SimHeuristics for Supply Chain Management

Helena Ramalhinho (UPF)
Angel A. Juan (UOC)
Martín Goméz Ravetti (UFMG)

SimHeuristics for SCM

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

http://fisher.osu.edu/centers/
SUPPLY CHAIN MANAGEMENT
Integrating and Managing Processes Across the Supply Chain

Business Logistics ≠ SCM

The objective of logistics manager is
- Provide goods or services to the customer according to their needs and requirements

Customer Relationship Management
Customer Service Management
Demand Management
Order Fulfillment
Manufacturing Flow Management
Supplier Relationship Management
Product Development and Commercialization
Returns

SUPPLY CHAIN BUSINESS PROCESSES

Tier 2 Supplier
Tier 1 Supplier
Logistics
Purchasing
Marketing & Sales
R&D
Customer/End-user

CUSTOMER RELATIONSHIP MANAGEMENT
CUSTOMER SERVICE MANAGEMENT
DEMAND MANAGEMENT
ORDER FULFILLMENT
MANUFACTURING FLOW MANAGEMENT
SUPPLIER RELATIONSHIP MANAGEMENT
PRODUCT DEVELOPMENT AND COMMERCIALIZATION

Right Product
Right Place
Least Cost
Right time

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.

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
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, connections

SimHeuristics

► Metaheuristics have been extensive applied to solve SCM problems with great success.
► Simheuristics extends metaheuristics capabilities through adding Simulation to solve Stochastic problem.
SimILS framework extending the original ILS framework

```
Procedure SimILS
  s_0 = GenerateInitialSolution
  s' = LocalSearch(s_0)
  (s', gf(s'), statistics) = Simulation(s', long)
  Repeat
    s' = Perturbation(s', history)
    s'' = LocalSearch(s')
    (s'', gf(s''), statistics) = Simulation(s'', short)
    s' = AcceptanceCriterion(s'', s', history)
  Until termination condition met
  (s', gf(s'), statistics) = Simulation(s', long)
  Return s', gf(s')
End
```
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)

Conclusions

► Supply Chain Management is an 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
  ▪ Accurate
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