



*ChainLink Technology Series*

# Warehouse Management Systems

---

**Technology for Global Supply Chain Performance**

Authored By: Carla Reed

Second Edition



### **About ChainLink Research**

ChainLink Research, Inc. is a Supply Chain research organization dedicated to helping executives improve business performance and competitiveness through an understanding of real-world implications, obstacles and results for supply-chain practices, processes, and technologies. The ChainLink Inter-Enterprise Model is the basis for our research; a unique, real-world framework that describes the multi-dimensional aspect of links between supply chain partners.

For more information, contact ChainLink Research at Harvard Square Center  
124 Mount Auburn Street, Suite 200 N., Cambridge, MA 02138.  
Tel: (617) 762-4040. Email: [info@clresearch.com](mailto:info@clresearch.com). Website: [www.clresearch.com](http://www.clresearch.com).

**Table of Contents**

**Executive Summary.....1**  
 Why a Warehouse Management Report? .....1  
 What you will learn in this report .....3

**Understanding Warehouse Management Needs Today .....4**  
 The Strategic View .....5

**Business Models and Processes.....6**  
 Off-shoring, Outsourcing and its impact on Distribution .....6

**Highlights and Innovation in Warehouse Management.....7**  
 Distributed Order Management .....7  
 Trading Partner Collaboration.....7  
 Returns Management/Reverse Logistics.....7  
 Special Orders .....8  
 Orchestration—Visibility and Control Platform .....8  
 RFID.....8

**Major WMS Capabilities and Benefits .....9**  
 Core functionality of WMS .....10  
 Understanding the solution components .....12  
 Primary Data Tables .....12

**Architectural Considerations .....14**  
 Process Views and major positioning .....15  
 ERP ‘Add Ons’.....16  
 Domain Leaders Lead WMS Functionality .....16  
 Combination of Operations and Information Support .....17

**Where will the Technology Go Next? .....19**

**Vendor Profile Chart.....21**

**Conclusions .....22**





[This page intentionally left blank]

## Executive Summary

Customer service, the timely flow of goods to market, and value-adding services to partners in the supply chain, all require modern Warehouse Management Systems in order to succeed. The complexity inherent in the performance of these seemingly simple tasks consumes a major portion of the time, labor and cost of the supply chain. As such, the selection of the best possible WMS solution is critical—knowing what the options are and how to rate and evaluate functionality takes skill and an understanding of the business impact of the implementation.

Of late, these have been radical changes in the Supply Chain Market—especially in the Warehouse and Logistics sector. Mergers & Acquisitions, as well as new exciting capabilities, give the buyer new approaches to implementation as well as enhanced value. Today's domain leaders in Warehouse management are real partners in your road to value—not just technology providers. And ERP providers are enriching their platforms with middleware and modern service oriented technologies to ensure there is a bridge between functional domains.

Not only enriching the business process to extract better performance has to be constantly reviewed, but also in today's global supply chain, the Orchestration of the chain needs to be managed with 21<sup>st</sup> Century Supply Chain technology!

Today's choices are better than ever!

This report has been designed to assist enterprises considering the implementation of warehouse management systems and provides both the novice and the information technology professional with a blueprint for evaluating and selecting appropriate technology for the distribution operations.

### WHY A WAREHOUSE MANAGEMENT REPORT?

Warehouse operations are a critical element of any supply chain environment—whether internally operated or outsourced to a third party. Likened to a control valve that can be adjusted to meet variations in supply and demand, storage and distribution facilities are *growing in importance* for companies in spite of the focus on inventory reduction. Outsourcing and off-shoring manufacturing operations, Port congestion, risk of supply chain disruptions as well as the shortage of logistics and other services that can impact the smooth flow of goods from source locations can be offset by a network of storage facilities that enables the key elements of success for any enterprise. And the backroom of the Retailer, whether retailer or store operations, needs deft management to ensure that goods are flowing into the point of sales environments.





Warehouse management systems, despite their relative maturity, remain an area of opportunity for software vendors and users alike. The market penetration for most software packages is low enough to keep the focus on sales and product innovation, as well as revising research and thought leading publications on this topic.

The recent revival in the use of RFID and other auto identification technologies in the distribution environment highlight potential process improvements that can be achieved through the capture of more granular and 'sensory' data. While leveraging investments in existing information systems, supplemented by the capabilities of yard, transportation and warehouse management applications, it is possible to create a 'virtual warehouse' environment. This in turn provides the flexibility required to respond to changes in demand, and shortages of supply. There are many paths to take; ensuring that the desired outcome is clear is one of the keys to success in the selection of technology enablers and process improvement.

### **So, how to begin?**

One of the first steps in evaluating and selecting a technology solution is to understand the business challenges—Policy, Performance or Process drivers—and from there, decide what Enabling technology (or service providers) are right for your business.

Right up front, we discourage a 'company deployment strategy'. What we mean is that users should evaluate their options and find the *best solution* to solve the business problem.

Despite the promotional literature and web media, there is no single solution that 'does it all'. Both large and small players have a different 'sweet spot' depending both on their heritage and their current partnering or acquisition strategy. The recent plethora of acquisitions of niche players by both WMS competitors and ERP vendors has further clouded the already muddy waters.

Our goal is to guide the reader through the steps in understanding what warehouse management technology is and does; which solutions apply to their specific environment, and the key differences between the wide range of options in the marketplace.

## WHAT YOU WILL LEARN IN THIS REPORT

This report will provide the reader with an understanding of both practices, as well as enabling (technology or service) options.

There are many options out there—it is important to know the difference between a warehouse management system, an inventory control system and a stock location system. Believe it or not, there are still many applications that are being marketed as warehouse management systems but lack the rich functionality of a domain leadership suite of applications designed to monitor and control storage and distribution operations.

**Cut your cloth to suit your coat**—it is just as bad to have an over-engineered solution as it is to have manual process and procedures to run your operation. This report and guide will provide both operations and technical team members with the ability to grade and rate functionality based on both information and business needs.



*ChainLink Research conducted the research for this report, through interviews with many firms that have successfully gained value from Warehouse Management practices. These are fresh and new stories. Therefore, in many cases, their firms have not approved the public pronouncements, so we may not always use their names. These interviews and cases provide an important validation point to the technology firm's claims of the value of their capabilities.*

*On another note, this report was created with the user/buyer in mind. It was not sponsored or financially underwritten by any of the technology firms mentioned in this report. In some cases, these firms may not agree with our assessment. This report is not a market report, i.e., focused at financials of market size and share. The audience is the buyer, and this is written for the user's benefit.*

This report was researched by ChainLink Research and is being published and circulated by Marsh.

## Understanding Warehouse Management Needs Today

**All distribution operations are not equal!** Storage and order fulfillment requirements will vary dependant on many factors—for example, seasonality of product, temperature control requirements, complexity of supply chain and inventory holding strategies. The warehouse of the present—and the future, should include flexibility to respond to fluctuations in demand, supply, and market factors that are a variable. Planning warehouse operations requires an understanding of the type of products to be received, stored and shipped. Streamlining the warehouse operations through a combination of industry best practices and information technology requires the same level of comprehension.



Unlike storage and material handling equipment purchases where it is possible to 'touch and feel' the product, investments in information system solutions require clear definition of the desired outcome and trust in the provider to deliver on the promise of their product. The procurement of such an 'intangible' requires an awareness of what is possible through implementing software with features and functions that will assist in process auto-

automation, data capture, and inventory management and control. Selecting a solution provider to translate the vision to an operational reality is an important step. Understanding the various options available will assist in further defining the best path to take. At a high level there are three primary options, delivered in very different ways.

In view of the foregoing, it is important to understand the current and future business model that will need to be supported. In most cases, global trade and logistics include an extended community of players—as such, software solutions need to be evaluated differently from traditional software that is implemented and integrated across a single enterprise.

Remember:

- Step 1 – Look at feature, function and **delivery architecture** (on premise or On Demand)
- Step 2 – Evaluate scalability based on trading partner 'on-boarding'—on a global level
- Step 3 – When evaluating professional services offered, look for deep domain expertise to change process and procedures in support of new information system capabilities

## THE STRATEGIC VIEW

Ten years ago, the warehouse manager was the 'red haired step-child' of most enterprises. Warehouses were considered an inconvenient expense, and the existence of large distribution networks was construed as the result of inefficient processes in manufacturing and sales forecasting. Lean programs were introduced to reduce cycle time across the manufacturing processes, with phrases like Kanban and Just in Time (JIT) indicating best practices. Manufacturing ruled—distribution was perceived as a support function, tolerated purely out of necessity.

Despite the best efforts of US based manufacturers, these lean practices were not enough. Manufacturing operations were outsourced to the lowest bidder, in many cases based in geographic locales on other continents. Business drivers included high labor and infrastructure costs for manufacturing—with no apparent product differentiation for items made in the USA versus other sources. As the factories closed down and the labor force was re-deployed into other fields (for the lucky ones) the 'brand masters' found that there were certain issues that had not been fully considered when making out-sourcing decisions. The Achilles Heel of the new outsource model relates to Logistics. The new factory states that the responses to the needs of consumers by developing manufacturing infrastructure are challenged by the need to match that with transportation networks to move the product to airports, seaports and other gateways. Added to which, there is a growing shortage of capacity—for both ocean and air freight on a global scale. Not to mention the constraints imposed on the movement of product across geographic boundaries as a result of increased safety and security measures. The USA 'peak season' for shipment of product and storage and distribution starts earlier every year. August of 2006 was positioned to match the activity of October 2005. The race is on to beat the congestion at ports across the country that results from seasonal demand.

This change in the status quo has elevated the warehouse into a strategic asset; having a well designed distribution network is now a competitive advantage. Managing facilities, transportation and inventory is a skill admired in the Board Room. Supply Chain Management now shares functional status with Sales, Marketing and Finance.

Warehouse management systems have grown in importance. No longer is it enough for a WMS to provide the tools to manage labor, space and products within a static environment. The WMS of the present needs to co-exist with key applications within ERP product suites—as well as with the technical topography of information systems within trading partner networks.

As such, scalability, interoperability, and collaborative capabilities are considerations that have equal importance to feature and functionality. And the vendor community is well aware of this growing need for flexible options!

## Business Models and Processes

### OFF-SHORING, OUTSOURCING AND ITS IMPACT ON DISTRIBUTION

Gone are the days when you could pop into the warehouse, walk through the aisles and validate the on-hand inventory position. In many cases, products are promised and fulfilled from storage locations in other regions, other continents, and even from partner inventory. The key to managing the flow of product to meet market demand is accurate information—down the SKU, lot, quantity, *purchase buy* date and location. Increasingly, the partners that are responsible for the manufacturing of ‘the brand’ are, in turn, supply chain orchestrators, managing a series of disparate factories (inter-related geographically), warehouses, and value added processing centers. These orchestrators, or OEMs, may never make, move, sell or service their own product. So their dependence on accurate information from their partners who play these critical custodial roles is higher than ever.

State of the art WMS systems provide capabilities to manage inventory at a local DC level, or across a network of DC facilities, storage locations, and, even at an intransit level, providing an aggregated view at multiple levels of detail. This can include location level, product level, lot level, and even derived detail; for example, a combination of product and lot across specific trade lanes.

This capability facilitates inventory reduction through having access to all product available for order fulfillment across a local or global network. This ‘virtual warehouse’ can leverage the same allocation and order fulfillment processes that take place within a ‘four walls’ environment. Based on availability and required delivery timeframes, prod-



uct can be allocated from a location in Europe for delivery to meet customer demand in Asia, Africa or the USA (subject to appropriate restrictions); increased transportation costs are offset by advantages in increased cash to cash cycle time, reduced obsolescence, etc.

Introduction of web-based collaboration tools has created even more opportunities to utilize this technology to manage a global supply chain - integrating value-added processing functions into the total elapsed supply chain cycle time (manufacturing, packaging, assembly). Collaboration is not just Demand Management or Sourcing function, but a robust Fulfillment function in distributed order management process. This provides the tools necessary to plan and execute across a network, versus the standard practice of planning sequentially (based on historical and forecast information), and passing down the order to one warehouse to fulfill.

## Highlights and Innovation in Warehouse Management

Much of the focus in day-to-day business is on ‘table stakes’ capabilities. But of particular note are the innovations that set the software firms apart, and do represent needed capabilities for many customers. Here are the highlights:

### DISTRIBUTED ORDER MANAGEMENT

Whether a small or large business, the fulfillment process usually encompasses several stages across a few supply chain nodes. The timing, coordination and optimal approach to fulfillment managed across multiple nodes, is the goal here. The most advanced WMS vendors have Order Management as a core capability. And the elite can manage this across nodes. There are also vendors who provide integrated platforms and can coordinate information and process, provide coordination for Manufacturing thru to Fulfillment, and display the monitoring of the process in control types of displays. So users might get DOMA capability from the platform provider (firms like Acsis) or from the elite WMS players like Manhattan and INFOR (formerly EXE).



### TRADING PARTNER COLLABORATION

The next layer on top of a DOMA architecture would be an inter-enterprise approach—the most advance capability yet. This leverages event management capabilities and can show the activities and connection points across the trading partner network. As events occur (or not), users can see the network in action and make appropriate changes to the process or workflow to ensure successful fulfillment.

### RETURNS MANAGEMENT / REVERSE LOGISTICS

Most businesses have to grapple with the nitty gritty of returns. For Retailers, the level of detail is huge. The work flow/disposition of these goods—who to send them to, tracking them—is a major role for today’s warehouses. Users have been alone on this issue for a long time, since Service Management software providers focused more on the outbound management and execution of complex service activities, rather than the Returns Management. Now the obviously has occurred. If you can pick, pack and ship it, you can execute a reverse! Manhattan and INFOR have major capabilities here.

## SPECIAL ORDERS

Deft coordination of all the elements of fulfillment is a challenge. And consumer oriented delivery, the so-called last mile, is a real challenge. Add to that concerns around delivery in hours, and sending the installer to the home. Only a few body builders would want to carry their new HDTV out of the store. But once you buy this, you want it—now. Think of the perfect delivery process, the management of these special orders as part of the WMS suite. Firms like Sterling Commerce (Yantra) lead here.

## ORCHESTRATION—VISIBILITY AND CONTROL PLATFORM

As mentioned before, the visibility and inter enterprise or multi-node management of the process is critical. Many firms do not need so much of a deep WMS (space optimization, etc.) as they need a platform for visibility, coordination, and/or integration to a multitude of different systems and WMSs across a complex chain. A more real time execution platform shines here. Again, firms like Acsis, though not a WMS, have this capability and direct and coordinate as well as integrate to systems like SAP.

## RFID

*RFID is an enabling technology whose time has come!*

A fully functional WMS, in conjunction with RFID, can create an environment where it is possible to not only do things better, but eliminate many of the traditional functions within a 'four walls' warehouse environment. Typical warehouse operations are traditionally very manually intensive, with a series of handoffs as product is moved from the receiving dock, the secondary and primary storage locations, and finally assigned to customer orders. In many cases each of these activities is accompanied by a 'paper trail' – to include manifests, pick lists, invoices and outbound shipment documentation.

The implementation of WMS, supported by barcodes, radio frequency data capture and task direction has enabled many efficiencies in this area. However, the layout of the facility has depended on storage location labeling in order to make the association between the product and its current position in the facility. The introduction of RFID could create a whole new set of opportunities. The product, through the addition of an RFID tag, would be able to communicate to the information systems and personnel. By 'empowering the product' it will now be possible to have dynamic inventory control creating an environment where it is possible to position product in any available space, without the need to have storage location/product assignment relationships. This is a total paradigm shift from traditional warehouse operations; the possibilities to change the processes and procedures are extensive. This could change the form and nature of storage facilities, reducing the need for expensive racking, material handling equipment and other systems needed to facilitate better inventory control.

## Major WMS Capabilities and Benefits

There are several types of warehouse management and control systems. These systems fall into three of the primary categories, as follows:

### Stock Locator System

- Location control—has a record of each storage location
- Inventory control—tracks inventory by individual location
- All tasks are user directed—you tell the system what to do

### Warehouse Control System

- Location control—has a record of each warehouse location
- Inventory control—tracks inventory by individual location
- All tasks are system directed—you are told what to do
- Users are usually single task oriented—receiving, replenishment, picking or shipping
- Allows for performance reporting

### Warehouse Management System

- Location control—has a record of each warehouse location
- Inventory control—tracks inventory by individual location
- All tasks are system directed—you are told what to do
- Users are usually multi-task orientated—task and labor optimization
- Includes yard and dock management modules
- Rules-based task direction and activity tracking
- Includes value-added processing and decision support modules
- Labor resource planning and control

A true warehouse management system (WMS) is not an inventory locator system. The locator system locates, tracks and manages inventory. A warehouse management system manages the warehouse operations, a totally different focus.



## **CORE FUNCTIONALITY OF WMS INCLUDES:**

### **Location/inventory management and space utilization**

- Storage locations allocated to product based on velocity (ABC) and product profiles
- Receiving process allocates goods to stock location and updates inventory/product files
- Slotting capabilities and 'shared locations' reduce 'honeycombing' and enhance space utilization

### **Goods receipt, put-away, picking and packing**

- System provides task direction, records operator activities and streamlines process
- Rules/event manager records product profile, lot level characteristics, dating, special handling, and maintains visibility
- Relationship between product, pack and ship requirements used to allocate packaging and transportation at the customer order and sub-set level (eg. refrigerated goods as part of order)

### **Real-time inventory management and reporting capabilities**

- Bar-coding and RF scanning records disposition of inventory as it is moved through the distribution center
- Inventory is cycle-counted as part of operation, ensuring accuracy and decreasing cost
- Product and lot level characteristics available for reporting and potential recall

WMS, when implemented in conjunction with industry Best Practices, enables space utilization, labor management, stock rotation and productivity improvement. RF devices replace the need for paper pick tickets—pickers are able to pick product, whilst cycle counting inventory, ensuring real-time inventory accuracy at the bin level.

- Integrated with material handling equipment (for example, conveyor, carousels, pick-to-light etc.) WMS can enhance personnel productivity, increase storage capacity, and optimize the distribution environment.
- Standard functionality includes the ability for WMS to collaborate with OMS, as well as TMS, and allocate product to customer orders, plan transportation mode, allocate packaging, and perform quality control as orders are fulfilled and staged for shipping.
- These activities can be performed in a 'virtual' environment, if required—facilitating advanced receiving, allocation of intransit materials to orders (planned cross-dock), as well as facilitating advanced logistics practices, for example, intransit merge.



There are many innovations that are possible through the combination of technology and industry best practices. The following table shows some examples of process improvement based on the implementation of industry best practices and WMS technology. This is not a conclusive list and merely serves to illustrate what is possible using ‘off the shelf’ software and solutions.

<b>3Pe</b>	<b>Enabling Capabilities</b>
<b>Space optimization</b>	Algorithms and slotting approaches to optimize the best approach based on order flows, product types, inventory strategies, product efficacy dates, etc.– integrated into WMS capabilities ensure that true product velocity drives storage and picking strategies within the warehouse.
<b>Labor management</b>	Irrespective of the storage environment, it is important to establish optimal productivity, increasing capacity through better labor utilization. System directed activities, for example task interleaving, eliminate non-value added activity.
<b>Inventory management</b>	Inventory velocity is critical – a WMS provides the capability to really manage the flow of inventory – into and out of the storage facility. Strategies like First in – First out (FIFO) and First Expired – First Out ( FEFO) can be enforced and managed through real-time cycle counting to ensure inventory accuracy and control.
<b>Receiving process improvement – advanced receipt – virtual receipt</b>	Shipper sends an advanced shipment notification (ASN) which is integrated into the WMS. This reflects the products ‘in transit’ as a receipt awaiting confirmation. On receipt, the WMS assigns a putaway location and updates inventory.
<b>Storage – thinking at the virtual shelf level</b>	As an extension of the ‘advanced receipt’ process, it is possible to assign intransit inventory to a ‘virtual location’, enabling customer order fulfillment based on ‘available to promise’ at the line item level.

Table 1 — 3Pe / Enabling Capabilities

## UNDERSTANDING THE SOLUTION COMPONENTS

A WMS is an integrated package comprising components that include radio frequency (RF) communications devices, dedicated, localized computer hardware, automatic identification equipment, and the application software. The major difference between the inventory control/stock location system and a WMS is that the WMS manages labor and resources, something that the locator system does not fully support. A locator system can minimize pick-path requirements and track tasks in the warehouse, but these systems do not have the processing capability to optimize tasks or provide true system directed task management. Some ERP systems have added warehouse control capabilities to their application suite, but the functionality provided by these modules varies considerably.

### ***Primary differences between ERP warehouse management modules and domain leadership WMS solutions***



The difference in functionality is based on how the warehouse or control system is set up, as well as the level of data that is used to drive the operations. The more rules and event based process management that the system is capable of, the more advanced the capabilities of the system. A typical ERP application includes tables and some form of logic to support warehouse management and location/inventory control. Domain leadership applications have taken this several steps further, and have developed advanced processing engines that support the operations functions and replace the need for manual supervision. Typically the type of data that is included in these systems can be broken into the following areas:

### **Primary Data Tables**

- Locally maintained data—this is data that is unique to the specific implementation of the warehouse management system. It includes Options Tables, Rules, Bins/locations by facility, user profiles, security and part/location relationship.
- Transaction data—this is data that is provided by the host system. This includes sales orders, customers, purchase orders, advance shipment notifications (ASN) and inventory details.
- Process driving data—This is the data that is created to support the warehouse operations. This includes pick plans, put away plans, cycle counting plans/instructions and replenishment plans/instructions.

- History—This is the data that is created as a by-product of the warehouse transactions and is used to support transaction tracking, as well as providing information for performance monitoring and reporting. This includes the data that is captured as workers perform tasks and provides a detailed audit trail of each activity at the worker, product, customer order, purchase order and associated level.



The warehouse and distribution modules that are available as part of an ERP package process and communicate data differently from a commercial WMS solution. Differences frequently can be illustrated in the following primary steps within the order fulfillment environment, as follows:

#### Step 1 – Communicating the task to the worker

- In an ERP environment the assignment of tasks to workers usually takes place in a batch environment, either ad hoc or at pre-determined times during the day. In a paper driven environment this creates pick tickets or labels, and a supervisor allocates the tasks to specific workers based on their availability and ability to perform the task<sup>1</sup>.
- A WMS, which is a rules-based execution system, assigns tasks dynamically, making the association between inventory, orders and resources in real time. Tasks are assigned and communicated to workers through hand held RF devices. Rules-based processing within the WMS ensures that worker activities are both directed and optimized.

#### Step 2 – Executing and Verifying Tasks

- In a typical ERP based structure, once a task has been assigned to a worker the worker updates the paper pick ticket/label at the completion of each task. This creates a lag between the time the activity is performed and when the system is updated.
- Using a RF supported WMS ensures that each activity is recorded, updating the system in real-time. This also ensures that the work performed is accurate through RF verification and bar code scanning. Most RF driver processes require fractional second response, and collect barcoded RFID data not usable by ERP.

#### Step 3 – Communicating the completion of each task

- When using the ERP option, workers normally update the system once the task has been completed.
- In the case of RF supported WMS, a real time view of each task is possible. Ongoing update at the worker and task level provides visibility for supervisors who need to know the status of tasks within the facility.

<sup>1</sup> Here we use ERP as illustrative of corporate systems where the ERP systems are remote from distributed warehouses and warehouse execution.

## Architectural Considerations

The options for the user community are expanding every day. The ubiquity of the Internet, the universal adoption of wireless technology, and the growing acceptance of technology as part of the workplace has increased the potential deployment of solutions in a storage and distribution environment. In addition to the traditional deployment of User License and 'site based' systems, most vendors are making their solutions available in a variety of manners, to include:

### Distributed/Virtual Warehouse

- Many firms have multiple warehouses. The warehouses can either be set up to support the whole network in a distributed manor, or exclusively support their own local territory or products.
- Multiple instance for each client—separate hardware and implementation
- Each specific instance of application can be modified, but if business has common ordering process, must be built on a common reference architecture

### On-Demand—Software as a Service vs. License

- On Demand software and services can be processed today for most applications in the supply chain
- Pricing based on pay as you go—volume discounts normally apply
- No maintenance or support fees
- Very low Total cost of ownership (TCO)
- Professional services for trading partner 'on-boarding' still applies, as in any implementation of software

A factor that is driving the delivery of software and services in an 'on demand' or hosted fashion is the increasing need for all supply chain participants to have real time information. The concept of a shared view of the supply chain, with each player updating and viewing a 'single version of the truth' has been



embraced by the links in extended supply chains. In most cases the delivery method includes some web or 'thin-client' component, presenting data to the community leveraging browser technology, PDA's and mobile computing devices.

When evaluating options it is wise to not only plan for the current business environment, but to allow for flexibility in terms of the addition—or removal—of trading community members.

## PROCESS VIEWS AND MAJOR POSITIONING

Technology is an enabler—the key to implementing software successfully is defining the business issues, understanding the real needs of the enterprise and what information is required in order to support the key operation indicators. Functionality requirements will vary, dependant on the role of the enterprise within the supply chain. The following includes a high level perspective of the primary enterprise models:



**Traditional Manufacturing Companies** —*fully integrated process of design, make, store, deliver.*

- Need capabilities that will support an integrated view across the supply process—raw materials to production—production to storage—storage to distribution—distribution to retail. Trends to outsource create a need to consider the information needs across extended supply chains—approaches can vary between treating outsource partner as a 'supplier' or an 'external/internal component' of the process.

**Brand Masters**—*own the brand but outsource primary operations functions*

- The sourcing model includes some level of collaborative information sharing during the design, make and deliver processes. Focus from an operational perspective is on the receipt of finished goods into distribution, managing inventory levels to meet demand and order fulfillment process. Capabilities required include detailed process view of inbound transportation, inventory within the fulfillment center, efficient pick, pack and ship processes to meet retail demand.

**Distributors**—own the retail/distribution channels

- Manage the customer expectation and experience. Need flexible supply chain networks in order to respond to fluctuations in demand—impacted by seasonality, new markets and new products. Out-source storage and distribution is frequently the option of choice—software ensures that they retail visibility into the process without actually managing the day to day operational elements.



Based on these very different business models and information needs, either one or a combination of the following warehousing and distribution software models will work.

**ERP ‘ADD ONS’**

Good for entities that are involved in more extended supply chain activities—make, store, deliver—and need to have integrated offering that takes into account the demand as well as the ability to supply to production. More integrated across the process but tends to have less deep functionality in supply chain vs. the domain leaders.

Buying ERP vs. a domain solution is most popular with larger entities, where the warehouse is one entity in the corporation, and not a primary function of the business. As the manufacturing focus of companies changes, a trend for most industries, there will be a need to re-evaluate this implementation model.

**DOMAIN LEADERS LEAD WMS FUNCTIONALITY**

Domain leaders are warehouse experts, not just technology companies. This includes evaluating software capabilities, purchasing software licenses, installing applications, training users, and providing internal application and user level support. This is consistent with traditional software acquisition and requires the participation of internal IT resources through all stages of the acquisition and installation. In most cases these software vendors focus on the development of domain leadership functionality. Distribution focus (buy–sell –deliver) focuses on streamlining warehouse operations—improving efficiency at the operational level—slotting, task direction, optimizing assets and personnel. Implementation personnel are skilled in technologies and business processes to streamline the warehouse and distribution environment.

## COMBINATION OF OPERATIONS AND INFORMATION SUPPORT

The third option for enterprises that need to manage inventory—in transit and at rest—is to adopt an ‘outsourced’ model for their storage and distribution needs. This includes the provision of asset based services as well as information technology solutions.

There are variants in operations, but basically, traditional transportation firms have upgraded to the 3PL or Lead Logistics Provider:

- **Third Party Logistics Solution providers—**  
There are many logistics service providers who offer applications and data integration as part of their offering. Providers that fall into this category tend to come from an asset based environment in either transportation or public warehousing. These providers offer a list of services and include the software as a component. There are many different options which include UPS, FedEx and Menlo Logistics, for example.



Some third parties acquire your warehouse technology and operate it. But this is waning in popularity as an approach (popular in the 90s). Today, these operators have robust WMS solutions to operate your process.

In many cases the value proposition is focused on visibility—inbound from supply location, inventory in multiple facilities, as well as outbound visibility. Some have internally developed applications—still others have chosen to invest in packages. The trend is to adopt a best of breed approach, amortizing the investment in technology across a wide spectrum of clients.

These providers have a combination of distribution, supply chain, customer service and other capabilities that enable a ‘one stop shop’— good for getting into new markets, managing supply chains with considerable variability, seasonality, etc.

Solutions offered can be tailored for both small and large enterprises. The following table is a very high level perspective of each of the primary business models, solution types and sample vendors in that sector.

<b>Supply Chain Model</b>	<b>Most Important Software Solution Attributes</b>
Integrated manufacturer – Buy/Make/Store/Deliver	<p>WMS need tight integration to ERP to manage financial transactions</p> <p>Small firms can use ERP foundation. Larger or multi-site firms need local real time performance.</p>
Brand Masters – manage the Design/Buy/Store/Deliver functions	<p>Demand Management</p> <p>Distribution Order Management</p> <p>Visibility</p> <p>Trading Partner Management</p> <p>May have outsourced WMS to 3<sup>rd</sup> party operator</p>
Distribution Companies	<p>WMS is the core enterprise system of this type of business</p> <p>Tend to purchase Domain Leader software</p>

*Table 2 — Supply Chain Model / Most Important Software Solution Attributes*



## Where will the Technology Go Next?

The trend towards extended supply and distribution networks, as well as new auto/id technologies—RFID, sensors—will require technology solutions that are scalable and flexible. Traditional approaches will not be able to meet these needs; however, technological innovation abounds. A global adoption of various wireless networks, tiny devices, highly scalable Internet, and global standards, creates a whole new set of opportunities.

What will this mean for the warehouse worker of the future? Will the roles of those whose daily bread is made picking, packing and shipping change as dramatically as that of the factory worker of the previous century? The answer is a resounding YES!

Process automation is a given. Technology is now available that will enable a storage and distribution environment very different from the warehouse of the past.

*Consider the following:*

### Material Handling—Smart Devices and Equipment

There is already a great deal of technology available for material handling within the warehouse environment. As the implementation of software enables entities to replace current with better practices, it will be possible to leverage investment in warehouse conveyances—for example AS/RS (Automatic storage and retrieval systems). In common use today are laser guided, pick to light, high rack warehousing with automated forklifts, etc. In addition, there is already convergence between traditional material handling equipment (such as fork trucks), auto identification and data capture technology. Smart robots that can locate goods, retrieve them and bring them to final shipping dock are also growing in popularity.

### Smart buildings and Real-time Locating

Innovation in facilities management can be incorporated into space planning and facility control in the distribution environment. Real time locating (RTLS)<sup>2</sup> technology provides capabilities to manage and monitor the movement of personnel and equipment. Integrated with 'facility maps', it will be possible to direct workers through a facility, reducing dwell time. WMS capabilities, triggered by RFID and other auto identification technology, will reduce the need to match product to specific storage locations, reducing 'honeycombing'—a common result of fixed location storage.



<sup>2</sup> Read the report: *Active RFID* ChainLink Research July 2007

### **Labor Management and Control—Task direction and decision support**

Voice activated functions, sensing technology, security and control devices can all be integrated into an environment where task direction optimizes the movement of personnel through a facility.

### **Inventory Management and Control—Smart products and packaging**

RFID, sensors, and other auto identification technologies are increasingly being incorporated into packaging, at the unit and case level. Leveraging existing wired and wireless networks, it is now possible for inventory to be tracked through each of the storage and distribution processes. Inventory control, already greatly enhanced through the adoption of cycle counting, will now be possible at the line, lot and batch level—in real time—without manual intervention. Enhancements include the interaction between the product, location and information. Systems can enable the elimination of traditional supervisory layers in the warehouse. In a more advanced scenario, the human element could be with material handling robots that interact with product, locations and the WMS—the mind boggles at the possibilities.



### **Fulfillment Collaboration**

Again, functionality exists, but is only modestly applied today. Modules, not only for Distributed Order Management, but that facilitate inter-enterprise visibility, can be incorporated into the monitoring and management capability of the Fulfillment processes of the enterprise. Within the virtual model, the tools to orchestrate the process can be enabled through tools that visualize the entire chain, as well as control the processes.

	SAP	Manhattan	Infor-Provia	Infor-WM2000	Infor-WM9	Infor-SSA	Red Prairie	Logility	Cadre	
Multiple Inventory Owners in Single Warehouse	●	●	●	○	●	●	●	●	●	Multiple Inventory Owners in Single Warehouse
Multiple Warehouses in Single or Networked Database	●	●	●	●	●	●	●	●	●	Multiple Warehouses in Single or Networked Database
Flexible Bin Location Setup	●	●	●	●	●	●	●	●	●	Flexible Bin Location Setup
Flexible Product Setup	●	●	●	●	●	●	●	●	●	Flexible Product Setup
License Plate Tracking	●	●	●	●	●	●	●	●	●	License Plate Tracking
System Directed, Automated RF Receiving	●	●	●	●	●	●	●	●	●	System Directed, Automated RF Receiving
Configurable Put-away Rules	●	●	●	●	●	●	●	●	●	Configurable Put-away Rules
Flexible, User Defined Reporting	●	●	●	●	●	●	●	●	●	Flexible, User Defined Reporting
Yard Management and Appointments	●	●	●	●	●	●	●	●	○	Yard Management and Appointments
Quality Control	●	●	●	●	●	●	●	●	●	Quality Control
Location Mapping - Multiple Configurations	●	●	●	●	●	●	●	●	●	Location Mapping - Multiple Configurations
Productivity/Utilization Reporting	●	●	●	●	●	●	●	●	●	Productivity/Utilization Reporting
Integrated Slotting - Flexible Configuration	●	●	●	●	●	●	●	●	●	Integrated Slotting - Flexible Configuration
Planning Waves, Zones, Reservation, Prioritization	●	●	●	●	●	●	●	●	●	Planning Waves, Zones, Reservation, Prioritization
Kitting (BOM, un-kit, costing, WIP/scrap tracking)	●	●	●	●	●	●	●	●	●	Kitting (BOM, un-kit, costing, WIP/scrap tracking)
Monitor Progress of a Pick Wave	●	●	●	●	●	●	●	●	●	Monitor Progress of a Pick Wave
Pick Options (Batch, Zone, Bulk, Pick & Pass, Sequencing)	●	●	●	●	●	●	●	●	●	Pick Options (Batch, Zone, Bulk, Pick & Pass, Sequencing)
Picking - RF, To List, Label, Special Instructions	●	●	●	●	●	●	●	●	●	Picking - RF, To List, Label, Special Instructions
Packing - System Directed, Rules Based	●	●	●	●	●	●	●	●	●	Packing - System Directed, Rules Based
Flexible Cartonization - User Defined Options	●	●	●	●	●	●	●	●	●	Flexible Cartonization - User Defined Options
Loading - Direct, By Order, Route/Stop	●	●	●	●	●	●	●	●	●	Loading - Direct, By Order, Route/Stop
Labor Optimization / Task Interleaving	●	●	●	●	●	●	●	●	●	Labor Optimization / Task Interleaving
Parcel Manifesting	●	●	●	●	●	●	●	●	●	Parcel Manifesting
Inventory Control	●	●	●	●	●	●	●	●	●	Inventory Control
Replenishment - User and System Directed	●	●	●	●	●	●	●	●	●	Replenishment - User and System Directed
Rotation - User Configurable Rules	●	●	●	●	●	●	●	●	●	Rotation - User Configurable Rules
Cycle Count - Full Functionality	●	●	●	●	●	●	●	●	●	Cycle Count - Full Functionality
Integrated Alerts/Messaging - E-mail, Page, Fax	●	●	●	●	●	●	●	●	●	Integrated Alerts/Messaging - E-mail, Page, Fax
Full WMS User Interface and RF Function on PDA	●	●	●	●	●	●	●	●	●	Full WMS User Interface and RF Function on PDA
Pickup and Delivery Confirmation	●	○	●	●	●	●	●	○	●	Pickup and Delivery Confirmation
Time Standards	●	●	●	●	●	●	●	●	●	Time Standards
Audit History	●	●	●	●	●	●	●	●	●	Audit History
Equipment Maintenance Management	●	○	●	●	●	●	●	○	○	Equipment Maintenance Management
Integrated Activity-Based Costing	○	●	●	●	●	●	●	●	●	Integrated Activity-Based Costing
Cross Docking	●	●	●	●	●	●	●	●	●	Cross Docking
Total Score	●	●	●	●	●	●	●	●	●	Total Score

Table 3 — Vendor Profiles

## Conclusions

Now, to get started. Strategy first! What are the business imperatives that drive you today? That being said, let's look at the two key myths that impact software selection:

- **The Integration Myth:** *Buying a solution from an ERP player will eliminate integration work.* There are two fundamental problems with this perception.
  1. Take a look today at the largest software houses. They offer a rich catalogue of software products. These firms are ERP in name only today (to their benefit, we think). And with many of their acquisitions, the capabilities you want may reside in another product on another platform. Thus, integration.
  2. Supply Chains are frequently multi-enterprise. So, you will be integrating with another firm. Transaction engines (EDI), Visibility Platforms, Service Oriented Architectures, etc. need to be the focus to achieve the multi-enterprise view.
- **The Product Road Map Myth:** *Larger companies that have more development dollars and overtime will enrich my product more. So promised future features are more likely to come from the big players than from the Domain Leaders.* Really? There are several issues with this fallacy:
  1. Large players have hundreds of products to prioritize their development dollars to—yours might not be that high on their list.
  2. Large development groups are technology centers, not necessarily schooled in the business issues. So when they do get around to coding, they may not genuinely understand the nuances of the needed capability.

Trade-offs between ERP and Domain leaders is a dicey issue. Many issues abound, and need sincere (not shallow) thinking to arrive at the right conclusion.

WMS is more than just software! It takes a team to truly define the requirements and translate these into a system solution—nay, a business success! Which vendor will be a better partner to help us to achieve our desired outcomes?

Make sure that you take into account the desired operational improvements once the technology has been fully deployed. New and more real time data and information can facilitate many things. Change management needs to be planned for ahead of time, too. Build an effective team of business, IT, and your partner to achieve the goal. Lacking this, even the best software, will disappoint.







Harvard Square Center  
124 Mount Auburn Street, Suite 200 N.  
Cambridge, MA 02138  
Tel: (617) 762-4040

Email: [info@clresearch.com](mailto:info@clresearch.com). Website: [www.clresearch.com](http://www.clresearch.com)