



Using Mobility to Elevate Warehouse Management

Enterprise mobility promises to infuse warehouses with greater agility and nimbleness, but getting there requires that manufacturers take a phased approach, dissecting every operational function and identifying key imperatives and process enhancements along the way.

Executive Summary

Without a proper dose of automation, warehouse managers are unable to achieve the operational performance and cost efficiencies needed to contribute to the greater good of the manufacturing enterprise. This is particularly important in materials handling, where the slightest inefficiency can lead to operational slowdowns and reputational damage with business partners and customers. To meet the requirements of increasingly demanding customers – where doing more with less is a business imperative – warehouse managers are laser focused on IT-enabled process changes that drive operational nimbleness and flexibility, with continuous focus on improving efficiency and productivity in significant warehousing tasks such as picking, put away, shipping, cross-docking, etc.

Enterprise mobility, according to both IDC¹ and Gartner,² is among the “four forces” shaping business-IT transformational decisions by delivering exponential productivity gains and incremental

business value. It is a key enabler of warehouse efficiency, flexibility and nimbleness, allowing manufacturers to live the future of work, today.

This white paper explores areas where mobility can be utilized and the key considerations for deploying mobility in a typical warehouse.

Mobility in Warehouse Management

Adopting mobility can boost the number of orders and packages processed daily by facilitating the whole range of warehouse functions from picking, put away, packaging, labelling and shipping, through receiving and cross-docking. For example, in the receiving area a warehouse operator can scan and identify incoming shipments and then reroute, inspect or relabel them. Similarly, in the shipping area an operator can scan outgoing packages to ensure order accuracy and can route them accordingly to the correct dock door or carry out any required value-added services as prompted on the mobile device.

Enabling the Mobile Warehouse

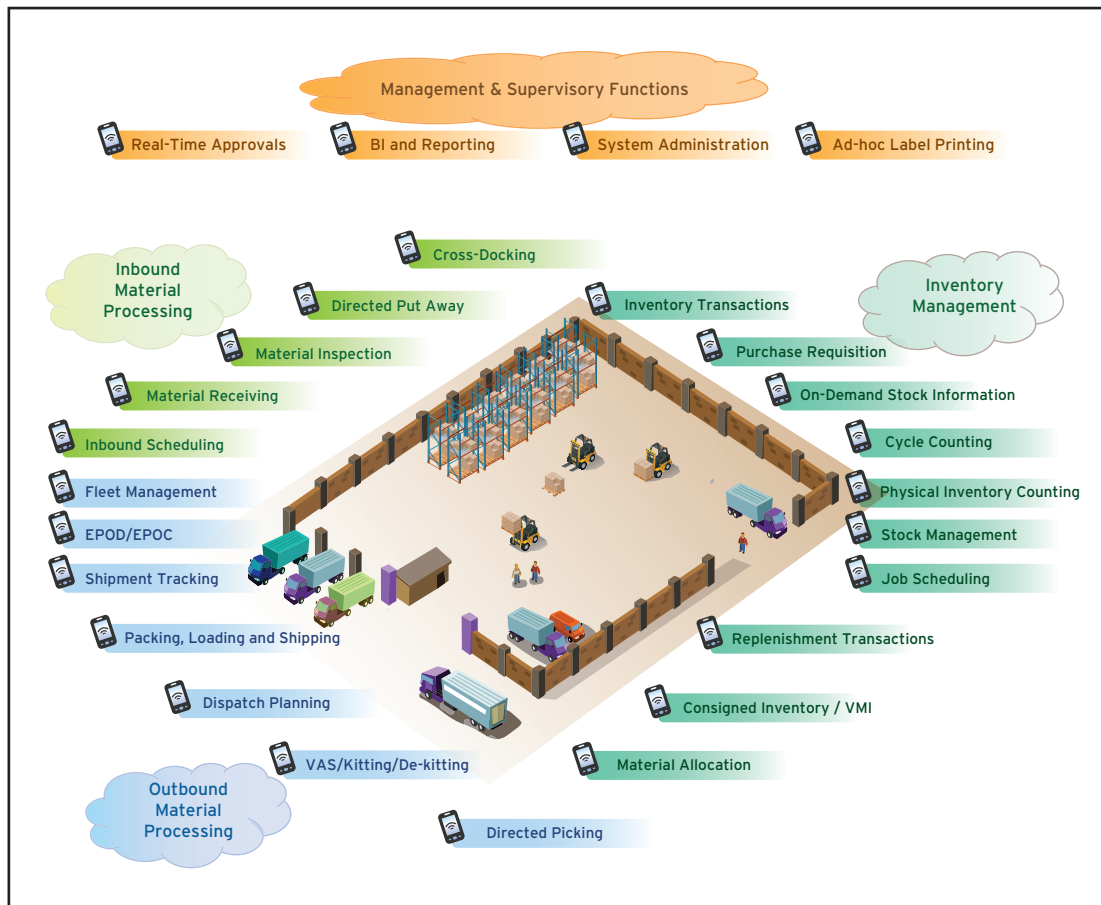


Figure 1

Figure 1 offers a high-level overview of the functions that mobility can support in a typical warehouse.

Once the contours of where mobility can help in warehouse operations are defined, warehouse managers can delve deeply to obtain a detailed understanding of how ground-level functions can actually be mobile-enabled and explore the benefits that can and should be derived from such initiatives.

The functions outlined in Figure 1 can be executed using different types of handheld mobile devices, including scanners, mobile computers and vehicle-mounted devices, or a combination of these. The selection of these devices for each function depends on parameters ranging from the warehouse's physical environment, the materials it deals with, Cap-Ex availability and other specific

organizational needs (which are beyond the scope of discussion here).

Core Functions

Inbound Materials Processing

The processes involving the receipt of goods into the warehouse can greatly benefit from the use of mobility. Figure 2 (on page 3) illustrates how mobility can be integrated with inbound materials processing along with the benefits of doing so.

Inventory Management

Inventory management is a core area within warehouse management where mobility can bring high levels of efficiency. Figure 3 (on page 4) shows how mobility can be integrated with inventory management functions along with the associated benefits.

Mobility's Inbound Materials Processing Benefits

Function	How to Enable Mobility	Benefit
Inbound Scheduling	Real-time updates can be exchanged using mobile devices between incoming shipments and the warehouse to facilitate efficient inbound scheduling. Based on these updates, the dock door assignments can be created and altered on a real-time basis.	Reduction in waiting time for vehicles at the receiving dock.
Materials Receiving	Inbound materials can be scanned, verified and received in the warehouse using a mobile device. The mobile device can be used to update the receipt status in the enterprise system in real time or in batches.	Flexibility at the floor level along with real-time updates.
Materials Inspection	Based on preconfigured quality plans within the enterprise system, inbound materials inspection can be carried out and the data can be entered for comparison against approved specifications using mobile devices. This can direct the warehouse worker to take the necessary action for inspection results based on pre-configured rules in the enterprise system.	Reduction in overall time and hence cost of quality assurance activities.
Cross-Docking Suggestions	Mobile devices can provide real-time visibility to orders requiring cross-docking and suggest suitable inbound shipments for fulfilment. Material can be allocated to these orders on the mobile device and shipped directly without having to be routed through the warehouse's inventory.	Reduction in time and effort needed to match inbounds and outbounds for cross-docking. Possibility for enabling cross-docking in warehouses that are unable to use this best practice.
Directed Put Away	Spot suggestions of locations for put away of materials can be displayed on mobile devices based on custom logic and rules depending on warehouse layout, location of existing items, item type and other parameters. Suggestion-based put away using mobility will enable easy consolidation of material in the warehouse based on any chosen parameter. In addition, mobility can enable scanning as opposed to manual key-in and real-time update of inventory records.	Saves time and effort for material consolidation while improving concurrent information availability.

Figure 2

Outbound Material Processing

In many businesses, a warehouse's efficacy is determined by how well it is able to process outbound orders. Figure 4 (on page 5) highlights how mobility can be integrated with functions of outbound material processing along with the associated benefits.

Management and Supervisory Functions

Besides the core warehousing functions, there are various management and supervisory functions performed by warehouse managers and shop floor supervisors that mobility can beneficially transform. Figure 5 (on page 6) reveals how mobility can help such functions along with the benefits.

Mobility Deployment Considerations in a Warehouse

Deploying mobility in a warehouse requires a disciplined approach to achieve its full potential. The deployment can either be a part of the organization's overall IT strategy or a warehouse-focused

engagement. Irrespective of the approach taken, deploying mobility in a warehouse requires special care across numerous aspects due to its process-intensive nature, coupled with the fact that it is a core component of the manufacturing value-delivery mechanism. Thus, it is imperative that the deployment blends in smoothly with day-to-day activities and causes minimal disruption. Figure 6 (on page 6) lays out our recommendations for a seamless deployment of mobility across the warehouse functions.

Objective Definition

In this stage, the general approach will involve identifying the strategic or tactical objectives that drive the introduction of mobility in warehouse(s). For example, the objectives can be improving inventory management, bringing down costs without impacting service, improving worker safety and/or achieving regulatory compliance.

Balance Top Floor and Shop Floor Goals

Management buy-in for the mobility program will ensure tight alignment of the technology with

Mobility's Inventory Management Benefits

Function	How to Enable Mobility	Benefit
Purchase Requisition	Purchase requisitions can be raised right at the point of source of demand in shop floors and warehouses using mobile devices.	Reduction of purchase lead time.
Inventory Transactions	Basic inventory transactions such as issue, receipt, transfer of goods, etc. can be carried out using mobile devices. The mobile application can provide information about the current location of materials, destination of materials, handling instructions and all other related data so the user can carry out the specific transaction.	Improving concurrent information availability and eliminating additional effort for maintaining updated information.
On-Demand Stock Information	Real-time information regarding availability of stock and other stock-specific information can be made available on mobile devices from anywhere, anytime. Information can be queried via different methods (e.g., item-based inquiry, location-based inquiry, etc.).	Improving concurrent information availability for faster decision-making.
Cycle Counting	Cycle count orders can be executed by scanning items planned for count at any location using a mobile device. The mobile application can keep track of the count and pending items while it can also require users to verify item and lot information.	Reduction in counting effort and enforcement of better operational discipline.
Physical Inventory Counting	Physical counting of all items in particular inventory locations can be handled using a mobile device. The application can keep track of the counts and also allow entry of items which did not have system records and hence for counts that were not generated.	Reduction in counting effort and concurrent update of information
Stock Management	Mobile applications can be used for stock management including updating the stock quantities, stock condition, location, pack details, registering stock relocations, etc.	Reduction in stock management effort with concurrent information availability.
Job Scheduling	Real-time notification of job and flow scheduling can be sent to shop floor workers on mobile devices. Also, dynamic status updates on work orders and assembly completion can be propagated using mobile applications.	Better availability of concurrent information.
Replenishment Transactions	Inventory levels can be managed using the enterprise system's planning and replenishment features (e.g., min-max, Kanban, etc.) that includes generating preapproved move orders. These move orders can be effectively tracked and transacted using a mobile device on the shop floor.	Reduction in time and effort for carrying out replenishments, thus increasing material availability.
Materials Allocation	Rule-based material allocations created by the enterprise system for different kinds of move orders such as outbound orders, issues to shop floor, inventory transfers, etc. can be viewed and managed using mobile devices. In cases where these need modification, such requests can be initiated, reviewed and approved by appropriate users based on configured workflow using their mobile devices.	Time savings by providing ground level flexibility in handling material allocations.
Consigned/ Vendor Management Inventory Receipt	Consigned or vendor-managed inventory can be received on a mobile device using a single receipt transaction to create the order line and receive the goods in a single step by pre-configuring the rules for order and line creation.	Effort reduction in consignment inventory management.

Figure 3

Mobility's Outbound Materials Benefits

Function	How to Enable Mobility	Benefit
Directed Picking	Pick lists generated by the enterprise system and assigned to specific users based on business rules can be viewed by warehouse workers on their mobile devices. These tasks are then executed by the user, based on directions provided by the mobile application that optimizes the task at every point based on material availability, route and other variables. The mobile application can also update the system concurrently with the current task status.	Time and hence cost savings in one of the most significant warehousing processes – order picking.
Packing, Loading and Shipping	Tasks related to containerization, labeling, loading and shipping can be administered and executed using mobile devices. Specific instructions can be transmitted to workers carrying out these tasks in the form of mobile notifications. Additional information such as cost items for shipping charges, outside service tracking numbers, etc. can be captured at this level using a mobile device.	Time and cost savings through efficient execution of packing and shipping process.
Dispatch Planning	Dispatches can be prioritized and hence accelerated by providing the dispatch planning system, real-time mobile updates on the readiness of shipments and other delivery requirements. Pre-dispatch tasks can be tracked through mobile devices and the information can be constantly fed to the dispatch planning system in real time to enable this.	Time savings and accuracy of dispatches by priority and delivery requirements.
Value-Added Services/ Kitting, De-kitting	Tasks for value-added transactions such as packing material as per delivery requirements, gift wrapping, etc. along with specific instructions can be dispatched through mobile devices based on requirements recorded in the system. Tasks such as kitting and de-kitting before dispatch can also be administered and executed through mobile devices.	Increased efficiency and accuracy in executing value-added services.
Shipment Tracking	Real-time information can be effectively tracked on delivery, stops, diversions and breakdowns by shipment handlers using mobile devices to provide updates and even request service. Tracking information at this level can help by providing customers with exact information on the status of shipments, which is important for B2C companies.	Enhanced tracking efficiency and greater customer satisfaction.
Fleet Management	Dynamic optimization can be achieved in fleet utilization by receiving location and status updates of vehicles in real time using mobile devices. Also, dispatches can be consolidated and optimized based on concurrent information. Route optimization can be achieved based on real-time information being received from mobile-enabled vehicles to enable traffic updates, weather conditions and other geo-relevant information.	Cost reduction through efficient fleet utilization and management.
Electronic Proof of Delivery/ Collection (EPOD/EPOC)	Electronic proof of delivery/collection along with signature capture can be implemented using mobile devices. The delivery person can use a specialized mobile device to record the acknowledgement from customer and to concurrently update status.	Time savings in obtaining proof of delivery and updating delivery status.

Figure 4

the organization's overall strategic objectives. This approach will help ensure the organization achieves synergistic benefits over the long term. On the other hand, it is also imperative that these objectives address key and significant pain points of the warehouse workforce, as well as the function. This will drive active participation and wholehearted adoption of mobility solutions by key stakeholders.

Put Numbers to Objectives

It is a good practice to calibrate objectives with numerical targets where quantitative measurements are feasible. This will help justify the investments needed for the deployment as well as make it easy to measure the results post-deployment. It may be difficult to assign exact numerical targets in most cases, so ballpark objectives can be set. For example, if inventory reduction is an

Mobility's Supervisory Benefits

Function	How to Enable Mobility	Benefit
Real-Time Approvals	Real-time approvals can be provided by supervisors and administrators for all warehouse processes using mobile applications. When an activity requiring approval is recorded, notifications are received by the supervisor(s) (based on pre-configured workflows), who can review and approve/reject the request concurrently from his device.	Time savings leading to cost savings through faster execution of processes.
Business Intelligence and Reporting	Business intelligence and analytical tools can be used to generate ad hoc reports with interactive charts and layouts on mobile devices that can be accessed from anywhere, anytime. This can take advantage of information updates provided through mobile devices in near-real time, thus giving scope to execute and track key warehousing aspects such as predictive replenishments, hours accounting, etc.	Faster and effective access to intelligent information and analysis leading to efficient decision-making.
System Administration	Some basic system administration functions such as user administration, device administration and parameters administration can be made accessible through mobile devices to administrators who work in distributed environments (e.g., modifying user access to specific functions, changing device configurations, changing parameter values of system parameters, etc.).	Time savings through ease of configuration management.
Ad Hoc Label Printing	Ad hoc label printing requests can be made through mobile devices from any point in the warehouse whenever needed by any user who has access to the specific function.	Time savings through ease of making print requests from anywhere.

Figure 5

objective, then mobility deployment can target a 7% to 10% reduction in inventory.

Process Evaluation

This requires an intensive evaluation of the warehouse processes in light of the objectives defined in the previous stage. Evaluation and analysis of key processes should result in re-engineering for improved execution efficiency in terms of cost reduction, speed, error reduction, productivity improvement, agility of information

flow and the other objectives already defined. The underlying focus will be to integrate mobility into the host of activities needed to maximize deployment benefits.

Mobility for Business Goals, Not Vice Versa

It is important to keep in mind that the objectives of deploying mobility, which were identified in the first stage, were to help attain business goals rather than deployment of a mobility strategy and devices. For example, suppose the existing

Key Considerations for Successful Warehouse Mobility Deployments

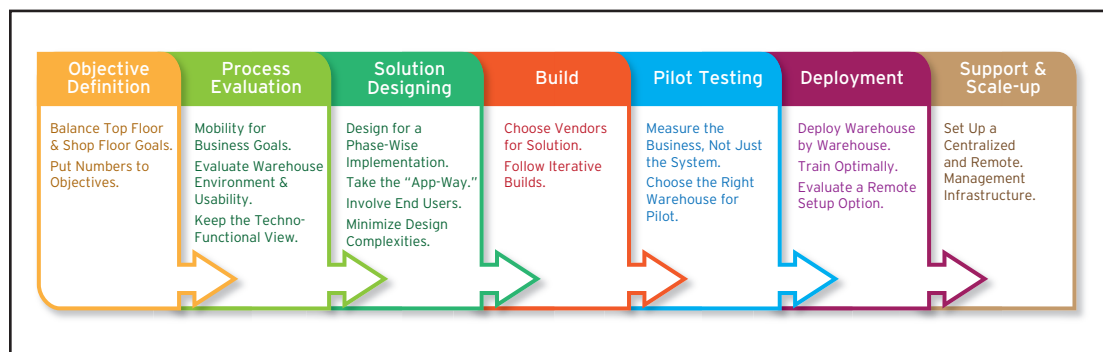


Figure 6

way of working involves inbound material put away and inventory consolidation as two separate processes and one of the objectives is to optimize inventory handling costs. The reengineered process should involve mobility-enabled directed put away which handles consolidation automatically rather than keeping put away and consolidation as two separate processes and mobile-enabling each process individually.

Evaluate Warehouse Environment and Usability

It will be comparatively easier to assess the environmental conditions in this stage while evaluating the processes. Detailed notes can be made here regarding circumstances such as dust exposure, extreme temperatures, possibility of contact with liquids and chemicals, possibility of drops and wash-downs and other such conditions experienced across various processes. Notes should also be taken for possible usability details such as the need for scanners, keyboards, touch-enabled interfaces, cameras or other such needs for the activities being chalked out. These will form valuable inputs while deciding the hardware features and form-factor requirements of the solution.

Keep the Techno-Functional View

The other key imperative is to determine techno-functional requirements such as flow of information, workflow needs, communication enhancement needs, etc. while evaluating and redesigning processes. This ensures more integrated brainstorming and eliminates the need to evaluate these activities at a later stage.

Solution Designing

The next stage involves detailing the complete solution by integrating both hardware and software design requirements. The hardware design will contain details of the kinds of mobile devices required along with their expected features and functionalities, device form factors, communication protocols, network requirements and other hardware and infrastructure needs. This should also take into account the environmental and usability needs detailed in the previous stage. The software design will detail the mobility-driven functional model required in the system to enable reengineered process flows from the previous stage. This should also detail the data flow, computational needs and algorithms, state diagrams, user interfaces and system interfaces of the solution based on techno-functional needs identified in the previous stage.

Design for a Phase-Wise Implementation

An effective approach for implementing mobility in a warehouse is to create a phased implementation plan based on criticality of functionalities, possibility of disruptions of critical processes, availability of resources and budget constraints. This step kicks off the phased plan because at this point, a more complete view of the process level requirements, techno-functional needs, environmental needs and usability requirements is available. On the other hand, the considerations of a phased plan can be more easily absorbed in the technical design, functional design, procurement needs, setup and installation needs, etc. – which will be challenging once the design is finalized.

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Take the 'App-Way'

An app-based approach rules the world of mobility today and is expected to prevail for the foreseeable future due to key benefits such as the ease of deployment and maintenance, scalability and flexibility it provides. (A detailed discussion on this topic is beyond the scope of this white paper.) Designing the warehouse mobility solution on an app-based architecture will help in leveraging those benefits. Each function can be deployed as a separate app, installable from an organization wide "app-store." Users can have access to apps based on their roles and the functions they execute on the ground. (For more insights on this subject, see our white paper ["Enterprise Mobile Apps: How Role-Based Apps Will Drive Productivity and Transformation in Manufacturing Companies."](#)) Some obvious benefits of this would be efficient access control, better supportability and maintainability, easier collection of feedback and issue tracking, efficient scalability, etc. Ideally, the apps should be designed to handle broader functions end to end; however, if functional interdependencies cannot be completely eliminated, they can be addressed by creating app dependencies requiring installation of all interdependent apps.

Involve End Users

At this stage, it is possible to get carried away by the expertise of architects and solution designers while ignoring the actual end users who will use

the system at the ground level. It is imperative to verify the design aspects that directly affect the end users within a chosen sample of users. For example, a picker's input is important in deciding whether the mobile devices used for picking should have touch-based interfaces or physical keypads. Again, these inputs need to be properly moderated in light of technical feasibility and budget constraints. In the end, it is good to know what can and cannot be provided instead of not providing something that could have been done with ease.

Minimize Design Complexities

The tendency to increase system complexity, in the design stage, for rare exceptional situations needs to be curbed to prevent time and cost overruns and ensure a more manageable and supportable solution. For example, ingress protection (IP) sealing levels of devices should be in tune with the current and predictable future environment of operations rather than making it too future-proof based on unpredictable changes in the work environment. Similarly, it is not advisable to build a complex feature into the software that will be needed only in very rare and unpredictable situations without exploring the existence of potential workarounds.

Build

This stage is where the solution is developed by procuring the hardware, developing the software and installing the infrastructure. As a prerequisite, the organization must evaluate each vendor and make hardware, software and infrastructure selections based on the organization's procurement processes and the resource base.

Choose Vendors for Solution, Not Just Products

In the vendor selection phase, it is important to choose vendors that can provide solutions for warehouse mobility deployment – and preferably have experience doing so. Like all enterprise products, taking a product-specific approach may not prove to be effective in attaining end-business objectives. Thus, a vendor that understands the specifics of the organization's business, and hence its warehousing needs, is typically a more reliable partner than the one with the lowest-cost or most feature-rich product.

Follow Iterative Builds

A significant consideration at this stage will be to go for an iterative build to deliver on the phased plan diagrammed in the previous stage. This will be more streamlined if the phased plan had been created with the necessary considerations incorporated in the design. Also, an app-based design will be helpful here to build/enhance a set of apps in each phase. This will ensure better cost and time controls during the build stage, with clear milestones and deliverables.

Pilot Testing

At this stage, a small-scale pilot is deployed to test the mobility solution with end users. This is where the solution deployment steps, installation and go-live sequences and considerations are tested before carrying out actual user acceptance testing. This is also the best time to conduct all necessary measurements for studying the effect of deploying mobility in a warehouse once user testing has started.

Measure the Business, Not Just the System

It is very important to perform measurements focused on the business objectives identified in the first stage of deployment rather than merely measuring the performance of the new system. For example, if inventory reduction was a strategic objective of this deployment, there should be some measure to monitor the inventory levels before and after deployment. It is best to not get carried away by measures of how fast the system is responding and how many defects are present in the software although they too are significant measurements to be carried out in this phase. This is where a real advantage of phased building and implementation can be felt. If the measurement results don't live up to the targets when the first phase is pilot tested, subsequent phases can include the necessary fine-tuning to correct course.

Choose the Right Warehouse for Pilot

It is crucial for pilot testing to choose a representative warehouse that covers the organization's core functions and processes. On the other hand, it is also imperative to not choose a warehouse for the pilot test that is critical to the business – one where disruptions would affect an important market significantly. Balancing these criteria is key.

Deployment

At this stage, the solution is deployed in the planned warehouses and used to carry out day-to-day business. In the case of a phased

A picker's input is important in deciding whether the mobile devices used for picking should have touch-based interfaces or physical keypads.

implementation, this stage will go live with just the first set of functionalities initially, with more functionality added at subsequent stages based on the plan created in the solution designing stage. User training is a key activity to be carried out before going live.

Deploy Warehouse by Warehouse

It is a good practice to deploy warehouse by warehouse. It ensures that the specialists who are needed for the go-live can focus on one warehouse at a time, thus reducing the total headcount needed. This also ensures that lessons learned during previous deployments can be carried over.

Train Optimally

To train all users equally in something as resource intensive as a warehouse can be costly and time-consuming. Instead, it may be optimal to subject all warehouse workers to a basic training, then provide specialized training that is functionally based and focused on key responsibilities, and then handpick a few across all the functions for in-depth training. Those who receive in-depth training can then help to train the others when needs arise.

Evaluate a Remote Setup Option

The initial setup and installation of mobile devices is a time-consuming and costly affair. In most cases, however, it is possible to do this remotely from a central location using a staging solution. The required setup can be pushed to devices on the ground with little or no end-user involvement. Hence, it is advisable to evaluate a remote setup option wherever feasible.

Support and Scale-Up

After successful deployment, a continuous process of support and scale-up of the solution is initiated. The deployed solution needs to be administered, managed and supported actively. It is also necessary to scale up the solution from time to time by introducing enhancements in the form of new functionality, advanced technology and platform upgrades. In a phased implementa-

tion, as discussed in the solution designing stage, the support and scale-up of the deployed phases continue in parallel to the implementation of the later phases.

Set Up a Centralized and Remote Management Infrastructure

The costs of support and scale-up can be prohibitive if it is managed and administered locally. It is important to centralize the support of mobile devices and the related infrastructure, including the wireless network. Scaling up activities executed occasionally also needs to be seamlessly deployed to ensure the least possible disruption to warehouse operations. Thus, consider a support and maintenance infrastructure that is centralized and can be remotely managed. Here, an app-based implementation, as mentioned earlier, can prove very useful since it makes maintenance and pushing of upgrades far easier and less intrusive compared to a more aggregated system.

Looking Forward

As IT advances, mobile devices are moving toward greater levels of integration with human activity. Enterprises are using this to their advantage by deploying smart mobile devices and apps that increase process efficiency and thus enhance productivity by enabling new ways of working.

Enterprise mobility is the most significant step in this direction. Successful organizations are those that use their power to build, operate and extend new-age warehouses today. Due to the immense benefits, the warehouses of tomorrow will evolve with tightly interwoven mobility. It is just a question of which organizations can move fast and are able to differentiate themselves at the onset, leaving laggards to play catch-up with market leaders.

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Footnotes

¹ IDC Manufacturing Insights: "Predictions 2012: Manufacturing."

² Gartner Predicts 2012: "Four Forces Combine to Transform the IT Landscape," www.gartner.com/id=1871420.

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