Assessing the Supply Chain Efficiency of Hardwood Sawmills in New York State Through Case Study Analysis and Data Envelopment Analysis Modeling

Patrick Penfield
Professor of Practice - Supply Chain Management
Whitman School of Management
Syracuse University
Agenda

• Introduction
• Hardwood Sawmills in New York State
• Supply Chain Assessment Tool
• Data Envelopment Analysis Modeling or Balanced Benchmarking
• Lessons Learned
• Summary
Patrick Penfield

• Teach Supply Chain Management at the Whitman School of Management
• 15 Years of Industry Experience
• 10 Years Teaching
Research Outcome

• Research Learning
  • Assessment Tool
  • Sawmill Supply Chain
  • DEA Modeling & Balanced Benchmarking
• Findings
Supply Chain Assessment

- 113 Questions
- Specific questions related to the supply chain
- Tested on four sawmills
- Ten iterations
- Assessment
  - 2 to 3 Hours

### Supply Chain Assessment

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
<th>Maximum Possible Points</th>
<th>Awarded Points</th>
<th>Awarded Weighted Score</th>
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<tbody>
<tr>
<td>Operations Planning</td>
<td>15%</td>
<td>100</td>
<td></td>
<td></td>
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<tr>
<td>Procurement</td>
<td>30%</td>
<td>100</td>
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<tr>
<td>Production</td>
<td>25%</td>
<td>180</td>
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<tr>
<td>Transportation</td>
<td>10%</td>
<td>70</td>
<td></td>
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<tr>
<td>Warehousing &amp; Inventory Management</td>
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<td>110</td>
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<tr>
<td>Ergonomics &amp; Innovation within the Supply Chain</td>
<td>5%</td>
<td>50</td>
<td></td>
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<tr>
<td>Environmental Practices</td>
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<td>120</td>
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</table>
Hardwood Sawmills – New York State
Supply Chain Management Within Hardwood Sawmills

Yards ➔ Debark ➔ Head Rig ➔ Resawyer ➔ Edger

Yards ➔ Debark ➔ Head Rig ➔ Resawyer ➔ Edger

Lumber Shipment ➔ Green Lumber ➔ Green Chain

Lumber Shipment ➔ Kiln Dry Lumber ➔ Kiln

whitman.syr.edu
Results of Assessments

- Different sawmills & different problems
  - Economy
  - Size of sawmill
  - Lumber produced
  - Location
  - Expertise
  - Layout

Looming Labor & Log Supply Issue?
Supply Chain Assessment Tool – Can it Help a Sawmill

• Survey – Gave us Information on Lumber Produced and Operational Costs
• Assessment Tool – Could it Help?
• Correlation? – Assessment and Inputs & Outputs of a Sawmill
Data Envelopment Analysis (DEA) or Balanced Benchmarking

• Linear Programming Technique
• Early 80’s
• Locate Best Practices
• After 2000 – Adapted for Excel
• Easier to Use

Analyzing Performance in Service Organizations – Sherman & Zu - MIT
DEA or Balanced Benchmarking

• Provides Unique Insight to Best Practices
• Opportunities to Improve
  • Productivity
  • Profitability
• Compares Inputs & Outputs
DEA or Balanced Benchmarking

• Benefits
  • Not “Flying Blind”
  • Assess Performance
  • Study Best Performers and Transfer Knowledge to Other Units
  • Test Assumptions Before Cutting Costs
DEA

• Data Envelopment Analysis
  • Efficient Frontier
  • Linear Programming
• Output
  • Cut Lumber
• Inputs
  • Labor
  • Energy Costs
  • Size of the Sawmill
• Relative Efficiency of 1

Maximize $z_o = \sum_r u_r y_{ro}$

Subject to $\sum_i n_i x_{io} = 1$

$\sum_r u_r y_{rj} - \sum_i n_i x_{ij} \leq 0$

$u_r, v_j \geq 0$
DEA/Balanced Benchmarking Findings

• Sawmills Cutting Large Amounts of Lumber – Highest Relative Efficiency Scores
  • Energy Costs – Big Impact on Operations
  • Less Labor the Better
Did the DEA Analysis Support the Assessment Score?

• Compare Assessment Scores to Efficiency Ratings
• Pearson Correlation Analysis
  • Significant Correlation – Score of .716
Lessons Learned

• Assessments – Key to Improvement
• DEA/Balanced Benchmarking – Powerful Tool
• Continuous Improvement Key to Success!
Conclusion

• Article was Published in the Forest Products Journal – July 2014
Questions?
Thank You!
Pcpenfie@syr.edu
1-315-443-3428