



Centre of Excellence in Supply Chain Management

# 11<sup>th</sup> Workshop on Logistics and Supply Chain Management

Louvain School of Management  
Université catholique de Louvain

**November 15th, 2010**

Facultés Universitaires de Saint Louis, Brussels

## PROGRAM

- 12:30 - 12:45      Sandwiches in the meeting room
- 12:45 - 13:30      *A Taxonomy and Review of the Fuzzy Data Envelopment Analysis Literature: Two Decades in the Making*  
Adel HATAMIMARBINI  
Université Catholique de Louvain, Belgium
- 13:30 – 14:15      *Organizational forms and performance in trucking service*  
Johan LUNDIN  
Lund University
- 14:15 - 15:00      *Comparison of Heuristics Procedures for An Integrated Model for Production and Distribution Planning in an Environment of Shared Resources*  
Géraldine STRACK, Bernard FORTZ and Fouad RIANE  
Université Catholique de Louvain, Belgium; Université Libre de Bruxelles, Belgium; Facultés Universitaires Catholiques de Mons, Belgium
- 15:00 – 15:30      Break
- 15:30 – 16:15      *Branch and Cut and Price for the Time-Dependent Vehicle Routing Problem with Time Windows*  
Saïd DABIA  
Technische Universiteit Eindhoven
- 16:15 - 17:00      *Minimizing the makespan of container storage and retrieval requests*  
AH GHAREHGOZLI, Yugang YU, Rene de KOSTER, JT UDDING  
Rotterdam School of Management, Erasmus University Rotterdam, Netherlands and Mechanical Engineering, Systems Engineering, Eindhoven University of Technology, Netherlands

## **Summary of Abstracts**

### *A Taxonomy and Review of the Fuzzy Data Envelopment Analysis Literature: Two Decades in the Making*

Adel HATAMIMARBINI

#### **Abstract**

Data envelopment analysis (DEA) is a methodology for measuring the relative efficiencies of a set of decision making units (DMUs) that use multiple inputs to produce multiple outputs. Crisp input and output data are fundamentally indispensable in conventional DEA. However, the observed values of the input and output data in real-world problems are sometimes imprecise or vague. Many researchers have proposed various fuzzy methods for dealing with the imprecise and ambiguous data in DEA. In this study, we provide a taxonomy and review of the fuzzy DEA methods. We present a classification scheme with four primary categories, namely, the tolerance approach, the  $\alpha$ -level based approach, the fuzzy ranking approach, and the possibility approach; and a secondary category to group the pioneering papers that do not fall into the four primary classifications. We discuss each classification scheme and group the fuzzy DEA papers published in the literature over the past twenty years. To the best of our knowledge, this paper appears to be the only review and complete source of references on fuzzy DEA.

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### *Organizational forms and performance in trucking service*

Johan LUNDIN

#### **Abstract**

In general, firms are either owned by investors or members (Chaddad and Cook, 2004). Member owned firms are commonly referred to as cooperatives, which we henceforth adopt. Several studies have been devoted to comparing these two types of organizational forms using different theoretical perspectives: Institutional theory (Emilianoff, 1948, 1995; Craig, 1993), Neo-classical theory (LeVay, 1983; Tennbakk, 1996), Transaction cost theory (Staatz, 1984; Ollila, 1989; Schrader, 1989), Game theory (Sexton, 1986; Staatz, 1987), Property rights theory (Fulton, 1995), Agency theory ((Jensen and Meckling, 1979; Bergeron and Lalancette, 1993; Hansmann, 1996). However, when it comes to understanding the competition between them, neo-classical theory and in particular industrial organization is the predominant choice (see some reference).

Previously, most studies on cooperatives focus on an agricultural context (see Sexton, 1986; Porter and Scully, 1987; Staatz, 1987), but cooperatives are also found in banking, stock exchanges, and law firms. However, we found that there exist cooperatives in one overlooked context, the trucking industry. These cooperatives consist of carriers (producers of trucking services), which together coordinate, market, and sell trucking services to customers. These cooperatives compete with commercial owner third-party logistics providers contracting carriers, which typically are investor owned. They also compete with themselves, since carriers have the option of going direct to the end customer.

Typically, when comparing cooperatives with investor owned firms based on efficiency, it is measured on three different aspects (Nilsson, 2001): technical efficiency (ability to maximize output from given inputs), allocative efficiency (ability to choose the cost minimizing method of producing a given output), and scale efficiency (ability to choose the correct level of output). Porter and Scully (1987) argue that the incentive problems associated with a cooperative reduces its ability to maximize out from given inputs, while others claim that cooperatives have improved information flows (Staatz, 1984) and less problems with moral hazard (Fernandez et al., 1998) leading to increased technical efficiency. When it comes to allocative efficiency, Ferrier and Porter (1991) show that horizon problems associated with cooperatives inhibits rational investments making it difficult to choose the cost minimizing method of production. In context of the trucking industry, investments consist of trucks, terminals,

and administrative tools. Since each carrier makes investment decisions in trucks, we explore what organizational form (direct channel, carrier-cooperative, third-party logistics provider) that leads to the most economical efficient decision from an economical point of view. Investments in terminals and administrative tools are on the other hand a decision for the entity facing the shipper, which could be the carrier using a direct channel or the carrier-cooperative/TPL. This decision becomes indifferent if the carrier-cooperative allows tradable residual claims (Bonin et al., 1993; Harris et al., 1996; Cook and Iliopoulos, 1999), which means that we can disregard it. Studies on cooperatives pertaining to scale efficiency (see Porter and Scully, 1987) argue that they typically lack of sufficient members in order to choose a correct level of output. They claim that this has to do with increasing cost of control as members increase and sometimes even legal restrictions on business volume. On the other hand, Fernandez et al. (1998) refer to cooperatives and IOFs as quasi-integrated enabling them to reach economies of scales and density to the same extent than vertically integrated firms, since they completely manage the coordination of the carriers. Hence, we focus on exploring the truck investment decision for different organizational forms in the trucking industry. The methodology draw on industrial organization and game theory using a two-stage supply chain model under deterministic demand, which we express as a Cournot competition model.

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## Comparison of Heuristics Procedures for An Integrated Model for Production and Distribution Planning in an Environment of Shared Resources

Géraldine STRACK, Bernard FORTZ and Fouad RIANE

### **Abstract**

In this study, we present a mathematical model which integrates tactical-operational production and distribution decisions in a shared resources environment. More precisely, we integrate lot sizing production and distribution decisions with vehicle routing decisions. We obtain a global multi-period multi-item multi-vehicle model where a capacity constraint models the link between production and distribution decisions. Three heuristics are presented in order to solve this global model. The first two ones are based on a decomposition approach with an approximation of the vehicle routing problem. The third heuristic offers a higher level of integration by taking into account transportation decisions in the production planning problem. Computational tests show that the performance of the heuristic depends on the amount of shared resources in the system and of the weight of the production cost against the distribution cost. The three heuristics allow to tackle problems of larger size than an optimal solution approach.

**Keywords:** Integrated model; Production; Distribution; Shared Resources.

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## *Branch and Cut and Price for the Time-Dependent Vehicle Routing Problem with Time Windows*

Said DABIA

### **Abstract**

In this paper, we consider the Time-Dependent Vehicle Routing Problem with Time Windows (TDVRPTW). Travel times are time-dependent, meaning that depending on the departure time from a customer a different travel time is incurred. Because of time-dependency, vehicles' dispatch times from the depot are crucial as road congestion might be avoided. Due to its complexity, all existing solutions to TDVRPTW are based on (meta-) heuristics and no exact methods are known for this problem. In this paper, we propose the first exact method to solve TDVRPTW. The MIP formulation is decomposed into a master problem that is solved by means of column generation, and a pricing problem. To insure integrality, the resulting algorithm is embedded in a Branch and Cut framework. We aim to determine the set of routes with the least total travel time. Furthermore, for each vehicle, the best dispatch time from the depot is calculated.

## *Minimizing the makespan of container storage and retrieval requests*

AH GHAREHGOZLI, Yugang YU, Rene de KOSTER, JT UDDING

### **Abstract**

We sequence multiple container storage and retrieval requests in a single block located in the stack area of an automated container yard by minimizing the makespan of a single automated stacking crane (ASC) operating above the block. A number of input/output (I/O) points are located at both the seaside and the landside of the block. Every I/O point has a list of storage containers each with a given storage location. Every retrieval container can be delivered to any I/O point either at the landside or at the seaside depending on whether it is to be transported by ship or truck/train. The problem is modeled as an asymmetric travel salesman problem. We develop a two-phase solution method to optimally solve the problem.

**Keywords:** Container storage and retrieval, automated staking crane, multiple I/O points, makespan