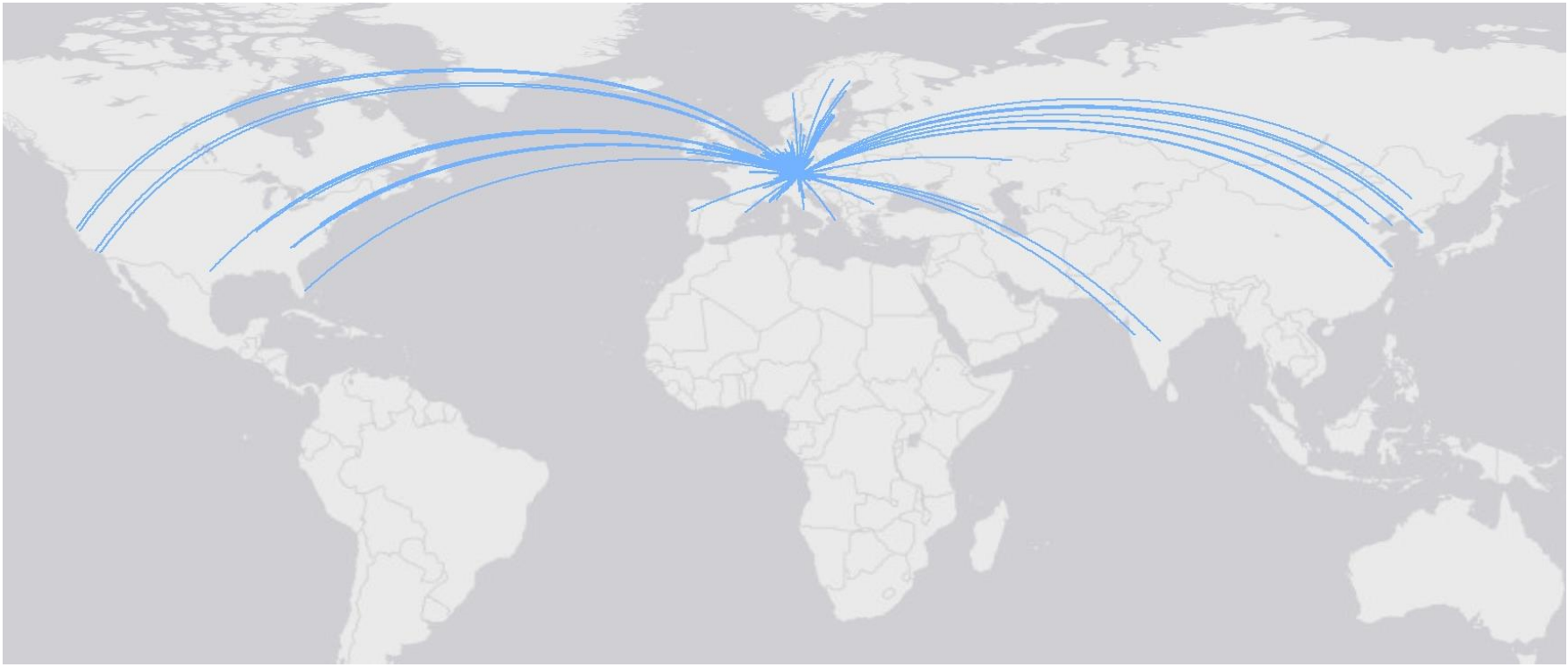
Chair of Urban Development
Department of Architecture
Technical University of Munich



Spatial effects of digital transformation.
An analysis on the example of an automotive R&D network

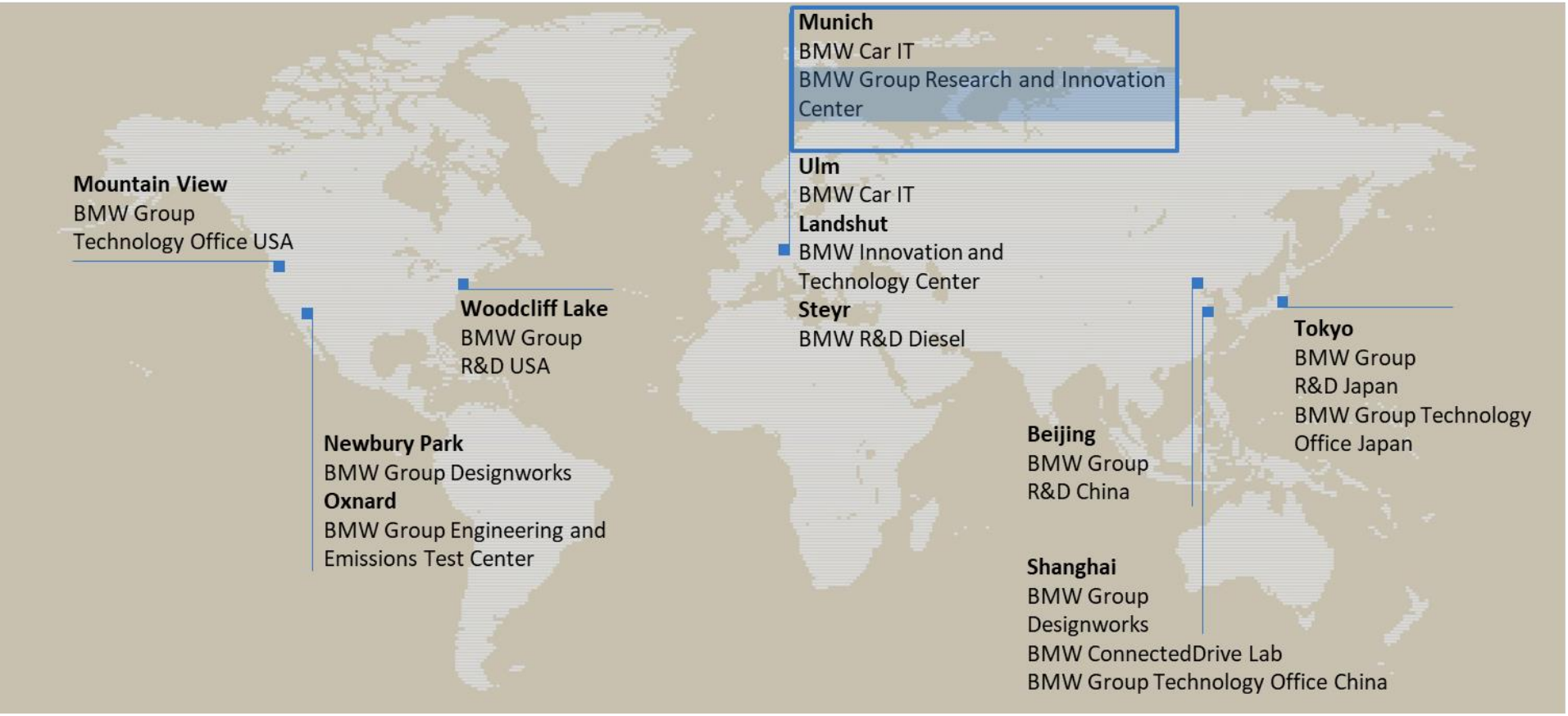
Jonas Glaesser

Overview

1. Introduction: The challenges of the automotive industry
2. Theoretical background
3. Question and hypothesis
4. Data
5. Preliminary findings
6. Next steps

The BMW Research and Innovation Center Munich

BMW R&D Network



1 Introduction
The automotive industry in turmoil

- Financial Crisis
  - In-house or outsourcing
- Technological changes
  - Electrification
  - Autonomous Driving
  - New business models (Transportation-as-a-Service)
- Pressure of technological change
  - Economic competition
  - Time-to-Market
  - Changing regulation
- Challenges for R&D and its spatial consequences
  - Sourcing of new technologies and competences

2 Theoretical background
Spatial approaches towards innovation and proximity

National Systems of Innovation (Lundvall and Johnson 1994; Amable 2000; Gertler, Wolfe, and Garkut 2000; Hollingsworth 2000)

- Influence of institutions on firms regarding innovation and learning (technological and non-technological)

Local Innovation Systems (Amin and Cohendet 2004)

- Based on the benefits of agglomeration economies and spatial proximity between firms
- Co-location and collaboration that support competition
- Clustering
- Urban amenities (Jacobs 1969)
- Tacit and codified knowledge

Role of proximty (Storper 1997; Boschma 2005)

3 Question and hypothesis

How does technological disruption change the spatial configuration of R&D relations?

Main Hypothesis

Technological innovation and location are interconnected.

The more established a technology is, the more likely it is to be outsourced, and the more disperse its context of origin will be.

Network Adjustment vs. Node Adjustment Hypothesis

Network Adjustment Hypothesis:

Under pressure of technological change, it is assumed that R&D networks open up to new locations, further industries, and other firms.

Node Adjustment Hypothesis:

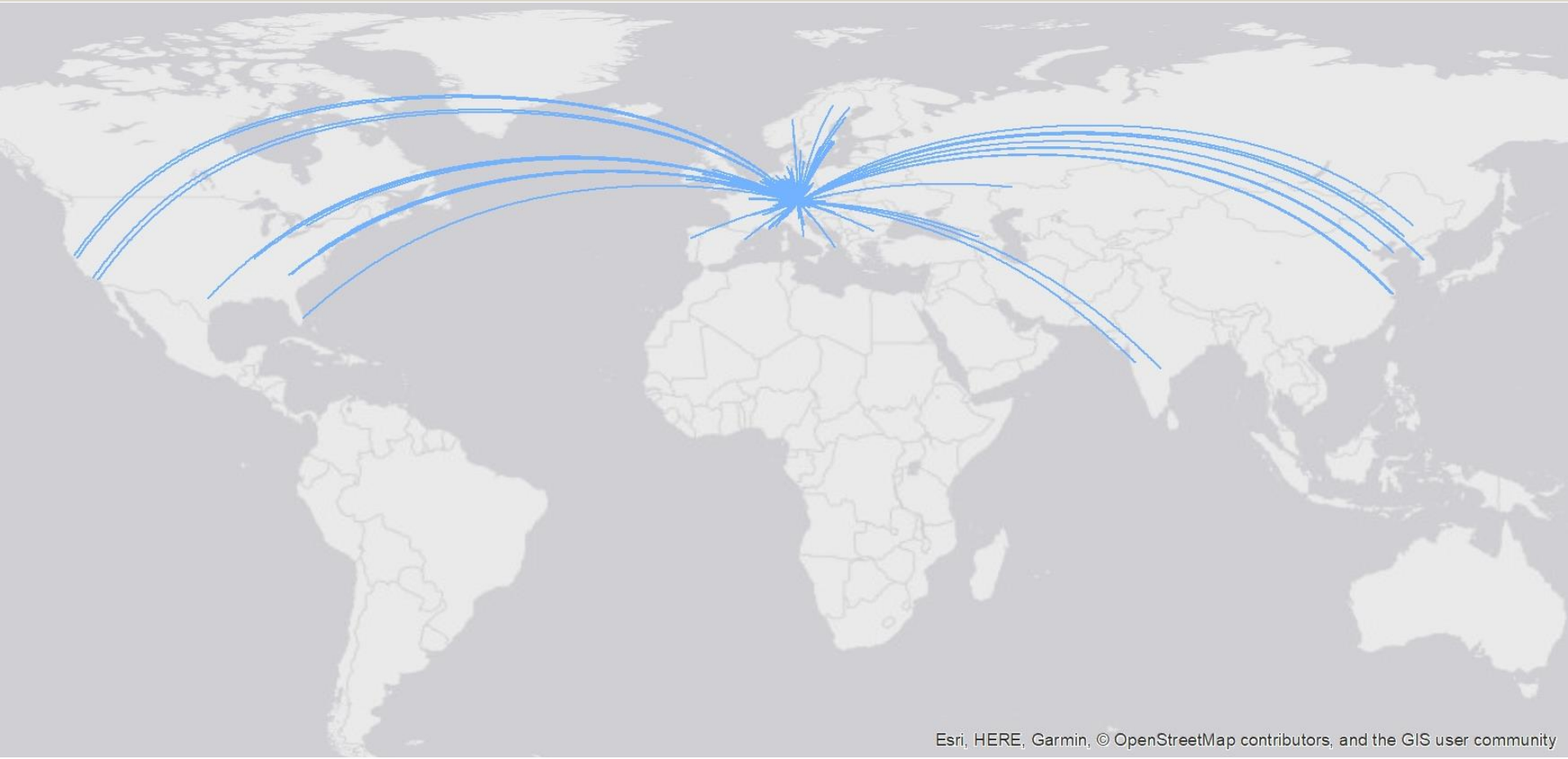
Firms (suppliers) rather change their processes and technological basis, in order to keep the existing linkages to central actors and not to lose the network as a resource for further transactions.

4 Data

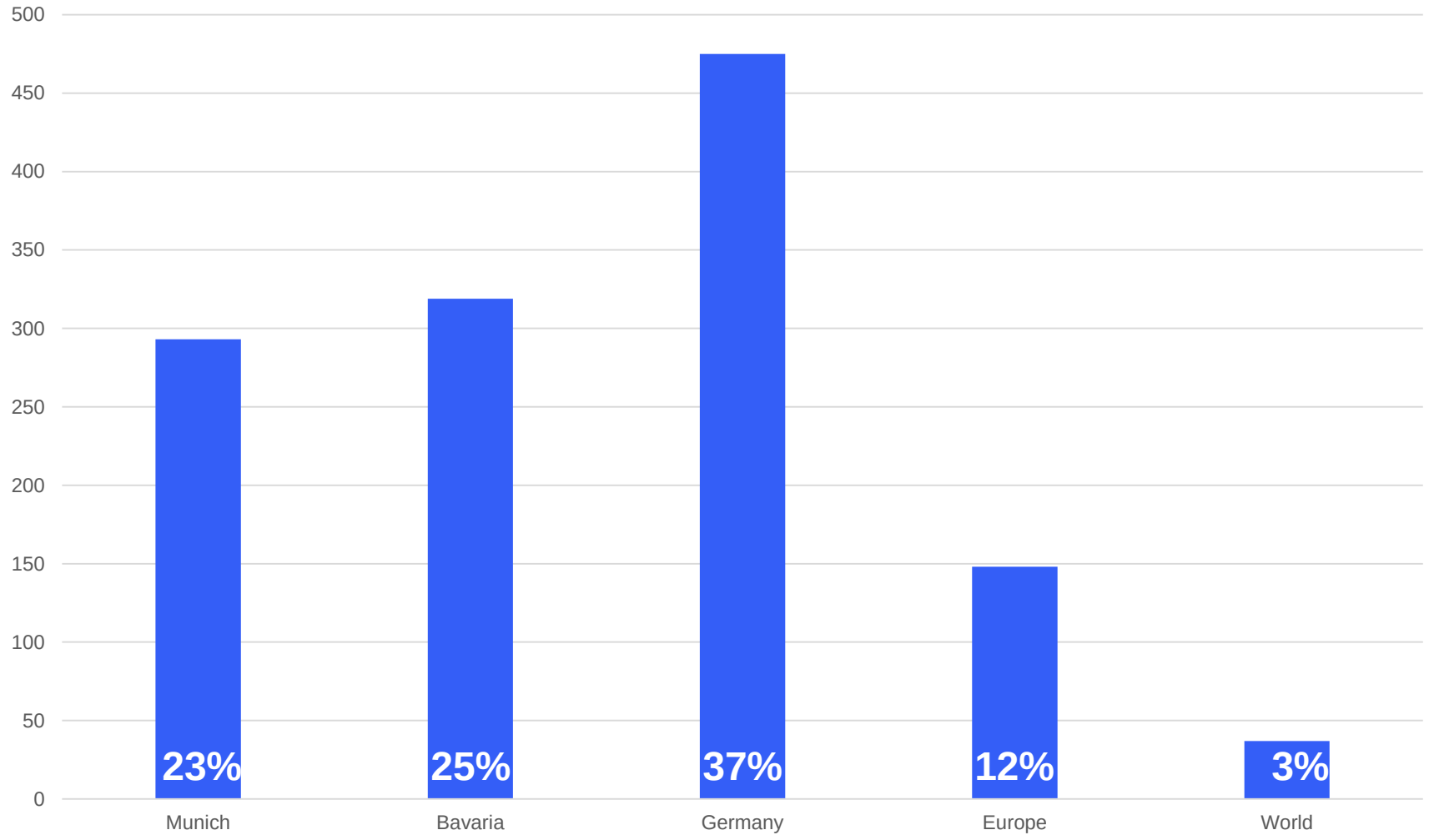
Supplier Data of BMW‘s external R&D commissions

Years	Attributes	Cases	Network perspective
2013	Internal BMW R&D department	82 BMW departments	4968 Nodes
2014	Development Service Providers	4886 firms	
2015			
2016	Commission (type of activity/service and financial amount)	114937 Transactions	114937 Edges
2017	Firm locations (exact addresses)	52 Countries	

5 Descriptive Analysis of R&D Supplier Linkages



Spatial distribution of Development Service Providers



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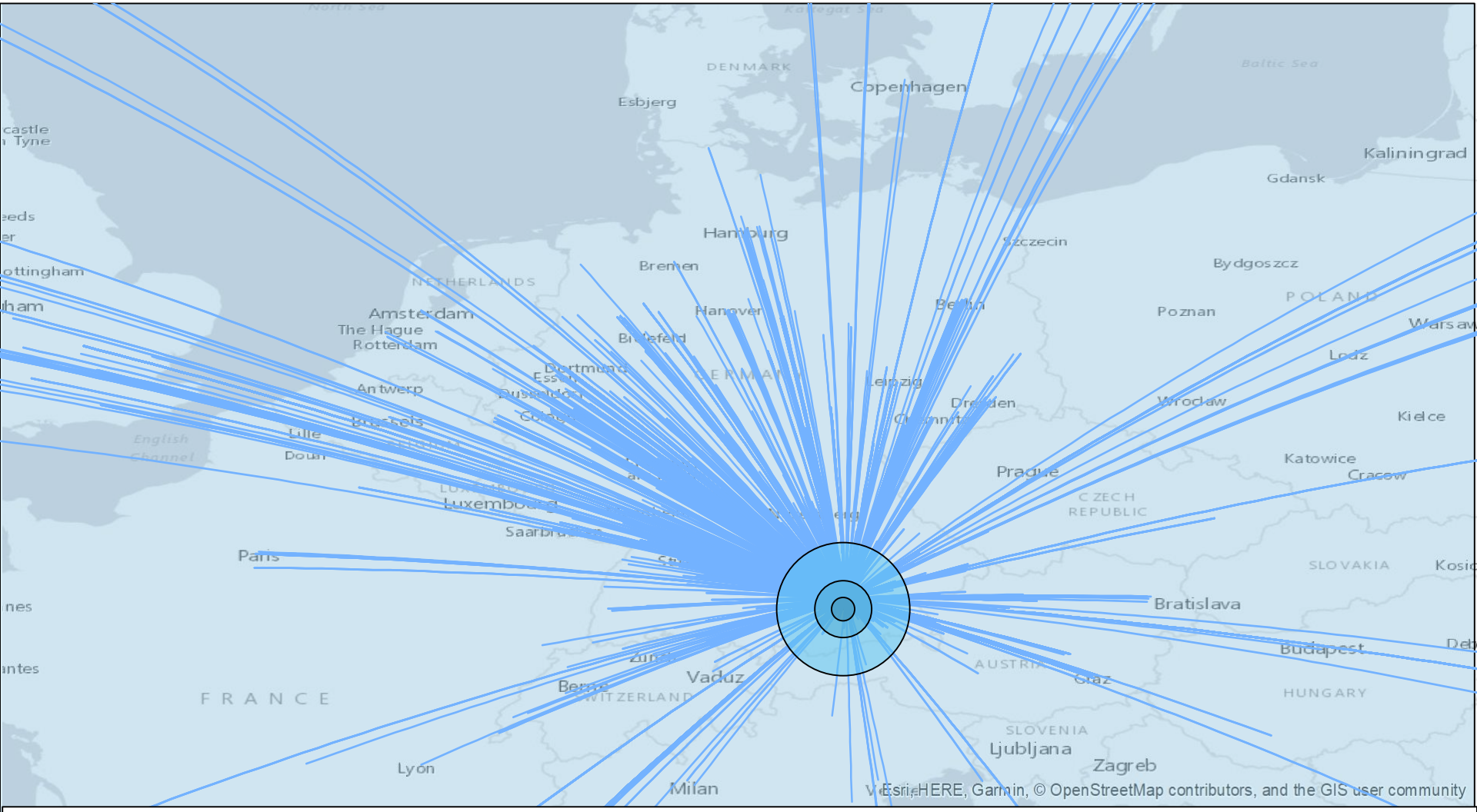
Spatial distribution of Development Service Providers transaction links

Permanent accessibility (< 5 km)	22%	1898
Commuting distance (5km to 50 km)	27%	2273
Metropolitan Region Munich (>50 km to 120 km)	6%	508
Europe	44%	3757
World	1%	78

Spatial distribution of Development Service Providers transaction links



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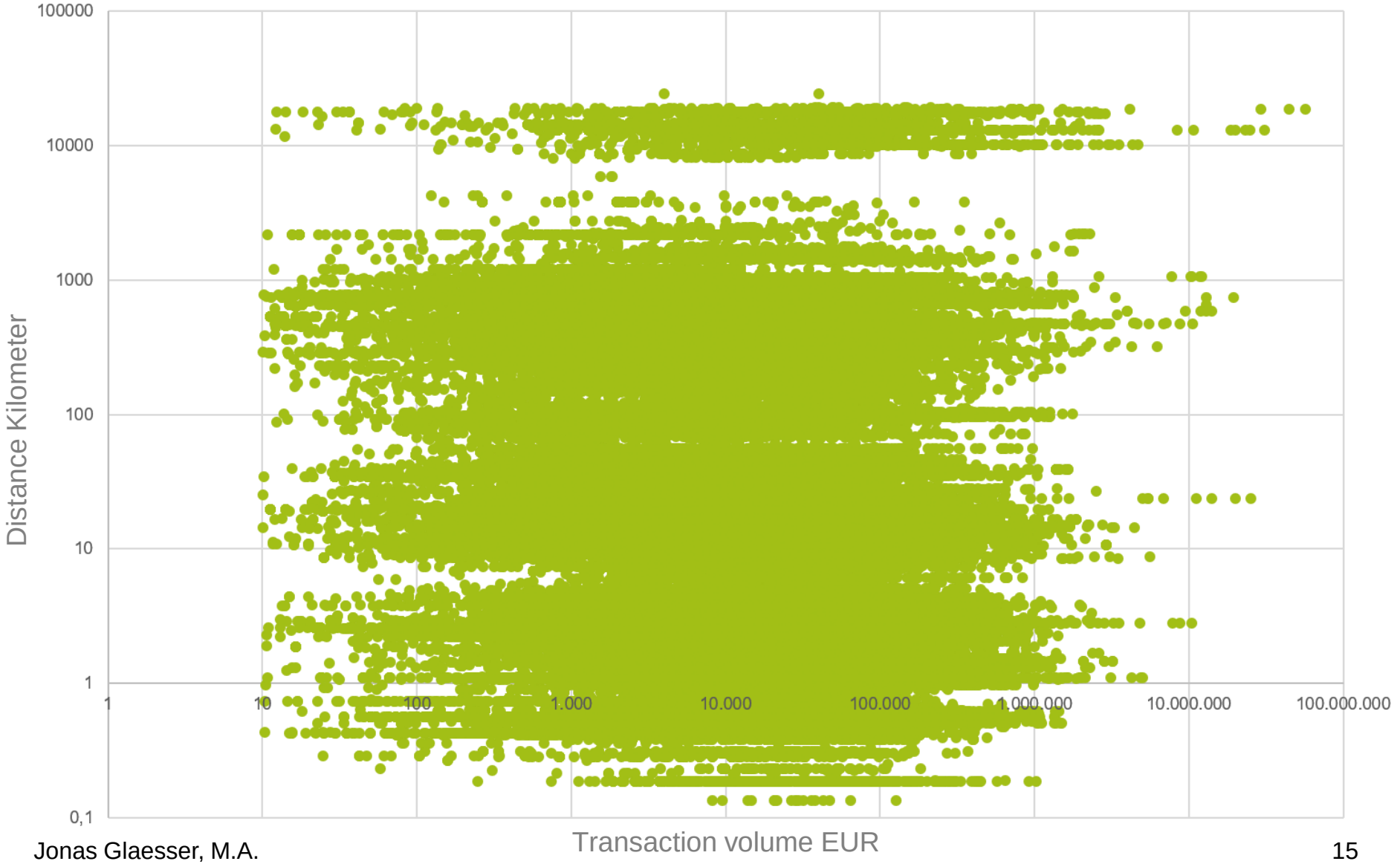
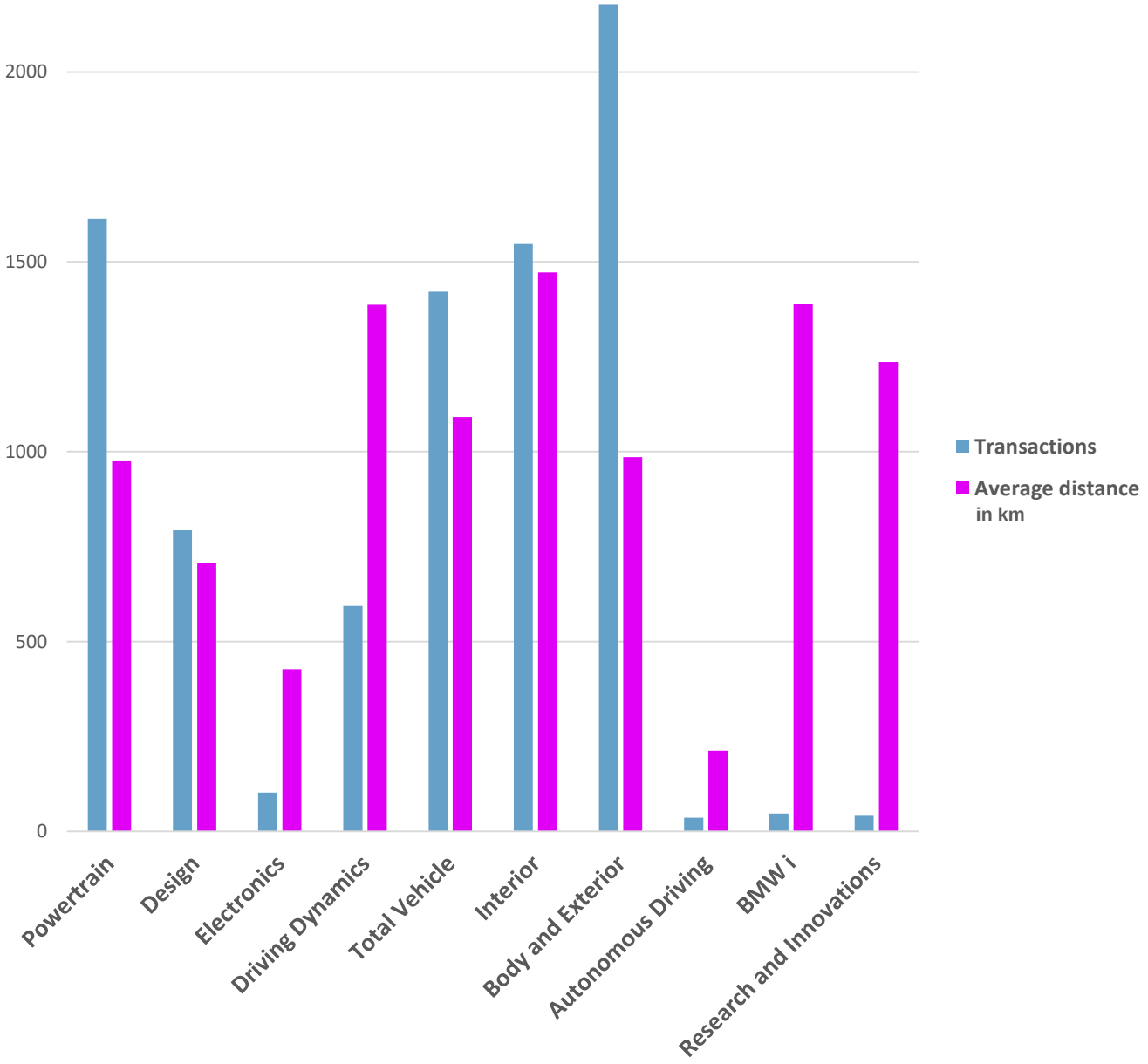
Permanent reachability (< 5 km)	Commuting distance (5km to 50 km)	Metropolitan Region Munich (>50 km to 120 km)	Europe
22 %	27 %	6 %	44 %

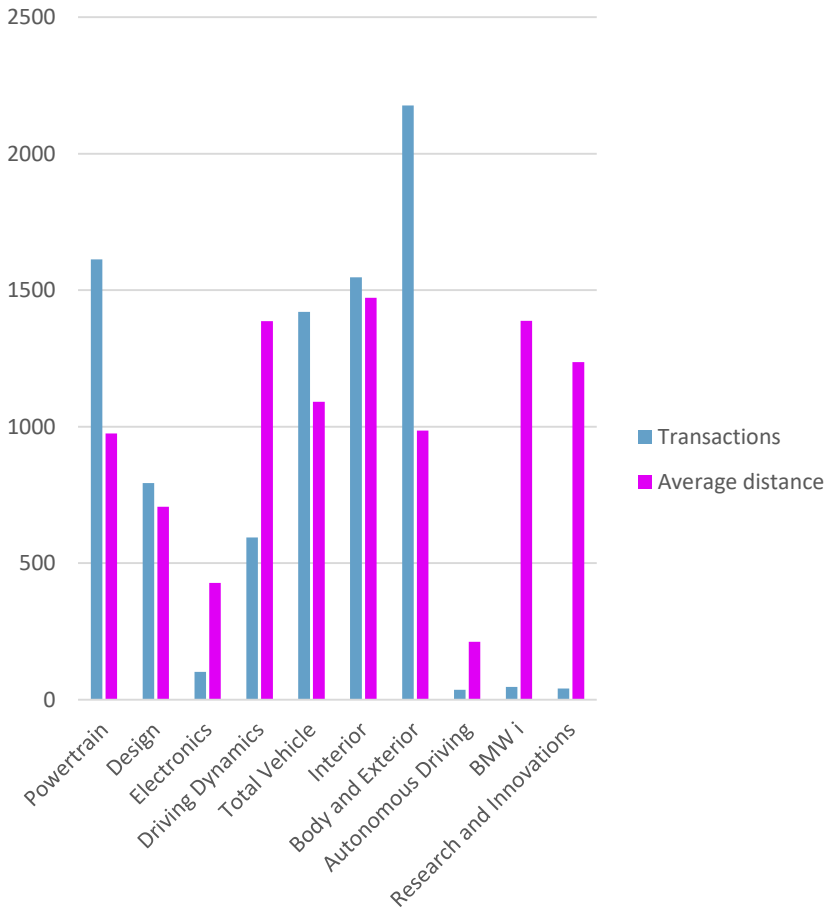
Spatial distribution of Development Service Providers transaction links



Analysis of Supplier Linkages

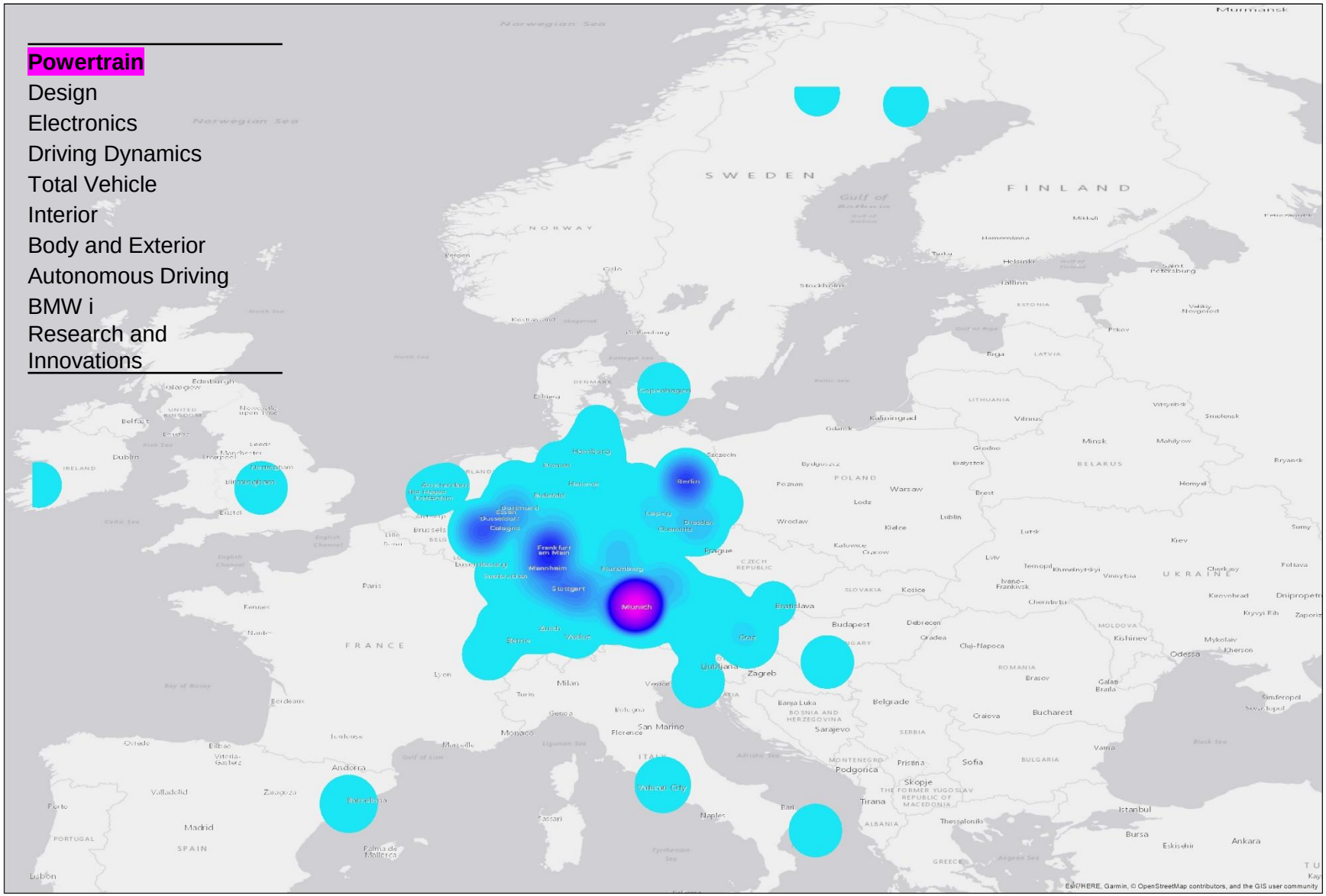


Analysis of Supplier Linkages: Interpretation

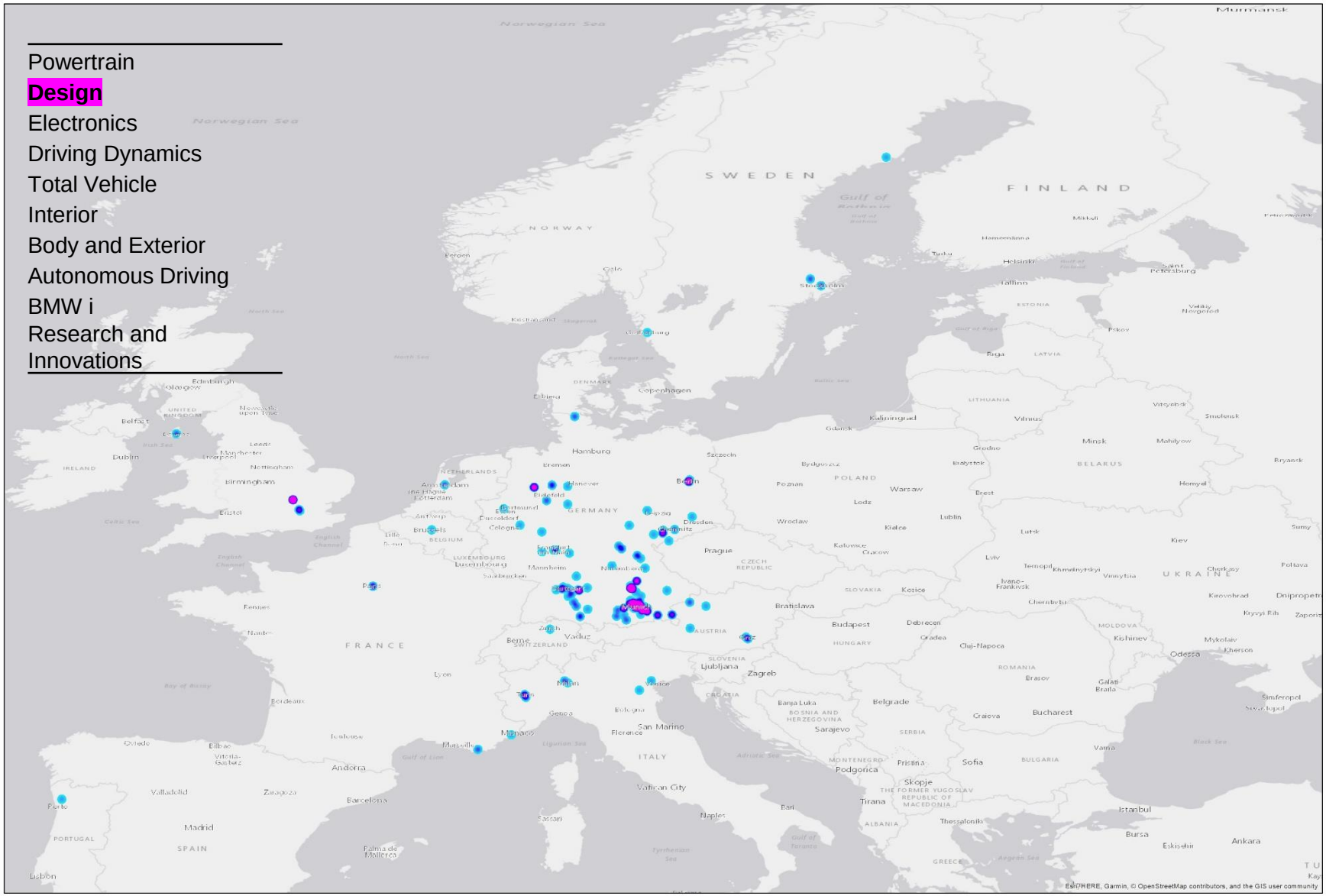


- New technologies are being developed inhouse
- Established technologies rely on a huge base of external linkages

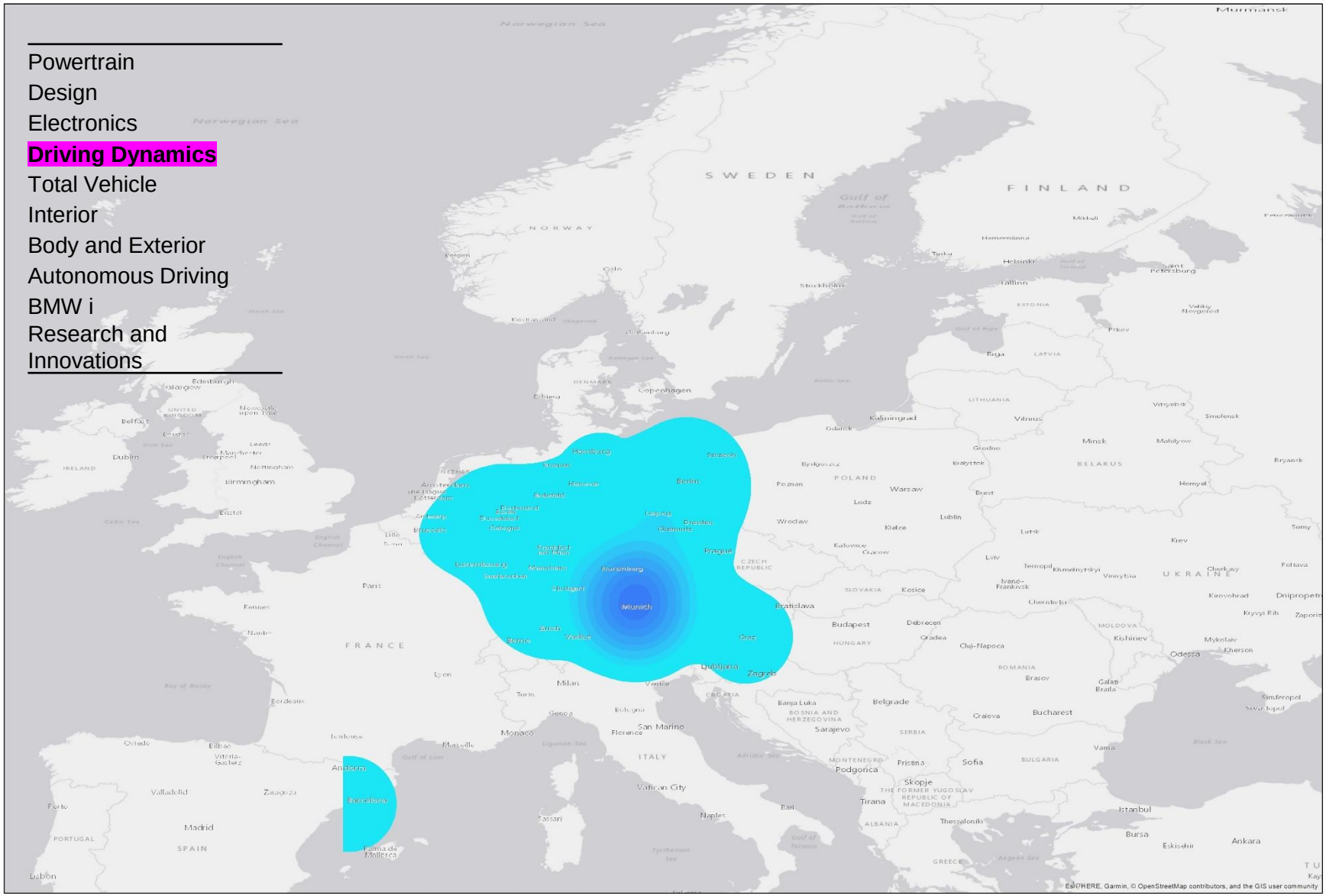
Spatial distribution of Development Service Providers transaction links



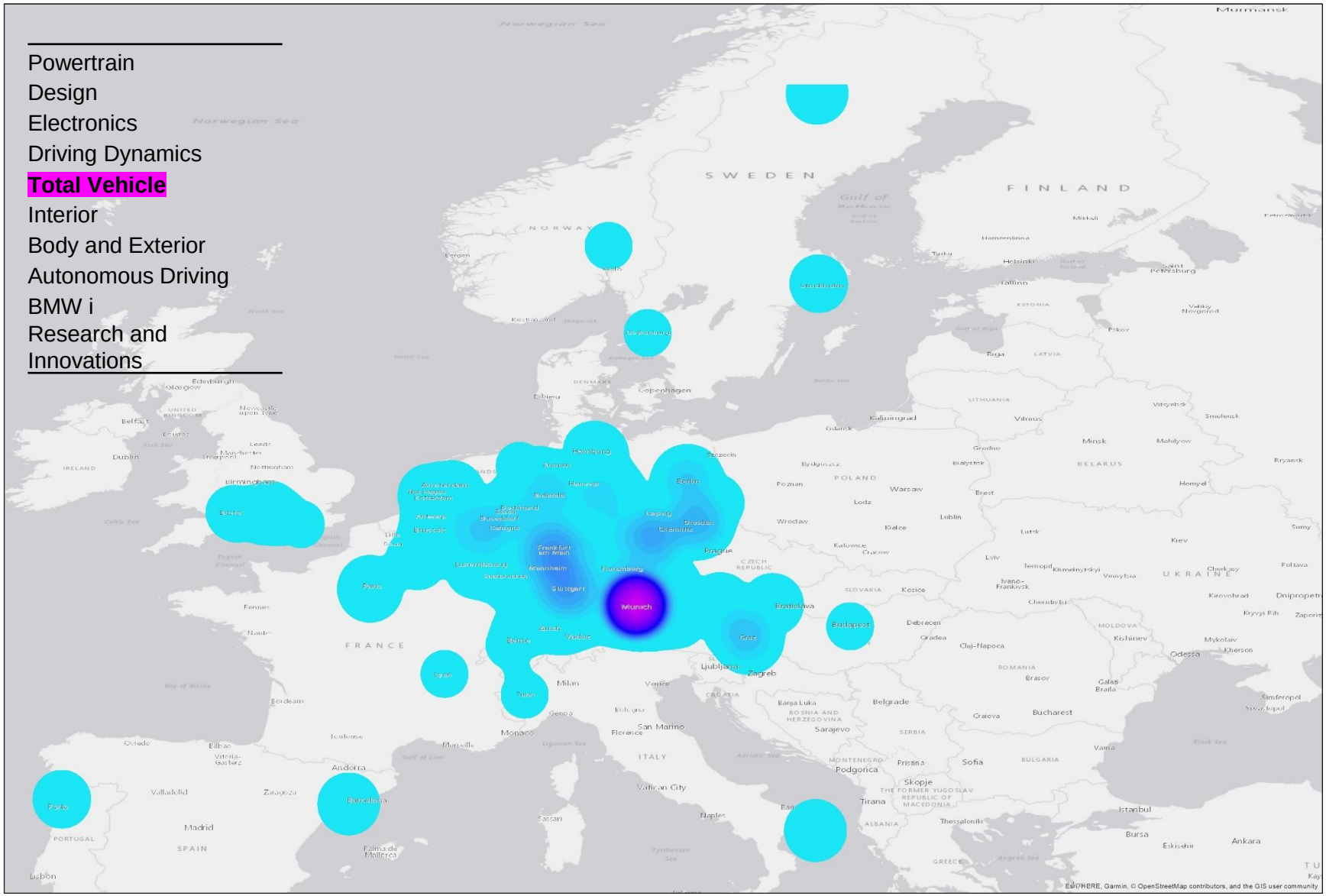
Spatial distribution of Development Service Providers transaction links



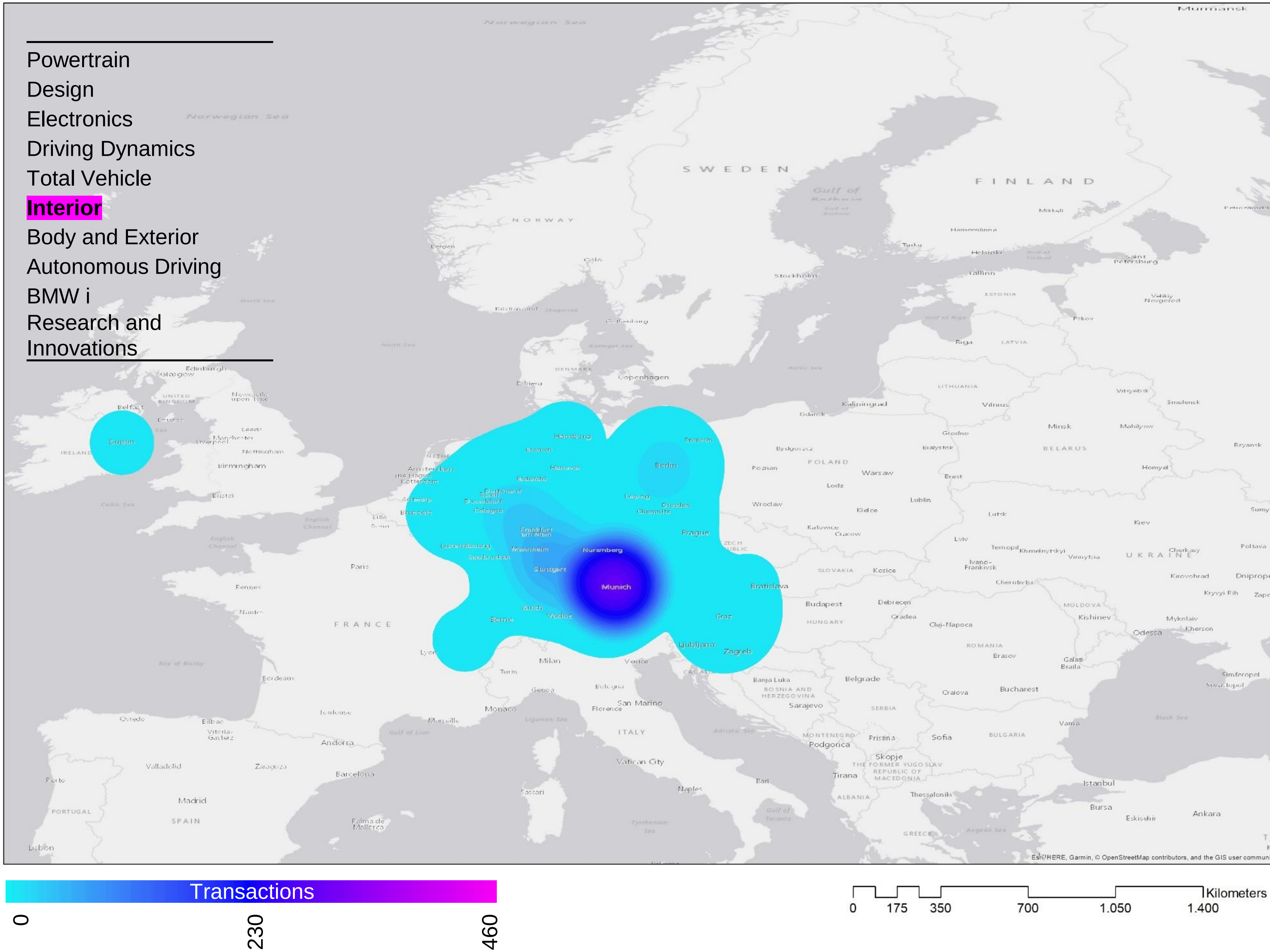
Spatial distribution of Development Service Providers transaction links



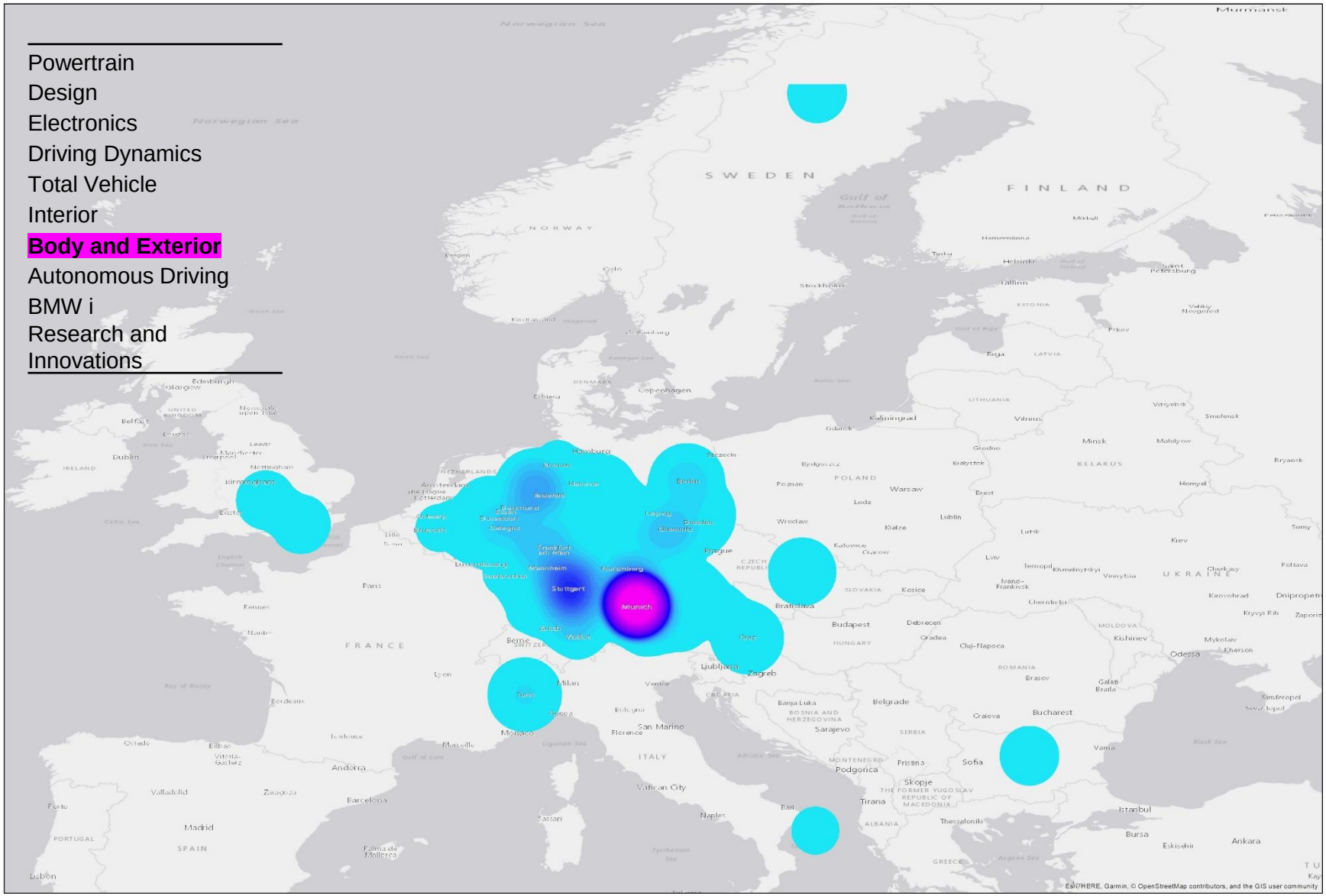
Spatial distribution of Development Service Providers transaction links



Spatial distribution of Development Service Providers transaction links



Spatial distribution of Development Service Providers transaction links



6 Next steps

- Enhancing the data set
  - categories of technological innovation to operationalize hypotheses
  - add branch information
  - Other variables (institutional proximity)
- Applying longitudinal analysis
  - Examine the changes over time

Thank you for your attention!

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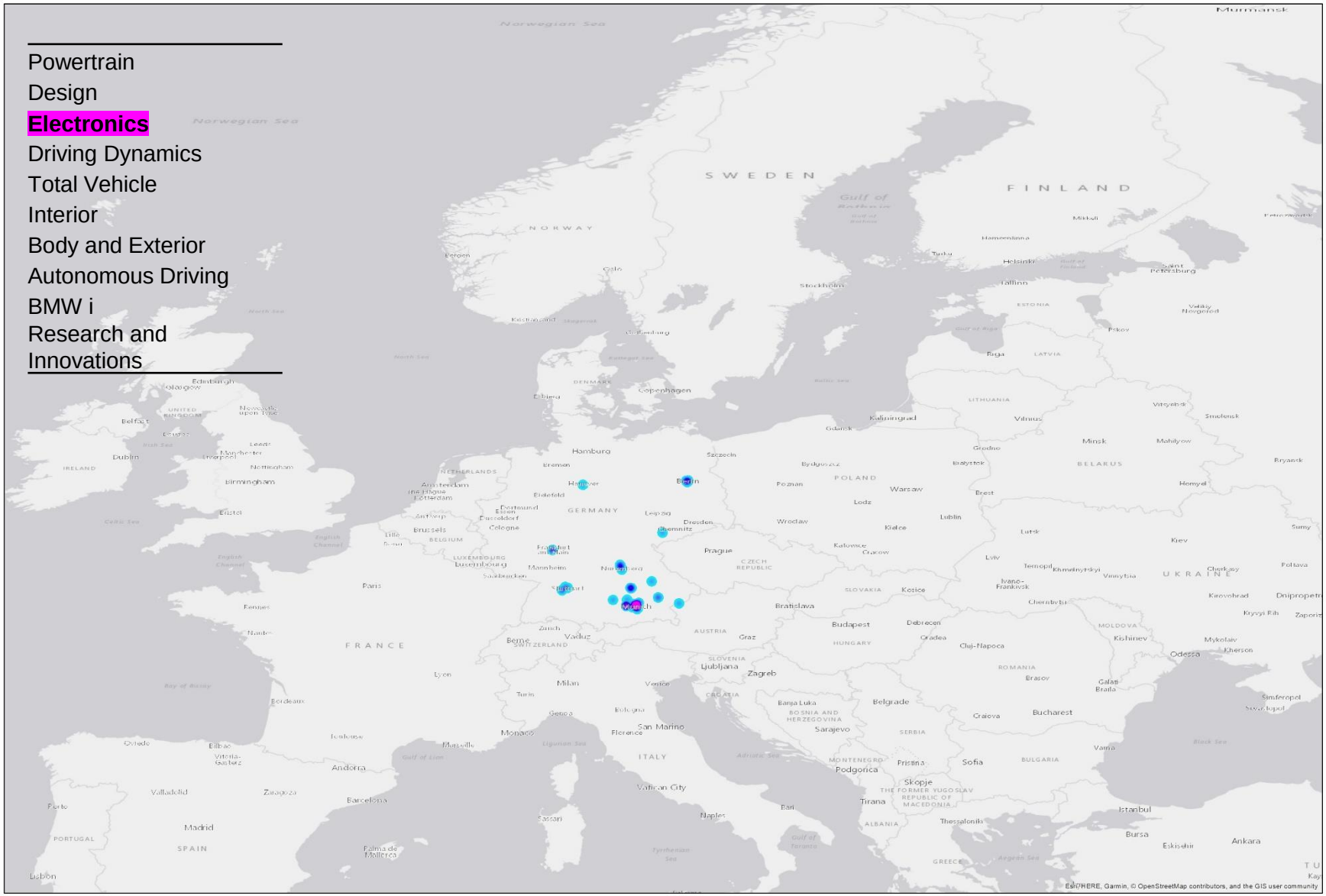
Backup

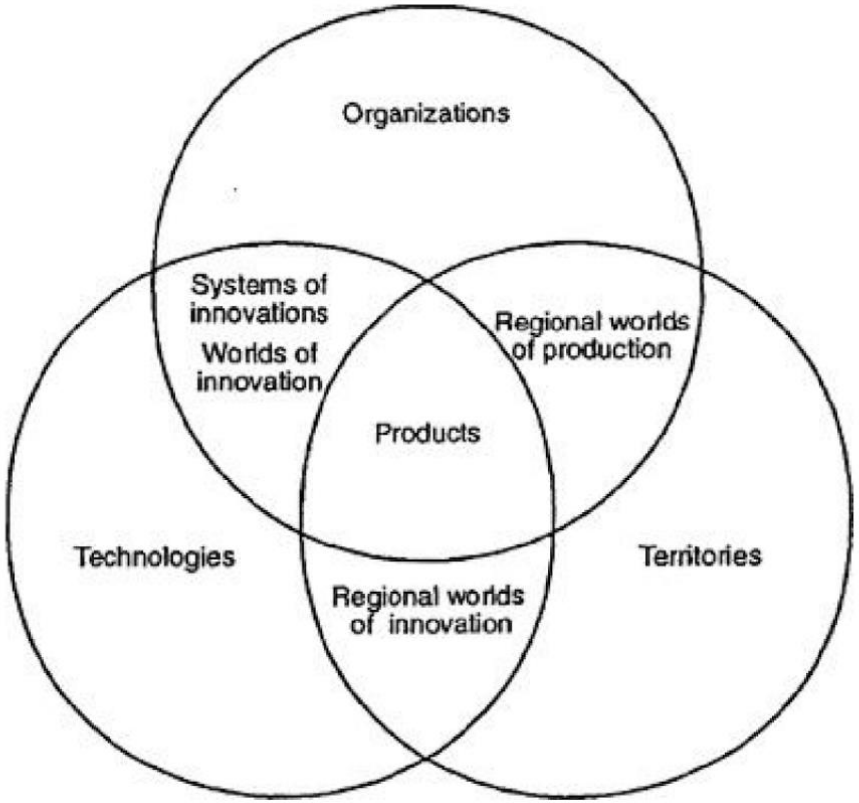
Spatial distribution of Development Service Providers transaction links



2 Theoretical background

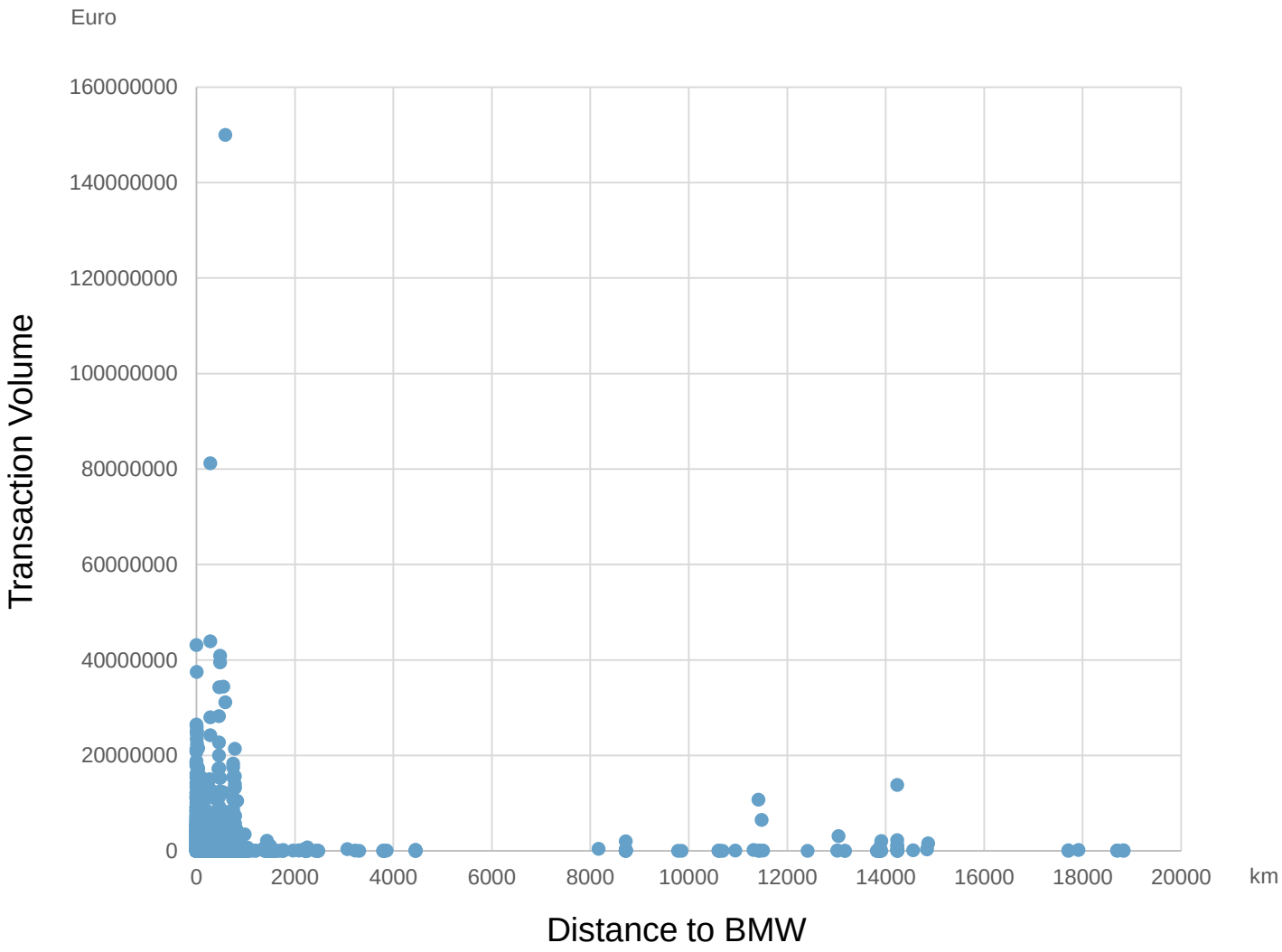
Holy Trinity (Storper 1997)

- Importance of localized production systems (proximity), despite advanced communication, information, transportation systems
- Localized conventions and norms as background for further economic activities (Maskell and Malmberg: 1999)
- Triad of technologies, organizations, and territories



(Storper 1997: p 42)

5 Descriptive Analysis of Supplier Linkages



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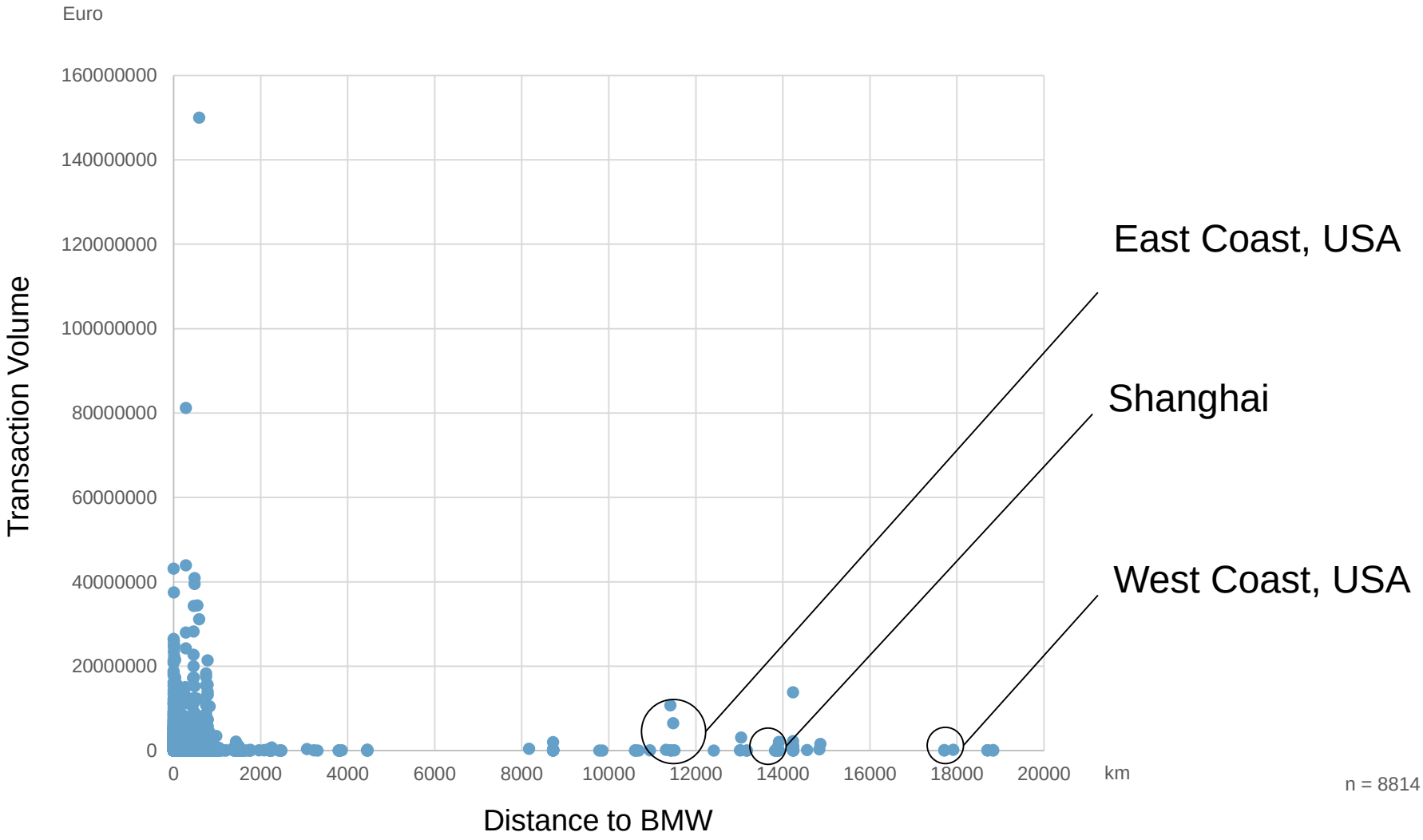
5 Descriptive Analysis of Supplier Linkages



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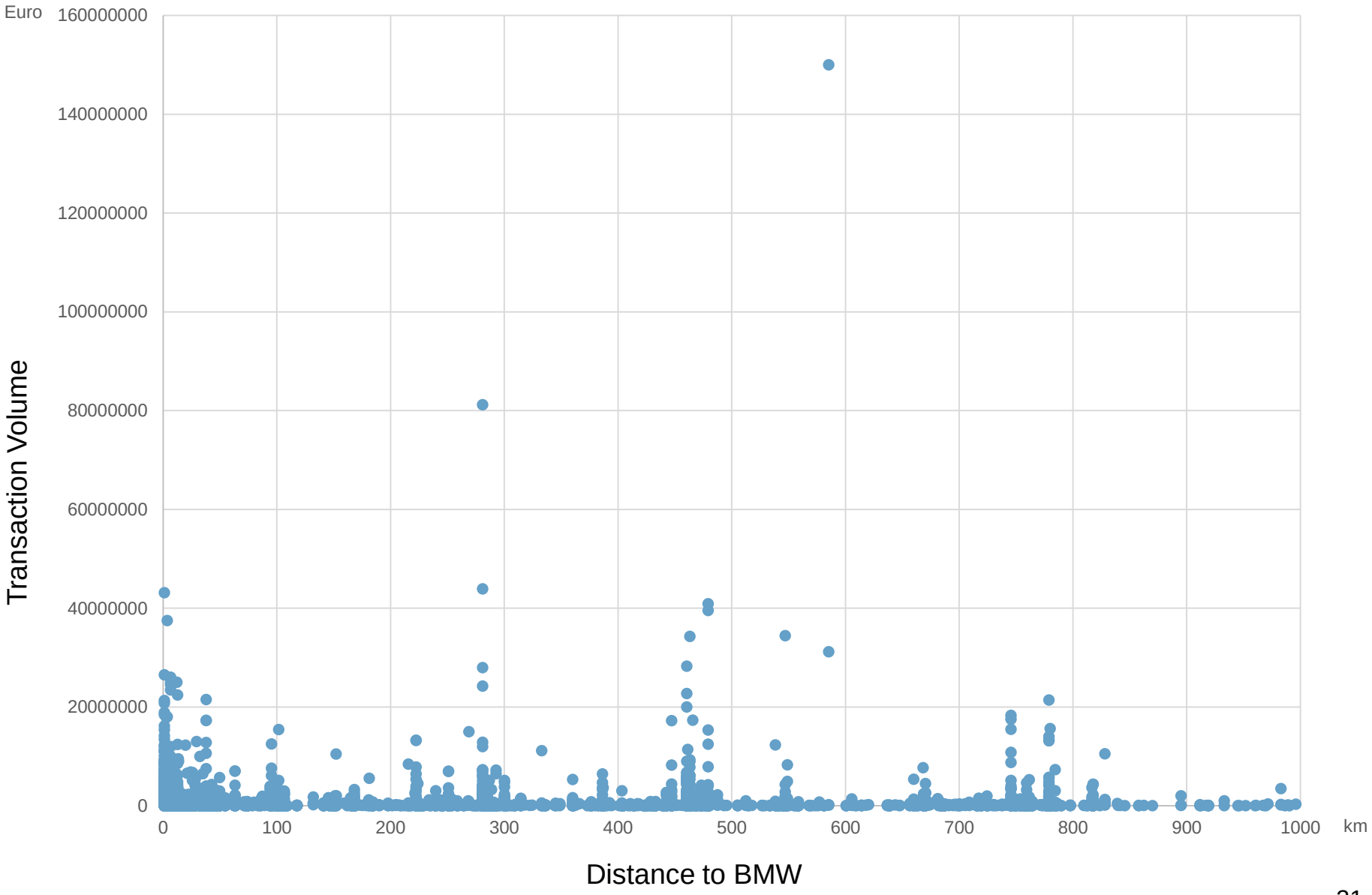

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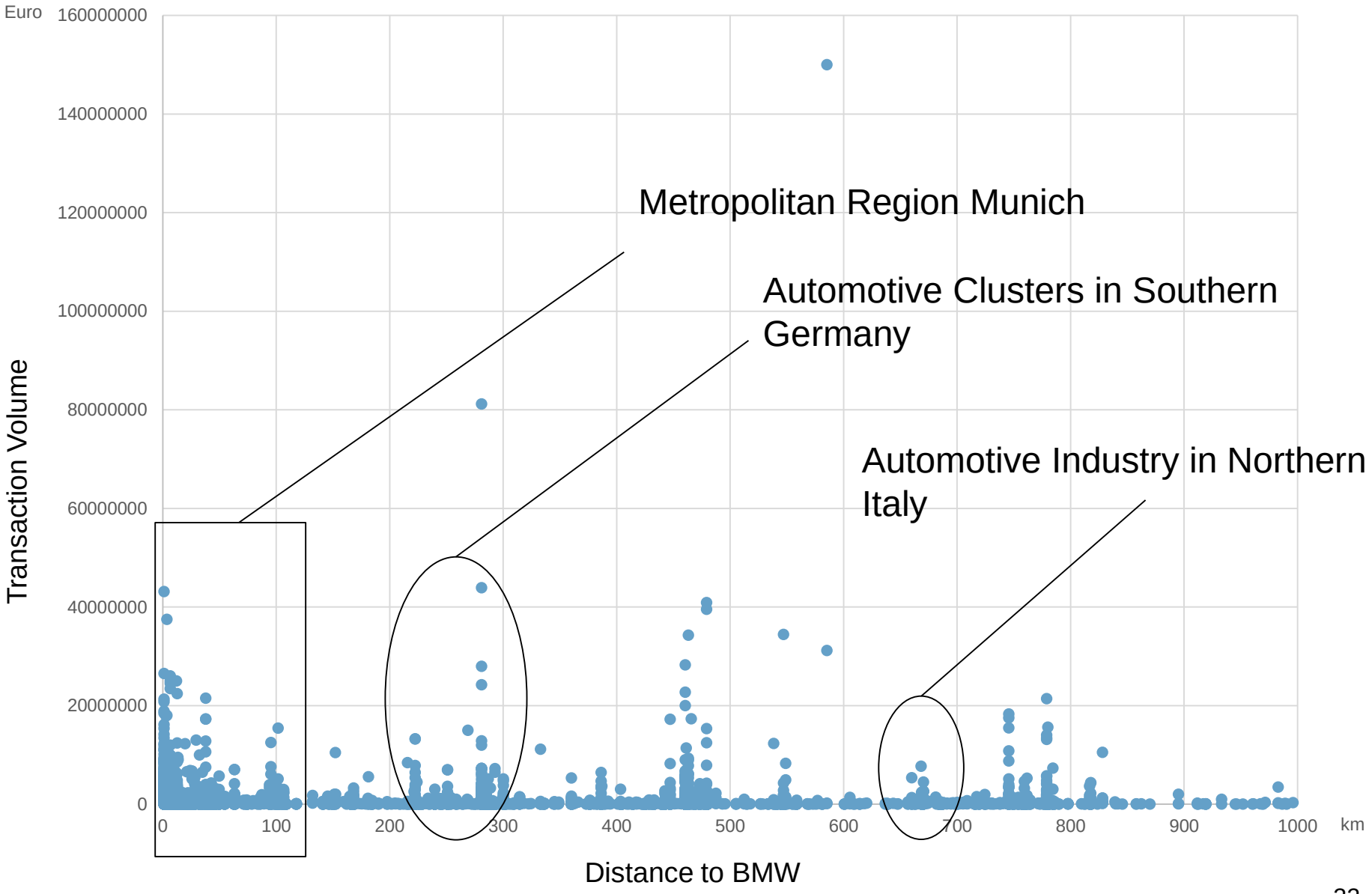
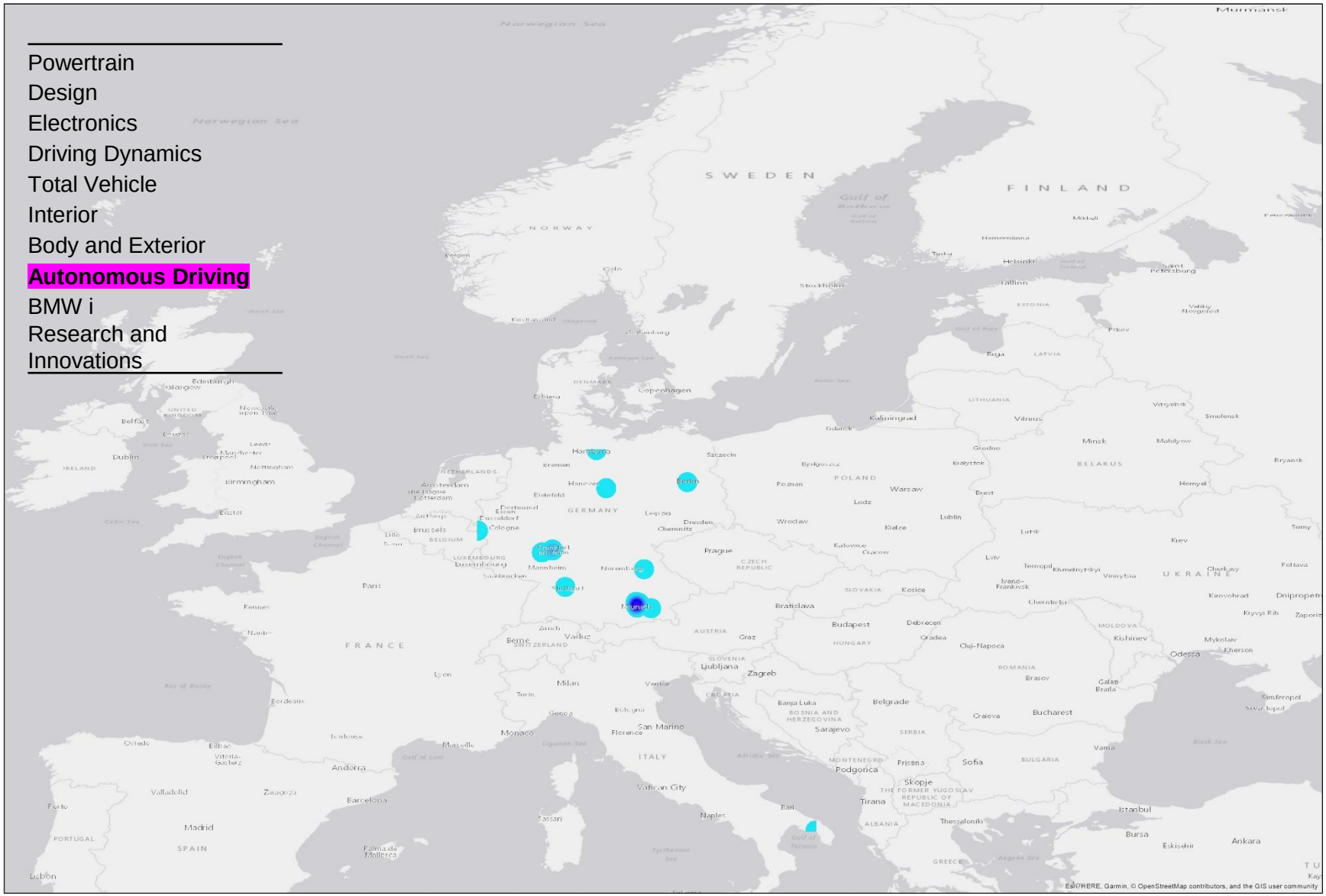


Spatial distribution of Development Service Providers transaction links



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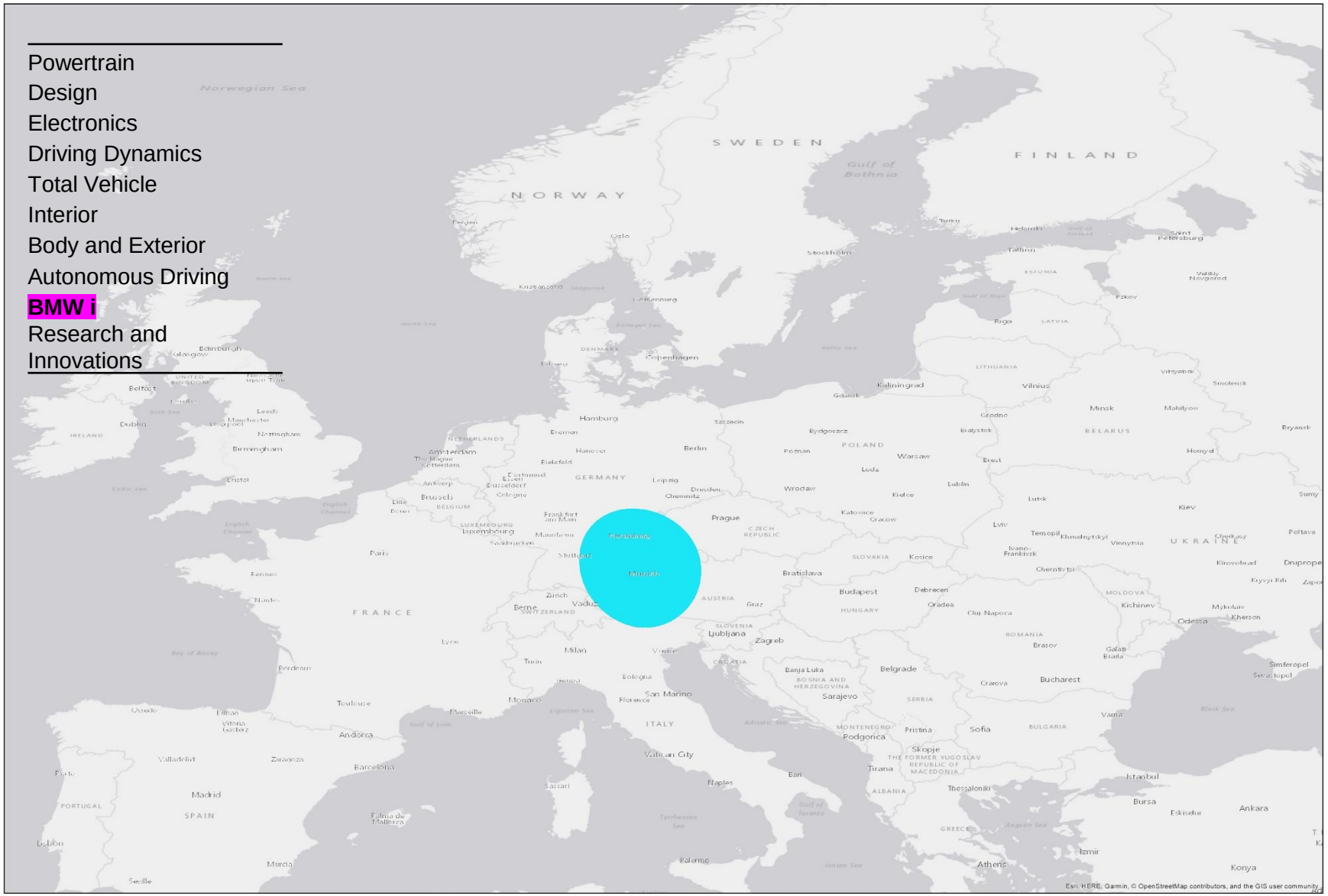

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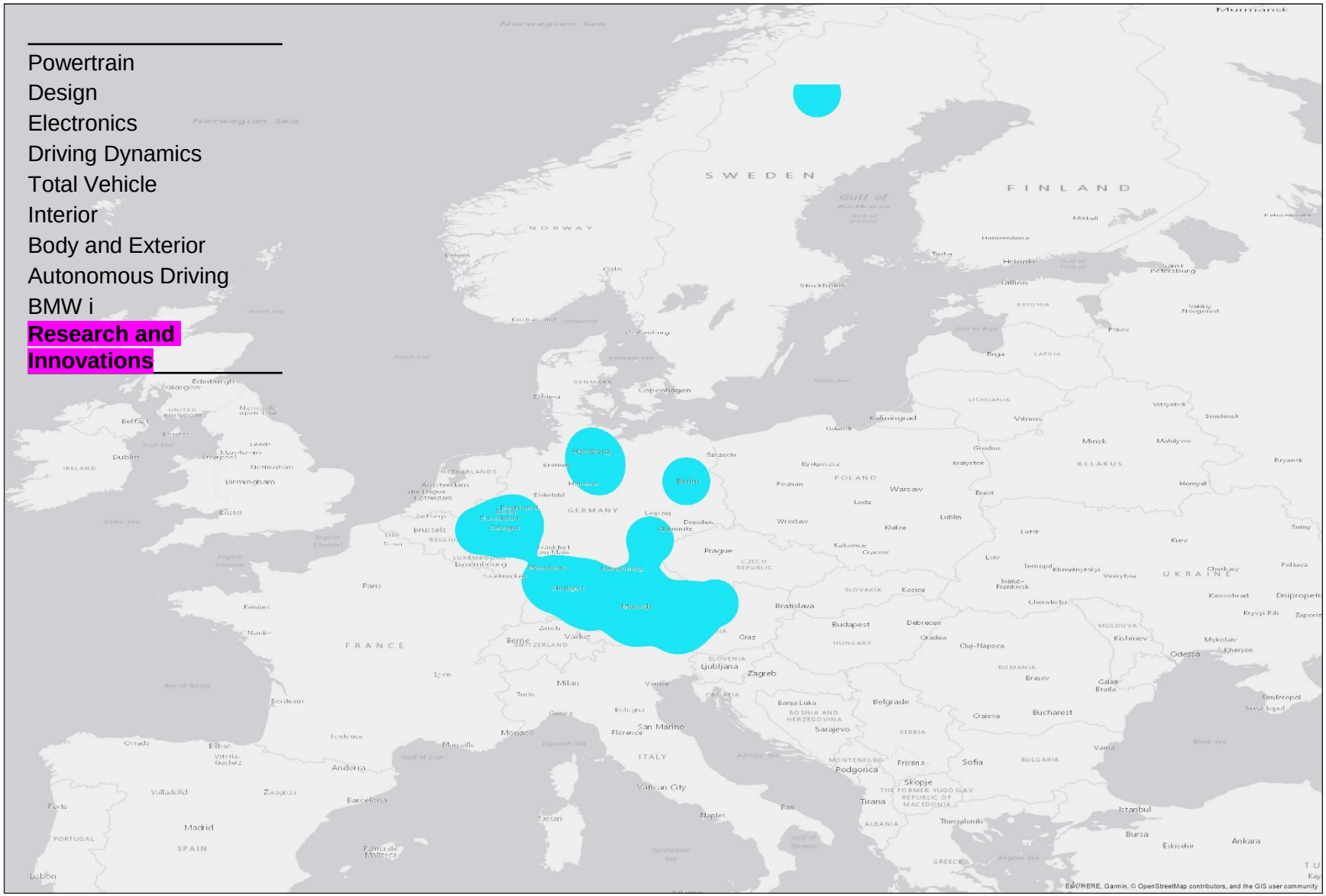

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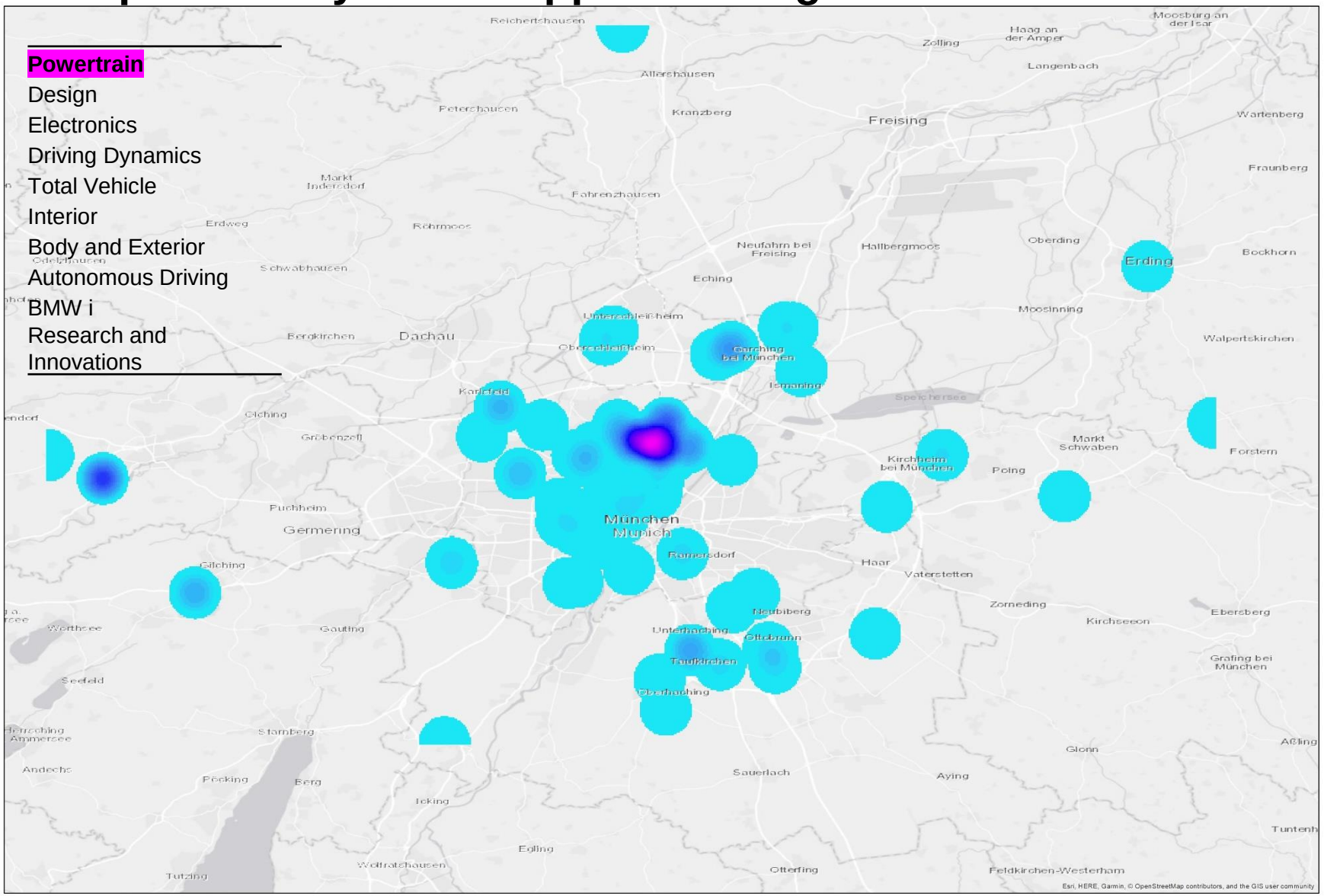

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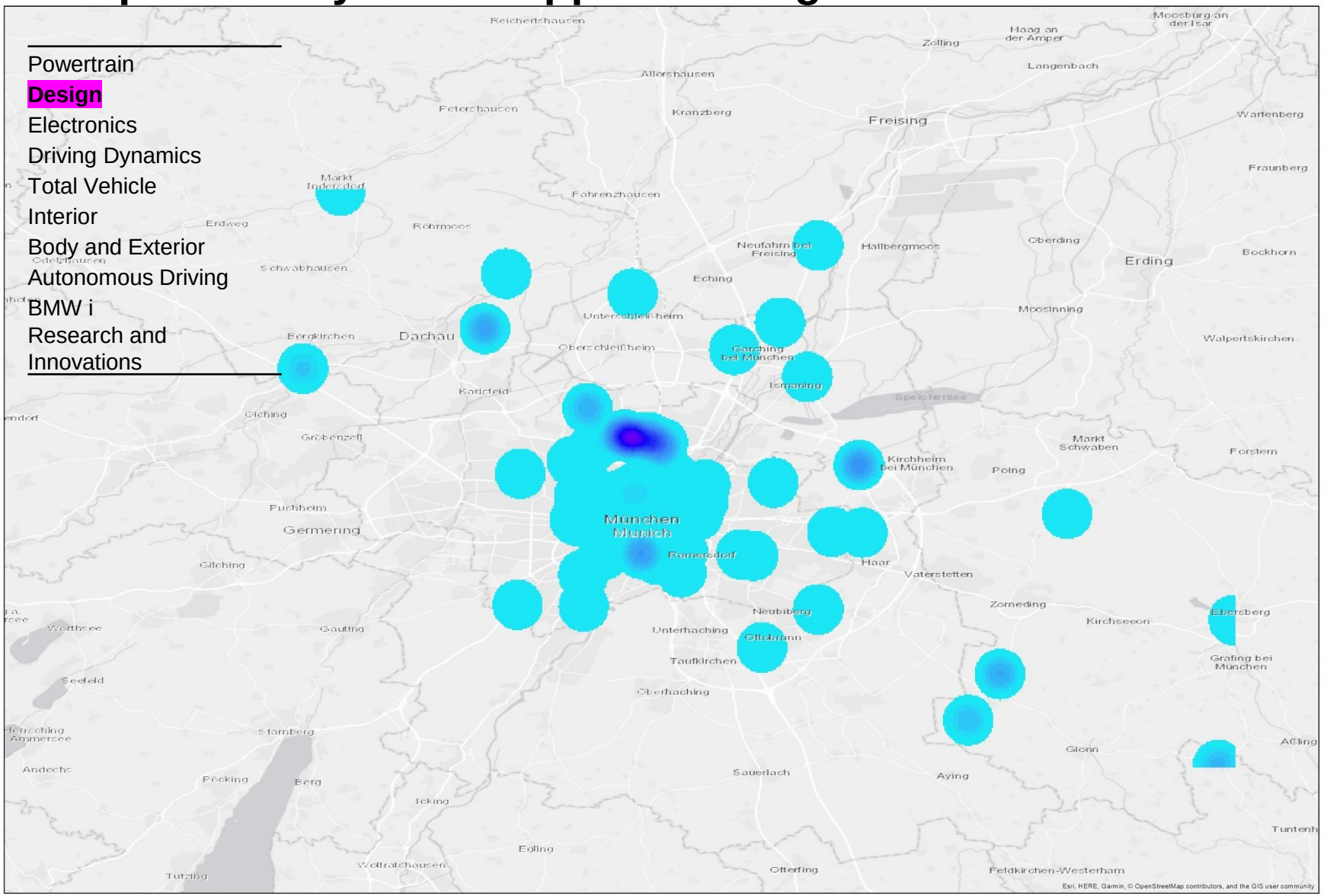

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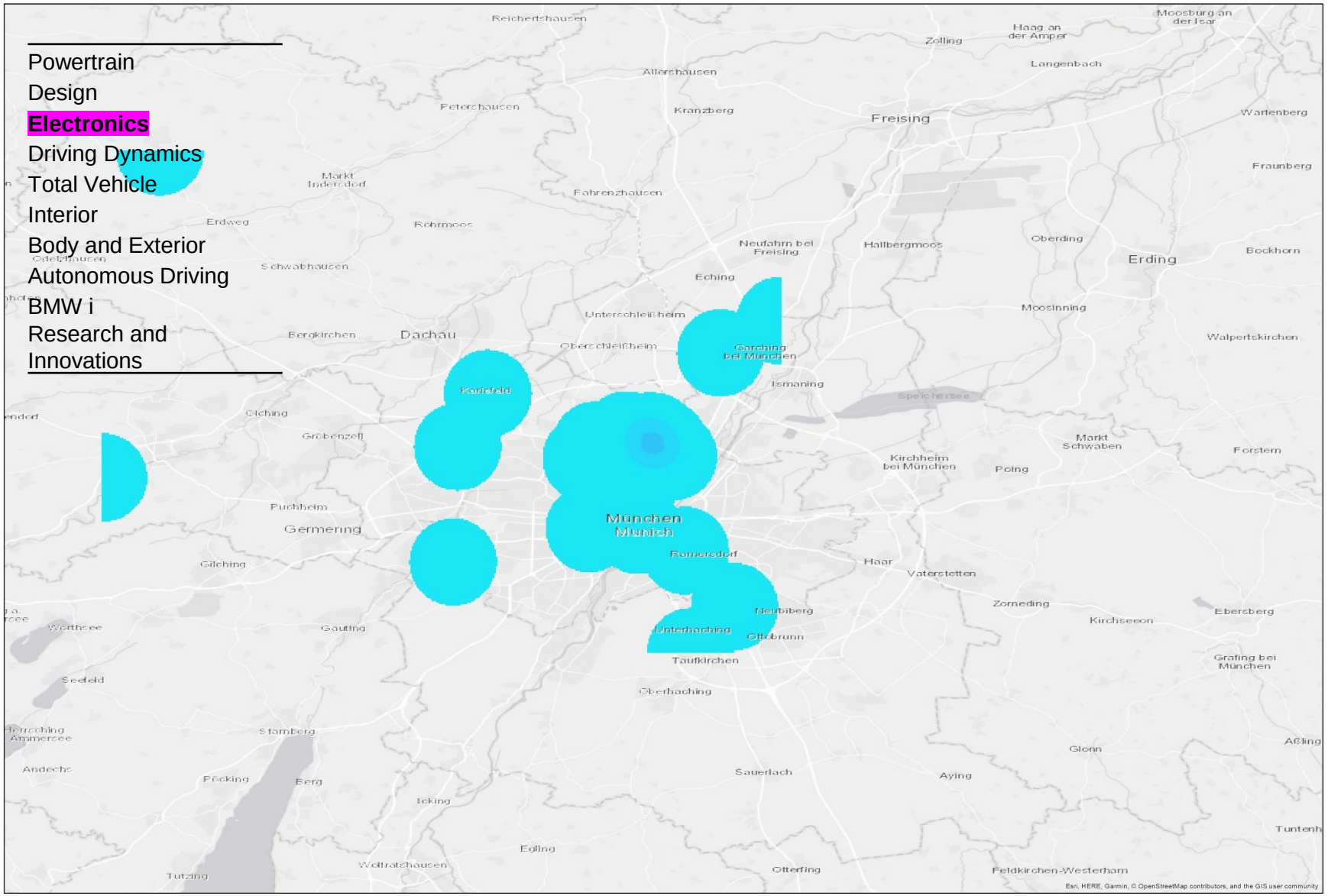

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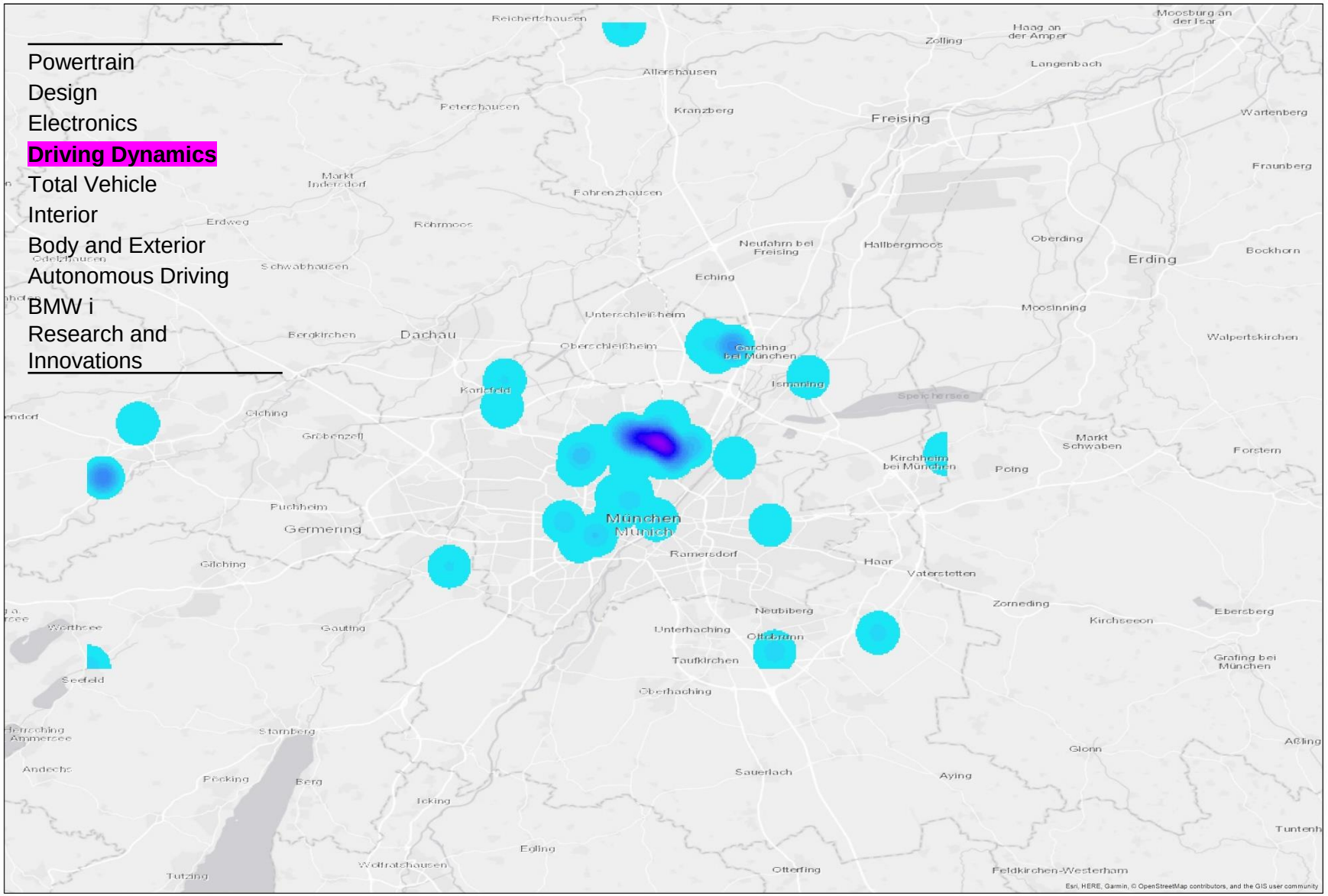

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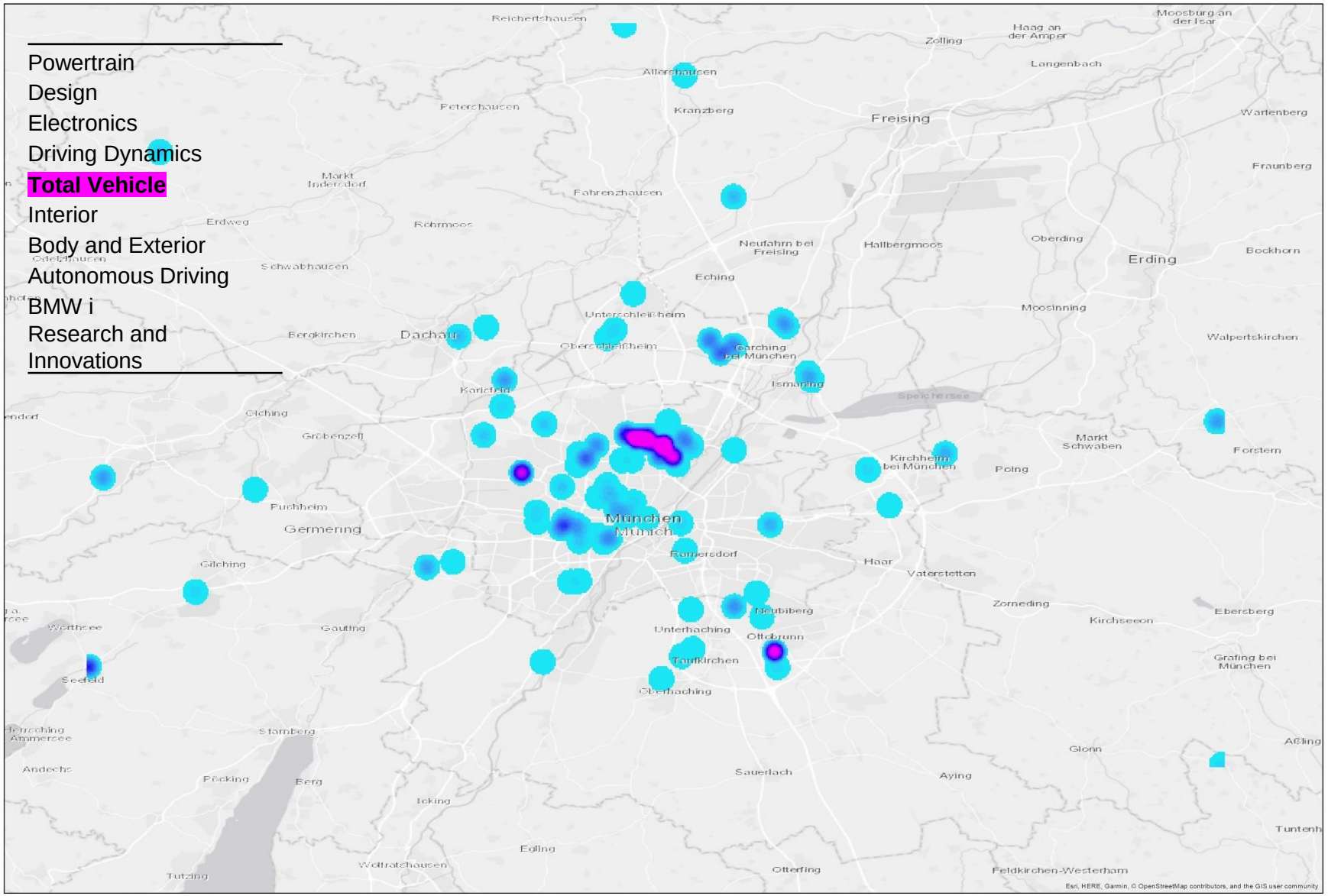

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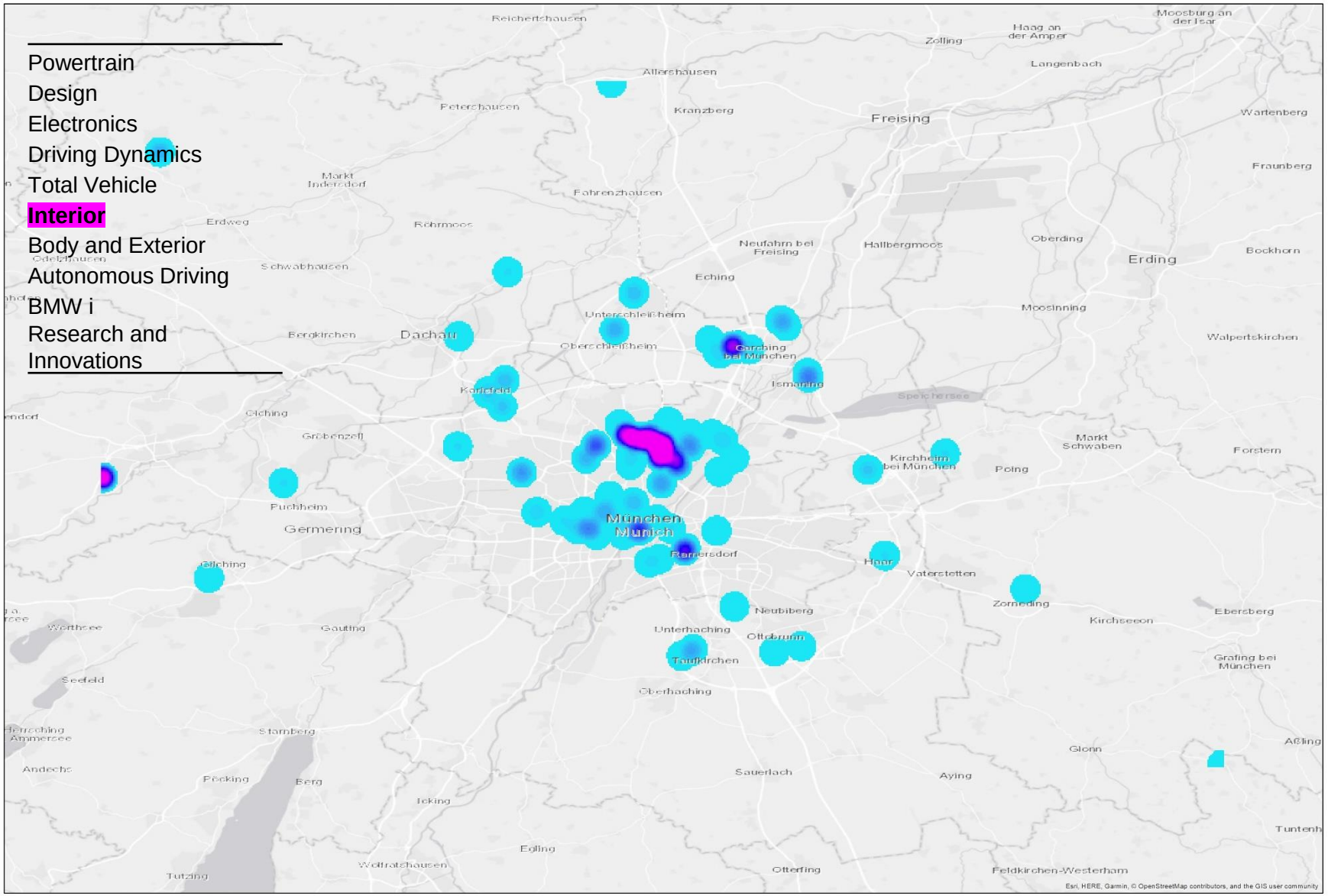

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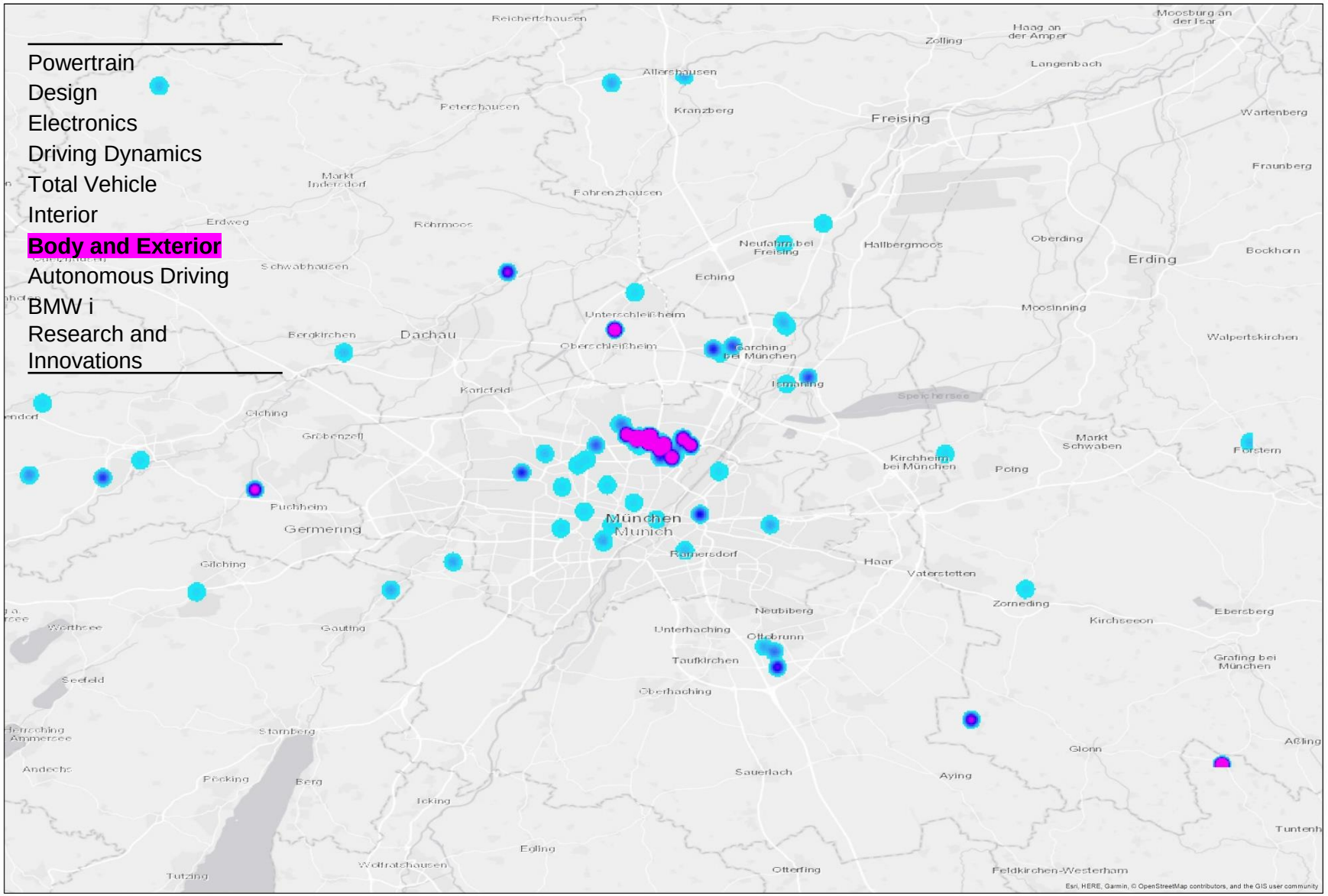

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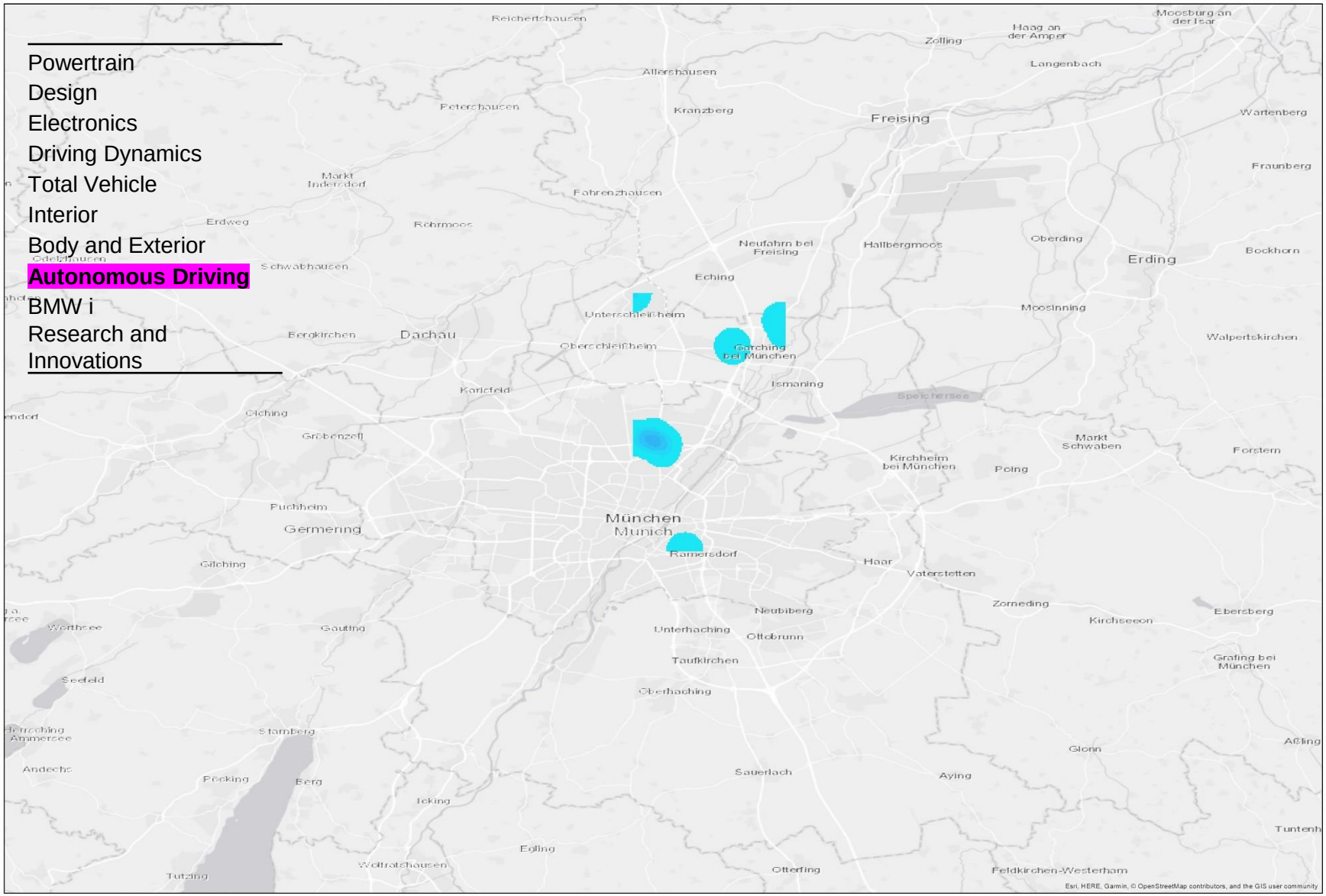

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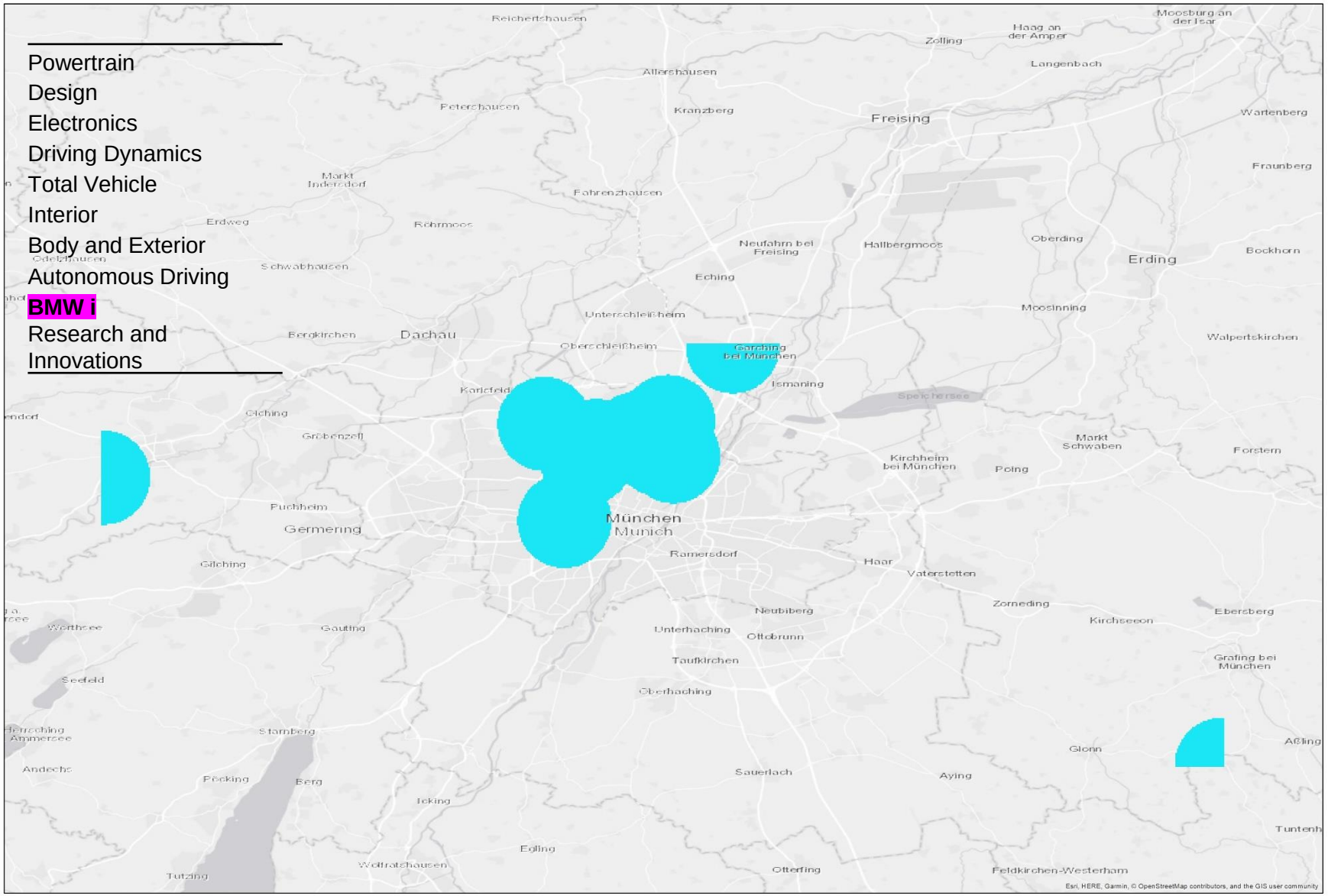

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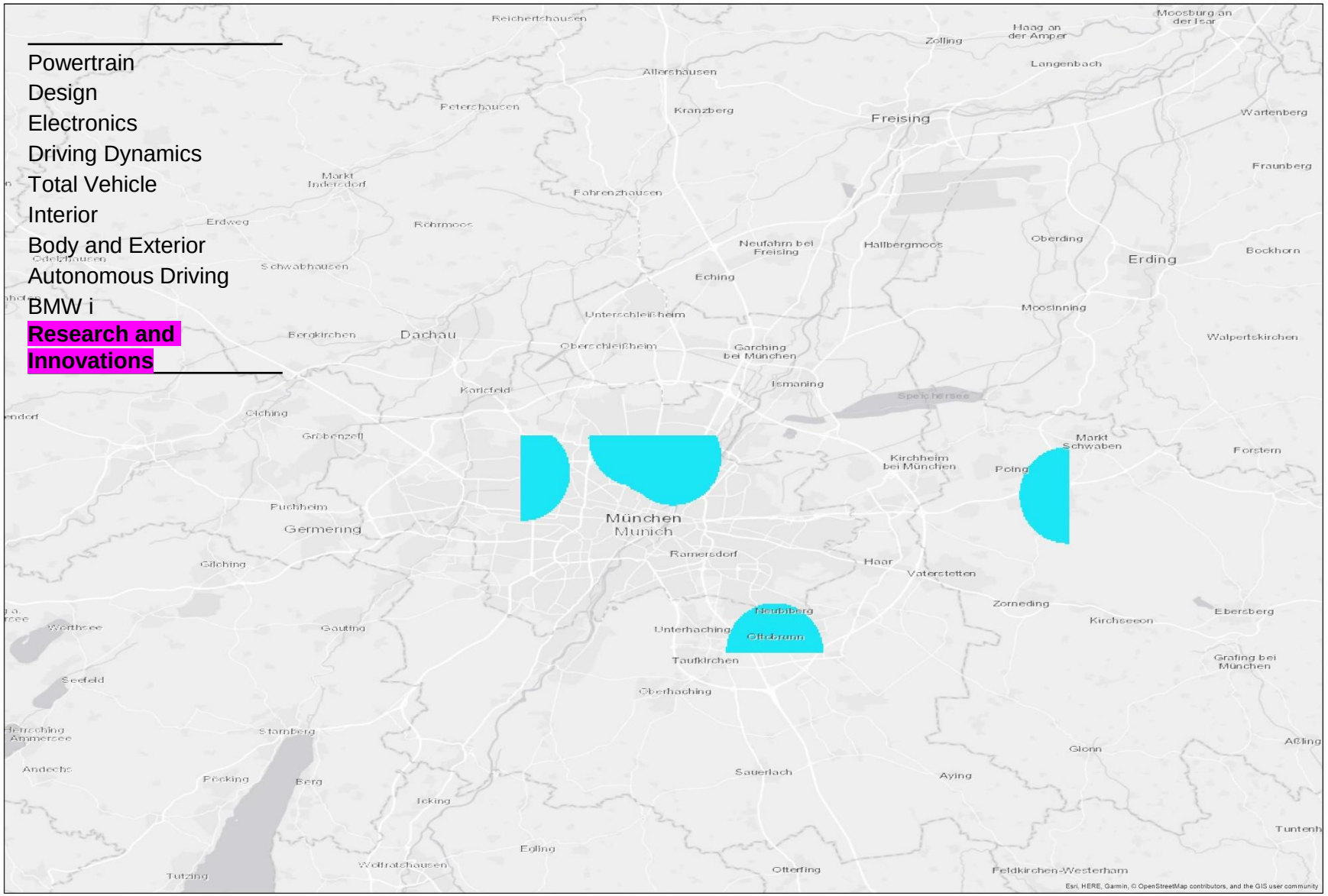
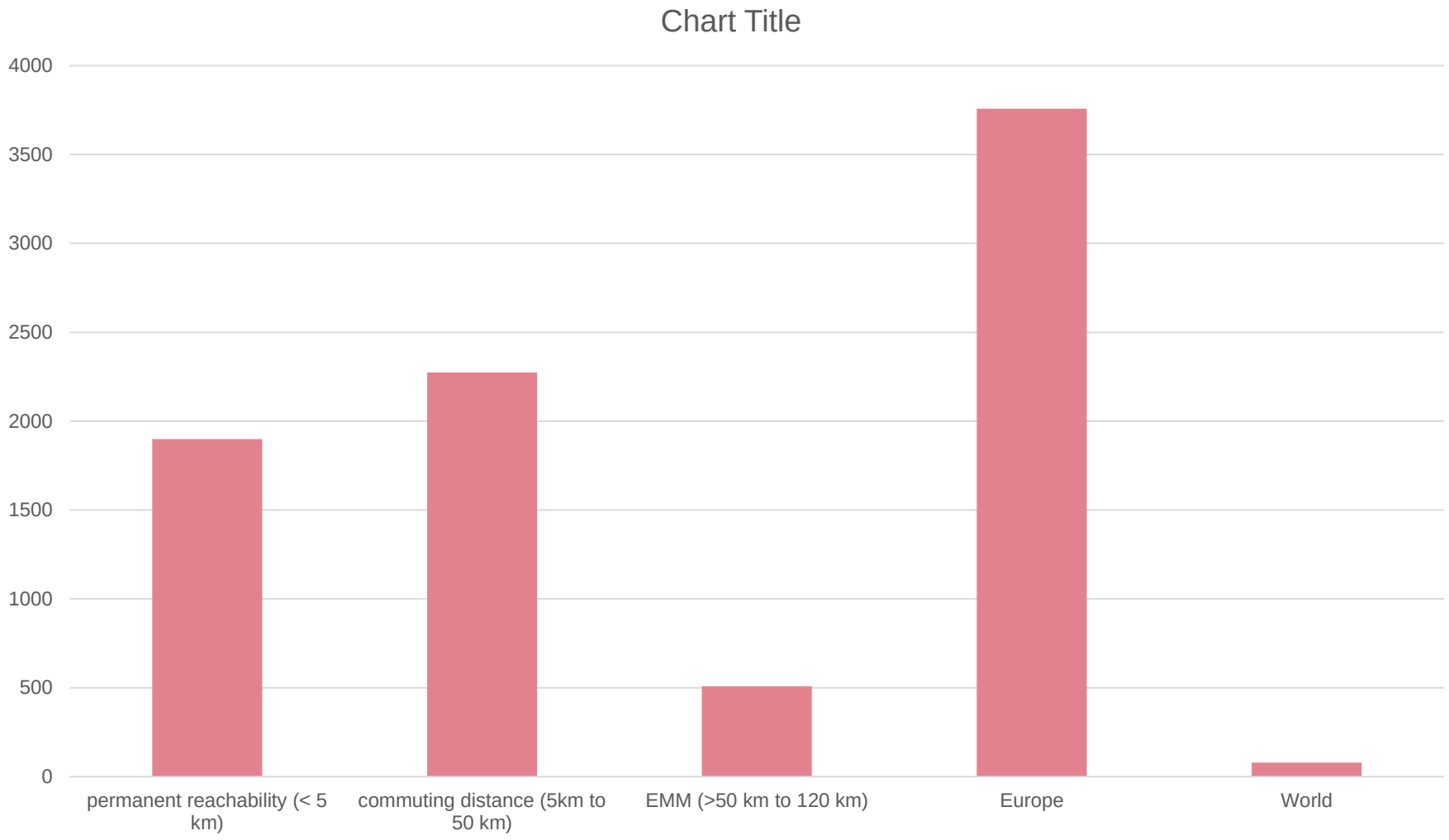
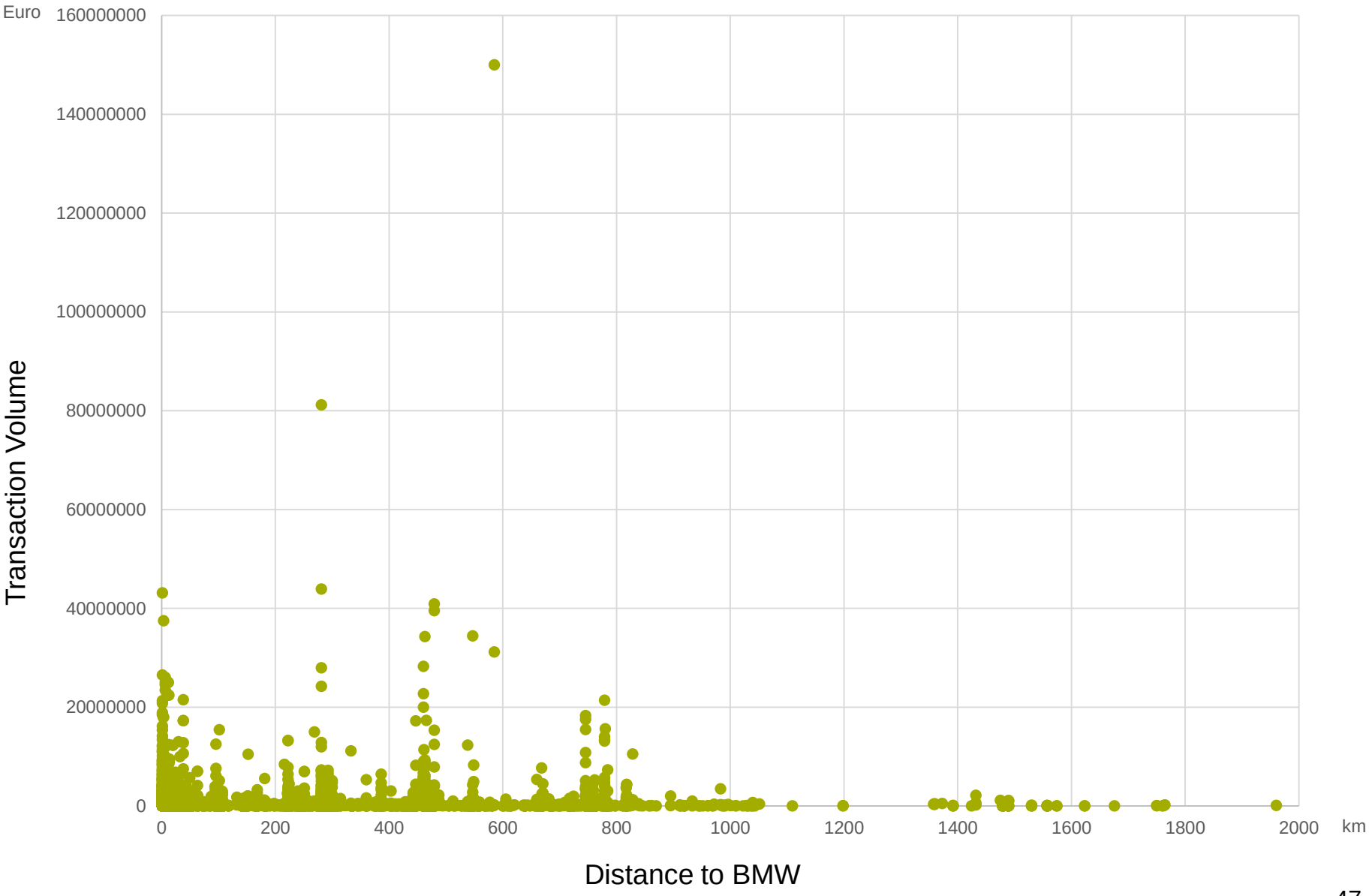


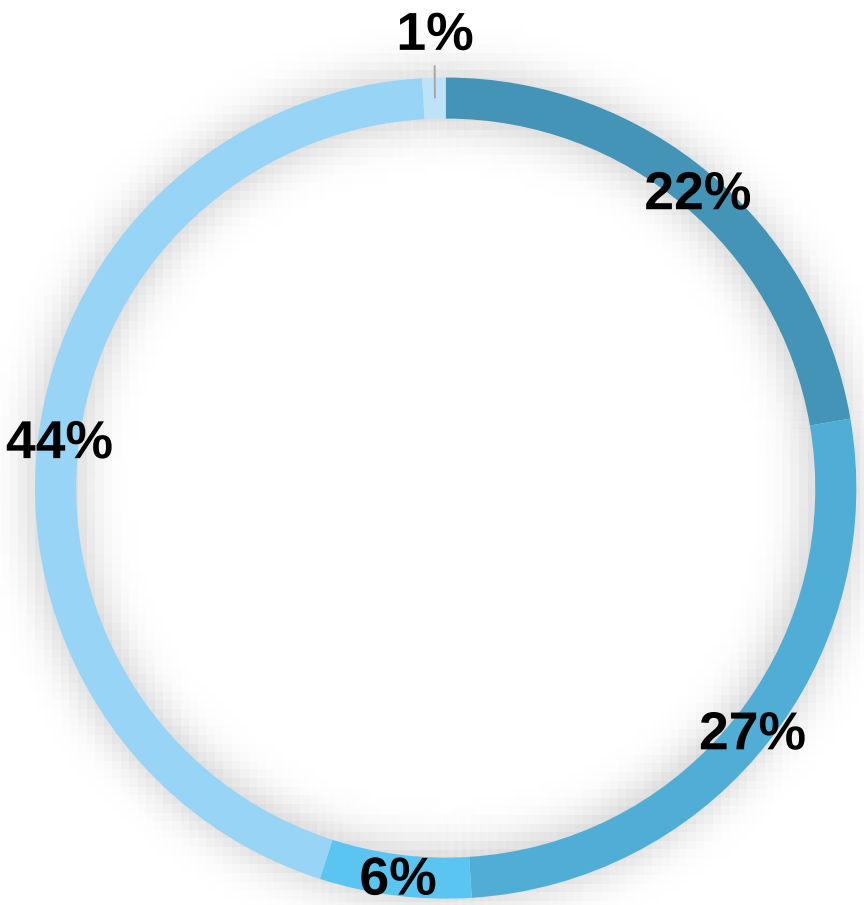
5 Descriptive Analysis of Supplier Networks



5 Descriptive Analysis of Supplier Linkages



Spatial distribution of Advanced Producer Service transaction links



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Spatial Distribution of Development Service Providers

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Empirical findings on new links

- multinational corporations with increasing experience and connectedness will be more likely to have further alliances in the future (Gulati, 1999)
- Embedded linkages: network evolve around trust and shared norms (Glückler 2007)
- multi-connectivity: new alliances were more likely to be formed between those firms that were linked to each other at a previous stage (Powell et al., 2005)

(cited by Bentlage 2018, forthcoming)