Advanced Analytics

Building a competitive advantage in New Zealand

November 2013
My background

Stanford University

Stanford Engineering

Lilly

UC University of Canterbury

Mathematics and Statistics

PA Consulting Group

Thomson Reuters

ComEd

An Exelon Company
Today

- Analytics
- Fonterra
- NZ Analytics Forum
- Developing analytics capability
Analytics is (just)...

The scientific process of transforming data into insight for making better decisions
## Background

**Business Analytics Spectrum**

### Business Analytics Landscape

<table>
<thead>
<tr>
<th>Competitive Advantage</th>
<th>Degree of Complexity</th>
<th>Prescriptive</th>
<th>Predictive</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stochastic Optimization</td>
<td>How can we achieve the best outcome including the effects of variability?</td>
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<tr>
<td>Optimization</td>
<td>How can we achieve the best outcome?</td>
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<tr>
<td>Predictive modeling</td>
<td>What will happen next if?</td>
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<tr>
<td>Forecasting</td>
<td>What if these trends continue?</td>
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<tr>
<td>Simulation</td>
<td>What could happen...?</td>
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<tr>
<td>Alerts</td>
<td>What actions are needed?</td>
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<tr>
<td>Query/drill down</td>
<td>What exactly is the problem?</td>
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<tr>
<td>Ad hoc reporting</td>
<td>How many, how often, where?</td>
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<tr>
<td>Standard Reporting</td>
<td>What happened?</td>
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</tbody>
</table>

*Based on: Competing on Analytics, Davenport and Harris, 2007*
Who is Fonterra?

The world’s leading dairy exporter: one third of global dairy trade.

Processes more than 20 billion litres globally per year into 2.4m t of finished products.

Revenues of more than $16 billion USD in over 100 markets. 16,800 staff globally.

Dairy provides 26% of New Zealand’s exports.

from ‘Cow to Customer’

4.4 MILLION COWS (NZ)
21 BILLION LITRES OF MILK GLOBALLY

85 ORIGIN SITES
90 ORIGIN STORES

4 TECHNICAL CENTRES

11 ORIGIN PORTS
1,500 VOYAGES

280 DESTINATION PORTS
100+ DESTINATION STORES

5,000 CUSTOMERS
MILLIONS OF CONSUMERS
Fonterra has a diverse global footprint

Saudi NZ
Milk Products
Processed cheese, sachet and canned milk powders, Feta

Malaysia
2 sites
Canned milk powder, fresh milk, UHT, cultured products, acidified milk products

Sri Lanka
Colombo
Milk powder in sachets, fresh milk, UHT, cultured products

Australia
New Zealand
Australia
11 sites
Fresh milk, powder, cheese, ice cream and yoghurt

USA
DairiConcepts
50/50 JV with Dairy Farmers of America
9 sites
Cheese, powders, cheese concentrates, milk protein concentrates, functional dairy replacement systems, hard Italian cheese

Venezuela
Colombia
Ecuador
Brazil
Argentina
Chile

Saudi Arabia

Dairy Partners Americas
50/50 JV with Nestle
13 sites.
Collection and processing fresh milk. Manufacture of dairy products, marketing and distribution of ingredient commodities and consumer goods

Soprole
99.4% Fonterra
Consumer dairy producer – milk, UHT, yoghurt, spreads, desserts

Prolesur
86% Fonterra
Cheese, milk powder, butter, whey permeate powders

Confidential to Fonterra Co-operative Group
Our consumer & foodservice offerings are sold through more than 35 local and global brands
Analytics is an evolving capability at Fonterra and other New Zealand organisations.

Independence  Reporting  Spreadsheet Optimisation  Best in class Optimisation Software & People  Real time decision making support?

WE ARE HERE
## Advanced Analytics

<table>
<thead>
<tr>
<th>Next steps</th>
<th>Long term objective</th>
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</thead>
<tbody>
<tr>
<td><strong>People</strong></td>
<td><strong>Centre of excellence</strong></td>
</tr>
<tr>
<td>• Analytics capability training</td>
<td>• Executives expect analytics behind key decisions</td>
</tr>
<tr>
<td>• Career progression plans</td>
<td>• Fonterra is a preferred employer for analytics professionals</td>
</tr>
<tr>
<td>• Internal and external links to best practice organisations</td>
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</tr>
<tr>
<td>• Academic partnerships for both research and recruiting</td>
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</tr>
<tr>
<td><strong>Process</strong></td>
<td><strong>All global solids are optimised</strong></td>
</tr>
<tr>
<td>• Pro-active asset footprint analysis</td>
<td>• Global strategic asset footprint model</td>
</tr>
<tr>
<td>• Global standards for tactical optimisation</td>
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</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Global tactical and strategic decisions support tools, based on common master data</strong></td>
</tr>
<tr>
<td>• Work with IS to ensure that future technology supports the analytics capability required</td>
<td>• Comprehensive business intelligence systems delivering accurate, timely information to leaders</td>
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<tr>
<td>• Common technology across business</td>
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<tr>
<td>• Master data strategy</td>
<td></td>
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<tr>
<td>• Technologies for visualisation and pricing</td>
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</table>
Optimisation plays an important role throughout Fonterra's Value Chain

<table>
<thead>
<tr>
<th>Source</th>
<th>Make</th>
<th>Deliver</th>
<th>Sell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational</td>
<td>Tactical</td>
<td>Strategic</td>
<td></td>
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<tr>
<td>Milk collection</td>
<td>Spot purchasing/selling milk</td>
<td>Milk pools; Contracting milk volumes; Milk collection impacts</td>
<td></td>
</tr>
<tr>
<td>Scheduling; Real-time plant management</td>
<td>Product mix - monthly manufacturing by site</td>
<td>Asset capability and investment</td>
<td></td>
</tr>
<tr>
<td>Inventory and transportation</td>
<td>Warehouse and vessel capacity planning</td>
<td>Warehouse and fleet planning</td>
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<tr>
<td>Order fulfilment</td>
<td>Demand Planning, pricing, GDT</td>
<td>Strategic markets, demand growth</td>
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Increasing Granularity and Tighter Constraints

Increasing Value and Flexibility
Pasture based farming drives the shape of the New Zealand milk supply curve, impacting the value chain

- A pasture-based farming model is more efficient and sustainable than feedlot (grain), but presents significant challenges from a value chain perspective
- NZ milk volumes are driven by grass growth – peaking in spring, but with very little available in winter
- The demand profile is relatively flat throughout the year, meaning that
- Fonterra’s global milk pools (outside of NZ) are a combination of pasture and feedlot farming systems, hence our overall supply curve is somewhat flatter. We also have a global sourcing business to bolster the supply.

**Fonterra New Zealand Daily Milk Collection**

![Graph showing milk collection from Jun to May for 2010/11 and 2011/12]
Most dairy products only use some of the raw milk components...

Raw milk composition

- **Water** 86%
- **Fat** 4.8%
- **Protein** 3.4%
  - Casein 2.7%
  - Whey Protein 0.7%
- **Other** 5.8%
  - Lactose 5.0%
  - Minerals 0.8%

... meaning they have associated co- and by-products – options for which must be planned simultaneously, accounting for both chilled and ambient distribution requirements and differing shelf lives.
Fonterra’s asset network introduces unique challenges on optimisation

- Capacity influences both short-term and long-term Product Mix outcomes
- Fonterra’s capacity is dictated by processing all of peak milk – and therefore much of the footprint is idle across the season.
- Stainless steel is expensive to build with a long life (30 years +),
Tool 1: SignalDemand for Tactical Planning

DEMAND
- Historical sales
- Contracts & Scheduling Agreements
- Supply Committed
- Remaining Unconstrained Demand
- GDT forecasted shipments

CONSTRANT DATA
- Estimated Time of Contracting Profile
- Transport bounds
- Inventory constraints

MODEL STRUCTURE
- Materials & Locations
- Material Alignment
- Transportation lanes
- Yields
- Resources
- Substitutions

SUPPLY
- Milk supply forecast
- Inventory
- Resource capacity
- Committed production
- Procurement volume

PRICE DATA
- Price reference materials
- BCP forecast
- Fonterra Commodity Price

COST DATA
- Manufacturing cost
- Storage cost
- Transportation cost
- Procurement cost

KEY OUTPUTS
- Optimised Demand
- Optimised NZ Supply
- Optimised Price
- Optimised Inventory

Optimisation Model
Tool 2: Supply Chain Guru for Strategic Investments

**Features and purpose**
- Network design software tool including transportation, product mix and logistics optimisation
- Long term planning
- Valuation and capital-constrained investment optimisation
- Scenario and simulation capability for sensitivity analysis

**Current use**
- Project Michelangelo: 10 year asset footprint plan
- Optimised green-field and brown-field manufacturing site selection
- Ten year milk, product and demand plan
- Strategic Logistics distribution network design
- Tactical network planning

**Future opportunities**
- Global asset footprint planning
- Supply chain assessments
- Global sourcing optimisation
- Mergers and acquisitions
- Distribution network design
- Global sourcing
- Milk pool investment
- Asset portfolio risk analysis
The power of the tool is also in its visual representation of the network and optimisation results.
Statisticians could help Fonterra…

<table>
<thead>
<tr>
<th>Predicting</th>
<th>Deciding</th>
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<tbody>
<tr>
<td>Peak milk volume</td>
<td>What/where/when to build</td>
</tr>
<tr>
<td>Drought and super-flush seasons</td>
<td>When to upgrade/maintain/replace</td>
</tr>
<tr>
<td>Auction prices</td>
<td>Buy/make</td>
</tr>
<tr>
<td>Premium prices</td>
<td>Growth markets to invest in (products and regions)</td>
</tr>
<tr>
<td>Competitor behaviour</td>
<td>Hedging and risk management strategies</td>
</tr>
<tr>
<td>Quality and safety issues</td>
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<tr>
<td>International dairy market behaviour</td>
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New Zealand Analytics Forum

Launched in March 2013
Organised by a steering committee of volunteers across 12 organisations
6 events this year
300+ attendees from 60+ organisations
Over 380 people on our mailing list

Analytics is the scientific process of transforming data into insight for making better decisions
Participating organisations

- ACC
- Airways
- Antuit
- Air New Zealand
- Auckland District Health Board
- Beca
- Callaghan Innovation
- Contact Energy
- Datamine
- Department of Conservation
- Department of Corrections
- Derceto
- Dragonfly Science
- Eagle Technology Group
- Electricity Authority
- Energy Modelling Consultants
- Entopix
- Ezibuy
- Fonterra
- Google
- Harmonic Analytics
- Hearne
- Hoare Research Software
- Housing NZ Corporation
- Incremental
- Interislander
- Inland Revenue
- IBM
- Kiwibank
- Loyalty NZ
- Meridian Energy
- Metservice
- Ministry of Education
- Ministry for the Environment
- Ministry of Justice
- Ministry of Social Development
- Mighty River Power
- NEC
- NZ Customs
- NZ Defence Force
- NZ Post
- NZTE
- Orion Health
- Optima
- Optimization
- Orbit Systems
- Pingar
- PriceTech
- Prodsol
- PwC
- Redvespa
- Statistics NZ
- Southern Cross Healthcare
- Telecom
- The Warehouse
- Transpower
- Trustpower
- Vector
- Statistics NZ
- University of Auckland
- Victoria Business School
- Wellington City Council
- Yellow
What we’re working on

- Production Planning
- SignalDemand
- TV Advertising buying in Australia
- Global optimisation models
- Third party sourcing
- Performance measurement
- Network footprint of retail outlets
- Optimum return of service obligation for Air Force Pilots
- Financial analysis for business line
- Step change optimisation implementation
- Network of the future
- Forecasting electricity demand
- Monte Carlo Simulation of Trustpower position in the market
- Global network design
- Pilot training Model
- Text mining unstructured accident descriptions to identify injury prevention opportunities
- Patient flows at Auckland City Hospital
- Use and presentation of quantitative information for decision making
- Retail pricing
- Analysis of influence effects on populations
- Using analytics as a means to improve business performance to out-compete rivals
- Radiotherapy treatment planning
- Fixed capacity, fixed input multi output production optimisation
- National fleet tracking
- Creating performance metrics
- 2014 Winter Olympics Demand analysis
- Contract centre long term resource planning
- Ambulance service efficiency gains
What we said we’re interested in – first event

- Managing analytics teams
- Selecting software and consultants
- Working with Universities
- Analytics success stories
- Training executives
- Communicating insights
- Model building principles
Developing Analytics Capability
Core analytics skillset

1. Formulate a problem

2. Select the right tool

3. Write code

4. Communicate
Any questions?
Thank You