Local "hives" a new model for urban goods distribution

VREF Conference on Urban Freight

I.D. Cardenas, R. Gevaers, J. Beckers
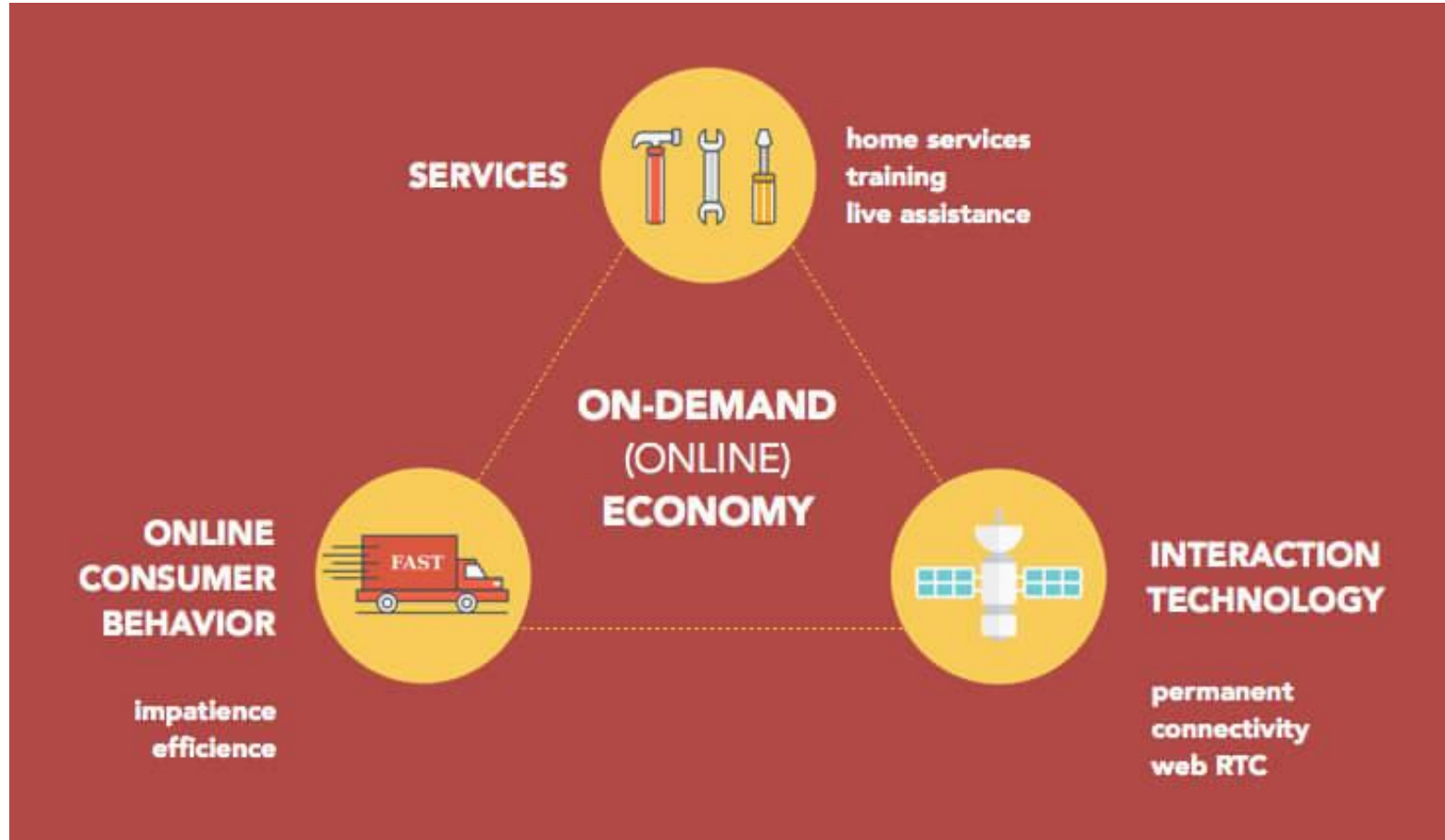
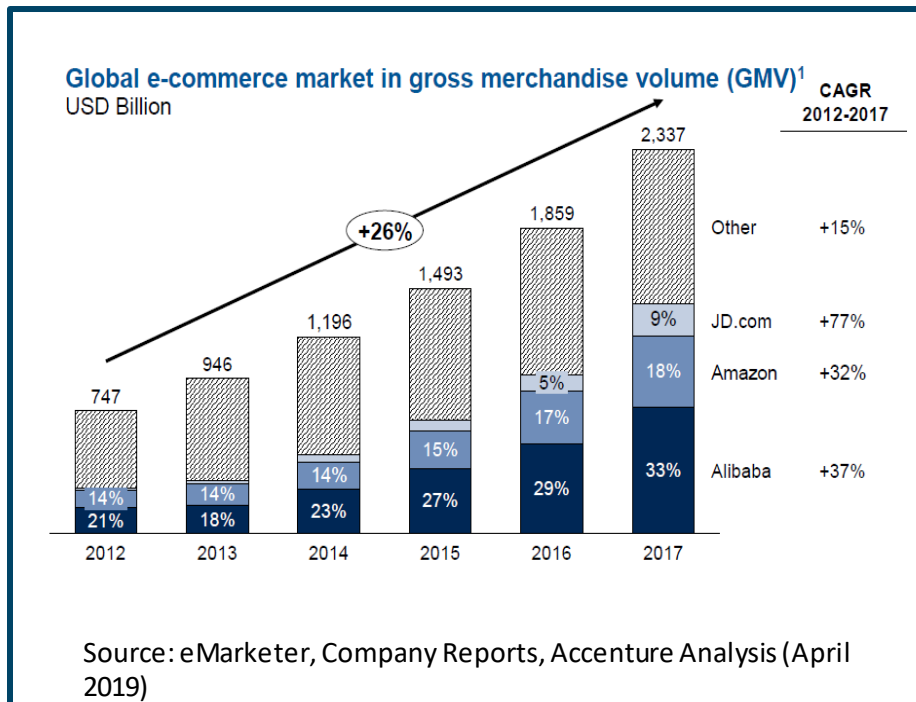University of Antwerp, Department of Transport and Regional Economics.

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Logistics in the on-demand economy

High costs for urban areas

Global e-commerce market in gross merchandise volume (GMV)[1]
USD Billion

CAGR 2012-2017

+26%

Year	GMV	Alibaba	Amazon	JD.com
2012	747	21%	14%	
2013	946	18%	14%	
2014	1,196	23%	14%	
2015	1,493	27%	15%	
2016	1,859	29%	17%	5%
2017	2,337	33%	18%	9%

	CAGR 2012-2017
Other	+15%
JD.com	+77%
Amazon	+32%
Alibaba	+37%

Source: eMarketer, Company Reports, Accenture Analysis (April 2019)

How green is online shopping?

New study suggests the knock-on effects of delivery trucks may worsen traffic congestion and transport-related carbon emissions, reports Conservation magazine
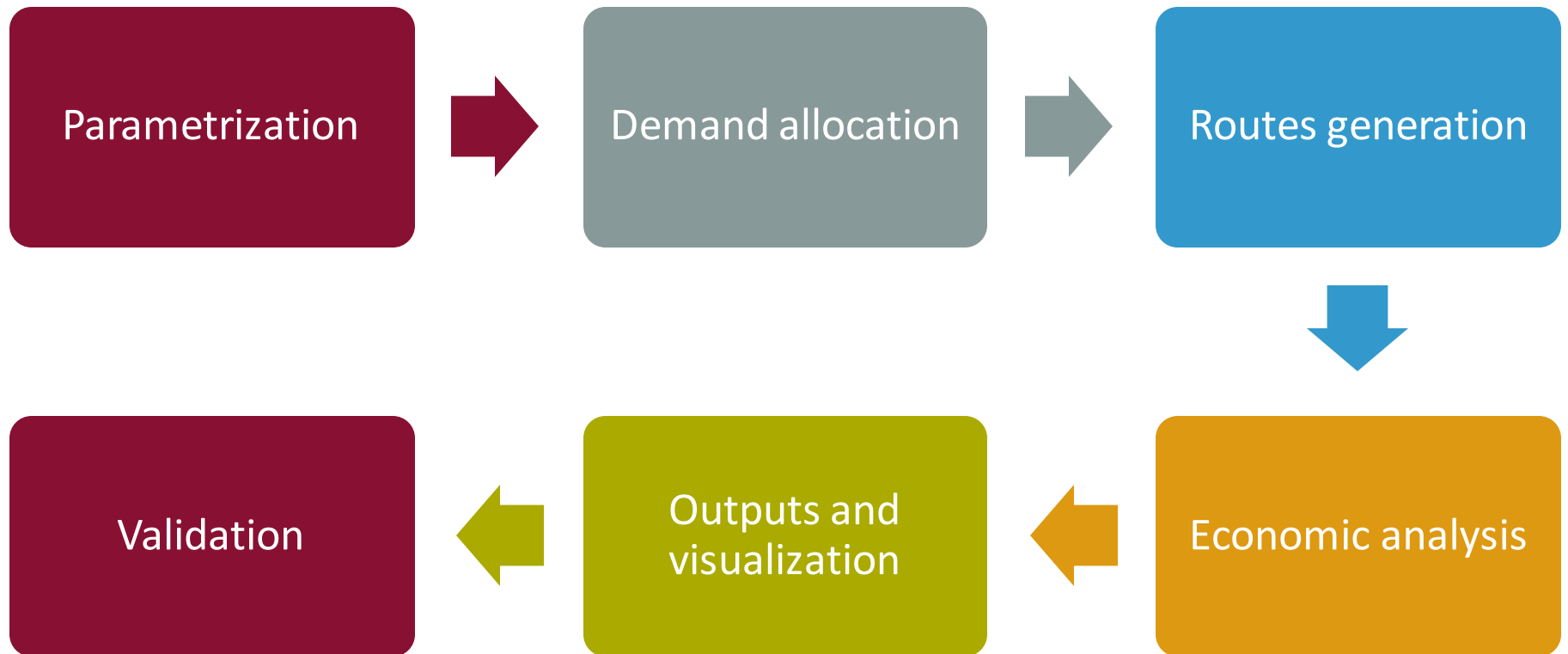
Shop online
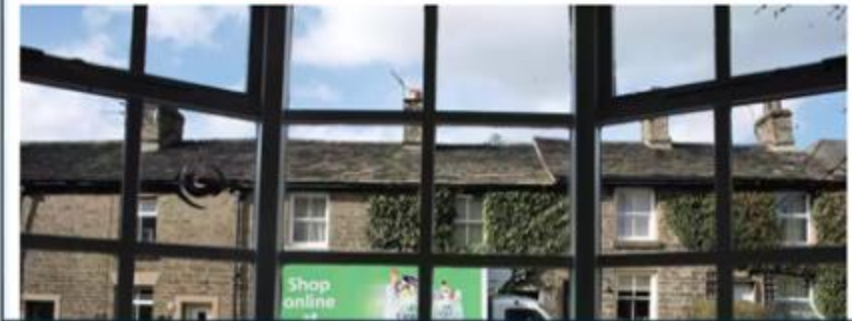
Micro-condolidation

- Close – Fast – Clean

Modeling micro-consolidation

Module 1. Parametrization

| Scenario Parameters	City Parameters	Company Parameters	Cost parameters
• Facilities network (hubs, micro-hubs and nano-hubs) • % of volume flowing through the network • Changes on vehicles' characteristics	• Road network • Potential locations for facilities • Policies and restrictions to freight • No. and locations of packages in the city	• % of packages served • Drop rate: deliveries per stop • Point of access to the city network • Time needed per stop and per package • Vehicle characteristics	• Labor costs factor • Infrastructure costs factor • Equipment costs factor • Vehicle costs factor • External costs factor

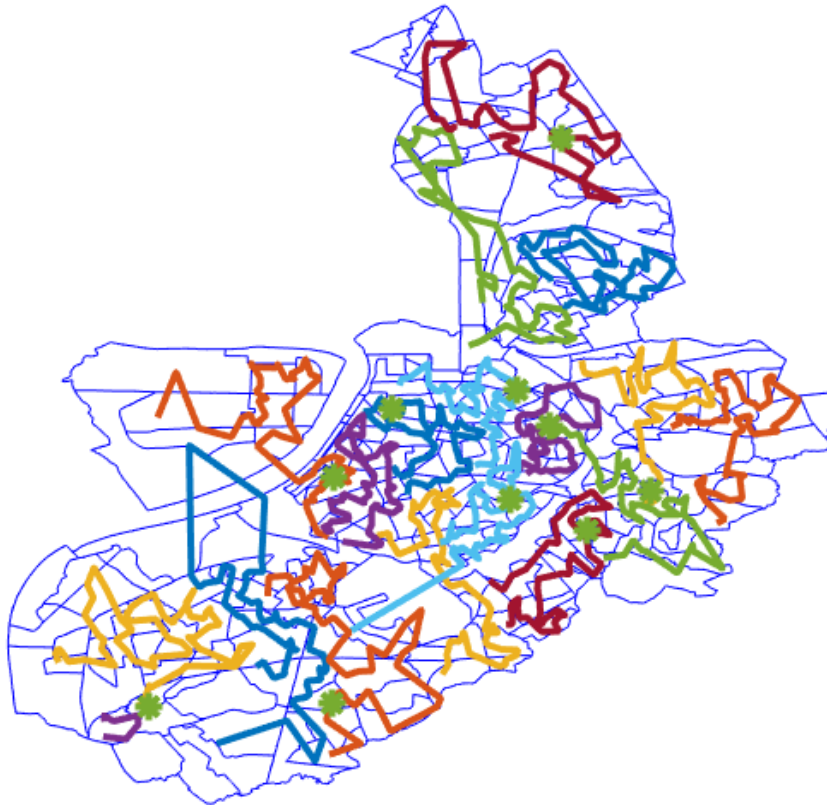# Module 2. Demand allocation

Company i
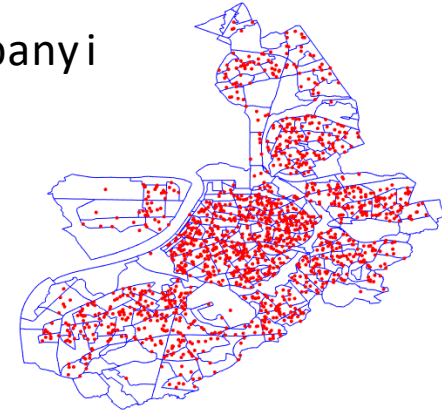
Company i+1
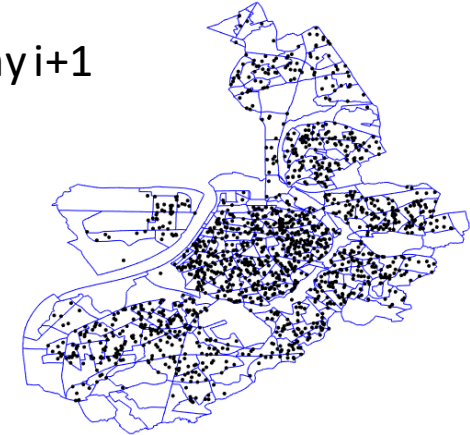
Depends on:
- Geographical characteristics
- Demand of the city
- Drop rate
- % of packages served

Forecasts:
- Average of stops per area unit
- Average of package/stop per area unit

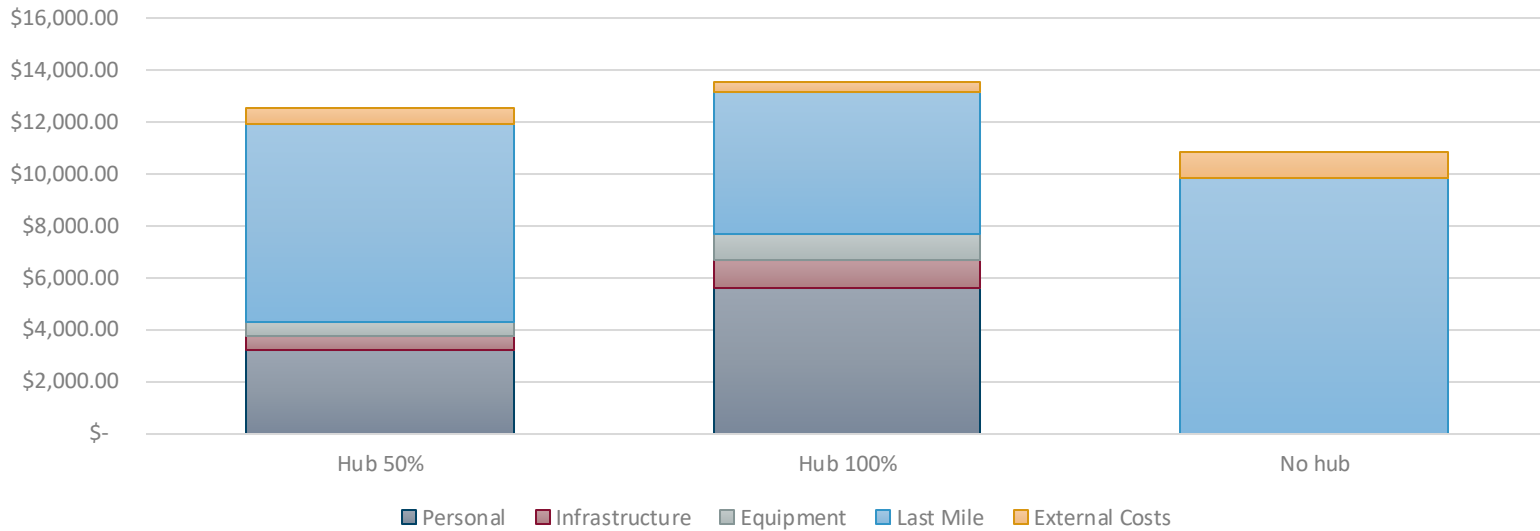# Module 3. Routes generation

Depends on:
- Road network
- Scenario parameters
- Average of stops per area unit
- Average of package/stop per area unit
- Points of access
- Service time
- Vehicle characteristics

Forecasts:

- No. of kilometers per type of road
- Total time to serve
- Throughput on the facilities

Module 4. Economic analysis

Depends on:
- Labor costs factor
- Infrastructure costs factor
- Equipment costs factor
- Vehicle costs factor
- External costs factor
- No. of kilometers per type of road
- Total time to serve
- Throughput on the facilities

Forecasts:

- Operational costs per category and total
- Total external costs
- Sensitivity analyses

Module 5. Outputs and visualization

Companies
- Baseline to forecast the challenges and benefits of switching to another logistics model
- Estimate changes on the demand patterns
- Benchmark the initiatives on sustainability

Cities

- Asses the effect from policies and restrictions
- Evaluate potential interventions
- Estimate the effects from the location of logistics facilities
- Gain insights on the freight transport behavior in the city

Module 6. Calibration and validation

Data
- 4 parcel logistics companies operating in Belgium
- 3-month window deliveries... parcels, all possible characteristics
- Protected by NDA
- Surveys at the shopping streets to catch the behavior of "low density" companies

Interviews
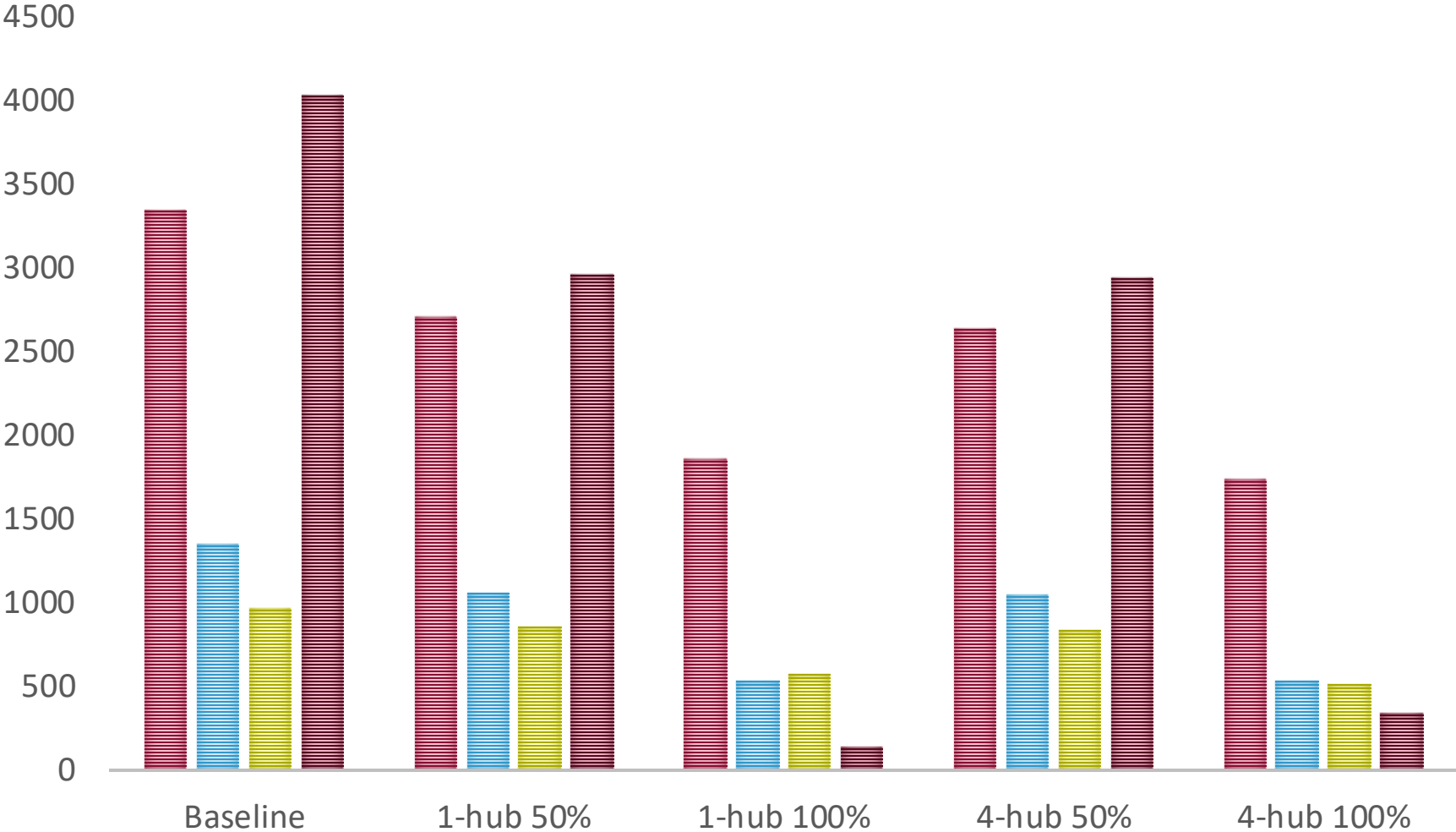- Validate parameters: especially the costs
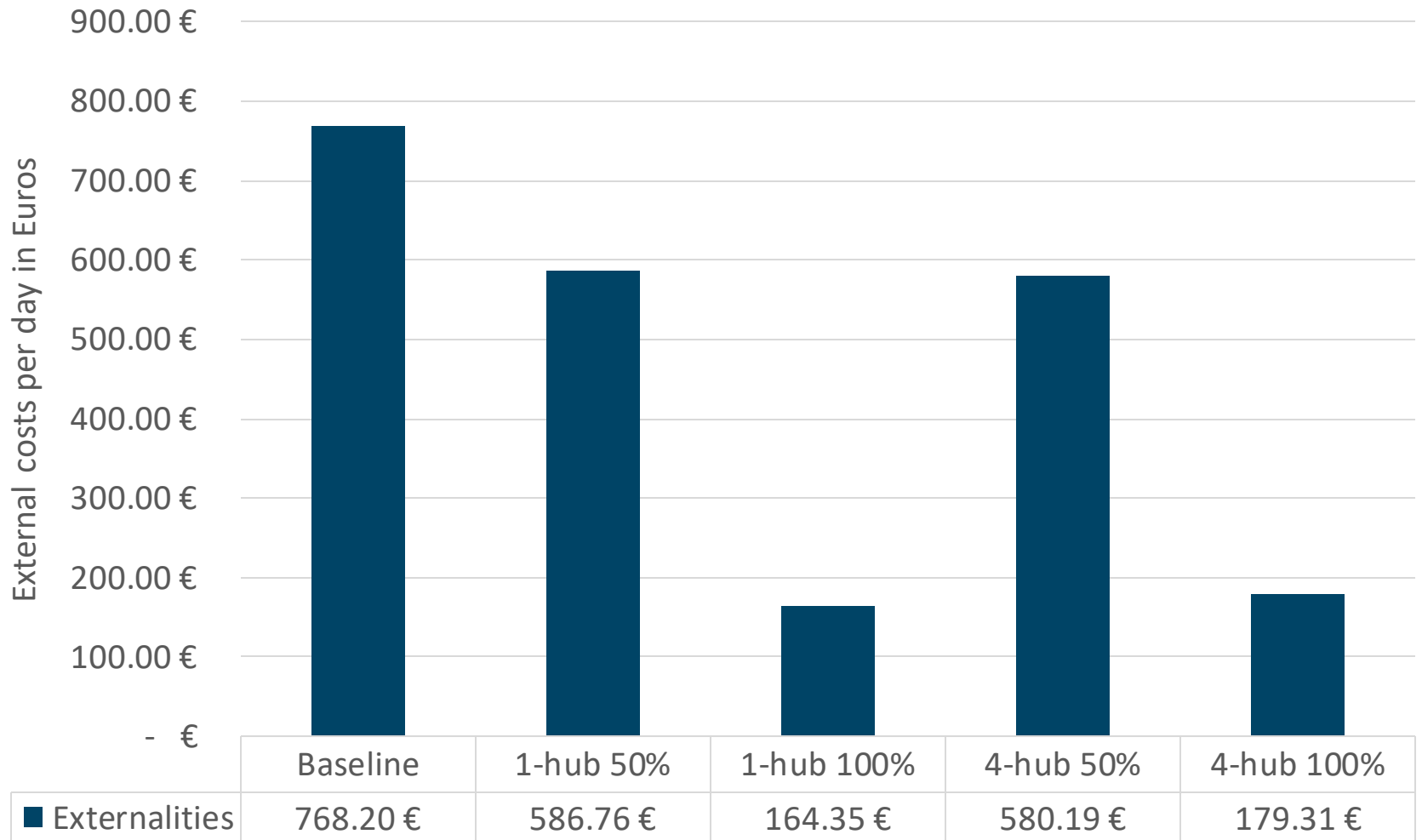
Preliminary Results

- Scenario 0: Situation As-is
  - 36.000 parcels/day
  - 6 companies / 70% share
  - Microscopic transport simulation

  - Scenario 1: 50% shift to bikes using 1 microhub
  - Scenario 2: 100% shift to bikes using 1 microhub
  - Scenario 3: 50% shift to bikes using 4 microhubs
  - Scenario 4: 100% shift to bikes using 4 microhubs
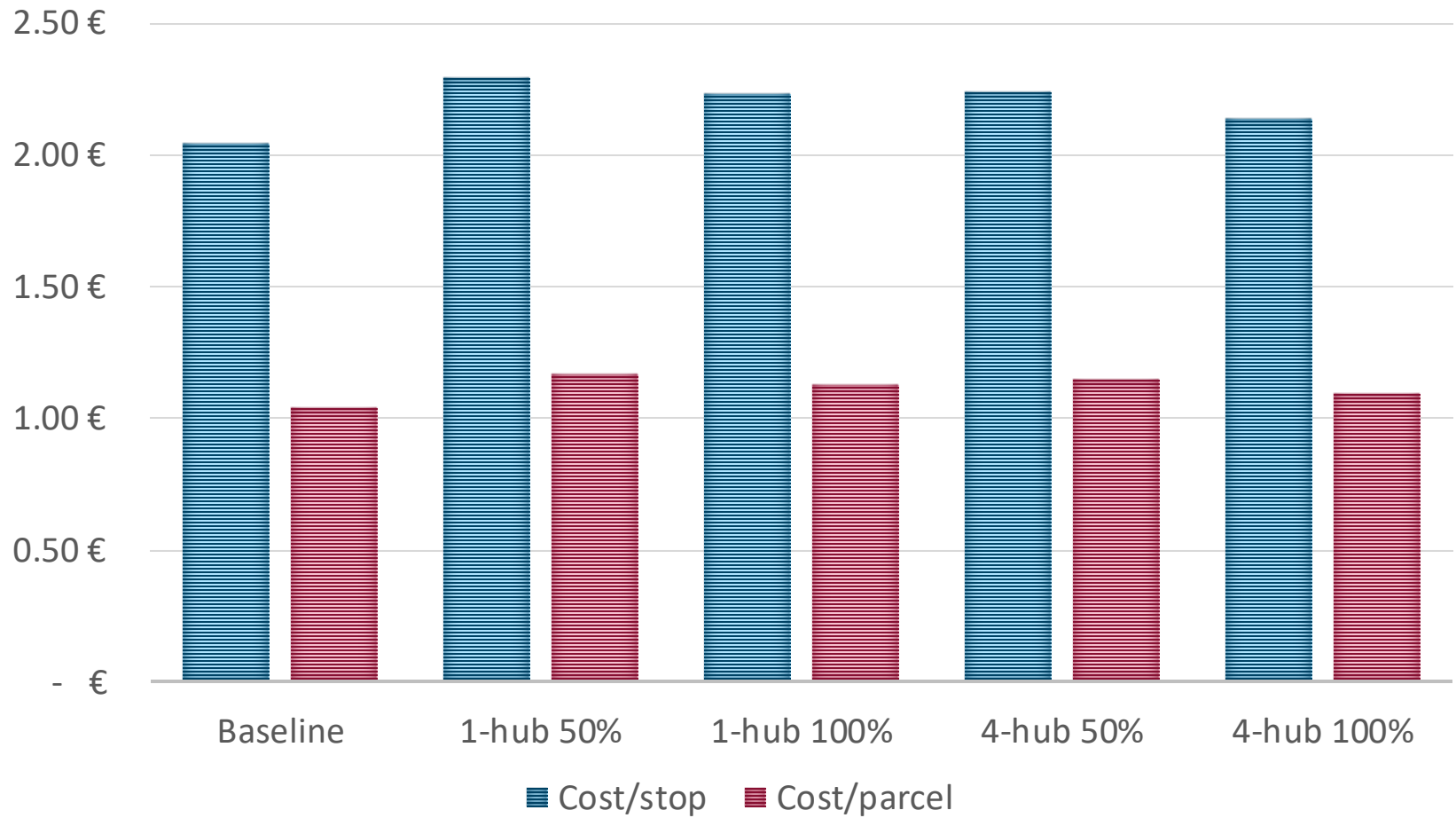
TOTAL KILOMETRES TRAVELLED BY VANS

Legend: ■ Km in highways ■ Km in primary roads ■ Km in secondary roads ■ Km in small roads
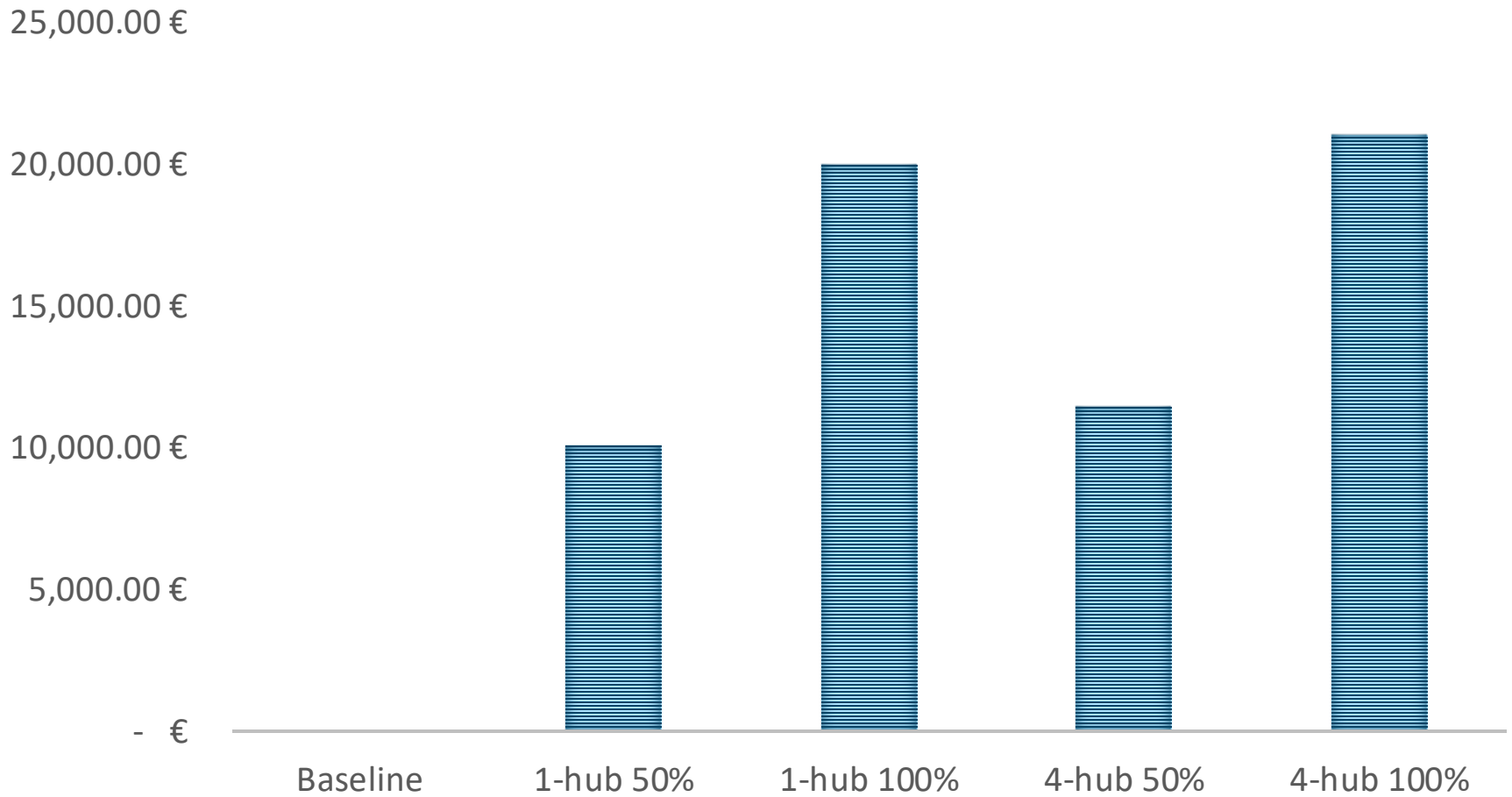
Categories: Baseline, 1-hub 50%, 1-hub 100%, 4-hub 50%, 4-hub 100%

External Costs

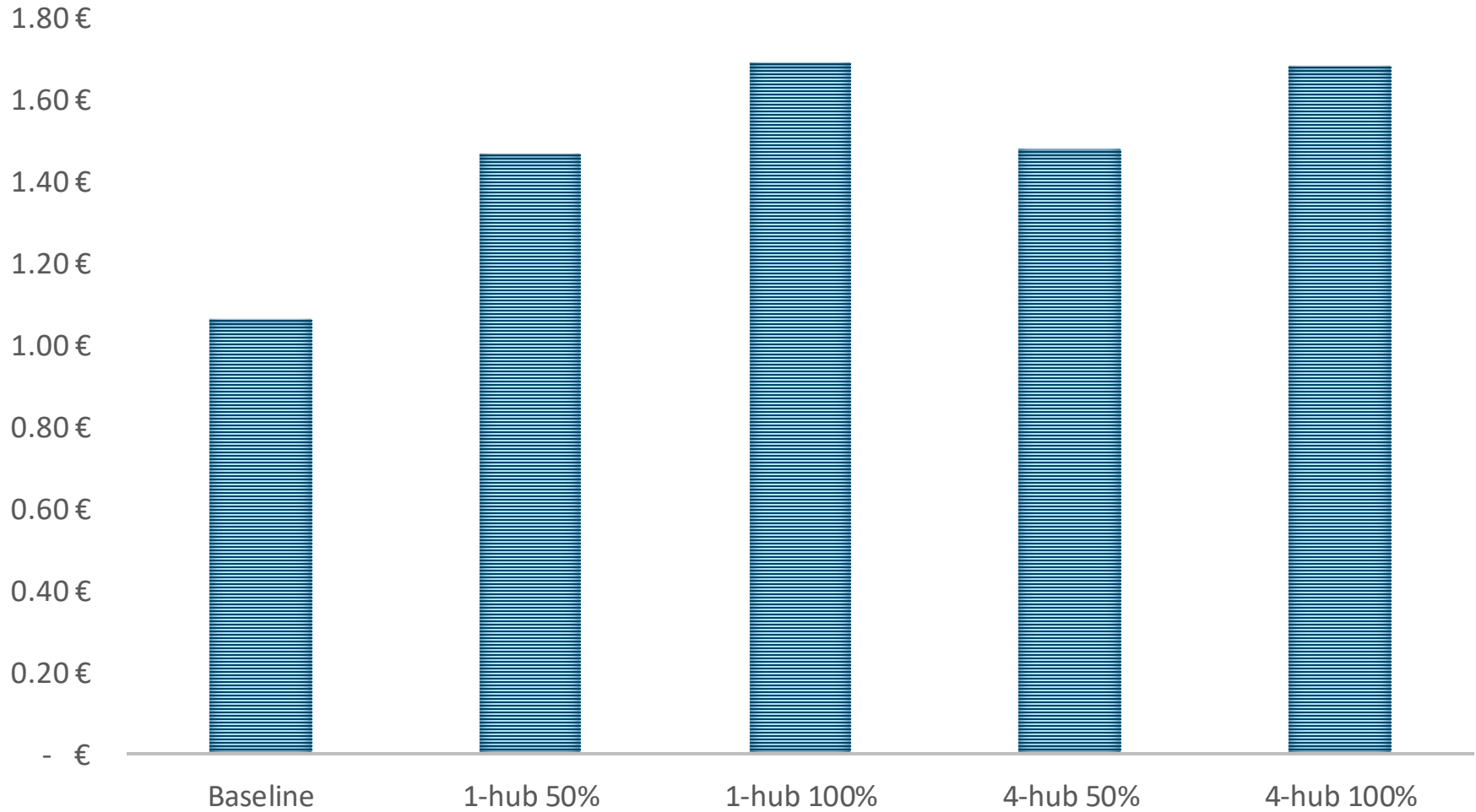|	Baseline	1-hub 50%	1-hub 100%	4-hub 50%	4-hub 100%
■ Externalities	768.20 €	586.76 €	164.35 €	580.19 €	179.31 €

OPERATIONAL COSTS - LAST MILE

Cost/stop   Cost/parcel

ADDITIONAL TRANSSHIPMENT COSTS

TOTAL COSTS/ PARCEL

Urban distribution a "hive" concept

❑ Cooperation

❑ Community

❑ Logistics

Cooperation

Cooperation

Itinerary

Austin (AUS) to Abu Dhabi (AUH) — Tue, Nov 14

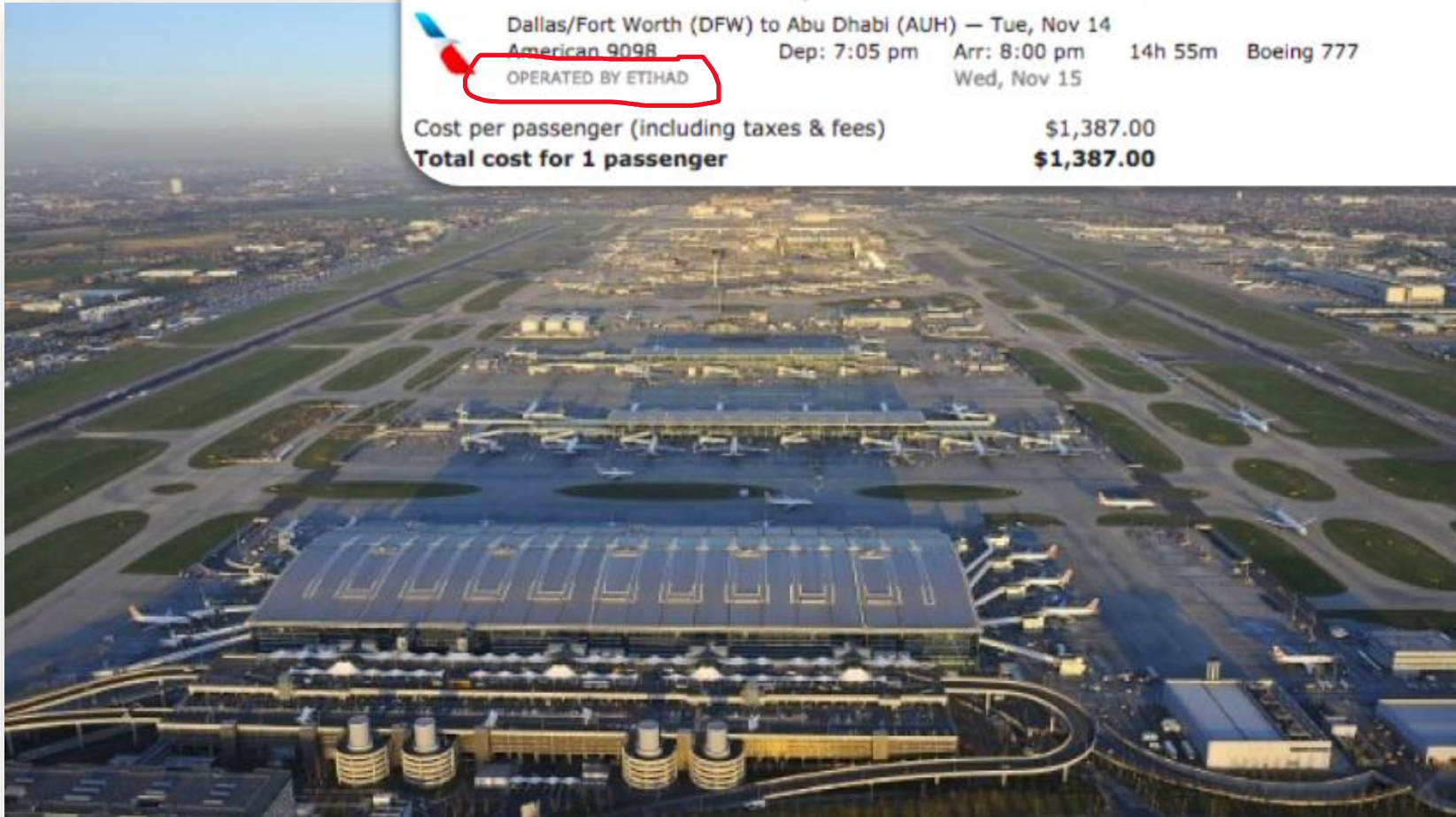Austin (AUS) to Dallas/Fort Worth (DFW) — Tue, Nov 14

American 1595	Dep: 6:25 am	Arr: 7:31 am	1h 6m	Airbus A321 (Sharklets)	Economy (N)
	Layover in DFW		11h 34m		

Dallas/Fort Worth (DFW) to Abu Dhabi (AUH) — Tue, Nov 14

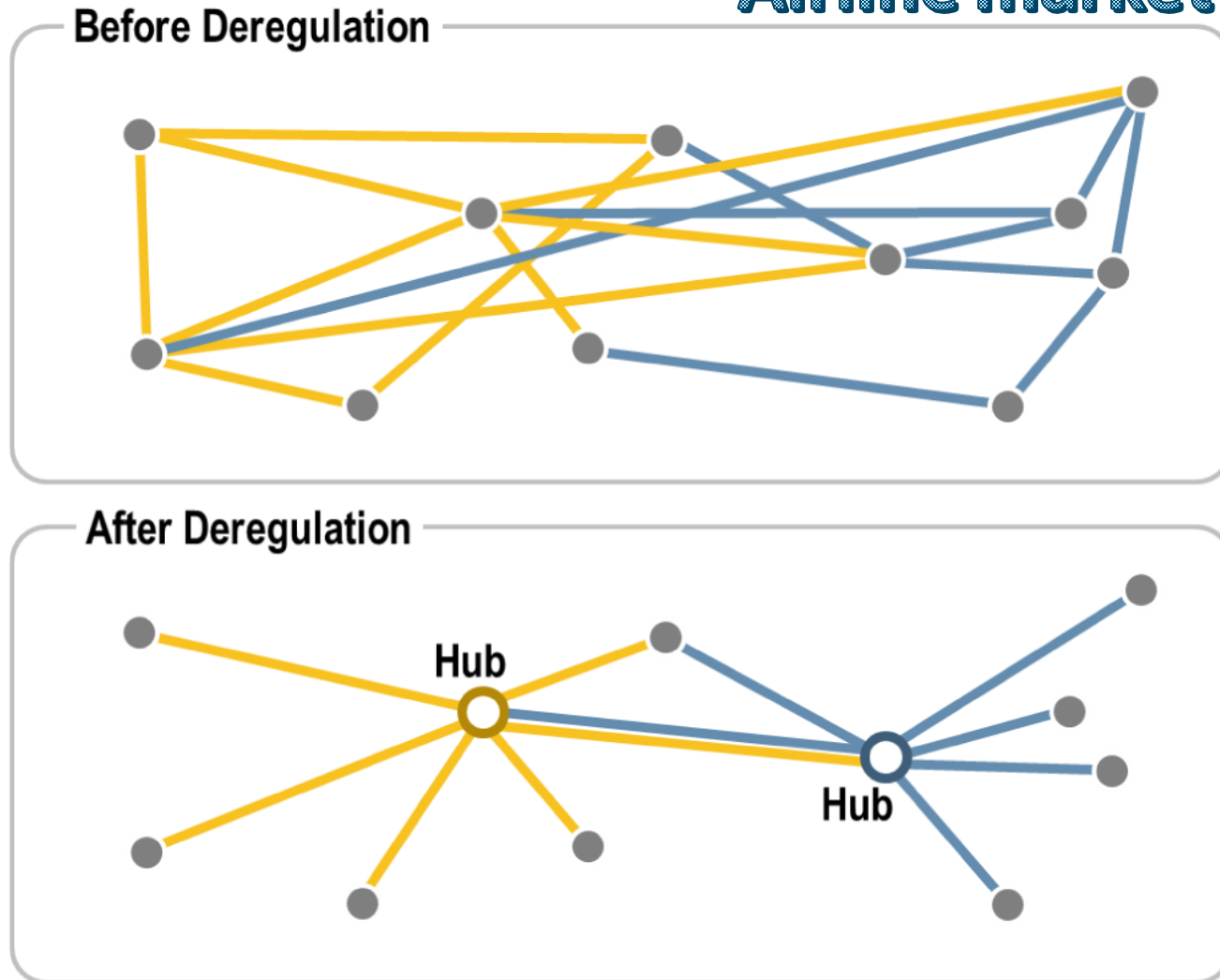|					
American 9098 OPERATED BY ETIHAD	Dep: 7:05 pm	Arr: 8:00 pm Wed, Nov 15	14h 55m	Boeing 777	Economy (N)

Cost per passenger (including taxes & fees) $1,387.00
Total cost for 1 passenger   **$1,387.00**

Cooperation

Airline market

Before Deregulation

After Deregulation

Hub

Hub

Impact on Community

Impact on Community

Impact on Community

What type of products?

Conclusions and further research

Model
- Calibrating some of the variables
  - Service time for bikes
  - Personnel for transshipment
  - Parking costs
- What is the "best" configuration
- Which percentage of the freight can fit in the micro hub model

Impacts
- Implications for cohabitation / collaboration / cooperation / etc.
- Implications for communities: reduction in traffic, increase on bikes, land use, shopping behavior
- Implications for business models: added value on the last mile returns/ on-demand logistics / hyper local procurement / customized services

Thank you for your attention!

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