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# Assessing Service Quality Improvement through Horizontal Cooperation in Last Mile Distribution

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Madrid, November 29 2016

# 1. Introduction

- Interfirm Cooperation

| | | Unrelated | Vertical | Horizontal |
|---|---|---|---|---|
| Marketing | | Rokkan et al. (2003) | Zhang et al. (2013) | Czernek, K. (2013) |
| R&D | | Teirlinck and Spithoven (2013) | Sheng et al. (2015) | Roijakkers and Hagedoorn (2006) |
| NPD | | Yam and Chan (2015) | Petersen et al. (2005) | Chen (2005) |
| L&T | Maritime | - | Álvarez-SanJaime et al. (2013a) | Álvarez-SanJaime et al. (2013b) |
| | Aviation | - | Fu et al. (2011) | Kuchinke and Sickmann (2005) |
| | Landside | - | Bahinipati et al. (2012) | **This work** |

# 1. Introduction

- Horizontal Cooperation in the landside

**Concept**

- Concerted practices among companies operating at the same level(s) in the market (EU, 2011)

**Context**

- Co-opetition (Cooperation + competition)
- Key elements: Trust & Committeemen

**Aims**

- Main: reducing transportation costs
- Others: reducing environmental impact, improving service quality, reducing risks…

# 1. Introduction

- Taxonomy of Horizontal Cooperation

| | |
|---|---|
| Type I Cooperation | • Agreements in which the involved companies coordinate their activities on a limited basis for a very short time |
| Type II Cooperation | • Medium term agreements for an entire project duration and a greater level of coordination |
| Type III Cooperation | • Organizations have a high level of integration for an unlimited duration |

Based on Lambert et al. (1999)

# 1. Introduction

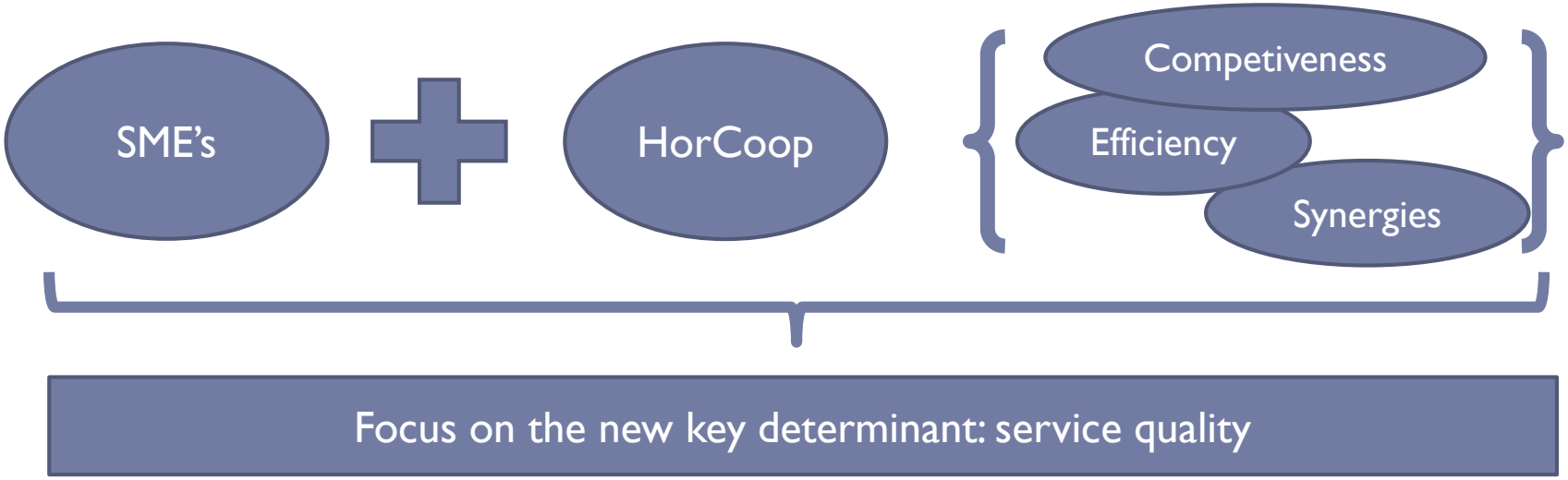
- Last mile distribution
  - The link between the supply chain and the final destination
  - Usually takes place in urban areas
  - Highly competitive environment


- Challenging environment
  - Globalization
  - Service quality as a growing success factor
  - SME's: limited resources

# 1. Introduction

## Horizontal Cooperation and Last Mile Distribution

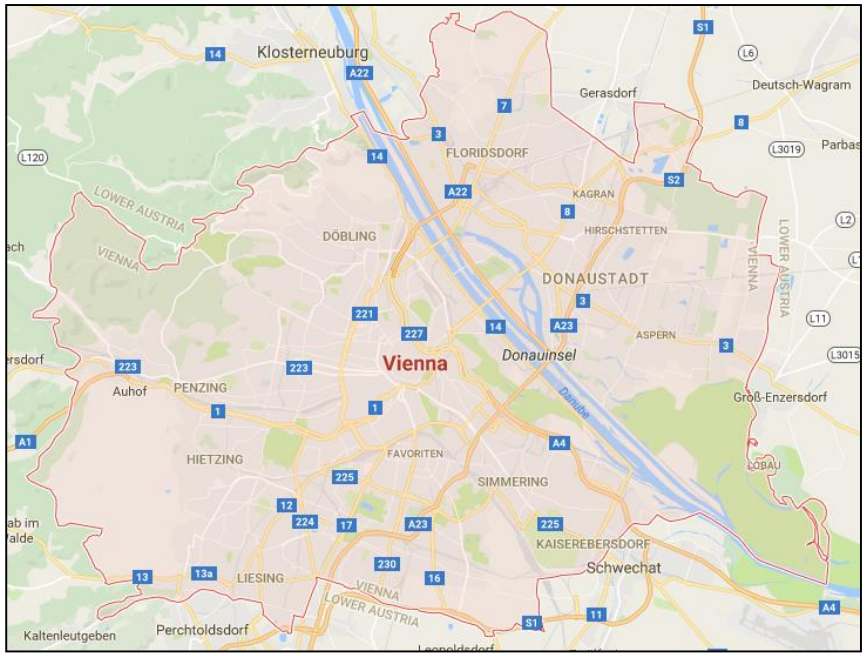
In order to facilitate competitiveness and efficiency in last mile urban distribution SME's can follow cooperation strategies with other companies by exploiting their synergies




**Research question: What would be the impact of Horizontal Cooperation on service quality in last mile urban distribution?**

# 2. Methodology

- Agent Based Simulation
  - Wholesalers
  - Stores (customers)
  - Vehicles

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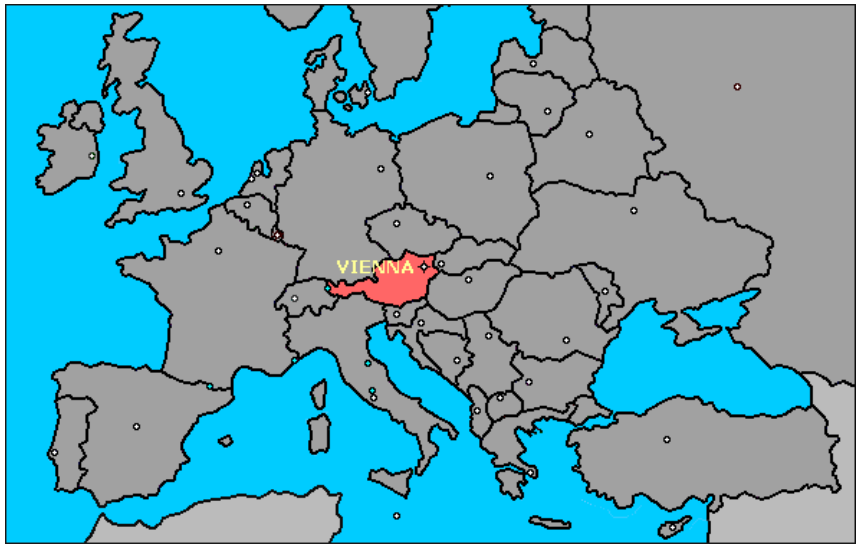
- Located in Vienna (Austria)
  - 2.4 million inhabitants
  - 414 $km^2$

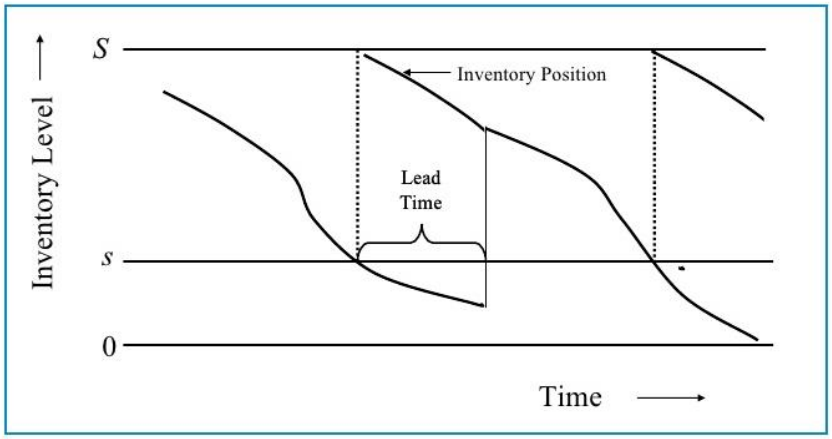


# 2. Methodology

- Preliminary assumptions
  - Wholesalers have identical cost structures and they provide their logistics service at a given and competitive price that cannot be changed in the short run
  - As a result, service quality (measured by lead-times) is the only determinant for a store to choose its wholesaler
  - A 3-month time-horizon is selected to simulate the coalition behavior in the medium time frame. This time period is simulated in which the small wholesalers engage in forming a coalition based on types I and II cooperations

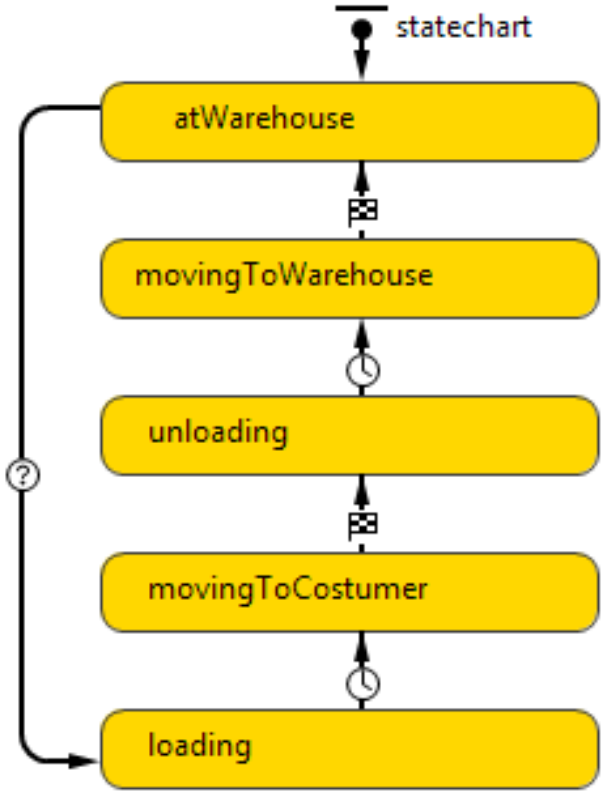
# 2. Methodology

- Wholesalers
  - Agents that may cooperate in order to improve service quality for their customers
  - In the initial scenario, a pure competitive setting is assumed in which no horizontal cooperation exists
  - Each wholesaler has its own customer base that is served if a product is requested.
- Stores (costumers)
  - Small shops in the study area with almost no stock- (micro enterprises)
  - Stores are assumed to employ an (s,S) inventory policy



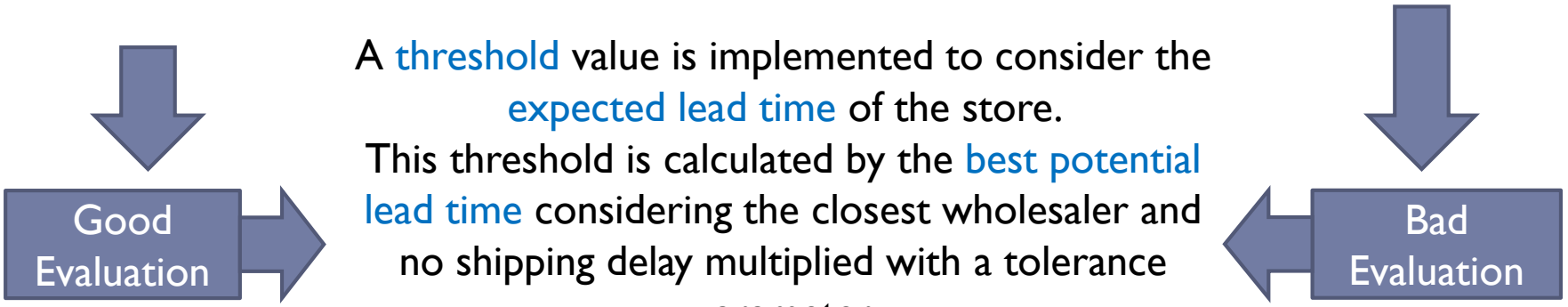
# 2. Methodology

- Vehicles
  - Transportation of products from wholesaler locations to store locations is performed by vehicle agents.
  - Therefore, each wholesaler has its own and homogeneous vehicle fleet.
  - Real data in roads and driving times are used



# 2. Methodology

- The cooperative behavior (I)
  - Each time an order arrives, the store makes an evaluation concerning the achieved service quality, measured by the lead time.



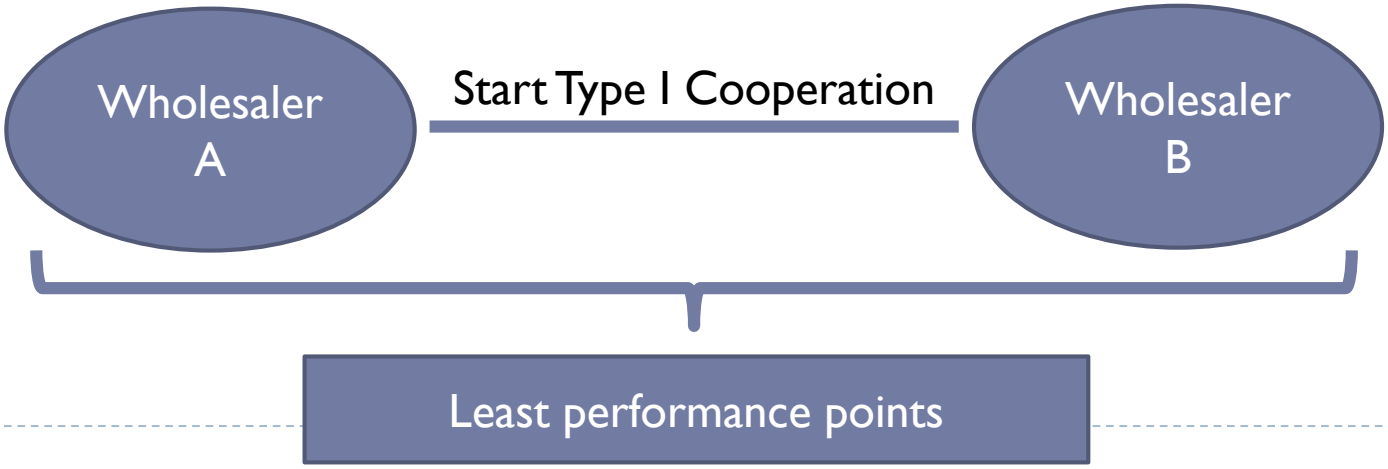

If products are delivered before this threshold, a positive performance point is given to that wholesaler

If products are delivered after this threshold, a negative performance point is given to that wholesaler

An extra point is given if the current shipment was shorter than the average lead time, otherwise, a negative performance

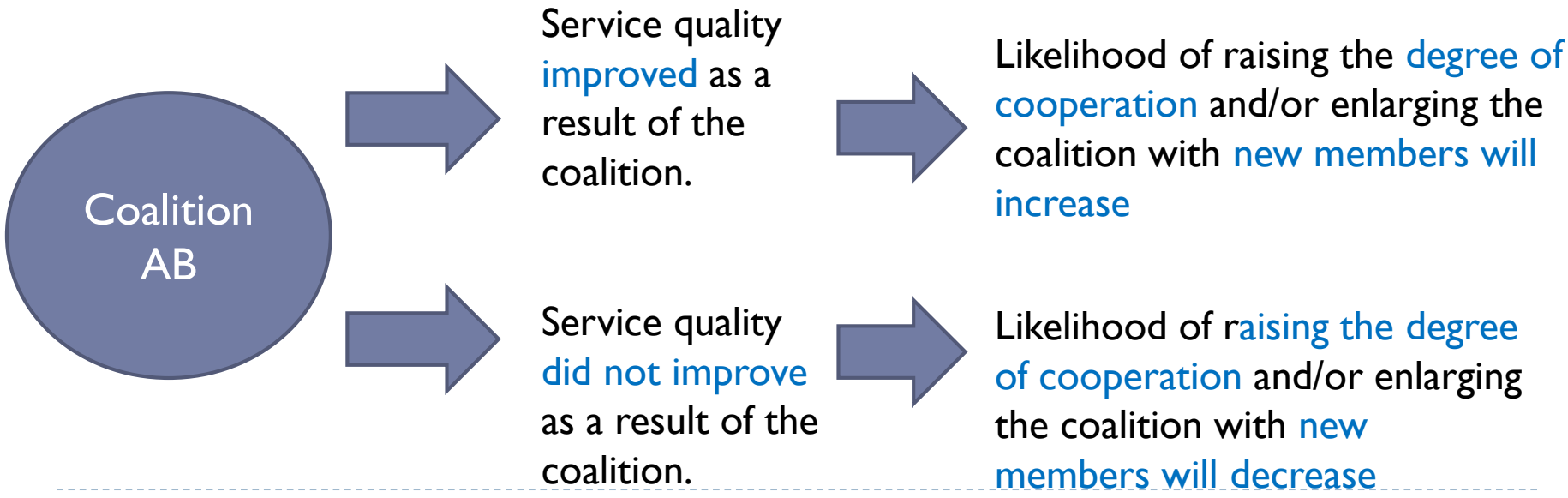
# 2. Methodology

- The cooperative behavior (II)
  - At the end of the working day, the wholesaler with the least performance points (the wholesaler with the weakest performance, namely wholesaler A) starts a coalition with another wholesaler in order to stay competitive.
  - The partner eventually chosen (namely wholesaler B) will be someone that also has a motivation to make the coalition due to negative customer evaluations (negative performance points).



# 2. Methodology

- The cooperative behavior (III)
  - Type I cooperation implies limited information sharing about their customers in such a way that A and B maintain the same shipping volume respectively, but potentially swap customers in order to improve service levels. After another evaluation period, the coalition is assessed with two potential outcomes



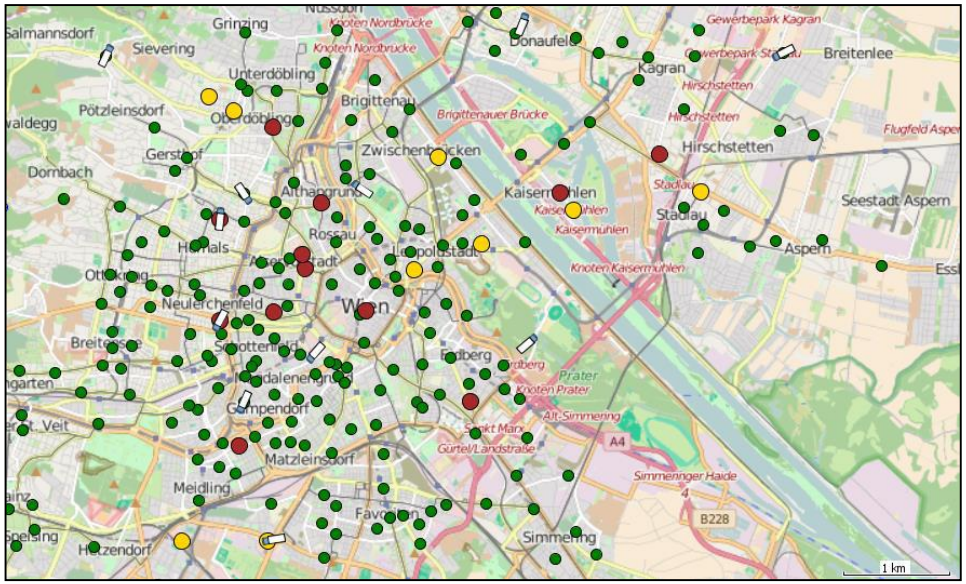
# 2. Methodology

- The cooperative behavior (IV)
  - Based on the coalition trust achieved over time, a coalition potentially upgrades to a Type II cooperation.
  - In the Type II cooperation, wholesalers share not only information about their customers but also orders.
  - Additionally, if the coalition service quality improves, other wholesalers may be interested in joining the coalition. In such a case, a Type I cooperation with the coalition is started and again evaluated based on the performance.

# 2. Results

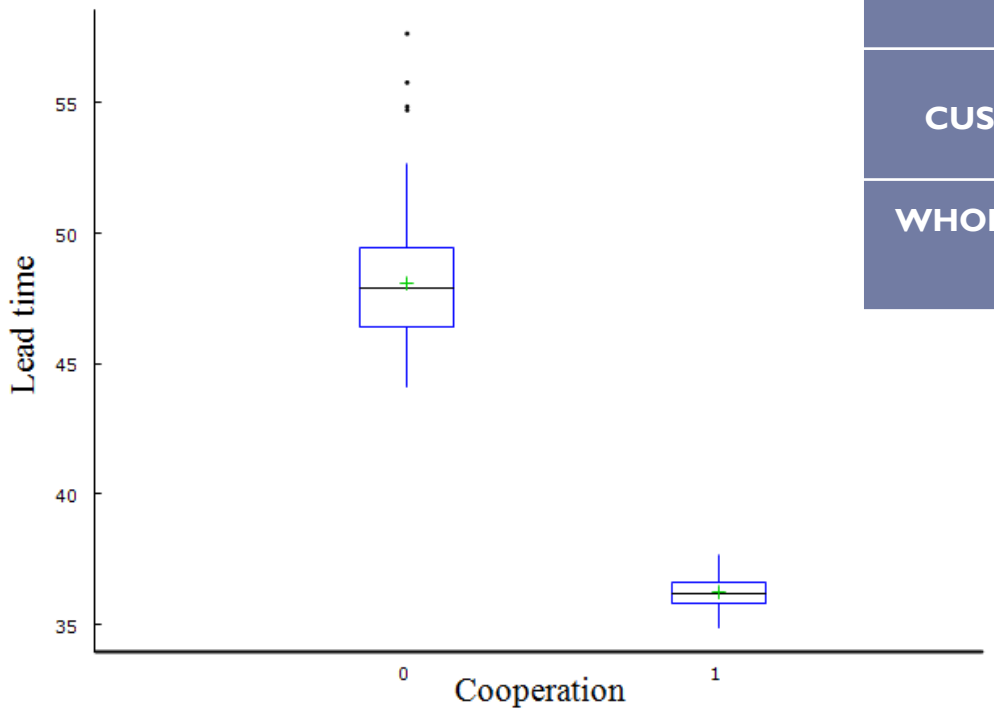
- The model was tested with 26 wholesalers and 273 stores, which interact in a geographic space based on spatial data originating from Vienna, Austria

  - User interface
    - Green dots: stores
    - Red dots: wholesalers that are not in the coalition
    - Gold dots: wholesalers that are in the coalition



# 2. Results

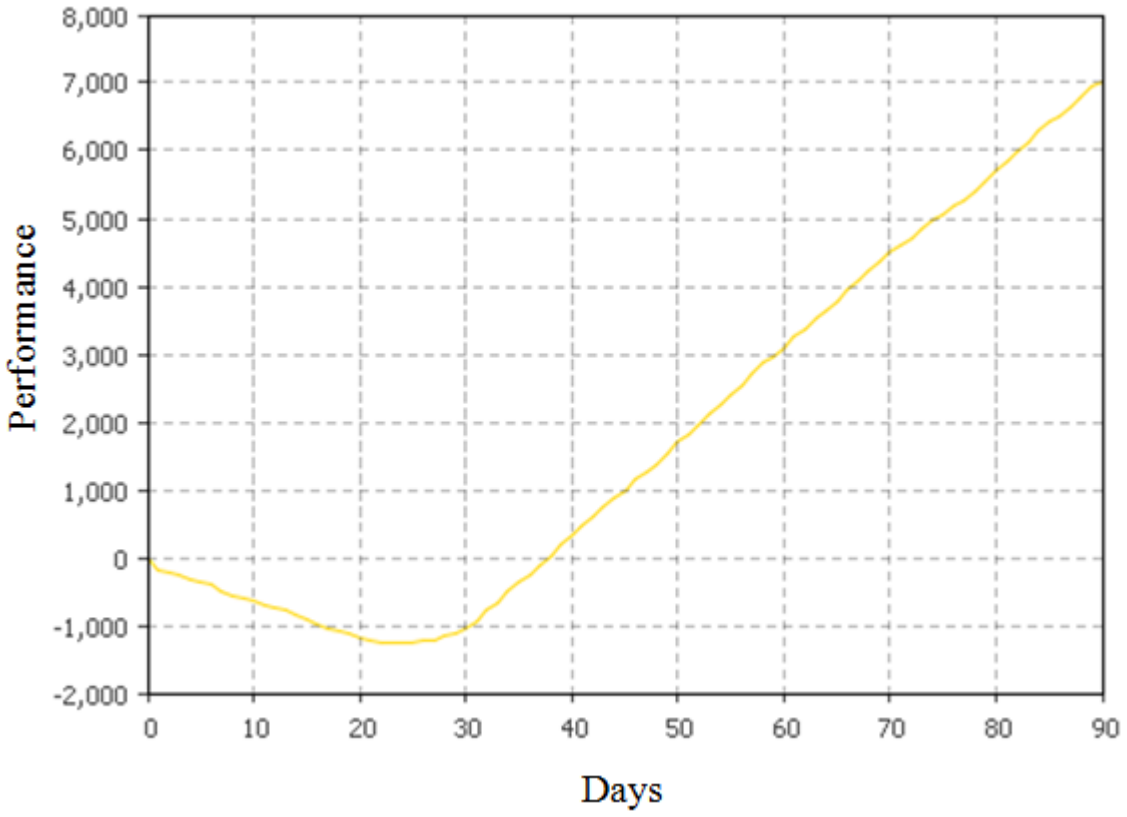
- Impact on leading times




| | MIN | MAX | AVERAGE |
|---|---|---|---|
| SYSTEM | -14% | -39% | -24% |
| CUSTOMERS | -18% | -45% | -30% |
| WHOLESALERS | -15% | -48% | -30% |

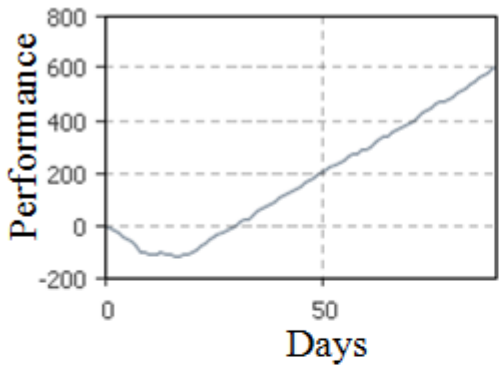
# 2. Results

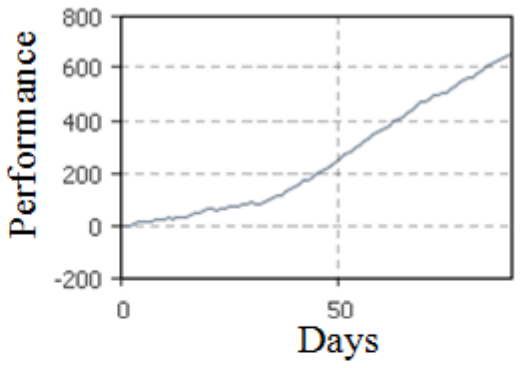
- Impact in wholesaler performance

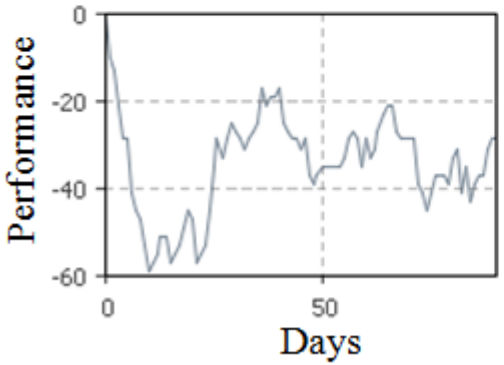


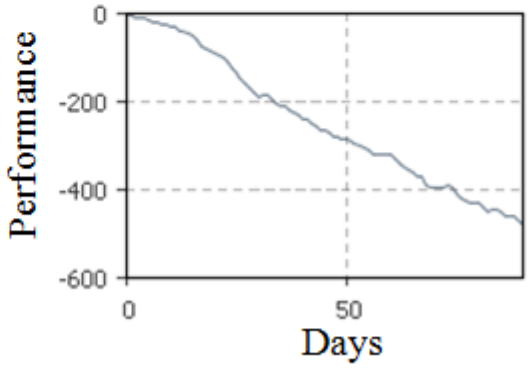
# 2. Results

- The four potential cases for individual wholesalers
  - Bad-good
  - Good-good
  - Irregular
  - Bad



# 3. Conclusions

- Horizontal Cooperation is an important strategy that SMEs can adopt in order to take advantage of greater economies of scale.
- This work has addressed the topic of Horizontal Cooperation from a service quality point of view in the context of urban deliveries.
- An agent-based simulation model was developed to investigate the impact of Horizontal Cooperation on lead times
- As a result, average lead time reduction reaches on average 24% in the test setting; however, lead times can be reduced by up to 39 %.

# 4. Some key references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# 5. Contact

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Madrid, September 29 2016

# 6. Is someone asking for impact on costs?

| Strategy | Reference | Impact on costs |
|---|---|---|
| Conjoint routes | Dahl et al. (2011) | -14% |
| | Wang and Kopfer (2014) | -11% |
| | Muñoz-Villamizar et al. (2015) | -25% |
| | Perez-Bernabeu et al. (2015) | -5%-90% |
| | Wang et al. (2014b) | -88.87% |
| | Cruijssen et al. (2007a) | -30.7% |
| | Ozener (2011) | -26-30% |
| Freight consolidation | Groothedde et al. (2005) | -14% |
| | Vornhusen et al. (2014) | -18% |
| | Verdonck et al. (2016) | -22% |
| | Wang et al. (2014a) | -5-50.31% |
| | Cruijssen et al. (2010) | -8% |
| Improving load factors | Li (2013) | -28% |
| | Bailey et al. (2011) | -27% |
| | Sprenger and Mönch (2012) | -25% |
| | Hernandez and Peeta (2014) | -1.84- 55.11% |

# 7. Is someone asking for impact on CO2?

| Strategy | Reference | Impact on $CO_2$ |
|---|---|---|
| Conjoint routes | Soysal et al. (2016) | -29% |
| | Danloup et al. (2015) | - 26% |
| | Andriolo et al. (2015) | [- 50%, -26.5%] |
| | Perez-Bernabeu et al. (2015) | [-92%, -5%] |
| | Ozener (2014) | -5.39% |
| Freight consolidation | van Lier et al. (2014) | -6.9% |
| | Pan et al. (2014) | -19% |
| | Pan et al. (2013) | -14% |
| | Ballot et al. (2010) | -25% |
| Improving load factors | Basu et al. (2015) | -66% |
| | Pradenas et al. (2013) | -30% |
| | Juan et al. (2014) | -23.6% |
| | Lin and Ng (2012) | -3-20% |