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Cloud-First Supply Chains: The Impact of SAP S/4HANA Cloud on Logistics and Procurement

Kingsley Olunosen Osobase [1,*], Daniel Felix Eyo [2] and Oluwatosin Oluwaseun Adeniran [3]

[1] *Federal University of Technology, Akure, Meteorology, Akure, Ondo, Nigeria.*
[2] *University of Calabar, Computer Science, Calabar, Cross River, Nigeria.*
[3] *Adekunle Ajasin University, Plant Science and Biotechnology, Akungba Akoko, Ondo State.*

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Abstract

As global supply chains face growing disruption from digital innovation, geopolitical volatility, and shifting consumer expectations, organizations are under increasing pressure to modernize logistics and procurement operations. This review examines the strategic impact of SAP S/4HANA Cloud, a next-generation cloud-native ERP suite built on the in-memory HANA database, on digital supply chain transformation. Unlike legacy systems, SAP S/4HANA Cloud offers real-time data processing, embedded analytics, machine learning, and flexible deployment options that enhance end-to-end visibility, process automation, and strategic sourcing. Drawing from scholarly literature, vendor documentation, and real-world case studies from leading Nigerian enterprises such as Dangote Group, MTN Nigeria, NNPC, and TotalEnergies Nigeria, the paper highlights how the platform enables predictive logistics, digital warehousing, automated procurement, and integrated supplier collaboration. The analysis also surfaces practical challenges, including change management, integration with legacy infrastructure, and compliance with data sovereignty laws. Ultimately, the paper positions SAP S/4HANA Cloud as a transformative enabler for resilient, intelligent, and adaptive supply chains, while emphasizing the importance of phased implementation, user upskilling, and continuous innovation for sustainable adoption.

Keywords: SAP S/4HANA Cloud; Digital Supply Chain; Logistics Management; Procurement Automation; In-Memory Computing; ERP Transformation; Real-Time Analytics; Supply Chain Visibility; Cloud Deployment Models

1. Introduction

The global supply chain ecosystem is experiencing unprecedented disruption and transformation, driven by accelerating digital innovation, geopolitical uncertainty, and evolving consumer expectations [5]. To remain competitive and resilient, organizations are increasingly investing in digital supply chain strategies that emphasize agility, transparency, and end-to-end integration [6]. Central to this transformation is the adoption of cloud-based enterprise resource planning (ERP) systems, which offer a foundational shift from traditional monolithic infrastructures to scalable, intelligent platforms that support real-time decision-making [8].

In this area, the emergence of cloud-first approach in ERP has become a hot topic [7]. In contrast to legacy on-premise systems, which, usually, have to be substantially capital-intensive and take a long time to implement, cloud-based ERP solutions are, indeed, flexible, modular, and constantly updated [8]. Such characteristics have allowed companies to be dynamically responsive to demand changes, logistics shocks, and variability in procurement, which have become essential in a post-pandemic world economy [9].

* Corresponding author: Kingsley Olunosen Osobase

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The example of this change is SAP S/4HANA Cloud, which is the next-generation ERP suite that utilizes the in-memory HANA database. It integrates core business functions with advanced analytics, artificial intelligence (AI), and process automation, offering a unified platform that supports end-to-end supply chain execution [10]. Its embedded capabilities for logistics and procurement management, ranging from real-time inventory visibility to intelligent sourcing, position it as a transformative tool for digital supply chain modernization.

These process capabilities are underpinned by a system of internal event detection and contextual interpretation that enables real-time responsiveness; logistics steps are monitored continuously, and through layered activity and status management, structured outputs are generated and exposed to external systems as shown in Figure 1, to ensure transparency and control across the entire supply chain.

Despite growing adoption, the practical implications of SAP S/4HANA Cloud on logistics and procurement remain underexplored in academic and industry literature. Existing studies often focus on the technical architecture, implementation challenges, or broader digital transformation journeys, without a dedicated lens on how S/4HANA Cloud specifically alters operational practices in supply chain functions.

This review addresses that gap by examining the impact of SAP S/4HANA Cloud on logistics and procurement processes, with a focus on its contributions to process efficiency, automation, visibility, and strategic decision-making. It synthesizes current knowledge from scholarly publications, industry white papers, and real-world case studies to provide a comprehensive understanding of the platform's transformative potential. Additionally, it identifies implementation challenges and outlines future research opportunities to guide both practitioners and scholars.

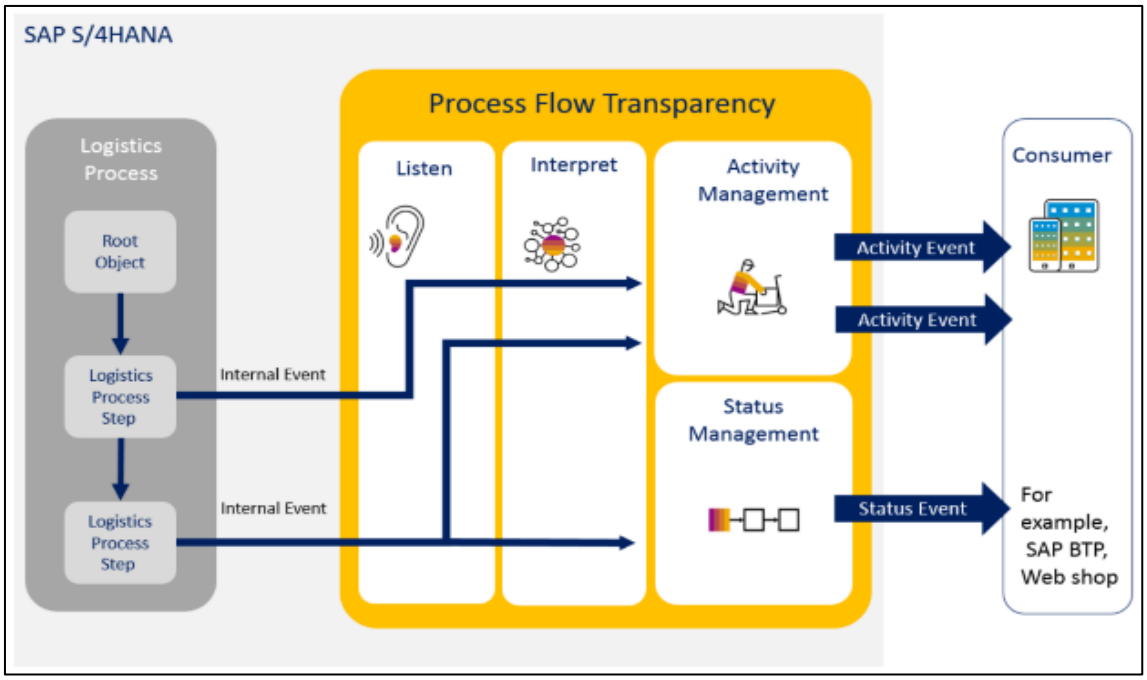

Figure 1 Overview of SAP S/4HANA Cloud in Supply Chain Management [1]

2. Understanding SAP S/4HANA Cloud

2.1. Architecture and Key Capabilities

SAP S/4HANA Cloud is the next-generation enterprise resource planning (ERP) system that enables the digital transformation of business enterprise in the cloud-native platform [12]. By using the SAP HANA in-memory database, it incorporates the fundamental business processes such as procurement, logistics, finance, and manufacturing into one real time operational platform [13]. This is a modular and extensible solution and the organization can just take what it only needs and leave the rest and have a scalable solution ready when it needs to expand [8]. The architecture unites user interfaces using the Fiori shell, application logic at the ABAP layer, and allows providing real-time analytics using CDS views on the HANA database, and the ability to use one device without changing integrated applications, thus opening access via device-agnostic methods, as shown in Figure 2. Some of its main capabilities include embedded

analytics, artificial intelligence (AI), machine learning (ML), robotic process automation (RPA), and all of it is included in the standard offering [11]. The system also includes SAP Best Practices, with predefined processes and real-time analytics providing the increased efficiency in the operation processes [10]. S/4HANA cloud has open API ecosystem and connectivity with SAP Business Technology Platform, which makes its easy to modify and integrate with other platforms like SAP Ariba, SAP IBP, and SAP Business Network [12].

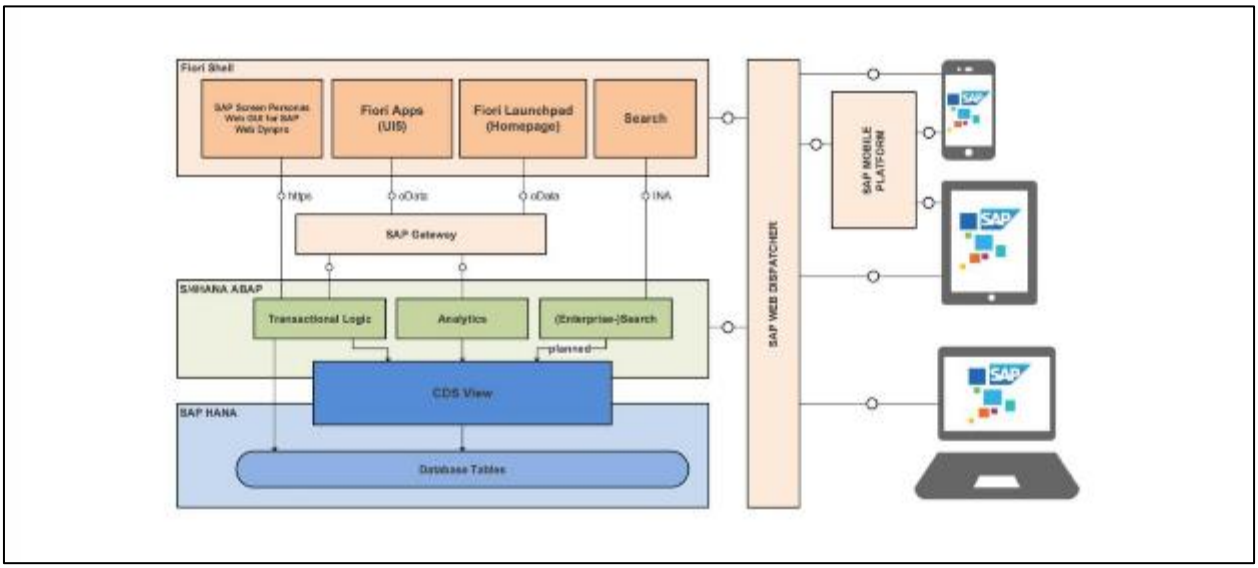

Figure 2 SAP S/4HANA Cloud System Architecture [2]

2.2. Differences Between On-Premise and Cloud Deployments

SAP S/4HANA is available in both on-premise and cloud-based versions, and there are very different aspects to consider in terms of its deployment method, maintenance, and flexibility. On-premise edition has the option of extensive customization, complete data control and conventional lifecycle management tools. Nevertheless, it is expensive and material investment is needed on the infrastructure, system upgrading and internal IT experience [15].

By contrast, SAP S/4HANA Cloud is provided as Software-as-a-Service (SaaS), either on hyperscaler or SAP-managed platforms. It is focused on speed of implementation, low total cost of ownership as well as sustained innovation with quarterly releases [8]. Although the possibility to customize is more limited in the cloud variant to maintain the possibility to upgrade, extensibility is made possible through standardized APIs and the SAP BTP. The cloud deployment model presents an active and flexible environment to businesses that are looking to achieve agility and scale of operations within its supply chain processes [16].

2.3. Real-Time Data Processing and In-Memory Computing

HANA in-memory computing platform forms the backbone of the SAP S/4HANA cloud, gearing the way business data is processed and analyzed radically. Nonetheless, in contrast to the conventional disk-based databases, SAP HANA is capable of retaining the data in the RAM, which can be processed in near-real time (processed analytic and transactional data) [17]. With this architecture, real-time analytics, ad hoc reporting and dynamic decision support can run in all business functions.

In both supply chain and procurement situations, this would mean having a real-time view of inventory, vendor performance, supply chain interruptions and financial data. Columnar storage model and high level compression too provide good utilisation of the memory and improve query performance.

3. Deployment Models and Flexibility

3.1. Public, Private, and Hybrid Cloud Options

SAP S/4HANA Cloud ensures a flexible model of deployment to adjust to the different needs of contemporary businesses: public cloud, private cloud, and hybrid deployments [1]. The two models have different trade-offs of standardization, control, scalability and innovation speed.

Under the public cloud model, SAP hosts and controls the complete infrastructure offering the standardized best practices and delivering the constant innovation with the quarterly updates [10]. The model is focused on speed, cost-efficiency, and short time-to-value, which also makes it an excellent solution to highly agile and scalable companies with a low IT overhead.

The private cloud alternative, however, offers a more configure-able environment running under the infrastructure of SAP or one of a hyperscaler such as AWS or Microsoft Azure [2]. It can be applied to companies that need more control in configurations, data residency, or even industry-specific compliance, and at the same time could enjoy the benefits of the elasticity and automation that the cloud offers.

A hybrid deployment puts together both on-premise systems and cloud based modules so that companies can upgrade gradually. This model allows supporting such scenarios, when a part of business departments moves to cloud, on which it is possible to realize cost reduction, and another part remains on legacy infrastructure because of compliance, operational or integration restrictions. Hybrid Hybrid designs are usually used as a step-by-step approach of large organizations to full cloud implementation [9].

3.2. Fit-for-Purpose Flexibility for Enterprises

The key idea of SAP S/4HANA Cloud is its adaptability, letting an enterprise adapt its deployment approach to business operation requirements, digital maturity and compliance requirements [5]. Organisations can start with a minimal implementation of a public cloud that covers basic services and grow to include more modules or move to private or hybrid to build more services.

Such flexibility is especially useful in the context of a global supply chain in which various regions or subsidiaries might need varying degrees of customization, data localization or integration. Modularity of the platform also allows performing a phased rollout, which means that businesses can tie the digital transformation efforts to specific strategic priorities without having to redesign the entire ERP landscape in a single step [6].

SAP S/4HANA Cloud allows the enterprises to advance their ERP strategy according to the growth pattern, risk level, and technological aspirations since it supports various deployment models and provides a high level of extensibility via the SAP Business Technology Platform [14].

4. Impact on Logistics Management

4.1. Logistics Planning and Visibility

SAP S/4HANA Cloud greatly strengthens logistics planning, as it makes the supply chain have the end-to-end visibility and be responsive in real-time [1]. The platform combines tracking data, business rule, analytics to enable dynamic planning and execution capability, with less latency time between decision and execution. Real-time shipment tracking, inventory, and demand changes give logistical planners the capacity to respond to disruptions, better streamline paths, and distribute resources.

Among the more important innovations is the enabled predictive estimated time of arrival (ETA) computation that relies on historical performance records, current GPS signals, and the machine learning models to predict delays and suggest alternative paths [18]. This not only enhances quality customer service with greater clarity of delivery expectations but proactive exception handling and cost management as well.

Furthermore, SAP S / 4HANA Cloud can be used with digital twins, or a logistics-related model replica that recreates the scale of the real world on a virtual system. Such models allow planners to evaluate the effect certain situations, including congestion in the port, delays by suppliers, or bad weather, will have before it happens. Paired with network simulation tools, digital twins enable organizations to carry out strategic what-if scenarios, design more resilient supply chain designs, and minimize operational risk.

4.2. Warehouse and Inventory Management

SAP S/4HANA Cloud provides advanced capabilities for warehouse and inventory management with intelligent automation of the processes and real-time connections to the physical property. The system uses an innovative combination of Internet of Things (IoT), machine learning, and embedded analytics to streamline intra-logistics streams, including resources allocation, and to drive the accuracy of operations in the warehouse space.

IoT integration is seamless, which generates the possibility of intelligent warehousing where we may track the flow of goods, the state of equipment, and the environment in real-time. AGVs, intelligent shelves and RFID sensors might directly communicate with the means of the ERP system and indicate the corresponding actions in terms of goods receipts, picking or replenishments [3]. Figure 3 depicts that AGVs communicate with intelligent shelves and an AGV traffic control center that is connected to the SAP S/4HANA Cloud and allows fully automated and orchestrated pack activities in the warehouse environment. This saves manual intervention, enhances throughput and chances of error by the human are minimized.

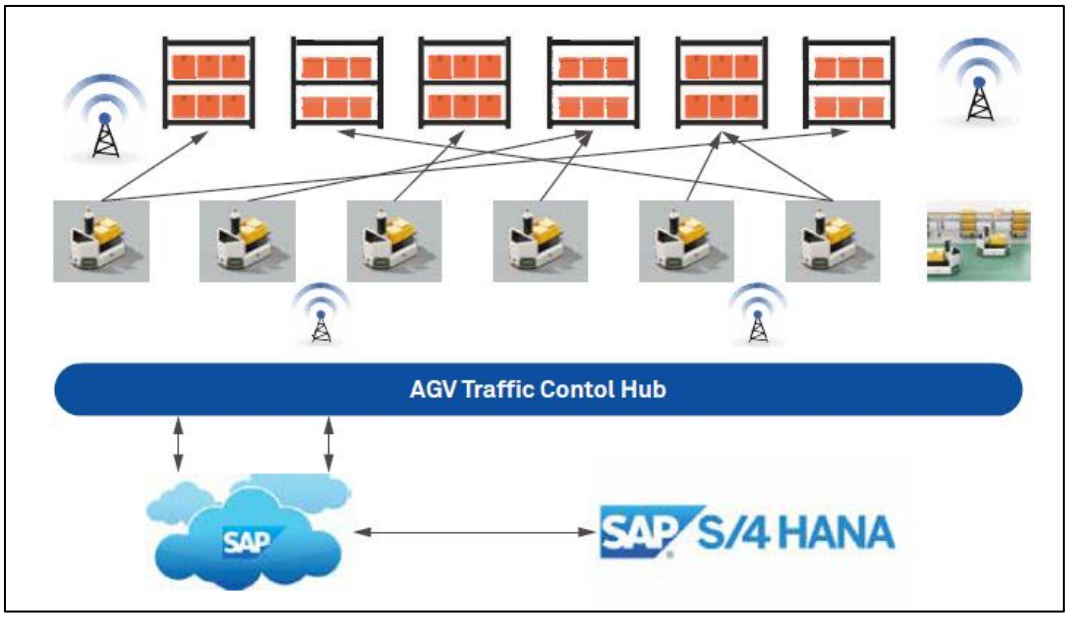

Figure 3 Automated Guided Vehicle (AGV) operations in a smart warehouse integrated with SAP S/4HANA Cloud [3]. The system uses IoT connectivity, shelf sensors, and a centralized AGV Traffic Control Hub to optimize warehouse automation and inventory flow in real-time

Besides automation, the SAP S/4HANA Cloud supports stock optimization, including real-time inventory overview, multi-location synchronization, and enhanced multi-location coordination. Planners can aid to track materials to a batch or serial number, use predictive analytics to anticipate demand and perform replenishment methods, based on real consumption rather than static reorder points. This does not only increase the inventory turnover but also decreases carrying costs and lead times.

4.3. Transportation Management

Transportation management is an essentially important aspect of end-to-end supply chain performance and the SAP S/4HANA Cloud achieves this via embedded SAP Transportation Management (SAP TM) functions [10]. Inserting transportation functions squarely into the mainstream ERP environment, the platform provides the opportunity of excluding standalone systems and of attaining smooth coordination between order management, logistics performance, and financial settlement.

SAP TM offers a complete package of freight planning and execution tools [10], which include carrier planning, load consolidation, shipment monitoring, cost check of freight costs [6]. All these tools are backed up by real-time data integration and automation of business rules, hence enabling logistics managers to make informed decisions in real time with the least possible manual interference.

Route optimization is one of the advanced capabilities, which is carried out by use of geospatial data and prior trends of transit traffic patterns to determine the most productive movement of the transportation, considering factors like delivery windows, vehicle capacities, and road conditions. This minimizes the number of transits, enhances on-time delivery and fuel consumption is reduced.

In addition, the platform helps to minimize the costs by automating the freight rate handling, contract optimization, and freight performance. Organizations will be able to greatly decrease the costs of logistics without decreasing levels of service by consolidation of shipment, cutting empty miles, and acting in advance with regards to carrier relations.

Enterprises with SAP TM integrated as part of S/4HANA Cloud will have the built-in, data-infused transport management setting that will lead to greater agility, cost savings, and increases in general logistics efficiency.

5. Impact on Procurement and Sourcing

5.1. Strategic Sourcing and Spend Analysis

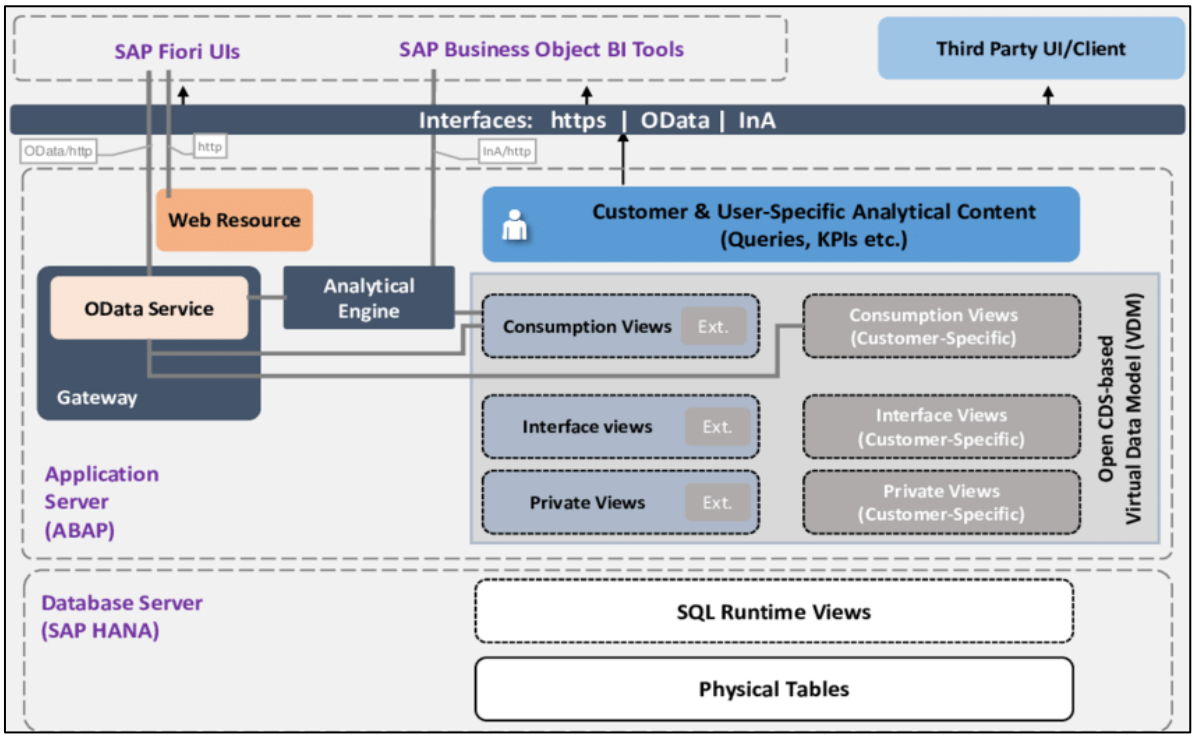

Figure 4 SAP S/4HANA Cloud architecture for procurement analytics and reporting [4]. The diagram illustrates how analytical content, such as KPIs and supplier metrics, is generated using Open CDS-based virtual data models (VDMs), OData services, and the SAP HANA database engine. These analytics are accessed through SAP Fiori UIs, Business Objects tools, or third-party clients for real-time decision-making

The AI- and ML-facilitated supplier evaluation provided by SAP S/4HANA Cloud [12] transforms strategic sourcing by allowing the user organizations to discover the most appropriate suppliers with the consideration of historical data on performances, cost effectiveness, and risk. These intelligence features enable sourcing officials to not just measure the performance of the past but also trends that would predict future performance, thus leading to more flexible and economical supplier relations.

Moreover, the sophisticated tools of spend analysis provide the real-time transparency of procurement spending by business unit, location and category. Such comprehensive spend data will enable the procurement leaders to detect maverick spending, enhance contract compliance and point out potential savings opportunities. When aligned with business strategic objectives, the procurement activities of organizations can improve sourcing decisions and event permanent value delivery. SAP S/4HANA Cloud accomplishes this functionality by means of an architecture that harmonizes SQL-based virtual information models, OData services and analytical engines to make it easy to access real-time KPIs, supplier information and spend dashboards through SAP Fiori UIs or third-party applications as shown in Figure 4 [4].

5.2. Supplier Collaboration and Integration

Through integrated supplier portals and business-to-business (B2B) connectivity [10], SAP S/4HANA Cloud fosters seamless collaboration between buyers and suppliers. The supplied parties are able to access purchase orders, declare delivery and present invoice using a single digital platform, eliminating the manual duplication of effort, stopping cycle times. The analytics-based design of the system enables procurement data to be analyzed based on the OData services, analytical engines, and virtual data models that enable them to create key performance indicators (KPIs) and

compliance insights on a real-time basis. The arrangement facilitates tailoring of consumption, interface, and personalized views, provided in SAP Fiori UIs or external tools to enable pro-responsive sourcing.

They can also conduct a risk assessment on the platform, combining third-party data with internal compliance guidelines, so that an organization can track the performance of its own suppliers, detect possible failures, and become compliant with regulatory requirements [5].

5.3. Automation of Procurement Processes

Procurement processes in SAP S/4HANA Cloud are highly automated end-to-end, including purchase requisitions, order processing, and goods receipts and invoicing, with embedded automation as well as intelligent process guidance [12]. The system provides contextual recommendation when carrying out purchasing activities though exceptions are automatically raised so that they can be resolved and having this enables a reduction in manual intervention and propels the purchasing cycle forward.

In addition, the capabilities are expanded across organizational boundaries when coupled with the solution of SAP Ariba and SAP Business Network to facilitate collaborative sourcing, contract lifecycle management, and real-time interaction with suppliers [10]. This linked system enhances the transparency of procurement, responsiveness, and operational efficiency around the globe.

6. Business Value and ROI

6.1. Efficiency Gains and Cost Reduction

SAP S/4HANA Cloud presents quantifiable business success due to the fact that it improves the process performance and minimizes operational expenses through automation, real-time analysis, and smart workflows [12]. In terms of hard evidence, recent direct empirical studies and industry reports indicate that cycle times in procurement, inventory and financial reconciliation have, after system implementation, dropped by 30 percent-plus or often greater [10]. Such benefits are due to less approvals, exception processing work, and less manual data entry or processing with spreadsheets.

From a financial perspective, Total Cost of Ownership (TCO) of SAP S/4HANA Cloud tends to be less than on legacy ERP systems [3], especially in terms of infrastructure, maintenance and upgrades delivery costs. Cloud-native deployments also relieve the organization of high capital costs on infrastructure and data centers as it is replaced with predictable operating costs achieved through a subscription model. Moreover, semi-automatic quarterly updates decrease the maintenance of systems implementation and make business assured that it will not be disrupted by lack of the newest capabilities. The move is not just an enhancement of financial planning, but it can lead to a faster time to value digital transformation initiatives.

6.2. Agility and Resilience in Disruptive Environments

The COVID-19 crisis has shown the necessity to have not only efficient supply chains, but resilient and flexible ones as well [5]. SAP S/4HANA Cloud enhances enterprise agility because it helps organizations to reorganize logistic chains, strategies of sourcing and inventory policy when they face immediate disruptions. Cloud infrastructure supports accessibility and scalability to the system even when it is not physically available; thus, enabling remote working and distributed teamwork in case of a crisis.

The platform includes advanced scenario planning tools that enable business leaders to run demand shocks, supplier delays, or geopolitical risk and evaluate both financial and operational impacts in real-time [10]. When used alongside predictive analytics, such functionalities make companies nimble enough to shift sourcing to other suppliers, redistribute inventory across geographies, or drop or change orders according to real-time constraints. This has led to the reported increase in supply chain sustainability, accelerated recovery in companies using SAP S/4HANA Cloud, and an increase in stakeholders having trust in such companies [10,12].

7. Challenges and Limitations

7.1. Implementation and Change Management

Despite its transformative potential, the implementation of SAP S/4HANA Cloud is often limited by organizational and operational-related challenges. Change management is among the most quoted issues, namely, the opposition of the users who are used to legacy systems and manual work [19]. The move to smart, cloud-based ERP requires both a technical setup and a cultural transition to a more data-based decision-making process and unification of processes.

The factor of user training is of first importance, especially concerning the scope of the system and transit to strategic and insight calling jobs [20]. The next negative outcome of insufficient investment in upskilling is underutilization of more advanced features like embedded analytics, robotic process automation (RPA), and machine learning (ML)-based recommendations. Also, the migration of the data on legacy systems can be very tricky and time-consuming where an organization has an imbalanced master data management or system fragmentation [21].

7.2. Integration with Legacy Systems

Whereas SAP S/4HANA Cloud was meant to be interoperable and modular in nature, integrating it with pre-existing IT infrastructure, especially custom made or highly customized legacy systems presents a serious challenge, technically. It is common that enterprises will require middleware or APIs to integrate their cloud ERP to applications outside or on premise databases [10]. Nevertheless, the cross-environment consistency of data and integrity of the processes necessitates a careful design and control within the hybrid context.

Latency, version difference and failure to support legacy data formats may cause operational inefficiencies unless addressed pre-emptively. Also, organizations whose technical debts run deep might endure huge expenses and time lag in arriving at smooth integration which demoralizes agile which platform is expected to facilitate.

7.3. Cloud Security and Data Sovereignty

Implementation of cloud-first ERP model also raises concerns related to cybersecurity, data privacy, and regulatory compliance. SAP S/4HANA Cloud includes secure end-to-end encryptions, identity management, and active threat investigations, although concerns are still on the rise, especially among industries with high regulation, e.g., healthcare, finance, and government activities [10].

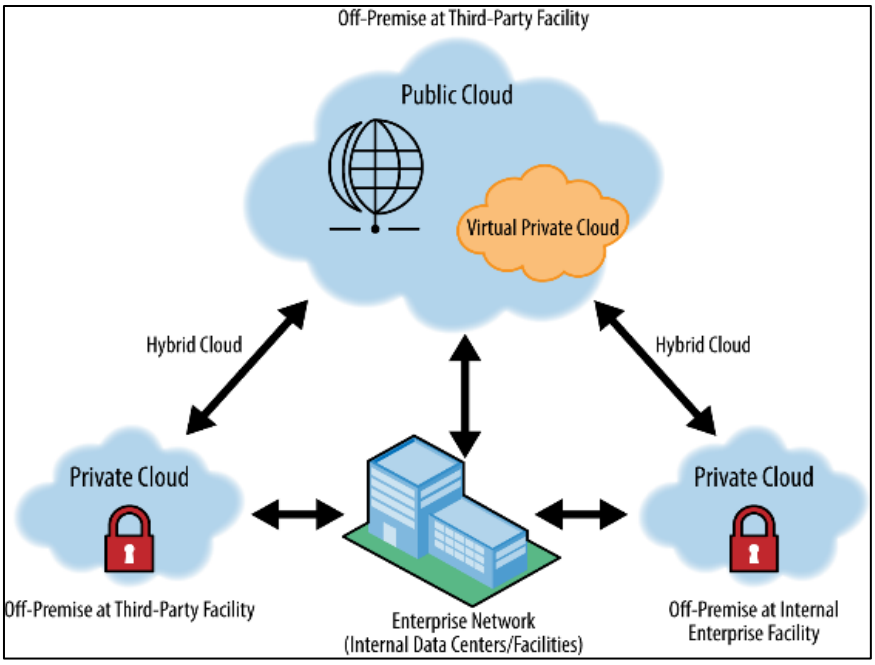

Figure 5 Cloud Deployment Models, illustrating the differences between public, private, and hybrid cloud configurations, along with examples of virtual private cloud (VPC) overlays [23]. The arrows indicate possible integrations between deployment types

The cloud deployment strategies are jeopardized by the data sovereignty laws that require data to be stored locally, or limitations may be imposed on data flowing between borders. The deployment model (public, private, or hybrid) should also be suitable to national and international data protection requirements (i.e., General Data Protection Regulation [GDPR], or agency-specific requirements) [22]. The inability to comply with these specifications results in legal sanctions imposed on a business and loss of stakeholder confidence in digital transformation. In order to facilitate the clarity of the architecture and the process of making strategic decisions, Figure 5 presents a visual dichotomy of the three major cloud deployment models, namely, Public, Private and Hybrid Cloud, including their common hosting environments as well as their integration points. This diagram helps highlight key trade-offs in control, customization, scalability, and infrastructure responsibility. The illustration also emphasizes the increasing adoption of Virtual Private Clouds (VPCs) within public environments, offering a middle ground between cost-efficiency and security.

8. Case Studies and Industry Applications

Table 1 Selected SAP S/4HANA Cloud implementations across sectors, highlighting technology stacks and outcomes.

Sector	Company	Key Use Cases	Technologies/Modules Used	Reported Benefits
Manufacturing	Dangote Group	Centralized logistics, predictive maintenance, and demand planning	SAP S/4HANA Cloud, IoT sensors, EWM	Reduced downtime, improved throughput, and agile manufacturing
Telecom	MTN Nigeria	Unified procurement, supplier automation, and retail inventory	SAP Ariba, SAP Business Network, S/4HANA Spend Analytics	Faster P2P cycles, improved stock visibility
Public Energy	NNPC	Compliance-driven procurement, logistics tracking	SAP S/4HANA Cloud, mobile confirmations, GRC integration	Greater transparency, regulatory compliance
Private Energy	TotalEnergies Nigeria	Scenario planning, depot management, and supplier onboarding	SAP IBP, Ariba, IoT fuel sensors, GRC, analytics	Risk mitigation, faster procurement, improved replenishment

Note: The case studies presented in this table are based on publicly available reports, vendor documentation, and industry analyses of SAP S/4HANA Cloud implementations. Specific configurations and outcomes may vary across organizations and deployment contexts.

8.1. Manufacturing Sector: Dangote Group

The Dangote Group, one of Africa's largest industrial conglomerates, exemplifies the potential of SAP S/4HANA Cloud in transforming manufacturing logistics. With operations spanning cement, sugar, salt, and fertilizer production, the company has leveraged SAP's cloud-first architecture to centralize its supply chain processes across multiple sites.

Using SAP S/4HANA Cloud, Dangote streamlined its logistics planning through real-time visibility into inbound and outbound transportation, inventory levels, and production cycles. By integrating Internet of Things (IoT) sensors with SAP's in-memory computing capabilities, Dangote achieved predictive maintenance for critical assets, reducing downtime and improving throughput. Advanced analytics enabled the company to forecast demand patterns and optimize raw material sourcing, which is critical in Nigeria's often volatile infrastructure and transport landscape. Additionally, the integration of SAP Extended Warehouse Management (EWM) into the S/4HANA core has improved warehouse automation, reduced lead times, and supported agile manufacturing responses.

8.2. Telecommunications Sector: MTN Nigeria

MTN Nigeria, the giant telecom operator in West Africa, has a sophisticated need of procurement and logistics, which include the supply of hardware to customer-facing managing inventory needs. Making the move to SAP S/4HANA Cloud allowed MTN to move towards more integrated procurement silos to a unified, streamlined system that provides visibility of spending and opportunity to automate communication with suppliers.

The connection with the SAP Ariba and SAP Business Network allowed the MTN to increase cooperation with its suppliers and accelerate the cycle time between the requisition and payment. S/4HANA managed intelligent spend analytics in procurement teams in terms of tracking by contract compliance and opportunities to obtain savings. In the

case of retail logistics, the platform facilitates dynamic allocation of stock through the region-based outlets so that SIM cards, mobile devices and products are distributed according to the current norms of demand. This responsiveness is very important in the dynamic telecom market of Nigeria as any delay in responding to the market may directly affect customer retention.

8.3. Energy Sector Applications: NNPC (Public) and TotalEnergies Nigeria (Private)

In an attempt to modernize the national supply chain infrastructures, public sector organizations such as NNPC have started to adopt cloud based ERP solutions. Where NNPC is concerned, SAP S/4HANA Cloud has distinguished itself by propelling transparency, regulatory compliance, and effectiveness in procurement and logistics operations that cut across exploration, refining, and downstream distribution.

NNPC minimized manual bottlenecks by transforming its procurement processes into digital ones and optimally integrated the checks with regulations to address Nigerian laws on procurement. Moreover, geospatial integration helps to track logistics traffic chains of petroleum product flow, between depots and retailing stations, ensures fewer leakages and increases accountability in operation.

TotalEnergies Nigeria, a major multinational company in the downstream petroleum sector in Nigeria has a comprehensive logistics and procurement network, which includes importation of products, freight depots, blending plants of lubricants and the distribution of more than one thousand retail outlets spread across the country. These operations are being integrated into a data-driven real-time ecosystem thanks in part to the adoption of the SAP S/4HANA Cloud.

With no dependency on spreadsheets or back-office systems, TotalEnergies can now run complex integrated scenario simulations to assess the impact of global crude price movements, FX fluctuations or a change of regulation (e.g. subsidy removal) locally to fuel prices and inventory levels using SAPs Integrated Business Planning (IBP) and embedded predictive analytics. This dexterity is central to the variously changing petroleum quotas systems in Nigeria.

The cloud platform enables centralized inventory visibility across inland and coastal depots, improving truck scheduling and demurrage management, particularly at congested ports like Apapa. Additionally, IoT-enabled fuel monitoring at retail service stations, integrated with SAP's analytics layers, offers real-time tracking of underground tank levels, enabling predictive replenishment and avoiding stock-outs during peak demand.

From a procurement standpoint, TotalEnergies has digitized its tendering and supplier onboarding processes using SAP Ariba. This integration ensures compliance with Nigerian content regulations and internal sustainability criteria, while significantly reducing procurement cycle time. Coupled with automated invoice matching and approval workflows, TotalEnergies has cut down on payment delays and supplier disputes, reinforcing vendor trust and transparency.

Furthermore, SAP’s embedded GRC (Governance, Risk, and Compliance) features help TotalEnergies adhere to both local (e.g., NMDPRA regulations) and international audit requirements, enhancing operational accountability and reducing exposure to compliance risks.

9. Conclusion and Recommendations

The digital transformation of supply chains has evolved from a strategic ambition into an operational necessity, driven by the need for real-time visibility, resilience, and efficiency in increasingly complex and volatile business environments. SAP S/4HANA Cloud emerges as a pivotal solution, enabling organizations to modernize their logistics and procurement functions through cloud-native architecture, intelligent automation, and deep integration across business processes. By embedding technologies such as artificial intelligence, machine learning, and IoT into its core modules, the platform supports agile decision-making, predictive analytics, and streamlined operations across the entire supply network.

Case studies from leading Nigerian enterprises—including the Nigerian National Petroleum Company Limited (NNPC), Dangote Group, MTN Nigeria, and TotalEnergies—demonstrate the tangible value of SAP S/4HANA Cloud in transforming fragmented legacy processes into unified digital workflows. From improved procurement cycle times and dynamic inventory allocation to enhanced contract compliance and supplier collaboration, these organizations have leveraged the platform to respond more effectively to regulatory shifts, foreign exchange constraints, and customer demands. At the same time, the transition to cloud ERP in the Nigerian context also surfaces critical challenges, such as user adoption hurdles, data localization concerns, and the integration of legacy systems.

To fully realize the transformative potential of SAP S/4HANA Cloud, organizations must approach implementation with a strategic, phased methodology that aligns technical deployment with business priorities. Change management and continuous upskilling are essential for mitigating resistance and driving user engagement. Firms are also encouraged to deepen their use of the SAP ecosystem, particularly platforms like SAP Ariba and SAP Business Network, to enhance visibility and collaboration across procurement functions. Ensuring data governance and regulatory compliance, particularly in light of Nigeria's data sovereignty considerations, remains a crucial aspect of sustainable adoption. Furthermore, organizations should begin exploring the next horizon of digital transformation by piloting advanced innovations such as blockchain-enabled supply chain validation, AI-based demand forecasting, and sustainability analytics through digital twins.

In summary, SAP S/4HANA Cloud provides a robust foundation for building intelligent and adaptive supply chains in Nigeria and beyond. Its successful implementation depends not only on technological capabilities but also on strategic alignment, organizational readiness, and continuous innovation. Enterprises that embrace this integrated approach will be better positioned to navigate disruption, drive long-term value, and lead in the era of digital supply networks.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] G. Welker, "Highlights for supply chain in SAP S/4HANA cloud, private edition and SAP S/4HANA | 2022 release," *SAP Community*, May 26, 2023. https://community.sap.com/t5/enterprise-resource-planning-blog-posts-by-sap/highlights-for-supply-chain-in-sap-s-4hana-cloud-private-edition-and-sap-s/ba-p/13553064 (accessed Jul. 10, 2025).

[2] Redwood, "SAP S/4HANA Architecture | Complete Guide," *Redwood*, 2025. https://www.redwood.com/resource/sap-s-4hana-architecture-guide/

[3] Wipro, "Autoguide AGVs and SAP S/4HANA for Smart Warehousing - Wipro," *Wipro.com*, 2020. https://www.wipro.com/applications/smart-warehousing-with-automated-guided-vehicles-and-sap-s-4hana-erp/ (accessed Jul. 10, 2025).

[4] A. Pattanayak, "SAP S/4HANA Embedded Analytics: An Overview," *Journal of Computer and Communications*, vol. 05, no. 09, pp. 1–7, 2017, doi: https://doi.org/10.4236/jcc.2017.59001.

[5] I. Mutambik, "The Role of Strategic Partnerships and Digital Transformation in Enhancing Supply Chain Agility and Performance," *Systems*, vol. 12, no. 11, pp. 456–456, Oct. 2024, doi: https://doi.org/10.3390/systems12110456.

[6] L. Ning and D. Yao, "The Impact of Digital Transformation on Supply Chain Capabilities and Supply Chain Competitive Performance," *Sustainability*, vol. 15, no. 13, p. 10107, 2023, doi: https://doi.org/10.3390/su151310107.

[7] B. Ahn and H. Ahn, "Factors Affecting Intention to Adopt Cloud-Based ERP from a Comprehensive Approach," *Sustainability*, vol. 12, no. 16, p. 6426, Aug. 2020, doi: https://doi.org/10.3390/su12166426.

[8] C. Lee, H. F. Kim, and B. G. Lee, "A Systematic Literature Review on The Strategic Shift to Cloud ERP: Leveraging Microservice Architecture and MSPs for Resilience and Agility," *Electronics*, vol. 13, no. 14, pp. 2885–2885, Jul. 2024, doi: https://doi.org/10.3390/electronics13142885.

[9] A. Raj, A. A. Mukherjee, A. B. L. de S. Jabbour, and S. K. Srivastava, "Supply Chain Management during and post-COVID-19 pandemic: Mitigation Strategies and Practical Lessons Learned," *Journal of Business Research*, vol. 142, no. 1, pp. 1125–1139, 2022, doi: https://doi.org/10.1016/j.jbusres.2022.01.037.

[10] SAP, "Embrace Agility and Upgrade Your Cloud ERP for Success," *Sap.com*, 2023. https://www.sap.com/resources/embrace-agility-and-upgrade-for-success (accessed Oct. 21, 2024).

[11] Accenture, "Accenture Technology Vision for SAP® Solutions 2020," 2020. Accessed: Jul. 10, 2025. [Online]. Available: https://www.accenture.com/content/dam/accenture/final/a-com-migration/manual/r3/pdf/Accenture-007123A-SAP-Tech-Vision-2020-Brochure.pdf

[12] S. Kumar Nendrambaka, "The Next Gen of SAP Cloud ERP with AI: Rise with SAP and Grow with SAP S/4HANA Cloud," *International Journal of Science and Research (IJSR)*, vol. 13, no. 11, pp. 1795–1797, Nov. 2024, doi: https://doi.org/10.21275/sr241128005454.

[13] Gartner Research, "Magic Quadrant for Cloud ERP for Product-Centric Enterprises," *Gartner*, 2023. https://www.gartner.com/en/documents/4800931

[14] M. N. Rizza, L. Greden, and M. Marden, "The Business Value of SAP Business Technology Platform with SAP S/4HANA Cloud - Executive Summary," *SAP*, 2023. https://www.sap.com/documents/2023/01/f22a3ecf-5b7e-0010-bca6-c68f7e60039b.html (accessed Jul. 10, 2025).

[15] G. U. Ebirim, I. F. Unigwe, O. F. Asuzu, B. Odonkor, E. E. Oshioste, and U. I. Okoli, "A Critical Review of ERP Systems Implementation in Multinational Corporations: Trends, Challenges, and Future Directions," *International Journal of Management & Entrepreneurship Research*, vol. 6, no. 2, pp. 281–295, Feb. 2024, Available: https://fepbl.com/index.php/ijmer/article/view/770

[16] A. Wattanajantra, "Is ERP the Key to post-COVID Business success?," *Sage Advice US*, Jan. 04, 2021. https://www.sage.com/en-us/blog/erp-post-covid-business/

[17] N. Bansla and Rajneesh, "Future ERP: In-Memory Computing (IMC)Technology Infusion," *Journal of Information Technology and Sciences*, vol. 6, no. 3, pp. 17–21, Oct. 2020, doi: https://doi.org/10.46610/joits.2020.v06i03.003.

[18] M. Zontul, Z. G. Ersan, I. Yelmen, T. Cevik, F. Anka, and K. Gesoglu, "Enhancing GPS Accuracy with Machine Learning: a Comparative Analysis of Algorithms," *Traitement Du Signal*, vol. 41, no. 3, pp. 1441–1450, Jun. 2024, doi: https://doi.org/10.18280/ts.410332.

[19] S. Tongsuksai, S. Mathrani, and K. Weerasinghe, "Critical Success Factors and Challenges for Cloud ERP System Implementations in SMEs: a Vendors' Perspective," *2021 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE)*, Dec. 2021, doi: https://doi.org/10.1109/csde53843.2021.9718428.

[20] SAP, "SAP S/4HANA Training & Certification Courses | Overview," *training.sap.com*, 2025. https://training.sap.com/content/sap-s4hana-training-overview

[21] D. Colgan, "A Journey We Must All Embark On: from SAP ECC to SAP S/4HANA for the Public Sector," *Deloitte*, Jan. 13, 2025. https://www.deloitte.com/dk/en/blogs/tech/blog-david-colgan-a-journey-we-must-all-embark-on.html (accessed Jul. 10, 2025).

[22] OECD, "EU Data Protection and Policy: considering Artificial Intelligence," *ComplexDiscovery*, Jul. 27, 2019. https://complexdiscovery.com/eu-data-protection-and-policy-considering-artificial-intelligence/?amazonai-language=de&mode=grid

[23] J. Bond, *Enterprise Cloud*. O'reilly, 2015.