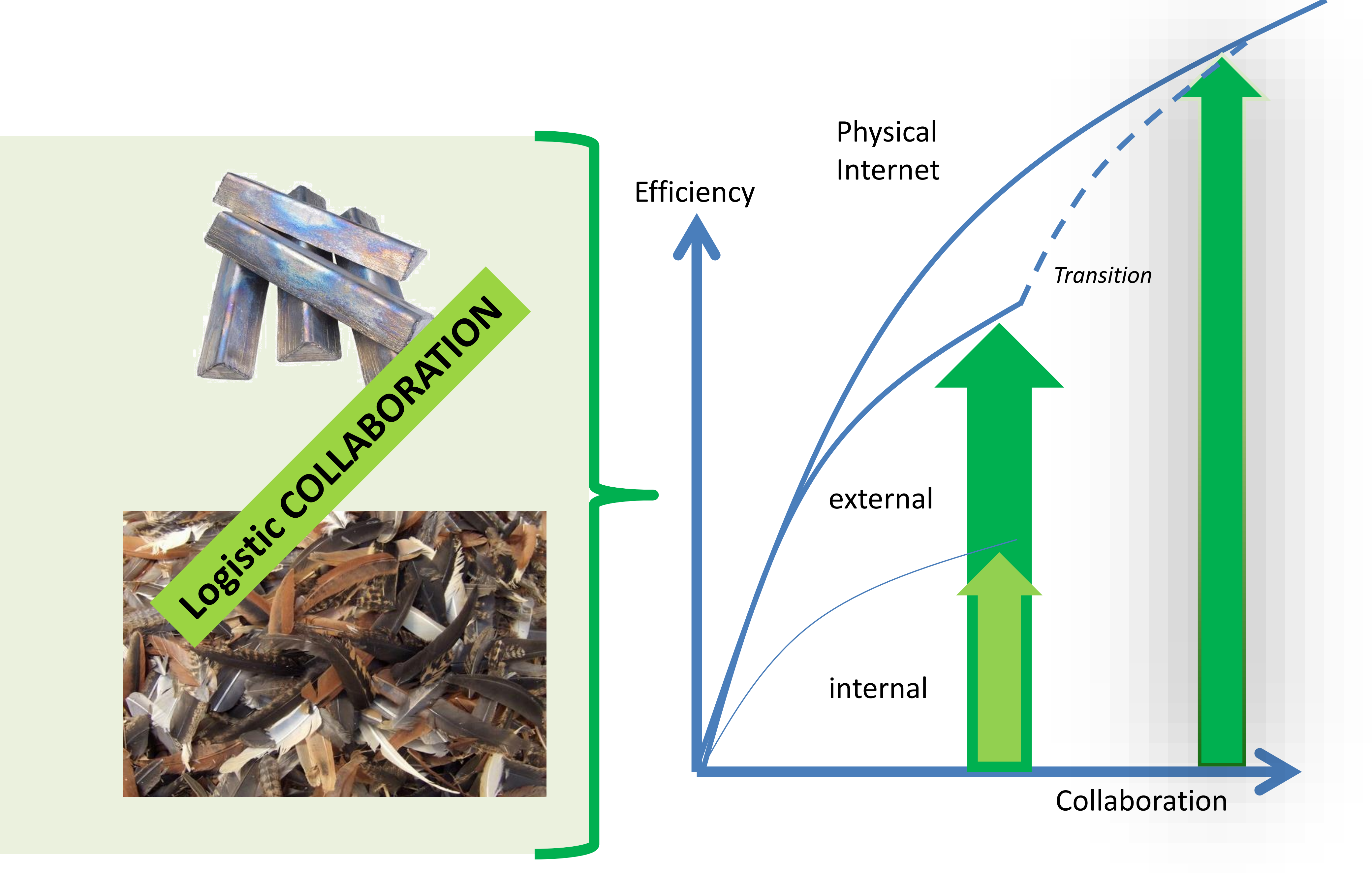
Horizontal Collaboration

Workshop 11.1

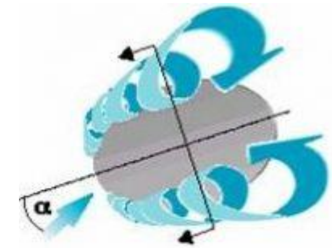
Dirk 't Hooft ARGUSi bv

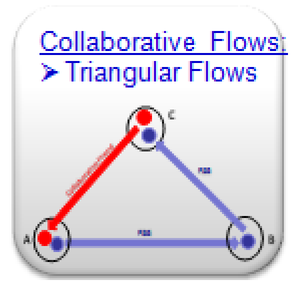


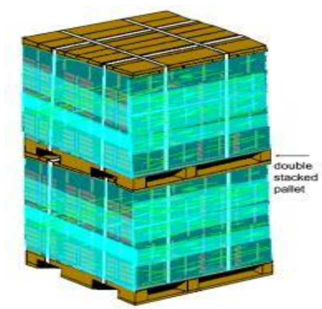
Logistic COLLABORATION
Physical
Internet
Efficiency
Transition
external
internal
Collaboration

Varying Levels of Collaboration Complexity

- Combining containers on trains
- Balancing loads
- Complex routes optimization (shuttles, Triangles etc)
- Combining loads to obtain game changing scale (e.g. creation of new trains)
- Sharing Storage Space
- Combining Pallets in a trailer
- Combining Stackable Pallets in a Trailer
- Combining deadpile loads
- Collaborative pallets







Way forward...?

Solo

1 Company optimization

P&G Supply Chain

Tupperware Supply Chain

In Partnership

Tupperware
+
P&G

Expand partnership

Multi-lane collaboration

Multi Party collaboration

3+ partners (*CO3 framework*)

TRUSTEE

Future Market Place

Physical Internet

10-30+ partners

Limits of collaboration?

Too many players?

Is there a breakpoint when it is best to move from active Collaboration to a market opportunity ?

Speakers workshop Horizontal Collaboration:

- Synchronization of intermodal freight shipments in the sharing economy, Joren Gijsbrechts KU Leuven

- Facilitating Horizontal Collaboration in transportation Maria Jezus Saenz Director Zaragoza Logistics Center

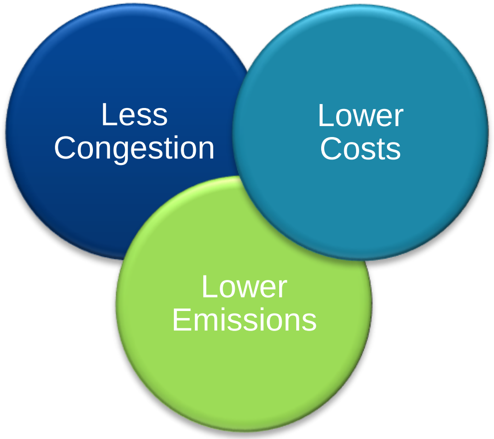
- Microzoning: A grid based approach to faciltate last-mile delivery, Boukje Schellens Analist ARGUSI

Synchronization of intermodal freight shipments in the Sharing Economy*+

Chuanwen Dong – Kühne Logistics University
Joren Gijsbrechts – KU Leuven

*Dong, C., Boute, R., McKinnon, A., and Verelst, M., 2017. Investigating synchromodality from a supply chain perspective. Unpublished working paper.
+ Gijsbrechts, J., Boute, R., 2017. Synchronization of intermodal freight shipments in the sharing economy. Unpublished working paper.

Introduction



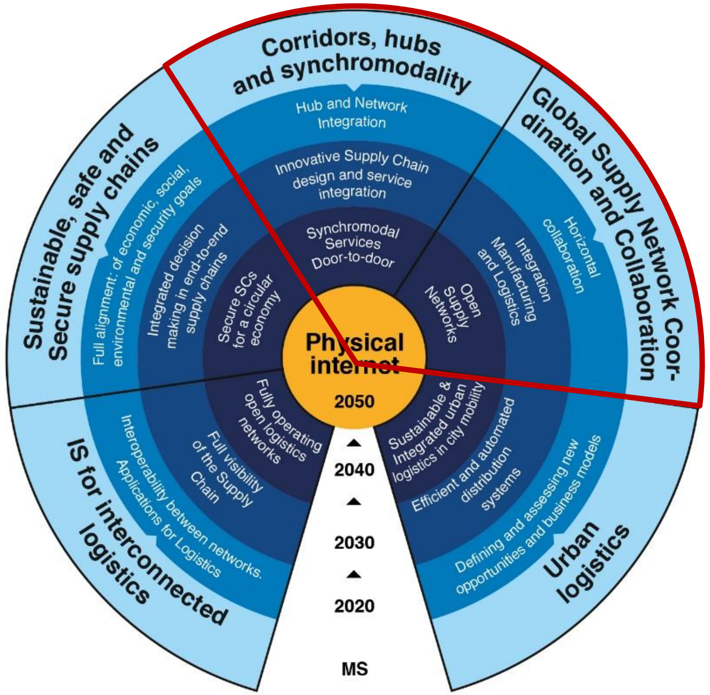
- State-of-the-art of logistics is not sustainable

- Vision: the Physical Internet Initiative
    - Horizontal Collaboration
    - Synchromodality

- KUL and KLU develop practical models and tools to support the business decision-making process

KU LEUVEN

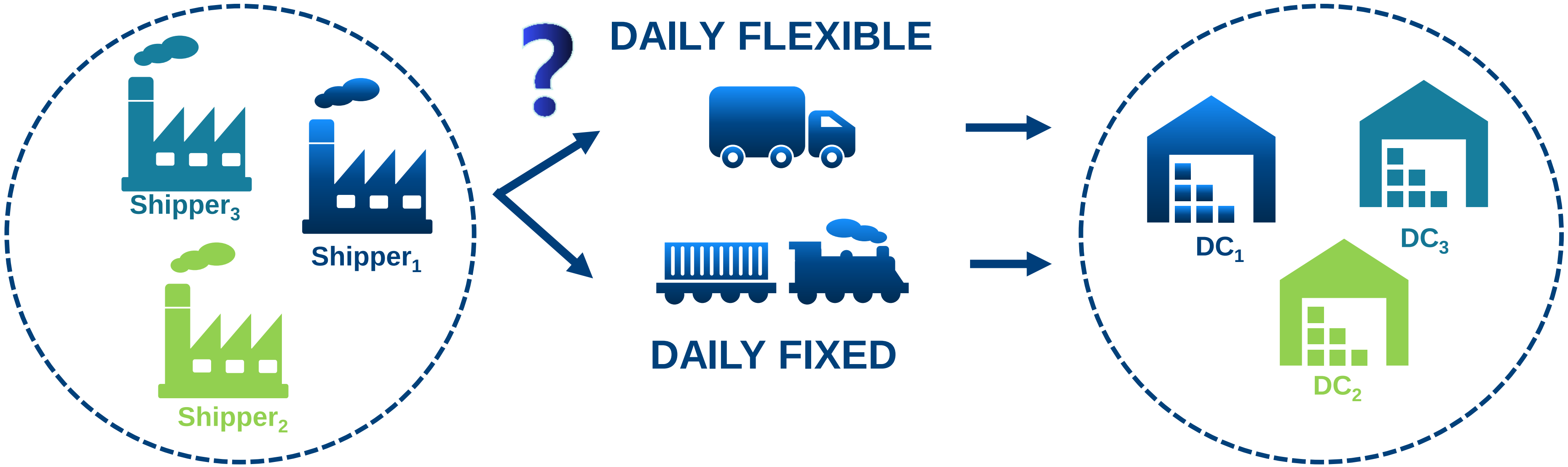
THE KLU



THE KLU

KU LEUVEN

Research Questions



1. How can *one shipper* maximize its modal shift to intermodal rail transport and obtain *cost savings?*
2. How can *multiple shippers collaborate* to achieve *additional* modal shift and cost savings?

Our Model

INPUT

Input Parameters

- Demand Pattern
- Road Transport Cost
- Intermodal Transport Cost
- Inventory Holding Cost
- Service Level

OPTIMIZE

Decision Variables

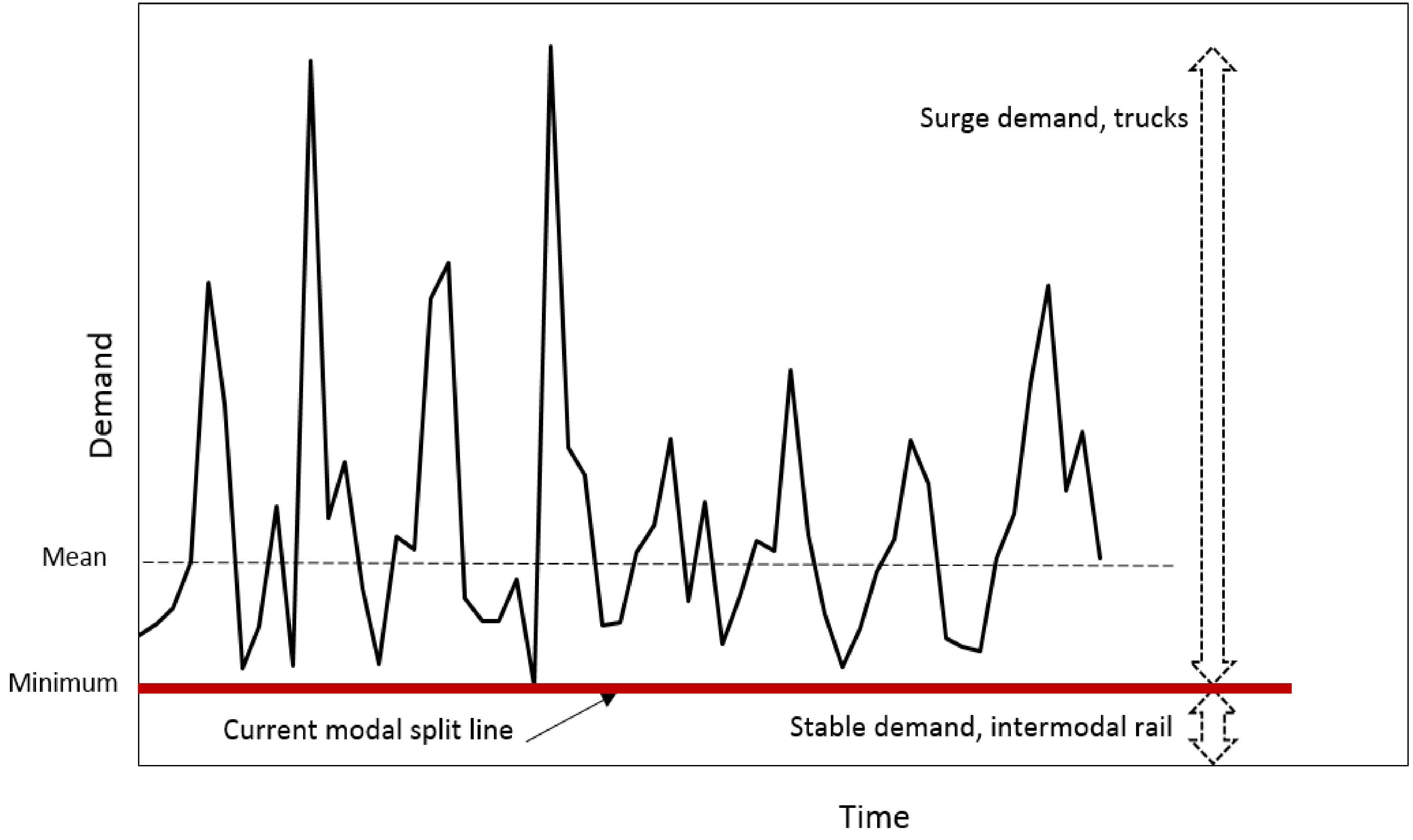
- Re-order Points
- Intermodal volume commitment
  - Individual
  - Aggregate

OUTPUT

Output Variables

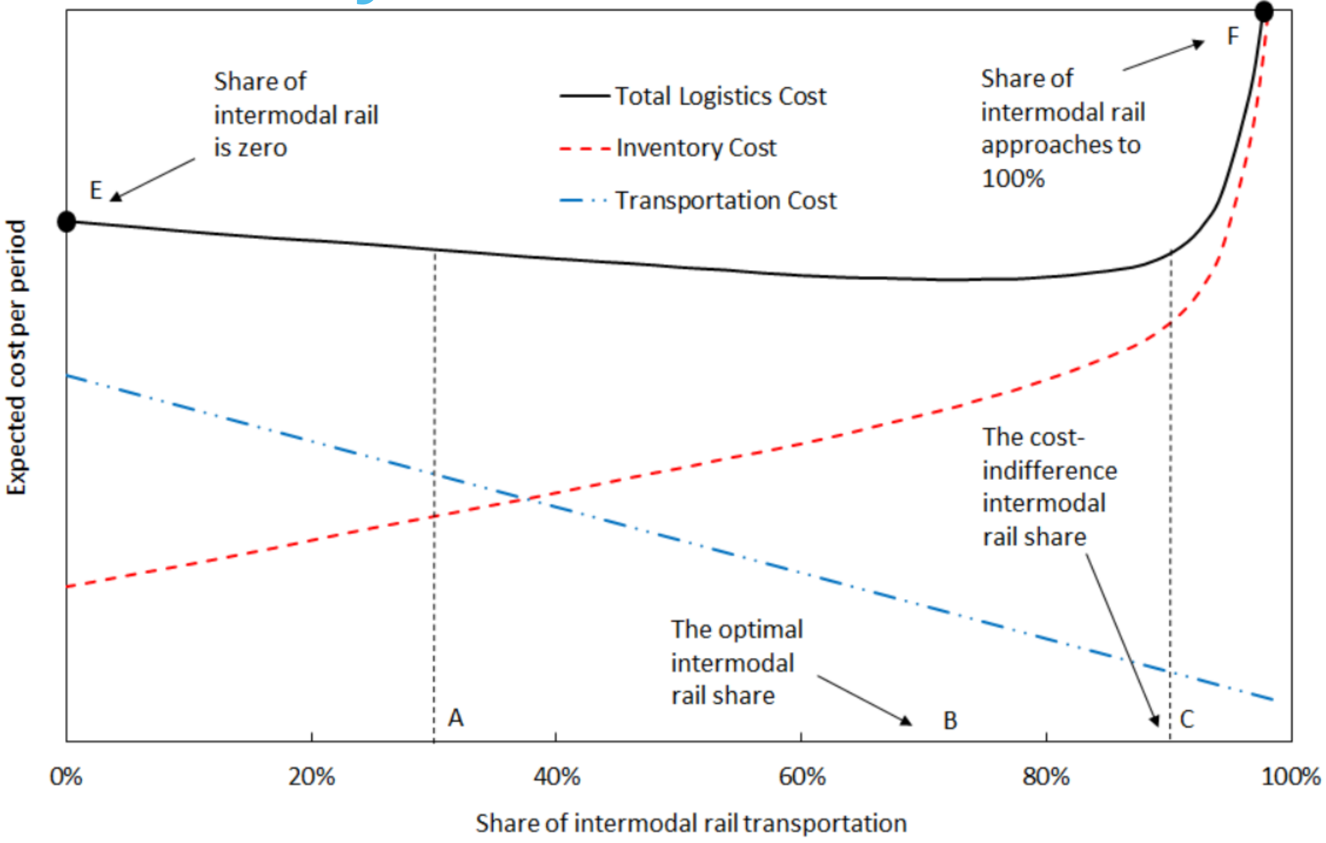
- the modal split
- the pre-commitment of intermodal volumes
- the resulting impact on logistics costs.

Current standard industry practice



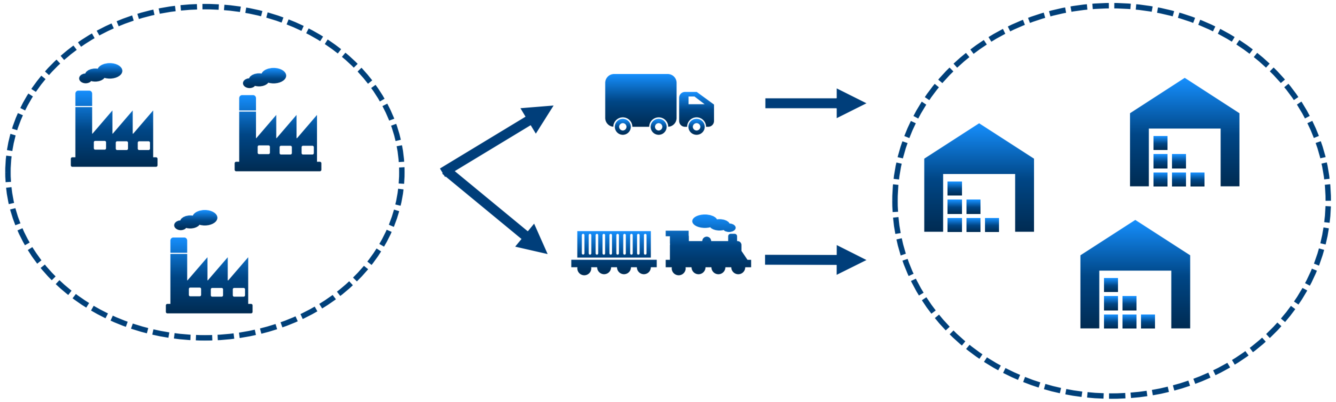
- Ship the stable demand via intermodal rail
- About 20-30% of freight volume intermodal

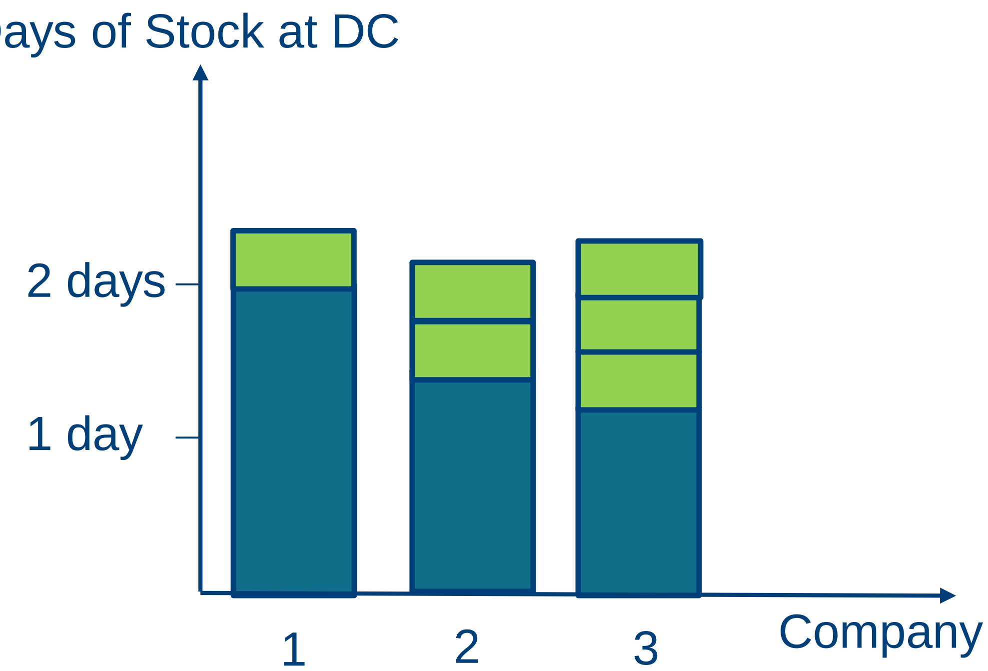
Our synchromodality model to maximize modal shift



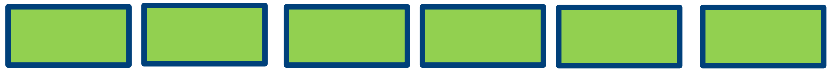
By looking at the total logistics costs perspective (*transportation and inventory*), it is possible to increase the share of intermodal rail from 20-30% to 60-70%

Behind individual optimization





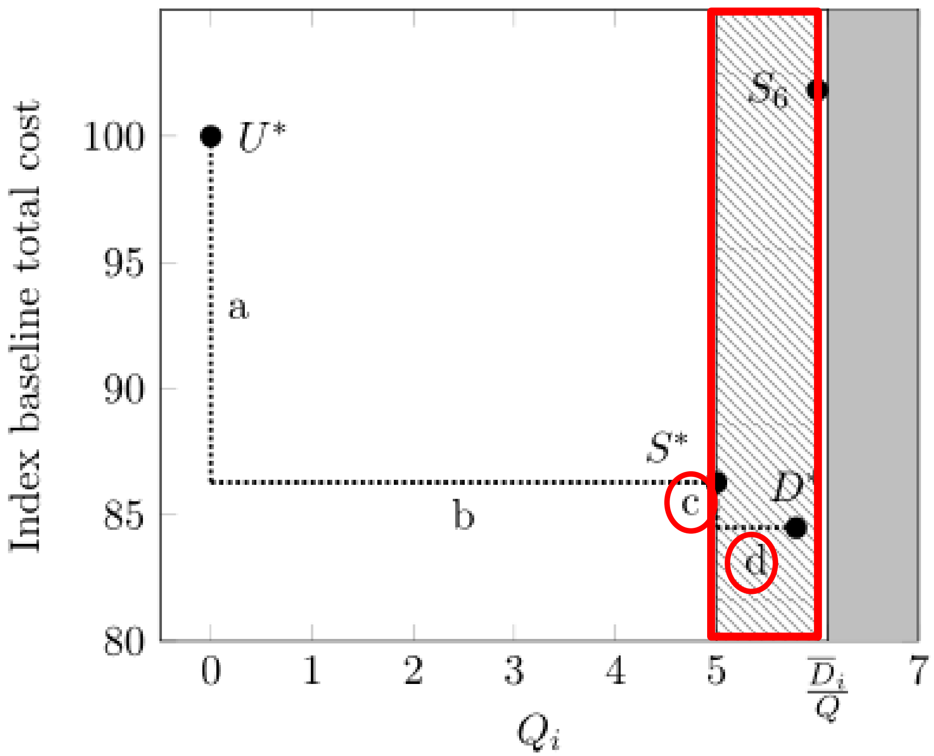
- From Individual to Group Commitment (of the intermodal volume)
- Daily Synchronization directs shippers towards same days of stock
- Example:
  - Daily Group Commitment of 6 Intermodal 45 ft Containers



Numerical Study

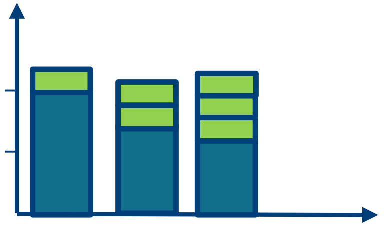
INPUT

OUTPUT



Input Parameters

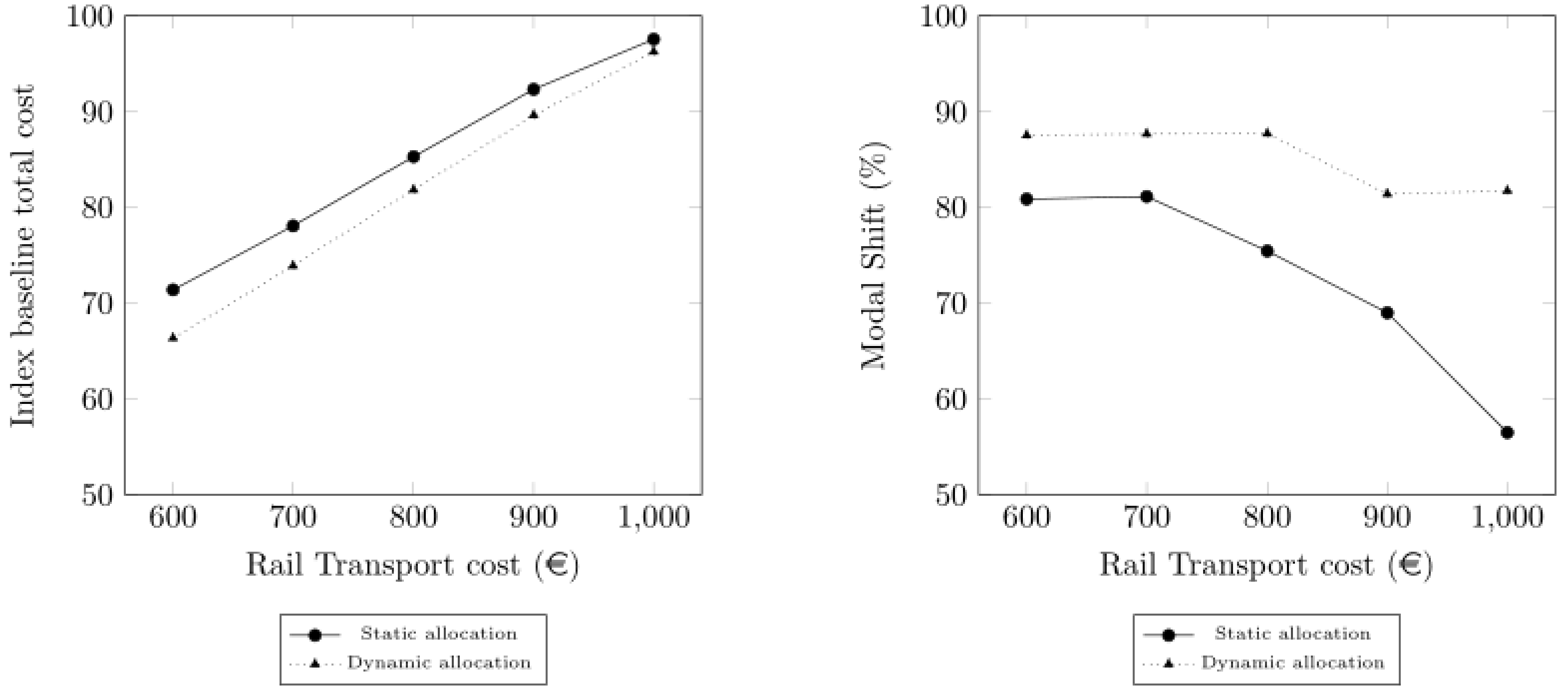
- 3 shippers
- Consumer goods sector inspired costs and demand pattern
- Synchronization Policy used



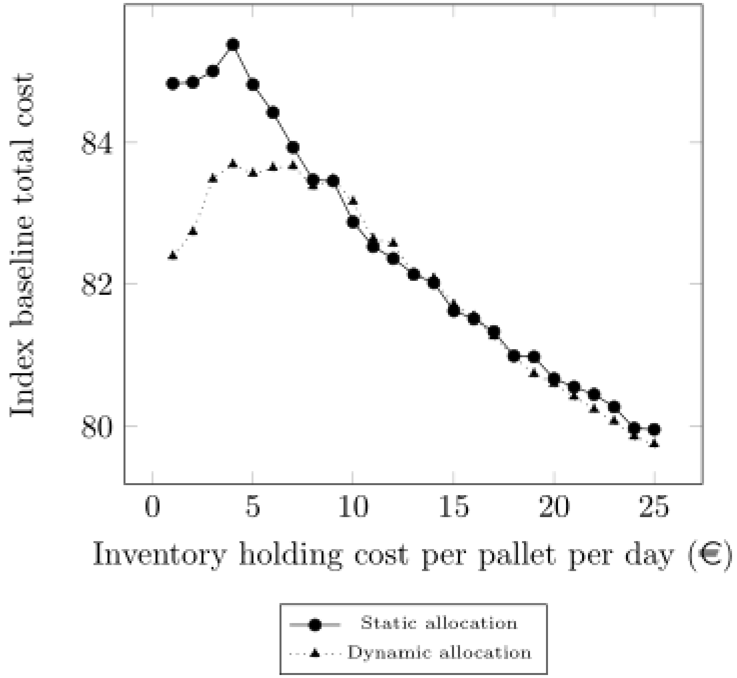
Results

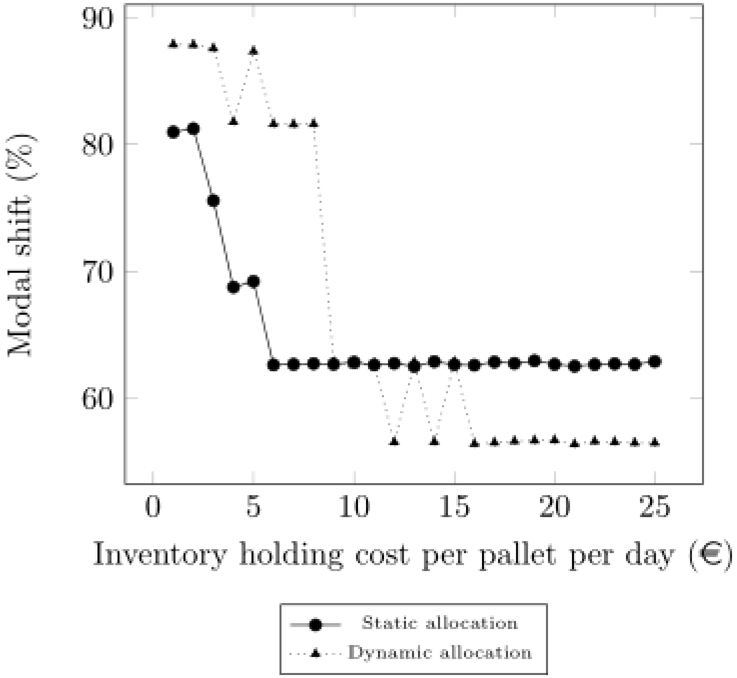
- More possible solutions can be found
- Slight additional Cost Savings (-1%)
- Increased modal shift (+5-10%)

Numerical Study – impact transport price

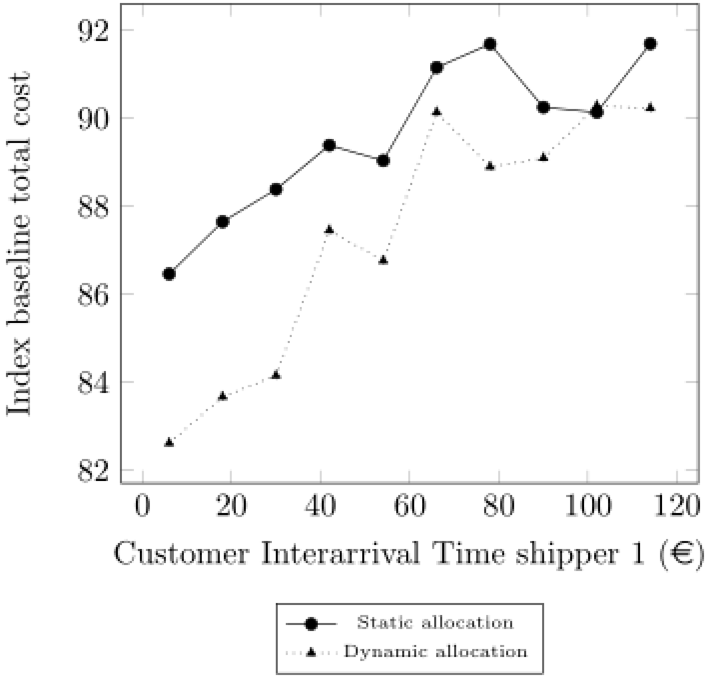


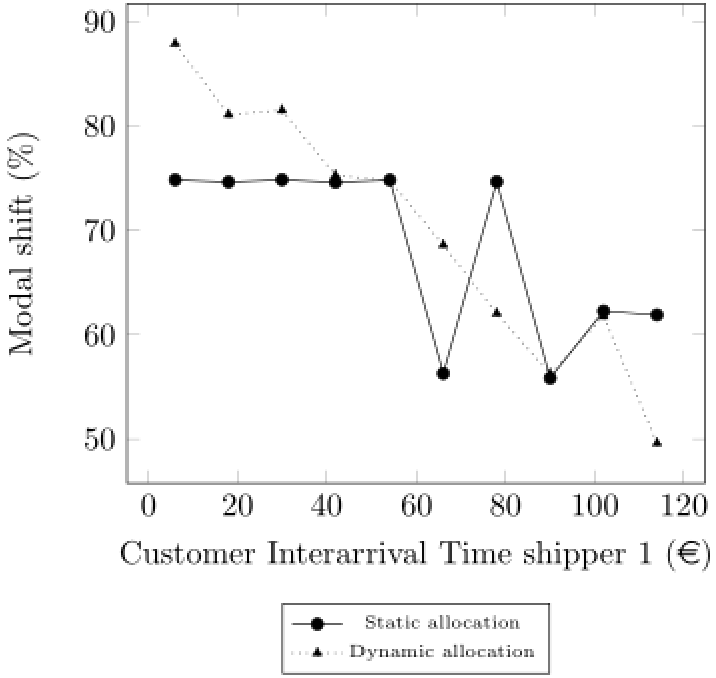
Numerical Study – impact inventory holding





Numerical Study – impact demand variability





Conclusion and next steps

- Significant Modal Shift is possible when integrating a holistic view
- Collaborative commitment of intermodal volume enhances a modal shift
- Integration of models into datasharing platforms is needed
- Integration machine learning algorithm to allow qualitative feedback practitioners

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ZLC
TALENT HUB FOR SUPPLY CHAIN
Zaragoza Logistics Center

Facilitating Horizontal Collaboration in Transportation

Maria Jesus Saenz, Full Professor
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ZLC | MIT GLOBAL SCALE NETWORK

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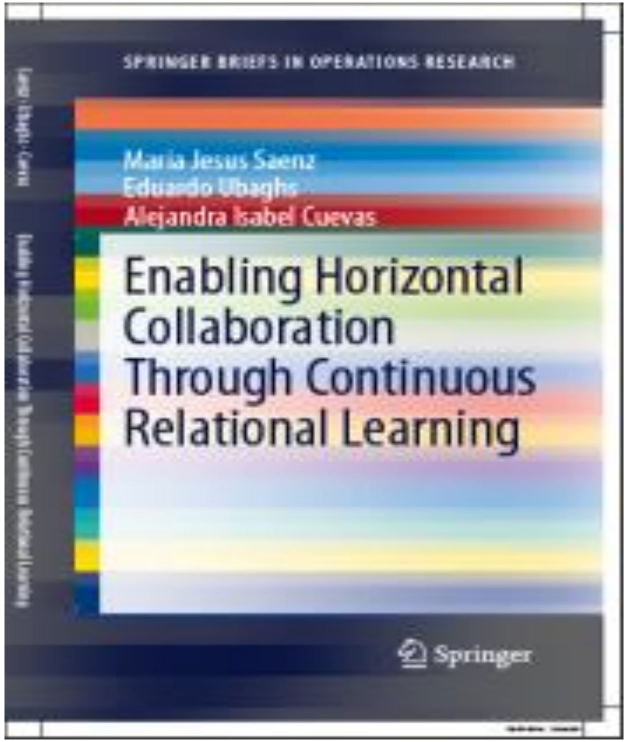
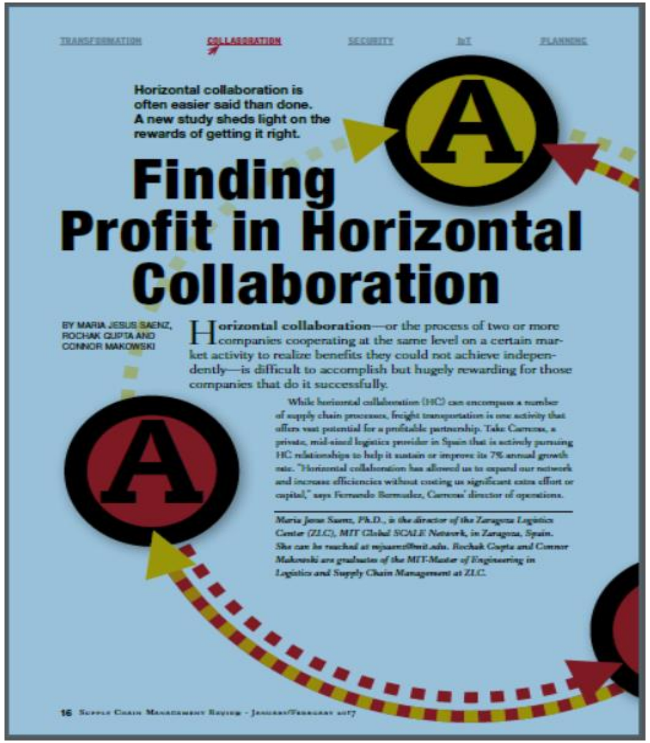
Publications on Horizontal Collaboration



Book, Springer, 2015



TRANSFORMATION COLLABORATION SECURITY IoT PLANNING

Horizontal collaboration is often easier said than done. A new study sheds light on the rewards of getting it right.

Finding Profit in Horizontal Collaboration

BY MARIA JESUS SAENZ, ROCHAK GUPTA AND CONNOR MAKOWSKI

Horizontal collaboration—or the process of two or more companies cooperating at the same level on a certain market activity to realize benefits they could not achieve independently—is difficult to accomplish but hugely rewarding for those companies that do it successfully.

While horizontal collaboration (HC) can encompass a number of supply chain processes, freight transportation is one activity that offers vast potential for a profitable partnership. Take Carreras, a private, mid-sized logistics provider in Spain that is actively pursuing HC relationships to help it sustain or improve its 7% annual growth rate. "Horizontal collaboration has allowed us to expand our network and increase efficiencies without costing us significant extra effort or capital," says Fernando Bermudez, Carreras' director of operations.

Maria Jesus Saenz, Ph.D., is the director of the Zaragoza Logistics Center (ZLC), MIT Global SCALE Network, in Zaragoza, Spain. She can be reached at mjsaenz@mit.edu. Rochak Gupta and Connor Makowski are graduates of the MIT-Master of Engineering in Logistics and Supply Chain Management at ZLC.

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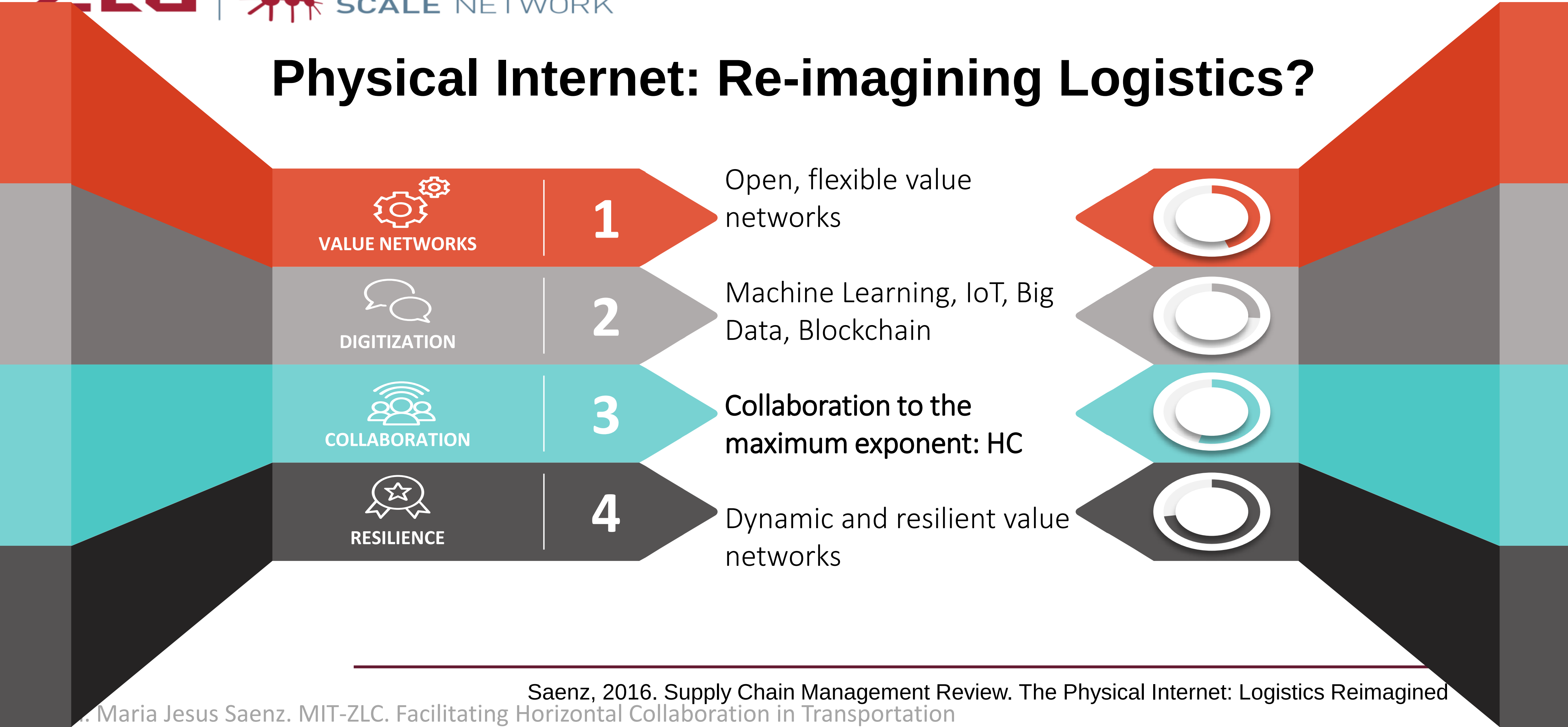
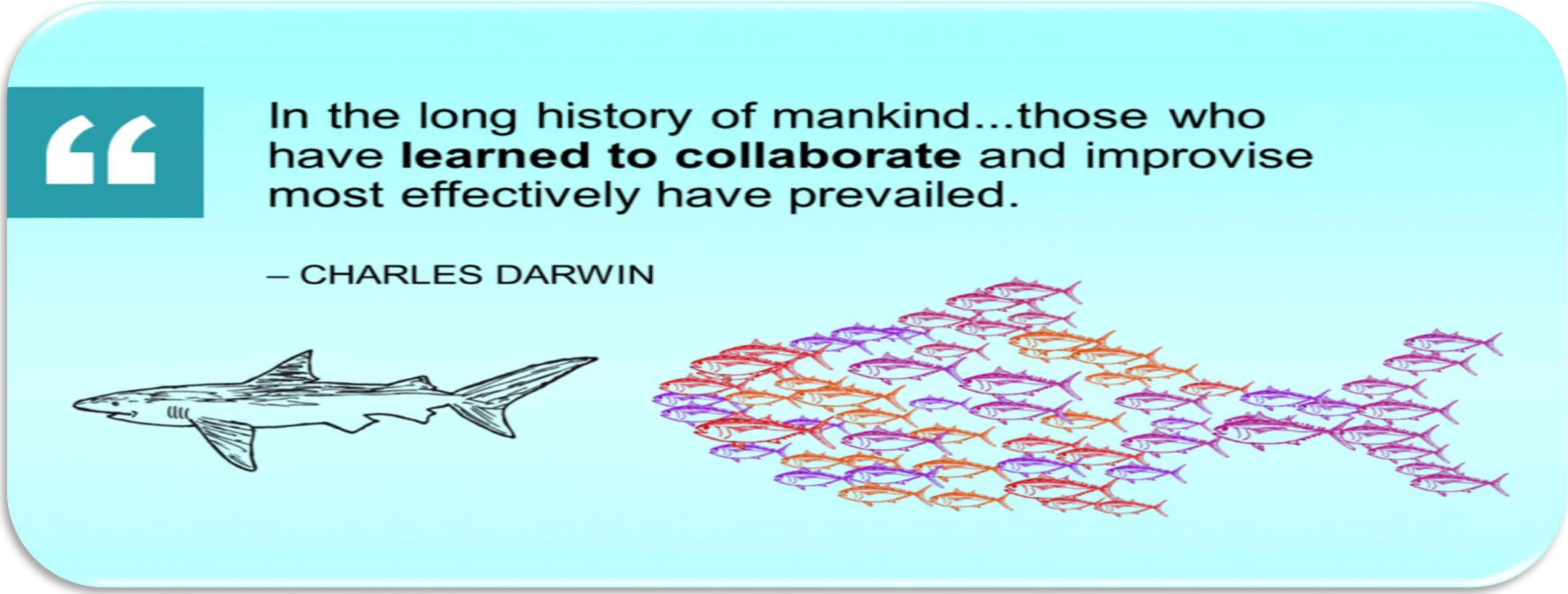
Article, Supply Chain Management Review, 2017

Physical Internet: Re-imagining Logistics?



Saenz, 2016. Supply Chain Management Review. The Physical Internet: Logistics Reimagined

Facilitating Horizontal Collaboration in Transportation



Facilitating Horizontal Collaboration in Transportation

About our Research

- Material Handling Industry (MHI)
- Interviews and cases studies with HC companies
- Survey N = 347
    - 57% Europe, 38% America, 5% Asia and Australia
    - 29% Executive level position, 50% Management level, 21% non-management level

Horizontal Collaboration Today

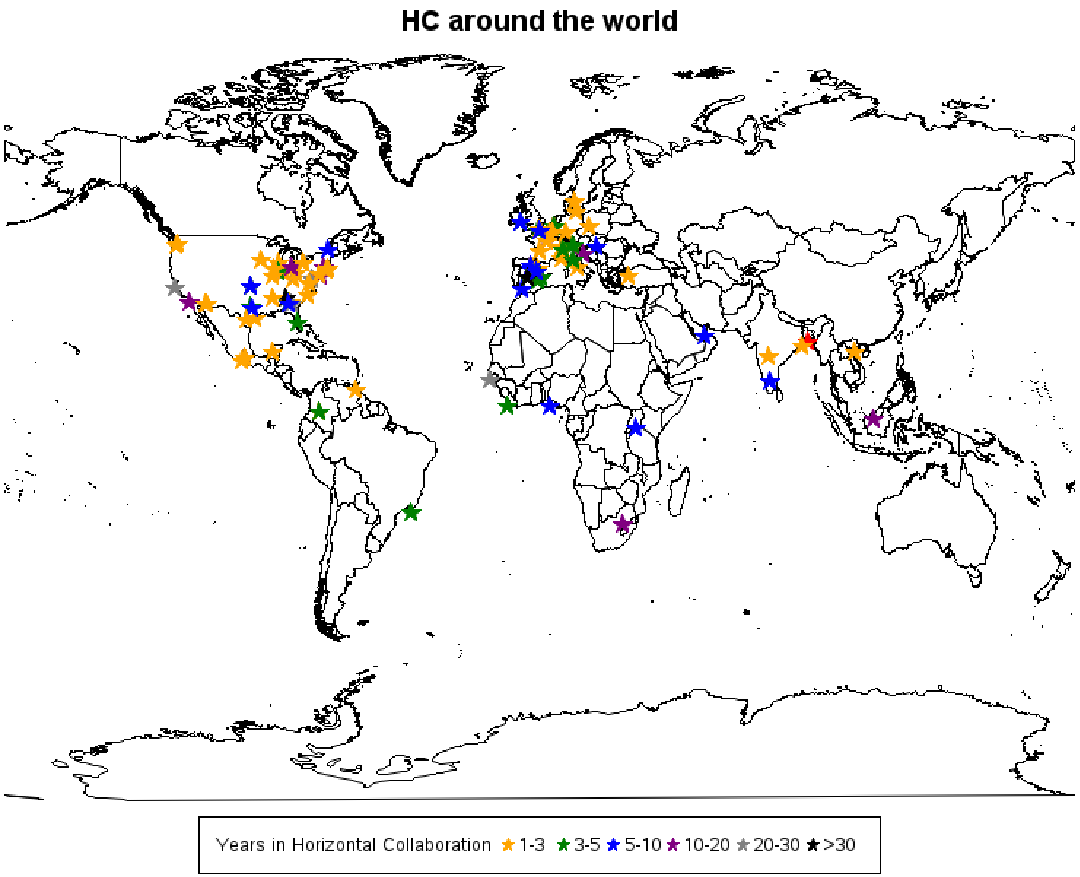


FIGURE 1

Drivers of horizontal collaboration

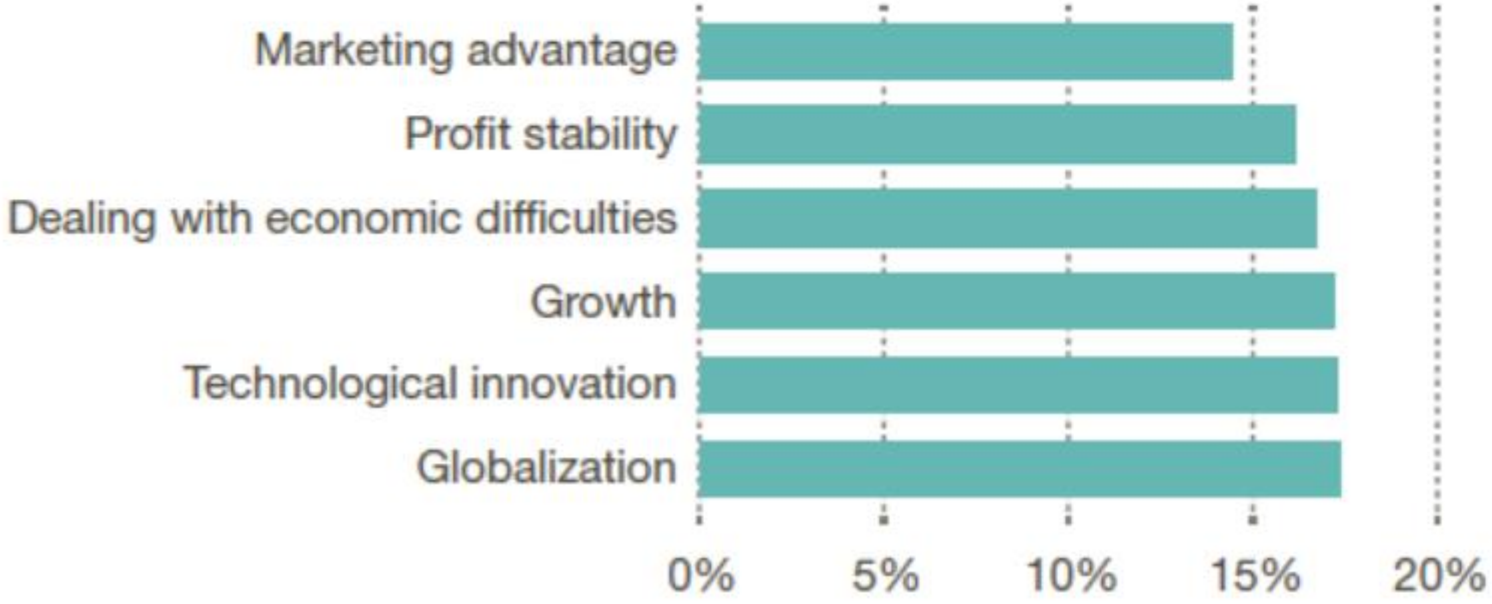



FIGURE 2
Barriers to horizontal collaboration
Capability and skills of personnel
Legal restrictions regarding competition
Fear of losing competitive advantage
Lack of cross-network visibility
Fear of the unknown
Increasing operational complexity
0%
5%
10%
15%
20%

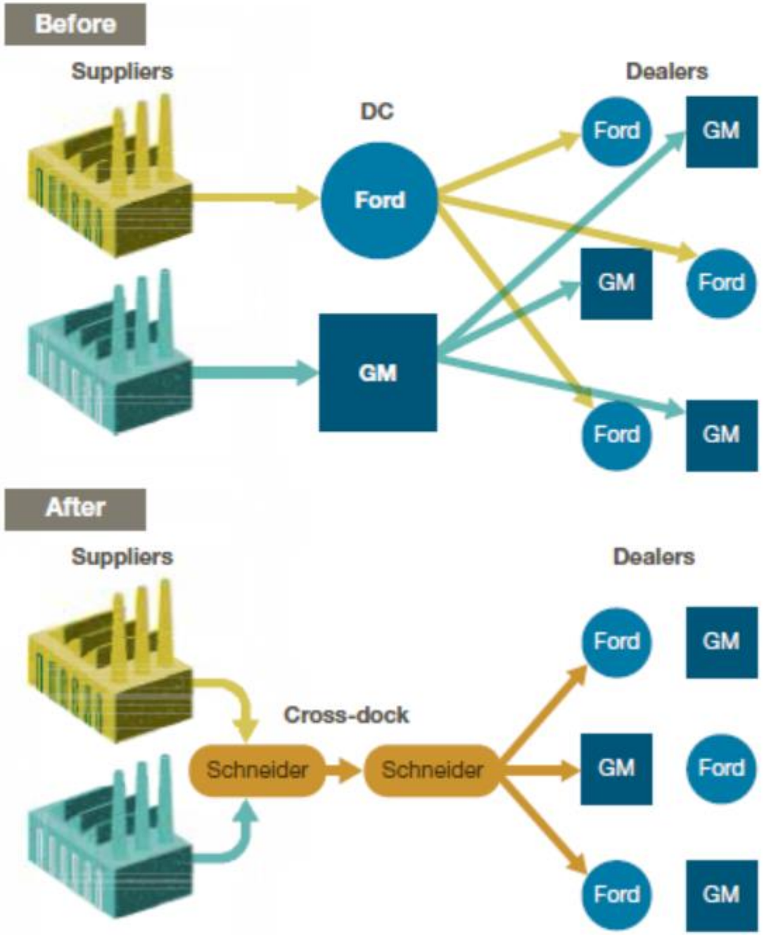
Types of Alliances in Horizontal Collaboration

- Shippers HC or Suppliers HC
- Customer HC
- 3PL HC - 4PL HC
- Inverse needs HC
- Multidimensional Collaboration: Vertical + Horizontal + Diagonal

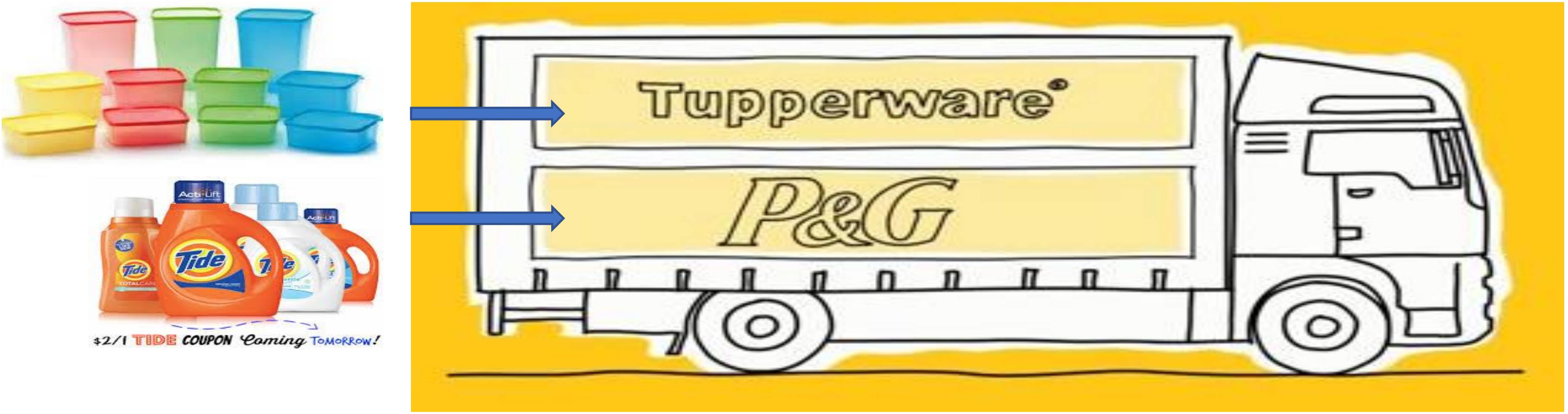
Shippers Horizontal Collaboration

FIGURE 3

Before and after horizontal collaboration–Representation of parts distribution networks



Suppliers Horizontal Collaboration



- Saving of 150,000 km of truck for eliminating trucks on the road
- Improvement in occupancy (volume & weight) 55% to 85% by the mixing heavy and light goods
- Reduction> 200 Tons CO2
- Intermodal Solutions

17% saving

3PL Horizontal Collaboration

Multidimensional Collaboration: Vertical + Horizontal + Diagonal

Open, flexible and dynamic value networks: Amazon-DHL-Audi

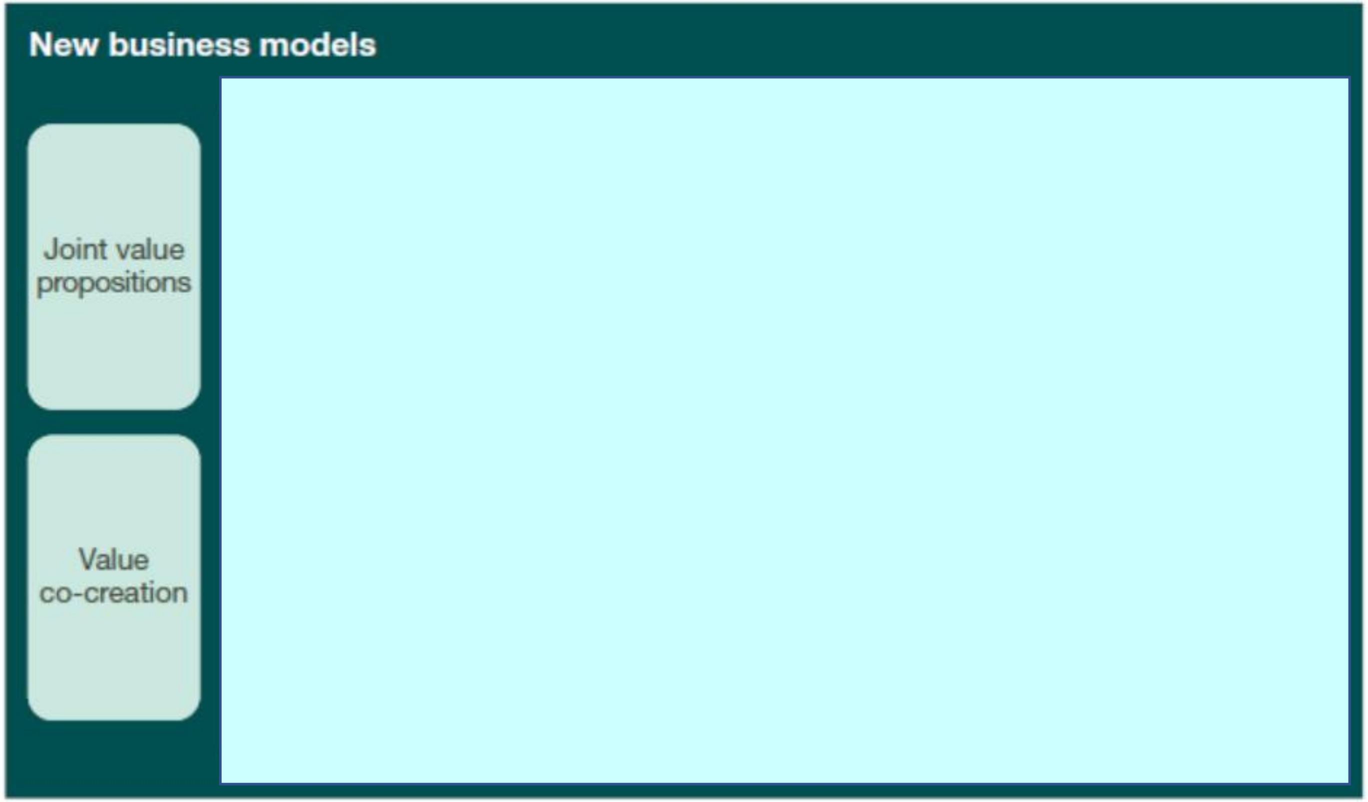
Multidimensional Collaboration: Vertical + Horizontal + Diagonal

Collaboration between Wallmart, Uber, Lyft and Deliv

Supply Chain 24/7, 2016. Walmart Partnering With Uber, Lyft and Deliv to Test Grocery Delivery Service

FIGURE 4

Instruments for horizontal collaboration and its benefits



How Horizontal Collaboration can happen

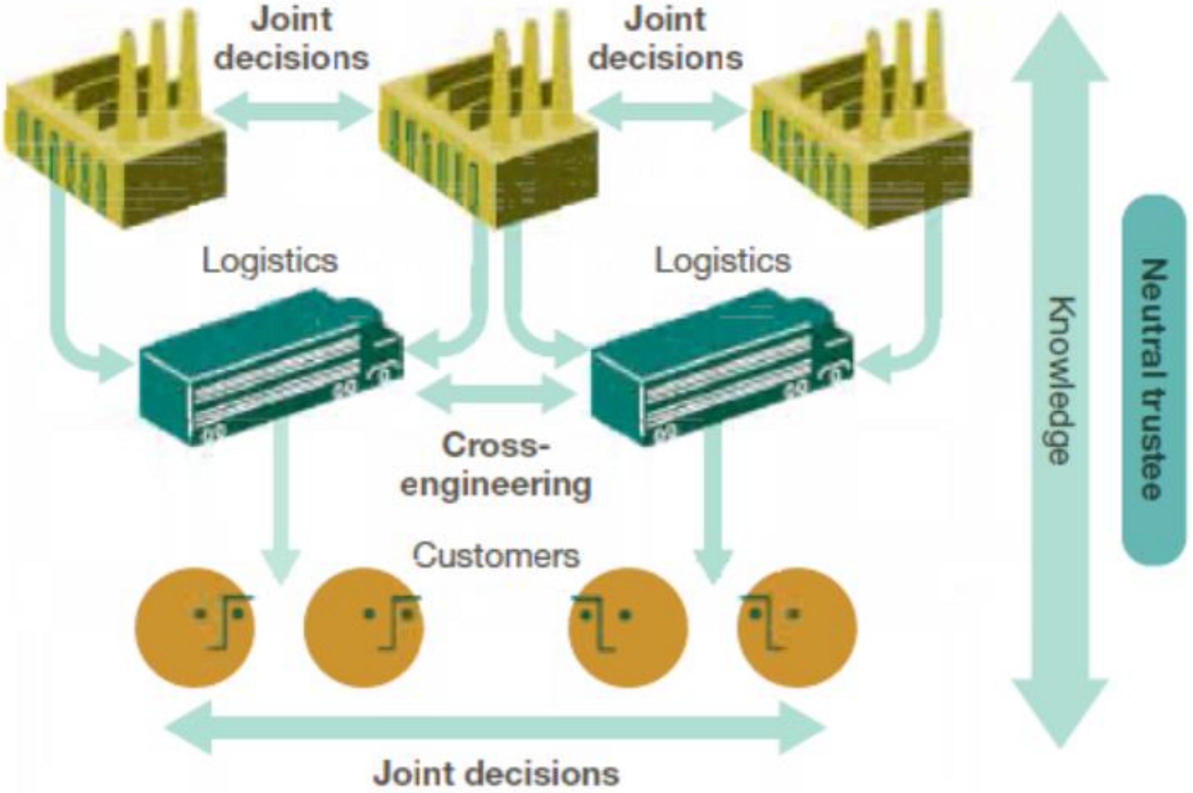
1. Establishing a **Central Trustee**
2. Identifying **Potential** for **VALUE** (improvements or savings)
3. Cross-engineer routes:
   - **Dynamic Pricing**
   - **Incentives:** adapt current structures + bring new partners
   - **Smart-Recognition** of possible partners: **Analytics**
4. **Micro-Pair** with partners
5. Developing **Trust**
6. **Reaching Efficiencies**

CRITERIA:
origins, destinations, delivery time-windows, frequencies of deliveries and their variabilities, compatibility of freight and handling, KPIs, information systems available or percentage of returns.

Machine Learning

FIGURE 5

Natural horizontal collaboration system



Moving from **Supply Chains ....**
... to **VALUE Networks**

Moving from **Profit Sharing ....** ... to **VALUE Sharing** in a collaborative environment

ZLC

TALENT HUB FOR SUPPLY CHAIN

Zaragoza Logistics Center

Facilitating Horizontal Collaboration in Transportation

Maria Jesus Saenz, Full Professor
mjsaenz@mit.edu

MIT GLOBAL SCALE NETWORK

Microzoning: A grid based approach to facilitate last-mile delivery

International Physical Internet Conference 2017

Boukje Schellens (MSc)

Dr Frans C.A.M. Cruijssen

Your Supply Chain Analyst

Table of Content

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Introduction & Definition

Problem description, definition and the link to Physical Internet

2

Method

Description of the developed method and the heuristics used

3

Research Results

Overview of the obtained results and the conclusions which can be drawn based on the conducted research

4

Microzoning in Practice

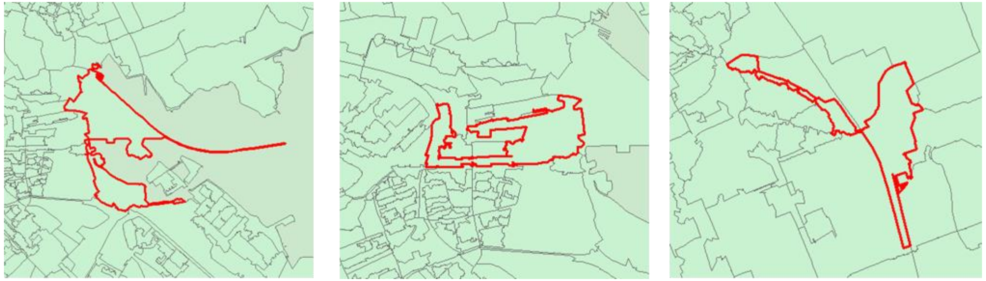
Results of a project which has been conducted for a parcel delivery company in the Netherlands

Introduction & Definition

Problem description

- What is microzoning?
  - Dividing a geographical area in smaller zones
  - Territory design or districting
  - A service zone consists of multiple basic units
- Why microzoning?
  - Overcome inefficiency of last-mile transport
  - Easier to reschedule similar microzones

  → Stimulates horizontal collaboration



Example of inefficient PC5 regions in the Netherlands

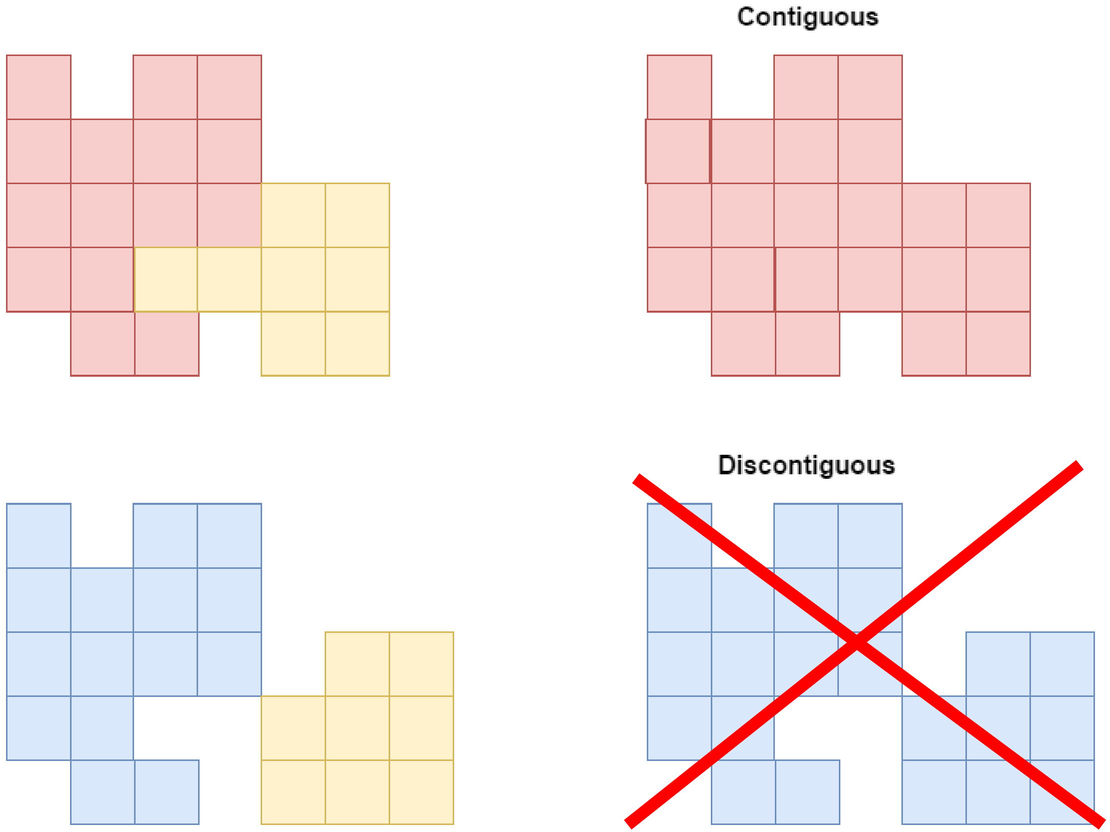
Microzoning & Physical Internet

- Physical internet uses automized planning and combines deliveries of multiple suppliers in one truck. This requires standardization of all elements of the supply chain process including standardized delivery zones.
- Microzones can become the π-containers for last mile delivery: modular, smart and standardized
- More efficient movements of physical objects
- Improves interconnectivity

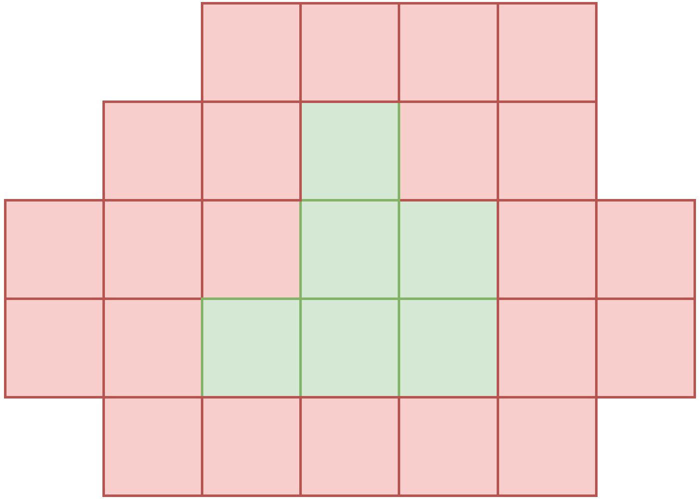
Hard Criteria (Constraints)

1. Complete and exclusive assignment: Every piece of land should belong to exactly one microzone.
2. Contiguity: a microzone should consist of a connected aggregation of land.
3. Compatible with natural and physical barriers
4. No holes: a microzone can not be located completely within another microzone.

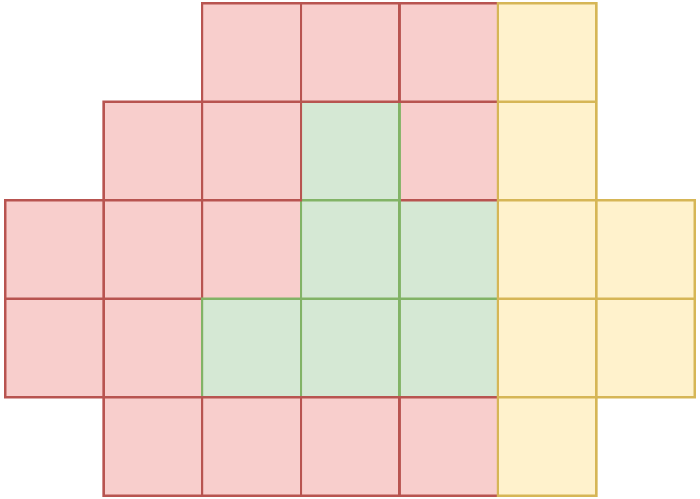
Contiguity



No holes



cluster completely within other cluster



cluster with 'no holes' constraint satisfied

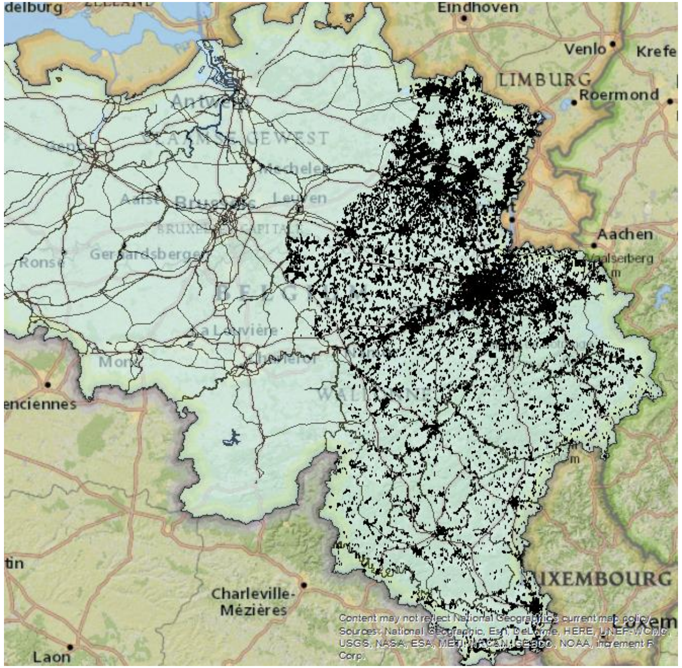
Soft Criteria (objectives)

1. Compactness: a microzone should be spatially compact
2. Minimize workload
3. Minimize the number of microzones

Method

Three phase Approach

1. Pre-processing phase
   - Obtain the right input for the initiation phase
   - Create a grid of the area
2. Initiation phase
   - Generates an initial solution which fulfils all constraints
   - Starts with every grid cell as unique microzone and merges them in an iterative approach
3. Optimization phase
   - Optimizing the initial solution to obtain the best possible solution
   - Move grid cells from one microzone to another to obtain best possible objective vaule

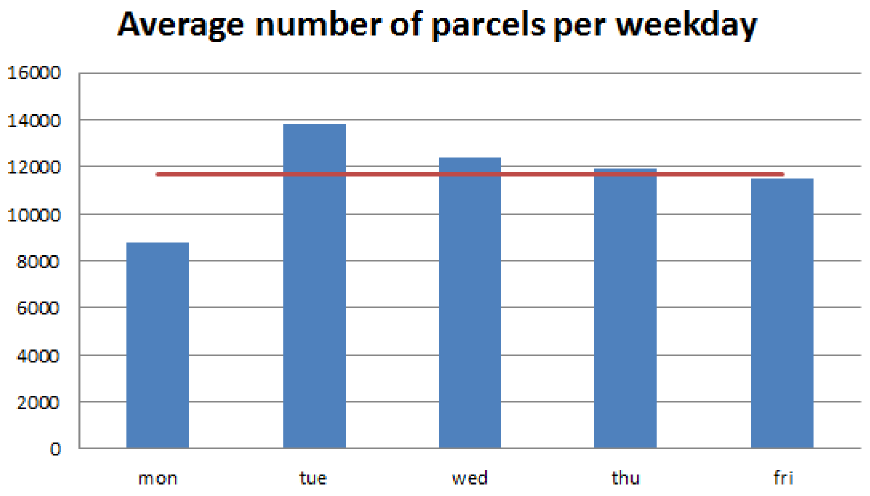


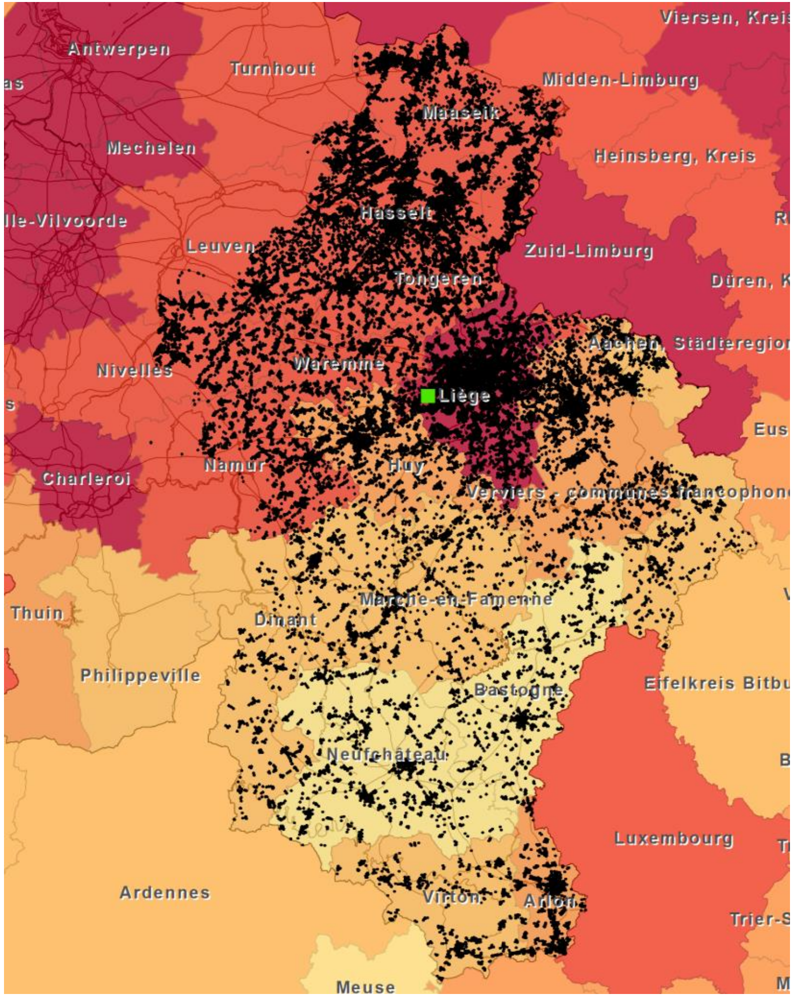
Heuristics

- Simulated Annealing *(S. Kirkpatrick, C.D. Gelatt & M.P. Vecchi, 1983)*
  - Slow cooling process, the probability of accepting a solution with a worse objective value decreases when the method comes closer to termination
- Tabu Search *(F. Glover 1989, 1990)*
  - Local Search algorithm which stores last found solutions in a Tabu List

Data

- 1 month of historical demand data of a parcel delivery company (consisting of 22 workdays)
- 2 regions in Belgium are considered:
  - 1 densely populated area around Liege
  - 1 rural area in the Ardennes





Antwerpen
Turnhout
Viersen, Kreis
Midden-Limburg
Maaseik
Mechelen
Heinsberg, Kreis
Hasselt
Leuven
Zuid-Limburg
Tongeren
Düren, K
Aachen, Städteregion
Nivelles
Waremme
Liège
Eus
Namur
Huy
Charleroi
Verviers - communes francophones
Thuin
Marche-en-Famenne
Dinant
Philippeville
Bastogne
Eifelkreis Bitbu
Neufchâteau
Luxembourg
Ardennes
Virton
Arlon
Meuse

E314
Genk
Hasselt
Leuven
Heerlen
Kerkrade
Maastricht
E40
Aachen
Vaalserberg
322 m
Liège
GIUM
Verviers
Seraing
Namur
Signal de Botrange
694 m
Dinant
WALLONNE
E 421
Buurgplaatz
Kneiff
560 m
Bastogne
Revin
DIEKIRCH
Diekirch
Content may not reflect National Geographic's current m
Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USG
GEBCO, NOAA, increment P Corp.

Research Results

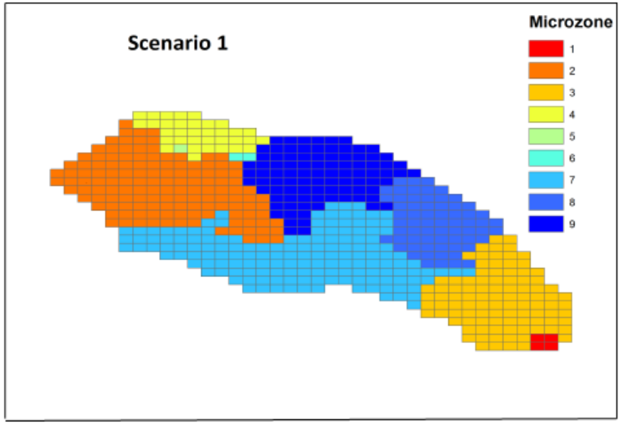
Scenarios

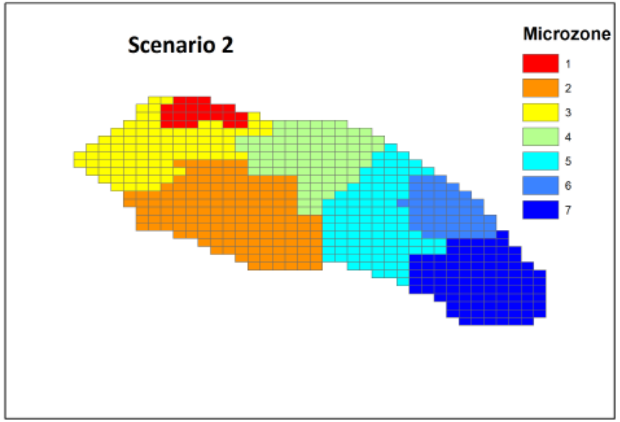
- 4 different scenarios have been tested:

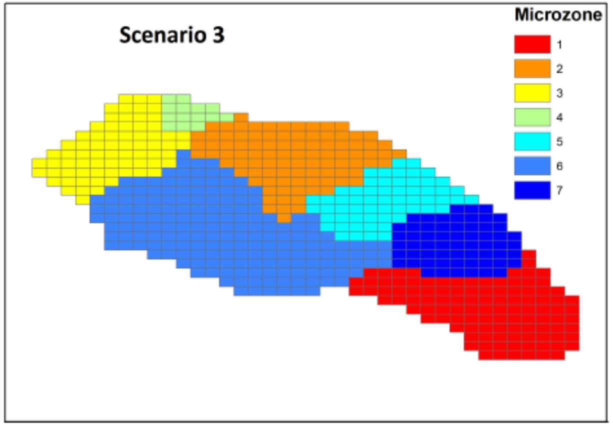
Overview of the four different scenarios with corresponding priorities

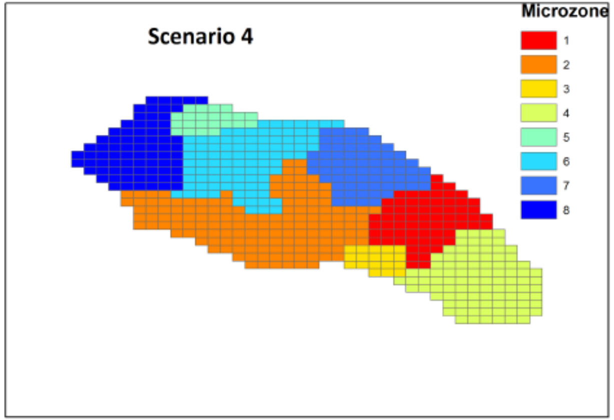
Scenario	ρ_1	ρ_2	ρ_3
1. equal priority	1	1	1
2. priority minimizing number of microzones high, priority minimizing workload low, priority compactness low	2	0.5	0.5
3. priority minimizing number of microzones low, priority minimizing workload high, priority compactness low	0.5	2	0.5
4. priority minimizing number of microzones low, priority minimizing workload low, priority compactness high	0.5	0.5	2

Microzones


Scenario 1
Microzone
1
2
3
4
5
6
7
8
9


Scenario 2
Microzone
1
2
3
4
5
6
7


Scenario 3
Microzone
1
2
3
4
5
6
7


Scenario 4
Microzone
1
2
3
4
5
6
7
8

Service zones & Routes

- Assumption: A service zone can have a maximum workload of 480 minutes on average per day
- In total 6 service zones were created:
- 4 in the dense area and 2 in the rural area
- The routes were pretty robust with a coefficient of variation between 0.1 and 0.17 for every route

Conclusions

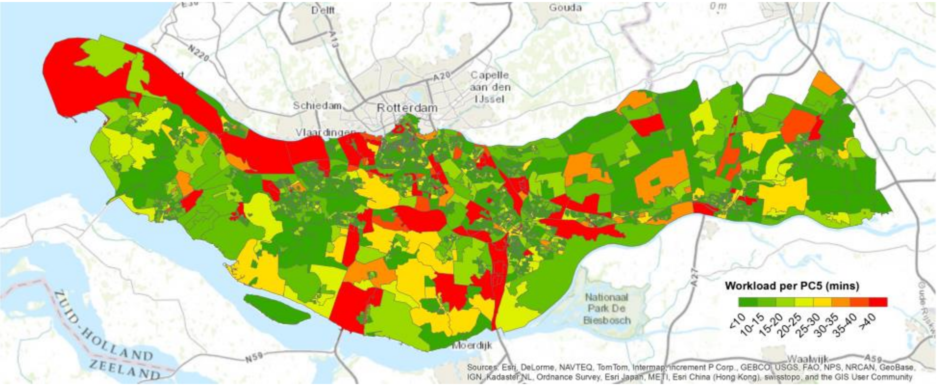
- Developed method is able to generate a solution which satisfies all predefined properties
- Stakeholders preference can be incorporated
- Method generates compact microzones for each scenario
- Robust routes can be created based on the developed service zones

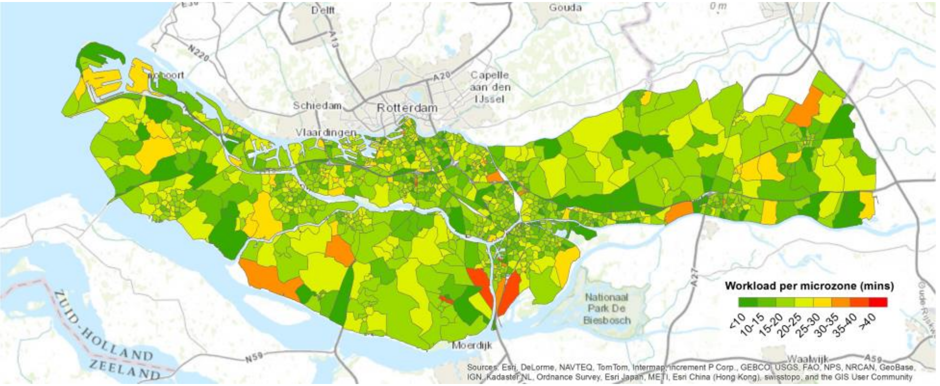
Microzoning in Practice

Scope of the project

- A project conducted for a parcel delivery company in the Netherlands
- Initial version of the microzoning approach based on Thiessen Polygons
- A microzone map for the whole Netherlands was developed
- Characteristic: a microzone should have a workload of approximately 30 minutes

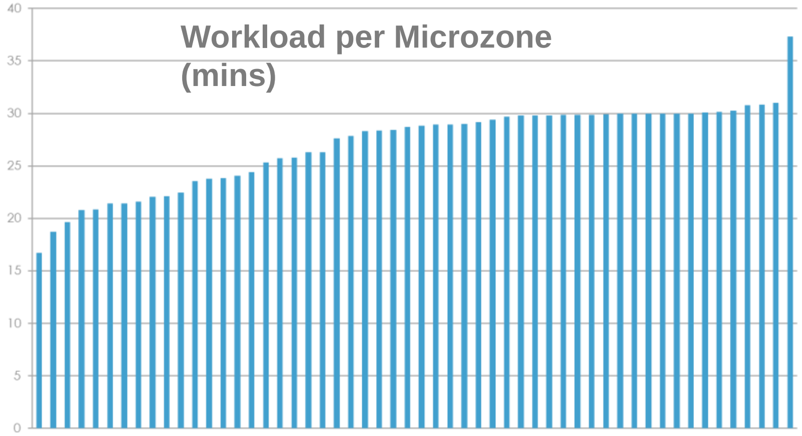
Workload microzones compared to PC5

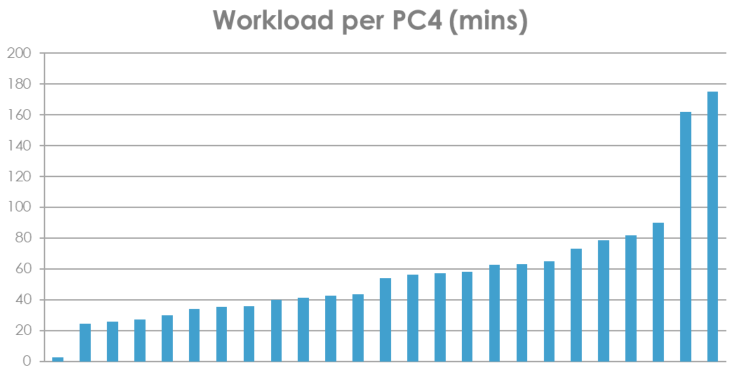


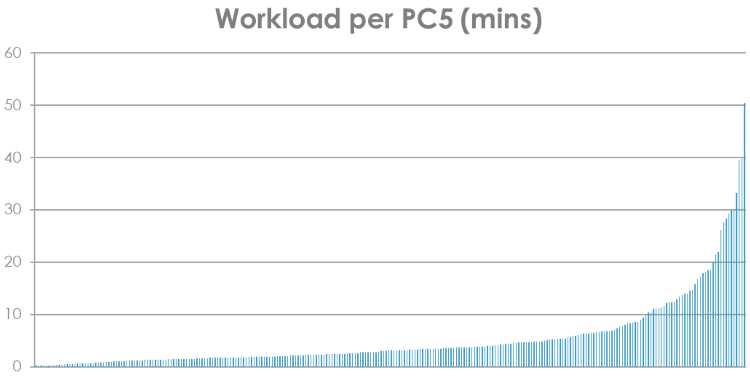


Results Rotterdam Area

	Average WL (mins)	Standard deviation	Coefficient of variation	# regions
Microzones	27	4	0.15	54
PC4	58	39	0.67	25
PC5	5	7	1.40	274







How to incorporate microzones in the system of Physical Internet

- Create a microzoning system for the whole world
- Create multi-layer microzones, like the NUTS system
- Incorporate public data such a land use and population density

Questions?