Modern™ WhitePaper

Managing Technical Debt and Data Fragmentation in Financial Services

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Executive Summary

Financial institutions face two interrelated challenges that constrain innovation and growth: technical debt and data fragmentation. Technical debt, the accumulated cost of deferred modernization decisions, typically represents 20%-40% of the value of the entire technology portfolio [1]. Research shows that a 10% increase in technical debt reduces a firm's return on assets by 16%.

Data fragmentation compounds this problem. Decades of mergers and acquisitions create environments where customer data lives in dozens of repositories, business logic is scattered across applications from different organizations, and core banking platforms operate in parallel. The result is extraordinary complexity that makes every change expensive, every integration project lengthy, and every compliance requirement manual.

The most successful financial institutions are addressing both challenges through an operational data layer like DataOS that embeds governance and execution into day-to-day operations. By treating data infrastructure as a strategic asset rather than a cost center, they gain the visibility needed to prioritize modernization, accelerate post-merger integration, and turn legacy complexity into competitive advantage. This approach connects data assets, pipelines, and policies across legacy and cloud environments, allowing technical debt and fragmentation to be continuously measured and addressed in alignment with business outcomes.

Introduction

Two Sources of Complexity

Banks and financial institutions are building AI-powered capabilities and digital experiences that require unified, reliable data. What stands in the way: technical debt and fragmentation across dozens of legacy systems.

For most institutions, this infrastructure results in two distinct but related problems. The first is technical debt: the accumulated cost of architectural decisions, integration shortcuts, and quick fixes that seemed reasonable at the time but now constrain what's possible. Engineers spend roughly 33% of their time managing the fallout from this debt [2]. In central data and BI teams, that number can reach 50% of capacity tied to production support and fixing broken pipelines.

The second is data fragmentation driven by mergers and acquisitions. Every merger brings new core banking platforms, payment systems, and customer databases. Every acquisition adds another layer of applications and data stores. Over time, these systems become deeply embedded in operations, expensive to maintain, and difficult to change.

Both challenges are addressable. Organizations with the right strategy can break this cycle and redirect engineering capacity toward innovation.

Five Areas Where Data Strategy Drives Value

Technical debt and data fragmentation represent strategic choices about where to invest capacity and how quickly to capture opportunity. Five areas show the highest return from modernization efforts:

Operational Resilience and System Stability

Legacy systems are complex and fragile. Changes carry risk. This drives a defensive posture where teams spend significant time on maintenance rather than building new capabilities. Engineers devote approximately 33% of their time to technical debt fallout and upkeep, diverting resources from value-generating activities [2]. Central data teams can spend up to 50% of capacity on production support.

State-of-the-art data infrastructure reverses this equation. Organizations that successfully modernize their data layer report dramatic reductions in unplanned work, faster deployment cycles, and the ability to respond to business needs in weeks instead of months.

Security Posture and Regulatory Compliance

Outdated technology creates security vulnerabilities. Legacy systems often lack modern security protocols for rapid threat detection and response. The siloed nature of platforms acquired through M&A makes comprehensive compliance difficult, leading to manual processes, delayed reporting, and regulatory fines.

Strategic data management provides unified governance across legacy and cloud environments. Banks can automate compliance workflows, reduce manual reconciliation, and ensure consistent security policies across all data sources. Regulatory compliance transforms from a cost drain into a source of advantage through faster reporting and lower operational risk. [4]

Innovation Velocity and Market Responsiveness

Up to 70% of business modernization initiatives depend on technology that is heavily burdened by technical debt [2]. This forces organizations to walk away from significant growth opportunities. In one McKinsey case study, a B2B business had to cut its modernization investment and forgo 25% of a potential $2 billion margin expansion due to the cost and complexity of its tech stack [2].

Financial institutions that address their data infrastructure can redirect this capacity. Instead of spending engineering time on maintenance, they can focus on new products, enhanced customer experiences, and AI-powered capabilities that drive revenue growth.

Customer Experience Excellence

Customers expect seamless, consumer-grade digital experiences. Legacy core banking and payment systems struggle to integrate with new digital channels, resulting in slow or inconsistent service. This applies equally to internal customers who depend on centralized capabilities to run their business functions.

Data fragmentation makes this worse. When customer information lives in multiple systems with different data models, creating a unified experience becomes a significant integration challenge. Data integration approaches solve many of these constraints, enabling the real-time, personalized experiences that customers expect from digital-native competitors.

Post-Merger Integration Speed and Synergy Realization

Mergers and acquisitions create immediate data fragmentation. Customer information exists in multiple systems. Product catalogs don't align. Risk models use different methodologies. The longer these parallel systems persist, the more expensive integration becomes and the slower the merged entity can move as one organization.

Leading institutions are using modern data architectures to accelerate this integration, often achieving in months what previously took years. By creating a unified data layer across legacy platforms, they can deliver single views of customers, consolidated risk reporting, and integrated product offerings without requiring full system replacement.

What's at Stake When Data Infrastructure Falls Behind

The consequences of unmanaged technical debt and data fragmentation can be severe. The following cases illustrate what's at risk when data infrastructure falls behind business needs:

Case Study	Type of Technical Debt	Core Data Management Failure	Impact to Company
Knight Capital (2012)	Legacy Code & Configuration Debt	Failure to consistently remove obsolete code and configuration data across all servers	$440 million loss, forced merger, business failure
TSB Bank (2018)	Architectural & Data Migration Debt	Poorly tested migration scripts and inadequate target data architecture to handle volume and complexity of customer data	£330 million in costs, 1.9 million customers locked out, £48.65 million regulatory fine
Citibank (2020)	Legacy System & UI/UX Debt	Lack of critical data validation and confirmation steps for large, unscheduled principal transfers in an error-prone interface	$900 million accidental transfer, $400 million regulatory fine for persistent data governance failures
Standard Chartered (2021)	Data Quality & Reporting Debt	Reliance on manual reconciliation and fragmented data sources to meet consolidated regulatory reporting requirements	£46.55 million fine for inaccurate liquidity reporting

The TSB Bank failure demonstrates how technical debt becomes enterprise risk. The issue was not just technology but corporate governance and the approach to managing technical risk. The resulting operational collapse, financial penalties, and loss of 80,000 customers show how data infrastructure challenges can threaten the entire organization.

The Operational Data Layer as The Strategic Solution

The most effective financial institutions treat technical debt and data fragmentation as quantifiable problems that can be systematically addressed. This starts with creating visibility into where complexity exists, what it costs, and how to prioritize remediation. In practice, this requires an operational data layer that coordinates metadata, governance, and execution across legacy and cloud environments, providing the foundation for both measurement and modernization.

A. Data-Driven Prioritization: The Tech Debt Balance Sheet

The first step is transforming technical debt from an abstract concept into a quantifiable business variable. This is achieved by creating a Tech Debt Balance Sheet. Technical debt can be quantified, but it takes effort and discipline. Once you understand the metrics, it changes the discussion because the numbers are significant.

Here are ways data management delivers impact on technical debt:

Quantify Cost of Delay: Calculates the lost revenue and increased operational cost of not fixing a piece of debt. Prioritizes high-impact, high-risk systems for immediate remediation.

Asset-Level Analysis: Analyzes debt at the application or database level, linking it directly to business value streams. Ensures that debt repayment is tied to clear business outcomes like improved resiliency and customer satisfaction.

Continuous Monitoring: Uses performance management systems and code-quality tools to track debt in real time. Provides predictive intelligence and allows for proactive intervention before issues escalate.

Calculate Cost to Support Minor Changes: Your PMO should be able to assess how much a simple change will cost to implement and support versus a modern data-driven approach. Couple that with the production support costs to maintain these applications and data environments, and you have a large debt number to track and address.

B. Modernizing Core Banking with an Operational Data Layer

Core banking systems are often the primary source of both technical debt and data fragmentation in financial institutions. Traditional approaches to modernization force a choice between expensive rip-and-replace projects or living with growing complexity. An operational data layer provides a third path: evolutionary modernization that delivers value incrementally while reducing risk.

How an Operational Data Layer Addresses Technical Debt and Fragmentation

DataOS provides an operational data layer that sits across legacy and cloud environments, enabling financial institutions to modernize without requiring full system replacement. [3] This approach addresses technical debt and fragmentation through several key capabilities:

Abstracting Legacy Complexity: DataOS creates a unified data layer over legacy mainframes and fragmented M&A systems, allowing modern applications to access data through consistent interfaces without needing to understand the underlying COBOL or proprietary database structures. This decouples innovation from legacy constraints, enabling teams to build new capabilities while legacy systems continue to operate.

Continuous Visibility and Measurement: By connecting data assets, pipelines, and policies across environments, DataOS provides real-time visibility into where complexity exists, what it costs, and how it impacts business outcomes. This enables data-driven prioritization of remediation efforts based on quantifiable business impact rather than gut feel.

Unified Governance Across Environments: DataOS enforces security and compliance policies consistently across both legacy and cloud platforms, and across systems acquired through M&A. This reduces manual reconciliation work that consumes central data teams and mitigates the risk of breaches caused by inconsistent security controls.

Domain-Based Data Products: Rather than forcing all data management through a central bottleneck, DataOS enables domain teams to take ownership of their data. Teams in retail banking, mortgage, and wealth management can build and deploy data products autonomously, building to standards rather than accumulating debt through quick workarounds.

Accelerating Post-Merger Integration: For M&A integration, DataOS creates a unified data layer that spans multiple source systems without forcing immediate consolidation. This allows single customer views, consolidated risk reporting, and integrated product catalogs quickly while deferring or eliminating the need for full platform replacements. By establishing consistent governance across all entities, financial institutions can realize synergies faster and at lower risk than traditional system consolidation projects.

C. Governance and Accountability

Addressing technical debt and data fragmentation needs structural commitment from the top. The most successful organizations embed this work into their operating model:

Strategic Funding: The CEO, CFO, and CIO must jointly allocate capital for tech debt remediation and integration work, tied to specific business KPIs. Ideally, a CDO is positioned to help drive these decisions, but they need to be empowered at a senior level to make a difference.

Product Team Ownership: The core unit of modernization should be the product team, held accountable for the entire lifecycle of its applications, including technical debt. Many high-performing companies dedicate two sprint cycles (about four weeks) every quarter specifically to technical cleanup.

D. Operationalizing the Strategy: A DataOS Approach

Addressing technical debt and data fragmentation at scale is not a one-time transformation but an ongoing operational challenge. Financial institutions need an operating approach that embeds visibility, governance, and accountability into day-to-day data operations. DataOS provides this operational layer by connecting data assets, pipelines, and policies across legacy and cloud environments, enabling institutions to continuously measure technical debt, quantify the cost of delay, and align remediation efforts with business priorities.

DataOS operationalizes data management across the enterprise. Rather than pursuing a rip-and-replace model, DataOS supports evolutionary change by enabling organizations to decouple innovation from legacy constraints, enforce governance consistently, and ensure new capabilities are built to high standards instead of accumulating new debt. By institutionalizing technical debt management and cross-platform integration within the operating model, financial services firms can shift from episodic cleanup efforts to a durable, data-driven discipline that supports resilience, regulatory confidence, and long-term growth.

Conclusion

Technical debt and data fragmentation are related challenges that constrain innovation and growth. They are business liabilities measured in lost customers, damaged reputations, and hundreds of millions of dollars.

The solution is disciplined and strategic. Quantify the debt. Prioritize remediation. Establish an operational data layer that spans all data environments. With the right data management platform, financial institutions can address pressing use cases and modernize incrementally, no rip-and-replace required. The result is a foundation that supports modern architecture, scales with growth, and breaks the cycle of legacy dependence. Technical debt stops being an unmanageable liability and becomes a strategic investment in an organization's future.

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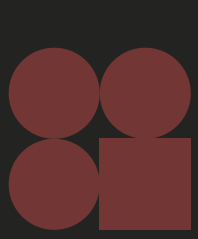

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