

# Optimizing the Front Line Workforce

## Unlocking the Real Benefits of Voice Technology in Warehousing Operations

### A Voxware White Paper

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## 1. Executive Summary

An increasing number of distribution center executives are turning to voice technology to improve picking operations. But for many companies, the real benefits of voice often remain untapped, despite expensive outlays for hardware and software. They settle for marginal improvements when a breakthrough is within reach. Why?

The answer lies in whether voice technology is implemented as a tactical tool to improve a *task* or a strategic initiative to empower the *workforce*. The simplistic view is task-centric: that speech recognition is just another way to capture data - in effect a humanized "talking scanner." The strategic view is people-centric: that voice technology is a key ingredient in optimizing *Floor Logistics*.

Floor Logistics describes the activities of warehouse workers. It is the sum of all the things these employees do - moving about, handling products, coordinating activities, reporting on progress, receiving direction, and dealing with exceptions.

The implications of optimizing Floor Logistics are profound, because the real pressing business issue in the warehouse is not a given *task* such as picking or replenishment - it is the effectiveness and contribution of the workforce as a whole. Optimize tasks and you get incremental benefits; optimize the *workforce* and you get competitive advantage.

The contribution of the workforce in logistics operations is crucial. Labor is the single biggest cost factor in warehousing, yet it is the least leveraged by technology. Distribution center workers have a huge impact on the ultimate bottom line - they either operate at top efficiency or waste time, make wrong decisions and other costly mistakes. Marginal improvements result from streamlining *tasks*, but breakthroughs come from a focus on *people*.

This paper introduces **Dynamic Workforce Optimization**, a major advancement in warehousing technology. It is a new approach, based on a proven technology foundation. Powered by a new breed of interactive voice-based software application, it is a people-centric solution to the challenges of labor utilization in the distribution center. Dynamic Workforce Optimization, through the operation of key technology enablers, improves Floor Logistics and maximizes the contribution of the front line workforce.

No logistics executive wants to invest in new technology and then fail to maximize the benefits received. That is why it is important to understand the challenges inherent to optimizing Floor Logistics and identify the "must have" technology enablers that any voice-directed system must possess if it is to deliver the broadest possible benefits to the enterprise.

## 2. It's All About People

Many organizations push for high performance by striving for uniformity in all warehouse processes. Assembly line manufacturing has proven that efficiencies are improved when workers perform pre-optimized tasks repetitively. Unfortunately, this approach often falls short in the distribution center due to three fundamental facts:

1. Floor Logistics activities are more complex than assembly line tasks.
2. While tasks might be uniform, the people who perform them are not.

3. Logistics activities rarely go exactly as planned. Exceptions are a practical, day-to-day reality that prevent totally uniform processes from being achieved.

This combination of complex processes, "non-uniform" humans, and exception conditions adds up to a huge management challenge - and a major opportunity to leverage technology for an operational breakthrough. Voice recognition is an ideal technology vehicle to address this challenge, but it must be applied in conjunction with *people-centric* software that has intelligence about the entire range of activities warehouse workers do.

Let's consider the issues of the human factor in Floor Logistics.

All of the activities in the distribution center are accomplished by people - but *people* are not interchangeable components. They differ from one another. They are the backbone of any warehousing operation, and effectively managing them is difficult because they have:

- Varying Experience and Abilities
- Varying Education and Motivation Levels
- Varying Languages and Cultures
- Varying Job Roles and/or Multiple Job Roles

Often, the workforce is a diverse group, speaking different languages and coming from different backgrounds. In some parts of the world, a trend toward multilingual warehouses is well-established.

For instance, in the United States over half of all warehouse workers speak Spanish as their first language, whereas over half of all managerial personnel are native English speakers. In certain US geographic areas, one can find warehouses where different workers speak Haitian French, Cuban Spanish, Mexican Spanish, Vietnamese, Cambodian, and other languages.

In Europe, multiple language workplaces are common in virtually all border areas. In addition, the reality of cross-border labor means that a distribution center may operate with workers from widely differing home areas who may speak a common language but with very different dialects.

Another issue confronting management is the variety of experience and abilities in the workforce. Few warehouses are staffed with nothing but highly motivated "super workers." Just like any other workforce or population, the larger the group the more likely you are to have a "bell curve" of experience and abilities (Figure 1).

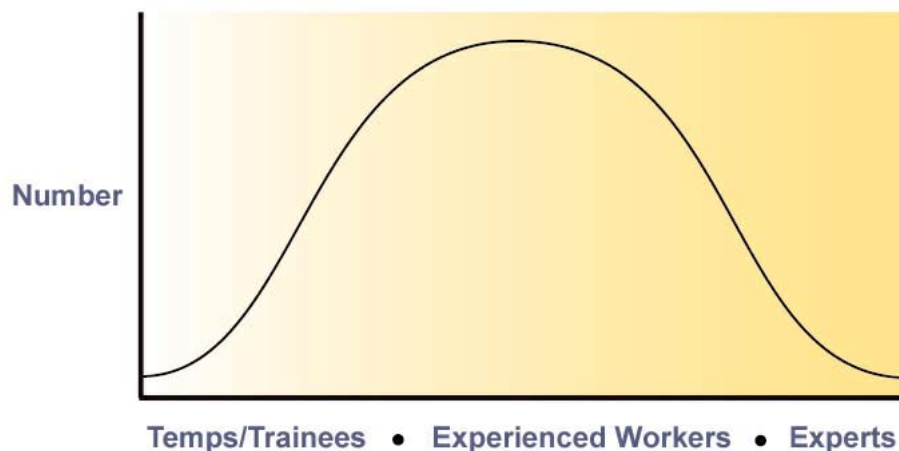


Figure 1: The "Ability/Experience Bell Curve"

In a typical warehouse operation, at one end of the curve you will have some workers who are relatively new (who presumably are less effective). At the other end of the curve are your "super workers" who out-work and out-produce everyone else. Somewhere in the middle is the bulk of the experienced workforce.

Of course, life is never as neat as a bell curve. In reality, the shape of the workforce experience curve for many companies varies with employee churn and business seasonality. Many enterprises bring on temporary workers to handle increases in volumes during the busy weeks. At those times, the experience curve is weighted more towards the left-hand side of the scale (Figure 2), and supervisory challenges are intensified because inexperienced workers naturally make more mistakes. Just when the enterprise needs especially high performance - during the busy season - what often happens is a drop in the effective contribution per worker.

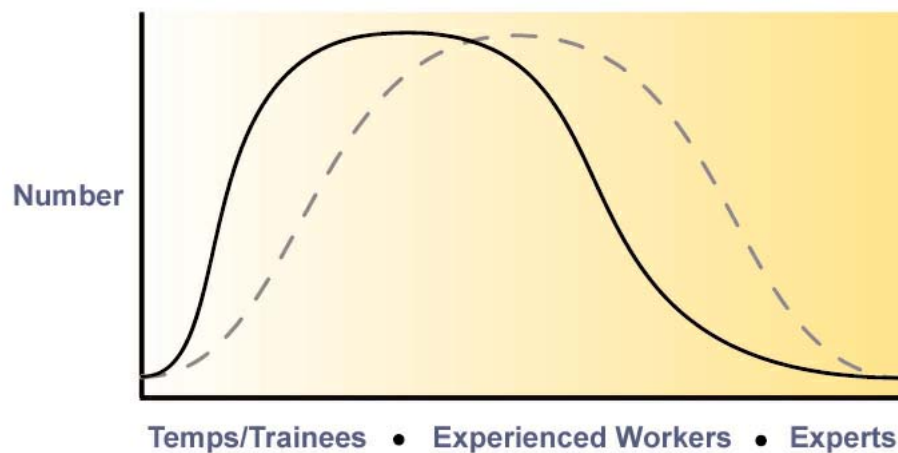


Figure 2: Ability/Experience Curve During the Busy Season

In any warehouse, supervision - or span of control - is one of the key challenges. How is such a diverse workforce trained? How is it possible for a single supervisor to give all individual workers the on-the-spot assistance, correction, and direction they need? Noted logistics expert Edward Frazelle writes:

"The size of the warehouse also tends to increase the span of control. The greater the span of control, the more skilled the managers and supervisors need to be. Unfortunately, there is a severe shortage in the number of highly skilled warehouse operations managers and supervisors. As a result, as the warehouse grows, the management requirements can quickly exceed the management and supervisory capability." <sup>1</sup>

How many supervisors is enough? Frazelle also notes:

"Our experience shows that operator-supervisor ratios in excess of 17 to 18 do not permit adequate supervision and that ratios less than 13 to 14 are too costly." <sup>2</sup>

One potential benefit of Dynamic Workforce Optimization technology is to effectively increase the span of control apart from adding more supervisory personnel. This can be achieved because, in effect, each worker has a "virtual supervisor" on his shoulder throughout every activity. While no technology can replace supervisory personnel, real-time workforce optimization capabilities can extend the reach of the supervisors you have.

<sup>1</sup> Frazelle, Edward. World-Class Warehousing and Material Handling, 2002, McGraw Hill, p62

<sup>2</sup> Ibid, p232

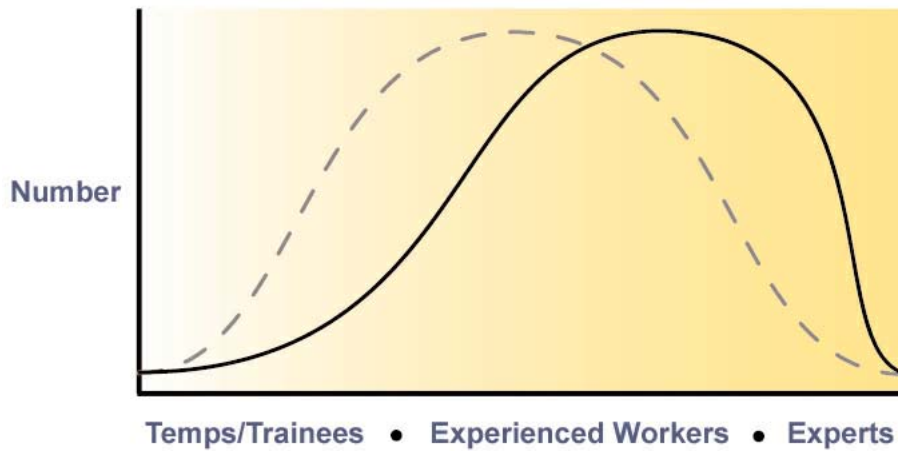


Figure 3: Optimizing the Contribution of Every Worker

The issue here is that workforce optimization technology must take all of this variation into account. The mission is to “move the curve to the right” (Figure 3) - that is, to provide leveraging technology that benefits *each* employee and makes any given employee's contribution more effective than it otherwise would be - regardless of where he or she falls on the ability/experience curve. We want temps to quickly get up to standard, experienced workers to produce like experts, and experts to be taken to new levels of effectiveness.

### 3. Floor Logistics – More than Capturing Data

If one dimension in workforce optimization is the variation and diversity of the labor pool, a second dimension is the range of complex activities the workers perform.

Marginal improvements can be realized when a new technology makes an existing task easier to perform. But breakthroughs come from “thinking outside the box” to revolutionize a business process instead of making incremental changes to it.

The introduction of voice technology into warehouse operations is a classic case in point. Some enterprises are implementing voice as a more efficient means of capturing data during picking and replenishment activities. But all this does is turn warehouse workers into talking scanners. While accuracy and productivity improvements may be sufficient to justify the investment in voice technology, an opportunity for greater benefits is not realized. Why?

Warehouse workers do *more* than capture data. By some estimates, data-capture represents less than 19% of what the average warehouse worker does. Floor Logistics encompasses much more. The point in time when data is captured (whether via voice or a scanner) is only a small part of the overall activity. Data capture also depends on the immediate presence of a physical label or identifier of some kind. Yet, when voice technology is being employed, the worker is “wired up and connected” throughout the *entire* activity - why not capitalize on this fact?

Dynamic Workforce Optimization is a major evolution in voice technology for the warehouse. It goes further than simple data capture and task improvement because it focuses on everything the worker does, and leverages the fact that the worker is always in constant, real-time communication. Examples of issues this more strategic approach can address:

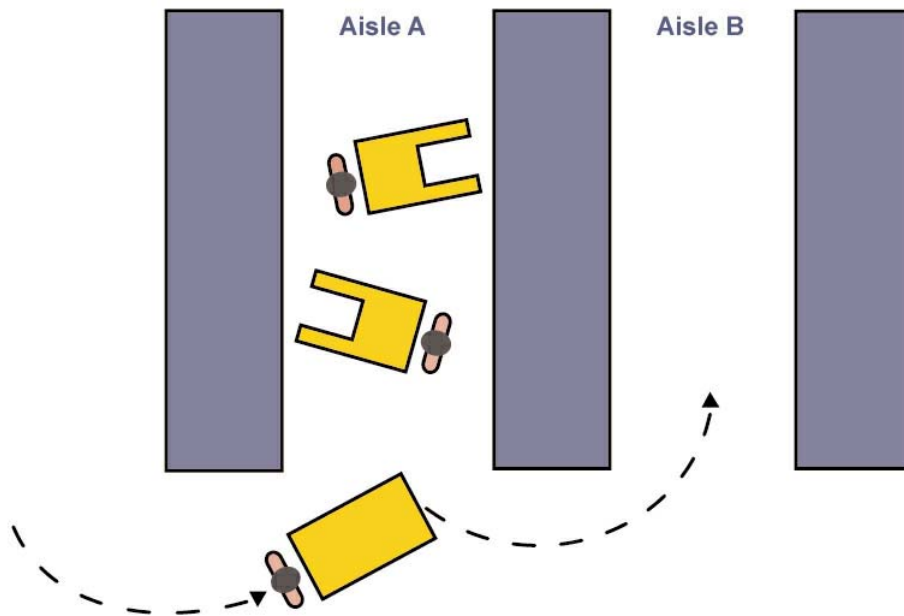


Figure 4: Situational Optimization - Worker Reacts to Conditions on the Floor

**Situational Issues.** A worker is directed into a given location (Figure 4), but finds that the aisle is blocked by several of his colleagues. With Dynamic Workforce Optimization, the worker can inform the system and be immediately redirected.

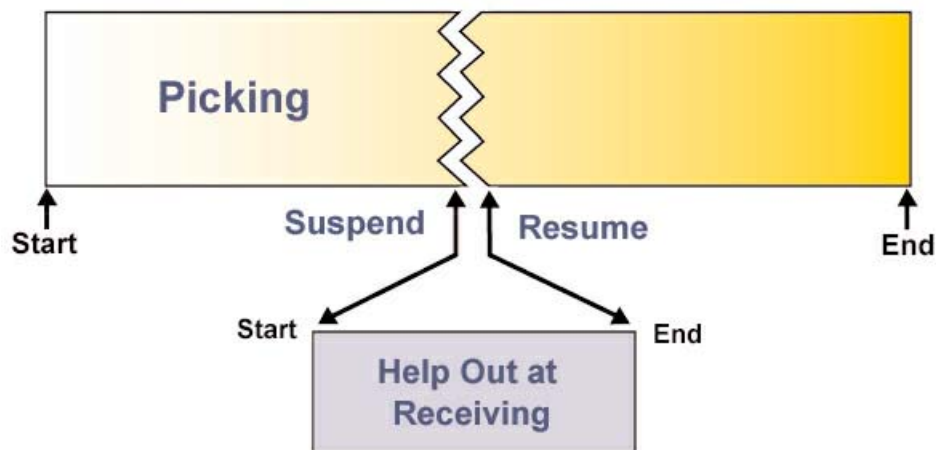


Figure 5: Optimized Utilization - One Worker Switches Between Job Roles

**Utilization Issues.** Site management determines that it would be effective to have certain (but not all) selectors help out in Receiving during unexpectedly busy times. Dynamic Workforce Optimization software allows authorized workers to temporarily switch job roles (in this example from Picking to Receiving), do a new activity, and then resume the work that was in progress (Figure 5).

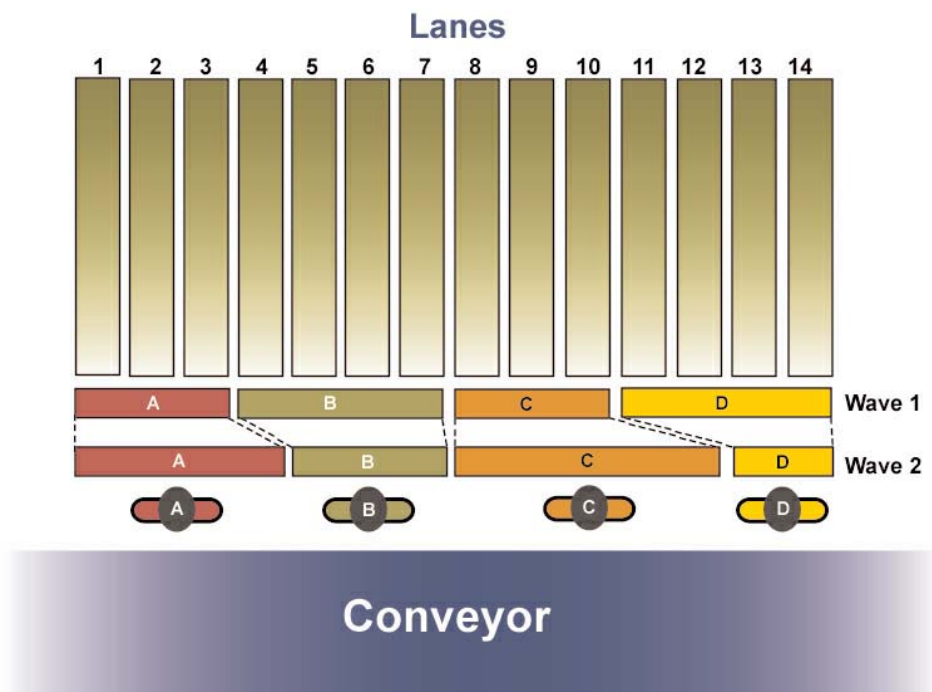


Figure 6: Optimizing Workgroup Contribution through Load Balancing

**Coordination Issues.** Workers put products into totes on a conveyor. Each worker has an assigned zone of lanes from which to pick. Fast workers finish tasks before their colleagues and stand idle until the conveyor moves again. Dynamic Workforce Optimization balances the workload (Figure 6), varying the number of lanes assigned to each worker so that nobody is idle.

**Qualitative Issues.** Workers can verbally identify *why* certain exception conditions occurred, such as a short pick because some products were damaged. This allows the WMS to be kept properly updated and synchronized.

Floor Logistics is a complex set of orchestrated tasks. To deliver breakthrough benefits, Dynamic Workforce Optimization software must successfully address multiple dimensions of the Floor Logistics challenge.

Among them:

- Workforce Diversity
- Process Complexity and Sophistication
- Exception Conditions

The ultimate goal is to have *each* worker contributing at his or her maximum, and to reduce labor cost as a percentage of warehouse operating expense. In order to achieve these goals, there are certain technology "must haves." They are described in the next section.

## 4. Key Enablers for Optimizing the Front Line Workforce

Dynamic Workforce Optimization typically utilizes a wearable computer such as the LXE MX3X, which is equipped with voice recognition and application software.

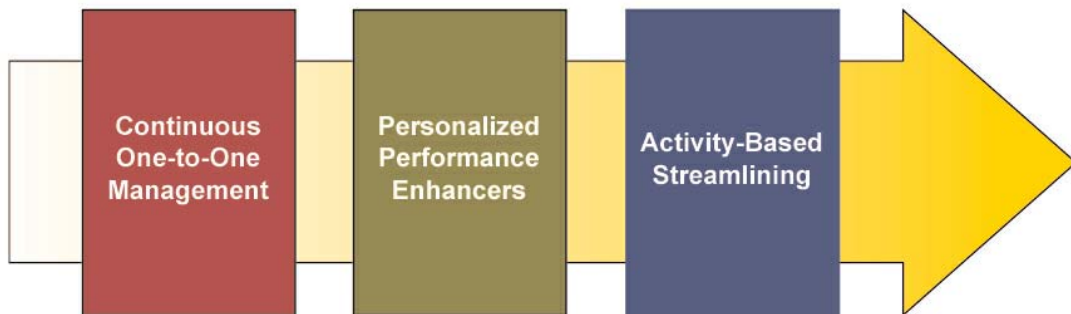


Figure 7: Key Technology Enablers

Whatever intelligence the solution has about worker activities and dynamic optimization is found in the software. It is important that the hardware is like LXE's MX3X: rugged, robust, and capable of operating in demanding industrial environments characterized by high noise and extreme temperatures. The key enablers for Dynamic Workforce Optimization are software-based:

- Continuous One-to-One Management
- Personalized Performance Enhancers
- Activity-Based Streamlining

### Continuous One-to-One Management

High quality supervision is a key factor in any effective warehousing operation. If cost was no object, the ideal solution would be to assign a supervisor to every worker - but supervision becomes too costly when supervisor-to-worker ratios dip below 1:13.

Figure 8: Continuous One-to-One Management Improves Supervisory Coverage

Voice technology - if it is coupled with the right software - gives us the opportunity to put a supervisor "on the shoulder" of each worker. The benefit realized is a lower cost of supervision for a given number of workers (Figure 8). In a sense, Continuous One-to-One Management gives workers the "perfect supervisor" who:

- Speaks many languages and thus can communicate with the worker in his or her native tongue.
- Is always there, throughout every activity, from start to finish.
- Knows the worker's abilities, experience and job roles - and is able to provide assistance that is tailored to the specific worker.
- Is simultaneously working alongside all other workers in the warehouse (knowing their languages and recognizing their abilities and roles), and can thus coordinate workers and tasks.
- Is expert in the logistics processes used at the site.
- Has total visibility into all aspects of the warehousing operation as each shift progresses.

When warehouse workers use voice technology, they are always "connected" and available. What a wasted opportunity, when the software they have simply uses their voices to capture data. So much more is possible.

Continuous One-to-One Management combines knowledge of the worker with knowledge of the logistics process, real time access to the WMS, and visibility into warehouse conditions to give superlative direction and optimize what each worker can achieve. For instance:

- Workers are only assigned work they are capable of performing.
- Authorized workers can be directed to switch - either temporarily or permanently - from one function to another (e.g., from Picking to helping out in Receiving).
- Work tasks are distributed to teams of workers based upon what each individual worker can accomplish, enabling the entire group to work at its maximum output.
- Errors are detected via interactive dialogs and corrected at the time when it is easiest (and cheapest) to fix them: when they happen.
- End-of-shift optimization is possible, whereby remaining work is assigned to workers according to their productivity rates - thus eliminating the problem of faster workers having nothing to do as the shift is ending, while slower workers are paid overtime to complete unfinished tasks.
- Training and "help" are provided in-line with worker activities, enabling workers to immediately ask what they should do next without having to find a supervisor.

Continuous One-to-One Management also gives site supervisors immediate visibility into logistics activities as they occur. Workers who need personal attention can be quickly identified, thus making supervisors more effective in the use of their own time. In addition, an individual can be interrupted via a special message (e.g., "Come to the Office") without having to go out to the floor to search for the worker.

## Personalized Performance Enhancers

There are lots of ways to give workers productivity tools, but often those tools have a "lowest common denominator" quality. They don't take individual capabilities and characteristics into account.

Dynamic Workforce Optimization technology solves this problem with Personalized Performance Enhancers - software-based facilities that understand each worker's language, abilities, and job role. Samples are:

- An "expert mode" that enables more highly skilled and experienced workers to take shortcuts and work even more productively.
- Assignment of higher work volumes to workers who have a track record of being able to accomplish more than the norm.
- The ability to immediately switch between job roles.
- Recognition that a given worker may operate in different physical environments (e.g., a very noisy freezer versus a quiet ambient area), with the ability to enhance system operation according to the actual location at any given time.

## Activity-Based Streamlining

The combination of several factors makes voice technology a key ingredient for optimizing worker performance.

- It is continuously active, no matter where the worker is. This makes voice a "flexible cost technology" because it can be employed in many different situations and in new ways - as opposed to a "fixed cost technology" such as pick-to-light that, once deployed, is very rigid and extremely expensive to change.
- It is the most immediate two-way communications vehicle available - information of all types can be sent and received at any moment.
- It is potentially the most natural interface and requires no intervention to use: workers simply listen and speak while their hands and eyes are free.
- Speech recognition enables workers to "multi-task" - listening to prompts and responding while they physically move about or do work using their hands and arms.

However, as we've already noted, voice recognition by itself will not optimize Floor Logistics unless it is integrated with Dynamic Workforce Optimization software. One characteristic of that software is Activity-Based Streamlining. This is the ability of the application to react to conditions *as they occur*, directing and coordinating workers to accomplish tasks in the most effective way.

Three areas where Activity-Based Streamlining can be applied are:

- Workflow Coordination
- Exception Management
- Error Correction

Floor Logistics must be well-coordinated. Activity-Based Streamlining is different from traditional WMS-based task interleaving because it takes into account workers' individual abilities. Activity-Based Streamlining can optimize the throughput achieved by a group of workers because it knows not only the mapping of the processes they do, but also their individual productivity and accuracy rates. It's like having an "industrial engineer in a box," constantly adjusting the group's work tasks for greater efficiency - but it does depend on having logistical and workforce intelligence in the application software.

Activity-Based Streamlining provides a centralized WMS with a flood of up-to-the-second information. In general, the WMS will initiate process and *inventory* related tasks, while the voice application optimizes worker *activities*. Tasks to be performed by co-workers such as drops, replenishment, and cycle counts can be detected and initiated more quickly than with any other approach.

Another element of Activity-Based Streamlining is the provision to management of detailed, real time visibility into Floor Logistics operations. Using a web interface, managers can track activities in one or more facilities from virtually any location. Real-time visibility enables management to pinpoint situations where immediate supervisory attention is needed, and thus use supervisory resources more effectively.

## 5. Technology Architecture: Empower or Impede?

Any logistics executive who decides to bring in new technology such as voice recognition is also - knowingly or not - making a *technology architecture* decision. Wearable computers, servers, software, RF networks, WMS applications - all components of a solution must operate within some kind of technology architecture if they are to effectively share information and produce results.

Unfortunately, "architecture" is something you cannot readily see. It sits in the background, providing its services. However, your technology architecture has a huge impact on the flexibility and solution longevity - or lack thereof - that you will enjoy. And while at first glance it may seem as if different voice technology solutions have the same features, in reality there are major architectural differences.

Technology architectures can take advantage of industry standards, or they can be proprietary. They can be current or outdated. They can offer options or place restrictions on future decision-making. In short, they can empower or impede.

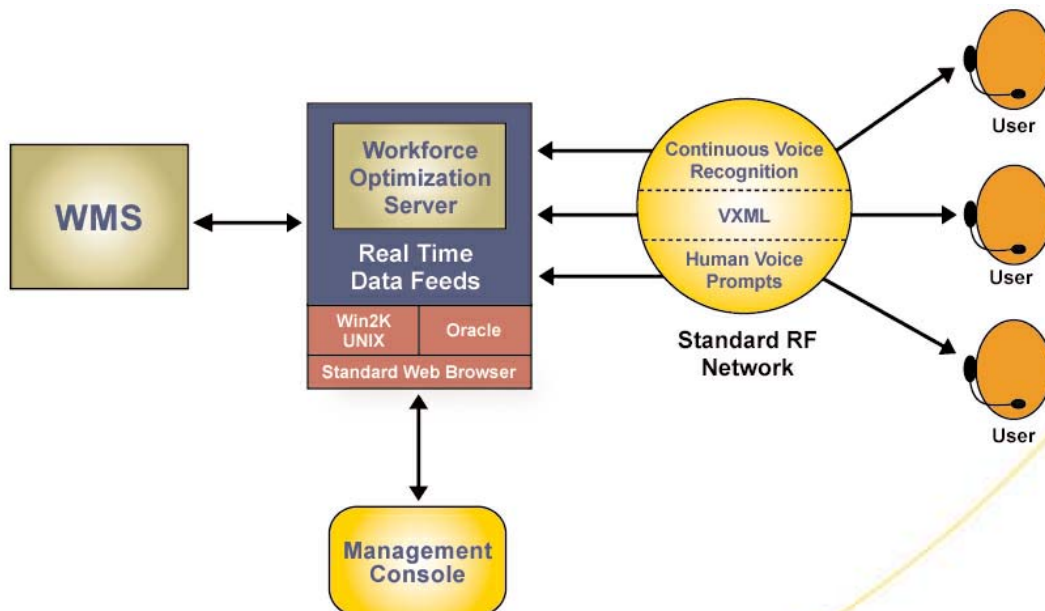


Figure 9: Technology Architecture Overview

The most important technology architecture requirements for Dynamic Workforce Optimization cover different planning issues. They include:

- Platform Independence
- Multi-Modal Capabilities
- Continuous "Smart" Voice Recognition
- Human Voice Prompts
- Web-native Systems Technologies

## Platform Independence

Traditionally, voice recognition solutions involve proprietary hardware - but that has now changed with LXE's entry of the MX3X into the voice market. As has been true with all computer technology, wearable computers will evolve on a path of becoming more powerful, yet more interchangeable with standard operating environments.

The benefits of platform independence are obvious to seasoned executives. Because the ultimate value of Dynamic Workforce Optimization is delivered by the software, enterprises prefer a choice in the hardware area. This helps to control cost, allows strategic vendor relationships to be leveraged, and provides flexibility for the future.

## Multi-Modal Capabilities

As we have already noted, voice technology is a key ingredient in Dynamic Workforce Optimization - but it is not the only ingredient. Warehouse workers can accomplish some tasks - for instance, the entry of very long lot or container numbers - more efficiently by scanning than with voice.

The next generation of wearable computers will be characterized by devices like the LXE MX3X, which have multi-modal functionality: voice recognition plus scanning plus a screen and keyboard. When coupled with good software, the MX3X makes it possible to give workers the very best tool for any given task at hand. Such capabilities are a natural extension of Dynamic Workforce Optimization's people-centric philosophy.

Multi-modal devices open up a whole new range of productivity improvements and managerial applications that will enable supervisors to get real time information and take action while they are on the warehouse floor. These devices will be a driving force behind the mass adoption of Dynamic Workforce Optimization technology in the distribution center.

## Continuous "Smart" Voice Recognition

Virtually all voice recognition solutions for complex industrial applications are "speaker dependent," meaning that accuracy is improved because the system "knows" who is speaking and has been trained to recognize the unique voice of each specific user. Ideally, any worker could pick up any available wearable computer and log on; this eliminates headaches that come from having to "map" specific users to specific devices.

Earlier systems employed "discrete" rather than "continuous" voice recognition. With discrete recognition, the user must pause between words, whereas with continuous recognition the user can speak normally, using a steady stream of words. Obviously, discrete recognition is far less suitable for industrial applications because the requirement to pause would both irritate users and slow them down to the point that the application becomes unusable.

Continuous speech recognition requires sophisticated software. One "workaround" is to severely restrict the vocabularies in applications in order to deliver a form of continuous recognition, but this places limits on what the applications can actually do. Rich applications need rich vocabularies.

In addition to being continuous, voice recognition for Dynamic Workforce Optimization must also be smart. It should automatically filter out words and phrases that are not part of the application, without requiring users to fiddle around with mute buttons, headsets, or switches. This permits workers to have discussions with supervisors and colleagues as necessary, without regard to the voice application. As soon as the worker resumes a task by speaking an application prompt, the smart recognizer - which has been "listening" all along - immediately reacts and gets back to work.

## Human Voice Prompts

Voice prompts are the directives a worker hears as he or she goes about assigned tasks. Some systems use "TTS," or Text-to-Speech prompts - which are computer-generated commands. One major headache with TTS is that the voice sounds unnatural and machine-like. The alternative is human voice prompts - an actual prerecorded human voice.

Ergonomics are very important in Dynamic Workforce Optimization technology, because every positive human factor contributes to increased productivity and accuracy. It is certainly not pleasing when workers are forced to listen to a mechanical voice all day long. Plus, in high noise environments productivity is lost because workers must constantly ask the system to repeat TTS voice prompts. The ergonomically better solution is the human voice prompt.

## Web-native Systems Technologies

Web-native systems technologies, such as Voice XML, Internet Protocols, and standard operating systems benefit the enterprise because they lead to the lowest cost of ownership over time. Also, web-native technologies are designed for high scalability. With web-native functionality, vital information can be made available to management in real time - regardless of location.

Architectures that take advantage of web-native technologies are also more stable, reliable, and "future proof" because they are part of the standards mainstream that most IT organizations require.

## 6. VoiceLogistics: Maximizing the Benefits

Today leading enterprises are taking a fresh look at leveraging their front line workforce. Traditionally, this group of workers has a huge impact on corporate profits yet it is the least leveraged by technology. Forward-thinking organizations are implementing Dynamic Workforce Optimization as a major step forward in maximizing the contribution that front line labor makes.

Voxware is the pioneer in Dynamic Workforce Optimization for Floor Logistics in distribution centers. Our product is VoiceLogistics®. Every day, thousands of workers in the distribution centers of leading companies like 7-Eleven, US Foodservice, Hagar, PETCO, 99 Cents Only Stores, Somerfield and Argos use VoiceLogistics to do their jobs in the most effective and efficient manner. Results have been impressive, with near-perfect accuracy, improved productivity, and significant cost savings in labor, training, and related operational areas.

If your company is considering voice technology for the distribution center, make sure that you will be able to unlock all of the potential benefits. Look beyond specific tasks to the question of optimizing what your workforce does. By adopting the strategic, people-centric approach, you will realize maximized benefits and keep your enterprise well-positioned for the future.