Caterpillar's Integrated Supply Chain Initiative

Jeff LeClair

Voice of the Customers

- Parts Availability: 99%
- Pricing Policies: 48%
- Parts Delivery Training: 27%
- Material Returns: 23%
- Genuine Brand Protection: 22%
- Marketing Support: 19%
- Remanufactured Parts: 17%
- Parts Catalogue: 15%
- Inv Mgmt Supp: 14%
- Order Processing Support: 9%
- Order Processing System: 7%
- Condition of Shipments: 6%
- Vendor Ship Direct: 5%
- Parts Representative: 3%
- Other: 1%

Key priorities for improvement are about supply chain performance of our networks!

Source: 2011 Heavy Equipment Parts Manager Satisfaction Survey China.
Assembly Success

Build In Sequence

Process Changes
- Visual Factory
- Standard Sequence Process
- Proactive Material Review
- Replenish to Daily Sequence
- No Overflow Areas
- Manufacturing Lead Days Aligned to when material is needed to be delivered
- XX Days Pre-Build in Sequence Report
- Launch In Sequence
- Build In Sequence
- Material Delivered in Sequence to POU
- Replenish Only on Consumption

Results
- POU Improved
- Attach In Sequence
- Throughput Improved
- CSD

Work In Process - WIP Caps

Keys to Success
- Determine work-in-process (WIP)
- Identify key locations for WIP
- Manage production to WIP limitations
- Capture daily WIP counts
- Analyze Offline Status Chart
- Investigate non-compliant areas

Results
- Increase in Turns
- Million Inventory Reduction
- Reduction in Peak Shaving (Work Done Outside)
- Improved Process Stability

Throughput Improvements
- Constant Throughput improvement required (All models)
  - Reduce variability (outliers)
  - Tracked by all models & areas
  - Build in Sequence

Global Manufacturing Foot Printing

- Global Capacity
  - Common designs and processes provide flexibility between global plants
  - Ensure capacity meets future customer demand
  - Target xx% capacity headroom to help maintain availability through demand spikes

- In-Region Manufacturing
  - Quicker delivery to customer, same time zone and language
  - Target is xx% of requirements sourced from within the region
  - All Regions

- Other benefits
  - Reduces the impact of exchange rate movements
  - Counters import duty and helps us be competitive
  - Demonstrates global diversity and engages us in emerging markets
Process Steps

- Product Availability Defined
- Lowest Cost Provider Definition
- Make vs Buy Strategy
- Make vs Buy Supply Stream Decision Making Process
- Metrics Alignment
- Common Goals Alignment (CGA)
- Communications Strategy
- Manufacturing Strategy
- Supply Chain Strategy
- S&OP process
- RCCP

PRODUCT AVAILABILITY (P.A.)

- Plant lead time
- P.A. 3 / 6 Weeks
- Transit time
- Up to 35 days
- Replenish. Order
- CSD

- PDC (Lane 1)
  - Transit time
  - 1 day max
  - PDC Lead time
  - 10 days max

- End user order
- Ship

- 3 weeks product availability

- Direct Ship

- Customers Regional
  - Transit time
  - Up to 5 days

- Customers (Overseas)
  - Transit time
  - 1 to 5 days

- End user order
- Ship

- 3 weeks product availability


**SUPPLIER RESPONSE TIME & LEAD TIME**

- **Regional Suppliers**
  - Supplier lead time
  - Transit time
  - Pick + Pack
  - Ship

- **Overseas and Other Suppliers**
  - Supplier lead time
  - Transit time
  - Pick + Pack
  - Ship

**Supply Chain Strategy - Global Sourcing**

- **SUPPLY CHAIN**
  - Best in Class Safety
  - Global Transport Network
  - Minimal Inventory VMI, PTP, PFEP
  - Robust Capacity management Systems, common front end Facility CPS driven

- **SUPPLIERS**
  - Global Suppliers
  - European Local Suppliers
  - Indian Local Suppliers
  - South American Local Suppliers
  - Global Supplier local

- **SOUTH AMERICA**
  - Local Suppliers
  - Global Supplier local

- **GLOBAL QUALITY STANDARDS**
  - Local Lead time Compliance
  - Global Leverage
  - Optimal Total Acquisition Cost
Solutions in a Global Supply Chain
Need to Include:

• Flexibility to adapt to actual market
• Visibility across the supply chain
• Leverage across business units and geographies
• Lowest delivered cost
• Strategic placement of inventory, both at rest and in motion
• Stock close to consumption points
• Consistency and reliability in a global arena
• Minimum disruptions, with proactive management
• Robust reporting and analytics

Performance Driven by Supply Chain & Proactive Management

<table>
<thead>
<tr>
<th>Sector</th>
<th>Industrial</th>
<th>Automotive</th>
<th>High Tech</th>
</tr>
</thead>
</table>
| Structural      | • Build to order or specification  
                     • Sole source suppliers  
                     • Lower volume | • Specific models with set variations  
                     • Many suppliers  
                     • Medium volume build to inventory | • Commodities  
                     • Many suppliers  
                     • High volume |
| Supply chain management enablers | • Managing process horizontally rather than vertically  
                     • End to end supply chain execution framework with reporting and analytics | • Rationalized warehouse and distribution center network  
                     • Forward stocking locations near production facilities with VMI/SMI  
                     • Shared transportation network across business divisions  
                     • Reverse logistics process |
The Vision – Areas of Opportunity

Inbound Logistics Management
- Warehouse Operational Excellence
- Sequenced material flow
- Optimized picking approach
- CAV compliant Subassemblies

Material Replenishment/Distribution
- Pull trigger initiation
- Logistic material delivery flow
- Yard Management
- POS Presentation and Availability

Conveyance Strategy
- Corporate and Returnable
- Process Integration
- Rapid Management Process
- Track and Trace Capable

Labor Strategy
- Skilled Logistics Professionals
- Full Time Hourly Resources

Systems Strategy
- Standard Hardware/Software Solutions
- Core and Common Platform
- Network Connectivity and Visibility
- MACH1 Aligned and Capable

Outbound Logistics Management
- POC/Lane Strategy Support
- Prime Product Breakdown Solutions
- Prime Product Shipment Management

Transportation Management
- Milk Run Designed and Optimized
- Dynamic Route Management
- Carrier Selection/Management
- Track and Trace Capable
- Event Management Capability

Strategic Areas Of Improvement

Supporting Critical Requirements

Logistics Costs as percent of GDP for select countries, 2009

Source: CSCMP State of Logistics Report 2010
## Supply Chain Responsibilities

<table>
<thead>
<tr>
<th>Processes</th>
<th>Planning</th>
<th>Material Requirements</th>
<th>Demand &amp; Order Mgmt</th>
<th>Supply Performance</th>
<th>Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Deploy Standard Work for all SC activities</td>
<td>• Lead / Assist Sourcing To Achieve Lowest TCO</td>
<td>• Manage POU availability</td>
<td>• Manage product availability</td>
<td>• Support supplier capacity planning</td>
<td>• Work with Global Transportation to optimize transportation</td>
</tr>
<tr>
<td>• Drive Continuous Improvement</td>
<td>• Own the Logistics Planning Process &amp; the PFEP</td>
<td>• Manage supplier metrics</td>
<td>• Manage build schedule &amp; sequence conformance</td>
<td>• Deploy processes at suppliers</td>
<td>• Perform on-site material logistics providers</td>
</tr>
<tr>
<td>• BU / SC Strategy Alignment &amp; Integration</td>
<td>• Define material replenishment plans</td>
<td>• Manage supplier S&amp;OP and collaboration processes</td>
<td>• Manage S&amp;OP process</td>
<td>• Address supplier quality issues</td>
<td>• Manage 3rd party logistics providers</td>
</tr>
<tr>
<td>• Manage SC 6Sigma Portfolio</td>
<td>• Optimize material flow</td>
<td>• Manage inventory &amp; record accuracy</td>
<td>• Own capacity &amp; constraint planning &amp; management</td>
<td>• Facilitate &amp; manage corrective action (RCCA)</td>
<td>• Drive improvements in POU availability</td>
</tr>
<tr>
<td>• Own and manage BU adherence to Supply Chain Rules</td>
<td>• Understand &amp; leverage 3rd party processes</td>
<td>• Address inaccuracies in IRA counts</td>
<td></td>
<td></td>
<td>• Conduct IRA counts</td>
</tr>
</tbody>
</table>

### Integrated Supply Chain Network Engineered

<table>
<thead>
<tr>
<th>Area</th>
<th>Focus</th>
<th>Steps</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Management / Option Planning</td>
<td>Total Aggregate Demand known</td>
<td>Define S&amp;OP process and develop metrics framework - for tractor level</td>
<td>Define RCCP process and develop metrics framework - for tractor level</td>
</tr>
<tr>
<td>Supply Planning</td>
<td>Develop supplier strategy</td>
<td>Develop supplier strategy and establish performance targets</td>
<td>Update customer, model, option history for changes</td>
</tr>
<tr>
<td>Supplier Sourcing</td>
<td>Lean Supply Base</td>
<td>Develop Individual supplier Profiles (parts/contacts/metrics)</td>
<td>Gather supplier information and component attributes</td>
</tr>
<tr>
<td>Supplier Capacity</td>
<td>Capacity Plan to match Caterpillar total demand requirements</td>
<td>Define S&amp;OP process and develop metrics framework</td>
<td>Define RCCP process and develop metrics framework</td>
</tr>
<tr>
<td>Supplier Development / Education</td>
<td>Production System @ Suppliers</td>
<td>Redesign production system using lean/pull principles</td>
<td>Conduct phased roll-out of lean production model</td>
</tr>
<tr>
<td>Material Mgmt/Replenishment</td>
<td>Right Part, Right time, Right location planned</td>
<td>Define / Implement material replenishment processes based on PFEP</td>
<td>Analyze stock location, quantities, and shortages</td>
</tr>
<tr>
<td>Pull Scheduling/Sequencing</td>
<td>Most effective Plan &amp; Execution of Material Replenishment</td>
<td>Update PFEP parameters</td>
<td>Define/Implement scheduling and sequencing rules</td>
</tr>
<tr>
<td>Lean Manufacturing</td>
<td>Lean Logistics Engineering Planning</td>
<td>Analyze current production system capabilities</td>
<td>Measure performance and continuously improve</td>
</tr>
<tr>
<td>Execution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT / Information Management</td>
<td>Systems aligned with process design</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key Strategies:**

- Total Cost of Ownership
- Establish continuous improvement focus
- Focus on main business VS's
Collaborative “Logistical Leadership”

- Global Supply Chain Integration Process/Plan
  - Overall Alignment of process’s
    - Demand Management – PEEP, Lot Sizing, EOQ’s
    - Consolidation/Containerization
    - In-transit Visibility strategy
    - Trade Compliance
    - Transportation Plan (Domestic & International)
    - Data exchange w/Supply Base; EDI, ASN’s

- Supply Chain Rationalization Strategy & Implementation (Domestic & International)
  - Capacity Analysis Program & Process’s ( EPP&S&OP,RCCP)
  - Quality Program & Process’s ( Pre-shipment Inspection & receipt )
  - Supply Chain Performance ( POU to Supplier FGI - CSD )
  - Key participant with GP in TCO process for sourcing, re-resourcing, Kitting, Sub-Assembly

- Supply Chain Development & Recovery Process’s (Domestic & International)
  - Supply Base Recovery & Improvement Strategy, Plan, Process’s & Execution
  - Value Stream Alignment Process & Execution; EDI,
  - Pull Replenishment strategies, plan & execution to POU

Logistics node and network services

<table>
<thead>
<tr>
<th>Service Offering</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Materials Acquisition</td>
<td>Procurement, Supplier Management, &amp; Expediting</td>
</tr>
<tr>
<td>Inventory Management</td>
<td>BPA Inventory Record Accuracy, Site Inventory Visibility, Network Visibility, &amp; Demand Planning</td>
</tr>
<tr>
<td>Logistics Center Services</td>
<td>Receiving, Putting Away, Picking, Materials Shipping &amp; Yard Management, &amp; Shell Life Management</td>
</tr>
<tr>
<td>Replenishment</td>
<td>Demand Signal Creation and Management, Material Movement From Storage Location To POU Consumption (Line Side Delivery, POU Line Checking, POU Truck Support, and Method: Order Specific Sequencing, Kan Bar, Kitting)</td>
</tr>
<tr>
<td>Finished Goods Shipping</td>
<td>Shipping, Documentation, Packing, Loading, Storage, &amp; Customer Installed Accessories</td>
</tr>
<tr>
<td>Network Services</td>
<td>SME, VMI, Cross Docking, Hardware Management, Consolidation &amp; Deconsolidation</td>
</tr>
<tr>
<td>Product Distribution Centers</td>
<td>Quality Inspections, Postponement Delay Management &amp; Storage</td>
</tr>
<tr>
<td>Bonded Material Services</td>
<td>Receipt, Storage and shipping of bundled materials</td>
</tr>
<tr>
<td>Sub-Assembly</td>
<td>Simple and Complex / Module Sub-Assemblies</td>
</tr>
<tr>
<td>Kitting</td>
<td>Picking and Grouping Sub-Components, Knock Down Kits</td>
</tr>
<tr>
<td>Sequencing</td>
<td>Arranging / Delivering Parts</td>
</tr>
<tr>
<td>Reverse Logistics</td>
<td>Manufacturing Facility Non-Production Materials Storage Locations (Cris)</td>
</tr>
<tr>
<td>Quality Management</td>
<td>Visual Inspection, Material Compliance Procedures Using Testing Devices, &amp; Sample Count</td>
</tr>
<tr>
<td>Packaging</td>
<td>Design, Acquisition, Deployment &amp; Ownership</td>
</tr>
</tbody>
</table>
Value Added

- Supply Chain Process development
- Advanced transportation planning and capacity management
- International and domestic transportation services
- Warehousing and distribution
- Customs, regulatory, and compliance services
- Network and transport routing optimization
- Visibility and metrics management

Leadtime Parameter Owners

Ownership Responsibilities for Lead Time Elements:

**Purchasing:** Acquisition/In Process

**Supply Chain:** Response Point to POU
### Lead Time Reduction and Cost Savings

<table>
<thead>
<tr>
<th>Order Issue Time</th>
<th>Supplier Time = customer firm zone</th>
<th>Transit + Distribution Time = Transit Time</th>
<th>Indirect Processing Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>90 days</td>
<td>16 days</td>
<td>1 day</td>
</tr>
</tbody>
</table>

**Average Lead Time Baseline**

- 1 day
- 30 days
- 16 days
- 1 day
- 48 days

59 days Gap

**Average Lead Time To Be**

**ΣDaily Spend by Supplier *( Lead Time Baseline - Lead Time Should be )**

= Total Savings $ xy Million

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### Value Driven Approach

- Mean of consumption
- Mean of Inventory
- Consumption Variation
- Critical Customer Requirement
- Excess Inventory: unacceptable

Our goal is to move the mean of inventory to close to mean of consumption, and reduce the inventory variation.

Process Variation Illustration
Data Measurement Plan

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Operational Definition</th>
<th>Data Source and Location</th>
<th>Sample Size</th>
<th>Who will collect the data</th>
<th>When will data be collected</th>
<th>How will data be collected</th>
<th>Other data that should be collected at the same time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOH</td>
<td>Inventory level / Daily consumption</td>
<td>Monthly inventory level and Daily inventory movement report in SAP</td>
<td>materials imported from suppliers</td>
<td>Names TBD</td>
<td>The first week of every month</td>
<td>Run SAP report</td>
<td>SKU, quantity, value, transaction code</td>
</tr>
</tbody>
</table>

How will data be used?  How will data be displayed?

- Identification of the Largest Contributors
- Identifying of Data is Normally Distributed
- Identifying Sigma Level and Variation
- Root Cause Analysis
- Pareto Chart
- P Chart
- Control Chart

Foundational Elements of Pull

- Andons
- Standardized Lot Sizes
- Stable Schedules
- Accurate & Timely ASN
- Disciplined Processes
- PFE
- Process
- Inventory Record Accuracy
- Production Routing Accuracy
- Supplier Delivery Performance
- Frozen Build Sequence
- Standard Packaging Requirements
How does the varying sectors handle the same kinds of challenges?

Can varying sectors work together to successfully overcome all kinds of challenges as they go to an international company?

You will notice that I have not talked directly how to integrate all the functional areas of your company to be successful. Why?

What internal corporate challenges do we face incorporated these concepts within the company? How could these challenges be overcome?
Solutions in a Global Supply Chain
Need to Include:

- Total Company support – all areas of business – not just Operations and Supply Chain
- Flexibility to adapt to actual markets globally
- Cultural awareness and integration
- Government influences in individual markets – added complexities
- We must plan our capacity and our production to optimize service and cost
- Corporate accountability lined up with accountable results.
- Leverage across business units and geographies
- We must design, build and execute an integrated supply chain network optimized for flexibility, velocity and total cost of ownership
- Visibility across the supply chain
- Lowest delivered cost
- We must simplify our supply chain through design for supply chain execution (modularity, lane strategy, commonality and change control discipline)
- Strategic placement of inventory, both at rest and in motion
- Stock close to consumption points
- Consistency and reliability in a global arena
- Minimum disruptions, with proactive management
- Robust reporting and analytics
- We must execute a robust PFEP that aligns supplier response to market needs integrated with NPI and sustained through the life cycle
- We must have visibility to every piece in motion throughout the supply chain (flow of information, physical flow and money) and the ability to action against events.

Caterpillar’s Integrated Supply Chain Initiative

- Jeff LeClair
- Global Logistics Development Manager, Global Network Operations, Parts Distribution Logistics Caterpillar
- Caterpillar is the world’s leading manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines, and diesel-electric locomotives. Caterpillar Logistics is launching a new integrated supply chain initiative, working with functional groups throughout the enterprise. In this session, the presenter will discuss this new collaborative planning effort improves supply chain performance and mitigates risks. Participants will learn how the company addresses the plan for every part, as well as how logistics, global purchasing, and supply chain management functions must be aligned to meet the needs of the end customer.