The Truth About Warehouse Management Software (WMS) Packages

The evolution of warehouse management systems (WMS) is very similar to the evolution of many other software solutions. Initially a system to control movement and storage of materials within a warehouse, the role of WMS is expanding to including light manufacturing, transportation management, order management, and complete accounting systems. To use the grandfather of operations-related software, MRP, as a comparison, material requirements planning (MRP) started as a system for planning raw material requirements in a manufacturing environment. Soon MRP evolved into manufacturing resource planning (MRPII), which took the basic MRP system and added scheduling and capacity planning logic. Eventually MRPII evolved into enterprise resource planning (ERP), incorporating all the MRPII functionality with full financials and customer and vendor management functionality. Now, whether WMS evolving into a warehouse-focused ERP system is a good thing or not is up to debate. What is clear is that the expansion of the overlap in functionality between Warehouse Management Systems, Enterprise Resource Planning, Distribution Requirements Planning, Transportation Management Systems, Supply Chain Planning, Advanced Planning and Scheduling, and Manufacturing Execution Systems will only increase the level of confusion among companies looking for software solutions for their operations.

Even though WMS continues to gain added functionality, the initial core functionality of a WMS has not really changed. The primary purpose of a WMS is to control the movement and storage of materials within an operation. Directed picking, directed replenishment, and directed putaway are key to the WMS. The detailed setup and processing within a WMS can vary significantly from one software vendor to another however the basic logic will use a combination of item, location, quantity, unit of measure, and order information to determine where to stock, where to pick, and in what sequence to perform these operations.

Do You Really Need WMS?

Not every warehouse needs a WMS. Certainly any warehouse could benefit from some of the functionality but is the benefit great enough to justify the initial and ongoing costs associated with WMS? Warehouse Management Systems are big, complex, data intensive applications. They tend to require a lot of initial setup, a lot of system resources to run, and a lot of ongoing data management to continue to run. That's right; you need to "manage" your warehouse "management" system. Often times large operations will end up creating a new IT department with the sole responsibility of managing the WMS.

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The Claims:

WMS will reduce inventory!

WMS will reduce labor costs!

WMS will increase storage capacity!

WMS will increase customer service!

WMS will increase inventory accuracy!

The Reality:

The implementation of a WMS along with automated data collection will likely give you increases in accuracy, reduction in labor costs (provided the labor required to maintain the system is less than the labor saved on the warehouse floor), and a greater ability to service the customer by reducing cycle times. Expectations of inventory reduction and increased storage capacity are less likely. While increased accuracy and efficiencies in the receiving process may reduce the level of safety stock required, the impact of this reduction will likely be negligible in overall inventory levels. The predominant factors that control inventory levels are lot sizing, lead times, and demand variability. It is unlikely that a WMS will have a significant impact on any of these factors.

The determining factors in deciding to implement a WMS tend to be more often associated with the need to do something to service your customers that your current system does not support (or does not support well) such as first-in-first-out, cross-docking, automated pick replenishment, wave picking, lot tracking, yard management, automated data collection, automated material handling equipment, etc.

Setup

The setup requirements of WMS can be extensive. The characteristics of each item and location must be maintained either at the detail level or by grouping similar items and locations into categories. An example of item characteristics at the detail level would include exact dimensions and weight of each item in each unit of measure the item is stocked (eaches, cases, pallets, etc) as well as information such as whether it can be mixed with other items in a location, whether it is rackable, max stack height, max quantity per location, hazard classifications, finished goods or raw material, fast versus slow mover, etc. Although some operations will need to set up each item this way, most operations will benefit by creating groups of similar products. For example, if you are a distributor of music CDs you would create groups for single CDs, and double CDs, maintaining the detailed dimension and weight information at the group level and only needing to attach the group code to each item. You would likely need to maintain detailed information on special items such as boxed sets or CDs in special packaging. You would also create groups for the different types of locations within your warehouse. An example would be to create three different groups (P1, P2, P3) for the three different sized forward picking locations you use for your CD picking. You then set up the quantity of single CDs that will fit in a P1, P2, and

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P3 location, quantity of double CDs that fit in a P1, P2, P3 location etc. You would likely also be setting up case quantities, and pallet quantities of each CD group and quantities of cases and pallets per each reserve storage location group.

If this sounds simple, it is…well… sort of. In reality most operations have a much more diverse product mix and will require much more system setup. And setting up the physical characteristics of the product and locations is only part of the picture. You have to set up enough so that the system knows where a product can fit and how many will fit in that location. You now need to set up the information needed to let the system decide exactly which location to pick from, replenish from/to, and putaway to, and in what sequence these events should occur (remember WMS is all about "directed" movement). You do this by assigning specific logic to the various combinations of item/order/quantity/location information that will occur.

Below I have listed some of the logic used in determining actual locations and sequences.

Location Sequence. This is the simplest logic; you simply define a flow through your warehouse and assign a sequence number to each location. In order picking this is used to sequence your picks to flow through the warehouse, in putaway the logic would look for the first location in the sequence in which the product would fit.

Zone Logic. By breaking down your storage locations into zones you can direct picking, putaway, or replenishment to or from specific areas of your warehouse. Since zone logic only designates an area, you will need to combine this with some other type of logic to determine exact location within the zone.

Fixed Location. Logic uses predetermined fixed locations per item in picking, putaway, and replenishment. Fixed locations are most often used as the primary picking location in piece pick and case-pick operations; however, they can also be used for secondary storage.

Random Location. Since computers cannot be truly random (nor would you want them to be) the term random location is a little misleading. Random locations generally refer to areas where products are not stored in designated fixed locations. Like zone logic, you will need some additional logic to determine exact locations.

First-in-first-out (FIFO). Directs picking from the oldest inventory first.

Last-in-first-out (LIFO). Opposite of FIFO, I have yet to see an application for this logic.

Fewest Locations. This logic is used primarily for productivity. Pick-from-fewest logic will use quantity information to determine least number of locations needed to pick the entire pick quantity. Put-to-fewest logic will attempt to direct putaway to the fewest number of locations needed to stock the entire quantity. While this logic sounds great from a productivity standpoint, it generally results in very poor space utilization. The pick-from-fewest logic will leave small quantities of an item scattered all over your warehouse and the put-to-fewest logic will ignore small and partially used locations.

Pick-to-clear. Logic directs picking to the locations with the smallest quantities in hand. This logic is great for space utilization.

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Reserved Locations. This is used when you want to predetermine specific locations to putaway to or pick from. An application for reserved locations would be cross-docking where you may specify certain quantities of an inbound shipment be moved to specific outbound staging locations or directly to an awaiting outbound trailer.

Nearest Location. Also called proximity picking/putaway, this logic looks to the closest available location to that of the previous putaway or pick. You need to look at the setup and test this type of logic to verify that it is picking the shortest route and not the actual nearest location. Since the shortest distance between two points is a straight line, this logic may pick a location 30 feet away (thinking it's closest) that requires the worker to travel 200 feet up and down aisles to get to it while there was another available location 50 feet away in the same aisle (50 is longer than 30).

Maximize Cube. Cube logic is found in most WMS systems however it is seldom used. Cube logic basically uses unit dimensions to calculate cube (cubic inches per unit) and then compares this to the cube capacity of the location to determine how much will fit. Now if the units are capable of being stacked into the location in a manner that fills every cubic inch of space in the location, cube logic will work. Since this rarely happens in the real world, cube logic tends to be impractical.

Consolidate. Looks to see if there is already a location with the same product stored in it with available capacity. May also create additional moves to consolidate like product stored in multiple locations.

Lot Sequence. Used for picking or replenishment, this will use the lot number or lot date to determine locations to pick from or replenish from.

It's very common to combine multiple logic methods to determine the best location. For example you may chose to use pick-to-clear logic within first-in-first-out logic when there are multiple locations with the same receipt date. You also may change the logic based upon current workload. During busy periods you may chose logic that optimizes productivity while during slower periods you switch to logic that optimizes space utilization.

Other Functionality/Considerations

Wave Picking/Batch Picking/Zone Picking. Support for various picking methods varies from one system to another.

Task Interleaving. Task interleaving describes functionality that mixes dissimilar tasks such as picking and putaway to obtain maximum productivity. Used primarily in full-pallet-load operations, task interleaving will direct a lift truck operator to put away a pallet on his/her way to the next pick. In large warehouses this can greatly reduce travel time, not only increasing productivity, but also reducing wear on the lift trucks and saving on energy costs by reducing lift truck fuel consumption. Task interleaving is also used with cycle counting programs to coordinate a cycle count with a picking or putaway task.

Automated Data Collection (ADC). It is generally assumed when you implement WMS that you will also be implementing automatic data collection, usually in the form of radio-frequency (RF) portable terminals with bar

code scanners. I recommend incorporating your ADC hardware selection and your software selection into a single process. You may find that a higher priced WMS package will actually be less expensive in the end since it has a greater level of support for the types of ADC hardware you will be using. In researching some WMS packages I saw references like "supports", "easily integrates with", "works with", "seamlessly interfaces with" in describing the software's functionality related to ADC. Since these statements can mean just about anything, you'll find it important to ask specific questions related to exactly how the WMS system has been programmed to accommodate ADC equipment. Some WMS products have created specific versions of programs designed to interface with specific ADC devices from specific manufacturers. If this WMS/ADC device combination works for your operation you can save yourself some programming/setup time. If the WMS system does not have this specific functionality, it does not mean that you should not buy the system. It just means that you will have to do some programming either on the WMS system or on the ADC devices. Since programming costs can easily put you over budget you'll want to have an estimate of these costs up front. As long as you are working closely with the WMS vendor and the ADC hardware supplier at an early stage in the process you should be able to avoid any major surprises here.

Integration with Automated Material Handling Equipment. If you are planning on using automated material handling equipment such as carousels, ASRS units, AGVs, pick-to-light systems, or sortation systems you'll want to consider this during the software selection process. Since these types of automation are very expensive and are usually a core component of your warehouse, you may find that the equipment will drive the selection of the WMS. As with automated data collection, you should be working closely with the equipment manufacturers during the software selection process.

Advanced Shipment Notifications (ASN). If your vendors are capable of sending advanced shipment notifications (preferably electronically) and attaching compliance labels to the shipments you will want to make sure that the WMS can use this to automate your receiving process.

Cycle Counting. Most WMS will have some cycle counting functionality. Modifications to cycle counting systems are common to meet specific operational needs.

Cross Docking. In its purest form cross-docking is the action of unloading materials from an incoming trailer or rail car and immediately loading these materials in outbound trailers or rail cars thus eliminating the need for warehousing (storage). In reality pure cross-docking is very rare, most "cross-docking" operations require large staging areas where inbound materials are sorted, consolidated, and stored until the outbound shipment is complete and ready to ship. If cross docking is part of your operation you will need to verify the logic the WMS uses to facilitate this.

Pick-to-Carton. For parcel shippers pick-to-carton logic uses item dimensions/weights to select the shipping carton prior to the order picking process. Items are then picked directly into the shipping carton. When picking is complete, dunnage is added and the carton sealed eliminating a formal packing operation. This logic works best when picking/packing products with similar size/weight characteristics. In operations with a very diverse product mix it's much more difficult to get this type of logic to work effectively.

Slotting. Slotting describes the activities associated with optimizing product placement in pick locations in a warehouse. There are software packages designed just for slotting, and many WMS packages will also have slotting functionality. Slotting software will generally use item velocity (times picked), cube usage, and minimum pick face dimensions to determine best location.

Yard Management. Yard management describes the function of managing the contents (inventory) of trailers parked outside the warehouse, or the empty trailers themselves. Yard management is generally associated with cross docking operations and may include the management of both inbound and outbound trailers. While some WMS vendors offer specific yard management functionality, many operations may find that a standard WMS can handle some of their yard management needs by setting up each trailer as a unique location within the WMS.

Labor Tracking/Capacity Planning. Some WMS systems provide functionality related to labor reporting and capacity planning. Anyone that has worked in manufacturing should be familiar with this type of logic. Basically you setup standard labor hours and machine (usually lift trucks) hours per task and set the available labor and machine hours per shift. The WMS system will use this info to determine capacity and load. Manufacturing has been using capacity planning for decades with mixed results. The need to factor in efficiency and utilization to determine rated capacity is an example of the shortcomings of this process. Not that I'm necessarily against capacity planning in warehousing, I just think most operations don't really need it and can avoid the disappointment of trying to make it work. I am, however, a big advocate of labor tracking for individual productivity measurement. Most WMS maintain enough data to create productivity reporting. Since productivity is measured differently from one operation to another you can assume you will have to do some minor modifications here (usually in the form of some custom reporting).

Activity-based costing/billing. This functionality is primarily designed for third-party logistics operators. Activity-based billing allows them to calculate billable fees based upon specific activities. For example, a 3PL can assign transaction fees for each receipt, and shipment transaction, as well as fees for storage and other value-added activities.

Browser Based. It seems as though WMS packages are adopting the browser based approach more quickly than many of the other operations related software packages. "Browser based", "web enabled", "E-WMS", are some new terms that can mean a variety of things. Since this is straying outside of my area of expertise, I'm not going to go into much detail here. Certainly this type of functionality has obvious benefits to third party logistic (3PL) operations and seems to be the direction most software will be going over the next few years.

Integration with existing accounting/ERP systems. Unless the WMS vendor has already created a specific interface with your accounting/ERP system (such as those provided by an approved business partner) you can expect to spend some significant programming dollars here. While we are all hoping that integration issues will be magically resolved someday by a standardized interface, we ain't there yet. Ideally you'll want an integrator that has already integrated the WMS you chose with the business software you are using. Since this is not always possible you at least want an integrator that is very familiar with one of the systems.

WMS + everything else = ?   As I mentioned at the beginning of this white paper, a lot of other modules are being added to WMS packages. These would include full financials, light manufacturing, transportation management, purchasing, and sales order management. I don't see this as a unilateral move of WMS from an add-on module to a core system, but rather an optional approach that has applications in specific industries such as 3PLs. Using ERP systems as a point of reference, it is unlikely that this add-on functionality will match the functionality of best-of-breed applications available separately. If warehousing/distribution is your core business function and you don't want to have to deal with the integration issues of incorporating separate financials, order processing, etc. you may find these WMS based business systems are a good fit.

Implementation Tips

Outside of the standard "don't underestimate", "thoroughly test", "train, train, train" implementation   tips that apply to any business software installation it's important to emphasize that WMS's are very data dependent and restrictive by design. That is, you need to have all of the various data elements in place for the system to function properly. And, when they are in place, you must operate within the set parameters. Costs are usually divided between the software license, hardware used to run it and some consulting / integrator fees (split one-third each) generally.

Example #1

Customer Service Person:	*Why didn't part XYZ ship to customer 123 yesterday?*
Warehouse Person:	*The warehouse management system couldn't find it so it didn't produce an instruction to ship it.*
Customer Service Person:	*Well my screen shows that we have 500 available in location 1A. Are you telling me that we don't have them?*
Warehouse Person:	*No, they're there all right.*
Customer Service Person:	*If I can see them on my screen, why can't the WMS find them?*
Warehouse Person:	*I don't know. I think if you don't have everything set up right, it won't let you ship it.*

Example #2

Warehouse Supervisor:	*I thought I told you to stock those pallets in location F12.*
Lift truck operator:	*I tried but the warehouse management system wouldn't let me.*
Warehouse Supervisor:	*Why wouldn't it let you?*
Lift truck operator:	*It told me that they didn't fit.*
Warehouse Supervisor:	*Well do they fit?*
Lift truck operator:	*Yes*
Warehouse Supervisor:	*Then why does the WMS think that they don't.*
Lift truck operator:	*I think it's because they sometimes come in a different size box.*

These are some very real examples (if only I could draw cartoons) of what you can expect when working with systems like WMS's. When implementing a WMS, you are adding an additional layer of technology onto your operation. And with each layer of technology there is additional overhead and additional sources of potential problems. Now don't take this as a condemnation of Warehouse Management Systems. Coming from a warehousing background I definitely appreciate the functionality WMS's have to offer, and, in many warehouses, this functionality is essential to their ability to serve their customers and remain competitive. It's just important to note that every solution has its downsides and having a good understanding of the potential implications will allow managers to make better decisions related to the levels of technology that best suits their unique environment.

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