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Data-Lineage Transparency in Automated Financial Reporting

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Abstract

The automation of financial reporting has shortened reporting cycles and reduced dependence on manual data preparation, yet it has simultaneously increased the difficulty of understanding how individual financial values move through interconnected information systems. Enterprise resource planning applications, robotic process automation, extraction-transformation-loading routines, consolidation engines, cloud platforms, analytical models, and digital reporting technologies may transform financial data repeatedly before the information reaches a published statement or management report. When these transformations are insufficiently documented, auditors and financial controllers may verify the final output without being able to reconstruct its complete origin and processing history.

This study develops a data-lineage transparency framework for automated financial reporting that connects reported values with their originating records, transformation rules, system interfaces, approval events, reconciliation controls, and final disclosures. Because authenticated organizational reporting data were not supplied, the analytical component is explicitly designed as a simulation-based methodological evaluation. A synthetic environment comprising 1,000 reporting data elements is used to examine four reporting maturity conditions ranging from spreadsheet-led processing to end-to-end lineage management.

A Lineage Transparency Index is proposed to measure source traceability, transformation visibility, ownership attribution, control evidence, and report-level mapping. Simulated analysis indicates that traceability completeness increases from 53% in fragmented spreadsheet-led reporting to 95% under an integrated lineage framework. The findings suggest that reporting automation alone should not be interpreted as reporting transparency. Transparency depends on whether organizations can reconstruct how data were created, transformed, approved, reconciled, and ultimately represented.

Keywords: data lineage, automated financial reporting, financial transparency, accounting information systems, audit trail, data provenance, digital assurance, XBRL

1. Introduction

Financial reporting is increasingly produced through interconnected digital systems rather than through a single accounting ledger followed by a largely manual reporting process. Transaction data may originate in enterprise resource planning systems, customer platforms, procurement applications, payroll systems, banking interfaces, asset-management applications, and subsidiary ledgers before being consolidated into general-ledger balances and financial statements. Automation can improve speed, consistency, scalability, and processing efficiency, but it also creates longer technological chains between the original business event and the value ultimately disclosed. Robotic process automation, automated journal entries, scheduled data pipelines, consolidation software, and machine-readable reporting formats can substantially reduce manual intervention while simultaneously making the underlying transformation process less visible to users who see only the final output. Harrast emphasized that automation in accounting creates governance, risk, access, and control considerations that must accompany efficiency benefits.

This development creates an important distinction between data availability and data transparency. A financial reporting platform may provide immediate access to thousands of accounting values while offering limited evidence regarding where those values originated, which transformations were applied, whether manual adjustments occurred, and who authorized those changes. The problem becomes particularly significant when the same reported figure is derived from multiple systems. Revenue, inventory, expected credit losses, tax balances, foreign-currency translations, and consolidated intercompany amounts can involve multiple stages of extraction, aggregation, adjustment, and classification. If the transformation history is incomplete, an auditor may identify an incorrect financial statement value but require considerable additional effort to determine where the error entered the reporting chain.

The importance of this issue is reinforced by earlier research on structured financial reporting. Debreceny, Farewell, Piechocki, Felden, and Gräning found material computational errors in early XBRL filings and demonstrated that machine-readable financial reporting does not automatically guarantee accurate reporting data. Their findings underline the importance of validation mechanisms that connect published data with the relationships and rules underlying their preparation. Pei and Vasarhelyi similarly emphasized the importance of standardized, machine-readable financial information and proposed an architecture in which multiple types of business data could be tagged, organized, analyzed, and assured through an integrated reporting environment.

A parallel development in audit research concerns the reconstruction of financial processes from digital records. Werner demonstrated that journal-entry data and accounting relationships can be used to reconstruct business-process control flows, while subsequent work by Werner, Wiese, and Maas showed that process mining can be embedded into financial-statement auditing and can strengthen the robustness of audit evidence in highly automated transaction environments. These developments are closely related to data lineage because both require auditors to understand not merely the final accounting value but the sequence of events, systems, and transformations that produced it.

The present study therefore examines data-lineage transparency in automated financial reporting. It argues that effective automated reporting requires a traceable connection between source transactions, transformation logic, system interfaces, control activities, accounting adjustments, reporting classifications, and final disclosures. The paper develops a multidimensional Lineage Transparency Index and evaluates it within a controlled synthetic reporting environment. Since no authenticated company data have been provided, all quantitative values are explicitly simulated and should not be interpreted as evidence from a real organization. The study contributes a methodological framework through which organizations can evaluate whether reporting automation is accompanied by sufficient transparency, reproducibility, accountability, and auditability.

2. Objectives of the Study

2.1 To Develop a Financial Data-Lineage Transparency Framework

The first objective is to establish a structured framework capable of tracing financial information from its original source through successive processing stages to the final report. The proposed framework considers source identification, transformation documentation, control evidence, ownership information, adjustment history, and report mapping as complementary dimensions of transparency.

This objective recognizes that complete financial lineage requires more than knowing which database supplied a final figure. Meaningful lineage should explain the business source from which the data originated, the transformations performed, the sequence of applications through which the information moved, and the relationship between intermediate calculations and the final reporting output.

2.2 To Measure Reporting Traceability Across Different Automation Conditions

The second objective is to examine how the visibility of financial-reporting data changes across different technological maturity conditions. Spreadsheet-led processing, logged data pipelines, centralized metadata repositories, and end-to-end lineage architectures provide different degrees of reconstructability even when each environment ultimately produces the same financial statement.

A quantitative Lineage Transparency Index is therefore proposed to represent multiple aspects of traceability. The intention is not to define a universal regulatory metric but to provide an adaptable analytical mechanism through which organizations can assess weaknesses in their own reporting information chains.

2.3 To Examine the Audit and Governance Value of Transparent Data Lineage

The third objective is to evaluate how transparent data lineage can strengthen automated reporting governance. Auditors require reliable evidence showing how financial information moves through systems, while management requires mechanisms for identifying errors, unauthorized changes, unresolved reconciliations, and inappropriate transformations.

The proposed model therefore evaluates data lineage as both an information-quality mechanism and an internal-control mechanism. Its value is expected to arise from improving error investigation, facilitating report reproduction, supporting audit procedures, documenting responsibility, and reducing dependence on informal organizational knowledge.

3. Review of Literature

3.1 Automation, Accounting Information Systems, and Financial Reporting Control

Accounting automation has changed the relationship between accounting professionals and transactional information. Automated processing reduces repetitive manual activities but transfers greater responsibility to information-system configurations, scripts, interfaces, rules, and programmed workflows. Harrast observed that robotic process automation can improve accounting efficiency while simultaneously requiring controls over bot authorization, system access, development, testing, and deployment. These concerns are directly related to data lineage because automated processing can alter financial information without generating the kind of visible manual documentation traditionally available in paper-based or spreadsheet-oriented environments.

Li, Dai, Gershberg, and Vasarhelyi examined organizational use of audit analytics and found that technological competence, management support, standards, and professional assistance influence the effective application of analytical technologies. Their results also indicate that more extensive audit-analytics use can improve internal-audit performance. The implications extend beyond analytics itself. Sophisticated reporting environments require organizational mechanisms that make automated processing understandable to accounting and assurance professionals rather than concentrating critical knowledge exclusively among system developers.

The movement toward continuous or near-real-time financial information strengthens this requirement. Traditional audit trails become more difficult to preserve when transactions are processed continuously across integrated systems. Earlier research on continuous auditing consequently emphasized the need to preserve information integrity and maintain orderly digital evidence concerning the movement of financial data. Data-lineage transparency can be viewed as an extension of this requirement into contemporary automated reporting architectures.

3.2 Structured Reporting, Data Quality, and Machine-Readable Transparency

XBRL and related structured-reporting technologies demonstrate that machine readability can substantially improve the accessibility and processing of financial information. However, standardized tagging does not eliminate errors arising from inappropriate mappings, calculations, extensions, or transformations. Debreceny and colleagues identified computational inconsistencies in early mandated XBRL filings, illustrating that digital reporting quality depends on the correctness of the data relationships embedded within the reporting process.

Research has also shown that structured reporting introduces trade-offs relating to consistency and comparability. Studies of mandatory XBRL implementation found that firm-specific taxonomy extensions and reporting choices can affect comparability even where reporting is formally standardized. These findings imply that users require more than a standardized final output. They require insight into how reported values were mapped, classified, aggregated, and transformed.

Pei and Vasarhelyi proposed a broader reporting model in which internal and external business information can be standardized and organized through XBRL-related technologies, enabling more detailed and potentially real-time reporting and assurance. Such architectures strengthen the theoretical basis for lineage-aware reporting because machine-readable information is most useful when individual values remain connected to their underlying resources, classifications, transformations, and assurance evidence.

3.3 Data Provenance, Process Reconstruction, and Auditability

The concept of data provenance concerns the ability to reconstruct where information originated and how it changed. Although accounting literature has not always employed the term “data lineage,” related research on blockchain, process mining, continuous auditing, and accounting-information architecture addresses many of the same underlying issues.

Dai and Vasarhelyi examined how blockchain could support a more verifiable accounting and assurance environment by preserving shared and validated transaction information within an architecture intended to strengthen transparency and continuous verification. McCallig, Robb, and Rohde subsequently developed a financial-reporting system design combining cryptographic mechanisms, network analysis, and blockchain storage to strengthen representational faithfulness and provide auditors with additional evidence concerning underlying financial information.

Process-mining research provides an equally relevant perspective. Werner demonstrated that accounting structures can be used to reconstruct control flows from journal-entry data, enabling auditors to understand how transactions move through complex automated systems. Werner, Wiese, and Maas further demonstrated that process mining can be incorporated into financial-statement audits and can improve the robustness of evidence in digital environments. Collectively, this literature suggests that contemporary assurance depends increasingly on the capacity to reconstruct the informational journey that links business events with final financial representations.

4. Research Methodology

4.1 Research Design and Synthetic Reporting Environment

The study adopts a simulation-based methodological design. No confidential enterprise resource planning records, financial statements, audit working papers, reporting-system logs, or organizational lineage repositories were supplied. Consequently, the paper does not present results from a completed corporate implementation.

A synthetic financial-reporting environment containing 1,000 reporting data elements is constructed for methodological evaluation. Each element represents a value capable of contributing to a management report, financial statement line item, reconciliation, note disclosure, or supporting schedule. The synthetic elements are distributed across source systems and passed through different transformation and consolidation stages.

Four reporting-maturity conditions are evaluated:

1. spreadsheet-led reporting;
2. automated extraction and transformation with technical logs;
3. centralized reporting metadata management; and
4. end-to-end lineage-enabled automated reporting.

The objective is to determine how readily a reporting item can be reconstructed under each condition.

Table 1: Dimensions Used to Evaluate Financial Data-Lineage Transparency

Lineage Dimension	Illustrative Evidence	Transparency Question	Control Relevance
Source traceability	Source system, table, account, transaction identifier	Can the reported value be traced to its original record?	Supports existence and accuracy testing
Transformation	Calculation, mapping,	Can every material	Identifies

visibility	aggregation, conversion rule	modification be reconstructed?	processing errors
Ownership attribution	System owner, preparer, approver	Is responsibility for each processing stage identifiable?	Supports accountability
Control linkage	Reconciliation, validation, approval evidence	Is the data connected with the control that validated it?	Strengthens control assurance
Report mapping	Financial statement, note, management report destination	Can the source-to-report relationship be reproduced?	Supports completeness and classification
Change history	Version, override, manual adjustment, timestamp	Can subsequent changes be identified?	Detects unauthorized or unexplained changes

The model does not assume that all source records should be universally accessible. Financial information can contain confidential employee, customer, supplier, tax, and commercially sensitive information. Data-lineage transparency therefore refers to controlled reconstructability for authorized users rather than unrestricted data disclosure.

4.2 Construction of the Lineage Transparency Index

A Lineage Transparency Index (LTI) is developed to summarize the degree to which a reporting item **can be reconstructed. Five principal dimensions are used:**

- source traceability;
- transformation visibility;
- ownership attribution;
- control evidence;
- final-report mapping.

The framework is intentionally adaptable. A regulated financial institution could assign greater weight to control evidence, while a highly decentralized enterprise might emphasize source identification and ownership.

4.3 Simulation Procedure and Evaluation Criteria

Each of the 1,000 synthetic reporting items is assigned a source record, one or more transformation events, an approval status, a control reference, and a final reporting destination. Selected records are then modified to simulate common lineage weaknesses, including undocumented transformations, orphaned spreadsheet adjustments, unidentified data owners, missing reconciliation references, overwritten mapping rules, and incomplete source identifiers.

The four reporting maturity conditions are evaluated according to five practical criteria: traceability completeness, transformation-rule visibility, reproducibility, unresolved lineage exceptions, and average investigation effort. The purpose is not to demonstrate that one specific technology universally produces a particular result. Rather, the controlled simulation illustrates the expected directional effect of progressively stronger lineage architecture.

Simulation outputs are interpreted as methodological demonstrations only. External validation would require authenticated organizational information, independent control testing, actual auditor observations, and longitudinal evidence concerning reporting errors and investigation outcomes.

5. Analysis

5.1 Transparency Across Reporting Maturity Levels

The simulation demonstrates a clear distinction between automated processing and transparent processing. Spreadsheet-led reporting provides the weakest lineage visibility because financial values may be copied, adjusted, linked, or overwritten without consistently recording the relationship between the original transaction and final report.

The introduction of logged extraction-transformation-loading workflows improves transparency because system events and processing steps become available for reconstruction. Nevertheless, technical logging does not necessarily explain accounting meaning. A technical log may identify that a field was transformed without explaining why the transformation was required, which financial-reporting policy justified it, or who approved the corresponding reporting rule.

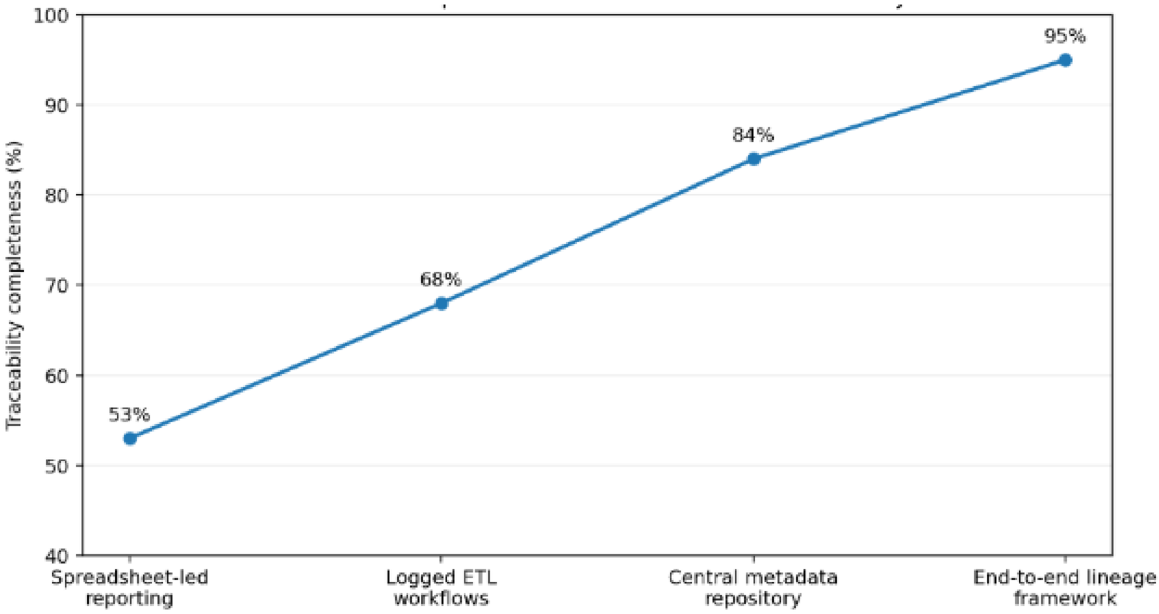
Table 2: Simulated Assessment of Reporting-Lineage Maturity

Reporting Condition	Traceability Completeness	Transformation Visibility	Control-Evidence Coverage	Simulated LTI
Spreadsheet-led reporting	53%	46%	42%	0.48
Logged automated workflows	68%	72%	61%	0.67
Central metadata repository	84%	85%	79%	0.82
End-to-end lineage framework	95%	94%	92%	0.94

The results suggest that lineage maturity increases when organizations move beyond recording technical processing events and begin to connect those events with accounting meaning, control documentation, responsible personnel, and report destinations.

5.2 Traceability Completeness in Automated Reporting

Graph 1: Simulated Improvement in Financial Data Traceability



The line graph demonstrates a progressive simulated increase in source-to-report traceability. Spreadsheet-led processing achieves 53% traceability completeness because many relationships depend on manual knowledge and locally maintained files. Logged workflows increase the measure to 68%, while centralized metadata management reaches 84%.

The simulated end-to-end lineage environment reaches 95%. The remaining 5% represents cases in which external-source limitations, legacy interfaces, manual judgment adjustments, or incomplete third-party metadata prevent complete automated reconstruction.

5.3 Lineage Exceptions and Financial Reporting Risk

The simulation further indicates that missing lineage information should itself be treated as a reporting-control exception. A financial value can be numerically correct while still presenting governance risk if its derivation cannot be reconstructed. In such circumstances, the organization becomes dependent on institutional memory or individual employees who understand undocumented transformations.

Three types of lineage exception emerged as particularly important in the synthetic environment. The first involved transformation opacity, in which the source data were identifiable but intermediate calculations were undocumented. The second involved ownership opacity, where the transformation was visible but no responsible preparer or approver could be reliably identified. The third involved report-mapping opacity, where source and intermediate data were documented but the relationship with the final disclosure depended on a manually maintained reporting workbook.

Such exceptions do not automatically imply a financial misstatement. They indicate weaknesses in reconstructability. The auditing significance of this distinction is important because transparent lineage supports investigation of errors without assuming that every documentation deficiency represents misconduct.

6. Discussion

6.1 Automation Efficiency Does Not Automatically Produce Transparency

A central implication of the study is that automated financial reporting and transparent financial reporting are related but conceptually distinct. Organizations can substantially automate transaction processing and financial consolidation while retaining fragmented evidence concerning the origin and transformation of reported information.

This distinction is consistent with Harrast's observation that RPA introduces important governance and control requirements alongside process efficiencies. It is also consistent with the evidence of Debreceny and colleagues, whose examination of structured financial reporting demonstrated that machine-readable reporting can contain computational errors when relationships are incorrectly implemented. Automation changes the location of financial-reporting risk rather than eliminating it.

Under manual reporting, errors may arise from data entry, spreadsheet formulas, or human aggregation. Under automated reporting, equivalent risks may arise from configuration rules, interfaces, scripts, taxonomy mappings, transformation logic, or automated journal mechanisms. The control response must therefore evolve from checking only the final output toward verifying the informational pathway that produced the output.

6.2 Data Lineage as Digital Audit Evidence

The second implication concerns external and internal auditing. An auditor traditionally evaluates evidence supporting financial-statement assertions. In increasingly automated environments, part of that evidence concerns the reliability of the processing architecture through which financial data have passed. Werner's financial process-mining research demonstrates that accounting data can be used to reconstruct control flows from journal entries, while the later work of Werner, Wiese, and Maas demonstrates that process mining can be integrated into financial-statement audit procedures. Data lineage extends this principle by connecting the reconstructed process with specific financial-reporting outputs.

For example, an auditor examining reported revenue should ideally be able to move backward from the financial statement to the consolidation entry, from the consolidation entry to subsidiary balances, from those balances to ledger accounts, and from the ledger to underlying transactional sources. Material adjustments, classification changes, currency translations, eliminations, and mapping rules should remain visible throughout the chain.

This does not mean that every auditor must manually inspect every data transformation. Automated lineage enables risk-based audit procedures by allowing exceptions to be identified where links are missing, rules changed unexpectedly, or transformations lack appropriate control evidence.

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6.3 Governance, Accountability, and Explainable Financial Reporting

The third implication is that lineage transparency strengthens accountability. When reporting values can be traced through systems but responsibility cannot be identified, transparency remains incomplete. Financial information is produced through interactions among accountants, controllers, system administrators, data engineers, financial analysts, and automated processes. Governance therefore requires both technical and organizational lineage.

Research by Li and colleagues indicates that technological competence, standards, management support, and organizational conditions influence effective audit-analytics usage. A comparable principle applies to lineage management. Technology can capture metadata, but accounting professionals must define which transformations are material, what supporting documentation is required, how exceptions are reviewed, and which individuals are responsible for maintaining reporting mappings.

Emerging accounting architectures based on cryptographically verifiable records further illustrate the importance of provenance and accountability. Dai and Vasarhelyi proposed a blockchain-enabled accounting ecosystem designed to strengthen verification and transparency, while McCallig, Robb, and Rohde demonstrated how secure information-sharing mechanisms and blockchain storage could strengthen representational faithfulness. However, immutable records alone cannot guarantee appropriate accounting classification or accurate financial interpretation. A permanently recorded incorrect transformation remains incorrect. Consequently, lineage governance must combine technical integrity with accounting judgment, authorization, and control validation.

7. Conclusion

Automated financial reporting is becoming increasingly dependent on complex interactions among accounting systems, data pipelines, robotic processes, consolidation platforms, analytical engines, and digital reporting technologies. These developments can improve reporting timeliness and operational efficiency, but they can also weaken transparency when financial information moves through technological processes that users cannot easily reconstruct. The present study therefore conceptualizes data-lineage transparency as the capacity to identify the origin, transformation history, ownership, control evidence, and reporting destination of a financial data element.

The proposed Lineage Transparency Index provides a structured method for assessing this capacity. The simulation demonstrates that fragmented spreadsheet-oriented processes provide substantially lower traceability than architectures that integrate technical metadata, accounting definitions, control evidence, approval information, and report mappings. The simulated increase from 53% traceability under spreadsheet-led reporting to 95% under an end-to-end lineage architecture illustrates the methodological proposition that transparency improves when each stage of financial data processing remains connected with the stages preceding and following it. These numerical values are synthetic and should not be interpreted as universal performance benchmarks.

The study also demonstrates that data lineage has implications beyond information technology. Transparent lineage supports financial controllers investigating unexplained balances, internal auditors evaluating control operation, external auditors reconstructing accounting evidence, and management determining responsibility for reporting transformations. A lineage exception may therefore represent an important governance signal even where the associated financial value has not yet been shown to be incorrect. Organizations seeking reliable automated reporting should treat missing transformations, undocumented manual adjustments, unidentified owners, unsupported mappings, and absent control links as matters requiring structured remediation.

The principal limitation of this study is its simulation-based design. No real reporting organization, confidential financial dataset, or independently validated audit outcome was analyzed. Future research should therefore apply the proposed index to authenticated financial-reporting environments and examine whether greater lineage transparency is associated with shorter reconciliation periods, fewer reporting errors, faster audit investigations, improved control effectiveness, reduced restatement risk, or more efficient financial-statement audits. Cross-industry research may also determine how lineage requirements differ among financial institutions, manufacturers, digital businesses, public-sector entities, and multinational corporate groups. Data-lineage transparency should ultimately be understood not as an additional technical documentation exercise but as a fundamental element of accountable and reproducible automated financial reporting.

References

1. Troshani, I., Rowbottom, N., & Stacchezzini, R. (2021). Digital corporate reporting: Research developments and implications. *Australian Accounting Review*, *31*(3), 213–232. https://doi.org/10.1111/auar.12334
2. Troshani, I., & Doolin, B. (2007). Innovation diffusion: A stakeholder and social network view of XBRL adoption. *Journal of Information Systems, 21*(2), 67–88.
3. Alles, M., & Piechocki, M. (2012). Will XBRL improve corporate governance? A framework for enhancing governance transparency through XBRL. *International Journal of Accounting Information Systems*, *13*(2), 91–108.
4. Hodge, F. D., Kennedy, J. J., & Maines, L. A. (2004). Does search-facilitating technology improve the transparency of financial reporting? *The Accounting Review*, *79*(3), 687–703.
5. Yoon, H., Zo, H., & Ciganek, A. P. (2011). Does XBRL adoption reduce information asymmetry? *Journal of Business Research*, *64*(2), 157–163.
6. Liu, C., Luo, X. R., & Wang, F. L. (2017). An empirical investigation of the impact of XBRL adoption on information asymmetry. *Journal of Business Ethics*, *145*, 445–466.
7. Bai, Z., Sakaue, M., & Takeda, F. (2014). The impact of XBRL adoption on the information environment: Evidence from Japan. *Journal of Accounting and Public Policy*, *33*(2), 181–198.
8. Kim, J. W., Lim, J. H., & No, W. G. (2012). The effect of first-time XBRL reporting across the financial information environment. *Journal of Information Systems*, *26*(1), 169–196.
9. Efendi, J., Park, J. D., & Subramaniam, C. (2016). Does the XBRL reporting format provide higher information quality? Evidence from the U.S. SEC mandate. *Journal of Business Finance & Accounting*, *43*(1–2), 50–75.
10. Blankespoor, E., Miller, B. P., & White, H. D. (2014). The role of dissemination in market liquidity: Evidence from firms' use of XBRL. *The Accounting Review*, *89*(1), 79–111.

11. Debreceny, R., Farewell, S., Piechocki, M., Felden, C., Gräning, A., & d'Eri, A. (2011). Flexibility and efficiency in XBRL reporting. *International Journal of Accounting Information Systems, 12*(3), 215–236.
12. Debreceny, R., Chandra, A., Cheh, J. J., Guithues-Amrhein, D., Hannon, N. J., Hutchison, P. D., Janvrin, D., Jones, R., Lamberton, B., Lymer, A., Mascha, M., & Nehmer, R. (2005). Financial reporting in XBRL on the SEC's EDGAR system. *International Journal of Digital Accounting Research, 5*(9), 1–26.
13. Pinsker, R., & Wheeler, P. (2009). Nonprofessional investors' perceptions of the efficiency and effectiveness of XBRL-enabled financial statement information. *Journal of Information Systems, 23*(2), 79–96.
14. Cordery, C. J., Fowler, C. J., & Mustafa, K. (2011). A solution looking for a problem: Factors associated with the non-adoption of XBRL. *Pacific Accounting Review, 23*(1), 55–71.
15. Steenkamp, L. P., & Nel, G. F. (2012). The adoption of XBRL in South Africa: Lessons from abroad. *Meditari Accountancy Research, 20*(2), 129–147.
16. Kaya, D., & Pronobis, P. (2016). The benefits of structured data: XBRL adoption and the effect on information environment. *Journal of Business Finance & Accounting, 43*(3–4), 229–259.
17. Debreceny, R., & Gray, G. L. (2010). Data mining journal entries for fraud detection: An exploratory study. *Journal of Information Systems, 24*(1), 37–60.
18. Alles, M. G. (2015). Drivers of the use and facilitators and obstacles of the evolution of big data by the audit profession. *Accounting Horizons, 29*(2), 439–449.
19. Sledgianowski, D., Gomaa, M., & Tan, C. (2017). Toward integration of big data, technology and analytics into the audit process. *Journal of Accounting and Finance, 17*(2), 23–34.