

Designing In-House Validation and Reconciliation Frameworks: A RegTech Approach to Pre-Submission Regulatory Risk Reduction

Laxmi Naga Durga Pandrapragada

Independent Researcher

Regulatory Reporting Architecture & Supervisory Compliance Frameworks

Mountain House, CA

laxmi.pandrapragada@gmail.com

Abstract:

Regulatory reporting programs operate under increasing supervisory scrutiny, where institutions are expected not only to produce accurate outputs but also to ensure that data is validated, reconciled, and controlled prior to submission. While many organizations implement validation rules and reconciliation processes, these controls are often fragmented, reactive, and disconnected from core reporting platforms. This creates gaps in pre-submission assurance, exposing institutions to regulatory risk.

This paper proposes a structured approach to designing in-house validation and reconciliation frameworks as part of an integrated RegTech architecture. It introduces a layered control model that combines rule-based validation, cross-system reconciliation, variance analysis, and exception management within a unified pre-submission assurance framework. The approach emphasizes automation, traceability, governance integration, and audit-defensible evidence generation.

Drawing on practical insights from regulatory reporting environments, this paper demonstrates how embedding validation and reconciliation capabilities within reporting platforms establishes a unified control architecture that enhances pre-submission assurance, strengthens audit defensibility, and aligns regulatory reporting processes with evolving supervisory expectations for transparency and data integrity [1], [3], [6].

Keywords: Regulatory Reporting, Validation Frameworks, Reconciliation, Pre-Submission Controls, Data Quality, RegTech, Control Architecture, Exception Management, Financial Reporting Systems, Audit Readiness, Supervisory Compliance, Risk Reduction, Data Consistency, Reporting Governance.

1. Introduction

Regulatory reporting has evolved into a high-stakes control function where accuracy, completeness, and consistency of submitted data are critical. Supervisory expectations extend beyond final reported figures to include the processes used to validate, reconcile, and certify those figures prior to submission [1], [5].

In many institutions, validation and reconciliation processes exist but are fragmented across systems, teams, and workflows. Validation rules may be implemented within reporting platforms, while reconciliations between source systems, general ledgers, and reporting outputs are performed manually or through separate tools. This lack of integration limits visibility into data quality and creates gaps in pre-submission assurance [2], [7].

These gaps become particularly critical in complex reporting environments such as CCAR, capital adequacy, and liquidity reporting, where data flows through multiple transformation layers before reaching final reports.

Without a structured and integrated control framework, discrepancies may go undetected until late in the reporting cycle, increasing operational risk and reducing confidence in submitted data [1], [6].

This paper proposes a structured approach to designing in-house validation and reconciliation frameworks embedded within regulatory reporting platforms. It introduces an integrated control architecture that unifies validation, reconciliation, and governance processes to provide a consistent pre-submission assurance layer. Such frameworks enhance data accuracy, consistency, and traceability, while strengthening supervisory confidence in regulatory submissions.

2. Limitations of Traditional Validation and Reconciliation Approaches

Traditional approaches to validation and reconciliation often operate in silos. Validation rules are typically implemented as edit checks within reporting systems, focusing on field-level accuracy or threshold conditions. Reconciliation processes, on the other hand, are frequently performed outside the platform, comparing balances across systems such as general ledger, sub-ledgers, and reporting outputs [2], [14].

This separation creates several limitations. First, discrepancies identified during reconciliation may not be traceable back to specific validation failures or transformation logic. Second, validation rules may not account for cross-system consistency, leading to situations where individually valid data elements produce inconsistent aggregate results. Third, manual reconciliation processes introduce operational inefficiencies and increase the risk of human error [2], [15].

Another challenge is timing. Traditional reconciliation processes are often performed late in the reporting cycle, leaving limited time for issue resolution. This reactive approach increases the likelihood of last-minute adjustments, which may not be fully controlled or documented, potentially weakening audit defensibility [1], [6].

These limitations highlight the need for a more integrated and proactive approach to validation and reconciliation within regulatory reporting environments. Addressing these gaps requires a unified framework that embeds validation and reconciliation within the reporting platform itself, enabling real-time consistency checks, traceability across systems, and structured pre-submission assurance.

3. Regulatory Expectations for Data Accuracy and Consistency

Supervisory frameworks emphasize the importance of data accuracy, completeness, and consistency across reporting processes. Regulatory expectations require institutions to implement robust control frameworks that ensure data is validated and reconciled prior to submission, thereby reducing the risk of reporting errors and inconsistencies [1], [3].

The Basel Committee's principles for risk data aggregation highlight the need for strong data governance, validation, and reconciliation processes to support reliable and auditable reporting outputs [1]. Similarly, supervisory guidance on capital planning and regulatory reporting underscores the importance of integrated control environments that maintain consistency across financial, risk, and reporting systems [6].

Consistency across systems is particularly critical in regulatory reporting environments. Reported figures must align with underlying financial records, risk systems, and data warehouses, ensuring that outputs remain coherent across the reporting ecosystem. Any discrepancies must be identified, investigated, and resolved within a controlled and traceable framework [1], [7].

In this context, validation and reconciliation are not independent activities but interdependent control mechanisms that collectively ensure data integrity. Meeting these supervisory expectations requires integrated frameworks that embed validation and reconciliation within the reporting lifecycle, enabling consistent, traceable, and audit-defensible regulatory submissions.

4. Framework Design: Layered Validation and Reconciliation Architecture

A robust in-house framework should be designed as a layered control architecture that integrates validation and reconciliation within the regulatory reporting lifecycle. This paper introduces a structured framework that unifies validation, reconciliation, and governance processes into a cohesive pre-submission assurance model embedded within reporting platforms.

The first layer is data validation, which includes rule-based checks for completeness, format, thresholds, and logical consistency. These rules operate at the attribute level and ensure that individual data elements meet predefined criteria, forming the foundational control layer for data quality assurance.

The second layer is cross-system reconciliation, which compares data across systems such as source applications, general ledger, data warehouses, and reporting outputs. This layer ensures consistency across the reporting chain by validating alignment between upstream data sources and downstream reporting outputs.

The third layer is variance analysis, which identifies deviations between reporting periods, expected trends, or benchmark values. This provides an additional level of control by detecting anomalies that may not be captured by rule-based validation or reconciliation processes alone.

The fourth layer is exception management, which captures, tracks, and resolves discrepancies identified through validation and reconciliation processes. This layer establishes structured workflows for issue resolution, ensuring accountability, traceability, and proper documentation of corrective actions.

The final layer is pre-submission certification, where data is reviewed, approved, and formally attested as accurate and complete prior to regulatory submission. This layer integrates validation and reconciliation outputs into a unified control evidence framework that supports audit readiness and supervisory review.

Collectively, these layers form an integrated and scalable control architecture that shifts regulatory reporting from fragmented, reactive validation processes to a proactive and continuous pre-submission assurance framework. This layered model aligns with supervisory expectations for strong internal controls, data governance, and audit-defensible reporting, as illustrated in Figure 1 [1], [3].

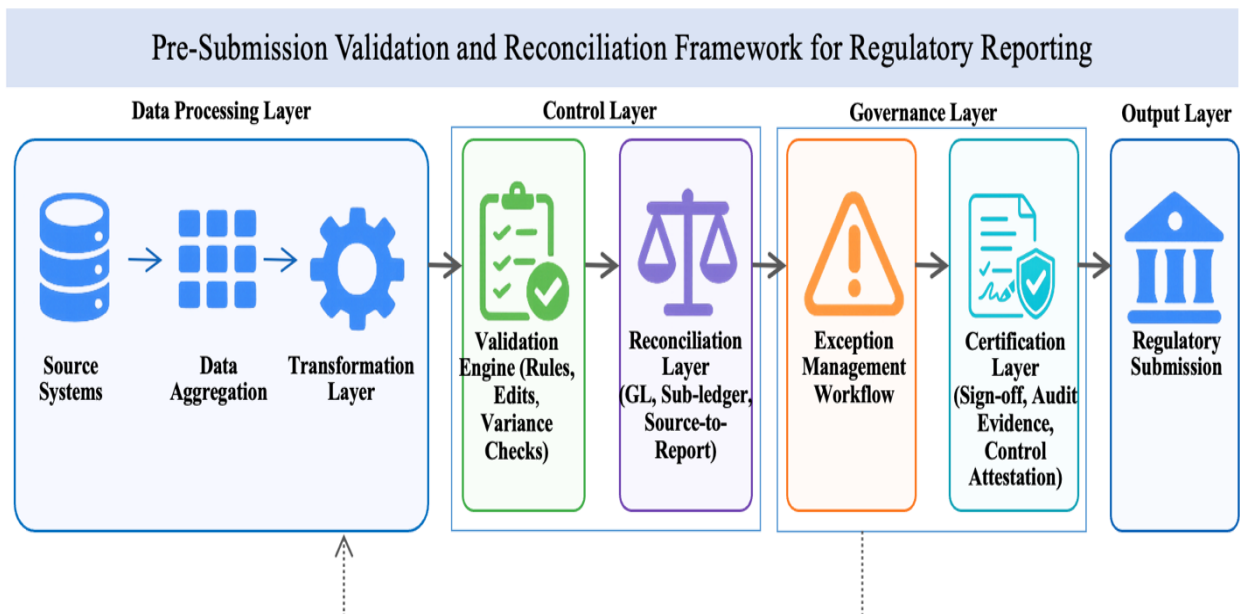


Figure 1: Pre-Submission Validation and Reconciliation Framework for Regulatory Reporting

This figure illustrates a layered control architecture integrating data processing, validation, reconciliation, exception management, and certification within a unified pre-submission assurance framework. The separation between control and governance layers highlights distinct responsibilities for data validation and

oversight, while the dotted feedback loop represents continuous control improvement by linking exception outcomes back to upstream data processing and transformation layers.

5. Cross-System Reconciliation Models

Reconciliation is a critical component of pre-submission assurance. Within the proposed framework, reconciliation is designed as an integrated control function that addresses multiple dimensions of data consistency across the reporting lifecycle.

One key model is general ledger to reporting reconciliation, which ensures that reported figures align with underlying financial records. This control is essential for maintaining consistency between financial statements and regulatory reports and serves as a primary validation point for financial accuracy.

Another model is source-to-report reconciliation, which traces data from source systems through transformation layers to final reporting outputs. This model provides end-to-end visibility into data flows and enables the identification of discrepancies introduced during data extraction, transformation, or aggregation processes.

A third model is intra-report reconciliation, which ensures consistency within reporting outputs. For example, totals and subtotals within a report must align, and related schedules should reconcile with each other to ensure internal coherence of reported data.

When implemented as part of an integrated control architecture, these reconciliation models enable institutions to detect inconsistencies across both data and transformation layers, reducing reliance on manual reconciliation processes and improving the timeliness and accuracy of issue resolution. This approach aligns with regulatory expectations for data integrity, traceability, and controlled reporting processes [1], [7].

6. Exception Management and Workflow Integration

Exception management is a critical component of the validation and reconciliation framework. Within the proposed architecture, discrepancies identified during validation or reconciliation are captured, tracked, and resolved through structured, platform-integrated workflows that form part of the overall control framework.

An effective exception management process includes categorization of issues, assignment of ownership, tracking of resolution status, and documentation of corrective actions. These elements establish clear accountability and ensure that all discrepancies are addressed in a consistent, traceable, and auditable manner. Workflow integration is essential for operational efficiency and control effectiveness. By embedding exception management processes within reporting platforms, institutions can enable real-time visibility into issues, streamline resolution workflows, and reduce reliance on external tools or manual tracking mechanisms. This integration also ensures that exception handling is directly linked to validation and reconciliation outputs, creating a cohesive control environment.

As part of an integrated governance layer, exception management plays a central role in maintaining data integrity and control completeness. It enables institutions to systematically manage discrepancies, generate audit-defensible evidence, and demonstrate effective issue resolution processes in alignment with supervisory expectations for strong governance and control frameworks [3], [10].

7. Pre-Submission Certification and Control Evidence

Pre-submission certification represents the final control layer within the validation and reconciliation framework. It involves the formal review, approval, and attestation of data prior to regulatory submission, ensuring that all validation and reconciliation checks have been completed within a controlled environment. Certification processes should be supported by comprehensive control evidence generated directly by the reporting platform. This includes validation results, reconciliation outputs, exception logs, and approval records, all of which collectively provide a transparent and traceable record of the reporting process.

The ability to generate audit-defensible evidence is critical for supervisory review. Institutions must be able to demonstrate that data has been validated, reconciled, and resolved through structured workflows, with all control activities properly documented and attributable within the framework [1], [2].

By embedding certification within the reporting platform, institutions can integrate validation, reconciliation, and exception management outputs into a unified evidence framework. This enables consistent control attestation, strengthens audit readiness, and ensures that regulatory submissions are supported by transparent, traceable, and defensible control processes.

8. Operational Benefits and Risk Reduction

Implementing an integrated validation and reconciliation framework provides measurable operational and control benefits within regulatory reporting environments. By embedding validation, reconciliation, and exception management within the reporting lifecycle, institutions can identify and resolve discrepancies earlier in the process, significantly improving data quality and reducing downstream corrections.

The framework enhances operational efficiency by reducing reliance on manual reconciliation processes and streamlining issue resolution workflows through platform-integrated controls. This leads to more consistent and timely reporting outcomes, particularly in complex environments with multiple data sources and transformation layers.

From a risk perspective, the framework reduces regulatory exposure by ensuring that data is validated, reconciled, and certified prior to submission. This proactive control approach minimizes the likelihood of reporting errors, reduces the need for post-submission adjustments, and strengthens overall reporting reliability.

In addition, the framework improves audit readiness by generating structured, traceable, and audit-defensible control evidence. This enables institutions to demonstrate control effectiveness during supervisory reviews, enhances transparency across the reporting process, and strengthens confidence in the integrity of regulatory submissions, aligning with evolving regulatory expectations for governance and control effectiveness [1], [2], [15].

9. Implementation Considerations and Challenges

Designing and implementing in-house validation and reconciliation frameworks requires careful consideration of architectural, operational, and governance factors. Successful implementation depends on the ability to integrate these frameworks with existing reporting systems while maintaining scalability and alignment with evolving regulatory requirements.

One key challenge is data complexity. Regulatory reporting environments involve large volumes of data sourced from multiple upstream systems, often with varying data structures, quality levels, and transformation dependencies. Integrating validation and reconciliation controls across these heterogeneous data flows requires robust data models and consistent metadata management.

Another challenge is governance. Effective implementation requires clearly defined ownership across data, rules, and controls, as well as coordination between technology, finance, risk, and reporting teams. Without strong governance structures, even well-designed frameworks may fail to deliver consistent control outcomes. Technology also plays a critical role. Reporting platforms must support automation, traceability, and real-time monitoring of validation, reconciliation, and exception management processes. This includes the ability to generate control evidence, maintain audit trails, and support scalable processing across reporting cycles.

Despite these challenges, implementing integrated frameworks provides significant long-term benefits. By embedding validation and reconciliation within the reporting architecture, institutions can establish sustainable control environments that improve data integrity, enhance transparency, and support audit-defensible regulatory reporting in line with supervisory expectations [1], [3].

10. Strategic Implications for Regulatory Reporting Programs

As regulatory expectations continue to evolve, validation and reconciliation frameworks must be treated as strategic infrastructure rather than operational add-ons. Institutions are increasingly required to demonstrate not only the accuracy of their reporting outputs, but also the robustness of the control frameworks that support them.

Integrated frameworks enable scalability by allowing institutions to manage growing data volumes and reporting complexity without compromising control effectiveness. They also support agility by providing structured mechanisms to incorporate regulatory changes, system enhancements, and remediation activities within a controlled environment.

Most importantly, these frameworks shift regulatory reporting programs from reactive issue resolution to proactive and continuous risk management. By embedding validation, reconciliation, and governance processes within the reporting lifecycle, institutions can identify and address discrepancies earlier, reducing operational risk and improving reporting reliability.

From a strategic perspective, such frameworks enhance institutional resilience by reducing reliance on manual processes and undocumented knowledge. They enable consistent control execution, strengthen supervisory confidence, and position regulatory reporting platforms as scalable, transparent, and audit-defensible systems aligned with long-term regulatory expectations [1], [6].

11. Conclusion

Validation and reconciliation are fundamental components of regulatory reporting, yet they are often implemented in fragmented and reactive ways. This paper demonstrates the importance of designing integrated in-house frameworks that provide a unified pre-submission control layer embedded within regulatory reporting platforms.

By integrating validation, reconciliation, exception management, and certification into a cohesive architecture, institutions can improve data quality, reduce regulatory risk, and enhance supervisory confidence in reported outputs. This approach enables a shift from isolated control activities to a structured and continuous control environment that supports transparency, traceability, and audit-defensible reporting processes.

The transition from fragmented controls to integrated frameworks represents a fundamental evolution in regulatory reporting design. As supervisory expectations continue to advance, such frameworks will be essential in enabling scalable, transparent, and resilient reporting systems capable of supporting sustainable and defensible regulatory compliance.

REFERENCES:

- [1] Basel Committee on Banking Supervision. (2013). *Principles for Effective Risk Data Aggregation and Risk Reporting (BCBS 239)*.
<https://www.bis.org/publ/bcbs239.pdf>
- [2] Basel Committee on Banking Supervision. (2018). *Progress in Adopting the Principles for Effective Risk Data Aggregation and Risk Reporting*.
<https://www.bis.org/bcbs/publ/d443.pdf>
- [3] Bank for International Settlements. (2020). *Principles for Operational Resilience*.
<https://www.bis.org/bcbs/publ/d516.pdf>
- [4] Board of Governors of the Federal Reserve System. (2011). *Supervisory Guidance on Model Risk Management (SR 11-7)*.
<https://www.federalreserve.gov/supervisionreg/srletters/sr1107.htm>

- [5] Board of Governors of the Federal Reserve System. (2024). *Comprehensive Capital Analysis and Review (CCAR) Instructions*.
<https://www.federalreserve.gov/publications/ccar.htm>
- [6] Board of Governors of the Federal Reserve System. (2015). *Federal Reserve Supervisory Assessment of Capital Planning (SR 15-18)*.
<https://www.federalreserve.gov/supervisionreg/srletters/sr1518.htm>
- [7] European Central Bank. (2017). *Guide on Effective Risk Data Aggregation and Risk Reporting*.
https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.risk_data_aggregation.en.pdf
- [8] Financial Stability Board. (2020). *Effective Practices for Cyber Incident Response and Recovery*.
<https://www.fsb.org/wp-content/uploads/P191020-1.pdf>
- [9] International Monetary Fund. (2019). *Financial Soundness Indicators Compilation Guide*.
<https://www.imf.org/en/Publications/Manuals-Guides/Issues/2019/11/04/Financial-Soundness-Indicators-Compilation-Guide-2019-46214>
- [10] Office of the Comptroller of the Currency. (2011). *Supervisory Guidance on Model Risk Management (OCC 2011-12)*.
<https://www.occ.treas.gov/news-issuances/bulletins/2011/bulletin-2011-12.html>
- [11] Committee on Payments and Market Infrastructures. (2012). *Principles for Financial Market Infrastructures*.
<https://www.bis.org/cpmi/publ/d101a.pdf>
- [12] International Organization of Securities Commissions. (2015). *Standards for Data Reporting and Aggregation in Financial Markets*.
<https://www.iosco.org/library/pubdocs/pdf/IOSCOPD507.pdf>
- [13] Financial Conduct Authority. (2018). *Transforming Data Collection from the UK Financial Sector*.
<https://www.fca.org.uk/publication/discussion/dp18-09.pdf>
- [14] McKinsey & Company. (2017). *BCBS 239: Making It Work for Banks*.
<https://www.mckinsey.com/industries/financial-services/our-insights/bcbs-239-making-it-work-for-banks>
- [15] Deloitte. (2019). *Data Lineage and Regulatory Reporting: Building Transparency and Trust*.
<https://www2.deloitte.com/global/en/pages/risk/articles/data-lineage-regulatory-reporting.html>