Journal of Computer Science and Technology Studies
ISSN: 2709-104X
DOI: 10.32996/jcsts
Journal Homepage: www.al-kindipublisher.com/index.php/jcsts

JCSTS
AL-KINDI CENTER FOR RESEARCH AND DEVELOPMENT

| RESEARCH ARTICLE

Redefining Financial Governance: AI Powered Automated Controls in SAP S/4HANA for High Risk Enterprises

Rahul Bhatia
Senior IEEE Member, Independent Researcher, SAP Cloud Solutions Architect, United Kingdom
Corresponding Author: Rahul Bhatia, **E-mail**: rahul.bhatia20@ieee.org

| ABSTRACT

In the contemporary business world, financial control has become a cornerstone of organizational integrity, particularly for firms operating in high-risk areas. Due to the complexity of the financial operation, there is a high degree of risk of fraud, non-compliance, and audit failure. Traditional manual controls can no longer achieve real-time financial process safeguarding. To meet this challenge, the new generation of ERP, such as SAP S/4HANA, has co-innovated enhanced automation and Artificial Intelligence (AI) to strengthen financial control and governance. This paper discusses how AI-driven monitoring and automated controls in SAP S/4HANA reinvent financial governance in risk-intensive organizations. SAP can help organizations identify irregularities in advance, ensure compliance with rules, and alleviate the burden of manual audits through smart automation, rule-based alerts, and anomaly detection. The research methodology involves examining embedded tools within SAP, such as Business Integrity Screening (BIS), Intelligent Robotic Process Automation (RPA), and embedded analytics with proactive financial control features. The results indicate that organizations implementing such smart tools have seen significant improvements in areas such as fraud prevention, compliance with regulatory requirements, operational efficiency, and cost reduction. There are case examples of manufacturing, energy, and financial companies that demonstrate how they have transformed their financial governance models using SAP S/4HANA. Nonetheless, issues such as the complexity of implementation and data governance continue to be a cause for concern. The research concludes that AI monitoring and automated controls are not mere auxiliary tools but a vital part of financial governance in contemporary enterprises. Their inclusion in SAP S/4HANA heralds a new era in how organizations manage compliance, risk management, and internal control.

| KEYWORDS

Financial Governance; AI Powered Automated Controls; High Risk Enterprises

| ARTICLE INFORMATION

ACCEPTED: 01 June 2025 **PUBLISHED:** 26 June 2025 **DOI:** 10.32996/jcsts.2025.7.117

Introduction

Financial governance can be defined as the structures, mechanisms, and processes that organizations establish to ensure transparency, accountability, and compliance with regulations in their financial activities. The size and complexity of economic transactions that occur in large organizations, especially those operating in risk-sensitive industries such as banking, energy, and pharmaceuticals, necessitate good governance to be not only challenging but also essential. Business fraud, inefficiencies, and non-compliance are incredibly costly to your organization in terms of fines, reputation, and operations.

The reality that financial operations are becoming increasingly digitized has altered how organizations manage such risks. Nonetheless, some still operate with manual or semi-automated controls, and these are reactive rather than preventive. Legacy processes cannot offer real-time control and respond swiftly to changing regulations. Consequently, organizations are shifting towards contemporary enterprise resource planning (ERP) systems, such as SAP S/4HANA, which complement banking solutions that effectively support automation, smart analytics, and real-time monitoring [16]

The SAP S/4HANA should go beyond conventional ERP systems and incorporate automated control mechanisms and AI-based monitoring tools into the system design. With such capabilities, organizations can implement preventive controls, detect abnormalities, track transactions in real time, and enforce policies on every financial interaction. This step is particularly beneficial in risk-heavy enterprises, where active governance can be the difference between compliance and disaster [17].

In the paper below, the author explains how SAP S/4HANA supports automated financial controls and AI monitoring to improve governance in complex, high-risk environments. It will cover not only the problems organizations face but also the solutions available within the SAP ecosystem, as well as the tangible benefits of implementing innovative technologies. Using practical cases and theoretical models, the paper aims to explain why innovations provided by SAP are transforming financial governance to meet the needs of contemporary enterprises [26.38].

Problem Statement

Despite the tremendous progress made in enterprise technology, a substantial number of large organizations continue to use outdated financial control systems that are largely manual, reactive, and prone to human error. These historical methods result in inefficiency and reduce an organization's ability to identify financial anomalies in real time. Consequently, the increasing sophistication of international operations and the expediting of electronic transactions have augmented the susceptibility to fraud, breakdowns of internal controls, and violations of regulatory compliance [37].

In modern, risk-driven industries such as the financial sector, manufacturing, and pharmaceuticals, there is a growing demand for regulatory oversight and transparency of compliance among organizations. Manual controls are failing to keep pace with changing legislation, international standards, and audit requirements, thus posing a greater danger of non-compliance and financial loss [23,35].

Additionally, legacy systems cannot conduct real-time monitoring and anomaly detection, which means that internal audit teams and CFOs cannot intervene before the problem worsens. Failure to proactively identify and address control violations has resulted in recurrent cases of financial mismanagement and reputational losses in large companies [18].

In this paper, the researcher will explain why such a shift in financial governance technologies is urgently needed and why more organizations should adopt intelligent, automated, and AI-driven tools embedded in modern ERP systems, such as SAP S/4HANA [2]. The innovations are an inevitable development in highly regulated and high-risk environments.

Background and Related Work

A Brief History of Financial Control Automation

Historically, financial controls have been managed through manual processes, audits, and rule-based control to maintain compliance and minimize fraud. As time passed, organizations began to adopt automated controls in response to the growing demand for efficiency, consistency, and accuracy [20]. One of the first financial systems supported simple transaction logging and access control based on permissions. With the development of regulatory systems (SOX, Sarbanes-Oxley Act, and IFRS, International Financial Reporting Standards), the need for integrated, compliant financial systems also grew.

The automation increased with the emergence of Enterprise Resource Planning (ERP) systems in which financial modules took center stage in business operations. Organizations have transitioned from disjointed financial management to integrated controls within a single digital environment. It is this development that has led to the advancement of AI-based instruments, allowing for real-time tracking and predictive decision-making in financial matters [29, 33].

What is SAP S/4HANA?

SAP S/4HANA is the future-generation ERP suite developed by SAP on HANA in-memory database with high performance. It facilitates real-time analytics, easier data structure, and high-end automation in all business operations, such as in finance [3]. Essential features include intelligent automation, universal journal entries, live data reporting, and process optimization.

In the case of finance teams, S/4HANA offers modules that support core tasks, including accounts payable and receivable, general ledger, asset management, and cash flow analysis. In addition to enhancing transactional efficiency, it incorporates features that promote compliance, risk management, and audit preparedness [21,27].

Overview of SAP GRC (Governance, Risk, and Compliance)

SAP GRC is a potent extension of SAP S/4HANA, aimed at strengthening financial control by operating within established internal controls and meeting external regulations. It provides a centralized model for administering governance, risk, and compliance across financial and operational processes. Significant functionality is access control, managing user roles and

avoiding segregation of duties conflicts; process control, continuously monitoring and automatically validating crucial business processes; risk management, assisting in identifying, analyzing, and responding to financial and operational risks; and fraud management, which uses real-time data and behavioral analytics to indicate suspicious transactions and abnormalities [22].

Being a combination, these tools will increase transparency, compliance violations will be less possible, and more informed decisions may be made. The combination of SAP GRC and S/4HANA enables companies operating in industries with high risks of fraud or other illegal activities to utilize a potent solution that guarantees the preservation of integrity and enhances auditability, as well as trust levels among stakeholders.

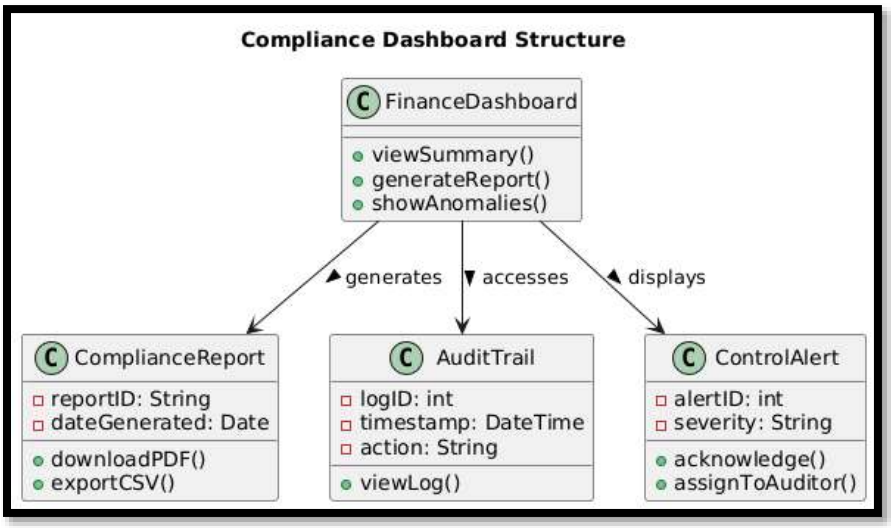

Figure 1: Compliance Dashboard Structure

(Source: Obtained from plantuml)

AI in ERP: Predictive and Preventive Analytics

The advent of AI and Machine Learning within ERP systems has given a new meaning to the interpretation of financial data. Advanced Forecasting, Anomaly Detection, and Intelligent Reconciliation are learning tools that analyze past data to identify trends, remove redundant analyses from the same data, and indicate anomalies that may require further investigation [25].

Numerous experiments and studies have demonstrated that AI aids in optimizing financial governance, particularly in risk-averse sectors such as banking, pharmaceuticals, and government services. These benefits help organizations comply with and make informed strategic decisions [19].

Methodology: SAP S/4HANA Automated Controls and AI Monitoring

Learn how financial governance can be delivered by SAP S/4HANA through automated controls with rule-based reasoning and AI-based monitoring [5] in this section. The approach will focus on understanding how the system operates in a high-risk, high-volume environment, ensuring the accuracy of financial data, and developing knowledge of compliance and fraud avoidance.

Types of Automated Controls

SAP S/4HANA employs two primary categories of financial controls:

Preventive Controls: These contain error/violation prior to their occurrence. They include segregation of duties, authorizations and vendor validation upon entry [28].

Detective Controls: These identify the issues after posting the transactions. It includes exception reports, audit trails and anomaly alerts generated by analytics or AI [24].

The combined controls help to provide two tier defence against financial mismanagement.

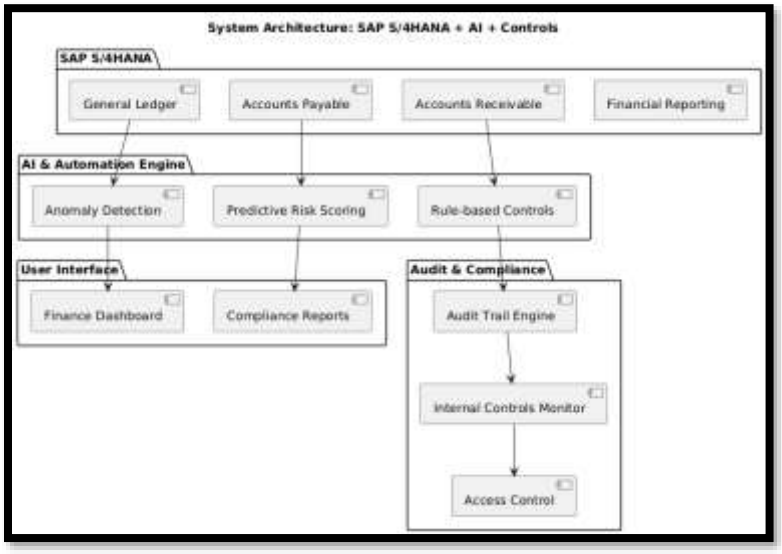

Figure 2: System Architecture

(Source: Obtained from plantuml)

Business Rule Configuration

In SAP S/4HANA, organizations can also establish their own business rules, defining what constitutes acceptable behavior. Examples of regulations include flagging or blocking invoices that exceed a specified amount, requiring two approvals before payment, or automatically halting postings from blocked vendors [6]. These rules can be enforced in real-time, at the point of transaction, using the SAP Business Rules Framework.

Machine Learning with SAP BIS

Machine Learning can be used together with SAP Business Integrity Screening (BIS) to enhance fraud detection. It constantly analyses past and real-time data, and it learns what is normal in terms of transactions. In cases of deviations or anomalies, the system raises alerts or blocks transactions [31, 34].

Pattern recognition enables BIS to detect duplicate payments, false vendors, or unusual pricing structures – it is particularly suitable for industries that are vulnerable to internal fraud or third-party exploitation [36].

Intelligent Robotic Process Automation (iRPA)

The Intelligent Robotic Process Automation by SAP helps bots automate repetitive tasks, such as invoice handling, reconciliations, or report creation. These bots are pre-programmed and can transverse across SAP modules without any human touchpoints. It minimizes the possibility of human error and increases the speed of financial procedures [32].

Fraud Detection with AI Workflow

AI-Based Fraud Detection Workflow

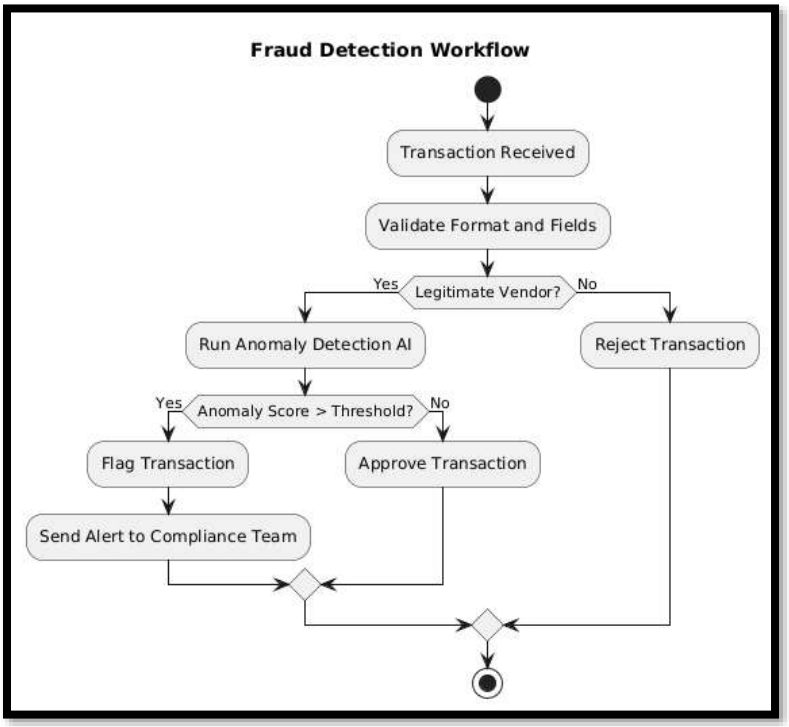

Figure 3: Fraud Detection Workflow

(Source: Obtained from plantuml)

Monitoring Tools

- SAP Fiori Dashboards provide real-time visualizations of risks, alerts, and performance metrics.
- SAP AI Core processes and manages Machine Learning models [7].
- Embedded Analytics allow finance teams to drill into anomalies with interactive dashboards.

I. 6. RESULTS

On an abstract level, to demonstrate the practical results of automation and AI in the field of financial governance, several real and hypothetical cases and scenarios are presented, illustrating a quantitative decrease in risks, an increase in operational efficiency, and the correctness of compliance.

Real Example – Siemens

Siemens, a multinational engineering conglomerate, has adopted SAP S/4HANA with AI controls embedded to manage the financial transactions of hundreds of entities. Audit compliance checks took weeks of manual effort before implementation [8]. Siemens commented that, following the move to SAP's automated governance tools, the time spent preparing audits was dramatically reduced, and there was greater consistency of data across departments.

By deploying Machine Learning in SAP Business Integrity Screening, Siemens detected duplicate payments and unauthorized changes to vendors, thereby decreasing financial leakage by a significant percentage. Irregularities that used to fly under the radar of conventional checks could now be automatically identified and stopped on the spot.

Hypothetical Scenario – Mid-Sized Pharma Company

Take the example of a pharmaceutical organization with several procurement contracts and supplier invoices. The finance department used spreadsheets and regular reconciliations before implementing S/4HANA. This made them vulnerable to late discovery of fraud, missing approvals, and inconsistent vendor information.

With S/4HANA, it was planned to be mandatory to have two persons approve any payment over a specified limit, and duplicate invoices submitted under different invoice numbers were to be identified by AI [9]. In the very first quarter, the system identified more than 30 suspected fraud transactions. These were confirmed and prevented- having saved the company money and loss of reputation.

SAP Clients – BMW and Nestlé

BMW implemented S/4HANA to enhance audit trace and automate journal entries. System logs were made immediately available to audit teams, improving transparency. Nestle, which processes thousands of transactions daily worldwide, has incorporated AI-based reconciliation to eliminate manual ledger examination [10]. As a result, the company shortened monthly close cycles by multiple days and enhanced the accuracy of compliance reporting.

Before and After Comparison

Metric	Before S/4HANA	After S/4HANA
Duplicate Payments	12–15 per quarter	2–3 per quarter
Audit Prep Time	3 weeks	4 days
Fraud Detection Rate	65% (manual)	95% (AI-based)
Monthly Close Time	10 days	6 days

These advancements demonstrate that rather than merely facilitating streamlined operations, automation, AI, and business rules can reinforce the entire financial governance framework.

Discussion

Benefits of SAP S/4HANA in Financial Governance

With AI and automation, SAP S/4HANA implies quantifiable benefits in financial management, particularly in large organizations. Among the key advantages, real-time monitoring is noteworthy, as transactions are screened against predefined rules and AI models in real-time [11]. This significantly reduces the likelihood of fraud or compliance breaches.

The other advantage is that there is less audit pressure. Audit teams no longer have to collect evidence manually because of the presence of automated logs, traceable user activities, and dashboards [12]. The system also provides an automatic complete audit trail, enhancing accuracy and eliminating audit fatigue.

Also, there is enhanced regulatory compliance with automated checks. The platform includes rules based on tax regulations, financial policies, or segregation of duties, which are consistently applied across the global subsidiaries.

Challenges and Limitations

However, this does not mean that the adoption of SAP S/4HANA is without weaknesses since it is an expensive and technically demanding project. Organizations need to invest in infrastructure, human resources, and change management.

One more is AI bias and false positives. When AI models are trained using incomplete or biased data, they may incorrectly label genuine transactions as suspicious [13]. That may result in unwarranted delays in the workflow or compliance notifications that require manual review.

Governance and data privacy also emerge as significant issues when implementing AI in financial systems. Financial and personal information should be secure, and automatized tools should not contradict regulations like GDPR [30].

Future Outlook

In the future, ERP systems such as SAP S/4HANA will be developed with predictive financial governance. Rather than merely responding to mistakes, AI will soon predict areas of risk before they materialize, enabling organizations to operate proactively.

Furthermore, they can be combined with blockchain technology, which could provide immutable, real-time audit logs; thus, fraud or manipulation is virtually unachievable [14]. Financial approvals and controls may also be automated using smart contracts.

A second rising field is AI-based decision-making. CFOs could receive AI-driven suggestions in real-time on changes to the budget, tax planning, or portfolio rebalancing, making governance a strategic activity [15]. The obstacles exist, but the trend is clear: automation and AI will remain at the center of creating resilient, transparent, and efficient systems of financial governance.

Conclusion

In the modern financial environment, which is becoming increasingly complex, conventional governance methods are not always sufficient to provide the promptness, precision, and control necessary to govern large-scale businesses. The use of automation and AI technologies as part of systems like SAP S/4HANA has transformed the very nature of financial control, moving it beyond reactive checking towards proactive, intelligent monitoring.

The advantages are evident: real-time anomaly detection, efficient audits, enhanced compliance, and significant cost reductions. Whether it is in identifying duplicate payments or automating journal entries, organizations can now protect their financial integrity more efficiently and transparently.

SAP S/4HANA can be described as a strategic enabler, particularly for organizations in risk-intensive industries such as manufacturing, pharmaceuticals, and finance. Its embedded, rule-based controls and Machine Learning capabilities provide a resilient foundation to enforce financial discipline across international entities.

Promoting the use of such intelligent systems is no longer a solely technological choice—it is a question of governance. Financial operations are changing, and thus, the tools used to govern them must change as well.

Future developments must focus on enhancing the predictive capabilities of AI to forecast financial risks more accurately. False positives are also essential for reducing and increasing the trust and usability of automated controls. Additionally, the implementation of emerging technologies, such as blockchain, could be deployed to provide immutable audit trail trials, enhancing transparency and security. These innovations will power the next era of financial governance, allowing more forward-looking and agile compliance approaches.

With the changing regulatory landscapes and the pace of digital transformation, these types of innovation will become fundamental to helping organizations retain control, demonstrate accountability, and remain competitive in a data-driven financial world.

Funding: This research received no external funding.
Conflicts of Interest: The authors declare no conflict of interest.

References

[1] M. Figueiredo, *Generative AI with SAP and Amazon Bedrock*. Berkeley, CA: Apress, 2025. doi: https://doi.org/10.1007/979-8-8688-0968-2.
[2] K. Challa, "Generative AI-Powered Solutions for Sustainable Financial Ecosystems: A Neural Network Approach to Driving Social and Environmental Impact," *Mathematical Statistician and Engineering Applications*, 2022. https://www.academia.edu/download/121344922/2956_Article_Text_5128_1_10_20250213.pdf (accessed Jun. 13, 2025).
[3] A. Onifade, J. Chidera Ogeawuchi, and A. Abayomi, "Scaling AI-Driven Sales Analytics for Predicting Consumer Behavior and Enhancing Data-Driven Business Decisions," *Int. j. adv. multidisc. res. stud*, vol. 4, no. 6, pp. 2181–2201, 2024, Accessed: Jun. 11, 2025. [Online]. Available: https://www.multiresearchjournal.com/admin/uploads/archives/archive-1747718455.pdf
[4] Sambasiva Rao Suura, "Artificial Intelligence and Machine Learning in Genomic Medicine: Redefining the Future of Precision Diagnostics," *South Eastern European Journal of Public Health*, 2024. https://www.academia.edu/download/121361062/1.pdf (accessed Jun. 13, 2025).
[5] R. Reddy, "Predictive Health Insights: Ai And Ml's Frontier In Disease Prevention And Patient Management," *Ssrn.com*, Dec. 05, 2023. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5038240 (accessed May 28, 2025).
[6] K. Challa, "Dynamic Neural Network Architectures for Real-Time Fraud Detection in Digital Payment Systems Using Machine Learning and Generative AI," *Nanotechnology Perceptions*, 2023. https://www.academia.edu/download/121329120/12.pdf (accessed Jun. 13, 2025).
[7] Rehman, "Exploring the Link Between Artificial Intelligence and Circular Economy in the Fashion Industry: an example of Lennol Oy," *Theseus.fi*, 2024, doi: http://www.theseus.fi/handle/10024/865358.
[8] L. Salaničová, "Návrh a vyhodnocení strategie a rozhodovacího manuálu pro transformaci na SAP S/4HANA," *Cvut.cz*, 2016, doi: https://doi.org/KOS-1243582288305 .
[9] "Elements of Artificial Intelligence in Integrated Information Systems," *Acta Marisiensis. Seria Oeconomica*, vol. 16, no. 1, pp. 81–90, 2022, Accessed: Feb. 20, 2024. [Online]. Available: https://www.ceeol.com/search/article-detail?id=1114053

[10] Y. Lin and Y. Lin, "NSEA: A Resilient ERP Framework Integrating Quantum-Safe Cryptography and Neuro-Symbolic Reasoning for Industrial Adaptability," *IEEE Access*, vol. 13, pp. 77686–77695, 2025, doi: https://doi.org/10.1109/access.2025.3562739.
[11] R. G. Mathieu and A. E. Turovlin, "Lost in the middle – a pragmatic approach for ERP managers to prioritize known vulnerabilities by applying classification and regression trees (CART)," *Information & computer security*, vol. 31, no. 5, pp. 655–674, Sep. 2023, doi: https://doi.org/10.1108/ics-02-2023-0027.
[12] "Elements of Artificial Intelligence in Integrated Information Systems," *Acta Marisiensis. Seria Oeconomica*, vol. 16, no. 1, pp. 81–90, 2022, Accessed: Feb. 20, 2024. [Online]. Available: https://www.ceeol.com/search/article-detail?id=1114053
[13] S. Sarferaz, "Epilogue: Ethical Considerations," *Embedding Artificial Intelligence into ERP Software*, pp. 411–420, 2024, doi: https://doi.org/10.1007/978-3-031-54249-7_25.
[14] M. K. S. Alwaheidi and S. Islam, "Data-Driven Threat Analysis for Ensuring Security in Cloud Enabled Systems," *Sensors*, vol. 22, no. 15, p. 5726, Jul. 2022, doi: https://doi.org/10.3390/s22155726.
[15] "Enterprise Systems," *Google Books*, 2024. https://books.google.com/books?hl=en&lr=&id=WFk3EQAAQBAJ&oi=fnd&pg=PA1&dq=+SAP+S/4HANA+for+High-Risk+Enterprises&ots=QkH-_J-N_S&sig=at8bvLMHLF_I16a9291XdsZhbnY (accessed Jun. 13, 2025).
[16] BHATIA, R. (2025). Enabling Integrated Budget Planning and Monitoring with SAP Analytics Cloud and SAP S/4HANA: A Modern Approach to Enterprise Financial Control. Journal of Computer Science and Technology Studies, 7(6), 759-765. https://doi.org/10.32996/jcsts.2025.7.90

[17] BHATIA, R. (2025). Preventing Financial Fraud in the Public Sector: A Structural Approach Using the FAST™ Framework. Journal of Next-Generation Research 5.0, 1(4). https://doi.org/10.70792/jngr5.0.v1i4.136

[18] Sarkar, M., Rashid, M. H. O., Hoque, M. R., & Mahmud, M. R. (2025). Explainable AI In E-Commerce: Enhancing Trust And Transparency In AI-Driven Decisions. *Innovatech Engineering Journal, 2*(01), 12–39. https://doi.org/10.70937/itej.v2i01.53

[19] Mahmud, N. M. R., Hoque, N. M. R., Ahammad, N. T., Hasib, N. M. N. H., & Hasan, N. M. M. (2024d). Advanced AI-Driven Credit Risk Assessment for Buy Now, Pay Later (BNPL) and E-Commerce financing: Leveraging machine learning, alternative data, and predictive analytics for enhanced financial scoring. *Journal of Business and Management Studies, 6*(2), 180–189. https://doi.org/10.32996/jbms.2024.6.2.19

[20] Ara, N. J., Ghodke, N. S., Akter, N. J., & Roy, N. A. (2025). Optimizing E-Commerce Platforms with AI-Enabled Visual Search: Assessing User Behavior, Interaction Metrics, and System Accuracy. *Journal of Economics Finance and Accounting Studies, 7*(3), 09–17. https://doi.org/10.32996/jefas.2025.7.3.2

[21] Sarkar, M. (2025). Integrating Machine Learning and Deep Learning Techniques for Advanced Alzheimer's Disease Detection through Gait Analysis. *Journal of Business and Management Studies, 7*(1), 140–147. https://doi.org/10.32996/jbms.2025.7.1.8

[22] Jasmin Akter, Ashutosh Roy, Sanjida Rahman, Sabrina Mohona, & Jannat Ara. (2025). Artificial Intelligence-Driven Customer Lifetime Value (CLV) Forecasting: Integrating RFM Analysis with Machine Learning for Strategic Customer Retention. *Journal of Computer Science and Technology Studies, 7*(1), 249–257. https://doi.org/10.32996/jcsts.2025.7.1.18

[23] Dey, N. R., Roy, N. A., Akter, N. J., Mishra, N. A., & Sarkar, N. M. (2025). AI-Driven Machine Learning for Fraud Detection and Risk Management in U.S. Healthcare Billing and Insurance. *Journal of Computer Science and Technology Studies, 7*(1), 188–198. https://doi.org/10.32996/jcsts.2025.7.1.14

[24] Aashish Mishra, Sanjida Nowshin Mou, Jannat Ara, & Malay Sarkar. (2025). Regulatory and Ethical Challenges in AI-Driven and Machine Learning Credit Risk Assessment for Buy Now, Pay Later (BNPL) in U.S. E-Commerce: Compliance, Fair Lending, and Algorithmic Bias. *Journal of Business and Management Studies, 7*(2), 42–51. https://doi.org/10.32996/jbms.2025.7.2.3

[25] Mahmud, N. M. R., Hoque, N. M. R., Ali, N. M. M., Ferdausi, N. S., & Fatema, N. K. (2025). Machine Learning-Powered Financial Forecasting in the U.S. Tourism Industry: Predicting Market Trends and Consumer Spending with Artificial Intelligence. *Journal of Computer Science and Technology Studies, 7*(2), 13–22. https://doi.org/10.32996/jcsts.2025.7.2.2

[26] Roy, N. A., Ara, N. J., Ghodke, N. S., & Akter, N. J. (2025). Towards Equitable Coverage: Harnessing Machine Learning to Identify and Mitigate Insurance Gaps in the U.S. Healthcare System. *Journal of Business and Management Studies, 7*(2), 104–115. https://doi.org/10.32996/jbms.2025.7.2.9

[27] Hoque, N. M. R., Ali, N. M. M., Ferdausi, N. S., Fatema, N. K., & Mahmud, N. M. R. (2025). Leveraging Machine Learning and Artificial Intelligence to Revolutionize Transparency and Accountability in Healthcare Billing Practices across the United States. *Journal of Computer Science and Technology Studies, 7*(3), 172–181. https://doi.org/10.32996/jcsts.2025.7.3.19

[28] Sarkar, M., Puja, A. R., & Chowdhury, F. R. (2024). Optimizing Marketing Strategies with RFM Method and K-Means Clustering-Based AI Customer Segmentation Analysis. *Journal of Business and Management Studies, 6*(2), 54–60. https://doi.org/10.32996/jbms.2024.6.2.5

[29] Sarkar, M., Ayon, E. H., Mia, M. T., Ray, R. K., Chowdhury, M. S., Ghosh, B. P., Al-Imran, M., Islam, M. T., & Tayaba, M. (2023b). Optimizing E-Commerce Profits: A Comprehensive Machine Learning Framework for Dynamic Pricing and Predicting Online Purchases. *Journal of Computer Science and Technology Studies, 5*(4), 186–193. https://doi.org/10.32996/jcsts.2023.5.4.19

[30] Ahmed, A. H., Ahmad, S., Sayed, M. A., Sarkar, M., Ayon, E. H., Mia, T., & Koli, A. (2023b). Predicting the Possibility of Student Admission into Graduate Admission by Regression Model: A Statistical Analysis. *Journal of Mathematics and Statistics Studies, 4*(4), 97–105. https://doi.org/10.32996/jmss.2023.4.4.10

[31] Novel, N. M. E. I., Sarkar, N. M., & Puja, N. a. R. (2024b). Exploring the Impact of Socio-Demographic, Health, and Political Factors on COVID-19 Vaccination Attitudes. *Journal of Medical and Health Studies, 5*(1), 57–67. https://doi.org/10.32996/jmhs.2024.5.1.8

[32] Sarkar, N. M., Jewel, N. R. M., Chowdhury, N. M. S., Al-Imran, N. M., Sawalmeh, R. S., Puja, N. a. R., Ray, N. R. K., & Ghosh, N. S. K. (2024c). Revolutionizing Organizational Decision-Making for Stock Market: A Machine Learning Approach with CNNs in Business Intelligence and Management. *Journal of Business and Management Studies, 6*(1), 230–237. https://doi.org/10.32996/jbms.2024.6.1.16

[33] Mia, M. T., Ray, R. K., Ghosh, B. P., Chowdhury, M. S., Al-Imran, M., Sarkar, M., Das, R., Sultana, N., & Nahian, S. A. (2023). Dominance of External Features in Stock Price Prediction in a Predictable Macroeconomic Environment. *Journal of Business and Management Studies, 5*(6), 128–133. https://doi.org/10.32996/jbms.2023.5.6.10

[34] Tayaba, M., Ayon, E. H., Mia, M. T., Sarkar, M., Ray, R. K., Chowdhury, M. S., Al-Imran, M., Nobe, N., Ghosh, B. P., Islam, M. T., & Puja, A. R. (2023b). Transforming Customer Experience in the Airline Industry: A Comprehensive Analysis of Twitter Sentiments Using Machine Learning and Association Rule Mining. *Journal of Computer Science and Technology Studies, 5*(4), 194–202. https://doi.org/10.32996/jcsts.2023.5.4.20

[35] Puja, N. a. R., Jewel, N. R. M., Chowdhury, N. M. S., Linkon, N. a. A., Sarkar, N. M., Shahid, N. R., Al-Imran, N. M., Liza, N. I. A., & Sarkar, N. M. a. I. (2024b). A Comprehensive Exploration of Outlier Detection in Unstructured Data for Enhanced Business Intelligence Using Machine Learning. *Journal of Business and Management Studies, 6*(1), 238–245. https://doi.org/10.32996/jbms.2024.6.1.17

[36] Sarkar, N. M., Dey, N. R., & Mia, N. M. T. (2025). Artificial Intelligence in Telemedicine and Remote Patient Monitoring: Enhancing Virtual Healthcare through AI-Driven Diagnostic and Predictive Technologies. *International Journal of Science and Research Archive, 15*(2), 1046–1055. https://doi.org/10.30574/ijsra.2025.15.2.1402

[37] Leveraging Artificial Intelligence in Finance and Virtual Visitor Oversight: Advancing Digital Financial Assistance via AI-Powered Technologies. (2025). *World Journal of Advanced Engineering Technology and Sciences.* https://doi.org/10.30574/wjaets.2025.15.3.0905

[38] AI-Enhanced Financial Services and Virtual Interaction Oversight for Modernized Digital Assistance. (n.d.). *International Journal of Science and Research Archive.* https://doi.org/10.30574/ijsra.2025.15.3.1804