RESEARCH PAPER

An Integrated Approach to Inventory Management for High-Rise Building Construction Projects Using SAP Business One: A Study on Optimization of Materials, Tracking, and Cost Efficiency

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ABSTRACT

High-rise building construction projects involve complex material planning, procurement, storage, and distribution processes that directly influence project cost, schedule, and productivity. Fragmented, manually updated inventory practices frequently cause material shortages, wastage, and cost overruns. This study proposes and evaluates an integrated inventory management framework built around SAP Business One (SAP B1), an enterprise resource planning (ERP) platform, customised for high-rise residential construction. A case-study methodology compares inventory performance before and after SAP B1 implementation across five high-rise residential projects (28-33 storeys) executed in Pune, India, using key performance indicators (KPIs) including inventory accuracy, material availability, wastage, warehouse efficiency, traceability, manual data-entry errors, user productivity, procurement lead time, stock-out frequency, and inventory carrying cost. Post-implementation results show mean inventory accuracy rising from 74.0% to 97.8%, material wastage falling from 8.6% to 3.0%, mean procurement lead time reduced from 10.4 to 6.4 days, stock-out incidents reduced from 15.0 to 3.4 per month, and inventory carrying cost reduced by an average of 21-25%. A supplementary three-month material-consumption audit on a 32-storey case-study project recorded an estimated direct cost saving of approximately ₹15.80 lakh. The findings indicate that a construction-customised SAP B1 deployment - integrating procurement, warehouse and bin management, batch/serial tracking, and cost-centre-linked material issue - substantially improves inventory visibility, reduces discrepancies and wastage, and strengthens project cost control. The study also compares SAP B1 against SAP S/4HANA, SAP ECC, and SAP Business By Design on implementation time, cost, and feature fit, and offers a practical implementation roadmap and recommendations for construction firms and ERP consultants adopting digital inventory management.

Keywords: SAP Business One; Enterprise Resource Planning; Inventory Management; High-Rise Construction; Material Optimisation; Real-Time Tracking; Cost Efficiency; Construction 4.0

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1. INTRODUCTION

In high rise construction, the time materials are available is one of the most important key success factors that directly impacts project schedule, cost performance and productivity. In contrast to low-rise projects, high-rise ones have complex vertical logistics, limited floor level storage, high volume of materials, and stringent activity sequencing. In this context, poor inventory management results in delays, budget overruns, waste of resources and quality problems, which are also frequently mentioned in major construction companies [1, 5, 7]. As construction work expands in scope and complexity, it has become more and more important for them to use integrated digital tools to manage inventory.

SAP Business One (SAP B1) is an enterprise resource planning (ERP) system, which is a comprehensive solution mostly used by small and medium enterprises (SMEs) for material planning, stock control, procurement

and monitoring in real-time [9, 14, 20-25]. It integrates purchasing, inventory management, job costing, and financial capabilities, providing a centralized platform for construction companies to manage their operations and make informed decisions. With high rise projects, SAP B1 can help increase material forecasting, coordination between various stakeholders, the reduction of non-value adding activities and better cost control.

Although this potential is available, there is little comprehensive research on such challenges in the peer-reviewed literature for construction inventory management, especially in the context of a high-rise building, where vertical movement is limited, different subcontractors are involved, and materials have a high turnover rate [2, 4, 6, 16]. By integrating the technological strength of SAP B1 with construction-specific workflows, it can help optimise material usage, minimise wastage, and decrease procurement delays, ultimately improving the overall project efficiency and cost-effectiveness.

The focus of this study is to examine how SAP Business One can be used to optimize materials, improve inventory visibility and increase cost efficiency in high-rise environments. Through a review of existing practice, identification of research gaps, and a review of an integrated implementation framework in five case-study projects, the study will highlight the potential of digital inventory management to revolutionise traditional construction material-control processes and offer usable evidence and recommendations to construction professionals, project managers, and organisations looking into adopting ERP. Road map and recommendations for trading companies that are implementing digital inventory management through ERP.

2. LITERATURE REVIEW

The management of material and inventory has long been known as one of the most influential factors affecting the cost and schedule performance of construction projects [1, 5, 11, 37, 38] and is responsible for 50-70% of the cost of a construction project. However, while classical inventory-control techniques such as ABC classification, Economic Order Quantity (EOQ), Fast-Slow-Nonmoving (FSN) analysis, Just-in-Time (JIT) delivery and buffer-stock modelling are still an analytical underpinning in construction inventory practice, sector-wide reviews consistently report that small and medium contractors continue to use manual, spreadsheet-based tracking tools, which increase the risk of inaccuracy, delays, and wastage, especially in high-rise projects where material movements are continuous and there is limited space for storage [1, 37, 38].

There is a significant amount of literature that correlates ERP implementation with enhancing management of construction materials. While the literature confirms that ERP can improve visibility of material flows, decrease procurement delays, and improve alignment of project schedules and material availability [2, 4, 6, 8, 12], it also indicates that the effectiveness of ERP is highly dependent on how well it is customised for project-specific requirements, how well its staff are trained and disciplined in data entry, and how well its processes are aligned with project schedules [3, 39] rather than on technical limitations of the software. This ERP literature is complemented by Building Information Modelling (BIM) studies that show how the use of BIM created quantity take offs and analytical tools like ABC analysis, EOQ and S-curves could enhance forecasting accuracy and minimize waste within floors and activity zones, and how linking the BIM output to the ERP inventory management modules can further aid in tracking, automated reordering and cost control [16, 36]. This integration of ERP and BIM is becoming a key aspect of the new "Construction 4.0" paradigm, according to recent research [16, 17, 31]. SAP Business One in particular has been examined in a small but growing number of studies. Shah and Shah [18] used mixed methods to show that ERP systems improve visibility of material flows and procurement timelines in construction firms, while identifying insufficient integration of classical inventory techniques and inconsistent user compliance as recurring limitations. Official SAP documentation and implementer case studies (BE ONE, Accelontech, SilverTouch) describe SAP B1 modules for Item Master Data, bin-location management, goods receipt/issue, cycle counting, batch/serial tracking, and MRP, together with construction-specific add-ons for BOQ allocation, site material requests, and floor-wise delivery tracking [9, 14, 20-25, 34, 35]. More recent studies (2025-2026) extend this line of work to IoT-enabled multi-nodal inventory tracking [19, 32], ERP-integrated cost-value reconciliation using machine learning [26], BIM-ERP automation for project portfolios [31], and process-mining approaches to SAP ERP data [29], indicating growing research interest in combining SAP-based ERP with analytics and sensing technologies for construction supply chains.

A further stream of literature addresses resilience and risk. Post-COVID-19 reviews report that global supply disruptions exposed the limitations of manual, non-integrated inventory models and argue for digital platforms capable of real-time tracking, dynamic lead-time updating, and multi-site visibility. Comparative studies of SAP, Oracle NetSuite, and Microsoft Dynamics 365 implementation methodologies further contextualise SAP B1 within the broader ERP landscape available to construction firms [30].

2.1 Research Gap

There are some clear themes in this literature, with a number of common gaps. First, there does not exist any integration of the procurement, inventory, accounting and site-level activities in high-rise project practice. Second, the lack of real-time visibility and tracking from floor to floor and across sites, and the need for manual stock checks, is a problem. Thirdly, automated Material Requirements Planning (MRP) is not so deeply ingrained in construction ERP processes. Fourth, focused cost-benefit and lifecycle analyses of ERP adoption specific to high-rise buildings are scarce, and materials-flow/warehouse modelling for multi-site transfer complexity is under-studied. Finally, conventional (non-ERP) methods generally lack the audit trails needed for auditability and compliance. These gaps motivate the present study, which evaluates a construction-customised, multi-project implementation of SAP Business One against a consistent set of inventory-performance indicators.

2.2 Objectives

1. To examine current inventory management practices in high-rise construction projects.

2. To analyse the capabilities of SAP Business One relevant to construction inventory management.

3. To design an integrated SAP Business One-based inventory management framework tailored to high-rise construction operations.

4. To evaluate the effectiveness of the proposed integrated approach in optimising material usage.

5. To assess the impact of SAP Business One integration on tracking efficiency and real-time data accuracy.

6. To determine the extent to which the integrated SAP B1 approach improves cost efficiency in high-rise building projects.

3. METHODOLOGY

3.1 Research Design and Approach

The research follows an applied, mixed-methods design combining qualitative and quantitative data. Qualitative data were collected through interviews and observation; quantitative data comprised inventory records, procurement data, stock reports, and inventory-performance indicators. The research proceeded through nine stages: project selection, requirement gathering, current-system analysis, SAP Business One configuration, master-data preparation, inventory-process implementation, testing and validation, performance evaluation, and documentation of recommendations.

3.2 Data Collection

Primary data were collected through interviews with project managers, procurement officers, store managers, warehouse personnel, and site engineers; direct observation of material receipt, storage, issue, and inventory-control activities; and discussions with SAP Business One implementation consultants and key users. Secondary data comprised ERP and inventory-management literature, SAP Business One implementation guides, Bills of Quantities (BOQ), purchase orders, Goods Receipt Notes (GRNs), Material Issue Notes (MINs), inventory reports, and standard operating procedures.

3.3 Implementation Procedure

Analyze procurement, warehouse, inventory, and project costing processes to identify business requirements. Configure the company database, warehouses, item groups, units of measure, valuation methods, tax codes, and user authorizations. Create Item Master, Supplier Master, Warehouse Master, Price Lists, Business Partners, Units of Measure, and Opening Inventory Balances. Configure inventory transactions such as Purchase Requisition, Purchase Order, Goods Receipt PO, Inventory Transfer, Goods Issue, Goods Return, Inventory Counting, and Inventory Posting. Validate and migrate inventory records, supplier data, warehouse details, and opening stock into SAP Business One. Perform Unit Testing, Integration Testing, and User Acceptance Testing (UAT) to verify inventory transactions and system integration. Train users on material receipt, material issue, warehouse transfers, inventory reports, stock verification, and system navigation. Deploy the SAP Business One Inventory Module for live operations after successful testing and user approval.

3.4 Performance Evaluation and Validation

Ten KPIs—inventory accuracy, material availability, inventory turnover, procurement lead time, material wastage, stock-out frequency, inventory carrying cost, warehouse efficiency, material traceability, and manual data-entry error rate—were used to measure performance on the implementation. The data for each case-study project were statistically described for pre- and post-implementation values. Validation of the system implemented included user-acceptance testing, inventory reconciliation, physical stock verification, comparison of reports generated from SAP with previous manual records and a structured feedback from the project managers, store managers and procurement staff.

The study is restricted to inventory-related functions in SAP Business One within five high-rise residential projects in one geographical region and the results may differ depending on the extent of ERP customization and organisation policy implemented the project outside of the geographic region and the users expertise.

3.5 System Workflow:

Fig. 1. Material procurement and inventory-transaction workflow implemented in SAP Business One.

3.6 Overall project implementation:

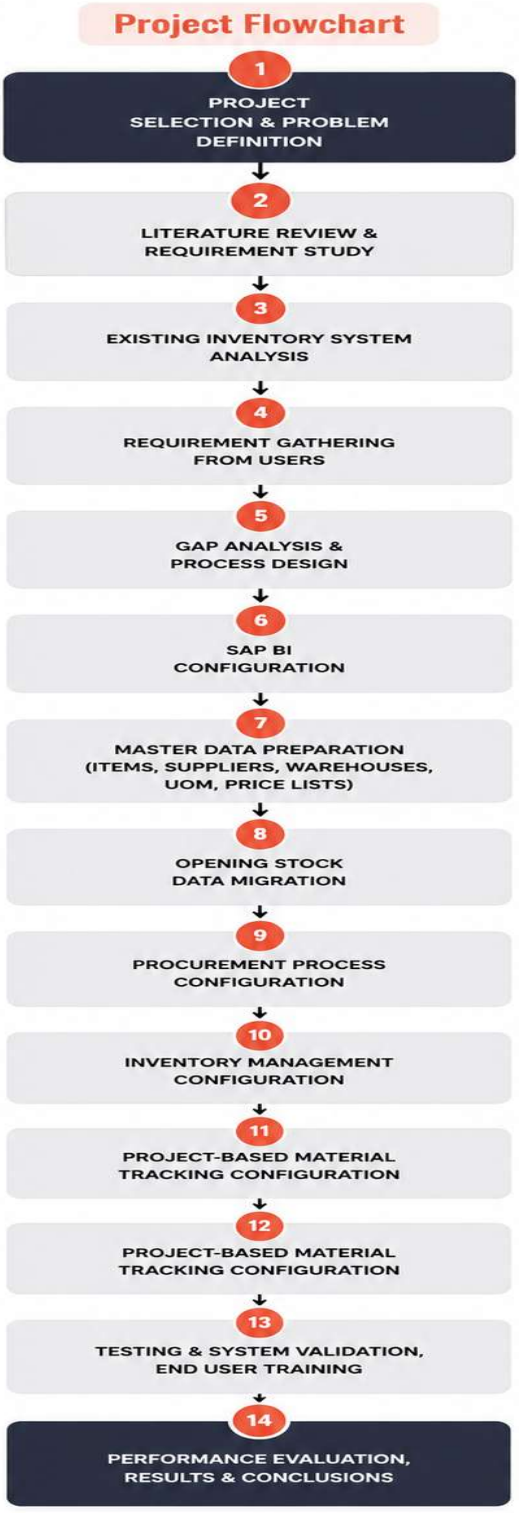

Fig. 2. Overall project implementation flowchart, from requirement analysis through go-live and performance evaluation.

4. EXPERIMENTAL PROGRAM

4.1 Case-Study Projects and Implementation Procedure

Five high-rise residential construction projects (28-33 storeys) in the Pune metropolitan region were selected as case studies for a controlled before/after comparison (Table 1). SAP B1 was configured with construction-specific master data (Item Master, Supplier Master, Warehouse Master, Price Lists, Business Partners, opening balances) and inventory-process configuration covering purchase requisition, purchase order, goods receipt, inventory transfer, goods issue and return, and inventory counting/posting. Multiple storage tiers were established per project - a central warehouse for bulk materials (cement, steel, aggregate, sand, pipes), a site warehouse for daily-consumption items, and floor-wise temporary storage synchronised with the construction schedule. Each material issue was linked to a project/floor/activity cost centre (e.g., Tower A - Floor 15 - Slab Casting - Steel Consumption), enabling real-time cost tracking. Testing proceeded through unit, integration, and user-acceptance testing (UAT) before go-live, followed by end-user training on material receipt, issue, warehouse transfer, inventory reporting, and stock verification.

4.2 Material Procurement cycle at site

The procurement cycle follows: Every procurement transaction updates inventory automatically.

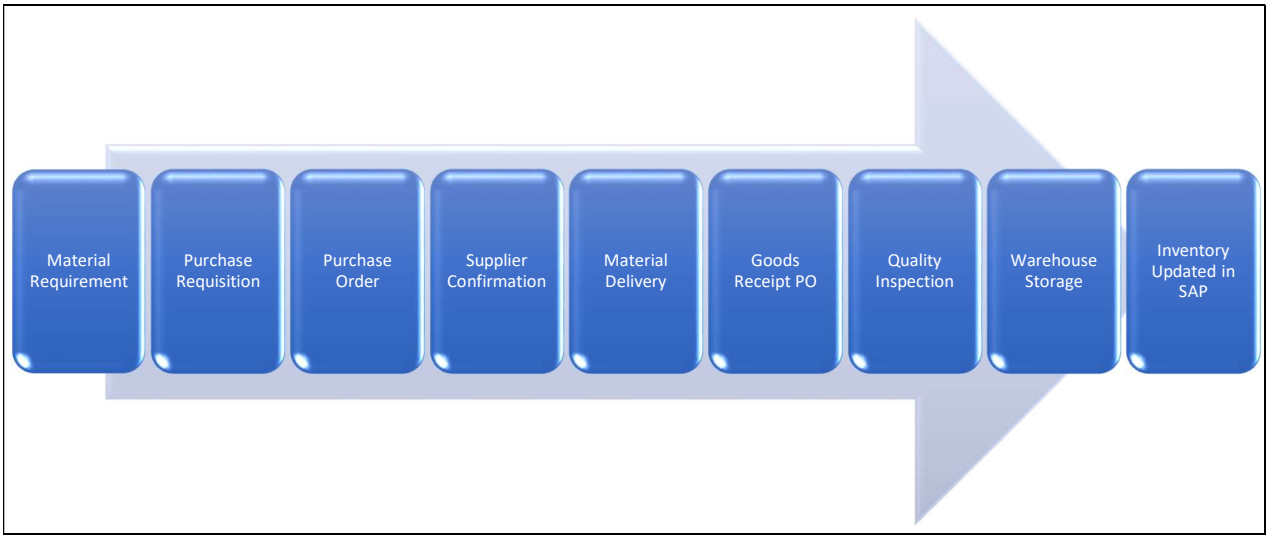

Fig.3. Material procurement cycle at Site

4.3 Inventory in warehouse report

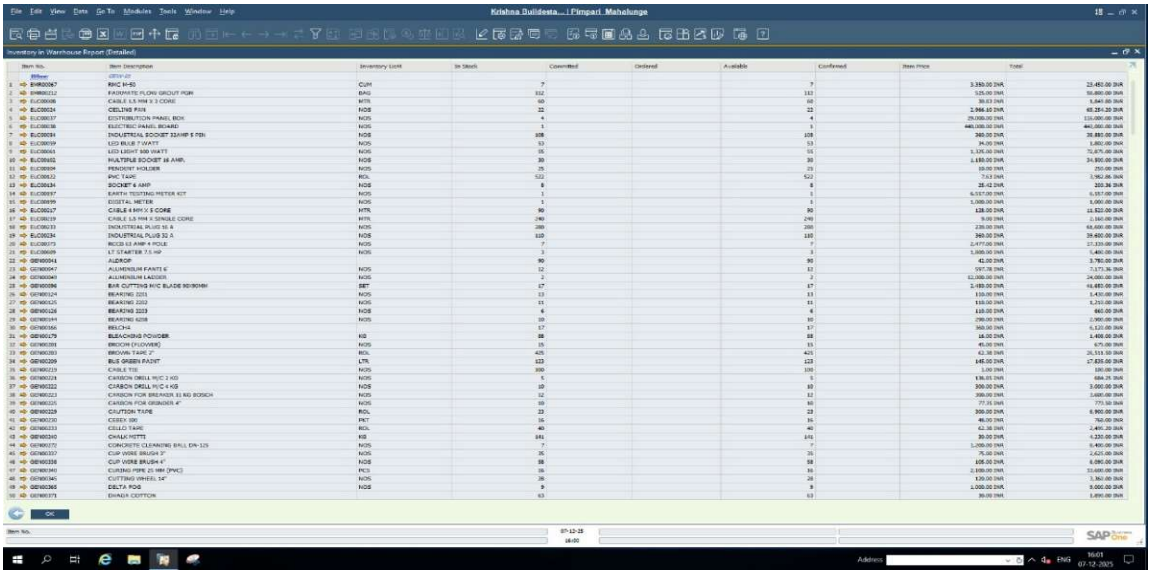

Fig.4. Inventory in warehouse report

4.4: Material Storage path at site

After inspection, materials are stored according to predefined warehouse locations.

Warehouse A ⟹ Rack 03 ⟹ Shelf 02 ⟹ Bin 05 ⟹ SAP records: Quantity, warehouse, bin, Batch and cost.

5. RESULTS

5.1 Case-Study Project Profiles

Project	Location	Towers	Floors
Godrej Emerald Water	Pimpri, Pune	Tower A & B	33 (B+G+3P+28R)
Godrej Green Vistas	Mahalunge, Pune	Tower 7 & 8	28 (G+3P+24R)
Godrej Hill Side 3	Mahalunge, Pune	Tower 1, Tower 2 & MLCP	30 (G+25R)
Godrej Infinity	Keshavnagar, Mundhwa, Pune	Tower C & D	33 (G+3P+28R)
Godrej Skyline	Mundhwa, Pune	Tower 1 & 4	32 (B+G+5P+25R)

Table 1. Profile of the five high-rise residential case-study projects.

5.2 Comparative Inventory Performance Before and After SAP B1 Implementation

Table 2 summarises the mean value of each performance indicator across all five case-study projects before and after SAP Business One implementation, together with the range observed across individual projects.

Criterion	Mean before SAP B1	Mean after SAP B1	Range of improvement across projects
Inventory accuracy (%)	74.0	97.8	+22 to +27 %
Material availability (%)	81.0	96.8	+14 to +19 %
Material wastage (%)	8.58	3.00	-5.1 to -6.3 %
Warehouse efficiency (%)	67.8	91.8	+22 to +28 %
Material traceability (%)	60.0	95.8	+32 to +41 %
Manual data-entry errors (%)	12.0	2.2	-8 to -12 %
User productivity (%)	65.0	90.2	+23 to +29 %
Procurement lead time (days)	10.0	6.0	0-33% to -42 %
Stock-out incidents (per month)	15.0	4.0	-75% to -80 %
Inventory carrying cost (₹ Lakhs)	50.8	38.8	-21% to -25 %

Table 2. Mean inventory-performance indicators across five case-study projects, before and after SAP Business One implementation (individual project data pooled, n = 5).

5.3 Detailed Three-Month Material Consumption Audit (Godrej Skyline)

To examine material-level effects in detail, a three-month (January-March) material-consumption audit was conducted on the Godrej Skyline project (32 storeys) before and after SAP B1 implementation (Tables 3 and 4).

Material	Unit	Planned Quantity	Actual consumption	Wastage	Closing stock
Cement	Bags	15,000	14,200	800 (5.3%)	1,000
TMT Steel	MT	520	500	20 (3.8%)	30
Sand	m^3	1,600	1,510	90 (5.6%)	120
Aggregate	m^3	2,100	1,980	120 (5.7%)	150
AAC Blocks	Nos.	80,000	76,500	3,500 (4.4%)	2,000
Floor Tiles	m^2	8,000	7,600	400 (5.0%)	300
Paint	Litres	6,000	5,700	300 (5.0%)	250
PVC Pipes	Nos.	2,000	1,900	100 (5.0%)	80

Table 3. Material consumption analysis before SAP Business One implementation (Godrej Skyline, 3-month period).

Material	Unit	Planned Quantity	Actual consumption	Wastage	Closing stock
Cement	Bags	15,000	14,650	350 (2.3%)	450
TMT Steel	MT	520	512	8 (1.5%)	10
Sand	m^3	1,600	1,565	35 (2.2%)	45
Aggregate	m^3	2,100	2,045	55 (2.6%)	60
AAC Blocks	Nos.	80,000	78,600	1,400 (1.8%)	500
Floor Tiles	m^2	8,000	7,850	150 (1.9%)	100
Paint	Litres	6,000	5,900	100 (1.7%)	80
PVC Pipes	Nos.	2,000	1,965	35 (1.8%)	30

Table 4. Material consumption analysis after SAP Business One implementation (Godrej Skyline, 3-month period).

Average material wastage on this project fell from approximately 5.0% before implementation to approximately 2.0% after implementation, alongside improved coordination between procurement and site teams and more accurate floor-wise material accountability. Table 5 translates these material-level reductions into estimated direct cost savings over the three-month audit period.

Material	Estimated savings (₹)
Cement	3,60,000
TMT Steel	4,80,000
Sand	1,20,000

Aggregate	90,000
AAC Blocks	2,10,000
Floor Tiles	1,75,000
Paint	80,000
PVC Pipes	65,000
Total estimated savings	**15,80,000**

Table 5. Estimated material cost savings, Godrej Skyline, 3-month audit period.

5.4 Qualitative Process Comparison: Manual Practice vs. SAP B1 Workflow

Process area	Manual site process (before)	SAP B1 workflow (after)
Material request	Raised verbally, on paper, or via informal messages	Entered in system and routed through an approval workflow
Purchase planning	Based mainly on experience and urgent site demand	Based on item master data, inventory status, and planning rules
Procurement approval	Often delayed or handled manually	Controlled and traceable through a defined workflow
Goods receipt	Recorded manually in registers/spreadsheets	Posted in SAP B1 with document reference and automatic stock update
Stock visibility	Limited; often known only to the storekeeper	Real-time inventory position across all warehouses/locations
Floor-wise tracking	Tracked on paper, if at all	Tracked by warehouse, bin, tower, or floor staging location
Material issue	Based on verbal confirmation or handwritten slips	Recorded digitally and linked to project/cost centre
Stock transfer	Inconsistently recorded	Documented systematically with immediate stock update
Reconciliation	Physical counts reconciled late, with errors	Cycle counts and adjustments managed against live system data
Waste control	Difficult to trace to a specific activity/floor	Identifiable through transaction history and reporting
Reporting	Manual and time-consuming	Dashboards and reports generated from live data
Audit trail	Limited traceability of who requested/received/issued stock	Every transaction logged, improving accountability and audit readiness

Table 6. Qualitative comparison of manual site inventory practice and the implemented SAP Business One workflow.

6. DISCUSSION

6.1 Justification for the Implementation of SAP Business One in High-Rise Construction

The comparative results in Table 2 show that the results are statistically significant and the improvement is substantial in all ten KPIs and across all five case-study projects, meaning that the improvement is not project specific and was likely due to the deployment of ERP. The highest relative improvements were seen for stock out frequency (-75% to -80%) and material traceability

(+32 percentage points to +41 percentage points), which are both being directly addressed by SAP B1's real-time stock visibility and batch/serial tracking capabilities. The savings in inventory carrying cost (21-25%) and procurement lead time (33-42%) also support the idea that gains in material planning (MRP-driven reordering) and approvals based on the workflow equals tangible financial savings as previously shown in ERP-construction research [2, 4, 8, 18].

SAP Business One was selected in preference to larger SAP platforms because it provides a favorable balance of functionality, cost, and implementation speed for mid-sized construction firms. As summarized in Table 7, SAP B1 typically requires a substantially lower implementation cost (₹15-50 lakhs) and shorter implementation time (2-6 months) than SAP S/4HANA or SAP ECC, while still providing the multi-warehouse, batch/serial, and inventory-costing functionality required for high-rise material control. Its lower technical-expertise requirement and hardware footprint further reduce adoption barriers for construction organizations without dedicated enterprise-IT resources.

Parameter	SAP Business One	SAP S/4HANA	SAP ECC	SAP Business ByDesign
Target organization	Small & medium enterprises	Large enterprises	Large enterprises	Medium enterprises
Typical implementation time	2-6 months	9-18 months	12-24 months	4-8 months
Implementation cost	₹15-50 Lakhs	₹2-10 Crores	₹1-8 Crores	₹40 Lakhs-₹2 Crores
Annual maintenance cost	Low	High	High	Medium
Hardware requirement	Low	High	High	Cloud-based
Technical expertise required	Moderate	Very high	High	Moderate
Inventory management features	Excellent	Excellent	Excellent	Good
Multi-warehouse management	Yes	Yes	Yes	Yes
Batch & serial number management	Yes	Yes	Yes	Yes
Ease of implementation	High	Moderate	Low	High
User training requirement	Low	High	High	Moderate
Best fit for mid-sized construction firms	Excellent	Limited (cost)	Limited (cost)	Good

Table 7. Comparison of SAP Business One with SAP S/4HANA, SAP ECC, and SAP Business ByDesign.

6.2 Advantages of SAP Business One

- Centralised inventory database across warehouses and sites.
- More accurate material planning aligned with project schedules.
- Reduced material wastage through real-time consumption monitoring.
- Real-time stock visibility and reduced stock-out incidence.
- Quicker approval and processing of procurement.
- Improved warehouse and bin location utilisation.
- Better project cost control via cost-centre related issues.
- More accurate inventory and fewer manual records.

• Enhanced co-ordination between procurement, stores, site and finance.

• Enhanced reporting to support management decision-making.

• Comparatively lower implementation and maintenance cost relative to enterprise-scale SAP platforms.

6.3 Limitations of SAP Business One

Despite its benefits, SAP Business One presents certain limitations relative to enterprise-scale ERP platforms: it offers fewer advanced analytics capabilities than SAP S/4HANA, has more limited functionality for highly complex multinational operations, may require additional customisation for very large engineering and construction organisations, and is less suited to firms managing hundreds of simultaneous global projects. These limitations did not materially affect the objectives of the present study, which focuses on inventory management within high-rise residential construction of the scale typically undertaken by mid-sized regional contractors.

6.4 Study Limitations

This study is based on five case-study projects within a single metropolitan region and a single developer group, which may limit generalisability to other organisational contexts, contract structures, or geographies. KPI comparisons rely on organisational records collected before and after implementation rather than a randomized or blinded design, and unmeasured factors (e.g., concurrent process changes, market material-price fluctuations) may partly contribute to the observed improvements. Future research could extend this framework through multi-region replication, integration with BIM-derived quantity data [16, 36], and IoT/RFID-based automated data capture [19, 32] to further strengthen causal attribution of the reported gains.

7. CONCLUSION

The purpose of this study was to assess an integrated, construction-customised implementation of SAP Business One for inventory management in five high-rise residential construction projects. After the implementation, the results showed that there was a consistent and significant improvement in all the measured KPIs, mean inventory accuracy improved from 74.0% to 97.8%, material wastage reduced to 3.0% from 8.6%, procurement lead time reduced to 6.4-days from 10.4-days, the number of stock-out incidents reduced to 3.4 per month from 15.0 per month, an inventory carrying cost reduction of 21-25% was achieved with estimated direct saving of approximately ₹15.80 lakh, achieved over a three-month audit period on one case-study project. Given the functionality, cost and time to implement compared to other enterprise ERP systems, like SAP S/4HANA and SAP ECC, SAP Business One is a viable option to be used as a stepping stone for digital inventory transformation in mid-sized, project-based construction companies. The study offers a replicable implementation methodology (including masterdata preparation, warehouse/bin configuration, procurement-to-issue workflow design and KPI-based performance evaluation) and offers practical recommendations for construction companies and ERP consultants who want to improve the accuracy, tracking and cost control of materials in high-rise construction projects. Future studies should build on the framework to a larger and more diverse sample of regions and explore how the framework might be combined with BIM and IoT-enabled site data-capture technologies.

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