A Sustainable Logistics Model in the Food Supply Chain

Dimitris Zissis, Emel Aktas, Michael Bourlakis,

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Transforming knowledge into action

Pilot 3

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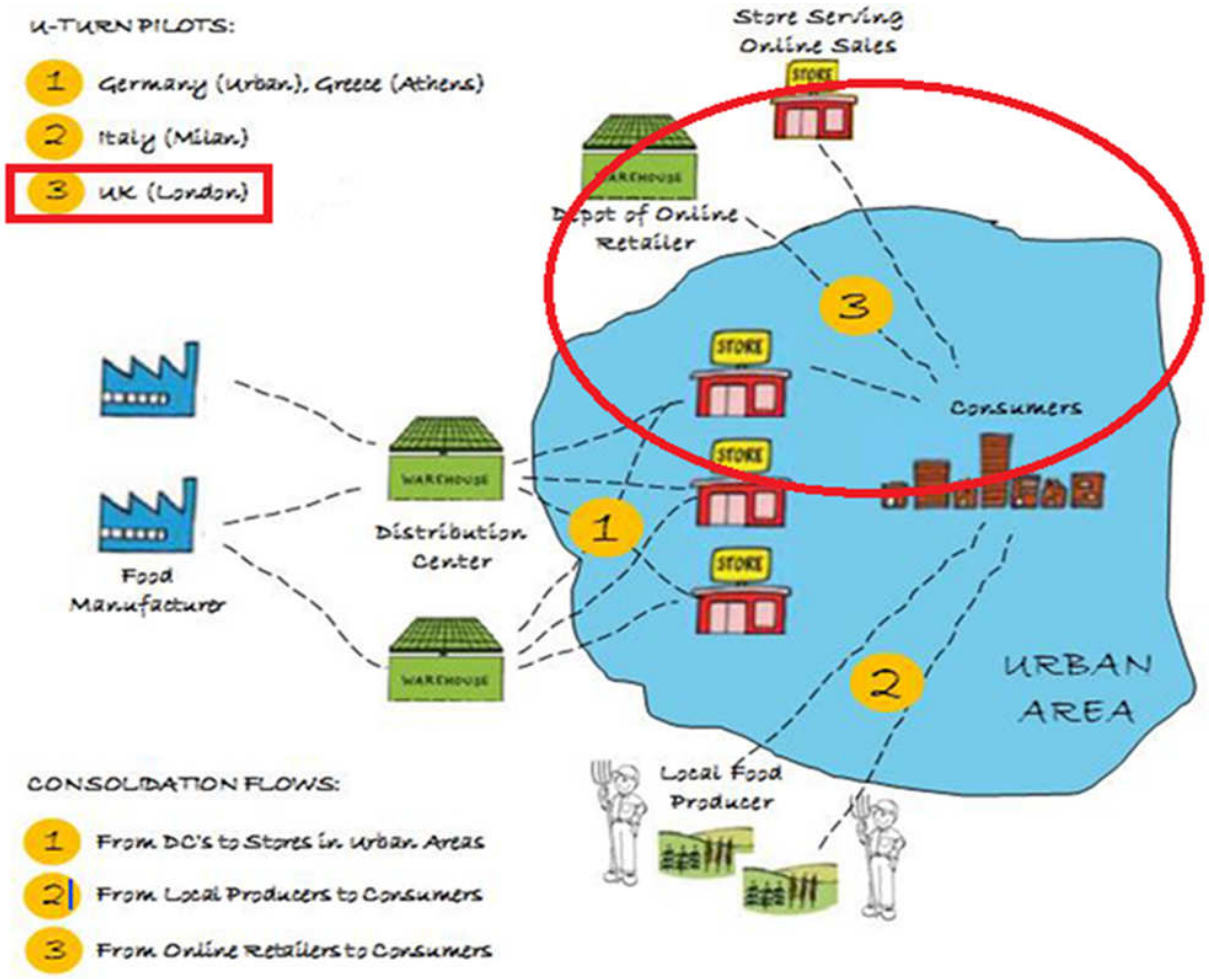

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Outline

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- Motivation
- Research Problem
- Current Situation
- Primary Data
- Collaborative Model
- Future Work

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Motivation

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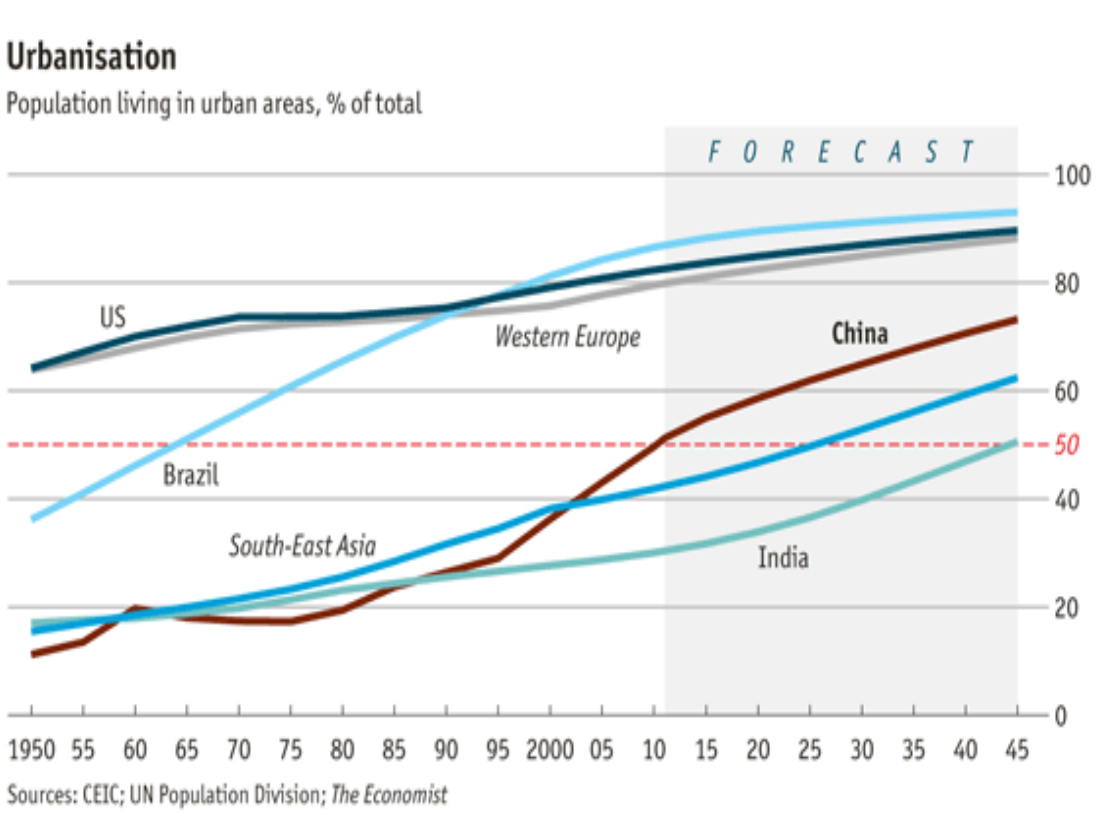
- 75% of the population in urban areas in Europe (estimation 80% by 2020)
- 21% of the CO2 emissions attributable to freight transport in the UK (or 6% of the CO2 emissions in the country)



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Research Problem

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- The UK online grocery retail market
  - Yearly growth: 17%
- The traditional grocery market
  - Yearly growth < 5% in the last 10 years

(IGD, 2015)

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Online grocery market

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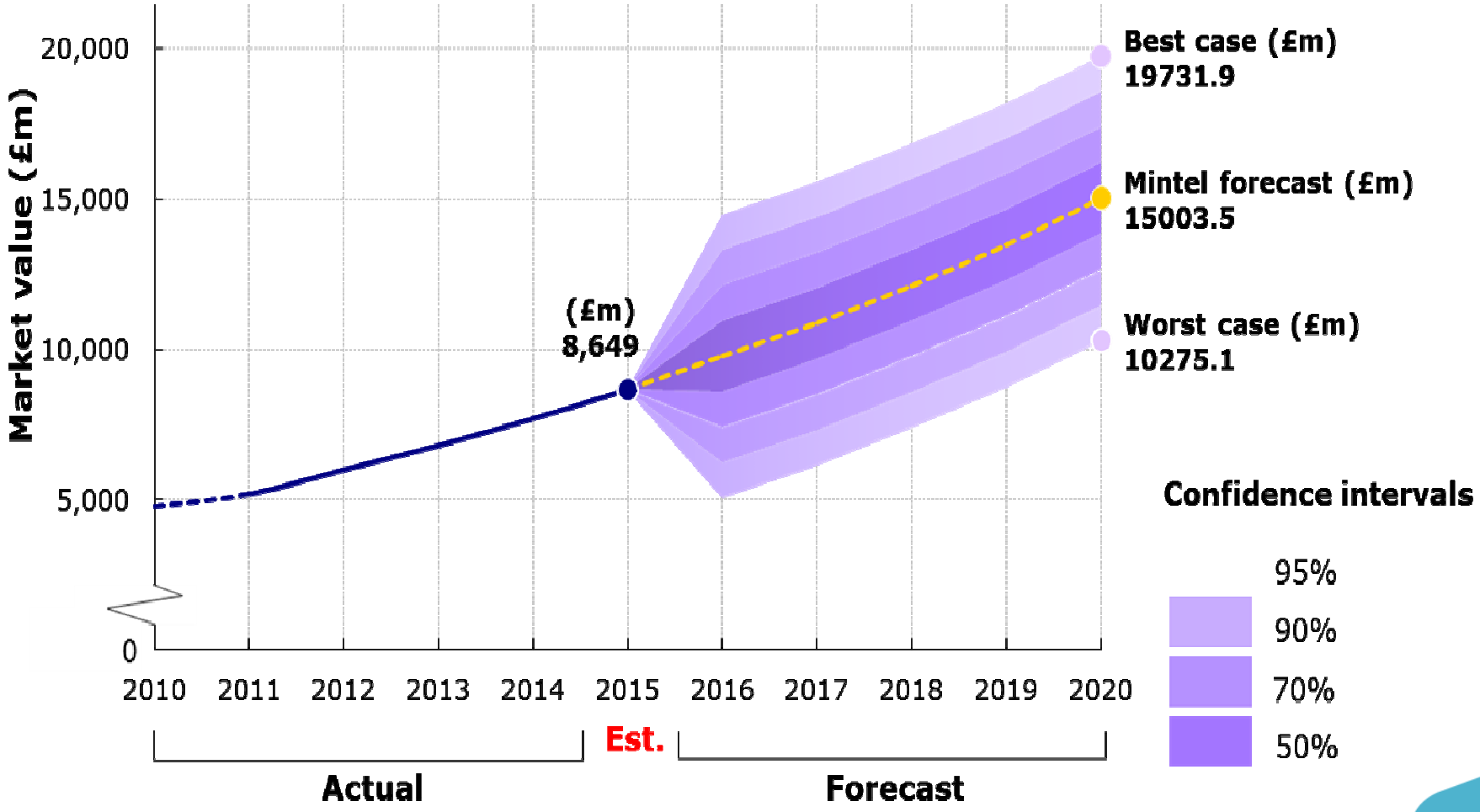
- Second larger (after Chinese)



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Growth of online grocery market

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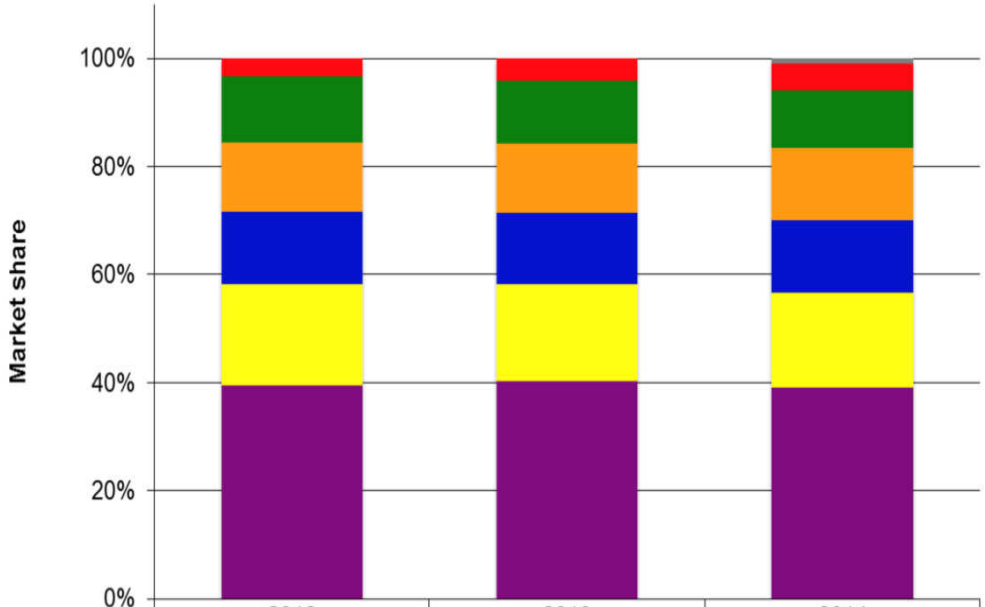
Overall Market Value

- 2012: £5.673 billion
- 2013: £6.555 billion
- 2014: £7.532 billion



	2012	2013	2014
Morrisons	0.0%	0.0%	0.9%
Waitrose	3.4%	4.2%	5.0%
Other	12.1%	11.5%	10.7%
Ocado	12.9%	12.9%	13.4%
ASDA	13.4%	13.2%	13.4%
Sainsbury's	18.7%	18.0%	17.5%
Tesco	39.5%	40.2%	39.1%

Mintel (2015)

Existing Model

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- **Home Delivery:** Delivery food to the consumers' location
- **Click & Collect:** Transports food to a predefined collection point and the customer has to collect his order

Logistics Models

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- Home Delivery
  - Attended
  - Unattended
- Picking and despatch
  - Fulfilment centre / dark store
  - Store fulfilment
- Routing and scheduling
  - Use of pricing to even out the demand

Current Situation

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- Number of orders: 94M for 2015 (185M for 2020)
- Time slot 1 hour
- Fee £1- £6 and delivery passes
- Average cost / delivery = £21 (Ocado)

Retailer R

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- **#346,745 transactions**
  - **from 01/06/2014 to 31/05/2015**
- Average number of deliveries by location
- The spoke serving the location
- Percentage of orders delivered / hour / day
- Average order weight for postcode
- Average order volume for postcode

Ocado data

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- **Ocado** (13.4% on 2014)
- **Financial report:** **2014** **2015**
- **Size:** **£972M** **£1,116M**
- **# Orders:** **8.684M** **10.14M**
- **Active Customers** **453K** **509K**

Retailer R's non-uniform demand

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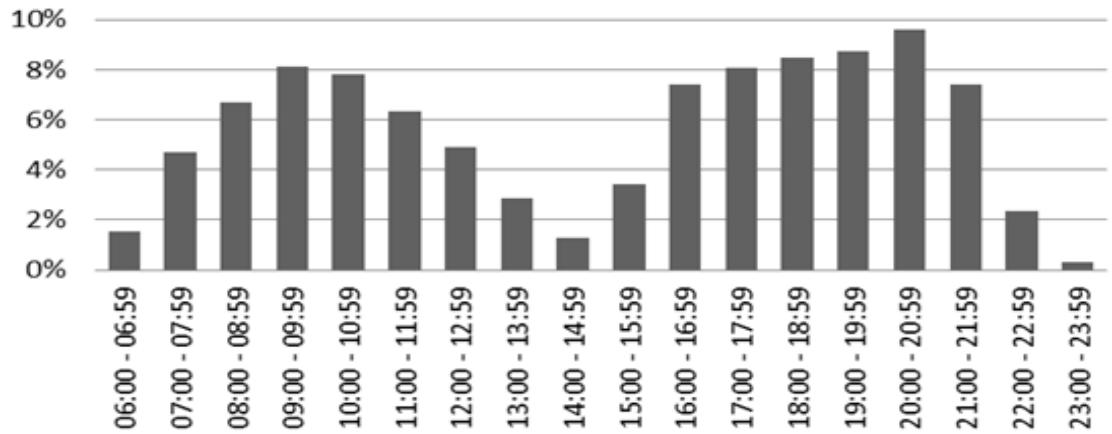
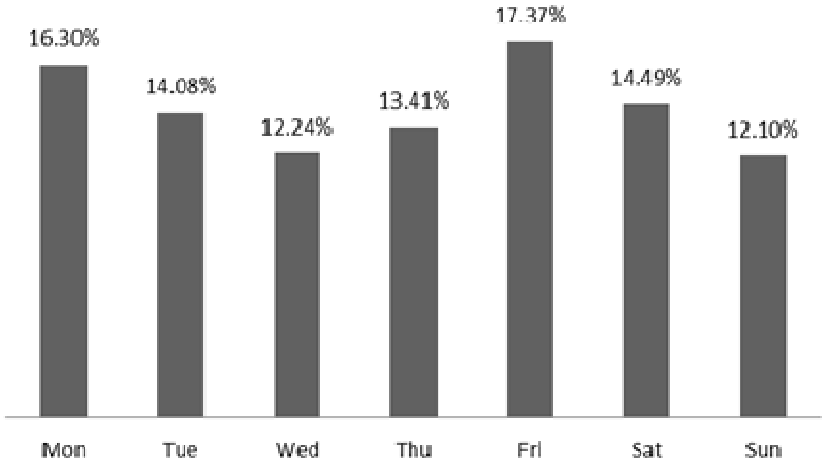


Morning & Evening Peaks

End-of-week & Start-of-week Peaks



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No collaboration

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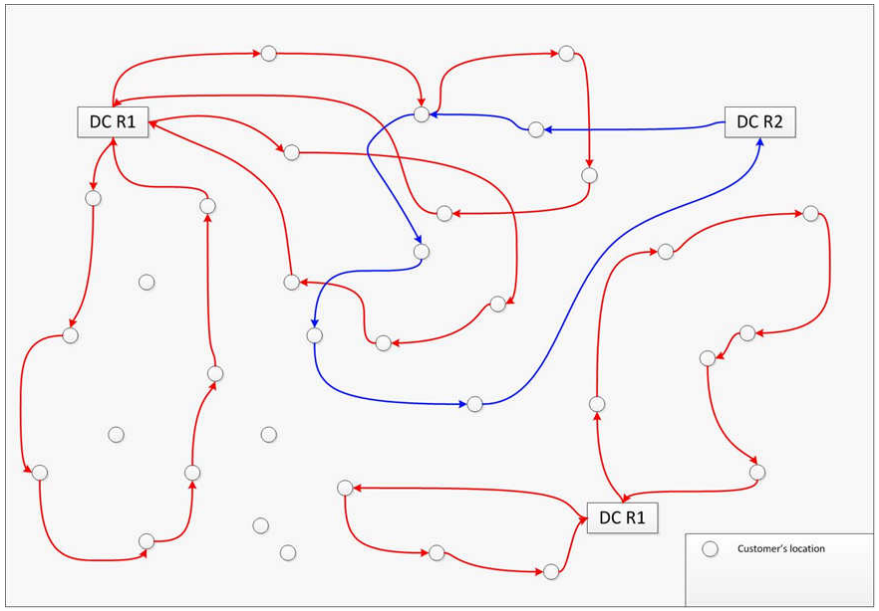

- Cost based on: How many DCs (N_i) are operated exclusively by the i-retailer and the distance (X_i) for satisfy his demand
- (Individual) Cost: $C_i = aN_i + cX_i$,

Where

a: the cost for each individually owned fulfilment centre

c: the cost per each travelled kilometre

Proposed model

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- Collaboration among the retailers
  - Single decision maker for the routing
  - Minimum overlapping areas
- Raise fleet utilization
- Reduced costs, emissions, noise levels
- Sustainable model

Collaborative model

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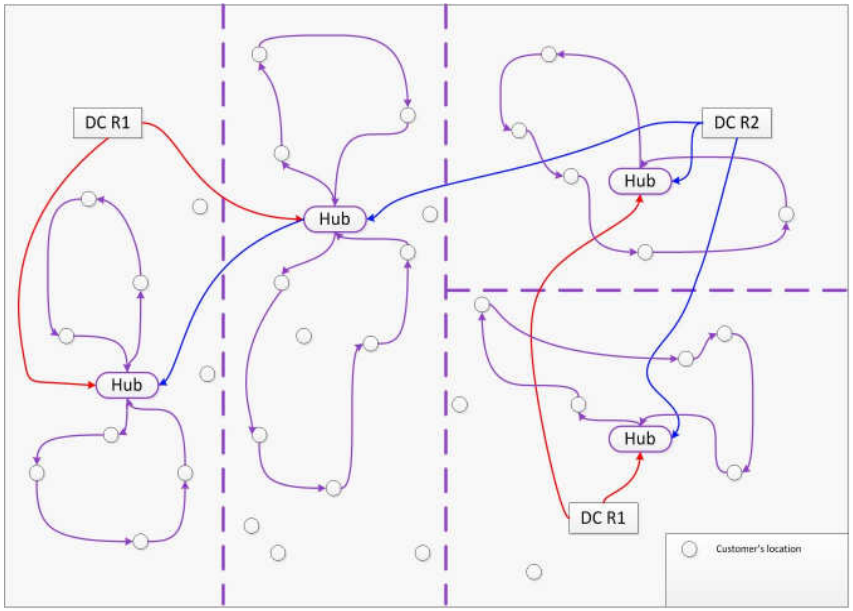

- Total distance: $TX < \sum_{\forall i} X_i$
- Total cost based on: total number of DCs (TN) and total distance (TX) for satisfy the home deliveries from all retailers
- Total cost: $CT = (a+b)TN + cTX$, where b is the additional cost when a DC is shared
- Question: $CT < \sum_{\forall i} C_i$? And what is the reduction?

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Now working on…

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- Design a game among the retailers, where retailers have an incentive to participate in the shared logistic model
- Simulate real data under the proposed distribution model
- Measure the economical and the environmental impacts

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Questions

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