The Kawerau Container Terminal

1. Opportunity identified to handle a logistics challenge
2. Methodology – Discrete Event Simulation (DES)
3. The feasibility study - the container terminal benefits
Opportunity identified – Industrial Symbiosis Kawerau
Methodology

1. Data collection
   • Exporters
   • Kiwirail
   • Shipping and transportation companies

2. Model Development in ExtendSim® - Discrete Event Simulation

3. Sensitivity Analysis
   • Cost changes in Packing
   • Cost changes in Storage
   • Cost changes in Rail freight
   • Cost changes in Road freight
   • Number of exporters packing at Kawerau
   • Truck size and/or weight limits
   • Number of wagons per train limits
   • Number of Trains available to the terminal

4. Feasibility Study
Methodology – Data Collection

Exporters
17 responded and 14 completed the interview, and participated in the discussions later.

Kiwirail, Ports, Shipping Companies and Transport Companies

Iteration – series of discussions
Methodology – Model Development

1. Model Development in ExtendSim® - Discrete event simulation

- Optimising by changes and runs
- Constraints
- Variance

A basic problem, schedule appointments for a dentist
Methodology – Model Development

Planterbot example
Methodology – Sensitivity Analysis

- **Cost changes in Road freight**
  - Number of Trains available to the terminal
  - Cost changes in Packing
  - Cost changes in Storage
  - Cost changes in Rail freight
  - Number of exporters packing at Kawerau
  - Truck size and/or weight limits
  - Number of wagons per train limits

1. **The model is reasonably sensitive to changes in road freight pricing.**
2. It is important that the number of trains available is matched to the volume.
3. **The model is not significantly sensitive to changes in packing, storage or rail freight prices.**
4. Significant changes to the size of trucks and trains are considered unlikely in the near future, if they occur the impact is likely to be minor.
5. Benefits to exporters are not uniform. Most scenarios show the use of KCT over a direct road service is equitable or better for more than 95% of containers modelled.
6. **The model is very sensitive to changes in customers choice to pack at KCT or simply tranship full containers to rail.**
Variation in cost for: Road freight

- A rise of up to 10% will have little impact on results.
- A rise of 35% will have a minor impact on results.
- A rise or fall of 45% or more will have a significant impact on the results.
Results

Social

Customer

Environmental

COST
## Results - Data analysis

<table>
<thead>
<tr>
<th>Industry</th>
<th>Packing &amp; Terminal Needs</th>
<th>Container Types</th>
<th>Seasonal Variation</th>
<th>Impact on Terminal Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food</strong></td>
<td>Temperature controlled High security High control Quick turnaround</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>Industrial</strong></td>
<td>Low dust Bespoke loading</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>Wood Products</strong></td>
<td>High Cube High weight limits Standardised</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>
Overall picture - Scenarios

Annualised TEU moved by scenario

- 10,000  20,000  30,000  40,000  50,000  60,000  70,000

Best Case
Most Likely Case
Worst Case Premium
Worst Case
Winter
Spring
Summer
Autumn
Light Packing
Moderate Packing
Heavy Packing
Auckland Weekly
Auckland Fortnightly

TEU
Results - Social impacts

Fatalities on Roads NZ
2015 – 218
2016 – 325
2017 – 378
2018 – 400
80% involve trucks

Reduction of heavy vehicle kilometers on State Highway 2
Social impact - Results

Number of Heavy Vehicle trips averted

- Best Case
- Most Likely Case
- Worst Case Premium
- Worst Case
- Winter
- Spring
- Summer
- Autumn
- Light Packing
- Moderate Packing
- Heavy Packing
- Auckland Weekly
- Auckland Fortnightly

Number of heavy vehicle trips:
0 1 000 2 000 3 000 4 000 5 000 6 000 7 000 8 000 9 000
Environmental impact

Range of CO2 Emission savings by scenario

- Best Case
- Most Likely Case
- Worst Case Premium
- Worst Case
- Winter
- Spring
- Summer
- Autumn
- Light Packing
- Moderate Packing
- Heavy Packing

Tons of CO2 Emissions reduced

- 0
- 1000
- 2000
- 3000
- 4000
- 5000
- 6000
- 7000
- 8000
Environmental impact - Results

Other emission reductions by scenario

Kg of Gas reduction

- 10 000 20 000 30 000 40 000 50 000 60 000 70 000

Best Case
Most Likely Case
Worst Case Premium
Worst Case
Winter
Spring
Summer
Autumn
Light Packing
Moderate Packing
Heavy Packing
Auckland Weekly
Auckland Fortnightly

NOx Reduction KG  Hydrocarbon reduction KG  PM10 reduction KG
Economic Impact - Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Best Case</th>
<th>Most Likely Case</th>
<th>Worst Case</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>$211,42</td>
<td>$207,61</td>
<td>$202,17</td>
<td>$175,32</td>
</tr>
<tr>
<td>Spring</td>
<td></td>
<td></td>
<td>$219,28</td>
<td>$176,91</td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td></td>
<td>$257,95</td>
<td>$291,54</td>
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<tr>
<td>Autumn</td>
<td></td>
<td></td>
<td>$279,27</td>
<td>$326,85</td>
</tr>
</tbody>
</table>

Average Savings (container)
Economic Impact - Results

Savings per container - Most Likely Scenario
Economic Impact - Results

Range of savings per container

- Best Case
- Most Likely Case
- Worst Case
- Premium

($200) to ($500)
Economic Impact - Results

Range of savings per container

Winter | Spring | Summer | Autumn

($100)  ($200)  ($300)  ($400)
Exporter example outputs

Customer Savings - 3 sites

Savings

$550,00

$450,00

$350,00

$250,00

$150,00

$50,00

$(50,00)

Containers
Conclusions

• Collaboration of companies and industries could provide benefit for all

• Under any of the tested Scenarios there is a feasible logistics solution that makes the terminal a viable option

• The economic benefits at an individual level are varied
  – under all scenarios at least 88% of containers are better off under the new supply chain than the status quo.
  – For most scenarios > 95% of containers are better off

• Risk of empty wagons are the main price drivers

• The social and environmental benefits are significant
Kawerau Terminal video – Clients talk

https://youtu.be/euAI0r9TzGc

https://fridayoffcuts.com/dsp_article.cfm?id=766&aid=9232

Publish it today on LinkedIn
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Questions?