A system dynamics model of city hubs
A case study in Stockholm

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25 October 2023

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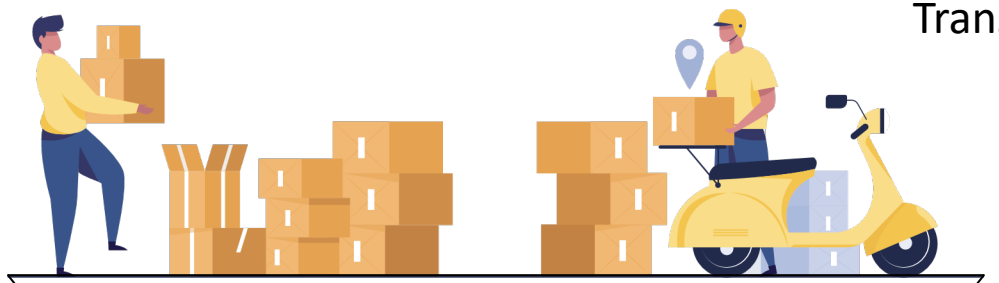
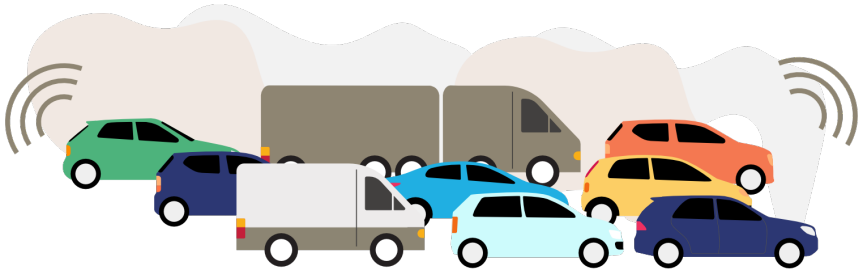
Context

Transportation of goods



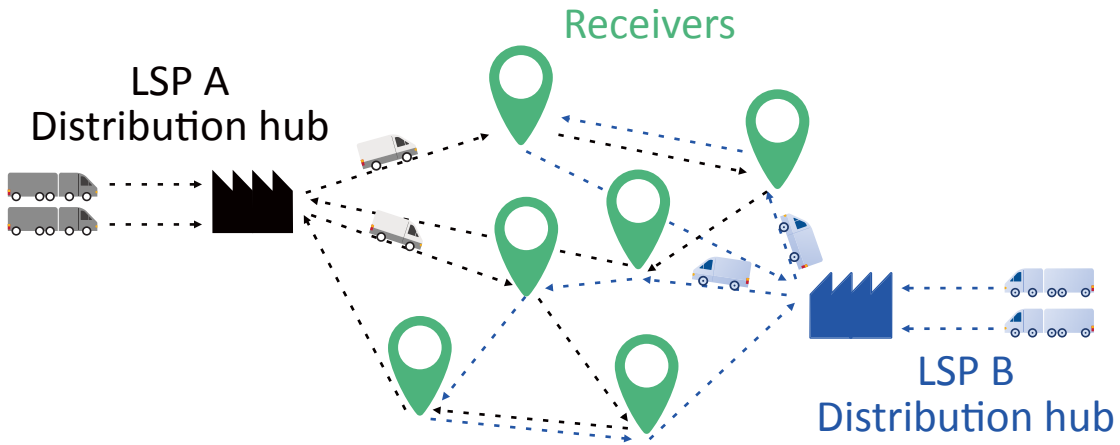


Currently unsustainable

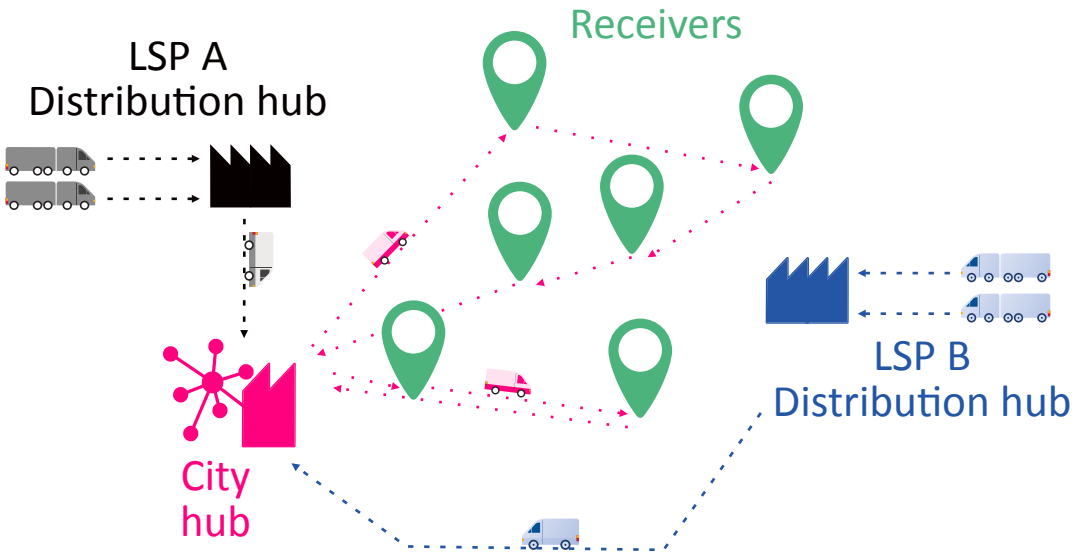
Urban environment

City hubs as one possible solution

a) System without city hubs



b) System with city hubs



Distance travelled

Up to 40-65% decrease

Fill rate

Up to 30-65% increase

Delivery time

Total costs

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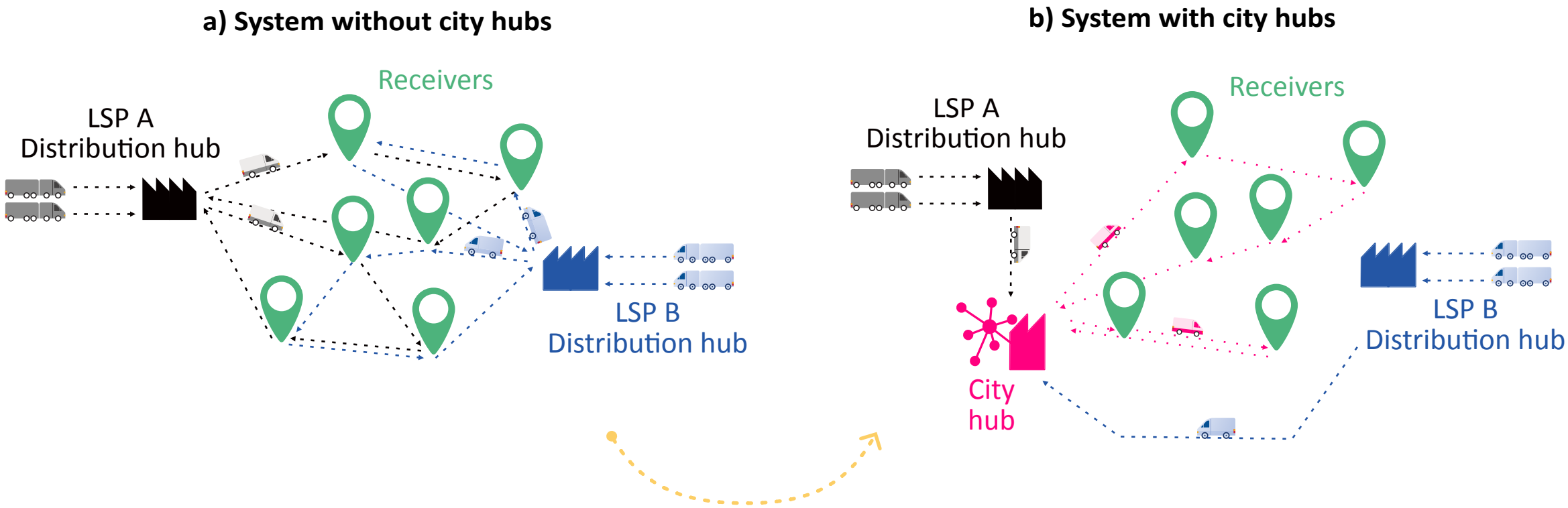
Problem formulation

City hubs are a possible solution to the negative externalities of the urban logistics system

However, city hubs have not so far been exploited to their potential.

What policies/decisions could help the implementation of city hubs?

Modelling the transition



System dynamics method

Group model building workshop

Interviews

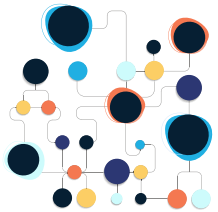
Workshop series with expert group

Existing literature

Qualitative model

Quantitative model

Scenario analysis

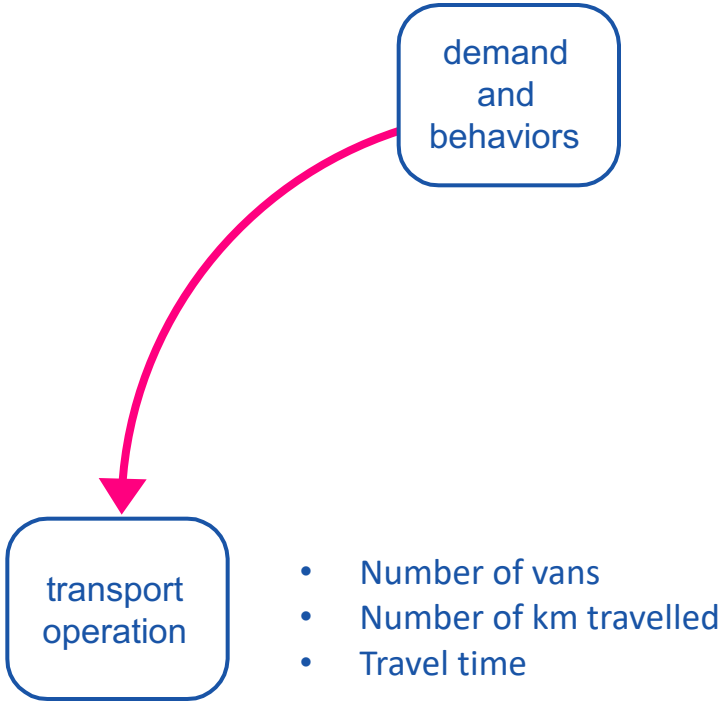


Model structure

demand and behaviors

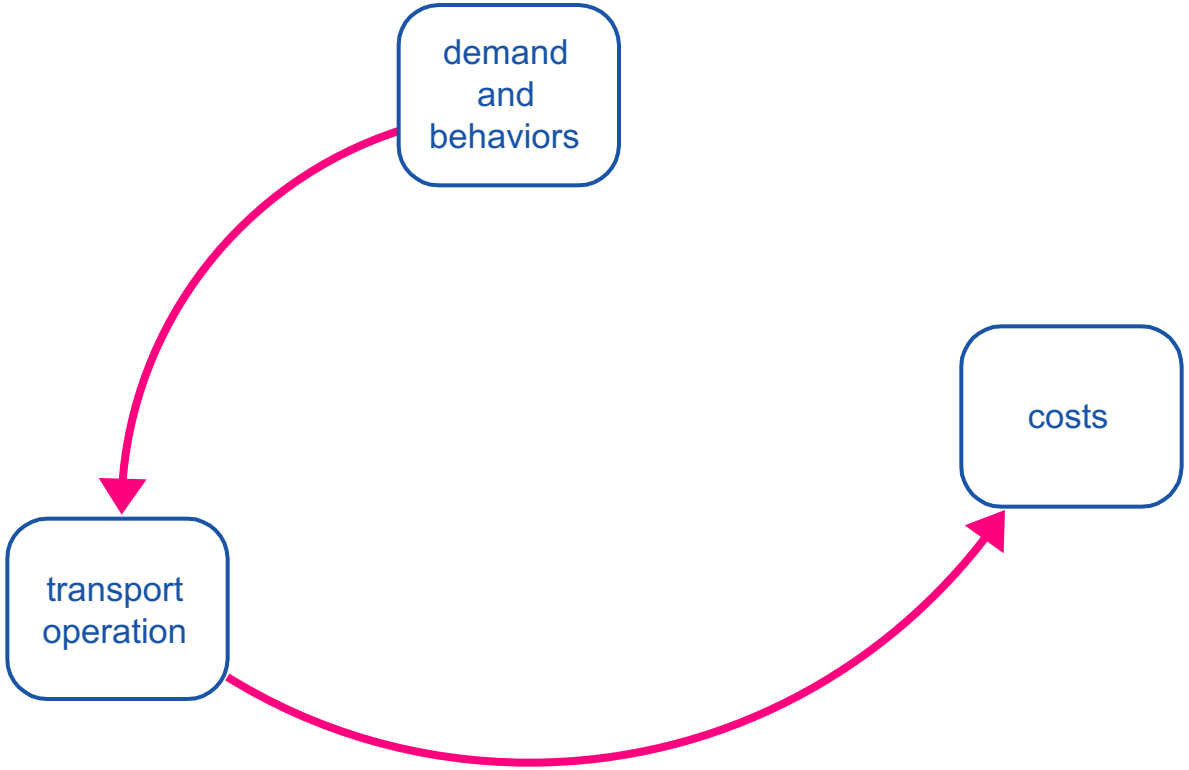
- Demand in the area
  - Number of packages → ~ **25000 packages/month**
- Number of actors in the area
  - Number of LSPs
  - Number of receivers

Model structure



- Number of vans
- Number of km travelled
- Travel time

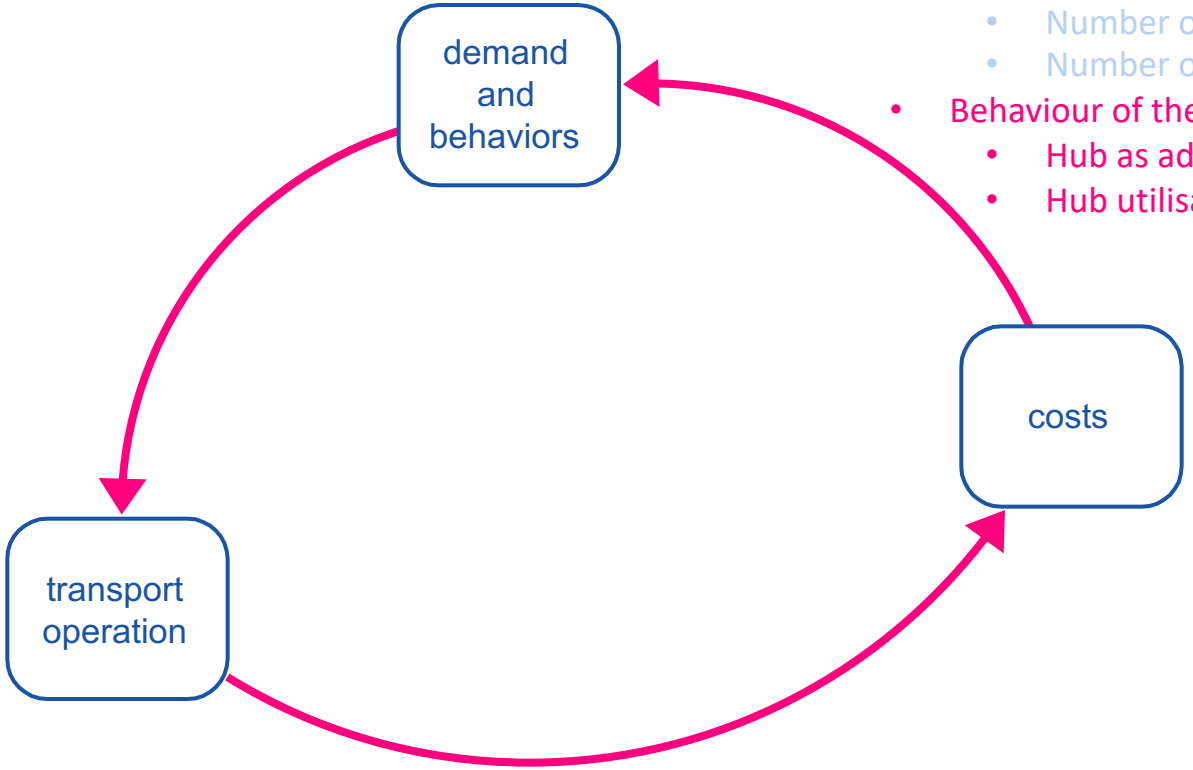
Model structure



- Total costs
  - Cost per km
  - Cost per hour
  - Cost per vehicle

Model structure

HUB INTRODUCTION

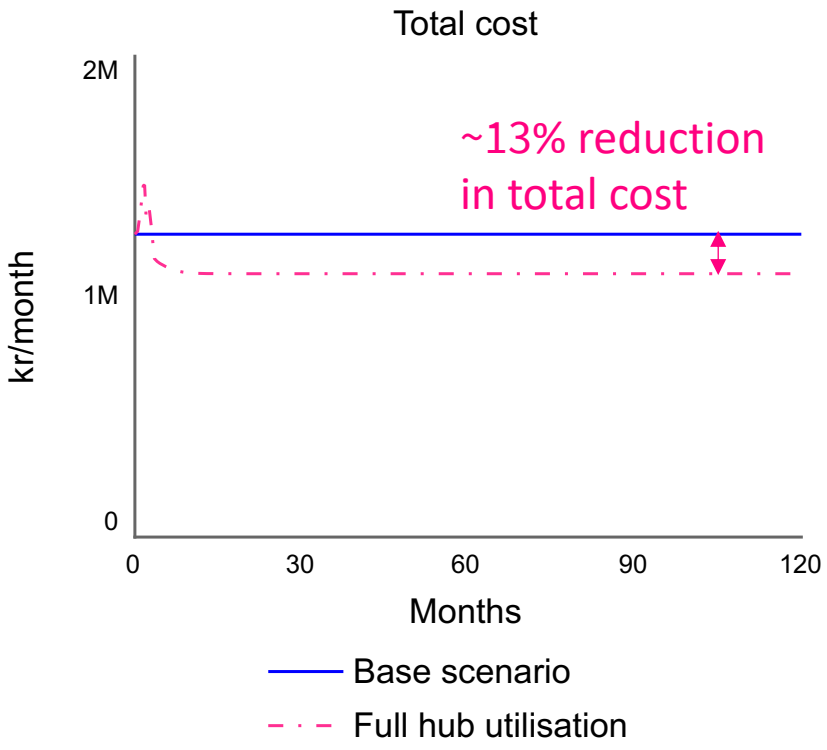


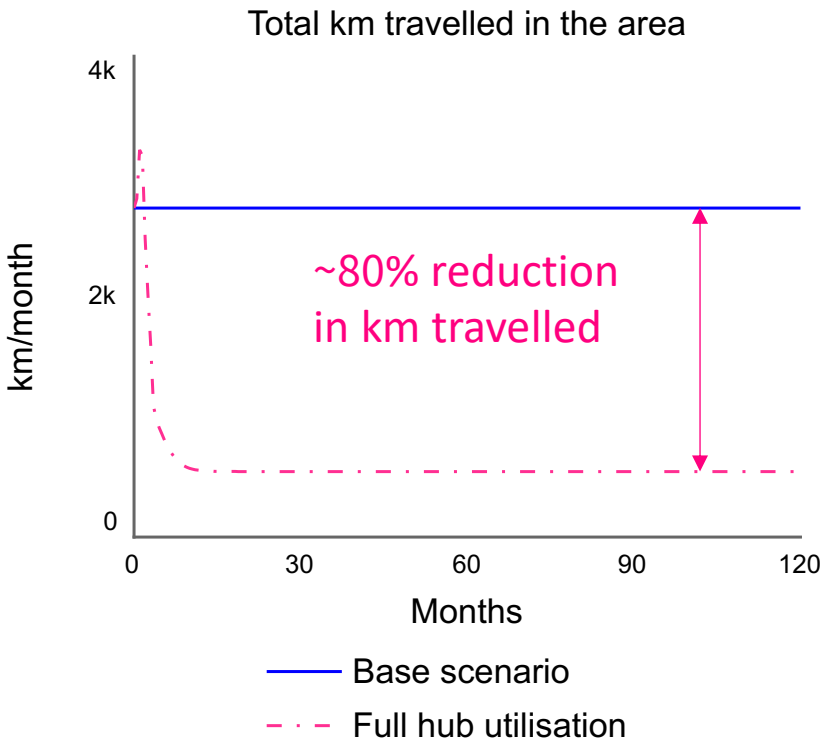
- Demand in the area
  - Number of packages → 25000 packages/month
- Number of actors in the area
  - Number of LSPs → 10 LSPs
  - Number of receivers → 100 receivers
- Behaviour of the actors in the area
  - Hub as additional actor
  - Hub utilisation

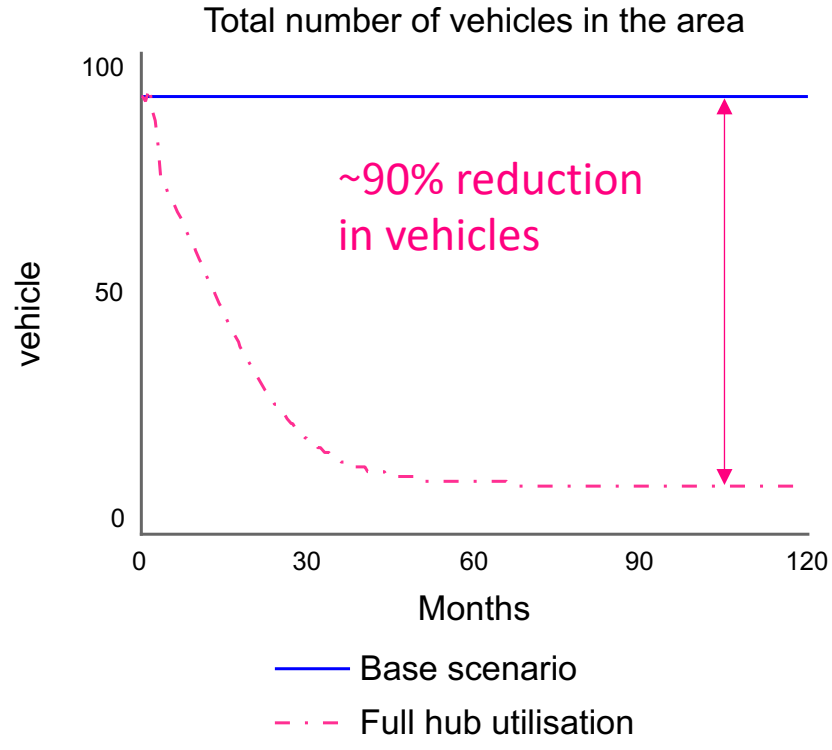
- Total costs
  - Cost per km
  - Cost per hour
  - Cost per vehicle
- Cost of the hub
- Revenue stream
  - Receivers fee
  - LSP fee
- Profit of the hub logistic provider

- Number of vans
- Number of km travelled
- Travel time
- Hub vans
- Hub km travelled
- Hub travel time

Reductions with hub







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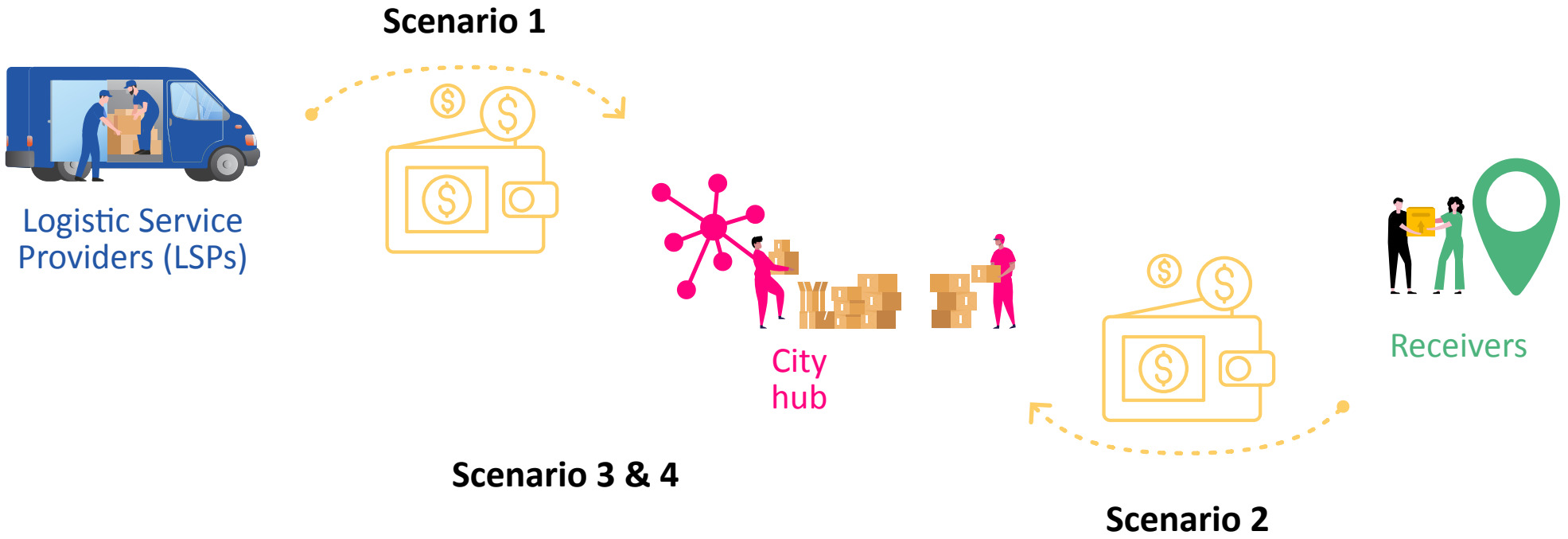
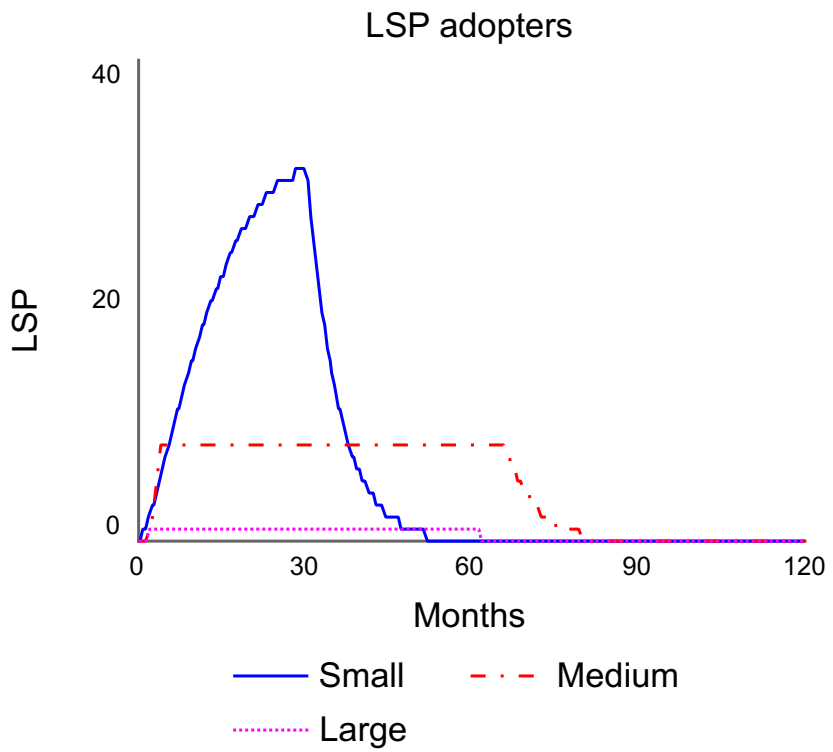
Scenarios

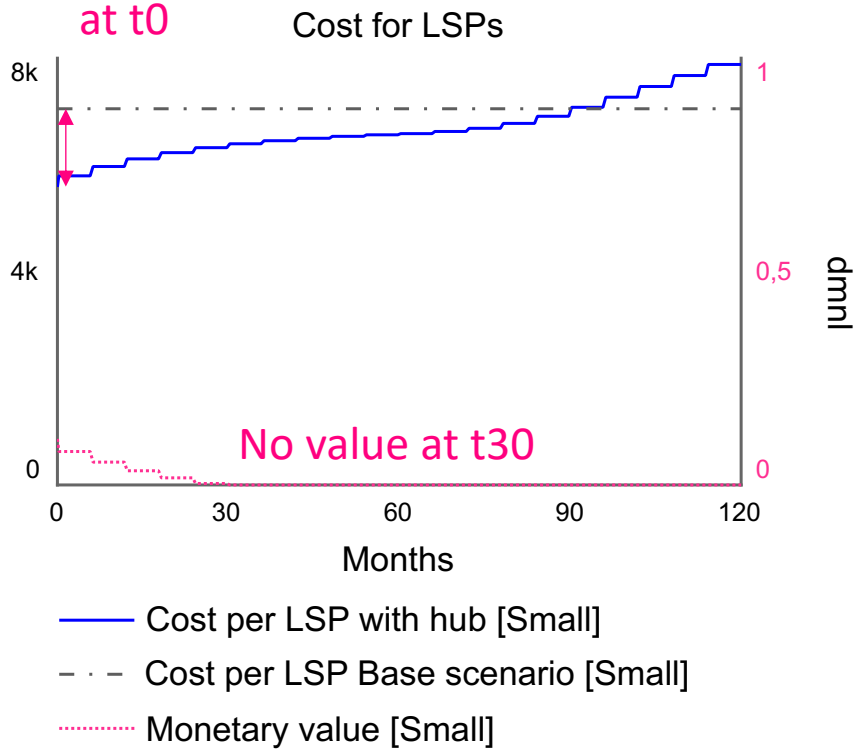

Scenario 1
Logistic Service Providers (LSPs)
City hub
Receivers
Scenario 3 & 4
Scenario 2

Scenario 1 – LSP

Input data	
Advertisement towards LSP	10% effectiveness
Initial LSP fee	0 kr/month



~20% reduction at t0



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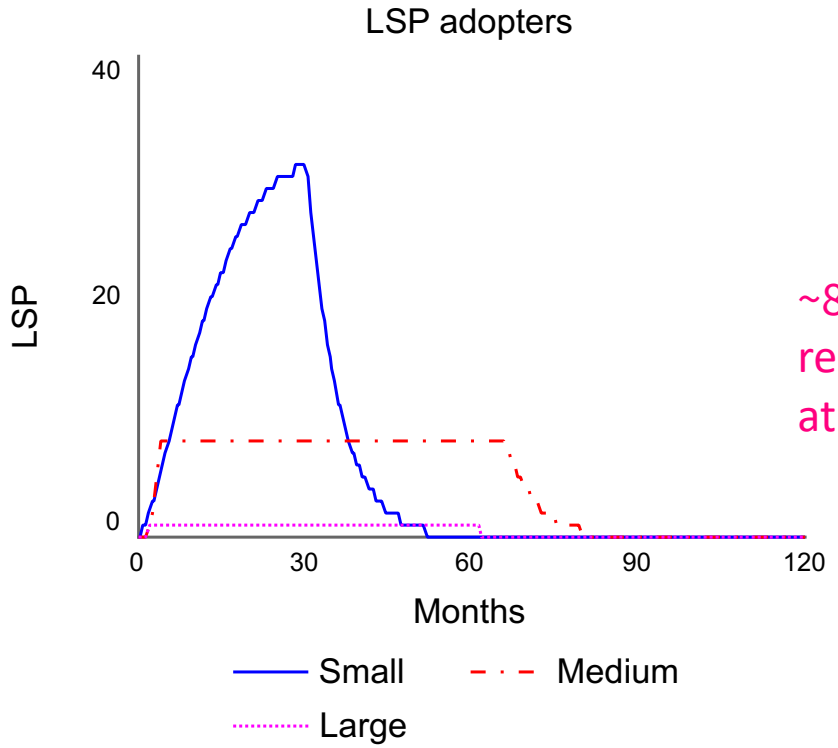
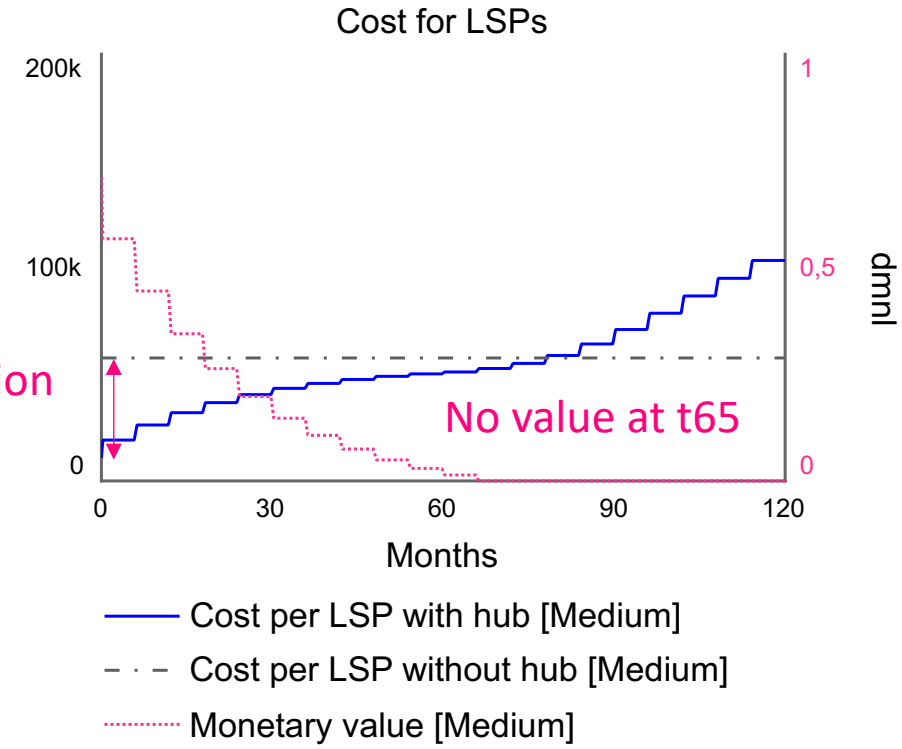


~80% reduction at t0



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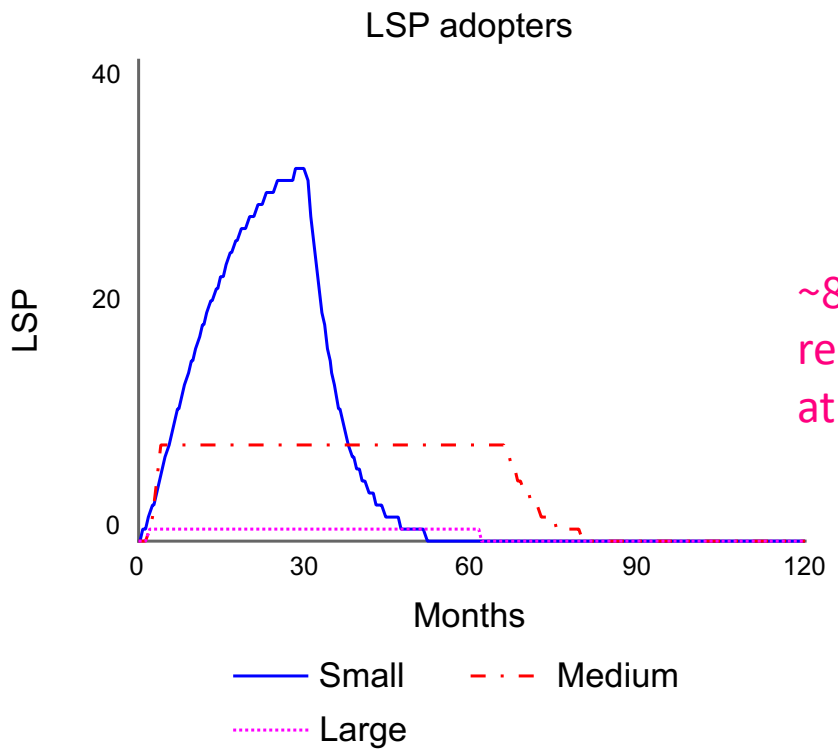
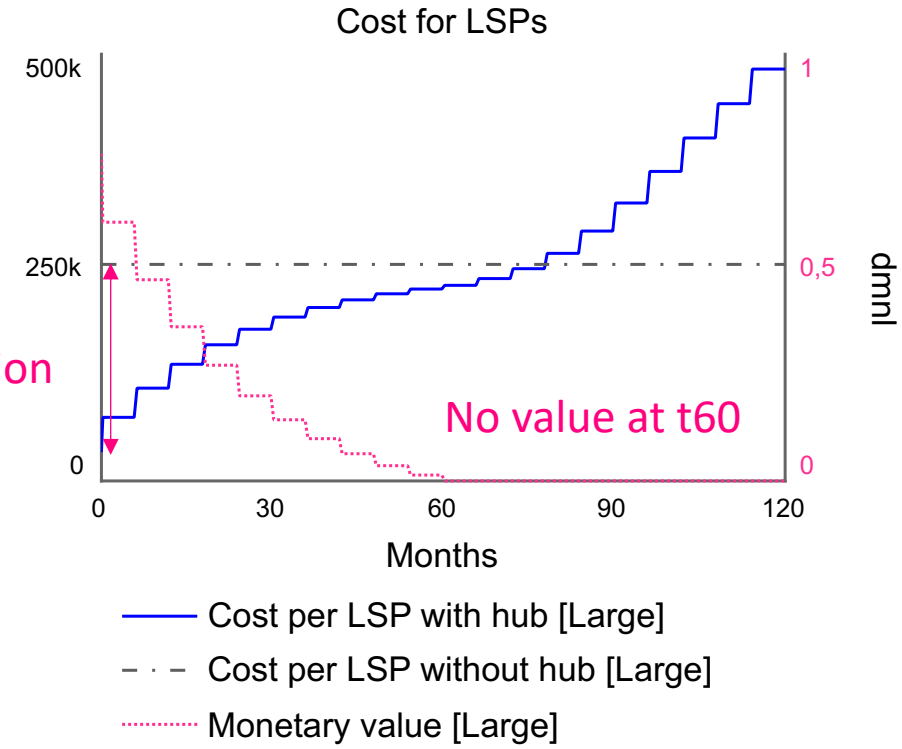
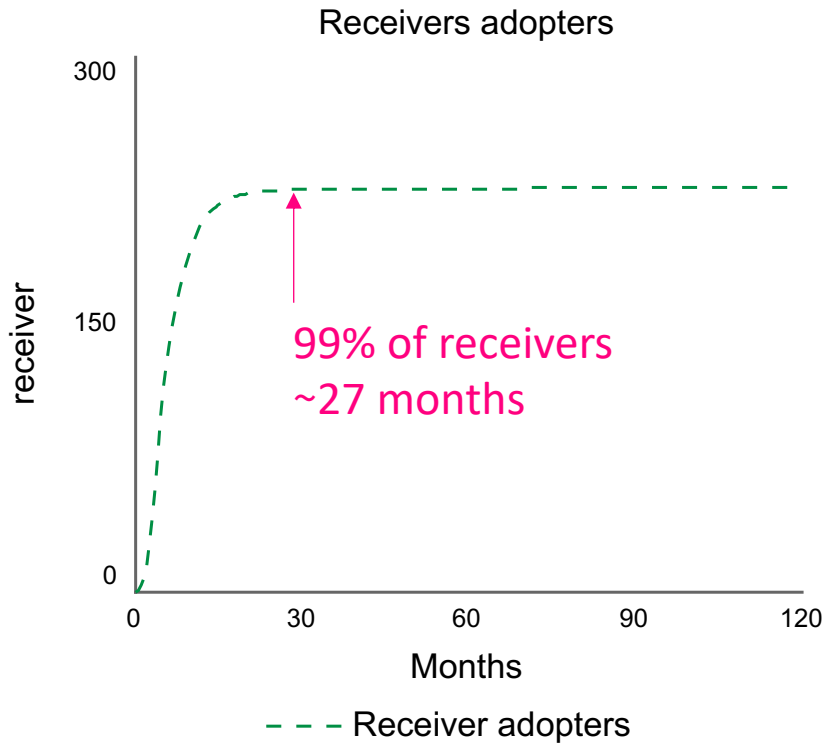


~85% reduction at t0



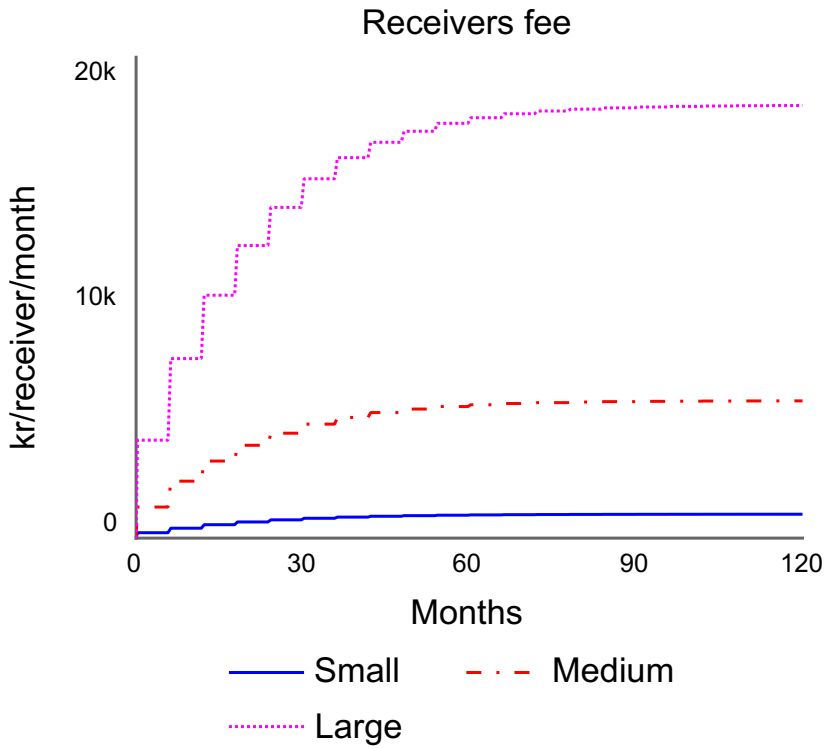
Scenario 2 - Receivers

Input data	
Advertisement towards receivers	10% effectiveness
Initial receivers fee	0 kr/month



Final receiver fees

- Small: 992 kr/month
- Medium: 5700 kr/month
- Large: 18000 kr/month

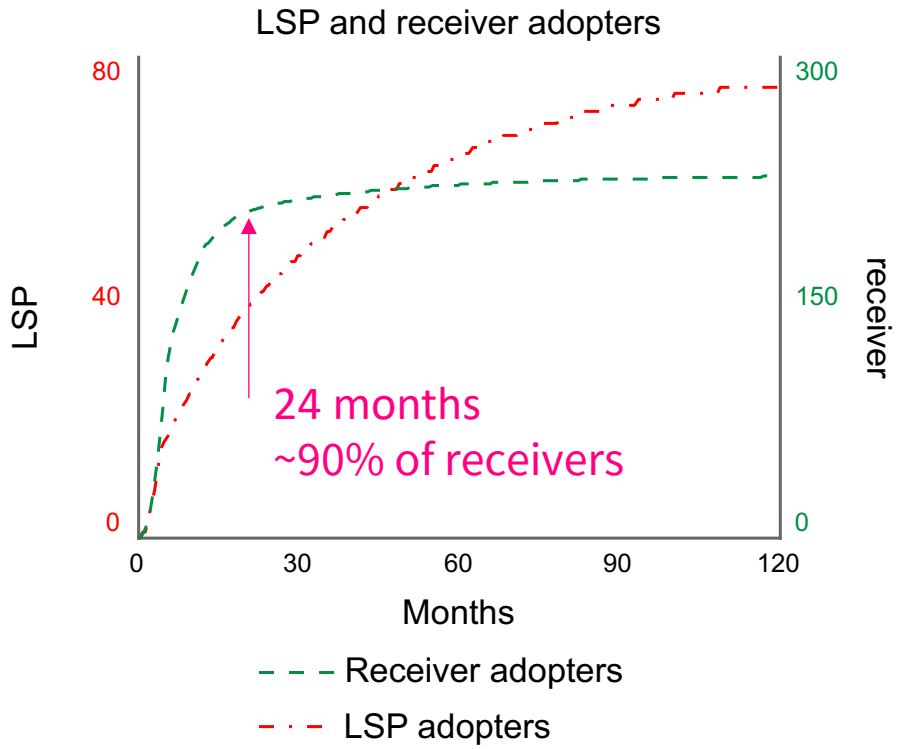


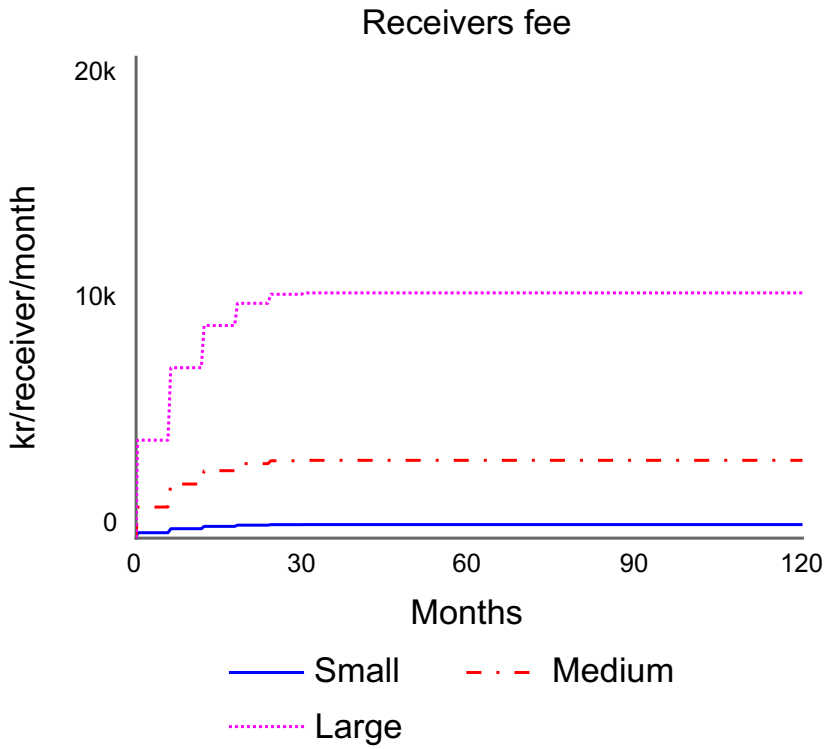
Scenario 3 – LSPs and Receivers

Input data	
Advertisement towards LSP	10% effectiveness
Initial LSP fee	0 kr/month
Advertisement towards receivers	10% effectiveness
Initial receivers fee	0 kr/month

Final receiver fees

- Small: 563 kr/month
- Medium: 3240 kr/month
- Large: 10200 kr/month





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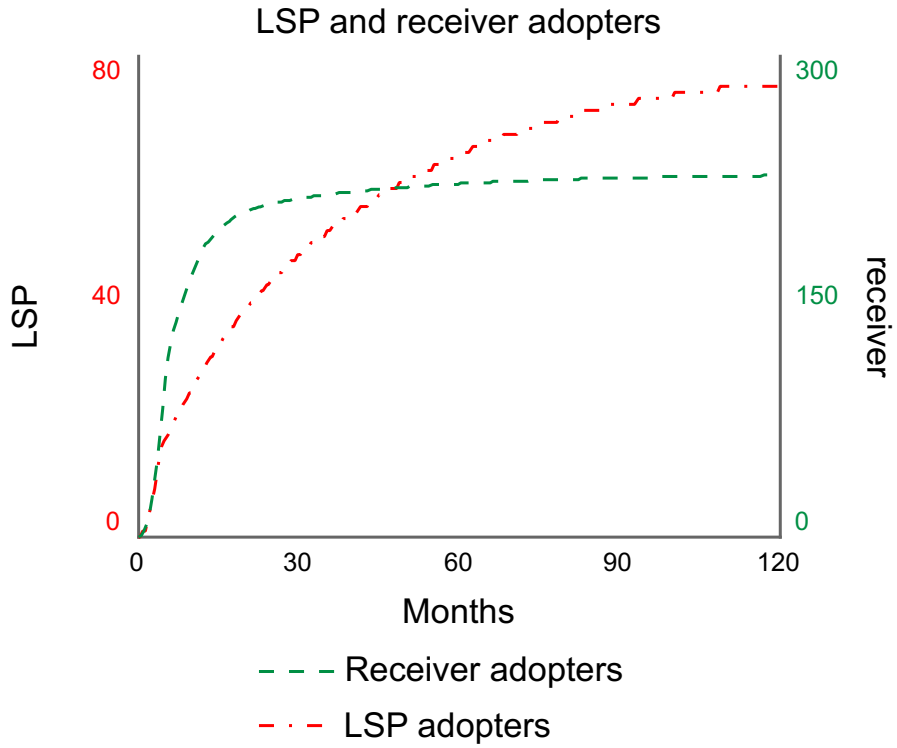
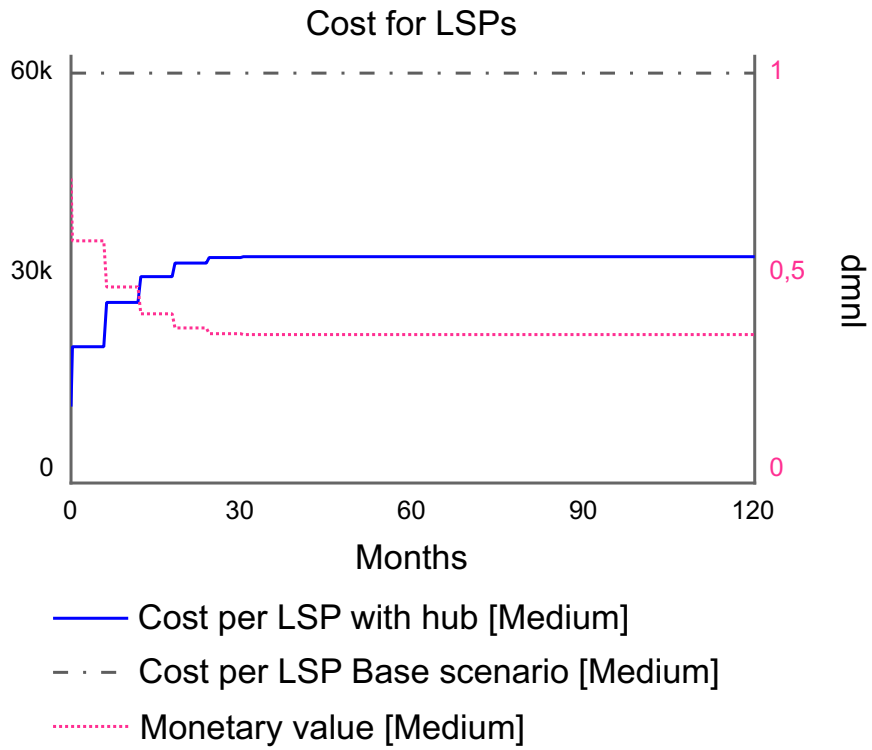
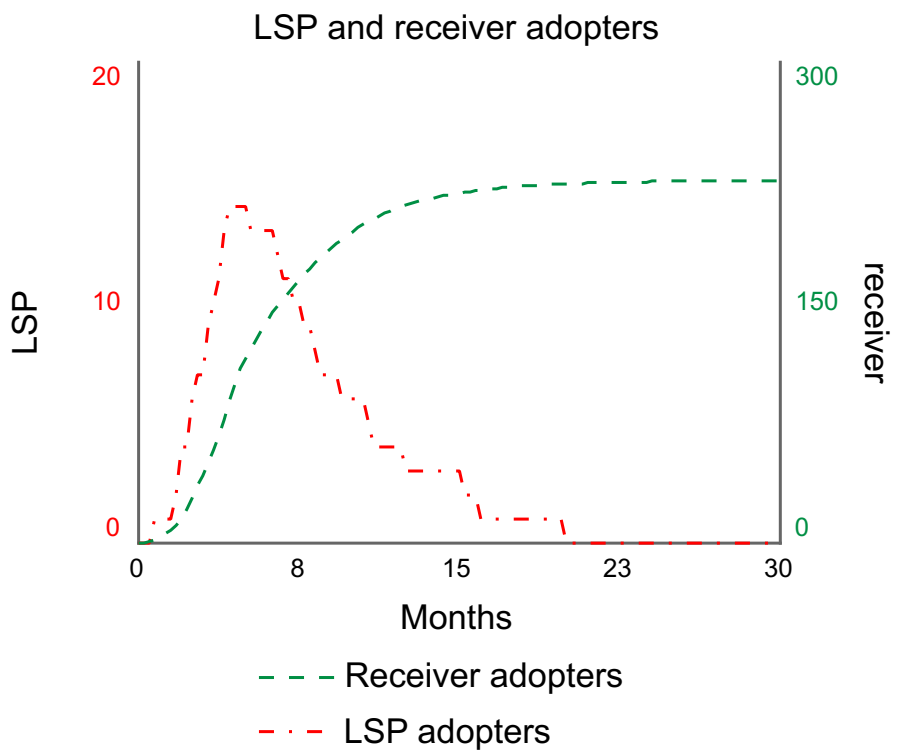




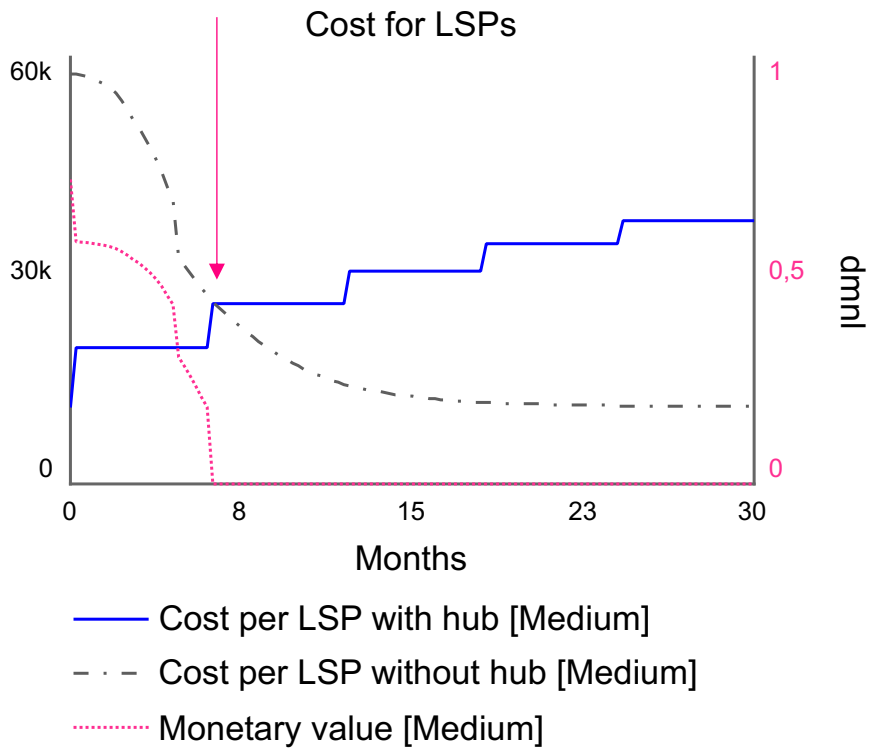
Scenario 4 – LSPs and Receivers

Input data	
Advertisement towards LSP	10% effectiveness
Initial LSP fee	0 kr/month
Advertisement towards receivers	10% effectiveness
Initial receivers fee	0 kr/month

Different assumption:
The LSP know about the cost reduction without hub



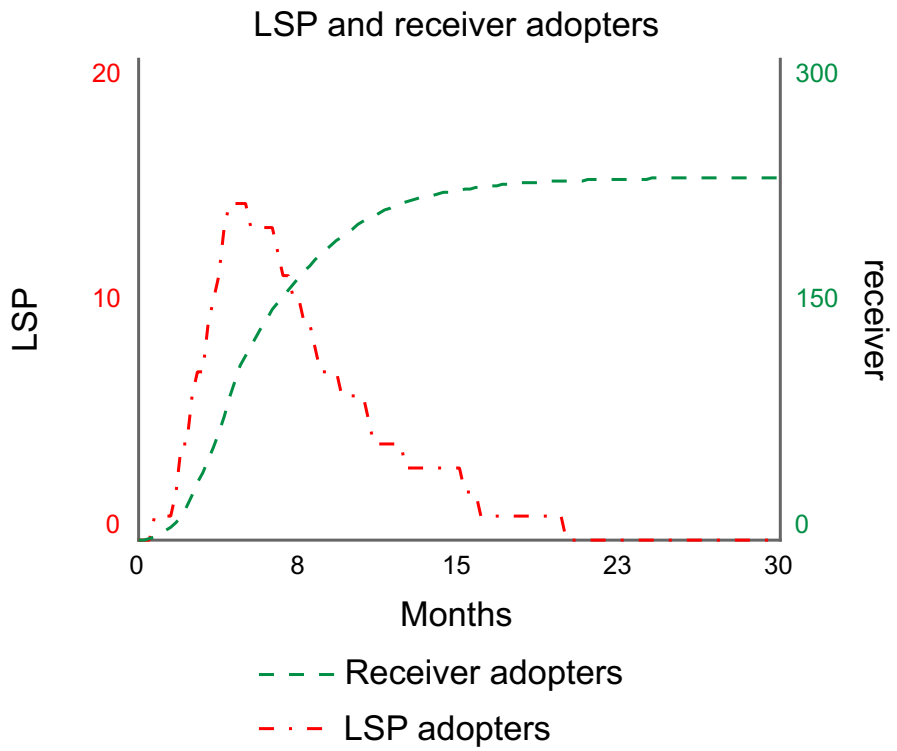
cost without hub
< cost with hub



Scenario 4 – LSPs and Receivers

Input data	
Advertisement towards LSP	10% effectiveness
Initial LSP fee	0 kr/month
Advertisement towards receivers	10% effectiveness
Initial receivers fee	0 kr/month

Different assumption:
The LSP know about the cost reduction without hub



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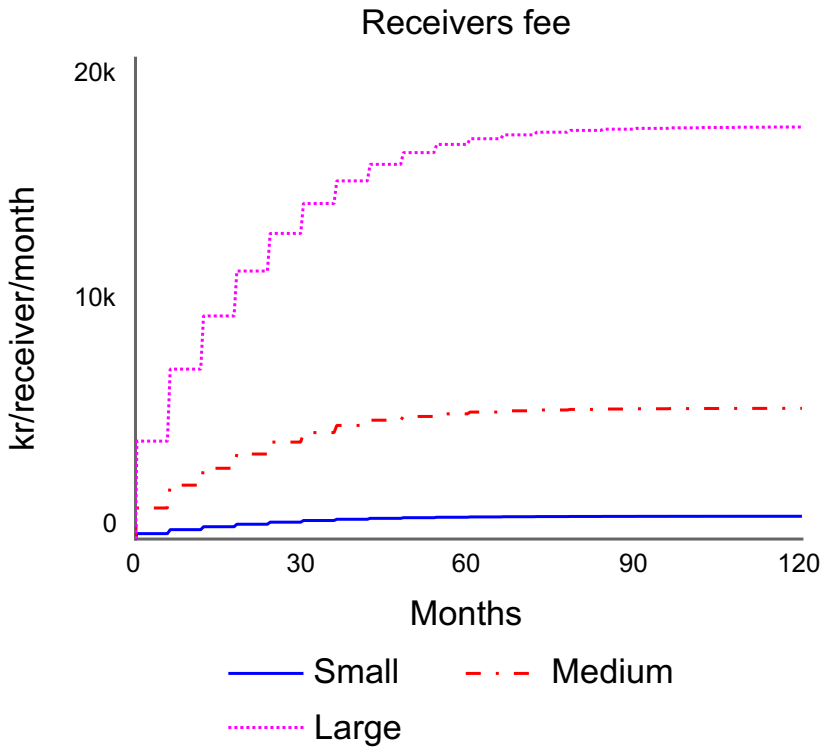
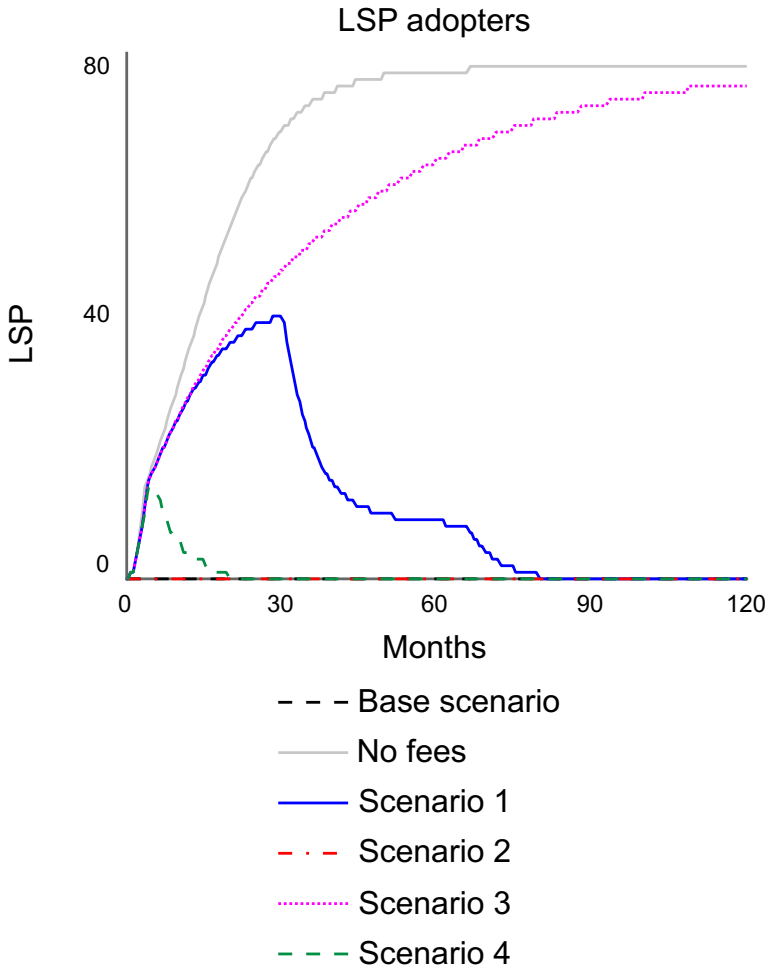
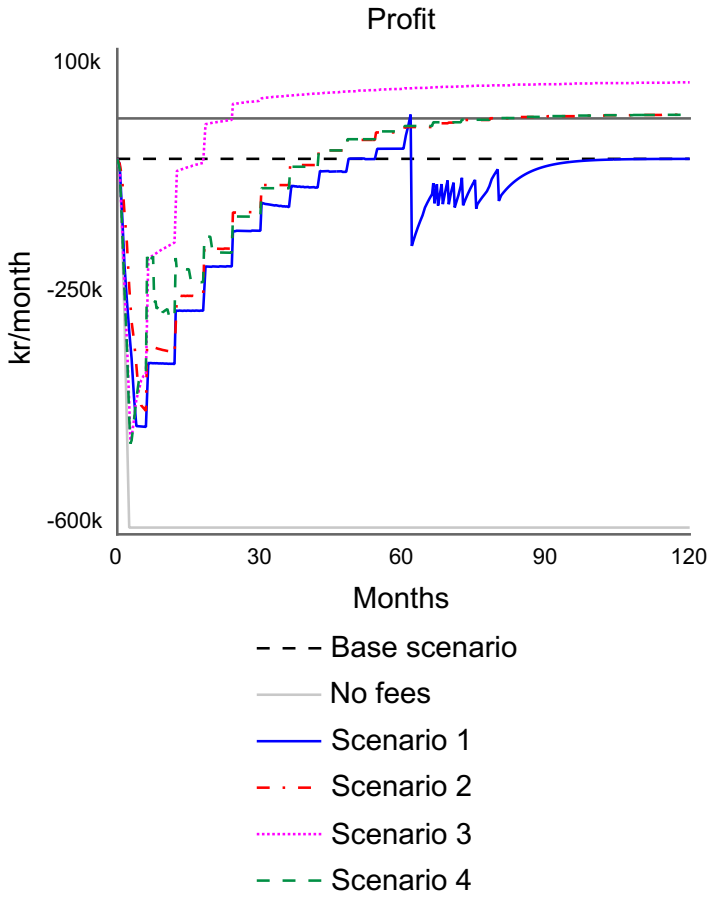
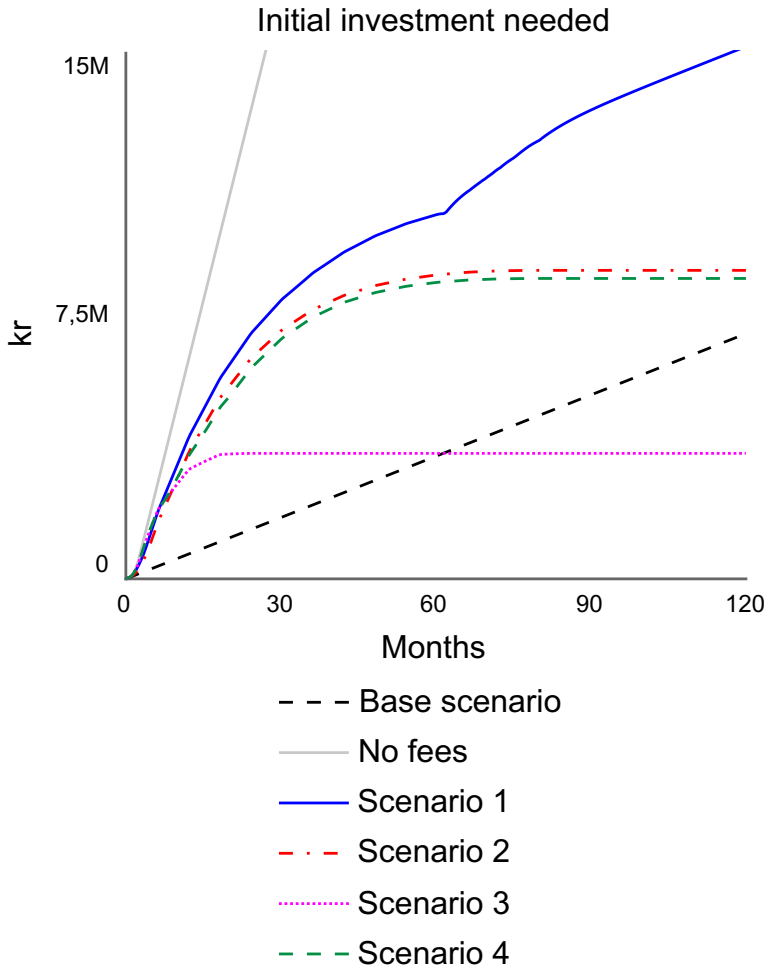


Scenario comparison







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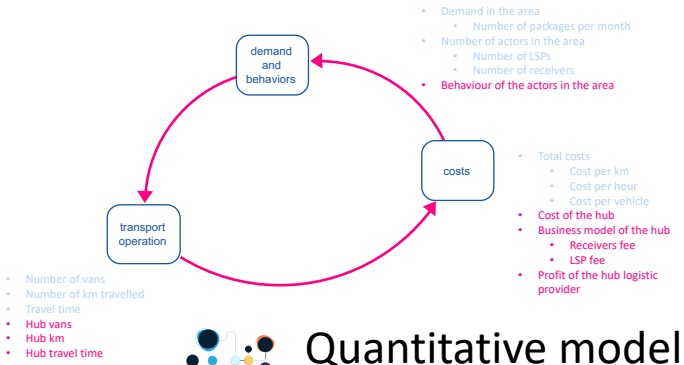
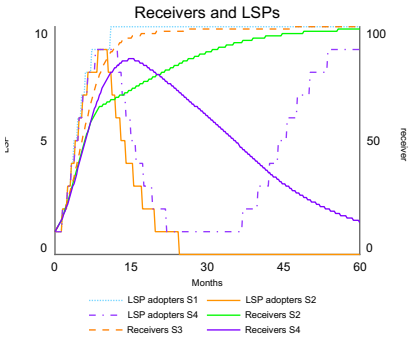
Conclusions



Quantitative model on city hub introduction



Scenario analysis considering different business models

Logistic Service Providers (LSPs)

Low cost reduction

High receiver fee

City hub

Receivers

Lower receiver fee if we include both actors… but it depends on knowledge!

Thank you for your attention!

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