Accelerating Financial Close Cycles in Multinational Enterprises: A Digital Optimization Model Using Power BI and SQL Automation

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Abstract- ***Multinational enterprises (MNEs) face increasing pressure to reduce their financial close cycles without compromising data accuracy, compliance, or audit readiness. This paper proposes a digital optimization model that integrates Microsoft Power BI with SQL-based process automation to accelerate the financial close process. The model addresses major inefficiencies in traditional workflows by enabling real-time reporting, automated reconciliations, and seamless data integration across multiple subsidiaries and ERPs. Leveraging insights from both internal implementation and comparative industry benchmarking, the study demonstrates how automation improves timeliness, reduces manual interventions, and enhances governance. Using a multi-phase methodological approach, the model was tested across a sample of five MNEs operating in diverse regulatory environments. Results revealed a 35% average reduction in close cycle time and notable improvements in data transparency. The findings have significant implications for digital finance transformation in large-scale enterprises seeking agility, control, and compliance in an increasingly complex regulatory landscape.***

Index Terms-Power BI, SQL Automation, Financial Close, Digital Optimization, Multinational Enterprises, Compliance

I. INTRODUCTION

The financial close cycle, often referred to as the "closing of the books," is a critical process in enterprise financial management. For multinational enterprises (MNEs), the complexity of this process is amplified by the need to consolidate financial data across multiple business units, currencies, time zones, tax jurisdictions, and regulatory frameworks. Traditionally, the financial close has been a labor-intensive and time-consuming process, often taking weeks to finalize. This delay can hinder timely decision-making, reduce operational agility, and expose organizations to compliance risks [1], [2]. In recent years, the growing demand for faster and more accurate financial reporting has compelled organizations to explore digital solutions that enhance the speed and accuracy of the close cycle [3], [4].

Power BI, a business intelligence (BI) and analytics tool developed by Microsoft, has emerged as a key enabler in transforming financial operations. When coupled with Structured Query Language (SQL) automation, Power BI becomes a powerful instrument for real-time data visualization, integration, and performance tracking [5]. The combination offers a solution to the data silos and manual inefficiencies that plague traditional financial close workflows [6]. SQL enables automated data extraction, transformation, and loading (ETL), while Power BI provides intuitive dashboards for monitoring close performance, identifying bottlenecks, and ensuring data consistency across business entities.

The financial close process encompasses several core activities, including journal entry preparation,

account reconciliations, intercompany eliminations, and financial consolidation. In MNEs, these activities are complicated by disparate accounting systems, complex ownership structures, and compliance requirements such as Sarbanes-Oxley (SOX), International Financial Reporting Standards (IFRS), and Generally Accepted Accounting Principles (GAAP) [7]. Manual processes not only prolong the cycle but also increase the risk of errors, necessitating rework and delaying audit readiness. As such, automation and digitalization are increasingly viewed as strategic imperatives for financial governance [8], [9].

Digital optimization models utilizing Power BI and SQL automation aim to address these challenges by introducing a scalable, integrated, and responsive solution. These models automate repetitive tasks such as data aggregation, validation checks, and exception handling, thereby freeing finance teams to focus on high-value tasks such as variance analysis, forecasting, and risk mitigation [10]. Furthermore, real-time access to consolidated financial data empowers CFOs and financial controllers to make data-driven decisions faster and with greater confidence [11], [12].

Several industry reports have underscored the importance of closing the books faster. According to a benchmarking survey by the Hackett Group, world-class finance organizations close their books in an average of 5.2 days, compared to 10 days for their peers [13]. The report links this performance advantage to automation, standardization, and BI adoption. These findings align with research from Gartner, which predicts that by 2025, 75% of large enterprises will adopt automation technologies in their finance departments, aiming to reduce the time spent on transactional tasks by over 30% [14], [15].

The COVID-19 pandemic further accelerated the push for digital transformation in finance. As remote work became the norm, enterprises quickly realized the limitations of manual close processes that relied on on-premises systems, spreadsheets, and emails. Many organizations were forced to expedite their adoption of cloud-based platforms, data analytics tools, and robotic process automation (RPA) to maintain business continuity [16]. In this context, Power BI and SQL-based optimization models gained significant traction as low-code solutions that could be quickly deployed without massive infrastructure investments [16], [17].

Despite the evident benefits, the adoption of digital optimization in financial close cycles is not without challenges. Organizations often grapple with data quality issues, legacy system integration, skills gaps, and change resistance from finance personnel [18]. Moreover, the implementation of new digital tools necessitates a governance framework to ensure data integrity, role-based access, and compliance with audit requirements [19]. Therefore, a successful transformation requires not only technology adoption but also process reengineering, stakeholder alignment, and continuous performance monitoring [20].

This study aims to address these concerns by proposing a comprehensive digital optimization model that combines Power BI dashboards with SQL automation scripts tailored for financial close activities. The model was piloted in five multinational enterprises operating in sectors such as energy, pharmaceuticals, manufacturing, logistics, and telecommunications. Each organization provided a unique set of operational and regulatory constraints, thereby offering a diverse test environment for evaluating the effectiveness of the model [21].

The objectives of this study are threefold. First, to identify the key pain points in existing financial close processes in MNEs. Second, to design and implement a Power BI-SQL-based optimization model that automates and visualizes key financial close tasks. Third, to evaluate the model's impact on close cycle duration, data accuracy, and stakeholder satisfaction through a combination of quantitative metrics and qualitative feedback [22], [23].

The contributions of this paper are both theoretical and practical. On a theoretical level, it extends the existing literature on financial process automation by introducing a modular optimization model adaptable to various enterprise resource planning (ERP) environments, including SAP, Oracle, and Microsoft Dynamics. Practically, the paper provides a step-by-step framework for MNEs seeking to adopt digital

tools to enhance the efficiency and accuracy of their financial reporting cycles [24].

The need to accelerate financial close cycles is no longer optional in today's fast-paced and compliance-driven business environment. MNEs that fail to modernize risk falling behind on both operational and regulatory fronts. By leveraging existing digital tools such as Power BI and SQL, organizations can achieve faster, smarter, and more reliable financial closes, thereby enhancing their agility, governance, and stakeholder trust [25], [26].

II. LITERATURE REVIEW

The literature on accelerating financial close processes in multinational enterprises (MNEs) spans across several intersecting domains: digital finance transformation, business process automation, enterprise resource planning (ERP), financial reporting compliance, and the strategic role of analytics tools such as Power BI and SQL. This section synthesizes findings from these streams to contextualize the need for optimizing financial close cycles and identifies the current research gap addressed in this paper.

2.1 Financial Close Process in Multinational Enterprises

The financial close process involves recording, reconciling, consolidating, and reporting financial results for a specific period, usually monthly, quarterly, or annually. In MNEs, this process becomes increasingly complex due to variations in accounting standards, multiple subsidiaries, currencies, and localized compliance requirements [27], [28]. Historically, the close process has been dominated by manual reconciliations, spreadsheet-based consolidations, and fragmented data sources, contributing to extended close cycles and increased risk of error [29].

Several studies highlight that longer financial close cycles correlate with inefficiencies in data collection, manual entry, lack of standardization, and communication delays across departments. For instance, PwC's Global Finance Benchmarking Report found that organizations with a high degree of automation in their finance functions report up to 50% shorter close times than their peers relying on manual processes [30].

Furthermore, the inefficiencies in the financial close have strategic consequences, delaying performance evaluation and hindering informed decision-making [31].

2.2 Drivers of Digital Transformation in Financial Operations

Digital transformation in finance is not a recent phenomenon, but its acceleration in the post-pandemic era has garnered increased academic attention. Automation, cloud computing, and business intelligence tools are now seen as integral to modern finance functions [32]. Key drivers of this transformation include pressure for faster reporting, increased data complexity, and evolving regulatory requirements such as the Sarbanes-Oxley Act (SOX) and International Financial Reporting Standards (IFRS) [33].

Literature has consistently emphasized the role of finance leaders in driving digital innovation. For example, a study by Deloitte revealed that CFOs who lead digital transformation initiatives are more likely to achieve significant improvements in data quality, close time, and audit readiness [34]. The integration of technologies like robotic process automation (RPA), artificial intelligence (AI), and advanced analytics has been shown to reduce transaction time and improve the accuracy of financial reporting [35].

2.3 Power BI as a Business Intelligence Enabler in Finance

Power BI has emerged as a widely adopted business intelligence tool for financial analytics and dashboarding. Its ability to connect with multiple data sources, perform advanced data modeling, and create interactive visualizations makes it a valuable asset for the finance function [36]. Researchers have noted that Power BI enables real-time tracking of key performance indicators (KPIs), allowing financial controllers and CFOs to detect anomalies and bottlenecks promptly [37].

Moreover, Power BI's self-service capability empowers business users to generate insights without relying heavily on IT departments [38]. This democratization of analytics is particularly relevant in financial close processes, where decision-makers require timely visibility into journal entries, reconciliations, and consolidations [39]. However, studies also note that while Power BI is a powerful visualization tool, its effectiveness is dependent on the quality and integration of underlying data [40], [41].

2.4 SQL-Based Automation for Data Integration and ETL

Structured Query Language (SQL) remains a foundational technology for data manipulation and integration. In financial operations, SQL is commonly used for automated extraction, transformation, and loading (ETL) of data from disparate ERP systems [42]. SQL scripting enables finance teams to automate recurring tasks such as trial balance extraction, variance calculations, and intercompany transaction reconciliations [43].

Academic studies have highlighted SQL automation as a practical alternative to more complex RPA platforms, especially for structured data environments. A comparative study by Rizzi and Govoni found that SQL-based ETL pipelines achieved comparable performance and scalability as commercial ETL tools, with the added advantage of customization and transparency [44]. SQL's compatibility with Power BI further enhances its relevance in integrated financial reporting frameworks [45].

2.5 Financial Process Automation and Continuous Close

The concept of a continuous close a model where financial transactions are processed, reconciled, and validated in real time has gained traction in both academic and professional circles [46]. This approach requires robust automation infrastructure and real-time reporting capabilities, both of which can be supported by SQL and Power BI [47], [48], [49].
Research by Gartner suggests that organizations pursuing continuous close models report higher data accuracy, lower audit costs, and improved regulatory compliance. Nonetheless, implementing a continuous close model requires reengineering existing workflows, overcoming change resistance, and ensuring data governance. These preconditions highlight the importance of integrated digital frameworks that align with business needs and IT capabilities.

2.6 ERP Integration Challenges and Opportunities

Multinational corporations typically operate multiple ERP systems across different regions and business units. This heterogeneity creates significant challenges for data consolidation during the financial close [50]. Studies by McKinsey and others have noted that integration gaps between ERP systems and analytics platforms lead to reporting delays and inconsistencies [51].

Several researchers argue for modular integration approaches where lightweight analytics tools like Power BI and SQL serve as bridges between fragmented ERP systems. Such configurations reduce dependence on high-cost ERP customizations while enhancing reporting agility. However, scholars also caution that poor data modeling and lack of metadata standardization can undermine the effectiveness of such integrations [52].

2.7 Change Management and Capability Building

The literature is replete with evidence that technological interventions alone cannot yield sustainable improvements in financial processes. Change management and capability development are equally critical [53]. Employees must be trained to interpret dashboards, write SQL queries, and understand the implications of automated reconciliations. Moreover, financial leaders must foster a culture of data literacy and process ownership to ensure accountability and innovation.
Some authors advocate for hybrid finance teams composed of accountants, data analysts, and system developers to bridge the skills gap and enable digital transformation [54]. Empirical evidence from transformation case studies suggests that successful initiatives typically include ongoing performance

monitoring, feedback loops, and role redefinition [55].

2.8 Research Gap and Contribution

While there is growing academic and industry recognition of the value of Power BI and SQL in financial operations, little empirical research has explored their combined application in accelerating the financial close cycle in MNEs. Most studies focus on isolated benefits either Power BI for visualization or SQL for ETL but not their integrated deployment as part of a digital optimization model.

This paper addresses this gap by developing, implementing, and evaluating a unified framework that leverages both Power BI and SQL automation in real-world MNE settings. It also contributes to the literature by offering a cross-industry perspective, with findings applicable to organizations operating under varied regulatory and operational conditions. This integrated approach offers a scalable and cost-effective alternative to expensive ERP add-ons and third-party automation tools.

III. METHODOLOGY

This study adopts a multi-phase methodological approach combining qualitative insights with quantitative data to design, implement, and evaluate a digital optimization model for accelerating financial close cycles in multinational enterprises (MNEs). The methodology is structured into five core phases: (i) process mapping and diagnostics, (ii) model design, (iii) automation development using SQL, (iv) dashboard development using Power BI, and (v) pilot implementation and evaluation. Each phase was executed collaboratively with five participating MNEs operating in sectors including energy, telecommunications,manufacturing, pharmaceuticals, and logistics.

3.1 Research Design and Approach

This study follows a design science research (DSR) methodology, which is well suited for developing and evaluating IT artifacts intended to solve organizational problems. The DSR framework involves building an artifact in this case, a digital optimization model and rigorously testing it in a real-world environment to ensure utility, validity, and replicability [56]. The research also integrates principles from action research, where researchers collaborate closely with practitioners to co-create solutions in an iterative manner [57].

By embedding the research within actual finance operations of MNEs, the study ensures contextual relevance and enhances the practical applicability of its findings. Data were collected over a 12-month period (January to December 2020) and analyzed using a combination of process mining, performance benchmarking, and user feedback.

3.2 Case Study Selection Criteria

Five multinational enterprises were purposively selected based on the following criteria: (1) geographical and operational diversity, (2) existing use of ERP systems, (3) documented challenges with financial close cycles, (4) openness to digital transformation, and (5) availability of internal finance and IT resources for implementation support [58]. Each participating firm maintained at least four operational subsidiaries across different continents and was required to close its books monthly and quarterly under both local and international accounting standards.

This purposive sampling approach allowed for maximum variation in close process maturity, regulatory exposure, and system architecture, thereby ensuring the generalizability of the model's applicability across industries [59].

3.3 Phase I: Process Mapping and Diagnostic Assessment

The first phase involved in-depth mapping of the existing financial close workflows within each MNE. Structured interviews were conducted with CFOs, financial controllers, ERP administrators, and process owners to identify current close activities, dependencies, systems in use, and pain points. Additional data were collected from internal reports, audit logs, and standard operating procedures (SOPs). A process mining tool was applied to log data from ERP systems to visualize process flows and identify

bottlenecks such as journal entry backlog, delayed reconciliations, and intercompany mismatches [60]. Across all cases, common challenges included reliance on Excel spreadsheets, lack of real-time visibility, insufficient data validation, and excessive manual effort.

3.4 Phase II: Model Design

Based on diagnostic insights, a digital optimization model was designed comprising three interconnected modules: (1) SQL-based automation for data extraction and validation, (2) Power BI dashboards for visualization and monitoring, and (3) role-based workflows for exception handling and approvals.

The model aligns with the financial close lifecycle, from ledger entry and account reconciliation to consolidation and reporting. It includes predefined templates for journal entry validation, trial balance extraction, and intercompany reconciliation logic. These templates were configured to align with IFRS, GAAP, and SOX reporting standards applicable to each enterprise.

A data governance framework was embedded in the model to ensure data quality, version control, and audit traceability. Metadata structures were standardized across subsidiaries to allow for effective cross-entity data aggregation and drill-down reporting.

3.5 Phase III: SQL Automation Development

Custom SQL scripts were developed to automate repetitive tasks typically performed during the close cycle. These scripts were written to connect directly to each MNE's data warehouse, extract general ledger data, reconcile trial balances, flag anomalies, and populate staging tables for Power BI integration [61].

Tasks automated via SQL included:

- Aggregation of general ledger entries by subsidiary, cost center, and account group
- Detection of out-of-balance accounts and inconsistent journal entries
- Generation of reconciliation reports for intercompany accounts
- Mapping of local chart of accounts to global standards

To ensure scalability and maintainability, SQL scripts were modularized and parameterized to accommodate schema differences across ERP systems (SAP, Oracle, and Microsoft Dynamics). Security protocols were enforced via role-based access and encryption of sensitive financial data in transit and at rest.

3.6 Phase IV: Power BI Dashboard Development

Power BI dashboards were designed to provide real-time insights into close progress, reconciliation status, exception reports, and performance KPIs such as "Days to Close," "Reconciliation Aging," and "Journal Entry Volume by Entity" [62].

Dashboard development followed an iterative design approach involving regular feedback sessions with end users. Wireframes were developed and validated to ensure alignment with user roles and decision-making requirements. Visual components included:

- Traffic-light indicators for reconciliation status
- Trend charts for close duration
- Interactive maps showing regional entity compliance
- Drill-down tables linking exception reports to journal entries

Data from SQL staging tables were ingested using Power BI's DirectQuery functionality to maintain near-real-time synchronization. Data refreshes were scheduled in alignment with close calendar milestones, allowing finance teams to track progress daily.

3.7 Phase V: Pilot Implementation and Training

The model was piloted over three financial cycles in each MNE covering monthly, quarterly, and annual close periods. Implementation support included virtual workshops, training sessions, and documentation for SQL scripts and dashboard usage.

A feedback loop was established using surveys and interviews to capture user experience, adoption challenges, and improvement suggestions.

Finance teams were trained to interpret dashboard insights, adjust automation parameters, and troubleshoot common issues. Adoption was tracked using usage logs and system-generated audit trails. Where necessary, adjustments were made to the data model, SQL logic, and visualization elements.

3.8 Evaluation Metrics

The effectiveness of the digital optimization model was evaluated using four quantitative metrics:

- Close Cycle Duration: Measured in business days from period-end to final reporting
- Manual Effort: Time spent on reconciliation and report generation
- Error Rate: Number of post-close adjustments required

User Satisfaction: Based on a Likert-scale survey across roles (CFOs, controllers, analysts)
Baseline values were established before implementation, and improvement percentages were calculated post-pilot [63]. Results were triangulated with qualitative feedback to ensure comprehensive evaluation.

3.9 Limitations and Ethical Considerations

The study acknowledges limitations such as sample size, variations in ERP maturity, and the short duration of the pilot. Furthermore, some improvements may not be fully attributable to the model alone, given concurrent initiatives in finance transformation across the participating MNEs.

All data were anonymized, and participation was voluntary. Informed consent was obtained from all interviewees. The study adhered to organizational privacy policies and followed ethical research guidelines for data handling and system access [64].

IV. RESULTS

This section presents the empirical findings from the pilot implementation of the digital optimization model across the five selected multinational enterprises (MNEs). The results are structured around the four core evaluation metrics: (1) financial close cycle duration, (2) manual effort reduction, (3) error rate in financial reports, and (4) user satisfaction. The data was collected over three reporting periods monthly, quarterly, and annual closes for each MNE during the 2020 fiscal year. These results demonstrate the tangible impact of integrating SQL-based automation and Power BI dashboards into financial close operations.

4.1 Financial Close Cycle Duration

A key objective of the optimization model was to reduce the duration of the financial close cycle. Table 1 shows a comparison of average close cycle durations (in business days) before and after implementation.

Table 1: Comparison of average close cycle durations (in business days) before and after implementation

MNE	Pre-Implementation Avg. Close Days	Post-Implementation Avg. Close Days	% Reduction
A	12.1	7.9	34.7%
B	10.5	6.4	39.0%
C	13.8	8.3	39.9%
D	9.7	6.2	36.1%
E	11.4	7.5	34.2%

The overall average reduction in close cycle duration was 36.8%, with the most substantial improvement observed in MNE C, which had previously relied heavily on manual consolidation in spreadsheets [65]. The model's automated data extraction and real-time monitoring tools enabled faster journal posting, reconciliation, and approvals. This allowed finance teams to initiate review and analysis concurrently with data capture, significantly compressing timelines [66], [67].

4.2 Manual Effort Reduction

Manual effort was evaluated based on time spent on non-value-added activities such as spreadsheet consolidation, journal validation, and exception tracking. Pre-implementation, finance teams reported spending an average of 28 to 35 hours per cycle on manual reconciliations alone.

Following deployment, automated SQL scripts generated reconciliation reports and validation summaries within minutes, and Power BI visualizations streamlined review processes.

Figure 1 illustrates the average reduction in manual effort per financial cycle.

MNE	Pre-Implementation Hours	Post-Implementation Hours	% Reduction
A	32.4	18.2	43.8%
B	28.7	15.5	45.9%
C	35.2	19.3	45.2%
D	30.1	16.7	44.5%
E	29.5	17.1	42.0%

The reduction in manual work averaged 44.3% across the organizations. Feedback from finance teams cited improved morale, fewer after-hours work requirements, and the ability to focus on analytical and review tasks rather than mechanical data entry [68].

4.3 Error Rate in Financial Reports

Error rates were defined as the number of adjustments or restatements made after initial report submission. Common sources of error included duplicate journal entries, intercompany mismatches, and incorrect account mapping.

Pre-implementation error rates ranged between 4.5% and 7.2% per reporting cycle. Post-implementation, the average error rate dropped to between 1.6% and 2.9%. The detailed breakdown is shown below:

MNE	Pre-Error Rate (%)	Post-Error Rate (%)	% Improvement
A	6.8	2.7	60.3%
B	5.5	2.2	60.0%
C	7.2	2.9	59.7%
D	4.9	1.9	61.2%
E	5.1	1.6	68.6%

These results demonstrate a 61.9% average reduction in reporting errors, attributed to automated controls built into SQL scripts (e.g., data integrity checks, intercompany balance validation) and real-time dashboard alerts flagging anomalies during the cycle [69], [67], [70].

4.4 User Satisfaction and Adoption

A post-implementation survey was administered to 65 users across the five MNEs, including CFOs, finance controllers, analysts, and IT staff. The survey used a 5-point Likert scale to assess satisfaction with system usability, perceived value, training effectiveness, and likelihood of continued use.

Metric	Average Rating (Out of 5)
Ease of Use	4.6
Perceived Impact on Efficiency	4.7
Data Visibility and Transparency	4.8
Training and Support Satisfaction	4.4
Overall Satisfaction	4.7

Respondents highlighted the ability to monitor progress in real-time, receive automated error alerts, and complete reconciliations earlier in the close window as key benefits. Over 92% indicated a strong likelihood of recommending the model to other business units.

Qualitative comments also emphasized the model's adaptability. One finance controller noted, "With the Power BI dashboards, we finally have one version of the truth across all our business entities without chasing files in email threads or spreadsheets." Another added, "The SQL automation saved us days

in journal matching we didn't realize how much duplication was happening until we saw it flagged live." [71]

4.5 Variations by ERP and Region

The model performed consistently across various ERP environments, including SAP ECC, Oracle E-Business Suite, and Microsoft Dynamics NAV. Some variation was observed based on ERP maturity and data model standardization.

MNEs with highly customized ERP configurations required additional mapping and testing to ensure SQL script compatibility [72], [73]. Similarly, subsidiaries in regions with differing accounting calendars or localized statutory requirements (e.g., LATAM, APAC) presented challenges for dashboard harmonization [74]. However, the modular structure of the model allowed for tailored adjustments without disrupting overall architecture.

4.6 Performance Dashboard Snapshots

To visualize results, snapshots from Power BI dashboards were anonymized and analyzed. Key insights included:

- "Days to Close" trend lines decreased consistently over the three cycles.
- Exception reports dropped by over 50% from the first to the third month.
- Reconciliation dashboards showed earlier and more even workload distribution across close days.

These indicators demonstrated how real-time transparency improved process planning and enabled earlier identification of blockers, shifting work upstream rather than compressing efforts near deadline [75], [76].

4.7 Cost Savings and ROI Estimates

While a detailed financial ROI analysis was beyond this paper's scope, preliminary estimates from participating MNEs suggest substantial labor and compliance cost reductions. For example, MNE A reported saving approximately 180 person-hours per month, equivalent to two FTEs redirected to strategic finance projects [77]. MNE D estimated a 40% decrease in audit preparation hours and associated consulting fees due to increased data traceability and standardization [77], [78].

These savings align with industry findings that process automation in finance can yield 25–40% cost efficiencies within the first year of implementation [79].

4.8 Summary of Findings

Metric	Average Improvement Across MNEs
Close Cycle Duration	36.8%
Manual Effort	44.3%
Error Rate in Reports	61.9%
User Satisfaction (Avg. Score)	4.7/5

These outcomes validate the hypothesis that a combined Power BI and SQL automation model can significantly improve the efficiency, accuracy, and transparency of financial close cycles in large, complex enterprise environments [80].

V. DISCUSSION

The results of this study reveal that implementing a digital optimization model using Power BI and SQL automation can significantly enhance the efficiency, accuracy, and transparency of financial close cycles in multinational enterprises (MNEs). This section interprets the findings in relation to the existing literature, addresses practical implications for finance professionals, outlines implementation challenges, and discusses scalability considerations. It concludes by reflecting on the theoretical contributions and managerial relevance of the study.

5.1 Interpretation of Key Findings

The reduction of average close cycle time by 36.8% across participating MNEs reinforces the argument that financial process automation is essential to enterprise agility and regulatory readiness [81], [82]. This finding is consistent with prior studies asserting that automation of routine tasks such as journal validations and reconciliations can compress

timelines by enabling parallel processing and exception-based reviews.

SQL automation enabled the extraction, transformation, and validation of data with a speed and precision that manual methods could not match. These results align with research by Rizzi et al., who highlighted SQL's advantage in structured financial data environments [83], [84]. Moreover, Power BI's real-time dashboarding capabilities provided end-users with unprecedented visibility into the close cycle, allowing for earlier issue identification and resolution.

The observed 61.9% reduction in error rates further validates the model's effectiveness. Automated data integrity checks in SQL scripts and real-time anomaly alerts in Power BI dashboards helped preempt misstatements that would otherwise have required rework. This supports literature suggesting that embedded controls in automation systems reduce the risk of human error and audit findings [84].

The 44.3% reduction in manual effort and the high user satisfaction (average rating of 4.7/5) indicate that digital tools not only improve outcomes but also positively impact user experience and morale. These outcomes reflect a growing trend in finance transformation where the focus shifts from labor reduction to value creation through analytics and decision support.

5.2 Practical Implications for Finance Leaders

For CFOs and finance leaders, these results offer actionable insights. First, adopting a hybrid technology stack comprising SQL and Power BI offers a low-cost, scalable alternative to high-end financial close management platforms. This is particularly advantageous for MNEs with fragmented ERP landscapes and limited IT budgets.

Second, the integration of automation and visualization creates a foundation for a “continuous close” model where financial activities are performed and validated in near-real time, rather than in compressed end-of-period windows. This allows for proactive rather than reactive financial management [84].

Third, the model enhances audit readiness. Audit trails generated from SQL processes and traceable dashboards improve the ability to provide evidence and justification for journal entries, adjustments, and consolidations. This can result in faster audits, fewer compliance penalties, and improved stakeholder trust [85], [86].

Fourth, the model supports a more strategic role for the finance function. With less time spent on data preparation, finance professionals can focus on scenario modeling, variance analysis, and business partnering activities that drive value rather than simply ensure compliance [87].

5.3 Implementation Challenges and Mitigation Strategies

Despite the compelling benefits, implementation was not without challenges. One major obstacle was the diversity and maturity level of ERP systems across subsidiaries. While SQL offered high customizability, differences in data models required additional time for mapping and validation.
Moreover, initial resistance from finance personnel accustomed to spreadsheet workflows posed a barrier. Change management literature consistently notes that user buy-in is critical to technology adoption. This was mitigated by involving users early in dashboard design, providing scenario-based training, and highlighting quick wins to build momentum [88].

Data quality issues also emerged as a constraint. Inconsistent metadata, incomplete journal entries, and unresolved intercompany discrepancies required data cleansing before automation could be fully effective. This reinforces prior findings that automation amplifies existing data issues unless governance structures are simultaneously improved [89].

To address these risks, the project embedded a data governance framework including role-based access, standard data definitions, and audit logs. These practices helped ensure accuracy and accountability across entities [90].

5.4 Adaptability and Scalability of the Model

A key strength of the optimization model is its modularity. The SQL components are written using parameterized queries and stored procedures, allowing them to be reused across entities with minimal rework. Likewise, the Power BI dashboards are structured with dynamic filters and drill-down capabilities that accommodate multiple entities, currencies, and accounting standards.

Scalability is further enhanced by the model's ability to interface with various ERP systems, including SAP, Oracle, and Microsoft Dynamics. This ERP-agnostic architecture ensures that MNEs can adopt the model incrementally, starting with high-impact areas and expanding over time.

For firms with advanced IT infrastructures, components of the model can be integrated into enterprise data warehouses or cloud platforms (e.g., Azure SQL, Power BI Service), enabling automated alerts, mobile access, and advanced analytics features [91].

5.5 Theoretical Contributions

From a theoretical standpoint, this study contributes to the literature on financial information systems by demonstrating how SQL and Power BI when combined in a cohesive framework can yield synergistic benefits that exceed their standalone functionalities.

It also supports the notion that digital transformation in finance requires a blend of technology, process reengineering, and human-centered design. Unlike traditional top-down implementations, the collaborative, iterative development of dashboards and automation logic ensured greater relevance and user adoption.

Finally, this paper advances the discourse on continuous close by offering an operational blueprint grounded in empirical data, rather than theoretical postulation. The proposed model serves as a stepwise pathway for MNEs to transition from periodic to real-time financial reporting [92].

5.6 Limitations and Areas for Further Research

While the study demonstrates clear benefits, several limitations must be acknowledged. The pilot was conducted in five MNEs, which may limit generalizability. Future research could expand the sample to include public sector entities or small and mid-sized enterprises (SMEs), where financial constraints and legacy systems may pose different challenges [93].

Moreover, the evaluation window was limited to one fiscal year. Long-term studies could assess how the benefits evolve over multiple reporting cycles, including during mergers, acquisitions, or regulatory shifts. Researchers may also explore integration with other tools such as RPA, AI-based anomaly detection, or blockchain for audit trails.

Finally, while this study focused on financial close, similar methodologies could be applied to adjacent processes such as forecasting, budgeting, and internal audit, expanding the impact of digital optimization across the finance value chain.

CONCLUSION

The complexity of financial close operations in multinational enterprises (MNEs) has intensified in recent years, driven by regulatory scrutiny, data decentralization, and the increasing demand for timely financial reporting. This study presented a digital optimization model leveraging Power BI and SQL automation to address the bottlenecks typically encountered in such environments. The proposed solution demonstrates clear empirical benefits in accelerating close cycles, improving data consistency, enhancing audit readiness, and increasing overall financial governance across complex global operations.

The empirical results, drawn from a multi-enterprise case study, revealed substantial reductions in manual effort, a measurable increase in data integrity, and a significant enhancement in time-to-close performance. Specifically, the financial close duration was reduced by up to 35% across the participating enterprises, with a parallel increase in reporting accuracy and real-time visibility. These

outcomes are in line with industry expectations around digital transformation in finance and reinforce existing calls for investment in intelligent automation tools to optimize financial operations [94].

The integration of Power BI and SQL Server allowed for centralized data aggregation, which is often a major obstacle in cross-border finance teams. By automating data extraction, reconciliation, and validation tasks, the model not only streamlined recurring operations but also reduced the dependency on spreadsheet-based processes that often carry high risks of error and version inconsistency [95]. The dashboard functionality in Power BI further contributed to intuitive visualization, which significantly improved stakeholder engagement and expedited managerial decision-making processes.

Another significant conclusion from the study relates to compliance and auditability. Regulatory frameworks such as SOX and IFRS require not only accurate but also traceable and well-documented financial records. The implementation of SQL-based logging and error tracking mechanisms facilitated audit-readiness by ensuring process transparency and robust change control. Enterprises in heavily regulated industries, such as energy and finance, particularly benefited from these enhanced capabilities.

Moreover, the proposed optimization model proved adaptable across diverse ERP environments, including SAP, Oracle Financials, and Microsoft Dynamics. This adaptability is critical for MNEs operating with heterogeneous financial systems across subsidiaries and jurisdictions. The model's interoperability with structured data sources, and its scalability across multi-tenant cloud environments, addresses a common technological limitation in traditional automation tools [96].

From a talent and resource management standpoint, the model allowed finance personnel to redirect their focus from routine manual reconciliation to higher-value strategic analysis. This shift aligns with broader digital finance transformation trends advocating for a redefinition of roles within the finance function. Employees surveyed during the pilot implementation expressed greater job satisfaction, citing decreased workloads and improved process clarity, which are significant for long-term digital adoption success [97].

Nevertheless, while the benefits are clear, the study identified several limitations and risks associated with the deployment of such automation models. These include initial setup costs, the need for skilled personnel in SQL and Power BI administration, and data governance complexities during system transitions. Additionally, cultural resistance to change and legacy system dependencies emerged as notable barriers in certain subsidiaries. Addressing these issues requires a well-crafted change management strategy, executive sponsorship, and cross-functional training programs [98].

In response to these limitations, the study recommends the following:

1. Phased Implementation: Enterprises should adopt a modular rollout strategy starting with low-risk financial processes to build early momentum and stakeholder confidence [99].
2. Centralized Governance: A dedicated center of excellence (CoE) for finance automation should oversee model governance, version control, and documentation, ensuring consistent deployment standards across regions [100].
3. Ongoing Training and Support: Investment in upskilling programs for finance teams to understand both the technical and analytical aspects of Power BI and SQL will be crucial for sustainability [101].
4. Continuous Monitoring and Feedback: Establishing feedback loops with users and integrating performance analytics into the optimization model can help iteratively refine and scale the solution [102].

In conclusion, this study affirms that digital optimization through tools like Power BI and SQL can revolutionize financial close operations in MNEs. By driving automation, real-time analytics, and cross-system harmonization, the proposed model not only accelerates closing timelines but also strengthens compliance, transparency, and strategic decision-making. Future research should explore how this model can integrate machine learning algorithms to proactively detect anomalies, optimize forecasting,

and predict close-cycle delays. Furthermore, sector-specific adaptations and cost-benefit analyses over longer time horizons would contribute additional granularity to the business case for digital close-cycle acceleration.

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