Decision Making in Winery and Packaging Operations

Optimised Scheduling and Real Time Monitoring

James Balzary
We manufacture wine in a world that is rapidly automating and optimising....
Why is it important?
For Large and Small businesses

2019
>20%
Automated Technologies

800,000
Automatable Tasks
PwC The Future of Work: 2017

9%
Investing in Automation and AI
Alpha Beta Strategy and Economics Report: The Age of Automation 2017
Fundamentals

Remain the Same in Wine Making
Value Leaks

Typical Supply Chain and Production Environments

- Viticulture
- Intake
- Crushing
- Wine Making
- Bottling & Packaging
- Distribution and Sales
Value Leaks
Operational and Organisational

Work Centre 1
- Production Order 1
- Priority Order 2
- CTP Order 1

Cap and Label
Box/Palletize
Filler
Cap and Label
Box/Palletize

Maintenance Order 1
- Production Order 1
- Production Order 2
- Production Order 3
Value Leaks

Resource Management

Strategic:
• Network Capacity
• Capital works
• Intake Optionality

Tactical:
• Winery Workload
• Labour
• Equipment
What is the capability of this machine???
Decision Making Puzzle

Can Intuition destroy value??

Four travellers approach a bridge…

Each travels at a different speed:

- A – 1 minute
- B – 2 minutes
- C – 5 minutes
- D – 10 minutes

Challenge: schedule the travellers to minimise the total time to cross the bridge

Notes:

- Travel at night
- Only one torch
- Maximum 2 travellers on the bridge at a time and they have to walk together with the torch
- Can only cross at the speed of the slowest person in a pair
- No tricks
Decision Making

A possible solution:

A & B \uparrow 2
A \downarrow 1
A & C \uparrow 5
A \downarrow 1
A & D \uparrow 10

where: A = 1, B = 2, C = 5, D = 10

Heuristic: use the fastest traveller as much as possible
Decision Making

Intuition often *destroys value*

An optimal solution:

\[
\begin{align*}
A & \uparrow & 2 \\
A & \downarrow & 1 \\
C & \uparrow & 10 \\
B & \downarrow & 2 \\
A & \uparrow & 2 \\
\end{align*}
\]

where: \(A = 1, B = 2, C = 5, D = 10\)

Heuristic: match the speed of the travellers as much as possible
Approach
Stages to Optimal Decision Making

SENSE
Real Time Data Capture

ANALYSE
Data Analytics with Prediction

OPTIMISE
Intelligent Optimisation

DECIDE
Flexible and Dynamic scheduling
IIoT

Smart Sensors

[Images of a smart sensor in an industrial setting and a monitor displaying sensor data]
### Accurate Performance Data

#### Continuous Improvement

<table>
<thead>
<tr>
<th>Objective</th>
<th>Production Rate (Product)</th>
<th>Production Rate Last Hour (Product)</th>
<th>Average Speed Last Min (Product)</th>
<th>Availability (Shift)</th>
<th>OEE (Product)</th>
<th>OEE (Shift)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24.0 cask/min</td>
<td>21.1 cask/min</td>
<td>19.0 cask/min</td>
<td>95.1 %</td>
<td>64.4 %</td>
<td>74.0 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Downtime (Shift)</th>
<th>Downtime (Shift)</th>
<th>Efficiency Machine (Shift)</th>
<th>Quantity (Lines)</th>
<th>Quantity (Shift)</th>
<th>OEE (Line)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 times</td>
<td>0:12:24 s</td>
<td>77.8 %</td>
<td>10,230 cask</td>
<td>4,531 cask</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OEE (Product)</th>
<th>Downtime Cause</th>
<th>Downtime Cause</th>
<th>Availability (Line)</th>
<th>Efficiency Machine (Line)</th>
<th>Quantity (Product)</th>
</tr>
</thead>
<tbody>
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<table>
<thead>
<tr>
<th>Quantity (Line)</th>
<th>Production Rate (Product)</th>
<th>Efficiency Machine (Product)</th>
<th>Add or Remove Tile</th>
</tr>
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<tbody>
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</table>

**Charts and Graphs:**
- Bar charts for OEE, Downtime, Efficiency Machine, and Quantity.
- Line graphs showing trends over time for various performance metrics.
Predictive Capabilities

For more accurate decision models

Equipment Run Rate

History

Now

Future

1
2
3
Plans and Schedules

Accurate Modelling of all Resources
Plans and Schedules

With Optimisation
Levels of Maturity

Planning

(Automatic) Optimised Planning & Scheduling
Automatic generation of optimized plans based upon constraints

(Automatic) Rule Driven Planning & Scheduling
Automatic generation of feasible plans based upon rules

(Manual) Constrained Planning & Scheduling
No constraint violations allowed while manually planning & scheduling

(Manual) Unconstrained Planning & Scheduling
Manual process, provides better visibility, but requires constraint checking
Benefits

Achievable ROI of Improved Planning and Scheduling

01
25% Decrease in Wine Movements

02
5-10% Decrease in Water Consumed

03
>10% Increase in Operator Utilisation

04
50% reduction in Contract Resources

05
Minimise make span and increase throughput

Winery and Packaging combined

Consistent rostering aligned to required work

Same wine throughput

15% Reduction changeover time