

Brownfield Versus Greenfield Tax-Engine Transformation In SAP S/4HANA Migrations: A Technology-Centric Decision Framework For Indirect-Tax Determination

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Abstract

The approaching end of mainstream maintenance for SAP ERP Central Component (ECC) has forced a large installed base of enterprises to choose a transformation path to SAP S/4HANA. The literature treats this choice — chiefly the contrast between a greenfield (new implementation) and a brownfield (system conversion) approach — almost exclusively at the level of the ERP digital core, while the external indirect-tax determination engine that sits alongside that core is rarely analysed as a first-class architectural decision. This paper argues that the tax-determination layer warrants its own brownfield-versus-greenfield analysis because of its distinctive technical characteristics: real-time coupling to order-to-cash and procure-to-pay processes, jurisdiction and content dependencies, accumulated custom determination logic, and large volumes of exemption-certificate and master-data. Drawing on peer-reviewed research in enterprise-system migration and legacy modernization, on a Carnegie Mellon Software Engineering Institute technical report, on official SAP and tax-vendor integration documentation, and on recent industry adoption research, the paper synthesises a technology-centric decision framework. The framework maps the recommended transition archetype to what an organization already possesses — its existing engine estate, customization burden and technical debt, data quality, deployment model, and content-currency requirements. The central finding is that neither path is universally superior; rather, a brownfield re-point is most defensible when a well-governed engine and clean determination logic already exist, whereas a greenfield re-implementation is most defensible when legacy logic is entangled, data quality is poor, or a clean-core, cloud-first target state is the strategic objective.

Keywords: *SAP S/4HANA; brownfield; greenfield; indirect tax; tax engine; tax determination; clean core; system conversion; Vertex O Series; ONESOURCE; legacy modernization.*

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I. Introduction

Enterprise resource planning (ERP) systems have become the transactional backbone of large organizations, and their replacement or modernization is among the most consequential technology programs an enterprise undertakes. The decision is now unavoidable for the SAP installed base: mainstream maintenance for SAP Business Suite 7, which includes SAP ECC, is scheduled to end on 31 December 2027, with optional extended maintenance available through 2030 at a premium. Industry modelling suggests that, despite an expected acceleration, only a little over half of the legacy base will have completed the transformation to SAP S/4HANA by the time mainstream maintenance lapses, leaving a substantial migration wave compressed into a narrow window.

Most practitioner and academic discussion of the migration frames the choice as one between two archetypes at the level of the ERP digital core. A greenfield approach is a new implementation that re-engineers processes on a clean slate; a brownfield approach is a system conversion that upgrades the existing landscape in place, preserving configuration, customization, and historical data. A third, selective or hybrid path blends the two. These archetypes are well characterised for the core, yet the external indirect-tax determination engine — the specialised subsystem that calculates sales and use tax, value-added tax (VAT), and goods-and-services tax (GST) at transaction time — is seldom analysed as an architectural decision in its own right.

This omission matters. The tax engine is not an ordinary module. It is invoked synchronously during order-to-cash and procure-to-pay processing, it depends on continuously changing external content (rates, rules, and jurisdiction boundaries), and over years of operation it accumulates a dense layer of custom determination logic, tax-code mappings, and exemption-certificate data. When an enterprise converts or rebuilds its ERP core, it must decide independently whether to carry the existing engine forward and re-point it, or to re-implement the

determination model afresh. The technical consequences of that decision — for upgrade stability, audit exposure, and long-term maintainability — are distinct from those of the core migration itself.

Objective and contribution

This paper develops a technology-centric framework for the brownfield-versus-greenfield decision as it applies specifically to the indirect-tax determination layer. Rather than asking which archetype is best in the abstract, it asks a more useful question: given what an organization already has, which transition archetype for the tax engine is most defensible on technical grounds? The contribution is threefold. First, the paper isolates the tax engine as a distinct unit of architectural analysis. Second, it identifies the technology dimensions that should drive the decision. Third, it offers a decision matrix that maps starting conditions to recommended paths, illustrated with representative cases.

Scope and method

The analysis is conceptual and integrative. It synthesises three bodies of evidence: peer-reviewed research on ERP implementation success factors and legacy-system modernization; authoritative technical documentation from SAP and from the principal tax-engine vendors describing how determination engines integrate with SAP ECC and S/4HANA; and recent industry adoption research that quantifies the prevalence of each migration approach. The scope is deliberately confined to the technology dimension of the decision; organizational, financial, and change-management considerations are acknowledged but treated as boundary conditions rather than as the focus.

II. The Tax Engine Within The Sap Architecture

Why tax determination is externalised

A modern enterprise rarely calculates indirect tax inside the ERP core. Instead it delegates determination to a dedicated engine that maintains the rates, rules, and jurisdiction content required to tax a transaction correctly anywhere the business operates. This externalisation is itself a clean-core design choice: it decouples volatile, jurisdiction-specific tax logic from the comparatively stable ERP core so that frequent regulatory change does not require modification of the core system. The leading engines — Vertex O Series, Thomson Reuters ONESOURCE Determination, and Avalara — package global content, calculation logic, and certificate management behind a service interface, and are offered through certified or SAP-endorsed integrations.

Integration mechanics

In an SAP environment the engine is wired into the application through the standard tax interface. In the United States, the S/4HANA integration uses an SAP-delivered tax procedure (for example, 0TXUSX) and condition types such as UTXJ within the pricing procedure; address data is passed to the engine, which returns a jurisdiction code and the calculated tax, and writes back the information required for legal reporting and compliance. Determination is executed for the Sales and Distribution, Materials Management, and Finance modules during order and invoice processing, covering both procure-to-pay and order-to-cash flows as well as logistics invoice verification. Vendors increasingly supply pre-built connectors, open application programming interfaces (APIs), and composable, side-by-side deployment options that align with SAP's clean-core extensibility strategy and reduce reliance on core modifications and middleware.

Two technical properties follow from this design and shape the migration decision. First, the engine is tightly coupled to transaction processing in real time, so any re-point or re-implementation must preserve correct, low-latency determination across every affected business process. Second, the determination outcome depends on master-data quality — material and customer tax classifications, ship-to and ship-from data, and exemption certificates — so the state of that data is as decisive as the engine configuration itself.

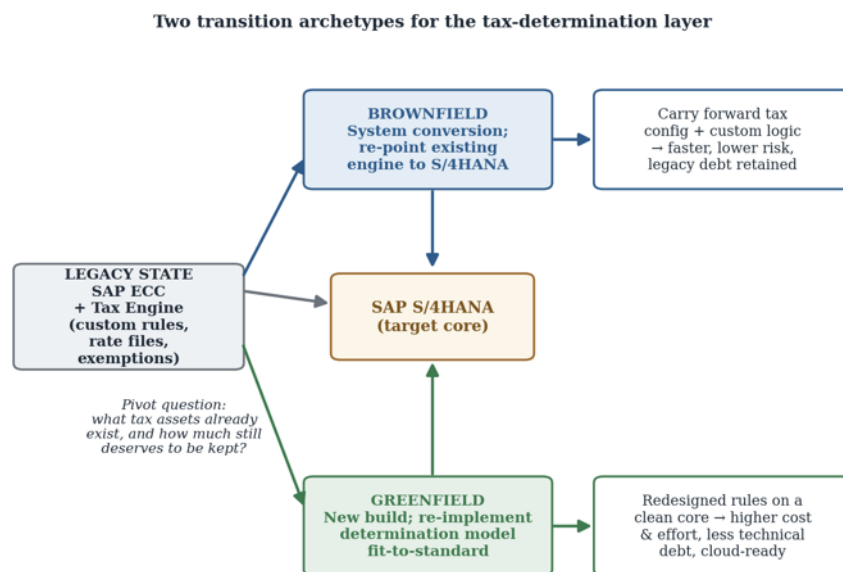


Figure 1. Brownfield and greenfield transition archetypes for the tax-determination layer. Source: author's synthesis of SAP and tax-vendor integration documentation [10]–[12].

III. Brownfield And Greenfield As Transformation Archetypes

Greenfield: new implementation

A greenfield migration installs and configures a new S/4HANA landscape from a clean slate. Its principal technical advantage is a clean core: outdated or unused custom code is eliminated, processes are redesigned to SAP best practice, and the system is positioned to adopt new releases, cloud deployment, and embedded innovation with minimal friction. The trade-off is cost and time, because critical customizations that the business depends on must be re-developed rather than carried forward, and the redesign demands extensive planning and change management.

Brownfield: system conversion

A brownfield migration converts the existing SAP landscape in place. It resembles a traditional technical upgrade, combining a database migration with an application conversion while retaining configuration, customization, and historical data. It is faster, initially less costly, and less disruptive than a greenfield build, and it preserves proven processes. Its principal technical risk is that it carries forward legacy inefficiencies and accumulated technical debt; without subsequent remediation, the converted system inherits the complexity it started with.

Hybrid and selective transitions

Between the two poles lies a family of selective approaches — sometimes labelled bluefield or selective data transition — that begin from a copy of the existing system, strip transactional and master data, convert the shell, and then reload selected data. These approaches let an organization preserve what works while redesigning what does not, avoiding a single high-risk big-bang cutover, at the cost of additional tooling and data-handling effort. A widely recommended variant is a two-step strategy: convert via brownfield first to limit disruption, then progressively remediate custom code toward a clean core.

Mapping the archetypes onto the tax layer

These archetypes apply to the tax engine with a specific meaning. A brownfield tax transition re-points the existing engine to the converted core, preserving determination rules, tax-code mappings, rate files, and certificate data. A greenfield tax transition re-implements the determination model, re-deriving rules from current requirements, adopting standard configuration, and consciously discarding legacy logic that no longer earns its place. The selective path re-points the engine for stable, well-governed jurisdictions while re-implementing determination for those that are entangled or non-compliant.

IV. Technology Decision Dimensions

Research on ERP implementation consistently finds that technical factors — the fit of the system, data management and conversion, data accuracy and quality control, and the compatibility of the data model with legacy systems — are among the decisive determinants of success, alongside organizational and process factors. Studies that rank critical success factors place appropriate system selection and technical implementation prominently, and an organizational-fit perspective shows that the gap between the package and existing processes strongly conditions outcomes. Translated to the tax layer, six technology dimensions structure the decision.

1. The existing engine estate

The first question is whether a tax engine already exists and how well it is governed. An enterprise running a current, certified engine with disciplined, well-documented configuration possesses an asset worth preserving, which favours a brownfield re-point. An enterprise with no engine, an end-of-life product, or determination logic embedded directly in the ERP core has little to carry forward, which favours a greenfield build.

2. Customization burden and technical debt

Legacy modernization research warns that conversion preserves not only assets but also liabilities. The Software Engineering Institute's analysis of modernization strategies frames the choice in terms of how much of a legacy system can be salvaged versus rebuilt, and systematic studies of modernization echo that the level of entanglement governs feasibility. Where determination logic has grown into a thicket of custom rules, user exits, and undocumented workarounds, re-pointing simply migrates technical debt; SAP's clean-core guidance explicitly prioritises eliminating the highest-risk, tightly-coupled extensions because they break during upgrades. Heavy, opaque customization therefore tilts the decision toward greenfield re-implementation.

3. Data quality and master data

Because determination depends on master data, the quality of tax classifications, jurisdiction data, and exemption certificates is pivotal. The ERP literature treats data accuracy and data-quality control as core technical success factors, and parallel-run experience shows that data-quality defects frequently surface only during migration. Clean, reliable data supports a low-risk brownfield re-point; pervasive data-quality problems argue for a greenfield rebuild that cleanses and re-derives the data rather than propagating defects into the new system.

4. Deployment model and clean-core constraints

The target deployment model interacts strongly with the decision. A move to public-cloud S/4HANA, or a clean-core, BTP-first strategy that decouples extensions from the core via released APIs and side-by-side services, constrains the kinds of engine customization that can be carried forward and therefore favours re-implementation against standard, side-by-side patterns. A private-cloud or on-premise target with greater tolerance for classic extensions can more readily accommodate a re-pointed engine.

5. Content currency and regulatory change

Indirect tax is subject to continual regulatory change, including the global spread of real-time and e-invoicing mandates. Where the engine's content and architecture already keep pace — through automated rate and rule updates and global determination coverage — a re-point preserves a working compliance capability. Where the legacy configuration cannot accommodate emerging mandates without significant rework, the marginal effort of re-pointing approaches that of re-implementing on a modern, content-current platform.

6. Risk, cost, timeline, and resources

Finally, the decision is bounded by risk tolerance, budget, schedule, and the availability of scarce SAP and tax-technology skills. The compressed migration window is expected to intensify demand for consultants and partners, making resource availability a genuine constraint. A brownfield re-point conserves scarce effort and shortens the schedule; a greenfield re-implementation spends more of both in exchange for a cleaner, more durable outcome.

V. A Decision Framework: Matching The Path To The Starting Point

Synthesising the six dimensions yields a decision matrix that maps an organization's starting conditions to a recommended tax-engine transition archetype. The matrix is not deterministic; it expresses the direction in which each condition pushes the decision, and real cases combine conditions that must be weighed together.

Starting condition (what you already have)	Leaning	Primary technical rationale
Current, certified engine; clean, well-documented rules	Brownfield re-point	Preserve a working, low-debt asset; minimise risk and schedule
Heavy, entangled custom determination logic and workarounds	Greenfield rebuild	Avoid migrating technical debt; reach a clean core
Poor master-data and certificate quality	Greenfield rebuild	Cleanse and re-derive data rather than propagate defects
No engine, or tax logic embedded in the ERP core	Greenfield build	Little to carry forward; externalise determination cleanly
Public-cloud / clean-core, BTP-first target state	Greenfield / selective	Re-implement against standard, side-by-side patterns
Mixed estate: some clean jurisdictions, some entangled	Selective / hybrid	Re-point the stable, re-implement the problematic
Severe time/resource constraint near the deadline	Two-step (brownfield then remediate)	Limit disruption now; pursue clean core afterward

Table 1. Technology-centric decision matrix for the tax-engine transition.

When a brownfield re-point makes the most sense

A brownfield re-point is the strongest technical choice when the enterprise already operates a current, certified engine whose determination logic is clean, well-documented, and largely standard, and whose master data and certificate inventory are reliable. In this situation the engine is a working asset; re-pointing it to the converted core preserves a proven compliance capability, conserves scarce skilled effort, and shortens the schedule, while the limited technical debt that is carried forward can be addressed through subsequent, targeted remediation. This case aligns with the profile of organizations that pursue brownfield for the core precisely because their existing landscape is well-optimised.

When a greenfield re-implementation makes the most sense

A greenfield re-implementation is the strongest technical choice when the existing determination logic is heavily customised and entangled, when master-data and certificate quality is poor, when no suitable engine exists, or when the strategic target is a clean-core, public-cloud system. Each of these conditions means that re-pointing would either migrate significant technical debt or be constrained by the target architecture; re-deriving the determination model against standard configuration yields a cleaner, more upgrade-stable, and more durable result, and is consistent with SAP's clean-core direction even though it demands more time, budget, and change management.

When a selective or two-step path fits

Many real estates are mixed: some jurisdictions are clean and well-governed while others are entangled or non-compliant. For these, a selective path re-points the stable portions and re-implements the problematic ones, concentrating effort where it yields the most risk reduction. Where the binding constraint is time or resources near the maintenance deadline, a two-step strategy — convert via brownfield first, then remediate toward a clean core — sequences the work to limit immediate disruption while still reaching the desired end state.

VI. Discussion

Empirical context

Industry research indicates that the broad migration choice is genuinely contested rather than settled. In recent survey research of SAP customers, organizations were split almost evenly between approaches: roughly a third reported pursuing a brownfield strategy, a comparable third a greenfield strategy, and a fifth a hybrid strategy, with the remainder undecided (Figure 2). The same body of research reports an average migration duration of about one and a half years and notes that roughly half of organizations already live on S/4HANA found that costs exceeded their original budgets, underscoring the stakes of the architectural decisions taken early in a program.

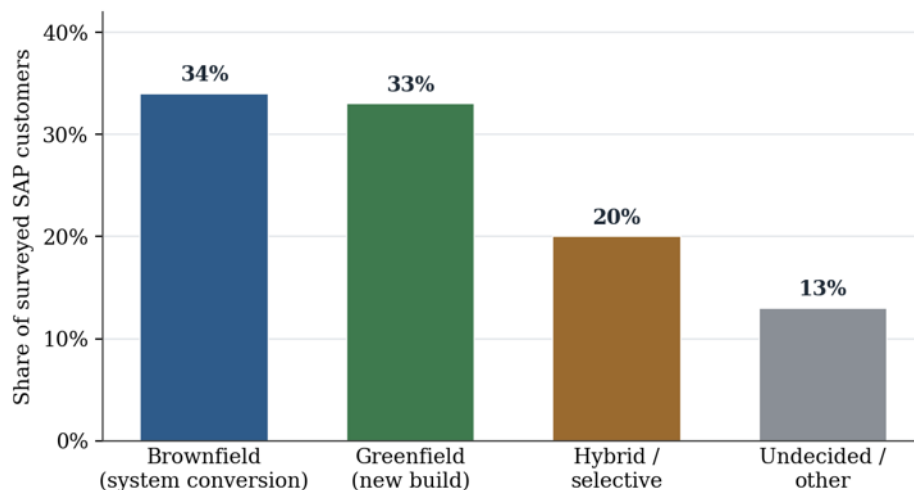


Figure 2. Distribution of SAP S/4HANA migration approaches among surveyed customers. Data source: ASUG S/4HANA Journeys research, 2024 [2].

The adoption trajectory provides the backdrop against which these decisions are made. Modelling based on SAP and Gartner data estimates that under a third of the legacy base was live on S/4HANA at the end of 2023, that a little over half may complete the transformation by the 2027 maintenance deadline, and that the figure could approach four-fifths by 2030 (Figure 3). The compression of so many programs into a short window heightens the value of decision frameworks that help organizations choose efficiently and conserve scarce implementation capacity.

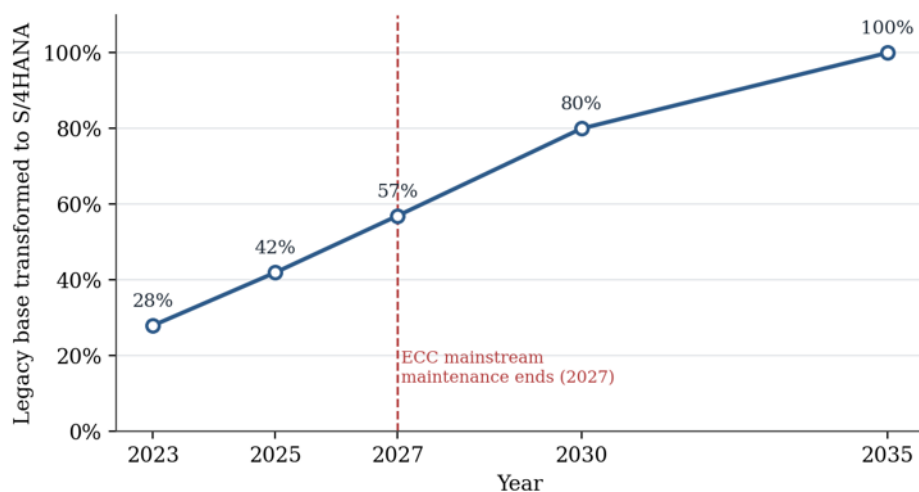


Figure 3. Modelled trajectory of ECC-to-S/4HANA transformation, 2023–2035. Data source: Basis Technologies adoption model and Gartner estimates [1], [3].

Implications for the tax function

Treating the tax engine as a first-class architectural decision has practical implications. It encourages tax and IT functions to inventory their determination logic and data quality early, to classify which assets genuinely deserve to be preserved, and to align the engine transition with the core program's archetype rather than defaulting to it. Because determination is real-time and audit-sensitive, the cost of an ill-judged re-point — propagated defects, undocumented logic, or constrained extensibility — is paid continuously after go-live, which strengthens the case for deliberate analysis before the program commits.

Limitations and future work

This study is conceptual and integrative, and its framework expresses directional guidance rather than a validated predictive model. The relative weight of the six dimensions will vary by industry, geography, and regulatory exposure, and the framework does not quantify the trade-offs. Future work could operationalise the dimensions into a scored assessment, validate the matrix against a portfolio of completed migrations, and examine

how emerging e-invoicing mandates and artificial-intelligence-assisted code remediation shift the balance between re-pointing and re-implementation.

VII. Conclusion

The migration from SAP ECC to S/4HANA forces a brownfield-versus-greenfield decision that the literature has examined thoroughly for the ERP core but rarely for the indirect-tax determination engine that operates alongside it. This paper has argued that the tax engine deserves its own analysis because of its real-time coupling, content dependencies, accumulated custom logic, and data-intensity. Synthesising peer-reviewed migration research, an established legacy-modernization technical report, official integration documentation, and recent adoption data, it has proposed a technology-centric framework that ties the recommended transition archetype to what an organization already possesses. The central conclusion is that the decision is conditional, not categorical: a brownfield re-point is most defensible when a clean, well-governed engine and reliable data already exist, whereas a greenfield re-implementation is most defensible when legacy logic is entangled, data quality is poor, or a clean-core, cloud-first target is the goal — with selective and two-step paths serving the many estates that fall in between.

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References

- [1]. Basis Technologies, The True State Of S/4HANA 2025. Basis Technologies, 2025. [Online]. Available: <https://www.basistechnologies.com/blog/the-true-state-of-s4hana/>
- [2]. ASUG, 2024 SAP S/4HANA Journeys: Voice Of The ASUG Member. Americas' SAP Users' Group, 2024. [Online]. Available: <https://www.asug.com/insights/the-state-of-sap-s-4hana-adoption-trends-successes-and-challenges>
- [3]. Gartner, Inc., "Estimates Of SAP S/4HANA Adoption Within The SAP Business Suite 7 / ECC Installed Base," Cited In Industry Adoption Analyses, 2023–2024.
- [4]. R. C. Seacord, S. Comella-Dorda, G. Lewis, P. Place, And D. Plakosh, "Legacy System Modernization Strategies," Technical Report CMU/SEI-2001-TR-025, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, PA, USA, 2001.
- [5]. E. De Vargas Agilar, R. Bonifácio De Almeida, And E. D. Canedo, "A Systematic Mapping Study On Legacy System Modernization," In Proc. 28th Int. Conf. On Software Engineering And Knowledge Engineering (SEKE), 2016, Pp. 345–350, Doi: 10.18293/SEKE2016-059.
- [6]. S.-J. Hong And Y.-G. Kim, "The Critical Success Factors For ERP Implementation: An Organizational Fit Perspective," Information & Management, Vol. 40, No. 1, Pp. 25–40, 2002.
- [7]. F. F.-H. Nah And S. Delgado, "Critical Success Factors For Enterprise Resource Planning Implementation And Upgrade," Journal Of Computer Information Systems, Vol. 46, No. 5, Pp. 99–113, 2006.
- [8]. "Identifying Critical Success Factors (CSF) In ERP Implementation Using AHP," Peer-Reviewed Study, Sciencedirect, 2024. [Online]. Available: <https://www.sciencedirect.com/org/science/article/pii/S1548771724000733>
- [9]. "Systematic Literature Review Of Critical Success Factors On Enterprise Resource Planning Post-Implementation," Cogent Business & Management, 2023, Doi: 10.1080/23311975.2023.2264001.
- [10]. SAP SE, "How To Extend SAP S/4HANA Cloud The Right Way — Clean Core," SAP News Center, 2025; And "ABAP Extensibility Guide — Clean Core For SAP S/4HANA Cloud," SAP Community, 2025.
- [11]. Vertex, Inc., "Vertex Indirect Tax Determination For SAP ERP And SAP S/4HANA," SAP Partner Solution Documentation, And "Streamline Tax Compliance With Vertex Integrations For SAP S/4HANA," 2025–2026.
- [12]. Thomson Reuters, "ONESOURCE Indirect Tax Integration For SAP ERP And SAP S/4HANA," Integration User Guide (US Tax Procedure 0TXUSX), 2019; SAP Partner Solution Documentation.
- [13]. Techtarget, "Compare SAP Greenfield Vs. Brownfield Approach For S/4HANA," Searchsap, 2026. [Online]. Available: <https://www.techtarget.com/searchsap/Tip/SAP-Greenfield-Vs-Brownfield-Approach-Which-To-Use-For-S-4HANA>
- [14]. Kyndryl, "Greenfield Or Brownfield: Choosing The Best Approach For SAP S/4HANA Migration," 2025. [Online]. Available: <https://www.kyndryl.com/us/en/perspectives/articles/2025/04/Sap-S4hana-Migration>
- [15]. "Cloud Migration Strategies For Legacy ERP Systems: Challenges & Solutions," International Journal For Research Publication And Seminar, ISSN 2278-6848, Vol. 16, No. 2, 2025.
- [16]. Sapinsider, "Maximizing SAP S/4HANA Strategies To Improve Tax Automation," 2026. [Online]. Available: <https://sapinsider.org/>