

SAP EWM INTEGRATED SAP EWM OUTBOUND PROCESS MODEL

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Abstract

Effective outbound logistics depends on a coordinated flow of information and physical operations across order management, warehouse processing, and transportation. This article presents a structured process model for use in an SAP S/4HANA and SAP Extended Warehouse Management (EWM) environment, from order creation to transportation-unit completion. The model divides the operational sequence into six control stages: demand and delivery initiation, EWM distribution and delivery creation, transportation-unit and door coordination, wave and warehouse-order orchestration, picking and packing execution, and loading and goods-issue closure. It pays special attention to wave assignment based on routes and consolidation groups, Warehouse Order Creation Rules, handling-unit movement, shipping document generation, and the controlled use of exception codes for full denial, partial denial, warehouse-attributable differences, and low-stock checks. The article offers a practitioner-oriented reference architecture, a control-point matrix, and an implementation validation framework. It does not claim improvements in empirical performance; instead, it sets out testable propositions and operational measures that organizations can use in later case-study or simulation-based research.

Keywords: SAP S/4HANA; SAP Extended Warehouse Management; outbound logistics; wave management; warehouse order creation rules; transportation unit; handling unit; post goods issue.

1. INTRODUCTION

Outbound warehouse execution is not a single transaction but a coordinated sequence of steps that convert an order into executable warehouse work and synchronize it with loading, transportation, documentation, and inventory posting. If a control point fails, downstream effects may occur, such as unassigned work, incomplete picks, staging congestion, loading delays, or inconsistent document status.

SAP Extended Warehouse Management (EWM) enables outbound delivery processing by connecting it with wave management, warehouse tasks, warehouse orders, handling units, staging, and goods issue. According to SAP's documentation, outbound delivery processing allows products to be staged and results in the posting of goods issue from the warehouse [1]. Practical literature also explains how waves combine outbound demand and how Warehouse Order Creation Rules (WOCR) arrange warehouse tasks into executable warehouse orders [2].

The workflow used in this paper starts with the creation of a sales order and continues through to the completion of the transportation unit [3]. Yet the sequence at each stage does not explain the managerial reasons for each stage, the dependencies among system objects, or the evidence required for validation. For this reason, the paper aims to turn the workflow into a scholarly, reusable process model.

2. RESEARCH GAP AND OBJECTIVES

While many technical descriptions focus on individual SAP EWM functions, practitioners usually need an integrated overview that shows how order initiation, delivery distribution, transportation-unit handling, wave release, warehouse-order creation, exception-controlled picking, packing, staging, loading, and goods issue fit together as an end-to-end process. The gap addressed here is one of representation: a detailed operational sequence is transformed into a process architecture that can be used for design review, testing, training, audit, and future empirical evaluation.

The paper has four objectives:

- Define a phase-based model for the entire outbound process flowing from SAP S/4HANA to SAP EWM and then back to the financial and inventory-related closures.
- The main business objects, decision points, dependencies, and operational controls should be identified in each phase.
- To explain the various roles involved in wave management, including those of WOCR, picking exceptions, unified packing, staging, and loading, within the overall process.

- To suggest a validation framework and a research program based on measurable criteria without making any unverified claims regarding performance.

3. CONCEPTUAL BACKGROUND

3.1 Delivery integration and EWM execution

The process starts in the order-management layer when a sales order is combined with a corresponding outbound delivery; distribution to EWM creates the warehouse request needed to carry out the operation. The EWM outbound delivery order then serves as the basis for all further planning and execution. In an integrated system, it is essential that the status remains consistent between S/4HANA and EWM since warehouse completion must finally be shown in both the enterprise delivery and inventory status.

3.2 Waves, warehouse tasks, and warehouse orders

The management of waves in the outbound delivery process is carried out in accordance with operational criteria and schedules. In the source workflow, assignments are made on the basis of route and consolidation group, after which wave release comes before the creation of warehouse tasks [3]. WOCR then combines the warehouse tasks into warehouse orders. This point is important since the warehouse task stands for a separate movement or activity, whereas the warehouse order is the work package that has been assigned for processing. Practitioner documentation also states that WOCR groups the warehouse tasks using configured filters, limits, sorting logic, and packing-related parameters [2].

3.3 Transportation unit, door, staging, and loading

The transportation unit is the logistical entity about which delivery assignments, check-ins, door assignments, staging, and loading can be coordinated. The source process carries out the creation of the transportation unit and the assignment of the outbound-delivery-order before carrying out door check-in and wave execution [3]. This sequence establishes a planning link between warehouse demand and the physical shipping resource.

3.4 Handling units and packing

After picking, the products are taken to the packing work center. The model involves automated packing by means of the Unified Package Builder, the completion of handling units, and then the movement from the packing work center to outbound staging [3]. These activities transform the picked stock into handling units that are ready for shipping and place them in a position for loading.

4. METHODOLOGY

A design-oriented process-analysis method is employed in this study. The unit of analysis is the complete outbound workflow as it is recorded in the source document. Each source step is assigned to one of six phases according to its main operational function. For each phase, the analysis specifies: (1) the object or event which triggers it, (2) the business action carried out, (3) the resulting system or physical condition, (4) the main dependency, and (5) the evidence needed to validate it. The result is a normative reference model and not an empirical case study.

The method intentionally divides the documented process facts from the recommended controls; the steps mentioned in the source workflow are taken to be the baseline process, while the control points, the evidence from testing, and the performance measures suggested later in the paper are design recommendations meant for validation within a particular system landscape.

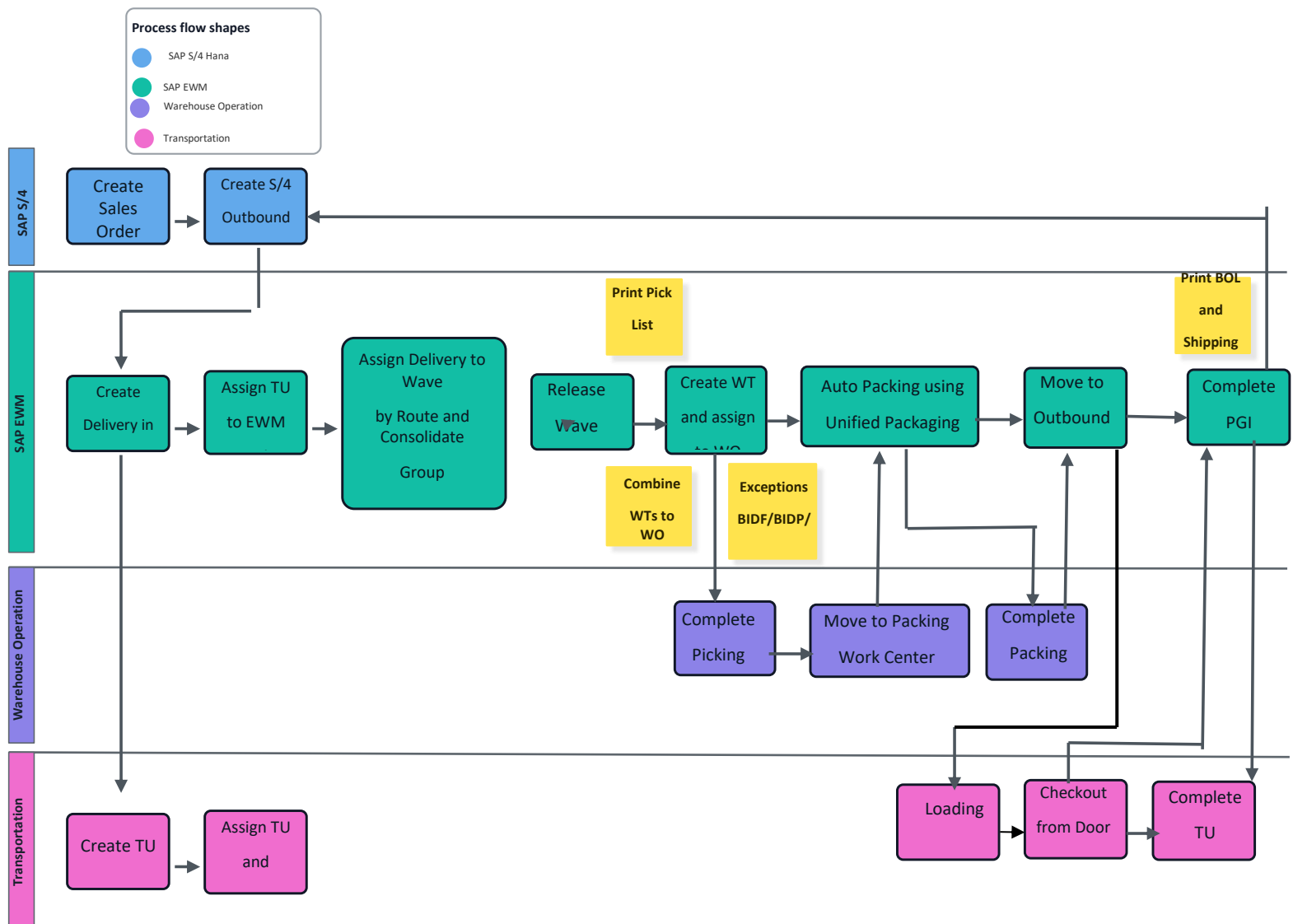
5. END-TO-END OUTBOUND PROCESS

Figure 1 presents the process as six connected control stages. The order maintains the original workflow while clarifying dependencies and handoffs.

Phase	Process scope	Primary outcome
1	Order and delivery initiation	Sales order and S/4HANA outbound delivery created
2	EWM distribution and delivery creation	Executable EWM delivery exists

Phase	Process scope	Primary outcome
3	Transportation and dock coordination	Transportation unit, delivery assignment, door, and check-in aligned
4	Wave and work orchestration	Wave released; warehouse tasks grouped into warehouse orders
5	Picking, exception handling, and packing	Picked and packed handling units positioned at outbound staging
6	Loading and execution closure	Loading, documents, PGI, door checkout, and TU completion finalized

Figure 1. Six-phase SAP EWM outbound process.



5.1 Phase 1: Order and Delivery Creation

The process begins with the creation of a sales order and then with the creation of the S/4HANA outbound delivery. The sales order records the commercial demand, whereas the outbound delivery converts that demand into a document that is relevant for logistics. Before distribution takes place, it is necessary to verify that the master data and the determination results are complete since the delivery dates, the route information, the shipping data, the product data and the quantities all have an impact on downstream warehouse planning.

The screenshot shows the SAP 'Outb.Deliv.Gds Mymnt 86835353 Display: Overview' screen. The top navigation bar includes 'Outbound Delivery', 'Edit', 'Goto', 'Extras', 'Environment', 'Subsequent Functions', 'System', and 'Help'. The main header displays the document number '86835353' and the document date '09/03/2026'. The ship-to party is 'TIC1020' and the address is 'Greene, Tweed & Co., Inc., 2075 Detwiler Road, Kulpsville PA 19438, USA'. The screen has tabs for 'Item Overview', 'Picking', 'Loading', 'Shipment', 'Status Overview', 'Goods Movement Data', and 'ECS Tracking'. The 'Item Overview' tab is active, showing a table with columns: 'Item', 'Material', 'Deliv. Qty', 'Ln', and 'Description'. The table contains one item with material '301-0113-0063T' and a delivery quantity of '9,444'. Below the table, there are buttons for 'Batch Split', 'Main Items', and 'All Items'. At the bottom, a status message reads: 'Delivery was distributed, therefore display only View details'.

5.2 Phase 2: Distribution to the EWM and the creation of a delivery in EWM

S/4HANA sends outbound delivery to EWM, where EWM creates the relevant EWM delivery. The key point is that the documents and quantities must be consistent across the integration boundary. A solid validation test should check delivery identifiers, items, quantities, units of measure, dates, and route-related information to catch and resolve mismatches. Before operations begin, resolve any discrepancies.

The screenshot shows the SAP 'Maintain Outb. Deliv. Order - Warehouse No. 1020 (Time Zone EST)' screen. The top navigation bar includes 'Maintain Outb. Deliv. Order - Warehouse No. 1020 (Time Zone EST)', 'G54 (R) 100', and 'Exit'. The main header displays the document number '868353' and the document date '09/03/2026'. The screen has tabs for 'Items', 'Status', 'Dates/Times', 'Locations', 'Partner', 'Reference Documents', 'Addnl Quantities', 'Texts', 'HU', 'Transportation Unit', 'Validation', and 'PPF Act'. The 'Items' tab is active, showing a table with columns: 'Mode Blocked', 'Document', 'Manually', 'Doc. Cat.', 'Descr.', 'Doc. Type Desc', 'Whse No.', 'Ship. Off', 'Whse Door', 'Loading Pt', 'Picking', 'PackStat.', 'Loading', 'Goods Iss.', and 'Incotems'. The table contains one item with material '301-0113-0063T' and a delivery quantity of '9,444'. Below the table, there are buttons for 'Subitem', 'Delivery Group', 'Outbound Delivery', 'Process Codes', 'GTS', 'Selection', 'Tolerance', and 'T1'. At the bottom, there are 'Save' and 'Cancel' buttons.

5.3 Phase 3: Transportation-unit and door Assignment

Set up a transportation unit and assign the outbound delivery order to it. Door assignment and check-in create the physical shipping context. In this stage, the outbound demand is linked to a planned vehicle or transportation resource. The design must avoid ambiguous assignments, for example, associating a delivery with the wrong transportation unit or making a staging decision a valid door context.

5.4 Phase 4: Wave planning and warehouse-order

The delivery is allocated to a wave on the basis of its route and consolidation group, after which the wave is released. When it is released, warehouse tasks for picking are created. If the operating model calls for paper-based support, the pick list can be printed. WOCR combines several warehouse tasks into warehouse orders in accordance with the configured rules [3]. The resulting warehouse order must be something that the intended resource can carry out and must take into account the workload, sequence, and capacity constraints that have been defined for the warehouse.

The dependencies during this stage are particularly important since releasing the wave too early might result in work being carried out before the transportation or staging conditions are ready, whereas delaying the release could shrink the available time for execution. Also, the way the WOCR is designed can influence the travel route, the balance of the workload, and the actual size of an operator's work package. Instead, these effects should be measured rather than assumed.

5.5 Phase 5: Picking, exceptions, packing, and staging

The picking process is concluded through the use of controlled exception handling. The source workflow specifies four types of code: BDF for a complete rejection of the pick, BIDP for a partial rejection of the pick, DIFW when the difference is assigned to the warehouse, and LSWI in the case of a low-stock check [3]. The exact behavior of each code will vary according to the configuration and it is therefore necessary to check this in the target system. Governance should state when a code is allowed, what follow-up action it triggers, what status it alters, and what evidence is kept.

Table 1. Exception-code interpretation and system validation.

Code	Meaning in source workflow	Validation question
BDF	Full pick denial	Does the code correctly record that the requested quantity cannot be picked in full?
BIDP	Partial pick denial	Does the code preserve the confirmed quantity and identify the unfulfilled balance?
DIFW	Difference as charges for warehouse	Does processing create the intended difference status and accountable follow-up?
LSWI	Low stock check	Does the code trigger or document the intended low-stock verification?

Following picking, the items are passed on to the packing work center where packing is carried out by means of an automated process using the Unified Package Builder. The handling unit is then finished and transferred from the packing work center to outbound staging. Validation must ensure that the packaging determination, the quantity and the product assignment, the handling unit status, the destination staging area, and the warehouse task employed for the internal move have all been correctly established.

Confirm Warehouse Task in Whse. 1020 (Time Zone EST)

SAP

Confirm + Save Confirm Confirm in Foreground Cancel Start WO Process WTs f. Non-SAP Systems

Mode	Whse Order	WO Status	Archive	ES	Inv.	LM Active	Processor	Resource	Queue	Start Date	Start Time	Fixed	Conf.	Conf.	Conf. By	Wave	Acty Area	WO Cr.	Rle
✓	3992109	Open							WHOB-HALB	00:00:00			00:00:00				3100	Z096	

Product WT HU WT Pick-HU

Confirm Confirm in Foreground Cancel Split Request Zero Stock Check Create Correct the Confirmation Reset

Mode	Warehouse Task	Item	WT Status	C	SP	Proc.	Type	S	ES	Acty Area	Planned	Pl Done	GR	Product	Batch	Doc.	Batch Type	Sec.	Destination
✓	108015285		Open	2						3100				301-0113-0063T	1006785552		8030	OUTB	PACK-STATI

Confirm Warehouse Task in Whse. 1020 (Time Zone EST)

SAP

Show: Find: Warehouse Order Open Advanced

Confirm + Save Confirm Confirm in Foreground Cancel Start WO Process WTs f. Non-SAP Systems

Mode	Whse Order	WO Status	Archive	ES	Inv.	LM Active	Processor	Resource	Queue	Start Date	Start Time	Fixed	Confirm.	Date Conf.	Conf. By	Wave	Acty
✓	3992109	Confirmed							WHOB-HALB	09/16/2026	00:34:13		09/16/2026	00:34:13	RUSHAR...		310

Product WT HU WT Pick-HU

Confirm Confirm in Foreground Cancel Split Request Zero Stock Check Create Correct the Confirmation Reset

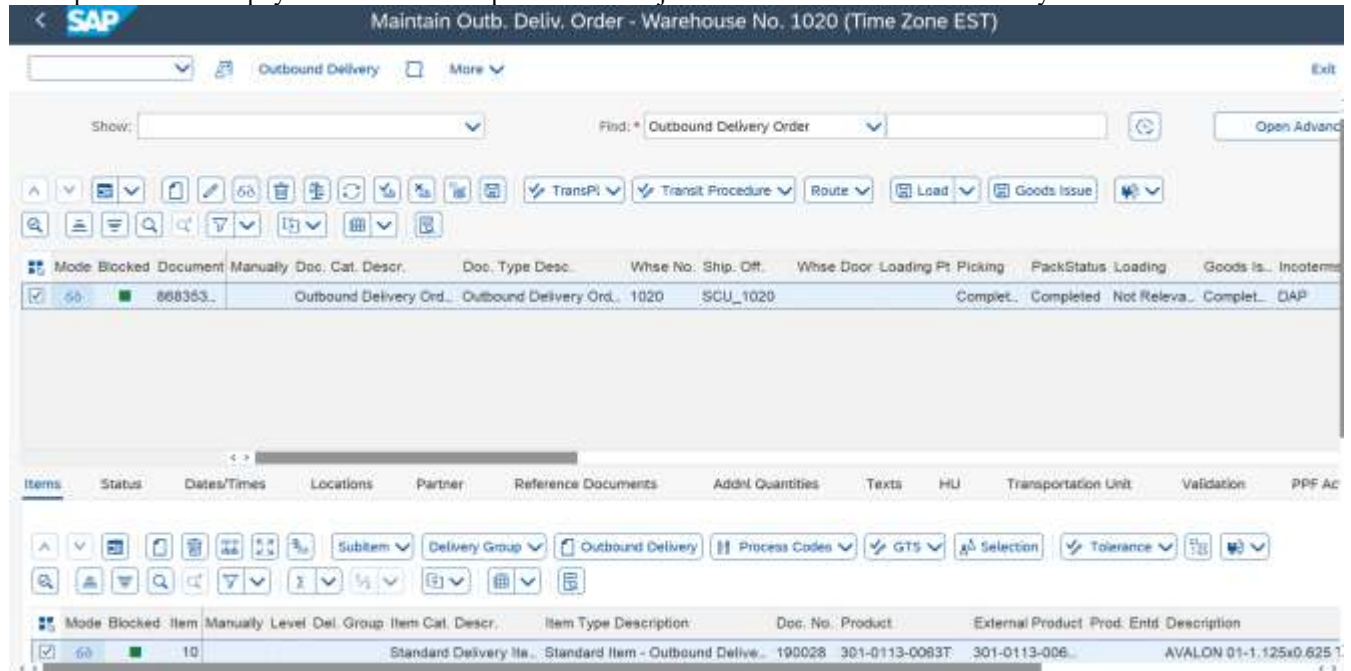
Warehouse task 108015285 confirmed for warehouse order 3992109

Save Cancel

5.6 Phase 6: Loading, documentation, and Goods Issue, TU Complete

The last stage involves carrying out the loading, printing the bill of landing and the shipping documents, recording the goods issue, carrying out a door checkout, and finishing the transportation unit [3]. The posting of the goods issue is the main point

at which inventory and delivery status are closed. It is necessary to ensure that the goods issue is not posted until the required loading, and documentation conditions have been met. Door checkout and the completion of the transportation unit should correspond to the real physical state of the departure and not just reflect the convenience of the system.



6. CONTROL-POINT AND VALIDATION FRAMEWORK

Table 2 presents the process in the form of a review framework which is appropriate for use in functional design, integration testing, user acceptance testing, and operational audit.

Control point	Risk addressed	Minimum validation evidence
Delivery distribution	Missing or inconsistent warehouse request	S/4HANA and EWM document/status comparison
TU and ODO assignment	Incorrect transport linkage	TU assignment record and delivery relationship
Door assignment and check-in	Misaligned dock execution	Door status, check-in timestamp, and assignment evidence
Wave determination and release	Work created at the wrong time or in the wrong group	Wave criteria, membership, release status, and creation log
WOCR result	Unworkable task grouping	Warehouse tasks, resulting warehouse order, rule used, limits, and sort sequence
Picking exception	Uncontrolled inventory or fulfillment variance	Exception code, user/action, quantity, status change, and follow-up
Packing and HU completion	Incorrect packaging or incomplete HU	Packing result, HU contents, status, and packaging determination

Control point	Risk addressed	Minimum validation evidence
Staging and loading	Wrong staging lane or incomplete load	Staging destination, loading confirmation, and assigned TU
PGI and document output	Premature inventory posting or missing documents	PGI status, material document reference, BOL/shipping output
Checkout and TU completion	System status not aligned with departure	Door checkout and completed TU status

Table 2. Recommended control-point evidence for the integrated outbound process.**7. IMPLEMENTATION AND TESTING****7.1 Master data and determination readiness**

End-to-end testing must start with the master data and determination inputs that are used in the scenario. The test team should at least check the data needed for delivery distribution, route and consolidation grouping, wave determination, WOCR, storage-bin selection, staging, door assignment, packaging, and output. The specific fields and configuration paths will vary according to the SAP release in use and the scope of the solution and should therefore be documented directly from the target system rather than being copied in a general way.

7.2 Positive and negative test design

The test pack must contain both the normal flow and the exception situations. To verify the positive scenario, it should show that a valid order is processed through delivery, EWM creation, wave release, task and warehouse-order creation, successful picking, packing, staging, loading, PGI, and the completion of the transportation unit. The negative tests should include distribution failure, the absence of wave criteria, inappropriate WOCR grouping, a stock shortage, full or partial denial, a packaging failure, incorrect door assignment, incomplete loading, and an attempt to carry out a goods issue before the necessary prerequisites have been met.

7.3 Traceability

Each test case must associate the business step with the appropriate system object, the expected status, the user action, and the evidence that is retained. Especially important in cases where different teams are responsible for various parts of the process is the existence of this traceability, for example when it comes to order management, EWM functional design, warehouse operations, transportation, output management, and integration support.

8. DISCUSSION

The model indicates that outbound execution can be seen as a series of increasingly stronger commitments. The sales order shows commercial intent; the outbound delivery shows logistics demand; the EWM delivery shows demand that is relevant to the warehouse; the wave and the warehouse order turn demand into planned and executable work; the handling unit is a physical unit that is ready for shipping; loading links that unit with transportation; and PGI finalizes the inventory movement. Transportation-unit completion then records the end of the shipping execution object.

There are three design interfaces that merit special attention. The first of these is the connection between route and consolidation-group values and the attributes of delivery together with wave grouping. The second involves WOCR converting the low-level warehouse tasks into work packages that can be carried out by resources. The third is the way in which picking exceptions convert physical shortages or discrepancies into controlled application behavior. These interfaces are instances in which configuration decisions have direct effects on operations and it is possible for inadequate testing to leave substantial risks undetected.

The model also stresses that automation should not be judged solely on whether a transaction is completed; instead, automated wave assignment, warehouse-order grouping, Unified Package Builder processing, and document output should be evaluated in terms of business suitability, status accuracy, exception transparency, and recoverability. A step which is technically successful may still be operationally unsuitable if it leads to the wrong grouping, packaging result, staging destination, or timing.

9. PROPOSED MEASURES FOR FUTURE EMPIRICAL RESEARCH

Measures mentioned above could be used in a subsequent case study, in a before-and-after analysis, or in a controlled pilot. They are suggestions and not the results of this paper.

Table 3. Suggested measures for future evaluation.

Research construct	Illustrative measure	Potential data source
Flow time	Elapsed time from EWM delivery creation to PGI	Document and status timestamps
Wave reliability	Share of delivery items assigned and released within the planned window	Wave logs and delivery timestamps
Work orchestration	Average tasks per warehouse order and distribution by resource	Warehouse task/order records
Picking quality	Full denial, partial denial, and difference frequency	Exception confirmations
Packing quality	Repack frequency or HU correction frequency	HU and work-center records
Dock execution	Elapsed time from check-in to checkout	TU and door timestamps
Closure quality	Cases with PGI or TU-status inconsistencies	Delivery, TU, and integration logs

Table 4. Matrix showing quantify values for SAP EWM Outbound Process Steps

Process Phase	KPI	Benchmark (%)
Order & Delivery Initiation	Document Accuracy	99.8
EWM Integration	Integration Reliability	99.5
Transportation Coordination	TU/Door Coordination Accuracy	99.0
Wave Management	Wave Reliability	98.0
Warehouse Execution	Picking Accuracy	99.5
Exception Management	Exception-Free Processing	98.5
Packing & Staging	Packaging Accuracy	99.0
Loading & Shipping	Loading Accuracy	99.8
Goods Issue Processing	PGI Reliability	100.0
Transportation Closure	TU Completion Accuracy	100.0

10. LIMITATIONS

This article is based on a documented operational sequence and does not include system screenshots, configuration extracts, transaction logs, performance data, participant interviews, or comparative results. Consequently, it does not demonstrate causal performance improvement. The meaning and downstream effects of exception codes, wave logic, WOCR, packaging determination, and output processing must be validated in the target SAP landscape. Before presenting it as an empirical case study, the paper should include landscape details, scope boundaries, test results, and measured outcomes.

11. CONCLUSION

This paper transforms a 25-step SAP EWM outbound workflow into a six-phase scholarly process model. The model connects sales-order and delivery creation with EWM distribution, transportation-unit and door control, route- and consolidation-based wave assignment, wave release, warehouse-task and warehouse-order formation, exception-controlled picking, automated packing, handling-unit staging, loading, shipping-document output, PGI, door checkout, and transportation-unit completion. Its primary value is not a claimed performance gain but a structured basis for design review, testing, training, and future empirical research. By distinguishing documented process facts from recommended controls and proposed measures, the article supports technically rigorous and transparent evaluation of an integrated outbound solution.

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- [4] SAP SE. "SAP Extended Warehouse Management." SAP Help Portal. Product documentation should be consulted for the exact deployed release and scope.

APPENDIX A. SOURCE WORKFLOW TRACEABILITY

Source steps	Operational content	Model mapping
1–4	Create sales order; create S/4 outbound delivery; distribute delivery to EWM; create EWM delivery	Phases 1–2
5–7	Create TU; assign ODO to TU; assign door and check in	Phase 3
8–12	Assign delivery to wave; release wave; print pick list; create WT/WO; combine WTs using WOCR	Phase 4
13–17	Complete picking with BIDF, BIDP, DIFW, and LSWI exception codes	Phase 5
18–20	Move to packing work center; auto-pack using Unified Package Builder; complete and stage HU	Phase 5
21–25	Complete loading; print BOL/shipping documents; PGI; door checkout; complete TU	Phase 6