Leveraging the Latest Innovations in Equipment Monitoring Telematics for Improved Material Handling Productivity

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The Warehouse Industry’s Challenge

1. Substantial forklift truck accidents result in costly injuries, lost work time and damages totaling 100’s $MM’s/Yr.

2. Forklift trucks and drivers account for over 80% of operating expenses.

3. Manual tasks associated with data collection and inventory tracking reduce driver productivity while increasing human error and rework.

4. Lack of real time visibility to fleet movement, utilization and driver activity limits productivity improvement.

Small gains in labor productivity beat large improvements in other cost areas
Answer: Turning Lift Trucks Into Smart Trucks

On-board sensors
- automatically collecting usage, operating and inventory data by driver, lift and load

Accurate location tracking
- real-time visibility inside and outside

Vehicle computer
- on-board computing and smart truck software

Mobile network connection
- wireless network integration
Leveraging Data for Productivity Improvements

3 Customer Examples

- **Sensored Vehicles**
  - Safety
  - Equipment Monitoring

- **Integrated Vehicles**
  - Fleet Management
  - Labor Productivity
  - Inventory Management

- **Automated Vehicles**
  - AGV & Hybrids
  - Mixed Fleets

Turning **Events and Data** into **Actionable Business Intelligence and Automation** is the next big opportunity for warehouse operations.
Example #1 – iWarehouse Labor & Warehouse Productivity Improvement

Costing and Budget Information Not Only for Labor, but also MHE
Actual Customer Results:

- Reduction of FTEs from 126 to 102
- Reduced fleet from 26 to 25
- Annual Shipped Units 9M to 11M
- Payback – 5.5 months

Costs by Customer

<table>
<thead>
<tr>
<th>Client</th>
<th>Unloading</th>
<th>Putaway</th>
<th>Picking</th>
<th>Packing</th>
<th>Outbound</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordstroms</td>
<td>$0.093</td>
<td>$0.250</td>
<td>$0.040</td>
<td>$0.267</td>
<td>$0.150</td>
<td>$0.800</td>
</tr>
<tr>
<td>Polo</td>
<td>$0.112</td>
<td>$0.330</td>
<td>$0.050</td>
<td>$0.290</td>
<td>$0.140</td>
<td>$0.922</td>
</tr>
<tr>
<td>Tommy Bahama</td>
<td>$0.145</td>
<td>$0.360</td>
<td>$0.062</td>
<td>$0.332</td>
<td>$0.152</td>
<td>$1.061</td>
</tr>
<tr>
<td>Kohl's</td>
<td>$0.070</td>
<td>$0.227</td>
<td>$0.041</td>
<td>$0.299</td>
<td>$0.151</td>
<td>$0.794</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>$0.105</td>
<td>$0.292</td>
<td>$0.048</td>
<td>$0.299</td>
<td>$0.151</td>
<td>$0.894</td>
</tr>
</tbody>
</table>

Complete Cost Visibility Based on Equipment and Labor

Costs by Process

<table>
<thead>
<tr>
<th>Department</th>
<th>Process</th>
<th>Client</th>
<th>Unit Name</th>
<th>Units / Hr</th>
<th>Units Processed</th>
<th>Total Hours</th>
<th>Unit Cost (unburdened)</th>
<th>Unit Cost (90 Day)</th>
<th>Total Cost</th>
<th>Productivity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forklift</td>
<td>Full Case Pick - NonWalmart</td>
<td>Locations</td>
<td>73.01</td>
<td>55,359</td>
<td>766.4</td>
<td>$0.250</td>
<td>$0.252</td>
<td>$13,956</td>
<td>124.4 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full Case Pick - WalMart</td>
<td>Locations</td>
<td>40.88</td>
<td>932</td>
<td>22.8</td>
<td>$0.389</td>
<td>$0.421</td>
<td>$352</td>
<td>106.7 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full Case Replenishment</td>
<td>Full Pallets</td>
<td>13.63</td>
<td>2,741</td>
<td>201.1</td>
<td>$1.306</td>
<td>$1.316</td>
<td>$3,580</td>
<td>104.3 %</td>
<td></td>
</tr>
<tr>
<td>Putaway</td>
<td></td>
<td>Pallets</td>
<td>23.96</td>
<td>2,459</td>
<td>102.6</td>
<td>$0.602</td>
<td>$0.787</td>
<td>$1,972</td>
<td>129.8 %</td>
<td></td>
</tr>
</tbody>
</table>
Actual Customer Results:

• Reduction of FTEs from 126 to 102
• Reduced fleet from 26 to 25
• Annual Shipped Units 9M to 11M
• Payback – 5.5 months

How does the integration of vehicle telematics and labor management impact the operation?

• Productivity Goals
• Costing
• Budgeting
• Incentives
• Planning New Facilities
• Contract Negotiations
Example #2 – Bobcat Company

BACKGROUND
4 Sites, First Implementation (Go Live May ‘14)

PURPOSE
Improved Productivity and Inventory Accuracy

• **Improvements seen in first 6 months**
  - 35% increase in Avg. number of pallets moved per hour
  - 25% decrease in number of drivers per shift
  - 5% increase in inventory accuracy
  - Over 50% reduction in new driver training. New drivers are trained within 1 day vs. 3-4 days on the older system
  - 30% Reduction in inventory counts

• **DC Velocity article published October 2014.**
Customer Data Display

Customer

WMS / ERP / LMS

SmartLIFT

SmartLIFT COCKPIT

SmartLIFT DRIVER GUI
Solution Benefits

1. **INCH-ACCURATE VEHICLE TRACKING**
   - Real-time visibility to vehicle location & bread crumb trail
   - Inventory locations optimized based on traffic

2. **REAL-TIME INVENTORY ACCURACY**
   - Real-time location of inventory is known
   - Time spent “hunting” for pallets is eliminated

3. **NO MORE SCANNING**
   - Hands-free / Voice-free scanning
   - Average savings of 8 to 14 seconds per move

4. **BIG DATA INTELLIGENCE**
   - Web-hosted BI Tools that display real-time forklift data
   - Automated email / text alerts
1 Inch-Accurate Vehicle Tracking - Breadcrumb View

Forklift Tracking:

- Real-time viewer – full operations visibility from anywhere

- Breadcrumb view:
  - *Historical truck movements plotted on facility map*
  - *Helps understand routing patterns, work flow, and congestion issues.*

- Replay
  - *Every forklift move is recorded*
  - *Historical moves can be replayed*
Inventory Tracking

- Pallet moves are tracked
- Pallet location (x,y,z) recorded

Track by location:

- With the forklift being tracked, inventory is tracked too!
- The real-time location of every pallet after the initial ID read is tracked
- Inventory data is real time accurate and complete
- No wasted time “hunting” for pallets and open slots
No More Manual Scans - Optical Label Reader

**Manual Scanning**

**Auto-Scanning**

**AUTO-SCANNING**

- The driver does not scan a single label!
- The Optical Label Reader (OLR) uses vision technology to scan 2D barcodes automatically
- On average, 8 seconds saved per move leading to a significant increase in productivity
- Inventory tracked by the x,y,z coordinates of the pallet forks
RF Driver Interface:

- Standard user interface for driver boosts productivity and reduces “screen touches”
- Streamlined GUI design
  - Clear definition of task
  - Real-time location indicator
  - Task timer
  - Exception handling
SmartLift: Big Data Meets Forklift

Dashboard:
- A web-hosted business intelligence tool
- Interactive and user configurable charts
- Threshold based email alerts
- **WIDGET BASED!**
- It is not possible to create a GUI that meets every employee’s needs on a 15” monitor!

In order for Big Data to be actionable, you need to provide:
Right information, to the right people, at the right time.
Example #3 - Nippon Express Europe

Objective: Optimization of staging and loading

<table>
<thead>
<tr>
<th>Manual Scans</th>
<th>Automatic Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Time consuming</td>
<td>• No manual action required by operator</td>
</tr>
<tr>
<td>• Error prone</td>
<td>• Secure registration of loading</td>
</tr>
<tr>
<td>• Not ergonomic</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manual Auditability</th>
<th>Automatic Auditability</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Some routes require photo’s</td>
<td>• Photo/video registration of all pallets</td>
</tr>
<tr>
<td>• Time consuming to make</td>
<td>• Clear image of all pallets</td>
</tr>
<tr>
<td>• Time consuming administration</td>
<td>• Links to WMS for easy administration</td>
</tr>
<tr>
<td>• Not 100% clear</td>
<td></td>
</tr>
</tbody>
</table>
Vision Based Locating (vs RFID)

Vision Based Locating Positives

- High locating accuracy
- No annual reoccurring tag costs
- Upscale possibilities

Vision Based Locating Requirements

- Equipping the forklift
- First registration on XYZ coordinate
- Changes to current work method

Driving Statistics

- Distances covered
- Chosen routes
- Ratio driving with / without load

Up-scale Possibilities

- Extend to entire operation
- First registration at inbound
- Complete automatic registration of all pallet movements
- Increased stock accuracy

Task Distribution By Actual Location

- Dynamic task allocation based on location
  → Reduce driving distances
Nippon Express Europe - Business Case

<table>
<thead>
<tr>
<th>Approximate daily savings</th>
<th>Estimated Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Staging scan: 6.6 hours</td>
<td>• (payback period &lt; 2 years)</td>
</tr>
<tr>
<td>• Loading scan: 6.6 hours</td>
<td></td>
</tr>
<tr>
<td>• Dismount while loading: 2.2 hours</td>
<td></td>
</tr>
<tr>
<td>• Take pallet photo: 5.0 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.4 hours</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional (estimated) benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Photo/video of all outbound pallets = ??</td>
</tr>
<tr>
<td>• Claim (&amp; claim handling) reduction = ??</td>
</tr>
<tr>
<td>• Administration of photos = 0.25 FTE</td>
</tr>
<tr>
<td>• Reduced check at staging area = 0.5 FTE</td>
</tr>
</tbody>
</table>
Warehouse view

Colors indicate areas with different (system) functions. Pallet sizes are kept in 3D.
Warehouse view with insert of 3D driver navigation

Warehouse view shows FLT’s as red arrows. Driver navigation shows shortest route to next pick up
Warehouse view with insert of 3D driver navigation

Driver picks up pallet. Left bottom corners shows that pallet is on fork
Warehouse view with insert of 3D driver navigation

Collision warnings if FLT’s are close or if FLT backs against products
What’s Next For Productivity Improvements?

- Enhanced User Experience
- Single Platform
- Upgradability

- Remote Diagnostics & Software Updates

- Browser Enabled Device Compatibility

- Enhanced Data Management
A New KPI: The Perfect Move

*Done correctly, the first time, at minimum cost*

- Right load picked
- Closest driver with right equipment (AGV or manned)
- Correct destination location and load orientation
- With no damage
- Optimal routing
- At optimum safe speed
- Minimum total time
- Fully tracked and updated in management software
- Truck load manifest verification
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