Robust Network Design for Forest Biorefinery Value Chain – decisions support systems for the transformation of the Canadian forest industry

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Research Question

What is new challenge of Canadian Forest Industry?

1. Design the configuration of the supply chain network
2. Deals with strategic and sensitive decisions

- Determining: the number, location, capacity and technology type of facilities, products portfolio, and market zones.

3. Using robust optimization & stochastic programming approaches to cope with the uncertainty of this new bio-refinery value chain networks.

- Demand
- Market
- Technology

Need of educational games to obtain awareness of problem

How we could design a decision support system for transportation in deterministic condition when we integrate strategic, tactical and operational planning?

The game has four Phases:
- Selection
- Swap
- Assignment
- Backhaul Route

Final goal is minimizing the total load and unload transportation cost

Discription of the four phases

Optimization Models

Cost for first Phase

<table>
<thead>
<tr>
<th>Team</th>
<th>Optimal</th>
<th>player</th>
<th>performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>48</td>
<td>67</td>
<td>72%</td>
</tr>
<tr>
<td>B</td>
<td>52</td>
<td>102</td>
<td>51%</td>
</tr>
<tr>
<td>C</td>
<td>54</td>
<td>107</td>
<td>50%</td>
</tr>
<tr>
<td>All(separately)</td>
<td>154</td>
<td>276</td>
<td>56%</td>
</tr>
<tr>
<td>All(integrated)</td>
<td>177</td>
<td>64%</td>
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</table>

Comparing Performance of Players

<table>
<thead>
<tr>
<th></th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Average</th>
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</thead>
<tbody>
<tr>
<td>Team A</td>
<td>72%</td>
<td>95%</td>
<td>97%</td>
<td>91%</td>
<td>88%</td>
</tr>
<tr>
<td>Team B</td>
<td>51%</td>
<td>84%</td>
<td>100%</td>
<td>91%</td>
<td>82%</td>
</tr>
<tr>
<td>Team C</td>
<td>50%</td>
<td>90%</td>
<td>98%</td>
<td>91%</td>
<td>82%</td>
</tr>
</tbody>
</table>

Why Transportation Game in my PhD work?

The game has a simple frame work for deterministic Transportation planning. In the game, the amount of demand, capacity of the mills and trucks are deterministic. However, our problem has uncertainty not only in the all of above factors but also in new technology and the market of new products. So, the game could be used as an interesting platform to introduce and analyze uncertainty.

Acknowledgments

Specially Thanks to: Maxence Adam, Jean-Gabriel Gill-Couture, Philippe Marier and Dag Fjeld.