



Simulation of Lumber Production Planning Using Software Agents: a Case Study

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SWST 51st Annual Convention

Concepción – Chile

November 10 – 12, 2008

From Physics

- To overcome inertia, is it easier to pull an object or to push it?



Presentation outlook

- **Objective**
- **Lumber market context in Québec**
- **Production Planning**
- **Lumber Production Planning (LPP)**
- **Simulation using agents**
- **Experiment**
- **Results and discussion**

Objective

- **To evaluate the logistical and financial performance of a softwood sawmill production planning process under push and pull based strategies using a simulation platform.**

Context for Québec's Lumber Industry

- **Competitive forces from low cost producers**
- **Timber cost going up**
- **Economic conditions, such as a stronger CDN\$ or taxes**
- **Market and customer changing forces**



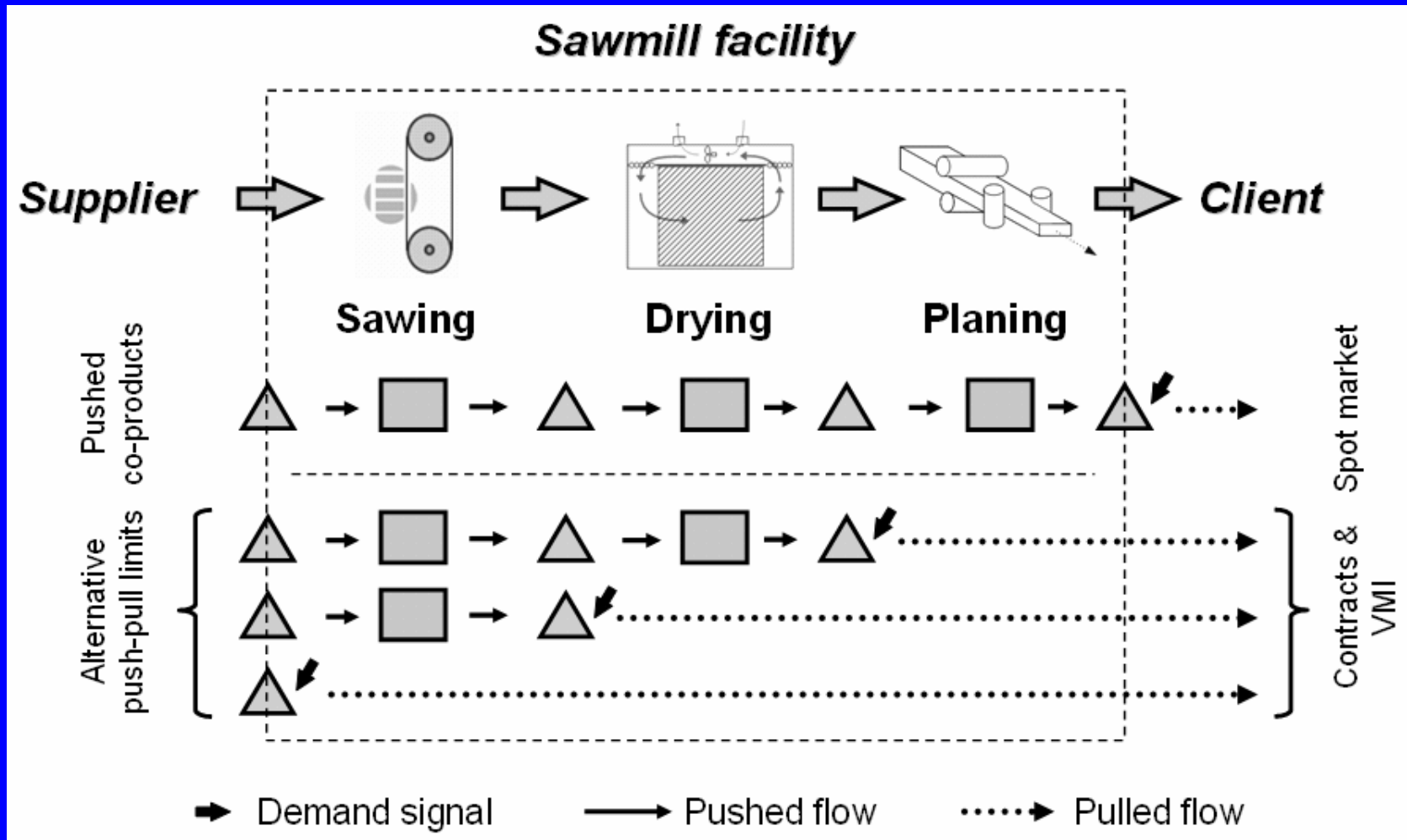
Production Planning

- To decide what, when and where to produce it, using different time spans
- Capacity planning (capacity allocation)
- Demand management (ATP and priority allocation)
- Materials requirement planning or sourcing

Production Planning

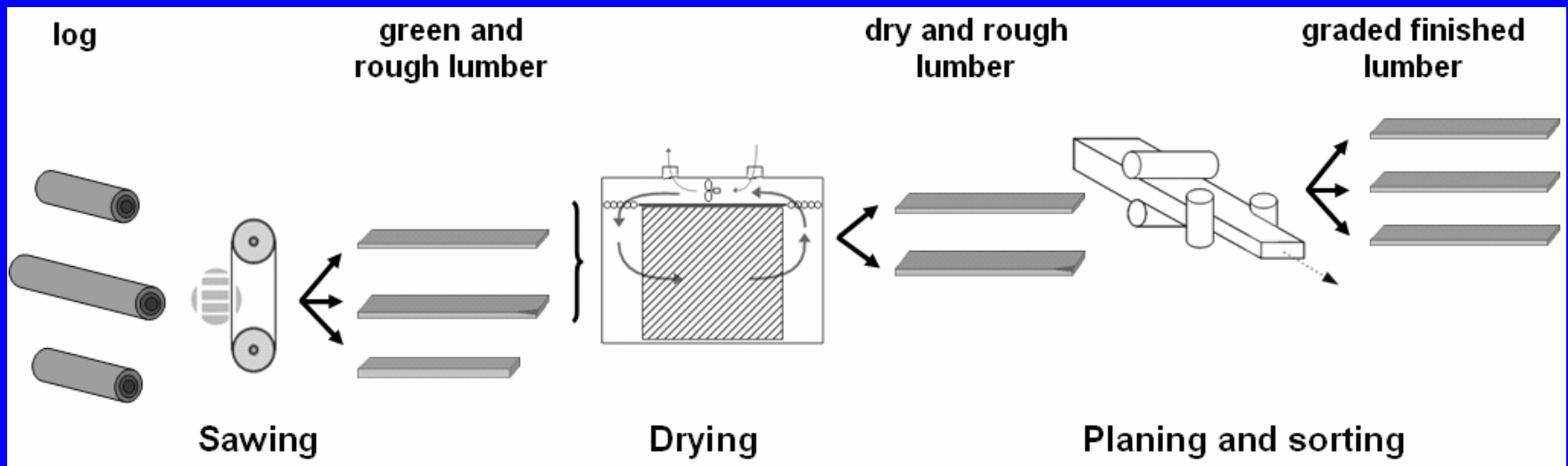
- **Drivers**
 - Supply driven (upstream signal)
 - Recipe driven
 - Demand driven (downstream signal)
- **Strategy elements**
 - Decision and information decoupling point
 - Performance criteria

Lumber Production Planning



Lumber Production Planning

- Divergent industry (V-type flow)



Lumber Production Planning

- **Approaches**
 - **Traditional: Producing lumber based on recovery optimization**
 - **Push**
 - **Command-based: Producing lumber based on targeted service levels at different points**
 - **Pull**

Simulation Using Agents



Simulation Using Agents

- **General characteristics:**
 - Emulate actual behavior
 - May have some autonomy
 - Some communication skills
 - Perform a given task
- **Specific**
 - Optimize decisions (Mixed models)
 - Exchange plans
 - Multi-agents

Simulation Platform

Gantt Graph - Microsoft Internet Explorer provided by I-Center

Address: http://foracdev-03.forac.ulaval.ca/fcid_PlanningUnitAnalysis115928011/Form

Kruger - Parent - Planning Unit Analysis - Gantt Graph

May 18, 2005

Start Date: 5/18/2005 12:00 AM

End Date: 7/18/2005

Show Data:

Processor	% Util.
+ AirDryingSpace	0 %
- KilnDryer	27 %
Dryer1	37 %
Dryer2	16 %
+ Finishing Lines	--
- Sawing Lines	--
Main	--

FORAC FOREST TO CUSTOMER

September 21, 2004

- Users
 - My Account
 - User Groups
- Static Definition
 - Company Structure
 - Planning Units
 - Supply Chains
 - Fabian's Supply Chain
 - Kruger's SC
 - Test Sawmill (Sawing with Warehouse)
- Administration
 - Data Operations
 - Suggested Configurations
 - Preferences

Forac ©2002-2003

FORAC Modeler

Location Editor

Map Size: Small Medium Large

Map Size: Small Medium Large

Map Orientation: N, N/E, E, S, S/W, W, N/W

Legend:

- 1
- 2
- ringSpace1
- ringSpace2
- ringSpace3
- ringSpace4
- ringSpace5
- ringSpace6
- ringSpace7
- ringSpace8

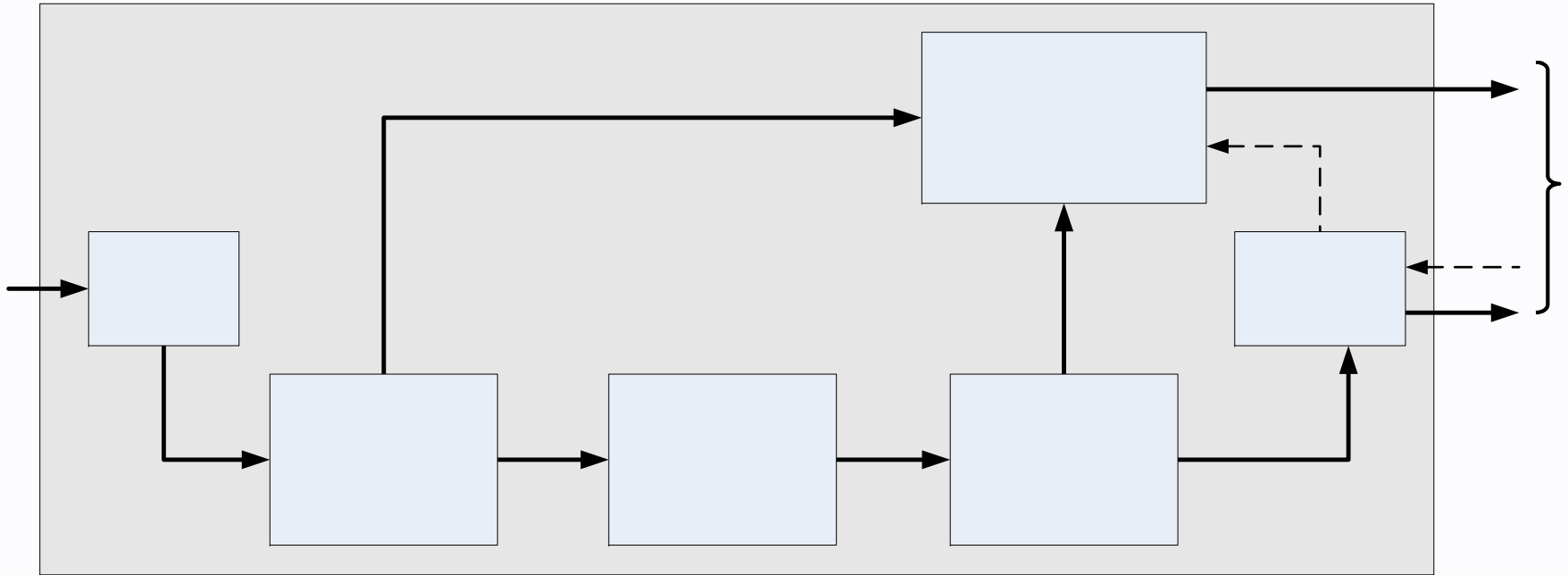
Hours: []

Timeline:

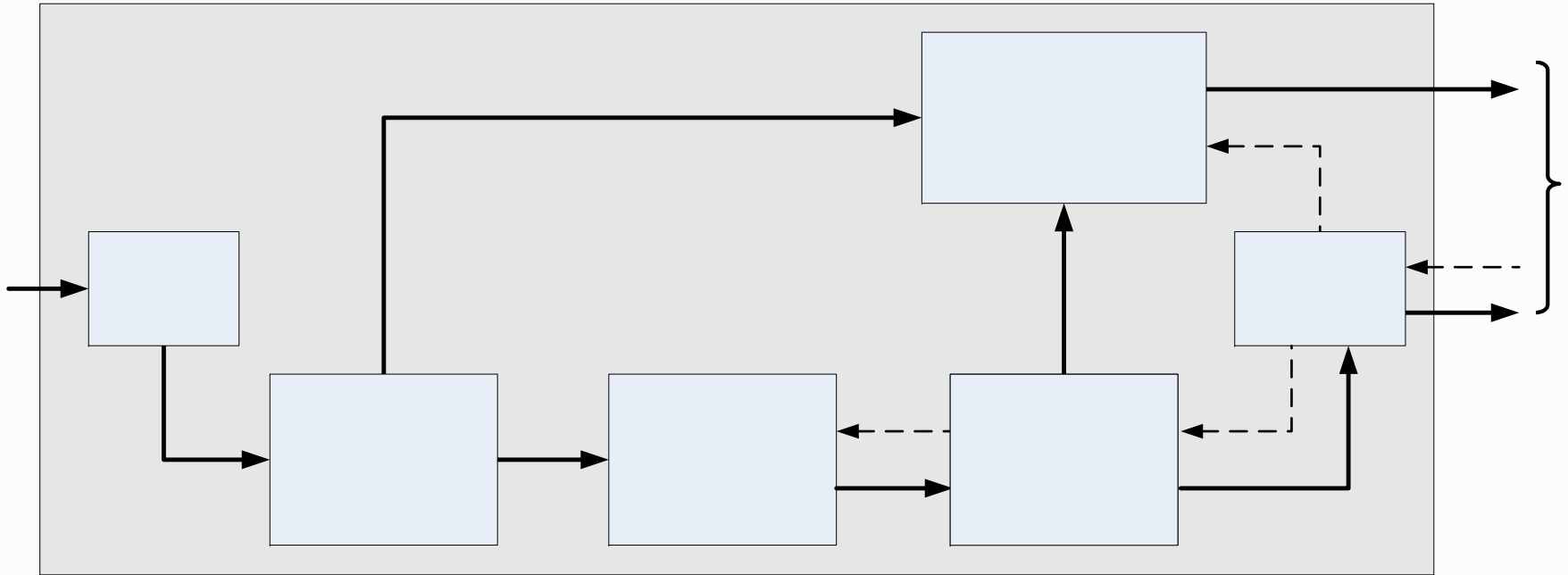
6/12/2005 6/19/2005 6/26/2005 7/3/2005 7/10/2005 7/17/2005 7/24/2005 7/31/2005 8/7/2005

Planning Engine
Parameter Lists
Order Templates
Source

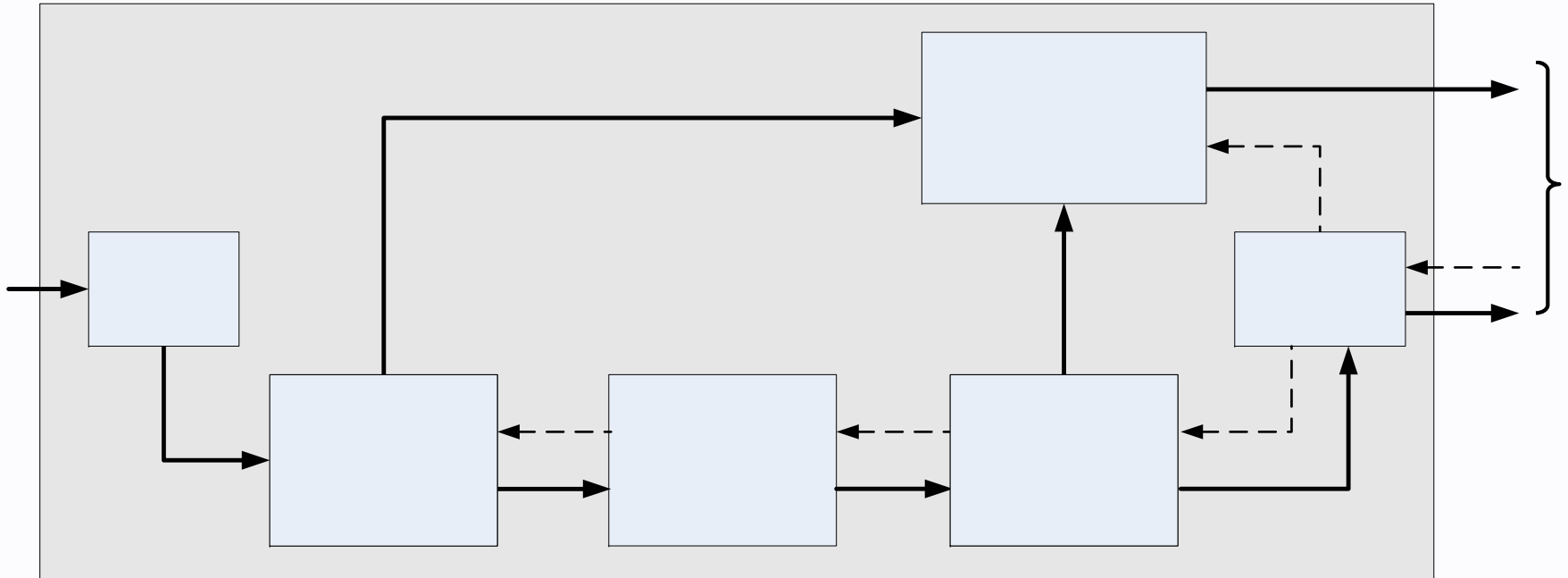
Simulation Coordination



Simulation Coordination



Simulation Coordination

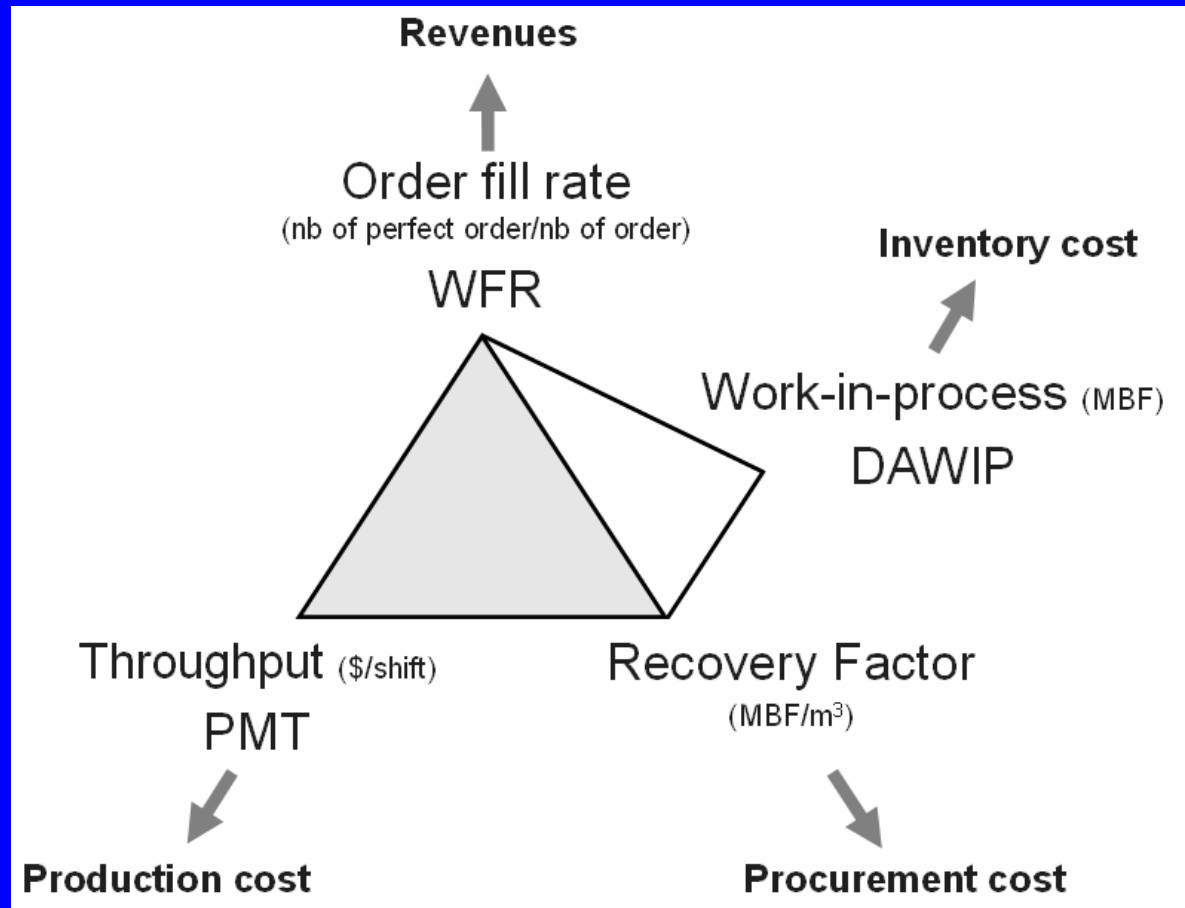


Experiment

- **Design for deterministic simulation**
 - Actual sawmill modeled using Optitek ®
 - Mixed design (54 runs or production plans)
 - **2 Controllable Factors**
 - Decoupling Point Position (3 levels)
 - Contracts levels for 2x4 RL 2& Better (60-80-100%)
 - **2 Noise Factors**
 - Supply Quality (normal and small)
 - Market prices (3 lists)

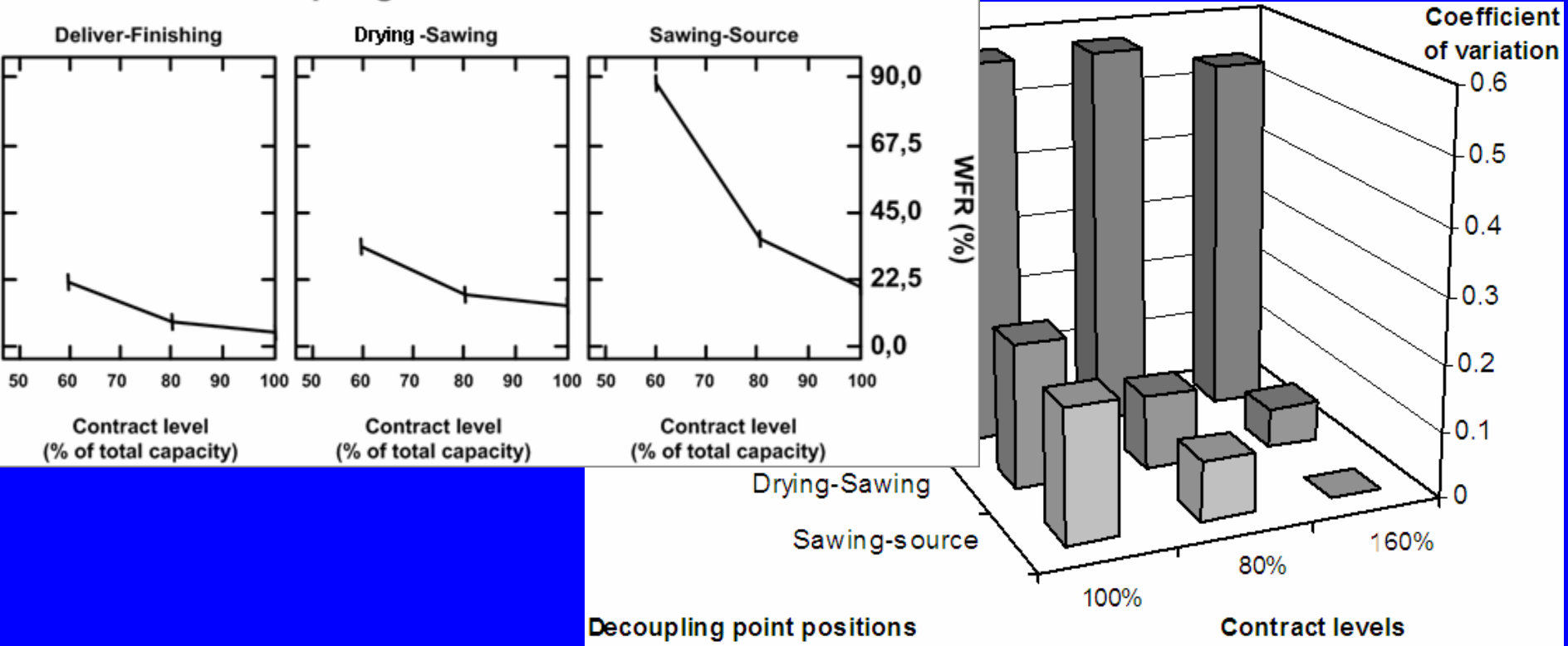
Experiment

- Performance evaluation



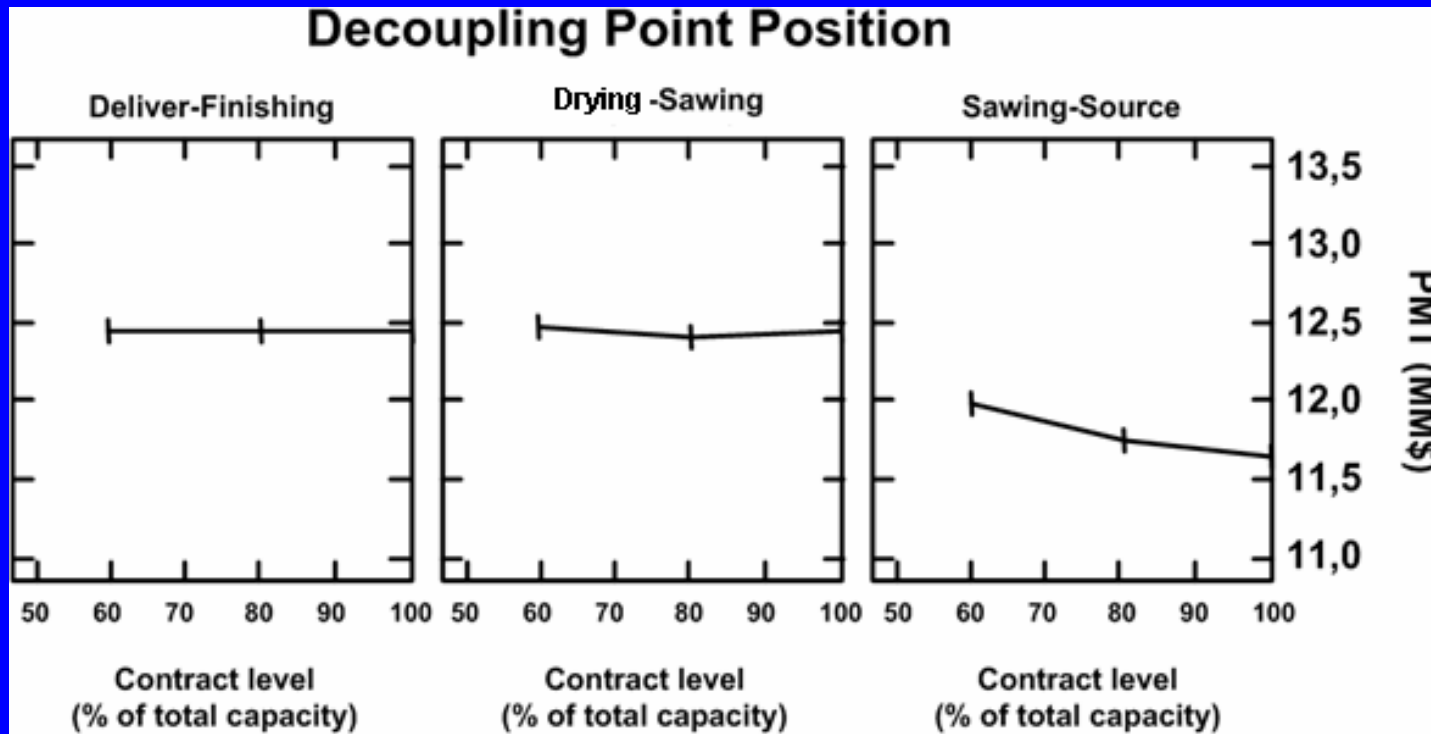
Results

Decoupling Point Position



- Pull strategy respond better to contracts

Results



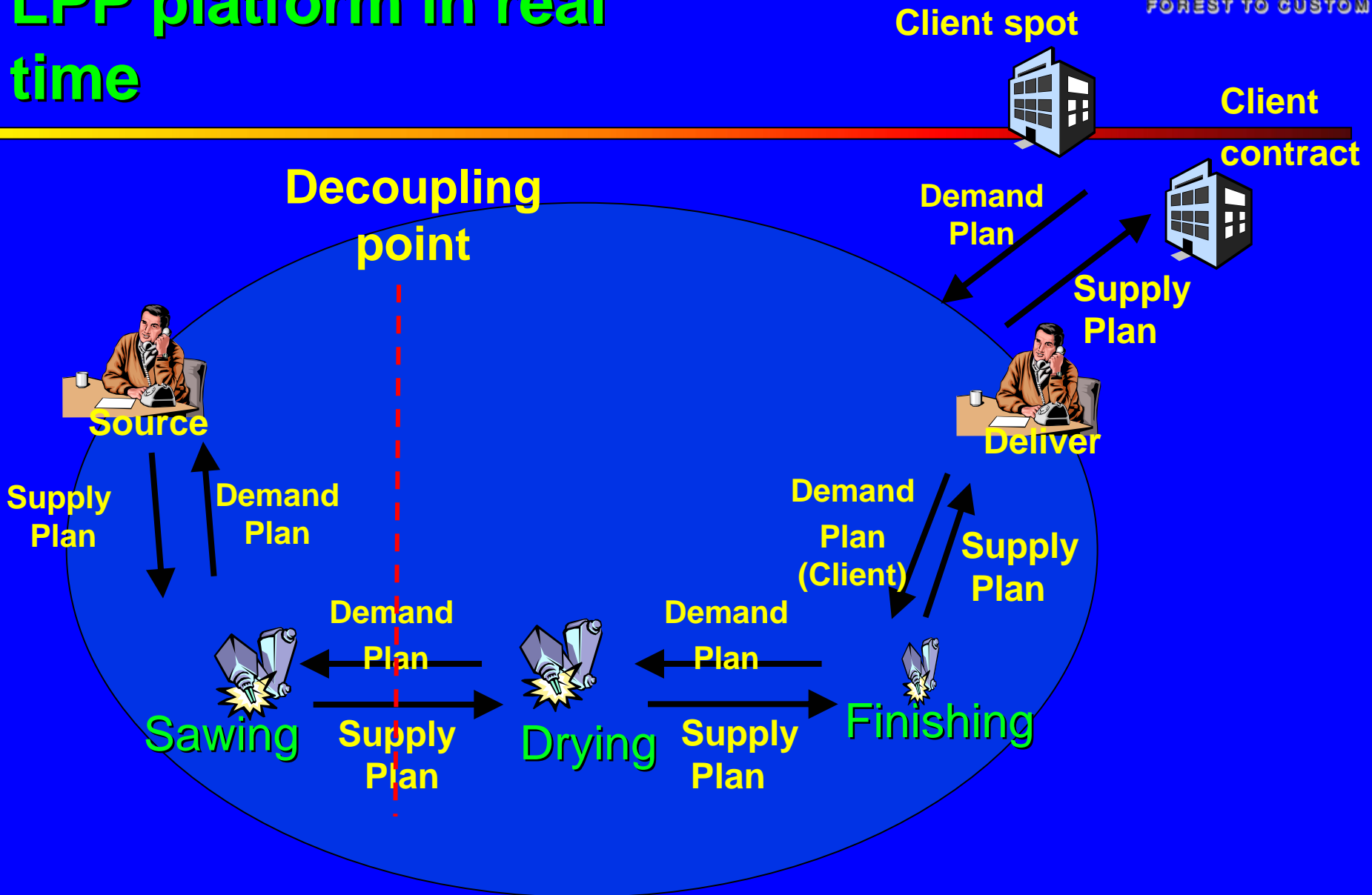
- **Push strategy generates more money (at least potentially)**

Discussion

Contract level	Average Potential monetary Throughput (\$)	Loss (\$)	Loss (%)	Premium (%)
Pure push strategy				
0%	\$ 12 433 143	\$0	0%	0%
Pure pull strategy (Configuration C)				
60%	\$11 987 220	\$ 445 924	3,59%	7,75%
80%	\$11 756 677	\$ 676 467	5,44%	8,99%
100%	\$11 637 634	\$ 795 509	6,40%	8,54%

- The sawmill should be “specialized” given its supply and technology and “match” this with the clients it serves

LPP platform in real time



**Thanks for your attention
...and congratulations for your endurance.**

For further details

- www.forac.ulaval.ca



- www.uach.cl/facultad/forestal/

