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Spectrum 5.0: Policy choices for 5G deployment.

Assessing 5G Capacity, Coverage and Cost Scenarios for The Netherlands

Dr Zoraida Frias
Dr Edward Oughton

14 September 2018, Madrid

MISTRAL: Multi-scale InfraSTRucture systems AnaLytics

Modelling and Analysis of UK and Global Infrastructure Transitions

Energy | Transport | Digital Communications | Water | Waste

Consortium Leader – Professor Jim Hall (University of Oxford)

- Support from EPSRC ~ £5 million
- University contributions ~ £1 million
- Industry contributions ~ £2 million

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MISTRAL: Multi-scale InfraSTRucture systems AnaLytics

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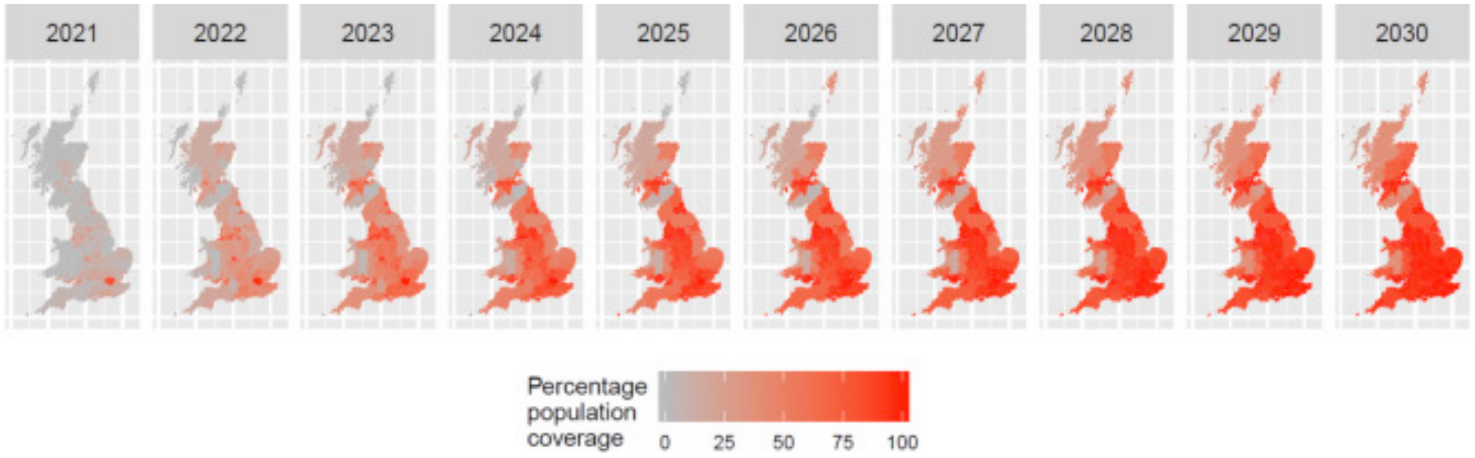
- Consortium research questions
  - *How will infrastructure systems perform in the context of major future changes like **population growth, technological change and climate change?***
  - *What would be the benefits of investing in new infrastructure **capacity** or of endeavouring to **manage demand** for infrastructure services?*
- New tools and methodologies

Analysis of future 5G rollout scenarios for Britain



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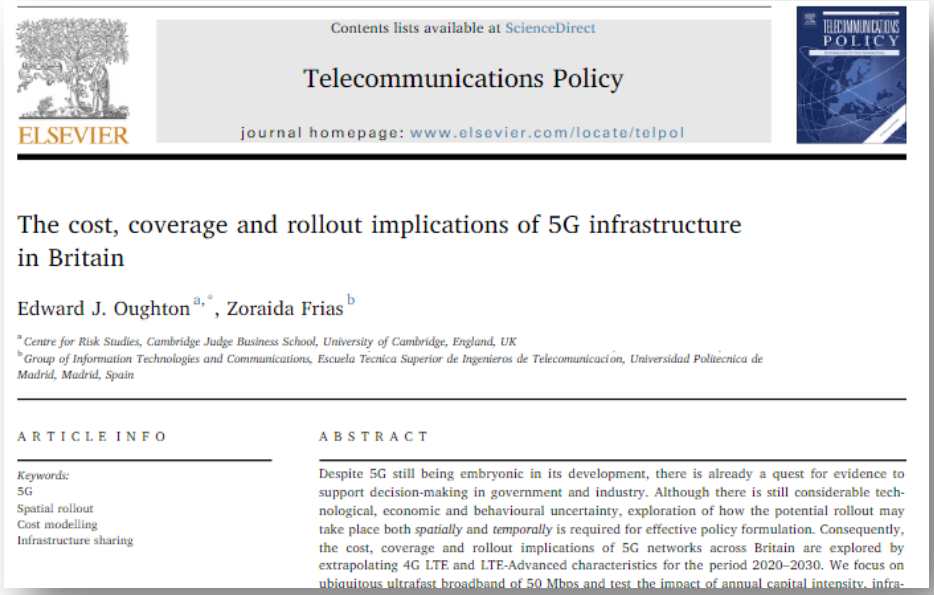

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The cost, coverage and rollout implications of 5G infrastructure in Britain

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ABSTRACT

Despite 5G still being embryonic in its development, there is already a quest for evidence to support decision-making in government and industry. Although there is still considerable technological, economic and behavioural uncertainty, exploration of how the potential rollout may take place both *spatially* and *temporally* is required for effective policy formulation. Consequently, the cost, coverage and rollout implications of 5G networks across Britain are explored by extrapolating 4G LTE and LTE-Advanced characteristics for the period 2020–2030. We focus on ubiquitous ultrafast broadband of 50 Mbps and test the impact of annual capital intensity, infra-

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Application to the Netherlands

Ministerie van Economische Zaken

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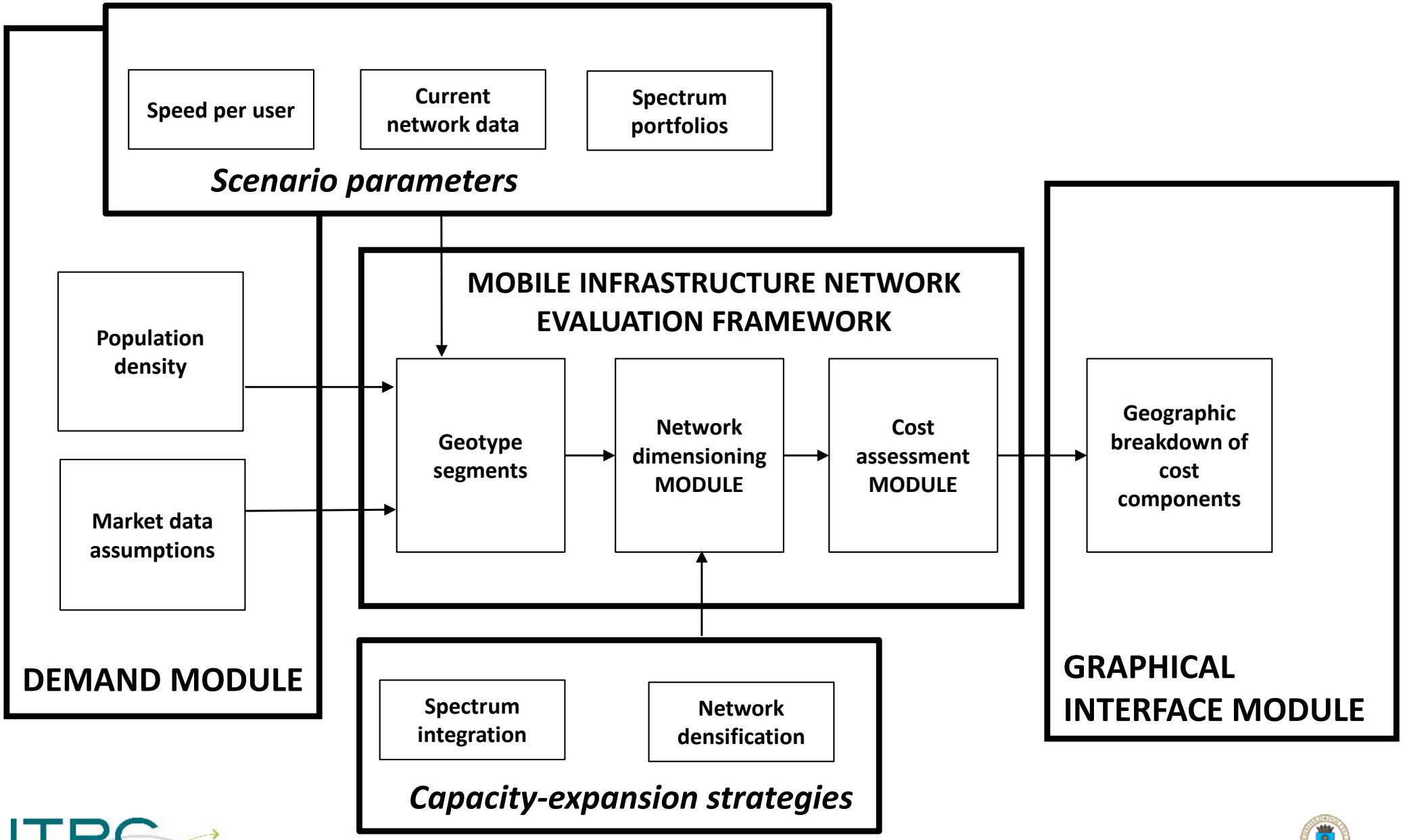
2. Methodology
3. Results
4. Findings
5. Future work

Research questions

1. What are the key costs components in the rollout of 5G under different capacity-expansion strategies?
2. What is the cumulative cost in relation to population coverage?
3. How do different strategies perform in meeting demand?
4. What are the costs per user?

Methodology



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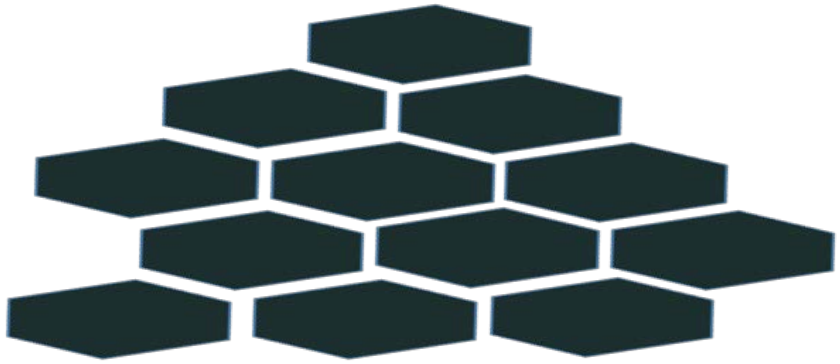
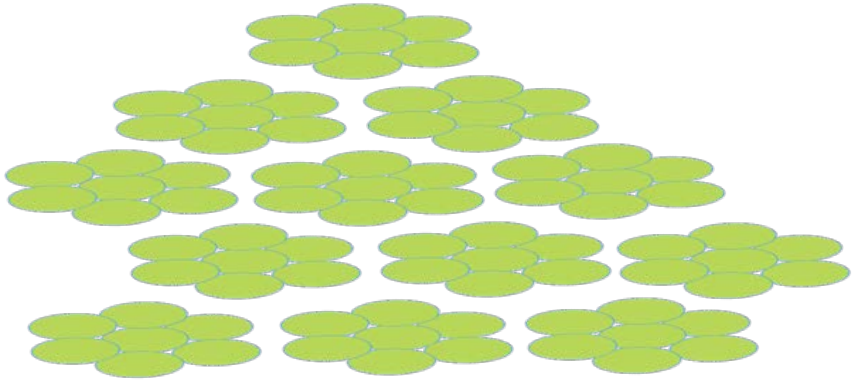
Infrastructure strategy options



Spectrum integration

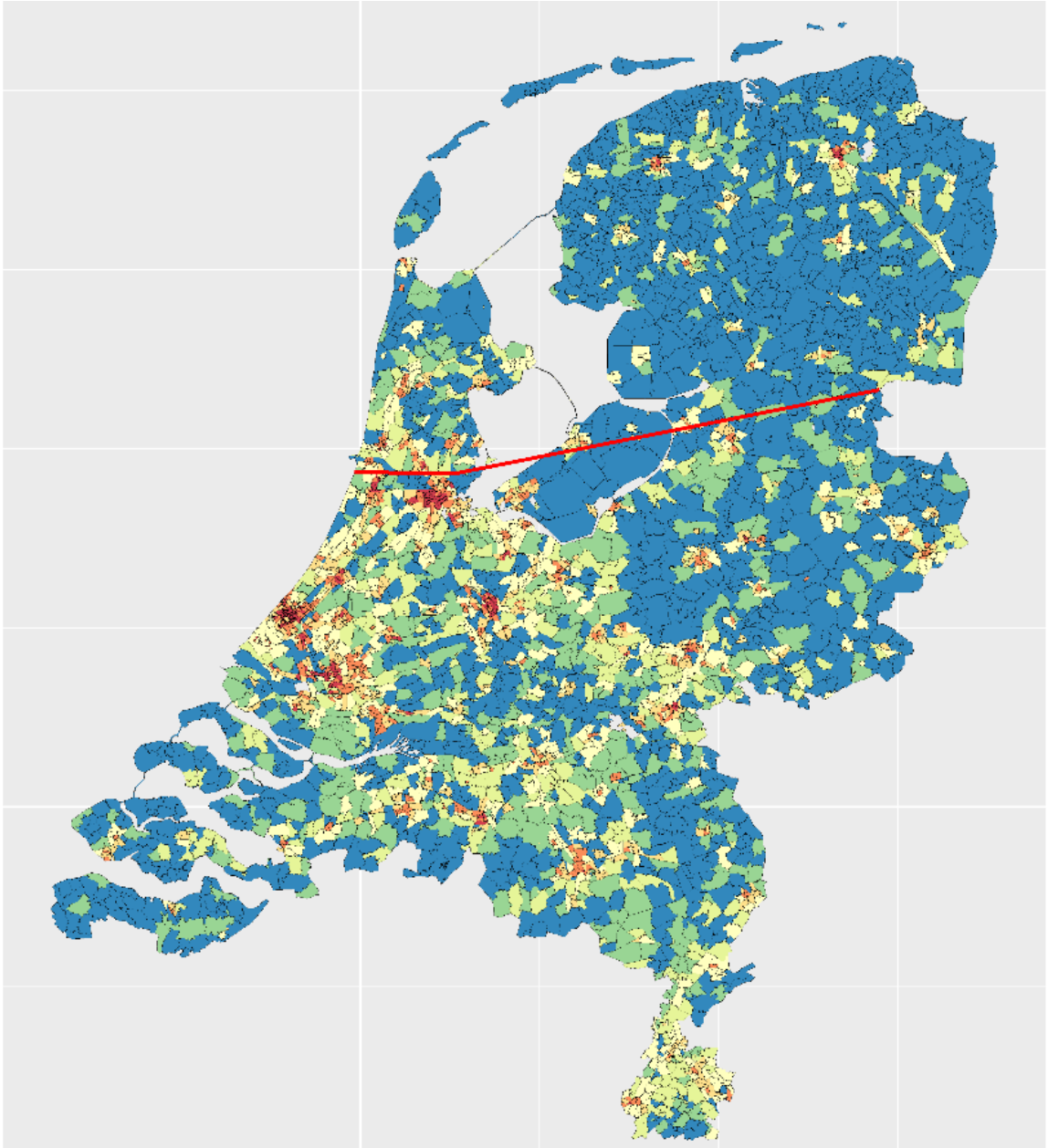
- Multi-carrier capabilities
- Using 700 MHz and 3500 MHz bands



Network densification (small cells)

- Small cells deployed on street furniture
- Using 3700 MHz band
- Cell range ~ 200 m

Geotypes



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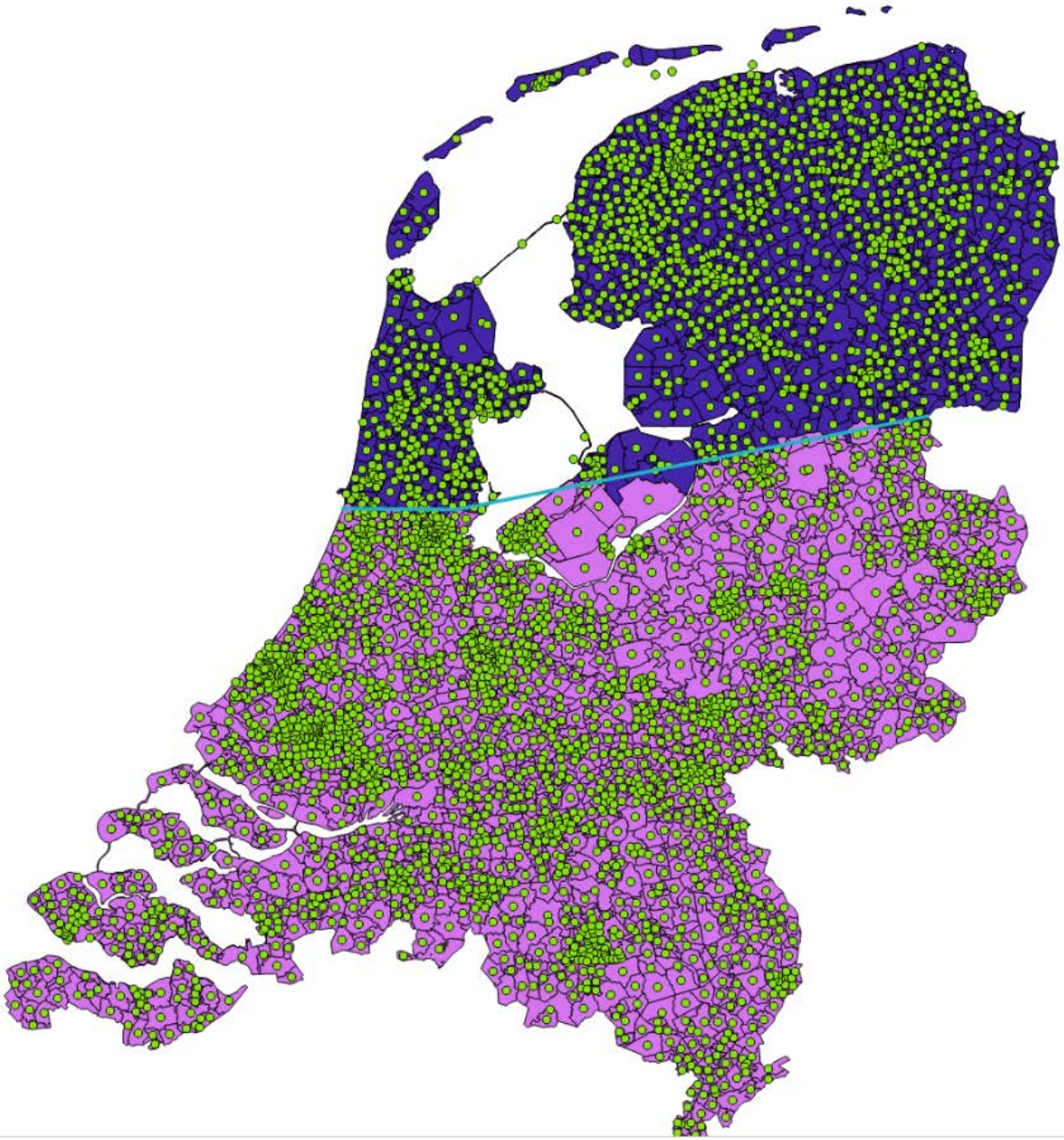
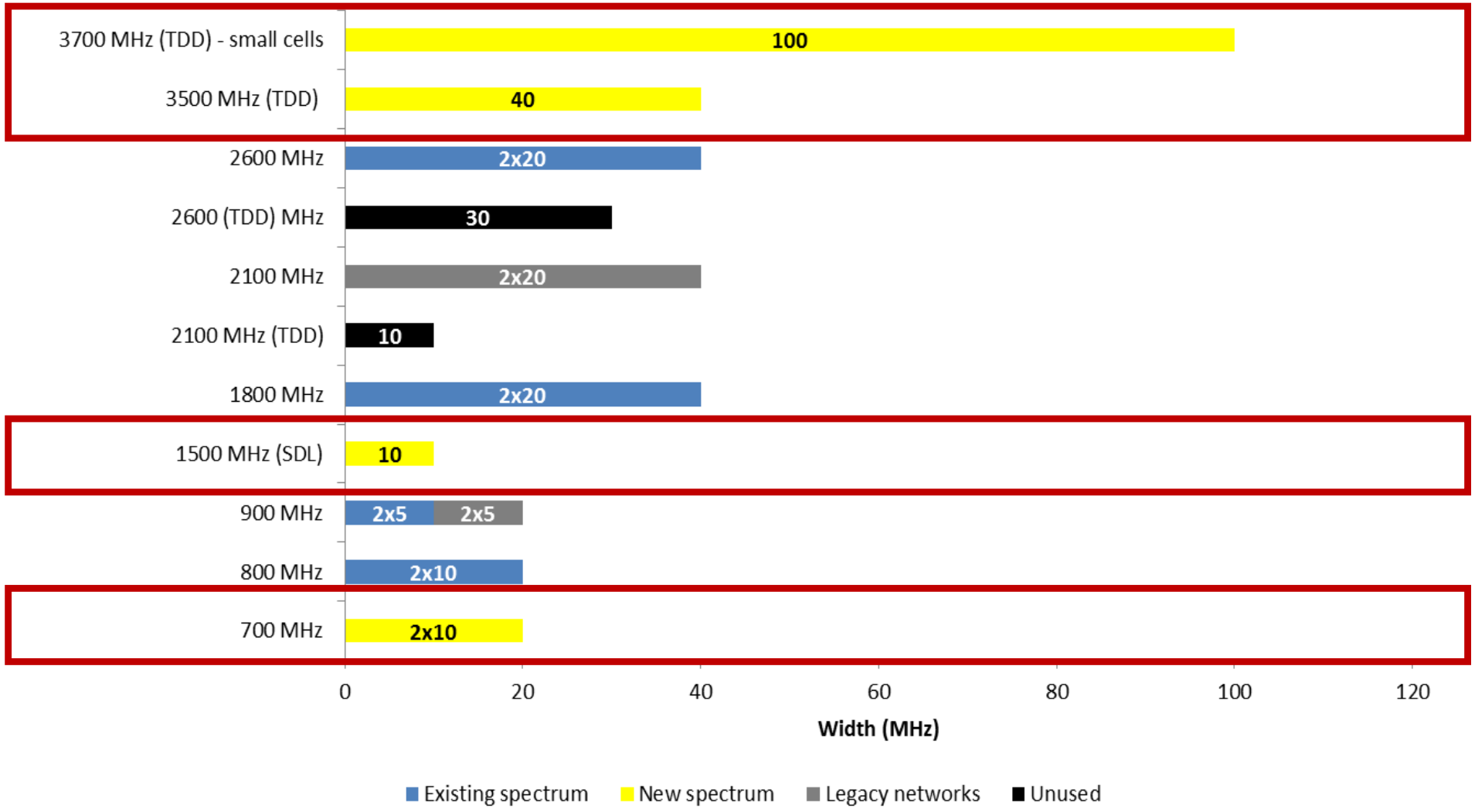
Methodology



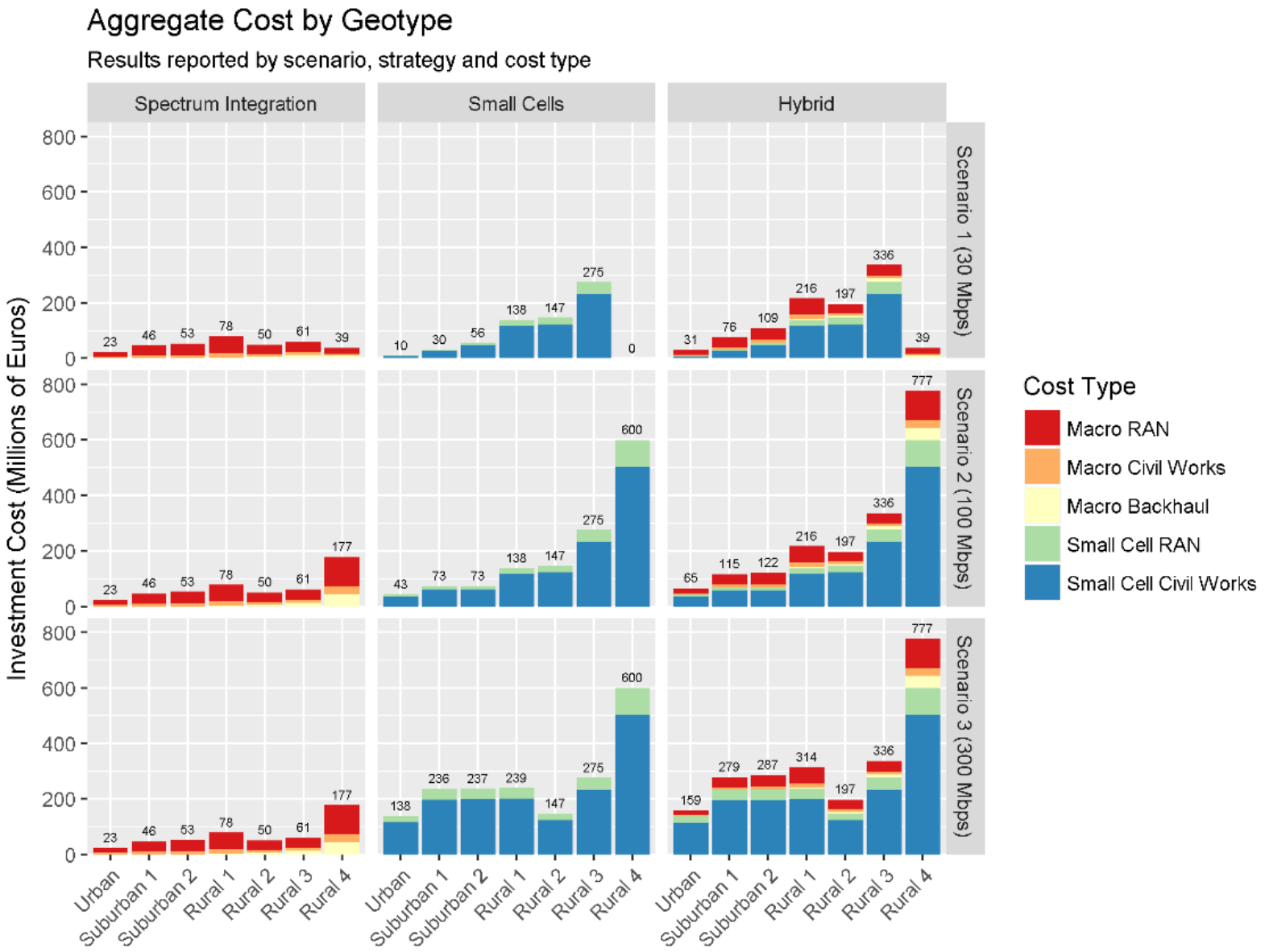
Market data assumptions

- We model *hypothetical* operators
- Market share : 30%
- Site share: 50 %
- Spectrum configuration:
  - Described below in current network data

Spectrum portfolio



Results



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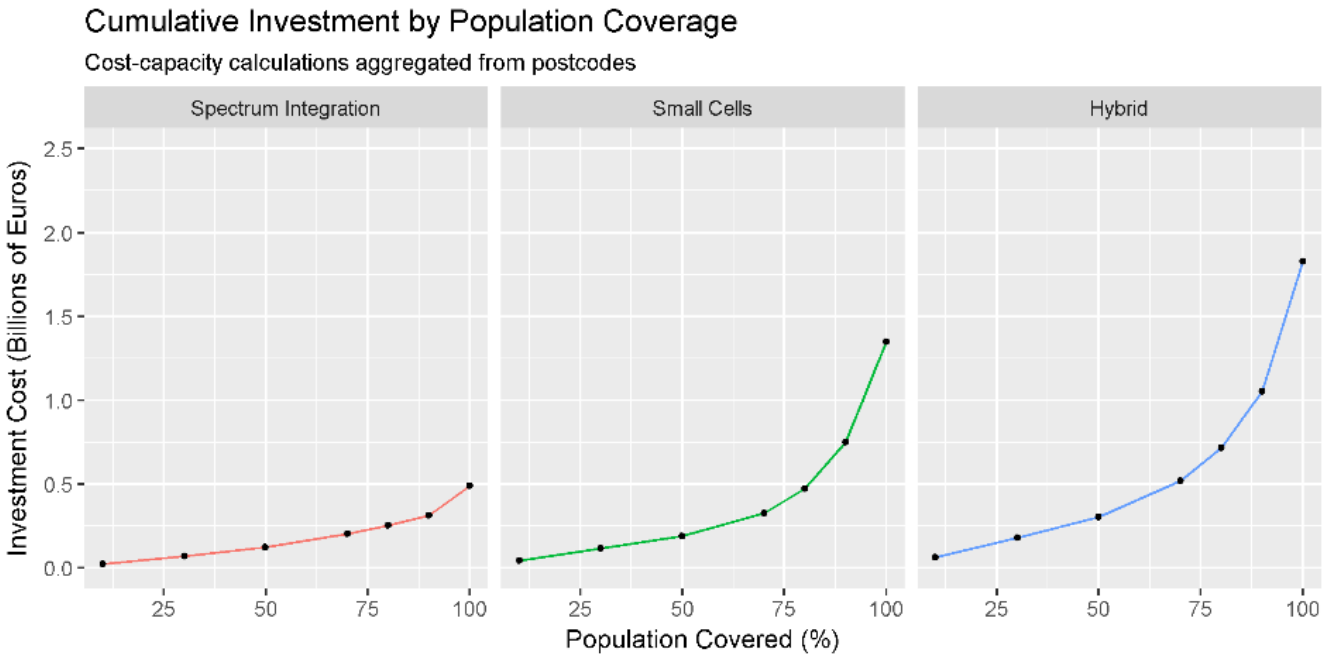
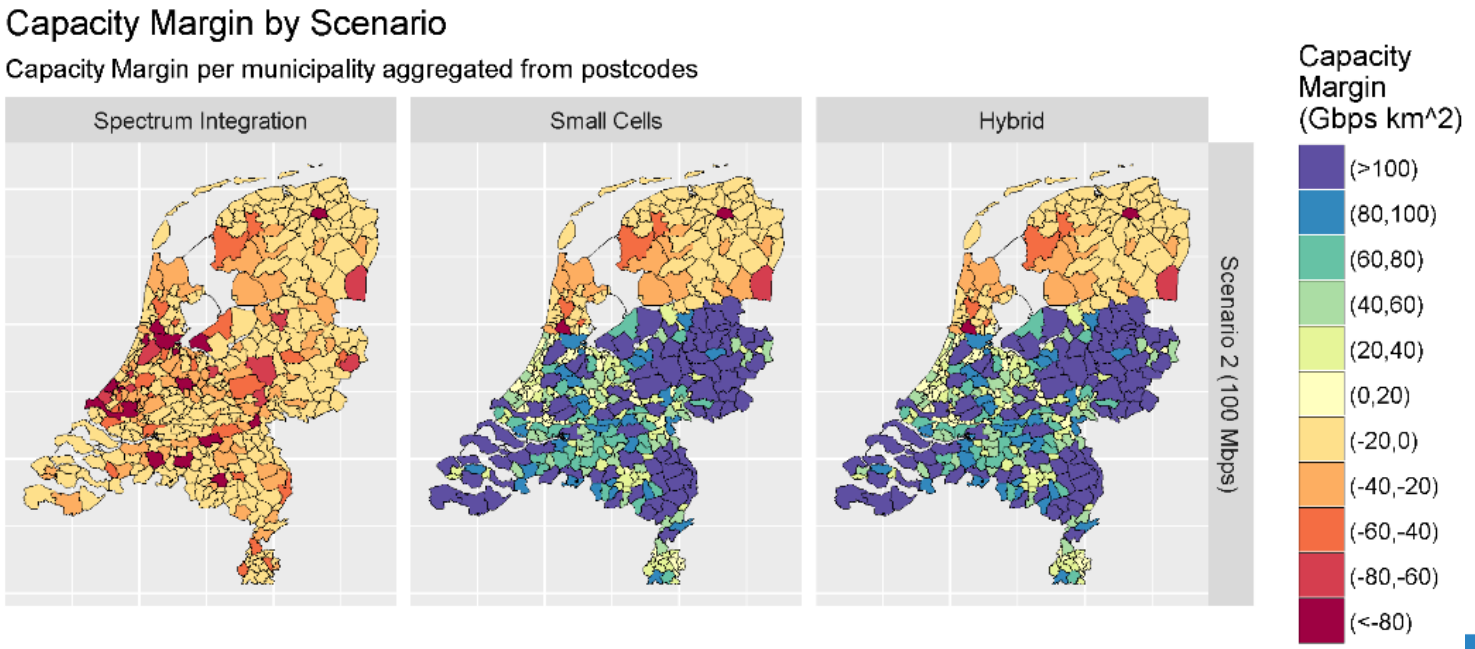
Results – Scenario 2 (100 Mbps)





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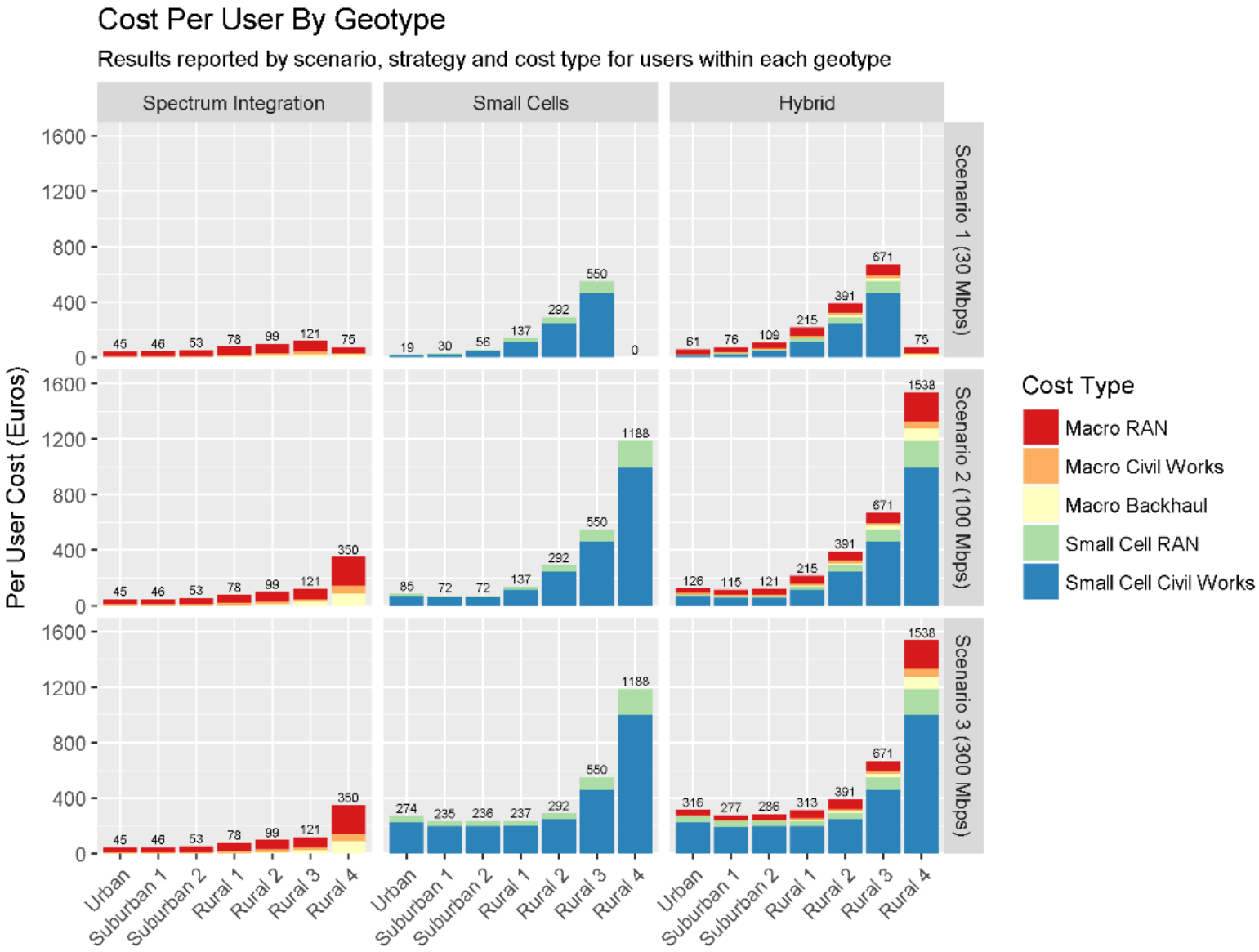
Results



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Findings

1. **What are the key costs components in the rollout of 5G under different capacity-expansion strategies?**
   - High speeds: civil works
   - Low speed: RAN costs -> bandwidth and spectrum prices

Findings

2. **What is the cumulative cost in relation to population coverage?**

3. **How do different strategies perform in meeting demand?**

	50 % pop	100 % pop	Likely strategy
30 Mbps	120 M€	350 b€	Spectrum integration / Network densification
100 Mbps	250 M€	1.4 b€	Network densification
300 Mbps	650 M€	1.8 b€	Network densification

Findings

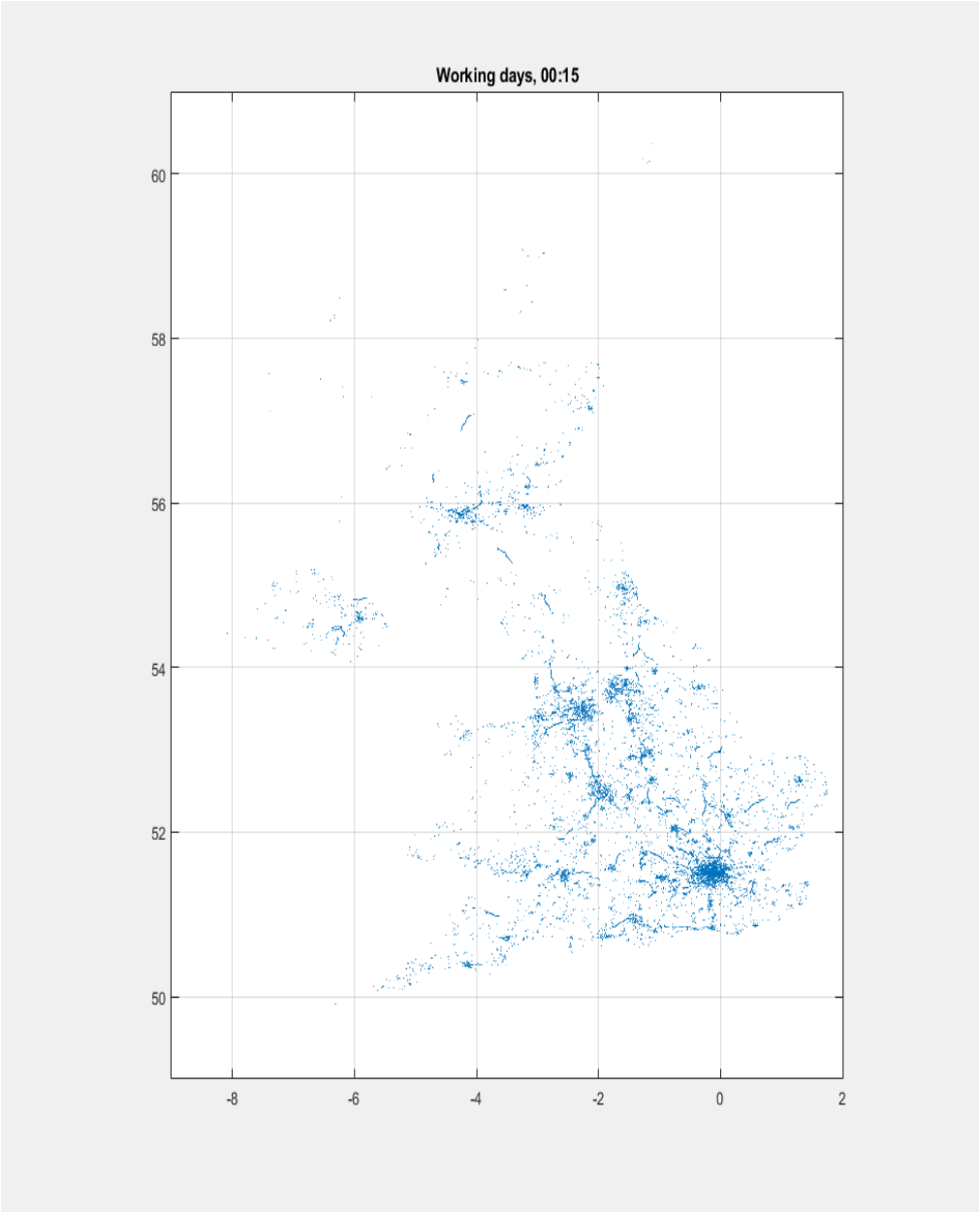
4. What are the costs per user?

	Spectrum strategy	Network densification (small cells)
30 Mbps	45 – 74 €	19 – 550 €
100 Mbps		85 – 1,200 €
300 Mbps		270 – 1,200 €

Limitations

- mmW may provide substantial cost-effective additional capacity
- Even if The Netherlands was a good case study, some input data are uncertain.
- Using population data may underestimate costs in rural areas.

Future work



Thank You!

Report

https://www.rijksoverheid.nl/documenten/rapporten/2018/04/05/onderzoek-naar-de-kosten-van-5g-uitrol-english

Further project information:

www.itrc.org.uk

Code/model:

www.github.com/nismod/digital_comms

Contact:

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Spectrum 5.0: Policy choices for 5G deployment.

BACK UP SLIDES

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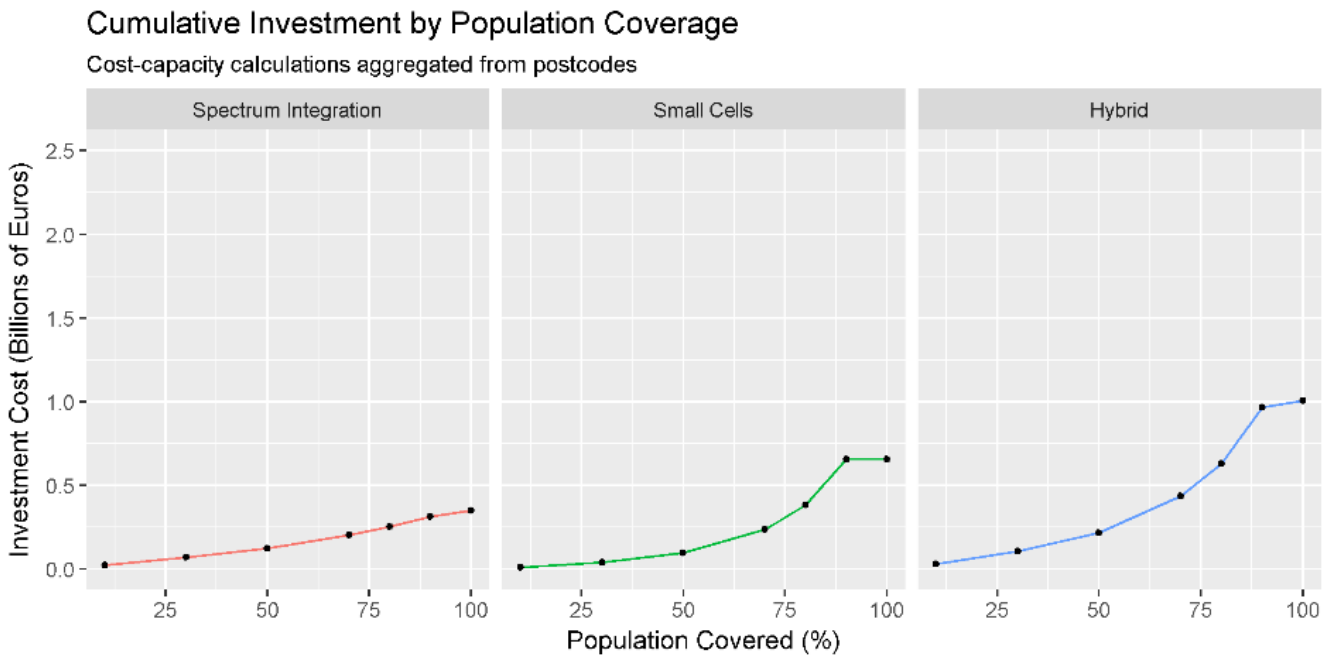
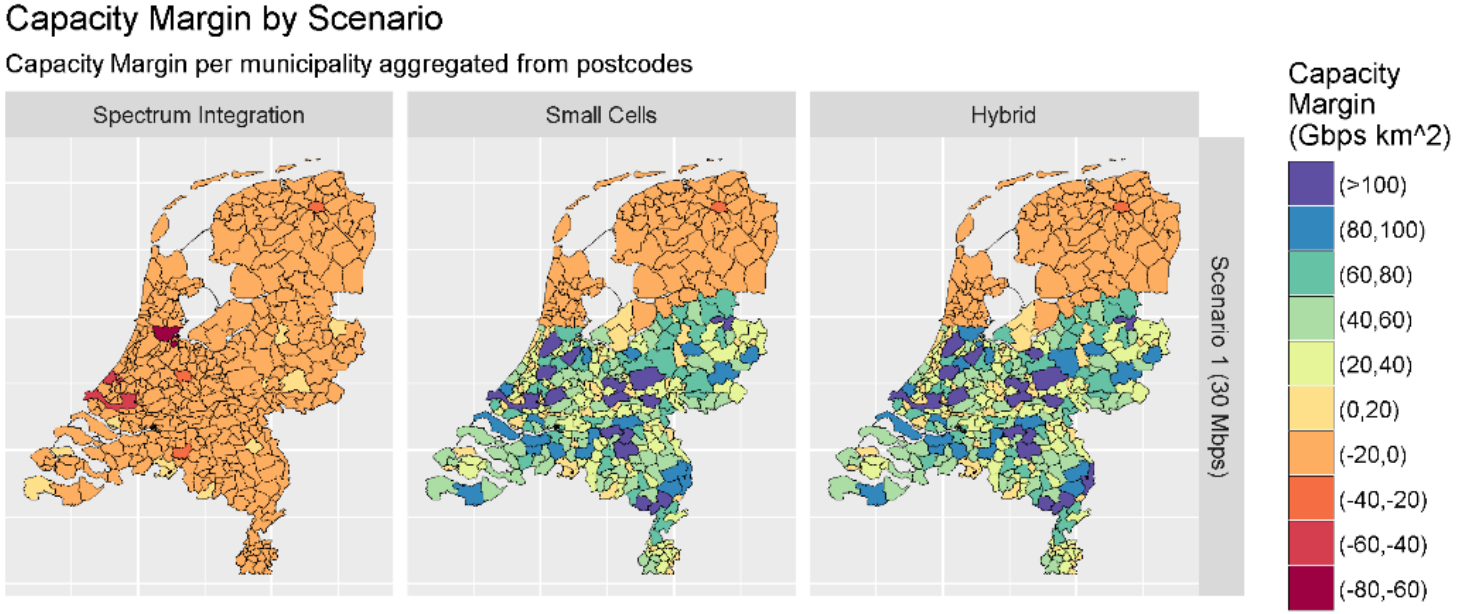
Cost elements

Strategy	Spectrum integration on macrocellular network				Network densification through small cells		
Cost type	**Deploying a 5G multicarrier BS**	**Additional carrier on current BS**	**Civil works**	**Fibre backhaul**	**Small cell equipment**	**Small cell civil works**	**Small cell backhaul**
Unit	BS	Carrier	Cell site	Km	Cell site	Cell site	-
Capex (€)	45,673	16,750	20,101	22,334	2,791	14,852	-

Data source: Ofcom, 5G NORMA and internal workshop with MNOs in The Netherlands

Results – Scenario 1 (30 Mbps)





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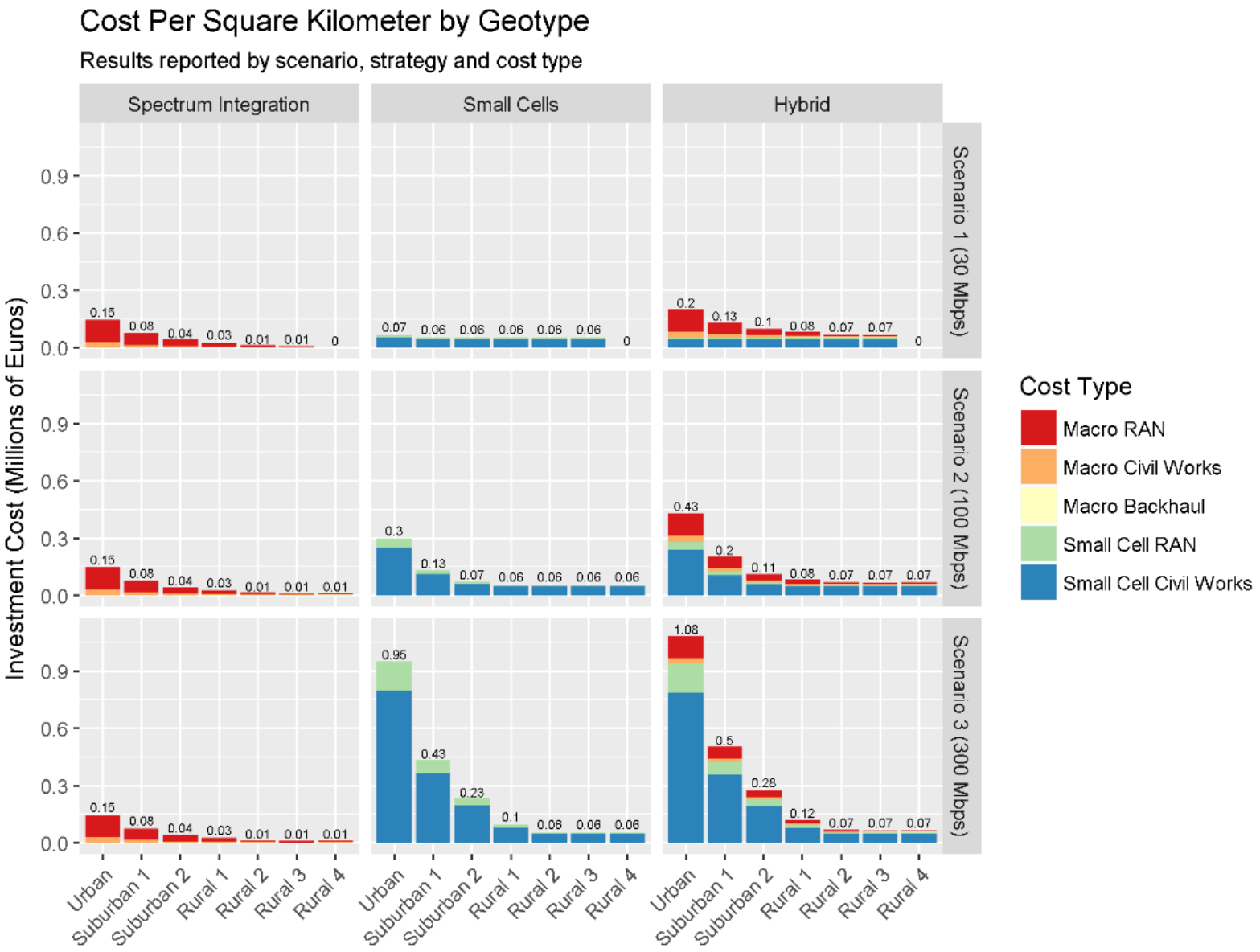
Results



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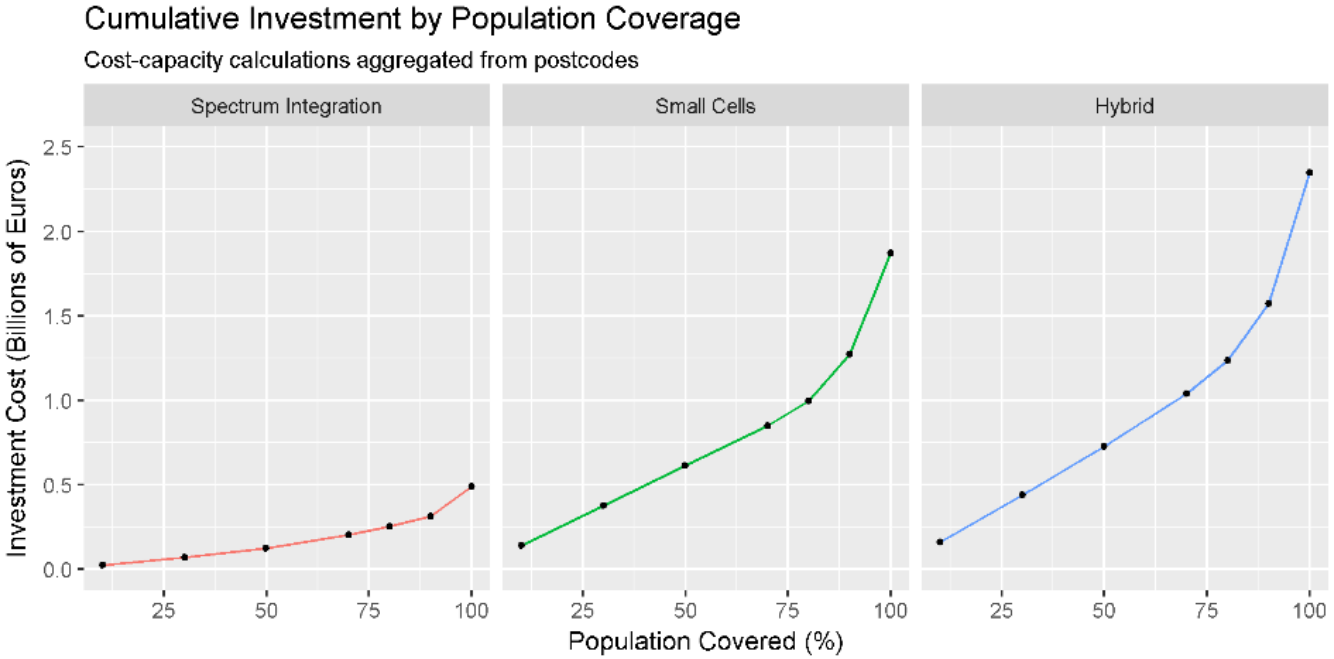
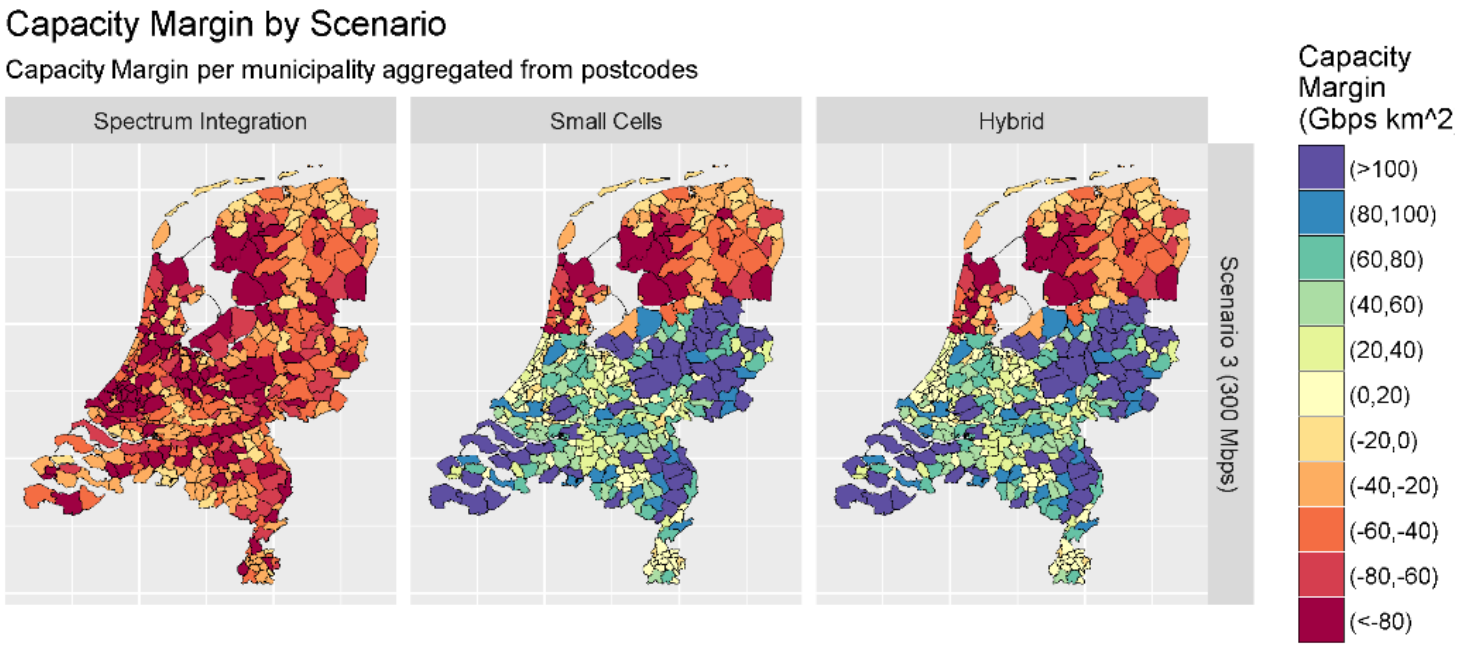
Results – Scenario 3 (300 Mbps)





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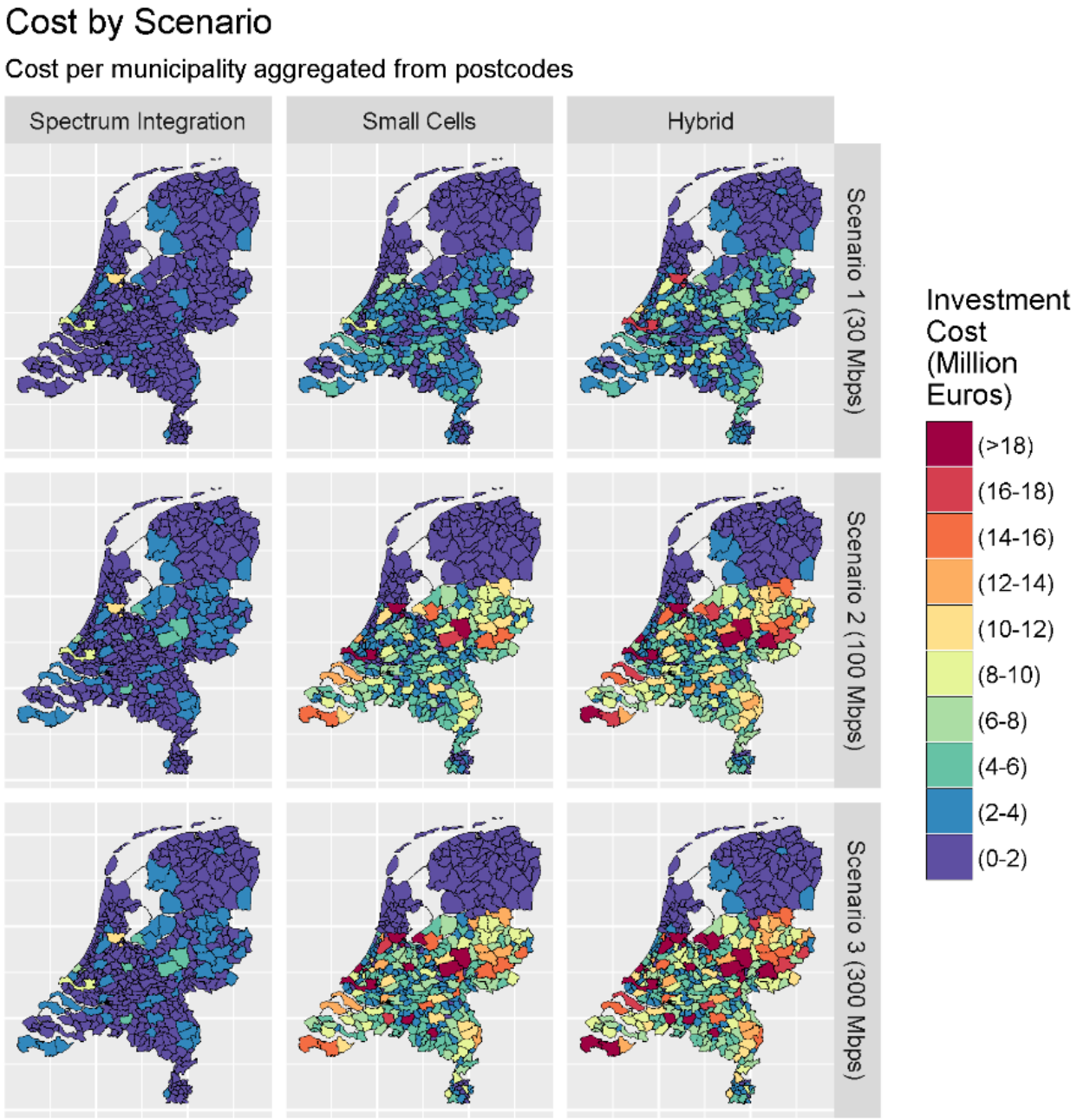

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