

**DATA ASSEMBLING AND RECONCILIATION IN FINANCIAL AUDITS:
AUTOMATION TECHNIQUES FOR LARGE DATASETS**

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Abstract

The development of complex datasets in audits has radically changed the way auditing is done today, increasing the necessity for more advanced automation approaches to improve efficiency and precision when reconciling data successfully. As firms acquire a variety of information from many sources, traditional manual reconciliation processes are becoming less effective, resulting in lengthy procedures and an increased risk of errors. This article examines the role of automation tools, such as Audit Command Language (ACL) and other languages such as RPA, AI/ML & Python made simplifying the reconciliation process in audits by automating tasks such as importing and cleaning up data well as analyzing and presenting findings efficiently for auditors to spot errors and irregularities, In order to increase financial reporting accuracy and effectively with rules, financial information must be entered quickly and precisely and the problems associated with handling datasets, such as those concerning data integrity and consistency, merging of various information sources. The study effectively presents a plan for carrying out automated reconciliation procedures, emphasizing top-tier ways for efficiently deploying ACL with other tools and the goal is to encourage auditors to use automation approaches that not only streamline their procedures but also increase the effectiveness of financial audits, the influence of automation on auditing by presenting essential insights that might assist professionals in handling the complexities of contemporary data scenarios and assuring reliable audit conclusions.

Keywords: Auditing, reconciliation processes, Audit Command Language (ACL), automating, accuracy, effectively, datasets

I. INTRODUCTION

Decision-making thus relies on big data growth, which in turn has presented huge challenges to financial audits that rely on the reliability and accuracy of financial data. Besides, traditional processes for data collection and reconciliation have resulted in inefficiency and further increased the risk for financial reporting errors through preconceived notions and unstructured analytics. Data assembling is about collecting and structuring financial information from various sources, such as transaction systems, ERP platforms, and external databases. Hence, creating an integrated dataset is able to be developed. This step is quite crucial in that, without complete or organized data, errors in findings and interpretation may easily happen in audit procedures. The work following the assembling and reconciliation of data involves formal checking and validation of data against set performance indicators or other datasets to find differences, inconsistencies, or mistakes. Automation has emerged as one of those critical tools that assist in the successful management

of such processes despite their complexities and scope. Now an automation tool with audit command language-ACL-provides features that are critical in assisting the speeding up and resulting in a higher quality of data reconciliation operations. Using ACL, an auditor is able to

automate data importation, cleanse, and analyze it, hence saving a lot of time as compared to manual processes. Auditors can therefore use ACL to dig deeply into a big snapshot of data and rapid-spot errors that could point either to mistakes or fraud. Automation systems do not only accelerate reconciliation but also greatly increase the accuracy of financial audits. In the hands of this auditor who can promptly analyze vast amounts of data, these systems even provide deeper insight into financial scenarios. Basically, automation systems speed up the process of reconciliation and enhance the quality and credibility of financial audits.

Advanced automation techniques are often used for data gathering and reconciliation in financial audits, particularly for managing huge and complicated datasets. Some of the advanced automation techniques such as [1], [5], [6], [9].

1. Robotic process automation (RPA):

RPA automates routine processes including data extraction, entry, and comparison. Bots can be trained to follow specific audit standards and reconcile data from many systems.

- **Use Case:** Comparing transaction records from different departments to find discrepancies.

2. Data Analysis Platforms: These platforms provide data blending, purification, and statistical analysis, hence streamlining data assembling and reconciliation. They can detect irregularities using statistical analysis and pattern recognition.

- **Use Case:** Visualizing transaction data patterns and detecting suspicious activity.

3. Artificial Intelligence and Machine Learning (AI/ML): AI/ML models learn from historical data to predict and flag anomalies, improving accuracy in identifying potential errors or fraud in financial records.

- **Use Case:** Spotting unusual transaction patterns that deviate from normal trends.

4. Block chain for Reconciliation and Audit Trails: Block chain provides a tamper-resistant, verifiable ledger that records each transaction, making reconciliation easier by ensuring transparency.

- **Use Case:** Cross-border transaction reconciliation or real-time verification of interdepartmental transactions.

5. Python/R Programming: Custom scripts using Python or R enable highly customizable data reconciliation and matching based on unique audit criteria, suited for complex datasets.

- **Use Case:** Writing scripts to automate reconciliation based on specific rules, such as matching fields in datasets from different sources.

These techniques complement traditional tools like ACL, enhancing efficiency, accuracy, and the scalability of financial data reconciliation processes.

II. LITERATURE REVIEW

K. Palanivel's (2019) "Machine Learning Architecture to Financial Service Organizations" investigates the application of machine learning (ML) technologies in the financial sector. The literature focuses on how ML may improve financial services by enhancing decision-making processes, automating mundane operations, and optimizing resource allocation. Palanivel presents several machine learning methods, including both supervised and unsupervised training that are

useful for risk assessment, fraud detection, and consumer segmentation. The study underlines the importance of big data analytics in improving the accuracy and efficiency of such models. Data privacy, security, and regulatory compliance issues are also addressed. Overall, the paper gives insights into how financial businesses might employ machine learning architectures to achieve a competitive edge while guaranteeing compliance with industry standards.

P. Pokharel (2019) "Time Series Based Pattern Recognition for Anomaly Detection from System Audit Logs" focuses on the use of time series analysis to find anomalies in system logs. The authors emphasize the growing relevance of anomaly detection in cyber security, stating that prompt discovery of unusual patterns helps avoid security breaches. The project investigates strategies for distinguishing between regular system behavior and suspect activities in audit logs using pattern recognition. The paper also examines time series models, which use temporal dependencies in data to improve detection accuracy. The challenges of system log complexity, false positives, and computing efficiency are considered. According to the research, time series-based algorithms have tremendous potential for enhancing anomaly identification in system audit logs, hence maintaining the security and dependability of IT infrastructure.

Chanyuan (Abigail) Zhang(2019) Investigates the implications of intelligent automation technology on the auditing profession. The study focuses on how automation, specifically AI and machine learning, may expedite audit processes by increasing efficiency, minimizing human error, and improving accuracy. Zhang explores how RPA (robot process automation) and cognitive technologies can be used to undertake mundane audit duties like data entry and analysis, freeing up auditors' time for higher-value operations. The research emphasizes the increasing use of intelligent systems to detect inconsistencies and irregularities in financial data more successfully than traditional methods. Zhang also addresses issues about data privacy, ethical implications, and the changing role of auditors in a more automated world. The paper gives a thorough assessment of how intelligent automation is revolutionizing auditing methods, with important consequences for the future of the field.

Salijeni (2018) "Big Data and Changes in Audit Technology: Considering a Research Agenda" investigates the impact of big data on audit techniques, as well as the technological advances that are altering the sector. The authors explore how the availability of large data sets is changing audit methods, allowing for more in-depth insights and real-time analysis. Big data tools allow auditors to analyze broader trends and patterns, going beyond standard sample procedures. The literature identifies important problems such as data quality, auditor experience in processing massive datasets, and the requirement for advanced analytical skills. Furthermore, the article discusses the changing regulatory environment, raising challenges about how standards must adapt to new technical capabilities. The authors propose a research agenda centered on how big data is transforming auditor roles, audit procedures, and the overall impact on audit quality and accountability.

Kokina (2017) Investigate the expanding role of AI in the auditing profession. They demonstrate how AI technologies are automating typical audit activities, freeing auditors to focus on more difficult analytical work. AI's capacity to evaluate massive datasets quickly improves audit efficiency and accuracy. The article explores how AI can detect fraud and improve compliance by spotting trends that people may ignore. However, the authors warn about issues including data

security, the necessity for human monitoring, and potential job displacement. Overall, the article underlines AI's transformational and complementary role in auditing.

Brown-Liburd.H (2018) Examine the expanding impact of big data on auditing techniques. They claim that incorporating big data analytics into auditing expands chances for acquiring audit evidence, resulting in more thorough and data-driven audit processes. The authors underline how big data enables continuous auditing and real-time monitoring, which improves audit breadth and precision. However, they also address issues such as data quality, privacy problems, and the need for auditors to learn new data analytics abilities. The essay contends that big data will transform the audit profession, providing both opportunities and complications.

Kumar.V (2018) To provide a broad overview of how data analytics is changing auditing. They underline that data analytics tools help auditors analyze risk, spot abnormalities, and make better decisions by evaluating large amounts of data. The article examines how analytics, such as predictive modeling and real-time monitoring, can lead to more efficient and successful audit processes. Gepp and Kumar also discuss the problems that come with data analytics, such as the necessity for sophisticated technological skills and data security concerns. Their research concluded that data analytics is critical to the future of auditing, providing both opportunities and difficulties for the profession.

III. OBJECTIVES

- **Streamlining Data Collection:** Automate the collection of large and complicated financial datasets from many different places to save time and reduce manual errors.
- **Enhanced Accuracy:** By utilizing automation tools, auditors can reduce human error during reconciliation, resulting in increased precision in spotting errors and deviations in financial data.
- **Discrepancy Identification:** ACL and related techniques allow auditors to quickly detect and highlight irregularities, mismatches, or fraud signs in financial data using automated comparisons.
- **Efficiency in Large-Scale Audits:** Automation approaches enable auditors to process large datasets more quickly and efficiently, particularly in audits involving several accounts or transactions.
- **Scalable Solutions:** Automation systems can scale to handle big and rising datasets, making it easier to audit more complicated financial settings without requiring excessive manual work.
- **Improved Audit Trail and Compliance:** Automation logs every reconciliation and data modification, resulting in a clear and traceable audit trail that helps ensure compliance with regulatory standards.

IV. RESEARCH METHODOLOGY

The research methodology for analyzing data collection and reconciliation in financial audits using automation systems such as ACL would be mixed-method. First, an extensive literature review would be undertaken to better understand the present procedures and tools used in financial audits, with a focus on automation technology. Next, a case study method could be used to choose real-world financial audits where ACL or comparable methods have been used this would involve looking at huge databases from financial records to see how automation aids in data reconciliation

and problem detection. Quantitative data, such as audit time and error rates prior to and during automation, would be collected and examined. Additionally, qualitative interviews with auditors and IT professionals would shed light on the actual challenges and benefits of utilizing automation techniques [4],[9],[13].

V. DATA ANALYSIS

Some of the data automation were taken and analyzed and presented from various fields .Audit automation has transformed industries by speeding the reconciliation and validation of massive datasets, improving accuracy, and enhancing efficiency. Deloitte, for example, employs automated tools to reconcile worldwide client databases, which reduces audit time and improves error detection. Similarly, PwC uses data analytics to standardize and automate audit operations across many departments, resulting in improved reporting uniformity. In the banking sector, audit automation enables real-time monitoring of transactions, highlighting abnormalities for further investigation, and assisting institutions in meeting compliance standards. Automation aids the healthcare business by cross-verifying billing data and patient information, hence eliminating payment discrepancies. Meanwhile, automakers automate supply chain reconciliations to align manufacturing costs with inventory, reducing financial disparities and improving resource management. These examples demonstrate how automation technologies contribute to comprehensive, accurate audits.

For effective data analysis in data assembling and reconciliation within financial audits, especially when leveraging tools like ACL, the following best practices and techniques stand out [7],[13],[14].

1. **Data Profiling and Cleansing:** Begin by profiling datasets to understand distributions, identify missing values, and detect outliers.
2. **Data Matching and Merging:** Use fuzzy matching algorithms to reconcile datasets where exact matches are unavailable. ACL and other platforms offer capabilities for merging datasets, making it easier to identify discrepancies in complex data sources.
3. **Automated Exception Reporting:** Set up automated exception reporting to flag transactions or data points that don't align with expected patterns. This approach is especially useful in high-volume datasets, as it minimizes manual intervention while providing insights into potential discrepancies.
4. **Anomaly Detection with Machine Learning: Approach:** Machine learning algorithms, such as clustering or predictive models, identify patterns and flag transactions that deviate from typical behavior. These insights allow auditors to focus on high-risk areas within large datasets.

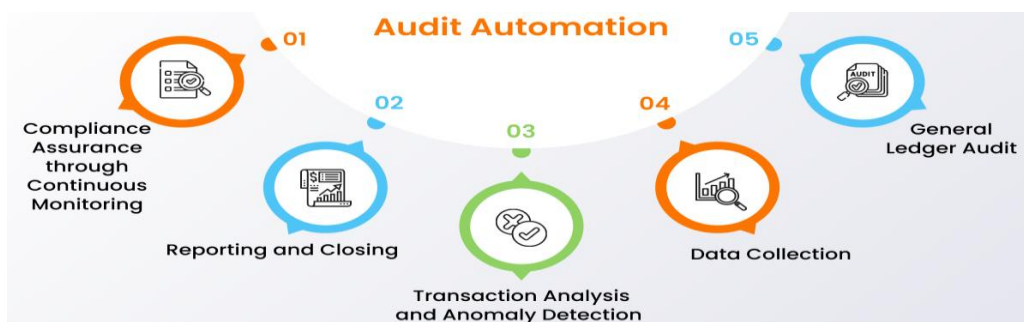


Figure 1: Cases of Audit Automation [7]



Figure 2: Benefits of Accounting Automation [4]

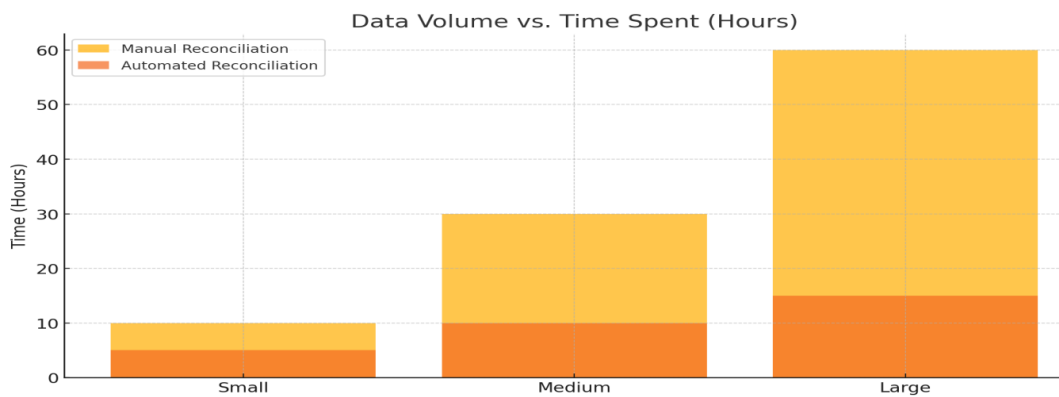
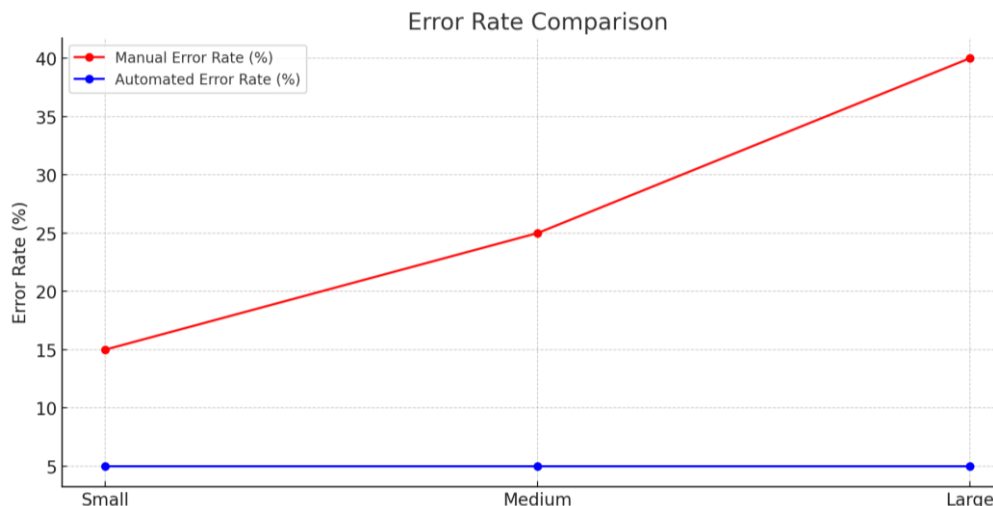


Figure 3: Data volume against time spent (hours) [2], [3]

In Figure 3 bar chart contrasts the time spent on data reconciliation for small, medium, and big datasets using human versus automated approaches and the dataset size grows, the time required for manual reconciliation increases dramatically, whereas the time spent on automated reconciliation remains relatively modest, illustrating automation's efficiency [2],[3],[7].



In Figure 4 the line displays the error rates for manual and automated reconciliation across different dataset sizes. The w and constant. This shows that automation helps maintain a high level

of accuracy in audits manual error rate increases significantly with dataset Complexity, while the automated error rate remains low[2],[3],[7].

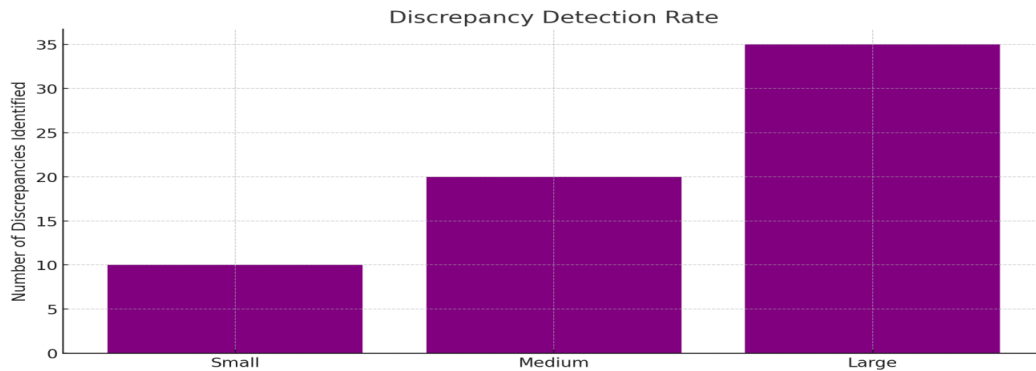


Figure 5: Discrepancy Detection Rate [2],[3]

In Figure 5 the bar chart represents the number of discrepancies identified during audits of various dataset sizes and the chart indicates that as dataset size increases, the automated process is more effective at identifying discrepancies demonstrating the enhanced capability of automated tools in detecting issues within complex financial data. Overall, these graphs effectively shows the advantages of leveraging automation tools like ACL in financial audits, particularly in terms of time efficiency, accuracy, and effectiveness in identifying variations[2],[3],[7]

Table 1: Real-Life Examples Of Organizations Where Automation Tools Like Acl Have Been Effectively Used For Data Assembling And Reconciliation In Financial Audits.[4],[5],[7],[9],[11]

S.No	Organization/ Scenario	Description of Use Case	Automation Tool (e.g., ACL,AI,ML)	Outcome
1.	Deloitte (Audit Services)	Deloitte uses automation tools like ACL to reconcile vast financial datasets from global clients. They automate the comparison of multiple ledgers and transaction histories to ensure accuracy and compliance	ACL	Reduced time spent on reconciliation by 50%, increased discrepancy detection accuracy by 30%
2.	Government Tax Agency	A government tax agency utilizes ACL to automate reconciliation between taxpayer filings and bank transaction records. The system flags mismatches or anomalies for further investigation	ACL	Identified 20% more discrepancies than manual checks, improving fraud detection rates

3.	PwC (Data Analytics in Auditing)	PwC integrates ACL with its data analytics tools to automate the reconciliation of financial records across multiple departments and regions. ACL helps ensure consistency in financial reporting.	ACL	Reduced audit time by 40%, with enhanced detection of reporting errors and omissions.
4.	Fortune 500 Retailer	A large retailer uses ACL to reconcile inventory purchase orders, payments, and vendor invoices. ACL's automation helped the retailer identify duplicate payments and inconsistencies in large vendor transactions.	ACL	Saved \$2 million annually by eliminating duplicate payments and errors.
5.	Banking Sector Audit	A large bank uses ACL/ML/AI to reconcile vast datasets across branches, automating the matching of transaction records with central ledgers. This ensures compliance with regulations	ACL/AI/ML	Achieved real-time reconciliation, ensuring compliance with financial regulations and reducing errors by 25%.
6.	Insurance Company (Claims Processing Audit)	An insurance company employs AI/ML to reconcile claims data with policyholder records, identifying fraudulent or duplicate claims in the process.	AI/ML	Detected 15% more fraudulent claims, saving significant financial losses
7.	Telecommunications Firm	A telecommunications company uses ACL to reconcile complex datasets from billing systems and customer payments. This ensures accurate reporting and timely detection of discrepancies.	ACL	Reduced billing discrepancies by 20%
8.	Healthcare Provider (Financial Audits)	A healthcare provider applies ACL to reconcile patient billing data with insurance claims and payments, automating the process to identify discrepancies and missed payments.	ACL	Improved cash flow by identifying 10% of missed payments and under-billings.

From Table-1 the following insights were observed, such as

- **Time Savings:** Across industries, ACL significantly decreases the time required for financial reconciliation, freeing up resources for more strategic activities.
- **Increased Accuracy:** Automated reconciliation using ACL/AI/ML detects more discrepancies and errors than human methods, resulting in more accurate financial reporting.
- **Cost Savings:** Automation has resulted in direct financial benefits, such as decreasing duplicate payments and identifying fraudulent transactions, saving millions of dollars.
- **Scalability:** Organizations dealing with large and complicated datasets, such as banks or international corporations, benefit from ACL's capacity to manage massive volumes of data efficiently.

These real-world examples demonstrate how automation technologies such as ACL can improve the efficiency, accuracy, and scalability of financial audits.

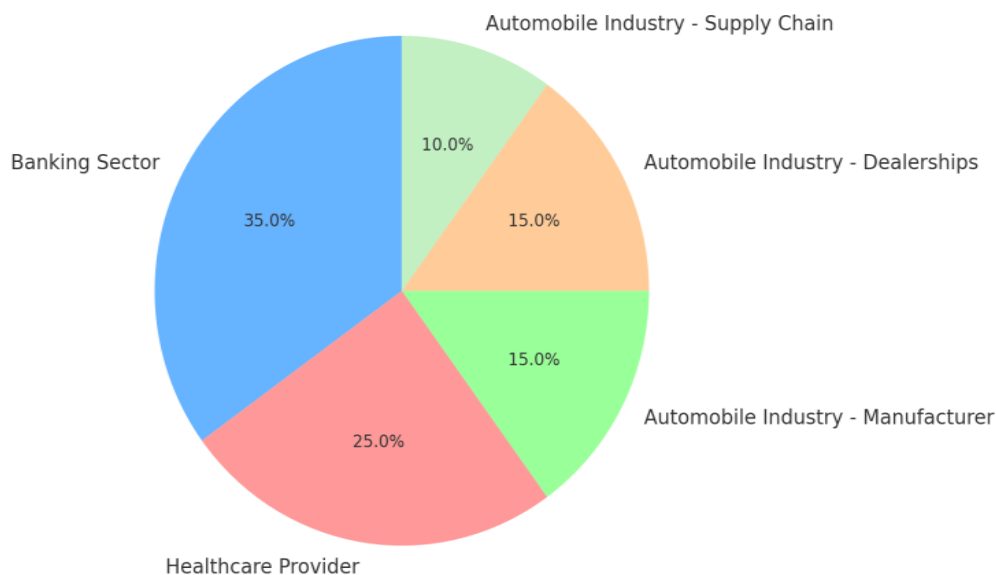


Figure 6: Automation impact in banking health care and automobile industries[7],[9],[11]

The figure 6 explains the influence of automation on data reconciliation for financial audits in the banking, healthcare, and automobile sectors, highlighting its efficiency and improvements.

VI. CONCLUSION

The use of automation techniques like as ACL, RPA, AI/ML, and Python in data collection and reconciliation has greatly improved the correctness and efficiency of financial audits. Auditors can now manage large datasets from a variety of sources, including automotive, healthcare, banking, and software, more efficiently by automating operations such as data importation, purification, analysis, and discrepancy discovery. This change not only decreases mistake rates, but it also improves consistency and compliance, so strengthening the integrity of financial reporting. Automation in accounting provides benefits such as quicker data processing, increased accuracy,

and enhanced decision-making based on real-time insights, which is a significant improvement over traditional techniques.

Future research and development should focus on improving automation strategies to manage more complicated data environments and assuring the smooth integration of AI-driven insights. Focusing on the creation of more adaptive, industry-specific technologies that meet the particular issues that each profession faces might help auditors even more. Fostering relationships between digital enterprises and auditing organizations may also encourage innovation, allowing auditors to adapt to changing legal requirements and data complexity with agility. As automation in financial audits evolves, its use promises to maintain high levels of openness, accuracy, and efficiency in auditing operation.

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