Typical Functions of Warehouse Management Systems (WMS) & Warehouse Control Systems (WCS)

Many businesses use Enterprise Resource Planning (ERP) software, which includes components for forecasting product life cycle, payroll, accounting, supply chain management (purchasing, manufacturing, distribution), employee data, customer relationship management and product sales. Some ERPs include a Warehouse Management System (WMS), but they do not necessarily control the movement of materials. Most ERPs allow WMS or Warehouse Control System (WCS) add-on functionality as a separate subsystem.

Host ERP/Accounting System *Used for Forecasting Accounting, Sales, Inventory*	
WMS *Used for Receiving & Order Fulfillment (Relates to Picking, Shipping, Priorities, Visibility, etc.)*	
Conventional Inventory Control • Pick Lists • RF Handhelds or Mobile PCs	**WCS (Warehouse Control System)** • Automated Equipment • Integrated Goods Movement into Storage and from Storage to Shipping

WMS/WCS

A WMS focuses on inventory from the time it arrives at the receiving dock to the time it leaves from the shipping dock. The software knows where inventory is, orders it when needed and tracks its movement. A WCS schedules, monitors and commands movement of inventory and tends to include some kind of automated equipment control. John T. Phelan[1] compared a WMS to a symphony's composer who creates a musical score; the WCS is the conductor who directs the orchestral instrument players while performing the symphony in real-time. As illustrated in the above diagram, WMS and WCS functions often overlap.

What are the features of WMS and WCS?

A WMS with a WCS has the building blocks indicated in the chart below. If the WMS is considered separately, it often misses the scheduling and equipment-related features.

ERP INTERFACE	Item Master/ Aliases	Sales Orders/ Expected Receipts	Receiving/ Storing	Shipping & Order Completion	Inventory Adjustments/ Reconciliation
SCREEN INFORMATION	User Roles & Authorization	Inventory Tracking	Order & Activity Visibility	History/User Productivity	Equipment Setup & Status
PRIMARY FUNCTIONS	Receiving/ Putaway	Allocation	Retrieval/ Operator Scheduling	Picking/ Transfer/ Cycle Count	Consolidation/ Shipping
ERROR HANDLING	Inventory Adjustments	Inventory Quarantine	Equipment Errors	Data Transmission Errors	Operator Errors
EQUIPMENT HANDLING	PC's	RF Handhelds/ VMUs	Scanners/ RFID	Pick-to-Light/ Pick-to-Voice	Printers/ Labelers
AUTOMATED EQUIPMENT HANDLING	Automated Storage/Retrieval	Conveyors/ Sorters	AGVs/STVs	Carousels/A-Frames	Robotics

NOTES

1. User Authorization Logins limit access and simplify displays by removing unnecessary data.

2. Putaway – Directs users to available storage locations or keeps track of user-selected locations.

3. Allocation – Reserves inventory for picking based on privilege markings, FIFO, lot requests, product expiration, available dock space or custom rules.

4. Work Scheduling – Assigns work to available RF handhelds or workstations when a workstation finishes its former work, based on order priority, location of the user, required sequence of orders to the dock, etc. Stores/Retrievals are done by a WCS which is tasked with keeping the equipment busy (Storage/Retrieval machines, vertical or horizontal carousels , A-Frames, Automated Guided Vehicles (AGV), etc.)

5. Picking – Validates loads and items by scanning barcodes.

6. Consolidation – Allows pallet building/ shipping container building considering like orders, customers, destinations, carriers, etc. It may track product in box ID's within other boxes or on pallets.

7. Shipping – Relieves inventory and confirms quantities to host when the container is shipped or when a shipping system has assigned a tracking number, etc.

8. History and Inventory Analysis – The data mining part of the system. It gives detailed historical feedback for products, loads, locations, people, equipment, etc. Most systems research problems with this data. Some systems move workers to certain areas based on what has been done or what is left to do. Some systems pay incentives based on historical data.

When do you need a WMS or WCS?

You need a WMS or a WCS when you can justify the return-on-investment such as manpower savings, space utilization, product turns and customer sales based on the following factors:

1. **Efficiency**: More picks per hour and fewer user touches per pick or putaway.
    a. ***Picking From a List versus Instant Updates*:** The problem with picking from a list is that it is not dynamic. It either anticipates before the pick is complete that the list has already been picked, or it expects a person to key in the actual picks afterwards. Anomaly picks must be keyed in later. WCS's and most WMS's replaces batch methods with dynamic picking:
        i. A picker with PC or RF Handheld confirms each pick and the inventory is instantly updated. Because of instant updates, cycle-counters can update inventory in the same area at the same time as pickers.
        ii. A picker can under-pick if there is not enough inventory. The WMS instantly adjusts the inventory and locates additional inventory to make up for the short.
        iii. A picker uses a barcode scanner which saves key entry and validates that the product stored or picked is correct.
    b. ***Pick by Order or Pick All Product From an Area*:** Instead of using a pick list of lines from a single order or single customer, a WMS can direct pickers to pick multiple orders from the same area for later sorting and consolidation. Since orders may span pick areas, any customer's order may require picking from a cooler, from automatic equipment and from high rack requiring an order-pick truck. A WMS can direct all 3 pickers to pick at about the same time for consolidating downstream.
    c. ***Route Pickers Efficiently*:** Lost and wasted operator time is reduced by routing pickers via shortest distances. Efficiency depends on granular location labeling of rack while reducing floor stacks and LIFO racks.
    d. ***Picking Oldest Product First*:** Pickers are directed to pick the oldest product, resulting in product rotation.
    e. ***Forecast Shipping Size*:** Some WMS systems preview the order and forecast the size of cart or box to pick into. This can save the consolidation step.

f. ***Communicate to Host*:** The WMS and Host ERP need not share a database, but the WMS must update the Host instantaneously with every receipt, ship, inventory adjustment or order status change. The ERP and WMS function as one, without periodic posting or operator keying.

g. ***Pass Along Shipping Information*:** Linkage to a shipping system allows package information to be passed instead of re-entered at the dock. In this case, the WMS must also keep customer shipping address, preferred carrier, etc. Information for packing lists, such as shipping weight, size and urgency, may also be passed from the ERP to WMS/WCS and on to the Shipping System.

2. **Responsiveness:** More responsiveness means shorter delays.

   a. *No Paperwork Delays*: Because work orders are assigned automatically the instant that they arrive from the Host, they are commonly picked within minutes instead of hours.

   b. *Responsive Screens*: Operators no longer wait for screen response.

   c. *Priority*: When urgent requests arrive, they leap-frog to the front of the queue.

   d. *KanBan Replenishment*: A WMS may support a min-max quantity in an assembly area, such that when the equipment or user decrements on-hand products, the supplementary quantity is automatically ordered.

3. **Accuracy:** Correct and complete customer orders may be the most compelling justification.

   a. Barcodes eliminate mispicks.

   b. Location labels reduce mislocation of product.

   c. Recount points catch inventory miscounts early.

   d. FIFO oldest components and oldest lots are picked before newer ones to insure product shelf life and eliminate fragmentation.

   e. Labeling reduces lost product since a barcode label is printed for each put-to container giving the operator printed verification of the destination, the quantity and other put information.

4. **Training:** New operators learn quickly.

   a. Since the screens look like home computer screens, they are easily navigated and intuitive.

   b. Online Help is a click away.

   c. The WMS/WCS is configured so that only relevant information is displayed for each user based on his role.

Bibliography: 1- "Is a Warehouse Management System/Warehouse Control System Right for your Company?" 8 Jan 2009,Material Handling Network, John T. Phelan, Jr., TriFactor, LLC.

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