SimHeuristics for Supply Chain Management

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SimHeuristics for SCM

- Outline
  - Supply Chain Management
  - Decision Problems in SCM
  - SimHeuristics
  - Applications
  - Conclusions
  - Future Research

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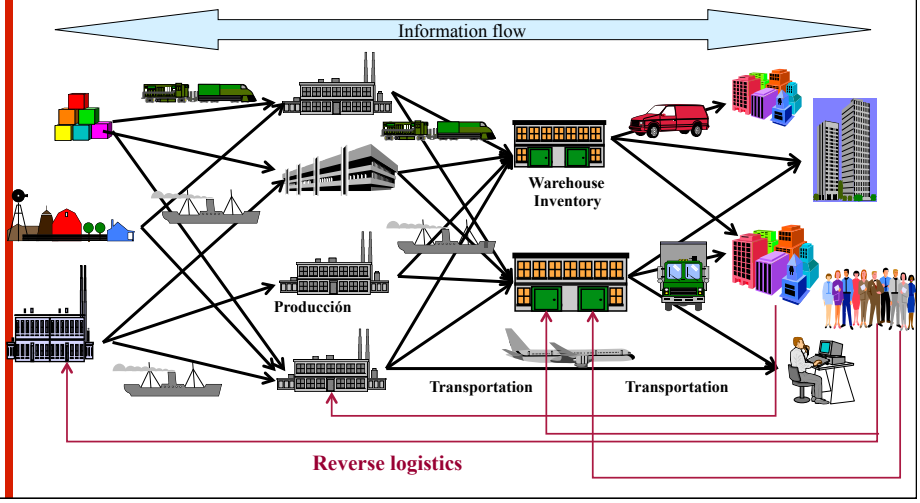
Supply Chain Management



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Supply Chain Management

- "It is the integration of **key processes** from suppliers to final consumers in order to obtain products, services and information that add value for consumers and other stakeholders" (The Global Supply Chain Forum, 1998).
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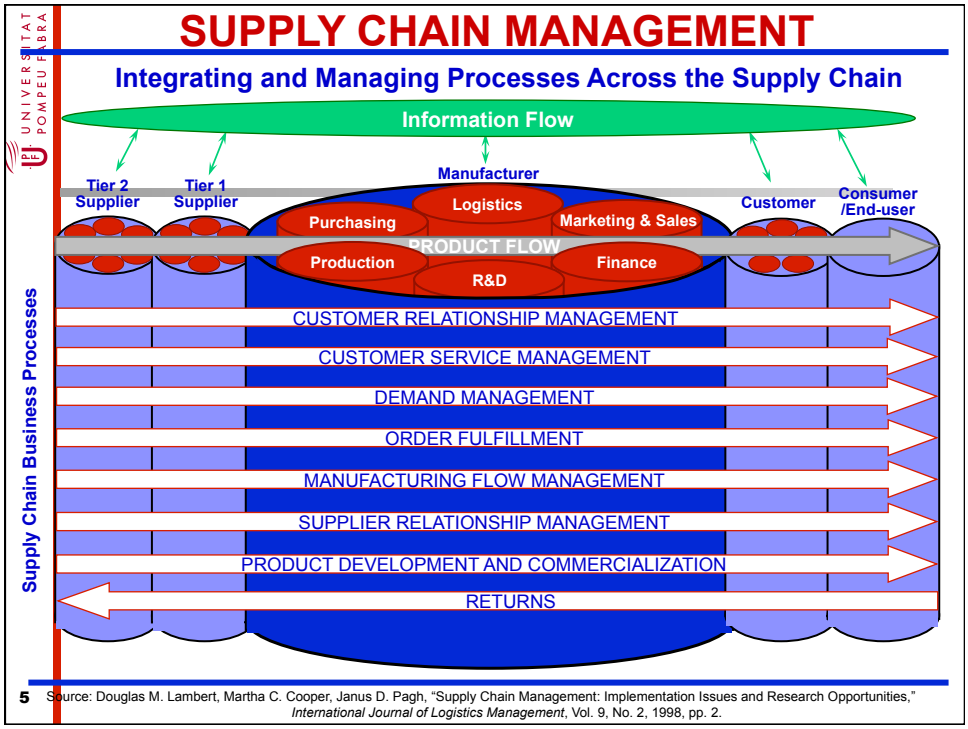

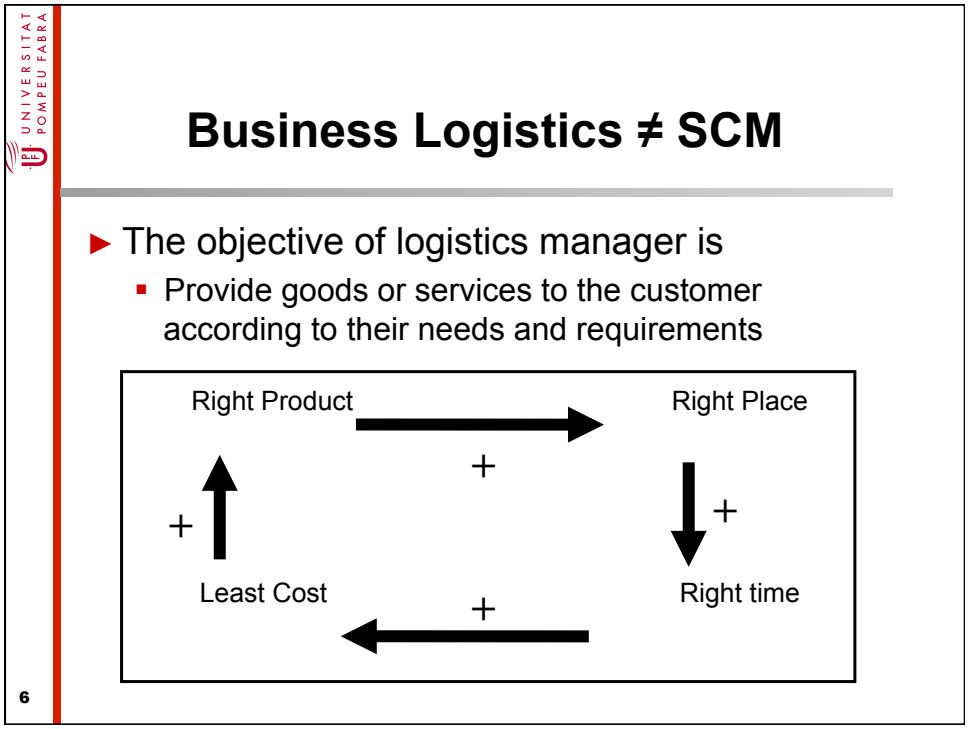

Objectives

- Describe the important role of uncertainty and stochasticity in SCM optimization problems.
- Point out that metaheuristics, and in particular simheuristics, can play a decisive role in SCM decision making process.

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Decision Problems in SCM

- Strategic problems
  - Cannot be easily changed in a short period
- Combinatorial optimization problems
  - The most frequent ones
- Stochastic data
  - Based on forecasted data
- The decisions have a great impact on the performance (cost, customer service, etc.) of the business.
  - Integration, Collaboration, Cooperation

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Decision Problems in SCM

- Supply Chain Network Design
  - Location, Inventory, Distribution, Procurement
- Manufacturing and Resource Strategies
  - Resource utilization, production planning, scheduling
- Sustainability and Green Strategies
  - Product design, manufacturing, returns
- Transportation and Distribution Strategies
  - Routing, assignment, coonnections

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SimHeuristics

- Metaheuristics have been extensive applied to solve SCM problems with great success.
  - Griifis, Bell, Closs (2012), Metaheuristics in Logistics and Supply Chain Management, Journal of Business Logistics 33:90-106.
- Simheuristics extends metaheuristics capabilities through adding Simulation to solve Stochastic problem.
  - Juan, Faulin, Grasman, Rabe, Figueira (2015), *A review of Simheuristics: extending metaheuristics to deal with stochastic optimization problems*, Operations Resaerch Perpective, 2:62-72

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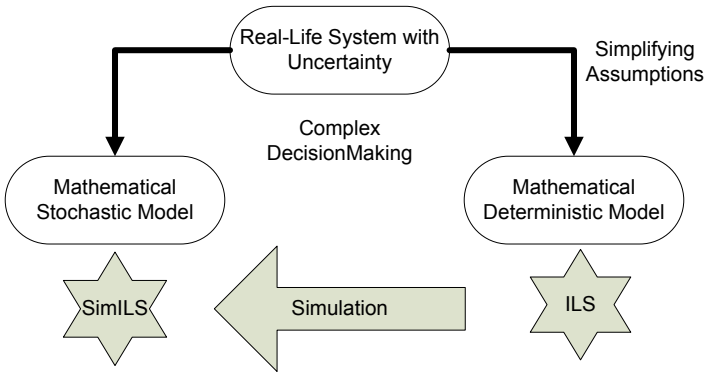
SimILS



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SimILS

- SimILS framework extending the original ILS framework

Procedure *SimILS*
  $s_0 = GenerateInitialSolution$
  $s^* = LocalSearch(s_0)$
  $(s^*, sf(s^*), statistics) = Simulation(s^*, \text{long})$
  Repeat
    $s' = Perturbation(s^*, \text{history})$
    $s'^* = LocalSearch(s')$
    $(s'^*, sf(s'^*), statistics) = Simulation(s'^*, \text{short})$
    $s^* = AcceptanceCriterion(s^*, s'^*, \text{history})$
  Until termination condition met
  $(s^*, sf(s^*), statistics) = Simulation(s^*, \text{long})$
Return $s^*, sf(s^*)$
End

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Applications

- Network Design Problem with marketing strategies
  - Locations, warehouse assignment and distributions strategies considering marketing policies.
    - * Ramalhinho, Pagés, Juan (work in process)
- Stochastic inventory-routing problem
  - Optimal routing and refill policy in a single period
  - Monte-Carlo Simulation with Multi-start Randomized Clarke and Wright savings heuristic.
    - * Juan, Grasman, Caceres, Bektas (2014)

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Conclusions

- Supply Chain Management is a important topic for many companies today.
- Many decisions in SCM must be taken within an uncertainty environment.
- Simheuristics can play an important role in helping in decision making:
  - Simple
  - Fast
  - Flexible
  - Accure

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Future Research

- Foresee more applications of simheuristics in SCM problems
  - Network Design Problems with International expansion, Logistics, Marketing Strategies
  - Collaborative transportation strategies in city distribution
- Main reference
  - Ramalhinho H. and Goméz Ravetti M (2016), Supply Chain Management in Handbook of Metaheuristics, editors M. Resende, P. Pardalos, R. Martí.

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