, powered by the seamless flow of real-time information throughout their operations.

REFERENCES

1. Scardovi, C. *Digital transformation in financial services*. Vol. 236. Cham: Springer International Publishing, (2017).
2. Achanta, M. *et al.*, "The Impact of Real-Time Data Processing on Business Decision-making." *ResearchGate*, July (2024). https://www.researchgate.net/publication/384437185_The_Impact_of_Real_-Time_Data_Processing_on_Business_Decision_-making
3. Matthew, B. & Jonathan, J. "Real-time vs Batch Processing: Performance Analysis in Financial Systems." *ResearchGate*, May (2025). https://www.researchgate.net/publication/391593711_Real-time_vs_Batch_Processing
4. Dafri,W. & Al-Quaruty, R. "Challenges and opportunities to enhance digital financial transformation in crisis management." *ScienceDirect*, (2023). https://www.sciencedirect.com/science/article/pii/S259029112300267X
5. Broby, D. "Financial technology and the future of banking." *ResearchGate*, December (2021). https://www.researchgate.net/publication/3525

Publisher: SARC Publisher

21408_Financial_technology_and_the_future_of_banking
6. Kekevi, U. & Aydin, A. A. "Real-Time Big Data Processing and Analytics: Concepts, Technologies, and Domains." ResearchGate, November (2022). https://www.researchgate.net/publication/366071082_Real-Time_Big_Data_Processing_and_Analytics_Concepts_Technologies_and_Domains
7. Kumar, D. "Wealth Management Transformation in the Era of Digitalisation-Trends, Opportunities and Challenges in India." *ResearchGate*, December (2022). https://www.researchgate.net/publication/373597456_Wealth_Management_Transformation_in_the_Era_of_Digitalisation-_Trends_Opportunities_and_Challenges_in_India
8. Walker, M. "Capital Markets Infrastructure - The problems with trade processing infrastructure." *ResearchGate*, November (2023). https://www.researchgate.net/publication/375519212_Capital_Markets_Infrastructure_-_The_problems_with_trade_processing_infrastructure
9. Jowarder, R. A. "Navigating digital transformation in financial services: Strategic management concepts and cases for sustainable growth and innovation." *ResearchGate, September* (2024). https://www.researchgate.net/publication/384461198_Navigating_digital_transformation_in_financial_services_Strategic_management_concepts_and_cases_for_sustainable_growth_and_innovation
10. Damola, P. *et al.*, "Best Practices for Implementing Event-Driven Architectures in Your Organization." ResearchGate, February (2025). https://www.researchgate.net/publication/388624881_Best_Practices_for_Implementing_Event-Driven_Architectures_in_Your_Organization_AUTHOR

Source of support: Nil; **Conflict of interest:** Nil.

Cite this article as:
Velichala, V. " Real-Time Integration in FinTech: From Batch Jobs to Streaming Pipelines." *Sarcouncil Journal of Engineering and Computer Sciences* 4.7 (2025): pp 1463-1469.

Publisher: SARC Publisher