

Background

- Simon, 1952 (Nobel prize winner, 1978) He was beginner researcher to use Laplace transform technique to analyze the supply chain stability.
- Forrester, 1961 (from MIT) - derived first order differential equation for the same reason.
- Towill, 1982 used Laplace transform to study inventory and order based production control system. He realized that inventory order based production control system has three crucial parameters that may cause instability: **DELAY, ALPHA AND BETA** (two control parameters of supply chain).
- Riddalls and Bennett, 2002; Lewis et al., 1995; Chandra, 2006 considered one delay.
- Stability of Inventory Dynamics in Supply Chains with Three Delays. [Rifat Sipahi, Ismail Ilker Delice, Dec. 2008].

Objectives

1. Find new decision making strategies in order to circumvent the detrimental effects of delays.
2. Collaborative strategy.
3. A clear assessment of under which conditions the strategy would be useful.
4. Provide robustness against delay uncertainties.

Structure of Production Distribution System

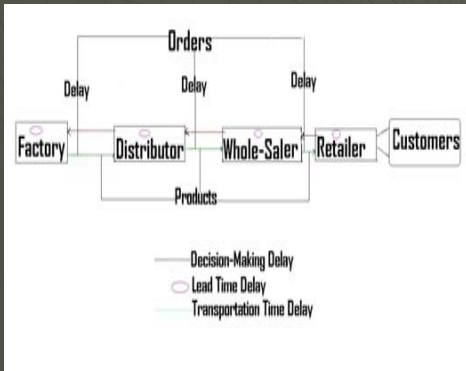


Figure – Product-Distribution

Basic supply chain structure applied in our experimental study of human decision making behavior.

Research Team:

Rodrigue Tchapgna , Rifat Sipahi

Department of Mechanical and Industrial Engineering

& Jean-Jacques Loiseau

École Centrale de Nantes (IRCCyN) France

Collaboration among Supply Chain

Oscillation of inventory levels are not desirable as they indicate increased costs due to excessive products or losing customers as a result of depletion of inventories. Several causes are behind the oscillations, one of which is the delay that is inherently present in the supply chain due to decision making delay, lead time delay and transportation delay. With collaboration, the manager should find another company willing to buy the excessive products at a lower price.

Servers

Router

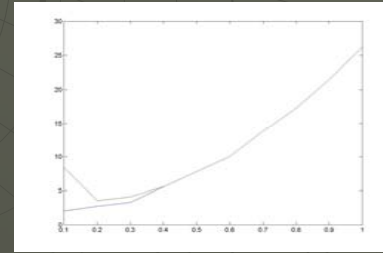
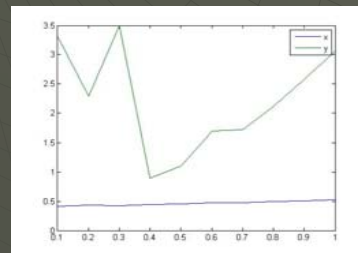
Supply Chain A

Supply Chain B

Supply Chain C

Effect of Collaboration on Stabilization of inventory

To assess the impact of the collaboration strategy, we calculate the area of the surface defined by the inventory without collaboration and cooperation in relation to a fixed reference.



Software Real-Time Simulation

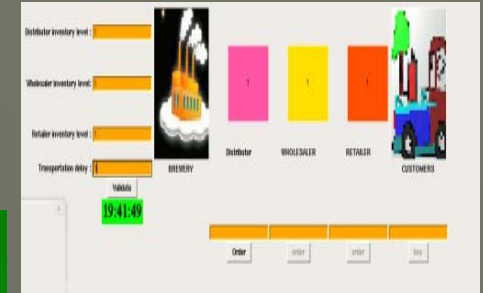


Figure – Software interface.

The objective is to enable the managers to simulate real situations, to make the right decisions to ensure finally stability of the inventory.

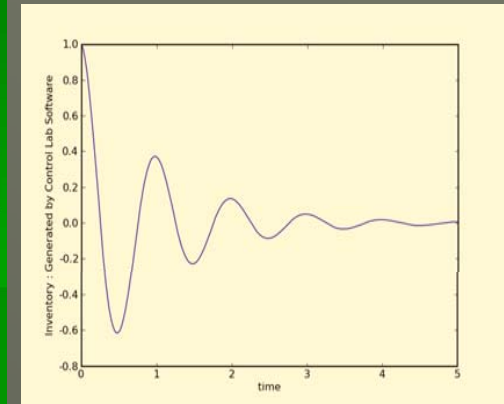


Figure – Inventory oscillation .

the simulation software allows the manager to observe the effect of his choice on the evolution of the inventory..

Conclusion and Future works

1. We show that the stabilization of the inventory levels can be achieved with this collaboration strategy, but not all the time,
2. We identify the admissible decision parameter set with which the stabilization is effective.
3. Cost optimization and investigation of product price dynamics.
4. In this regard, we see that managing supply chain is a combination of Operations Research, Systems Engineering and Mathematics.