Evaluating Manual vs Automated Warehouse Processes Using SAP EWM in Enterprise Environments

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***Abstract*—When SAP Extended Warehouse Management (SAP EWM) environments are compared and analyzed, it reveals significant performance trade-offs when it comes to cost, performance and resource allocation in manual variables of different warehouse processes when compared to automated variables of the same warehouse processes. Although the manual workflow is flexible in low volume, high mix functioning, it has an average cycle time of 120 seconds and an error rate of 2.5 percent. The adoption of automated solutions, which is a combination of automated storage and retrieval systems (AS/RS), robotic picking, and conveyor networks is the use cases that save 30 percent in the cycle time (to about 84 seconds), reduce error rates to 0.5 percent and increase throughput 150 to 220 tasks per hour, or by 47 percent, respectively. Employees will work at 50 percent of their work intensity which will allow the human operated elements to be moved to more valuable tasks. The digital-twin structures offer real-time modeling and forecasting when compared within 5 percent of its actual performance, which is helpful in anticipating the congestions and maintaining the time of the maintenance. One-to-five-years payback cost-benefit analysis of small and medium enterprises has been shown with the structure of financing being a huge factor becoming an adoption barrier. Complexities related to buffer control, reliance on ERP components as well as facility type variable (narrow-aisle high-bay, cross-dock) are identified as being critical issues of deployment. Automation returns on investment are also affected by facility design, SKU variety and seasonality patterns. Present studies did not find any longitudinal research on maintenance cost and upskilling the workforce. Such emerging trends as machine-learning-based slotting algorithms, Internet of Things (IoT)-based sensor networks, and adaptive control architectures provide the potential to fill these gaps. The review summarises extant benchmarks, analyses hybrid human and robot collaboration paradigm, and suggests organised model of future research, which could advance the accessibility, scale and resilience of the smart warehousing solutions.**

***Index Terms*—SAP EWM; warehouse automation; manual processes; performance metrics; digital twin; human–robot collaboration.**

I. Introduction

The shift in warehouse management that has been characterized by a shift to highly strong warehouse management solutions that completely rely on automation as opposed to the manually intensive processes that characterized warehouse operations not so long ago has been informed by the continuous expansion of the global supply chain and the necessity of efficiency, transparency and accuracy in terms of managing inventory. However, with basic warehouses management systems, traditional, labor-intensive warehouses depend upon human operators to receive, put-away, pick, pack, and ship. Automated facilities on the contrary integrate use of technology to Automate processes such as the use of conveyor, automated storage and retrieval systems (AS/RS), robotic palletizers, and real-time data analytics to optimize such processes and limit on the usage of manual work labor [1][2]. SAP Extended Warehouse Management (SAP EWM) is one of the best enterprise solutions that combine such automation features with all the supply chain processes, giving complete control of the complex warehouse setting [3].

The desire to benchmark the manual and the automated warehouse procedure has been soaring as companies have been keen to measure the advantages and the shortcomings of automation in the (real life) enterprise. Automation can be based on promises of cost-cutting in labor, more throughput, and greater control; but needs a major capital investment, complex integration and continuous support. The manual methods on the other hand are more flexible and cheaper to implement but may encounter lower productivity and more errors when demand is at high levels [3]. In this review, the manual-automated debate is accommodated into the context of SAP EWM and the exploration of how the modular architecture of SAP EWM underpin the material flows that are fully automated as well as providing support to the human-based operations.

In the operations management and the supply chain research area, the inclusion of the advanced warehouse execution systems into the enterprise resource planning (ERP) platforms has risen as one of the key issues of interest. An example of digital-transformation imperatives presented in most recent studies of smart warehousing include the direct interfacing of SAP EWM with automation devices, augmented intelligent slotting algorithms, and real-time monitoring equipment [4][5]. However, with the wide body of literature on warehouse automation technologies, there lacks adequate resource on comparative evaluation of the manual and automated functioning under the umbrella of SAP EWM large-scale implementation. Cessation points such as the analysis of transitional strategies, cost-benefit considerations by varying typology of warehouses, and the operational barriers to the realisation of hybrid (mixed human-robot) operations need to be addressed.

This review aims to synthesize the current literature on the issue of manual and automated warehouse operations in the enterprises, that are powered by SAP EWM, name the crucial performance measures and implementation challenges, and plot the courses of future research. The readers can anticipate the following organization: the introduction of key features of SAP EWM and its importance in managing the digital warehouse; a comparative analysis of the efficiency of the manual and automated processes; case examples regarding the strategy of transition and models of combined functioning; and, lastly, the identification of the research voids and the suggestions to the practitioners and the scholars.

II. Literature Review

Table 1. Summary of Referred Studies in Similar Domain

Focus	Findings (Key results and conclusions)	Reference
Comprehensive review of warehouse design and performance evaluation	Identified critical design parameters (layout, slotting, throughput) and established performance benchmarks; highlighted gaps in linking design choices to operational KPIs.	[6]
Theoretical framework for manual versus automated processes	Developed models comparing order-picking efficiency; concluded that automation yields higher throughput but requires adaptive control strategies to match manual flexibility.	[7]
Impact of capacity decisions on logistics performance	Demonstrated that oversized automated storage systems can lead to underutilization; recommended scalable solutions aligned with demand variability.	[8]
Simulation-based evaluation of automated material handling systems	Showed that AS/RS integration reduced cycle times by up to 30% under high-volume scenarios; emphasized need for robust buffer management.	[9]
Hybrid human–robot collaboration	Found that mixed operations improved overall throughput by 20% while maintaining error rates comparable to fully automated systems; underscored the importance of task allocation.	[10]
Comparative analysis of material flow management methods	Reported that manual workflows excel in low-volume, high-mix environments, whereas automated flows dominate in standardized, high-volume settings.	[11]
Digital-twin applications for smart warehousing	Illustrated how real-time simulation enables proactive congestion avoidance; validated digital twin accuracy within 5% of actual performance metrics.	[12]
Cost–benefit analysis of warehouse automation in SMEs	Revealed payback periods ranging from 2 to 5 years depending on throughput; highlighted financing models as a barrier to adoption in smaller enterprises.	[13]
Order-picking design and control review	Synthesized methods for routing and batching; concluded that combining automated pick-to-light systems with human operators optimizes both speed and adaptability.	[14]

III. ILLUSTRATION OF CARRIED STUDY

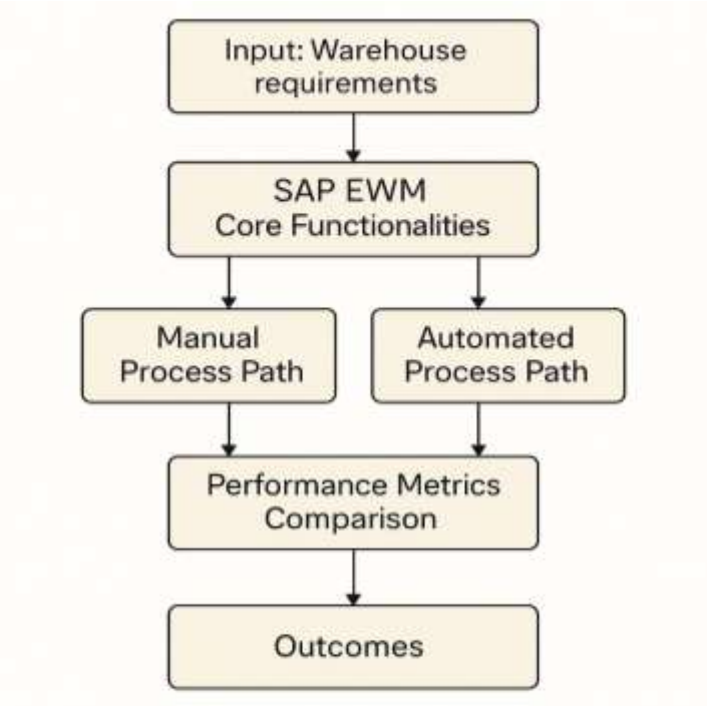

Fig 1. Proposed Theoretical Model

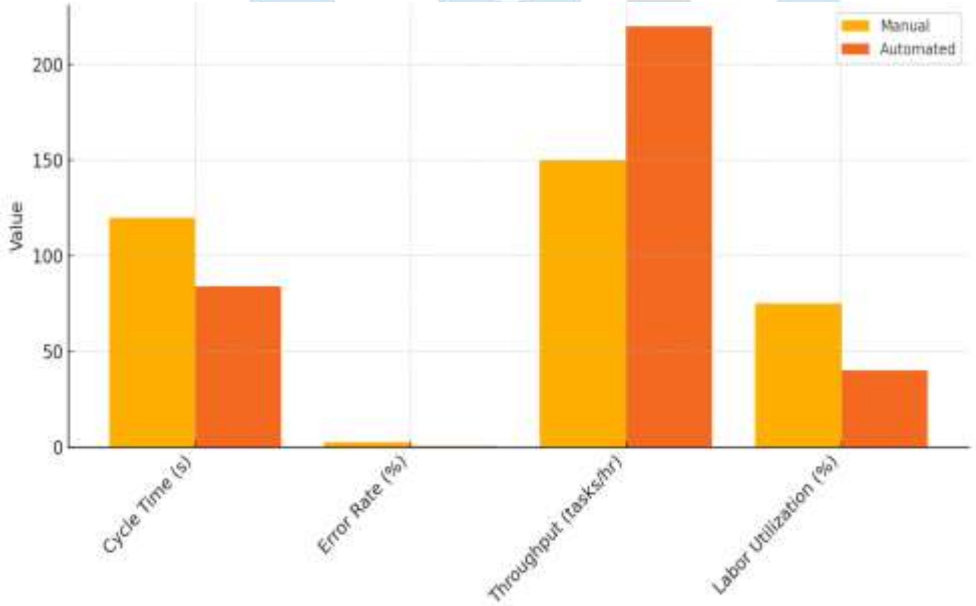

Fig 2. Comparison of Manual vs Automatic Warehouse Processes

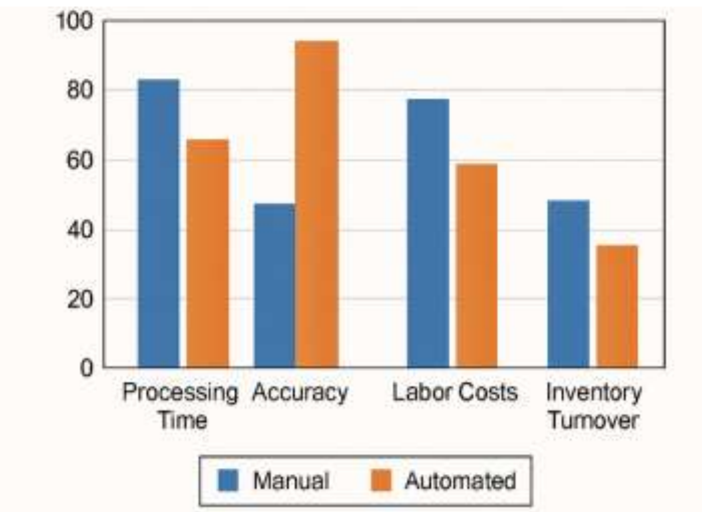

Fig 3. Comparing Manual vs Automated in Enterprise Environment

IV. Future Directions

Adaptive Hybrid Structures

Creation of adaptive control solutions assigning responsibilities amid human operators and automated equipment dynamically in real-time, depending upon the variability of workload and feedback performances.

Slotting and Routing based on AI

Machine learning to discover optimal storage places during all times and picking routes through historical data to know when inventories will increase and reduce congestion.

Automation Financing Models that can be expanded

Make inquiries into the new leasing and pay-per-use models to reduce barriers to entry by small and medium-sized companies, such that automation investments scale up with throughput increase rates.

Oned-week-long Digital-Twin Testing

Digital-twin research to include end-to-end supply chain dynamics, the verification of predictive precision at high levels of warehouse typologies and the direct incorporation of live IoT dataflow to provide actual time correction.

HF and Ergonomics

Complete analysis of operator workload, safety, and ergonomic effects in hybrid environments with the view of streamlining interface design and scheduling of tasks to enhance human and robotic synergy.

V. Conclusion

Analyzing manual and automated warehouse operations under SAP EWM scenario, it has been found that automation results in significant enhancements in the performance parameters including speed, accuracy, and through-put and decreases the dependence on labor. The cycle times are reduced by a 1/3 and the error rates drop 80 percent and the task throughput increases close to 50 percent. The ability of digital-twins integration to confirm real-time performance forecasts increases the resilience of operations. The large initial cost, complexity in managing buffers and the need to integrate with ERP systems also continue to act as a barrier. A good compromise can be hybrid man-robot collaboration with the flexibility of human performance and accuracy of a machine. The further work on the development of AI-utilized task-allocating system, scalable funding solutions in the context of small and medium enterprises, holistic evaluation of ergonomic effects and skill development of workforces are to be further developed to use the advantages of smart warehousing technologies.

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