Using Simulation Modelling to Improve the Profitability and Supply Reliability for an integrated Steel Supply Chain

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Our vision: Helping organizations and individuals make better faster decisions… when it really matters.

We are passionate about helping organizations answer two simple but important questions:

1. How much **better** can you do ... ?
   
   ![Graph showing performance improvement over time]

   - A lot...
   - A little...

2. How **best** to do it... ?
   
   ... in the simplest and fastest way, with lowest cost and risk...?

**Our CUSTOMERS include...**

- bhpbilliton
- Microsoft
- TATA
- Cargill
- Daimler
- ABB
- FUJITSU
- PENGUIN RANDOM HOUSE
- LARSEN & TOUBRO
- utah gov
- UNDP

**Our RESEARCH PARTNERS include...**

- MERLYNN
- REALIZATION.
- Amalama
- AnyLogic
- SAP
- Duke
1. Project Introduction

2. Business Challenge

3. Why Simulation & Why AnyLogic?

4. Model Demos and Insights Gained
   a) Hot Coil Finishing
   b) Steel & Slab Plant
   c) Steel Supply Chain Model

5. Q & A
1. Project Introduction

Project Background

• One of the largest European steel manufacturers
• Major pressure to improve profitability and service levels
• Many past initiatives/investments did not deliver expected ROI
• Focus on asset utilization, cost-reduction and debottlenecking

Project Objectives

• Can we build simulation models to accurately represent a steel supply chain with all its complexities, constraints, interdependencies and variability?
• Can we use these models to:
  • Determine primary causes of past performance gaps?
  • Determine likely operational and financial impact of changes?
  • Identify and test new, potentially counter intuitive, global optima planning and execution rules to be implemented in SAP?
1. Introduction - Steel Supply Chain

Logistics
- Construction
- Aviation
- Automotive
- Appliances

Customers

- Steel Supply Chain
- Logistics

Diagram showing the process from iron ore to finished steel products, including stages like Blast furnace, Ladle metallurgy, Continuous casting, Hot strip mill, Cold mills & coating lines.
2. Business Challenge

Management at all levels is responsible for:
• Making **reliable** commitments and **judging impact** of changes
• Deciding on what rules to use to **optimize the system** not just subsystems (considering all trade-offs)

This is challenging because:
• Companies today is subject to more and more **VUCCA** (Volatility, Uncertainty, Complexity, Constraints, Ambiguity)
• In such systems, changes can have **non-linear impacts**, making decisions and predictions very challenging

Why current tools are inadequate:
• **Static decision support tools** (ERP, spreadsheets etc.) cannot fully consider complexities, constraints, dynamic interdependencies and variability.
• Even when simulations are used, it is mostly to analyze or **optimize at a subsystem level**.
3. Why Simulation, Why Anylogic?

Why Simulation?
• Can consider all the critical system interdependencies, constraints, complexities and variability
• Can provide a range of likely outcomes for single scenarios, do sensitivity analysis and direct scenario comparisons
• Can provide a low risk, low cost way to test the impact of any changes on both operational and financial performance

Why AnyLogic?
• Can replicate the real world complexity through the use of both Agent-based and Discrete Event simulation methods
• Ability to create self-configurable models to cut dev time, ensure usability and scalability for range of system configs
• Ability to export model as stand alone app and option to use AnyLogic Cloud to run resource intensive models
4a. Hot Coil Finishing Simulation Model

Business Case

- Determine impact of **investment choices** and management policy changes to **avoid congestion** and **improve flow**
  - Increasing the Hot Strip Mill output
  - Double width coils
  - Upgrade wagon fleet

Insights gained

- Discovered that every rule starts with “**it depends... 😊**” and that most of these rules have never been documented
- Identified best options to **reduce congestion** during peak production periods based on throughput, WIP and cost impact.
- **Lowest cost option** between 2 alternative wagon designs yielded **highest total cost** of ownership
- Quantified the impact of **changing the product mix** – validated the results from the overall supply chain model
- Tested diversion assumptions from overall supply chain model
- Potential to use model to test new operational rules that can possibly allow **full automation**
4a. Hot Coil Finishing Simulation Model Demo
4b. Steel and Slab Simulation Model

**Business Case**
- Test impact of **changes in demand and product mix**
- Test new **operating philosophies** to improve efficiency in achieving targets.

**Insights gained**
- Through complex representation of **internal plant scheduling** the model was able to test operating philosophies around:
  - **Scheduling of casters** based on speed and sequence lengths per product grade, product width and caster
  - Alternative **prioritization rules** for products and casters
  - Alternative **maintenance strategies**
- Operational and Financial Impact quantification of:
  - producing more **complex products** and
  - changing **ladle management rules**
4b. Steel and Slab Simulation Model Demo
4c. Steel Supply Chain Model

Business Case
- Determine main causes of past congestion and low reliability
- Identify global-optima algorithm for dynamic Manuf & Distribution routings
- Quantify the operational and financial benefits of implementing a Theory of Constraints based integrated supply chain solution
- Create Decision Support Tool to validate system-wide impact of policy changes and/or assess reliability of annual plans and commitments.

Insights gained
- Past congestion and low reliability mainly caused by systemic bias from lowest-cost-per-ton-routing prioritization model & balancing of capacities.
- Verified strategic decisions to divert material to alternative processing centers during demand peak to decrease congestion/increase throughput
- Could quantify impact of increase in Hot Strip Mill output on the rest of the system and proactively adjust order book and routing policies to maintain flow and prevent congestion
- Developed new “Low-WIP/Max Flow” campaign rules on production centers
- Model is now used on a weekly, monthly and quarterly basis to quantify impact of external & internal changes and for making reliable commitments
- Ability to test anti-fragile rules
4c. Steel Supply Chain Model Demo
Q&A

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