

### What is TOD?

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 Purpose - reduce car usage by providing other alternatives

- Ability quantify TOD using index - objective decisions
- Spatial comparison of TOD - local and regional scales
- Not only planning for better development, but also for transit users
- Methodology transferable to any other scale

### Conclusions



### Methodology



### Methodology

### Existing Methods

- Analysis of TOD limited to areas around stations.
- Limited analysis of regional scale.

- Quantitative method of analysing TOD - Develop an 'index' to quantify/measure TOD
- Such a TOD index should be computed using spatial analysis
- TOD analysis at two scales - local and regional
- This allows TOD planning by not only planning for 'D' i.e. Development but also by planning for 'T' i.e. Transit.

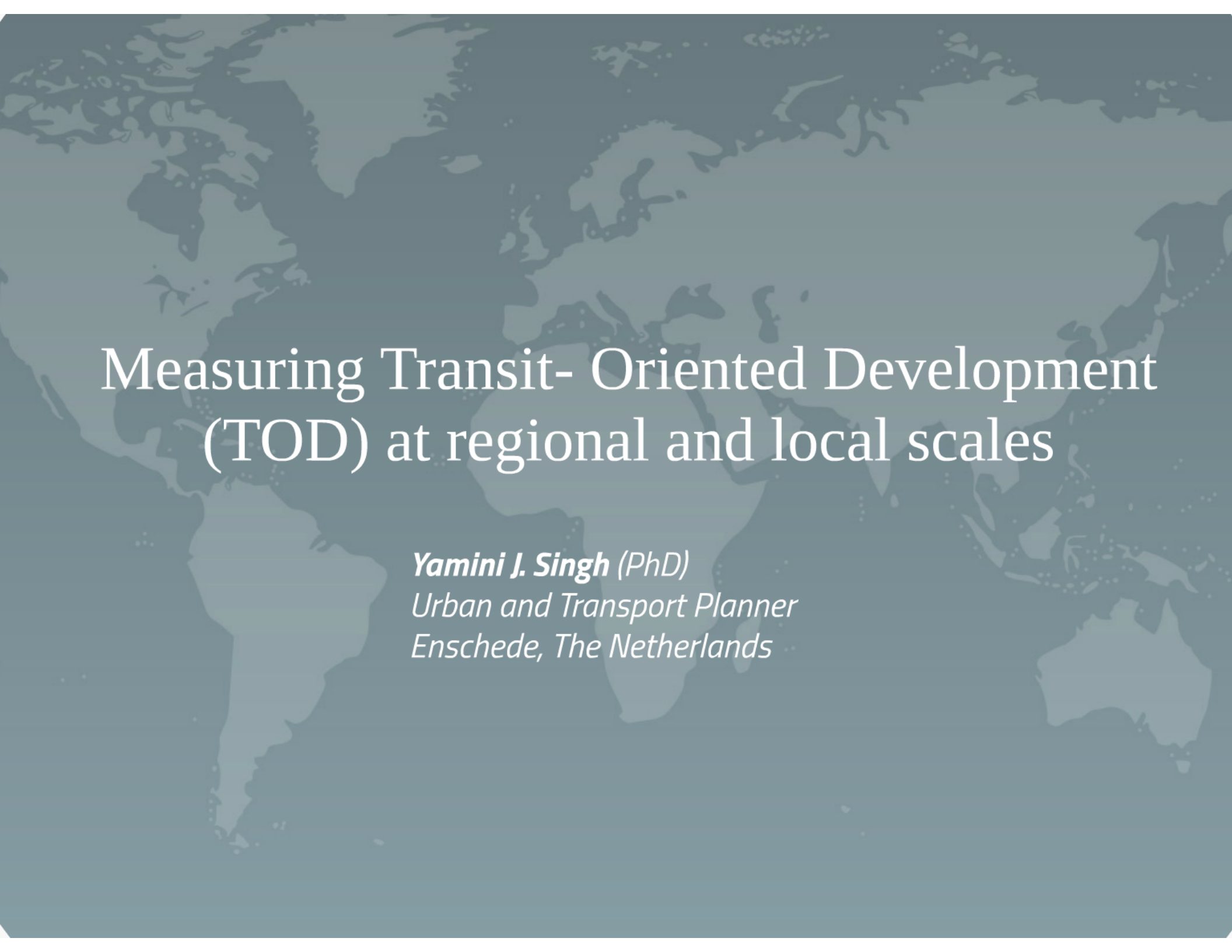
Objective 1	Objective 2	Objective 3
Measuring TOD at local scale around transit nodes to plan for more transit-oriented development.	Measuring TOD at regional scale to plan for better Transit.	Developing a Planning Support System (PSS) for planners to make detailed TOD proposals.

### Our Idea!

### Case Study area



- The City Region - case study to demonstrate our methodology
- has 21 train stations along the regional rail network
- has 20 metropolitan bus - two per station



# Measuring Transit- Oriented Development (TOD) at regional and local scales

***Yamini J. Singh*** (PhD)  
*Urban and Transport Planner*  
*Enschede, The Netherlands*

Benefits of TOD:  
 • Increased transit ridership  
 • Reduced car use  
 • Increased walkability  
 • Increased safety  
 • Increased economic vitality  
 • Increased quality of life  
 • Increased environmental sustainability

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## Our Idea!

Measuring Transit-Oriented Development (TOD) at regional and local scales

- Ability to quantify TOD using an Index - objective measures
- Spatial analysis of TOD - local and regional scales
- Not only planning for better 'development' but also better 'transit access'
- Methodology is transferable to any other case study

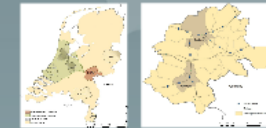
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Measuring TOD using TOD Index at regional scale

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Purpose - reduce car usage by providing other alternatives

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# Existing Methods

# Typology creation:



1 - Residential TOD  
2 - Activity Center TOD  
3 - Heavy transit and low development TOD

- Recommendation for TOD planning for each typology - not unique for each node. Qualitative approach - subjective!
- But each node area is unique and unique recommendations needed.
- TOD plans hence made could be less effective - loss of public resources when plans fail.
- **An alternative methodology needed where every node is treated uniquely! Replacing qualitative with quantitative approach**
- **Also - analysis of TOD at a larger scale is needed.**

# Existing Methods

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- Such a **TOD Index** should be computed using spatial analyses
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## Objective 1

Measuring TOD at local scale around transit nodes to plan for more transit-oriented 'Development'.

## Objective 2

Measuring TOD at regional scale to plan for better 'Transit'.

## Objective 3

Developing a Planning Support System (PSS) for planners to make detailed TOD proposals

# Our Idea!



Measuring Transit-Oriented Development (TOD) at regional scale

Yamini J. Singh  
Urban and Transport Planning  
Enschede, The Netherlands

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### Objective 2

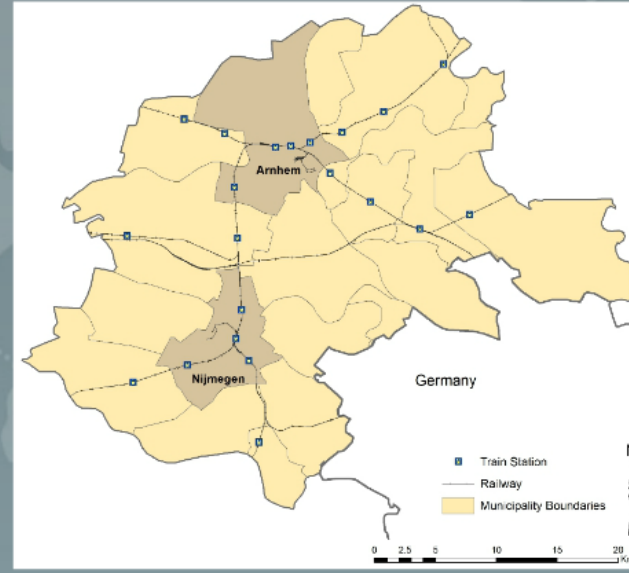
**Measuring TOD at regional scale to plan for better 'Transit'.**

### Objective 3

**Developing a Planning Support System (PSS) for planners to make detailed TOD proposals**

**Our Idea!**

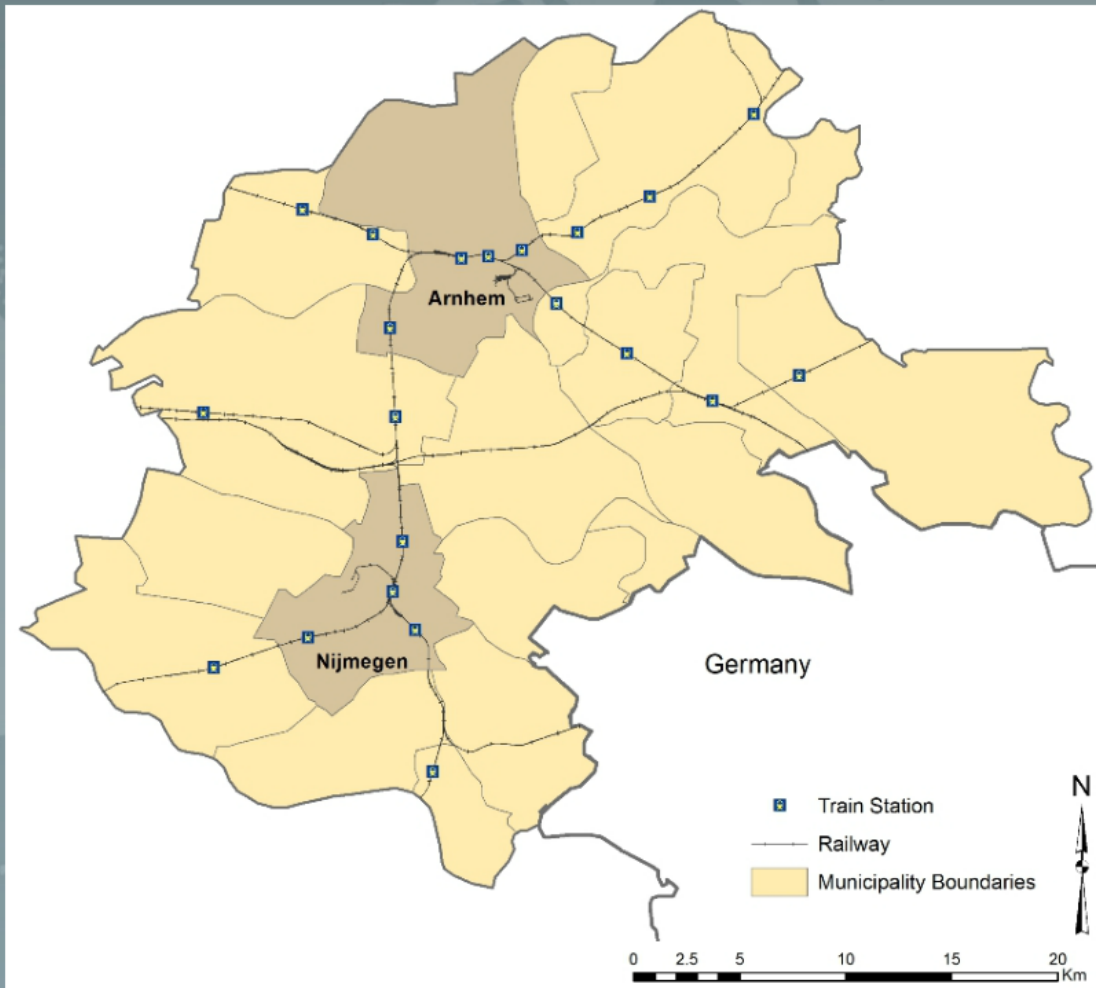




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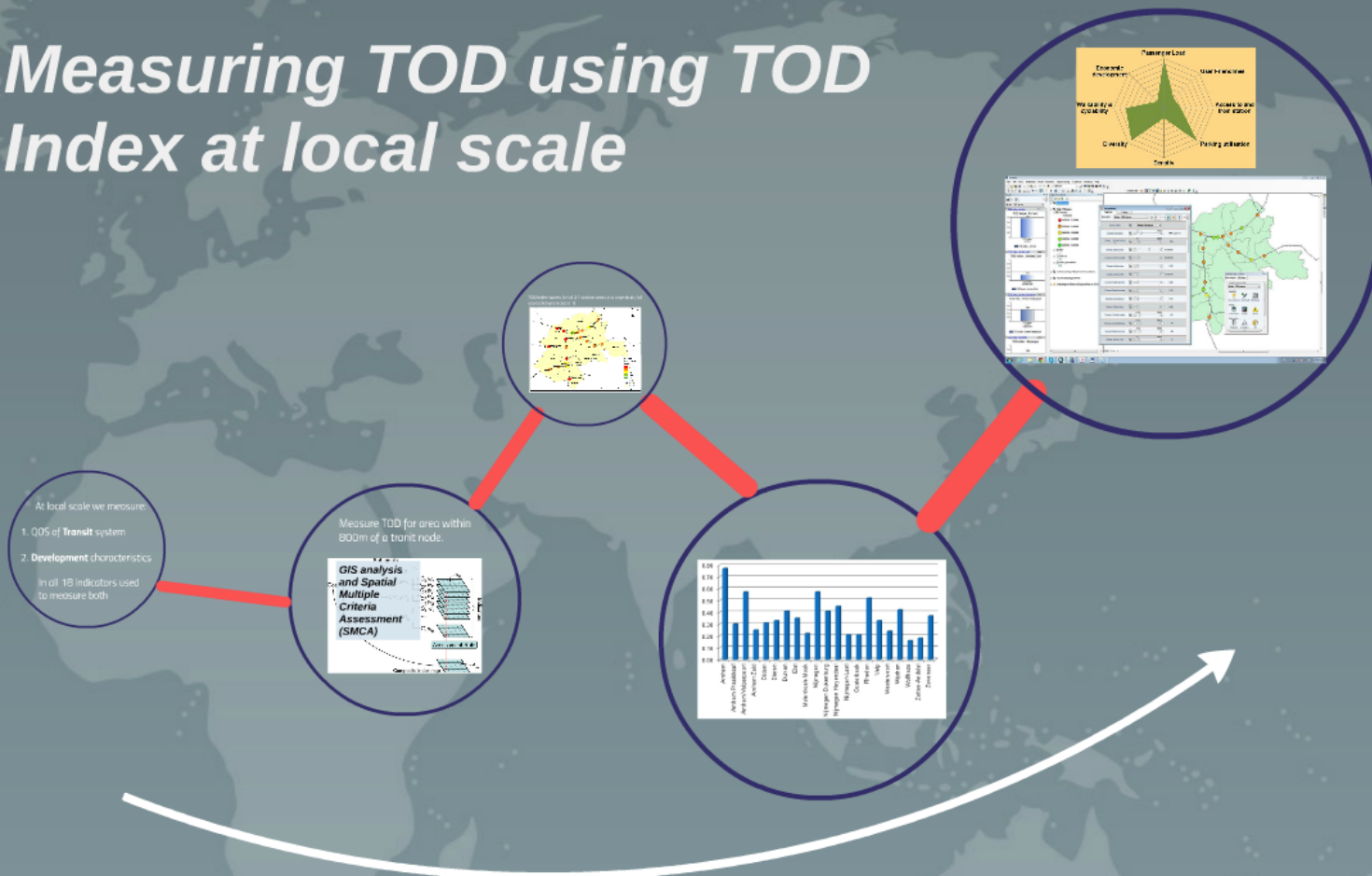
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# Measuring TOD using TOD Index at local scale

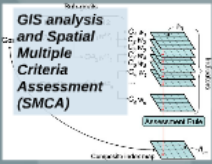


# Methodology

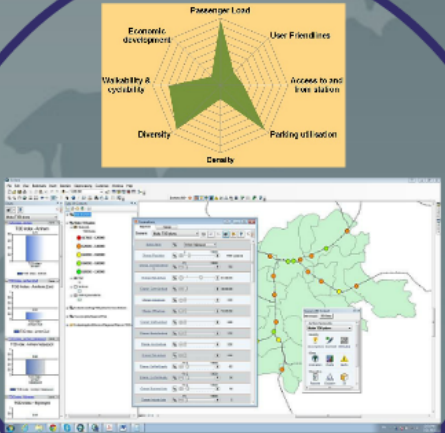
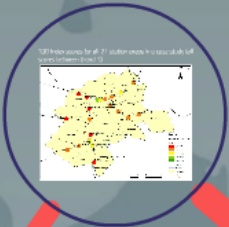
# Measuring TOD using TOD Index at local scale

- At local scale we measure:
1. QOS of Transit system
  2. Development characteristics
- In all 18 indicators used to measure both

Measure TOD for area within 800m of a transit node.

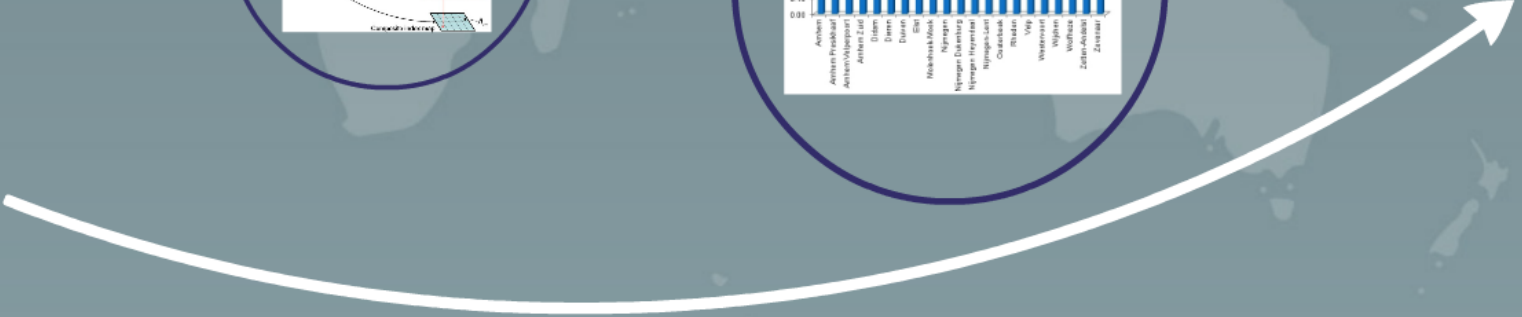


**GIS analysis and Spatial Multiple Criteria Assessment (SMCA)**



**Indicators:** Economic development, User friendliness, Access to and from station, Parking utilization, Density, Diversity, Walkability & cyclability.

**GIS Map:** Shows the spatial distribution of TOD indicators across the city area.





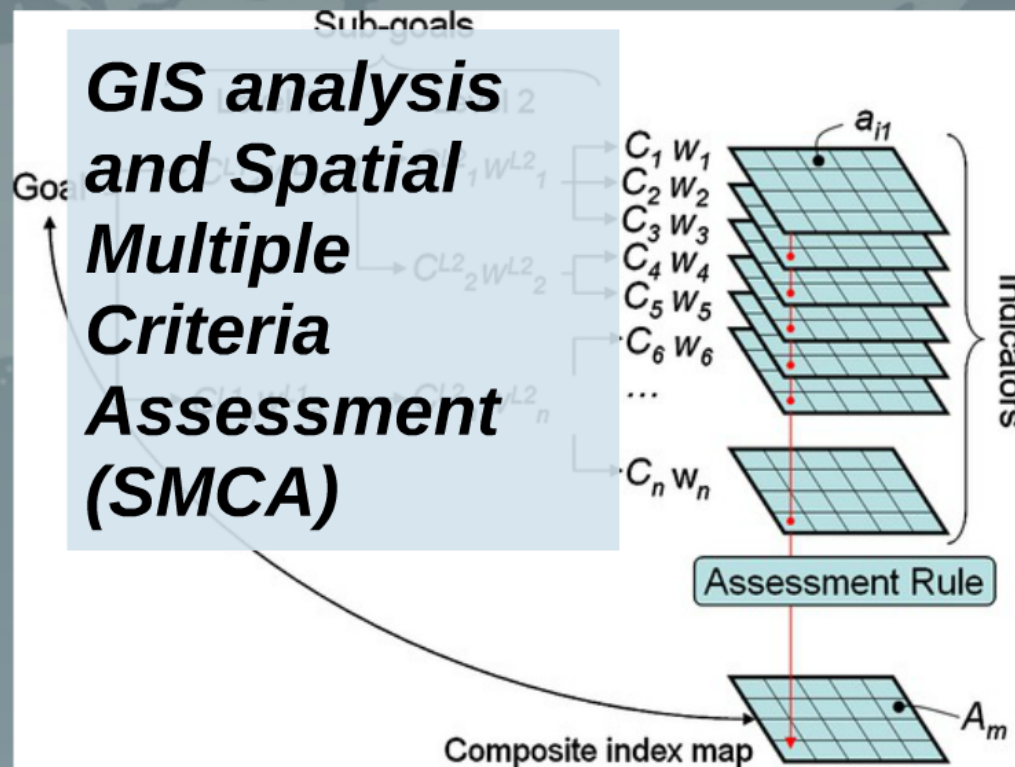
At local scale we measure:

1. QOS of **Transit** system

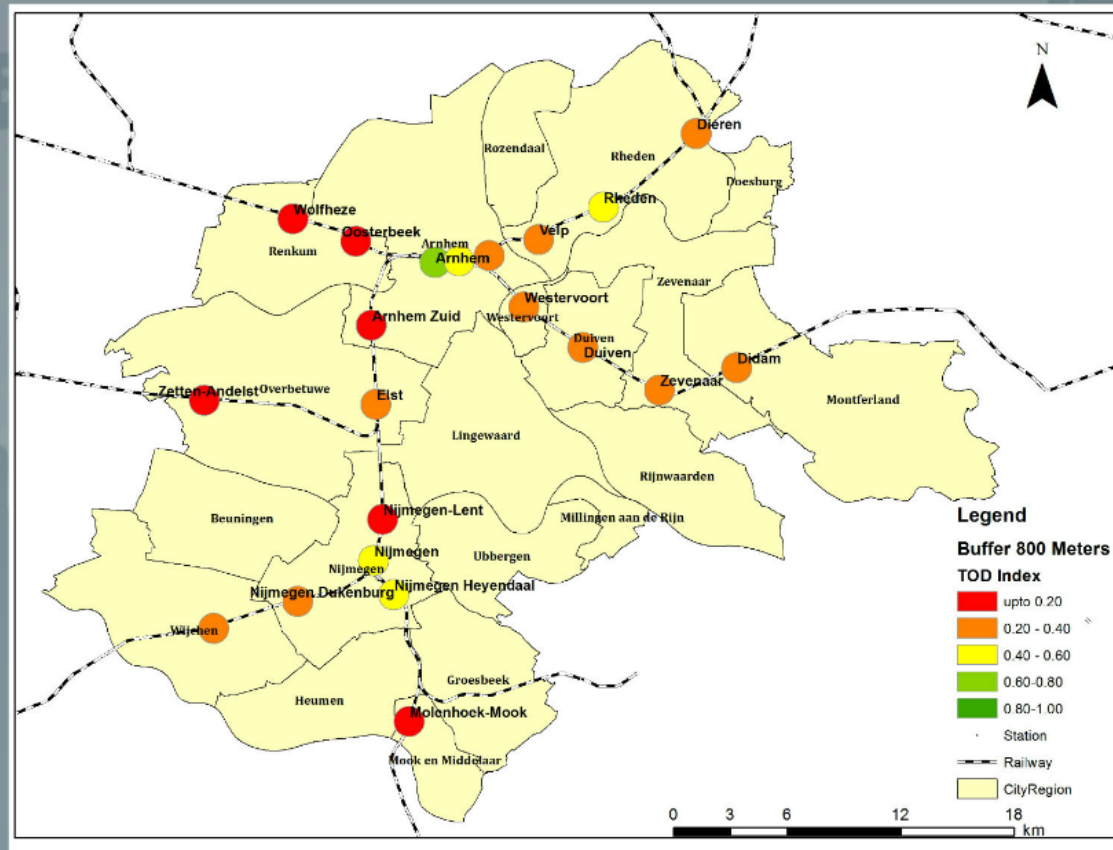
2. **Development** characteristics

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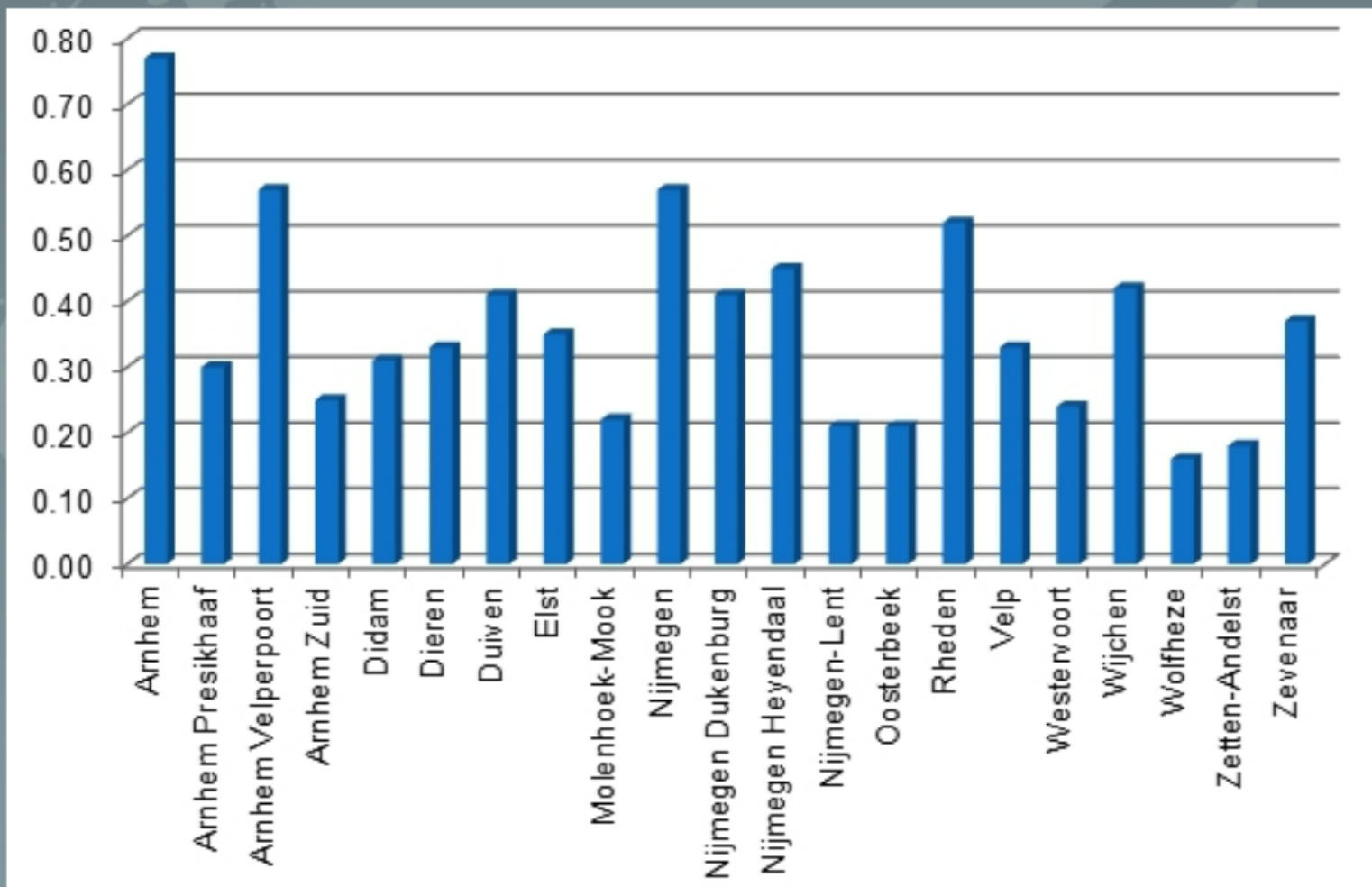
Measure TOD for area within 800m of a transit node.

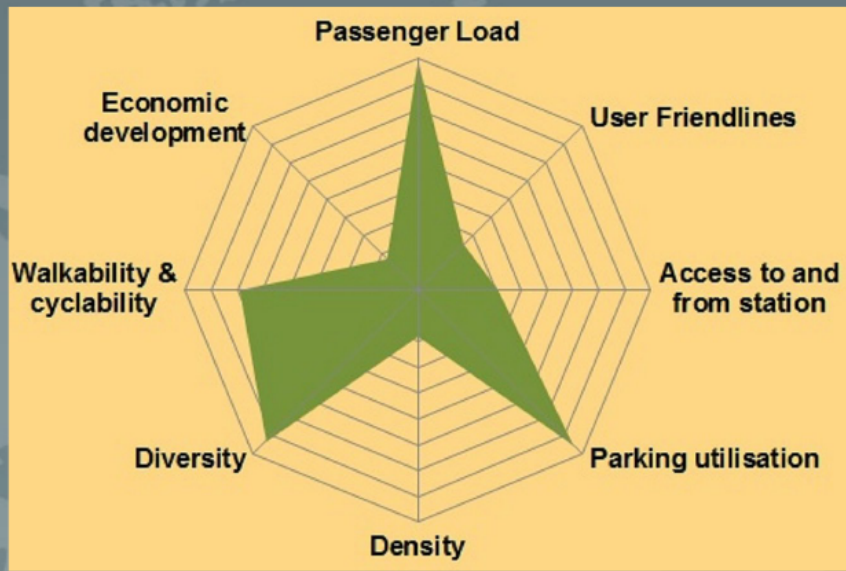


TOD Index scores for all 21 station areas in a case study (all scores between 0 and 1)





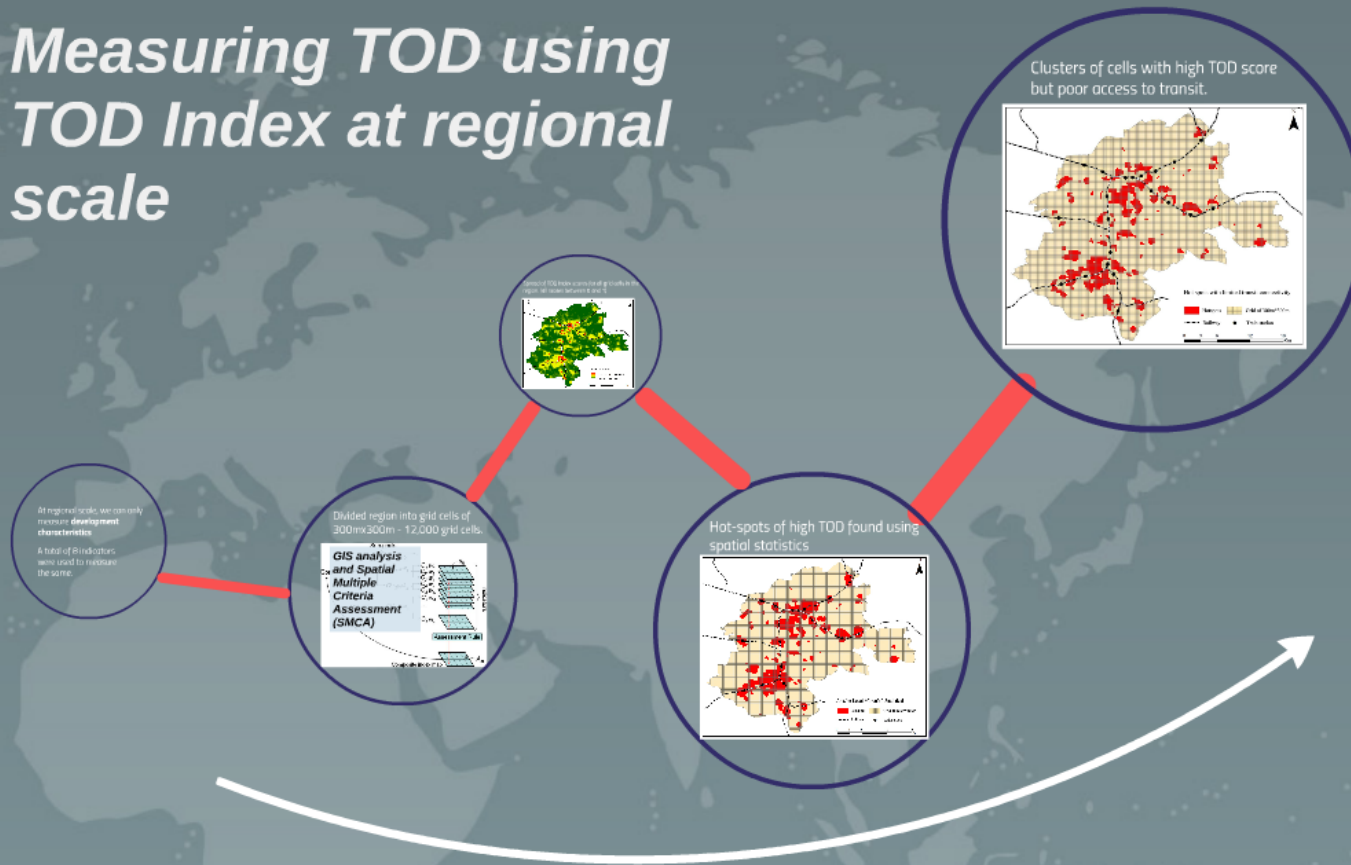




The screenshot displays the Gctaria software interface. On the left, there are four charts showing the TOD index for different stations: Arnhem (0.75), Arnhem Zuid (0.25), Arnhem Velperpoort (0.65), and Nijmegen (0.64). In the center, an 'Assumptions' table lists various parameters for the 'Arnhem Velperpoort' station. On the right, a map shows a rail network with colored dots representing stations. A 'Scenario 360 Content' window is also visible, showing 'Make TOD plans'.

Station Name	Change_Procedure	Value	Unit
Arnhem Velperpoort	Change_Procedure	10000	1500 persons
Arnhem Velperpoort	Change_CommercialInd	10000	100
Arnhem Velperpoort	Change_ResLanduse	51350.00	
Arnhem Velperpoort	Change_CoverLanduse	30.0000	
Arnhem Velperpoort	Change_IndLanduse	0.00	
Arnhem Velperpoort	Change_OffLanduse	10.0000	
Arnhem Velperpoort	Change_HealthLanduse	0.00	
Arnhem Velperpoort	Change_SportsLanduse	0.00	
Arnhem Velperpoort	Change_AccomLanduse	0.00	
Arnhem Velperpoort	Change_EduLanduse	0.00	
Arnhem Velperpoort	Change_CarParkSpace	-10	10000
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Arnhem Velperpoort	Change_BusinessInd	-10	10000
Arnhem Velperpoort	Change_IndustriLanduse	0	10000

# Measuring TOD using TOD Index at regional scale



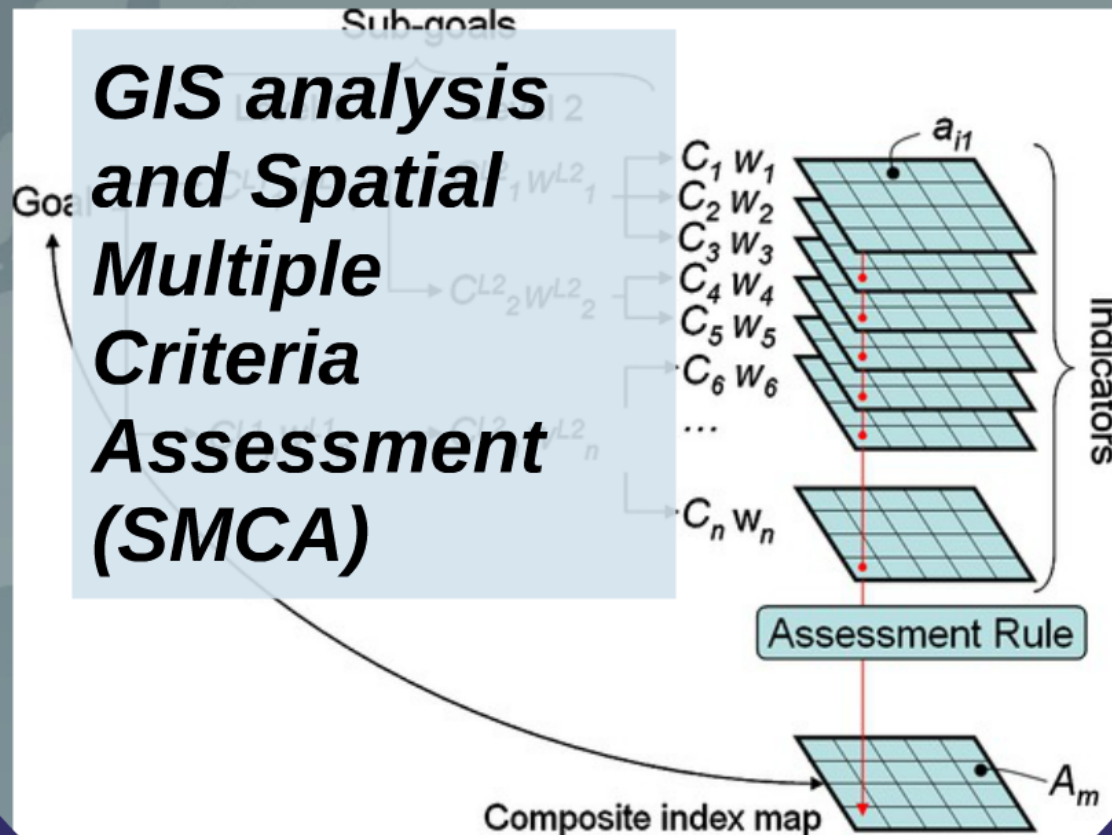
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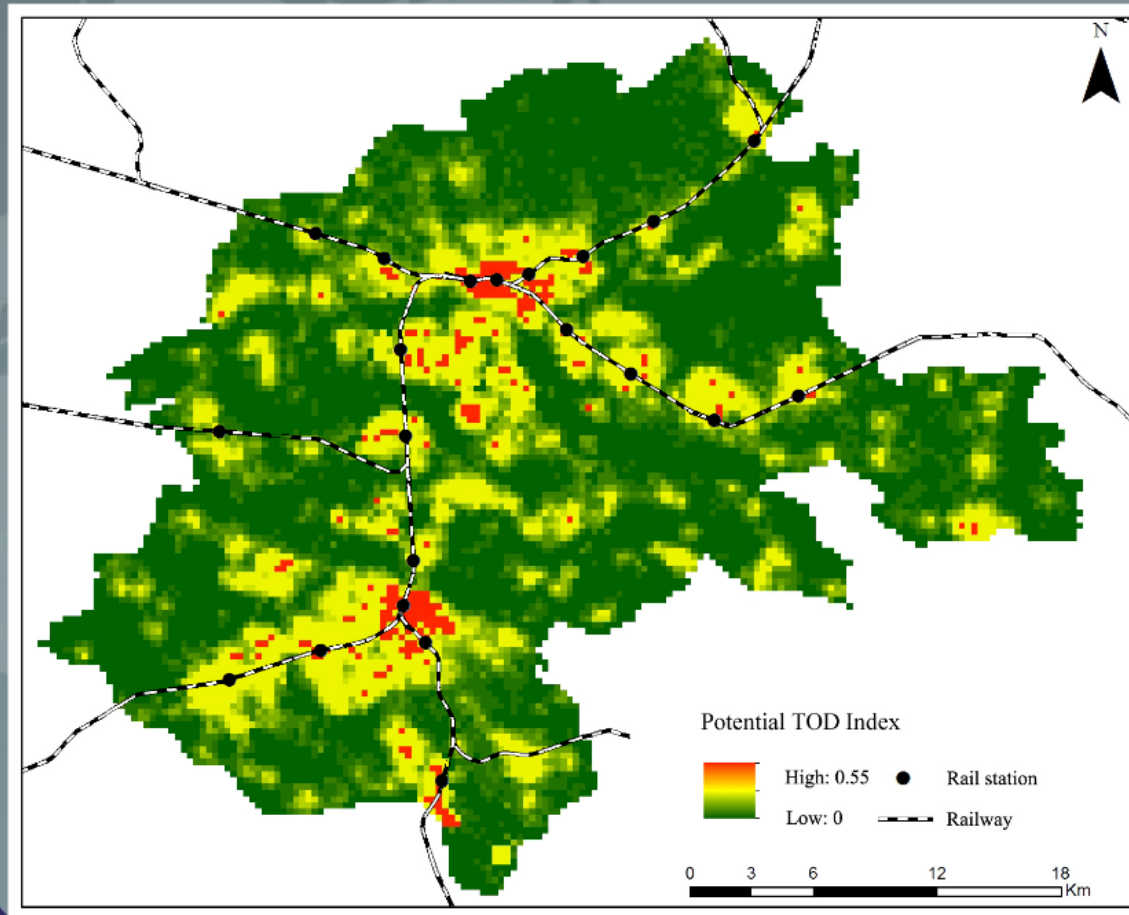
At regional scale, we can only  
measure **development  
characteristics**

A total of 8 indicators  
were used to measure  
the same.

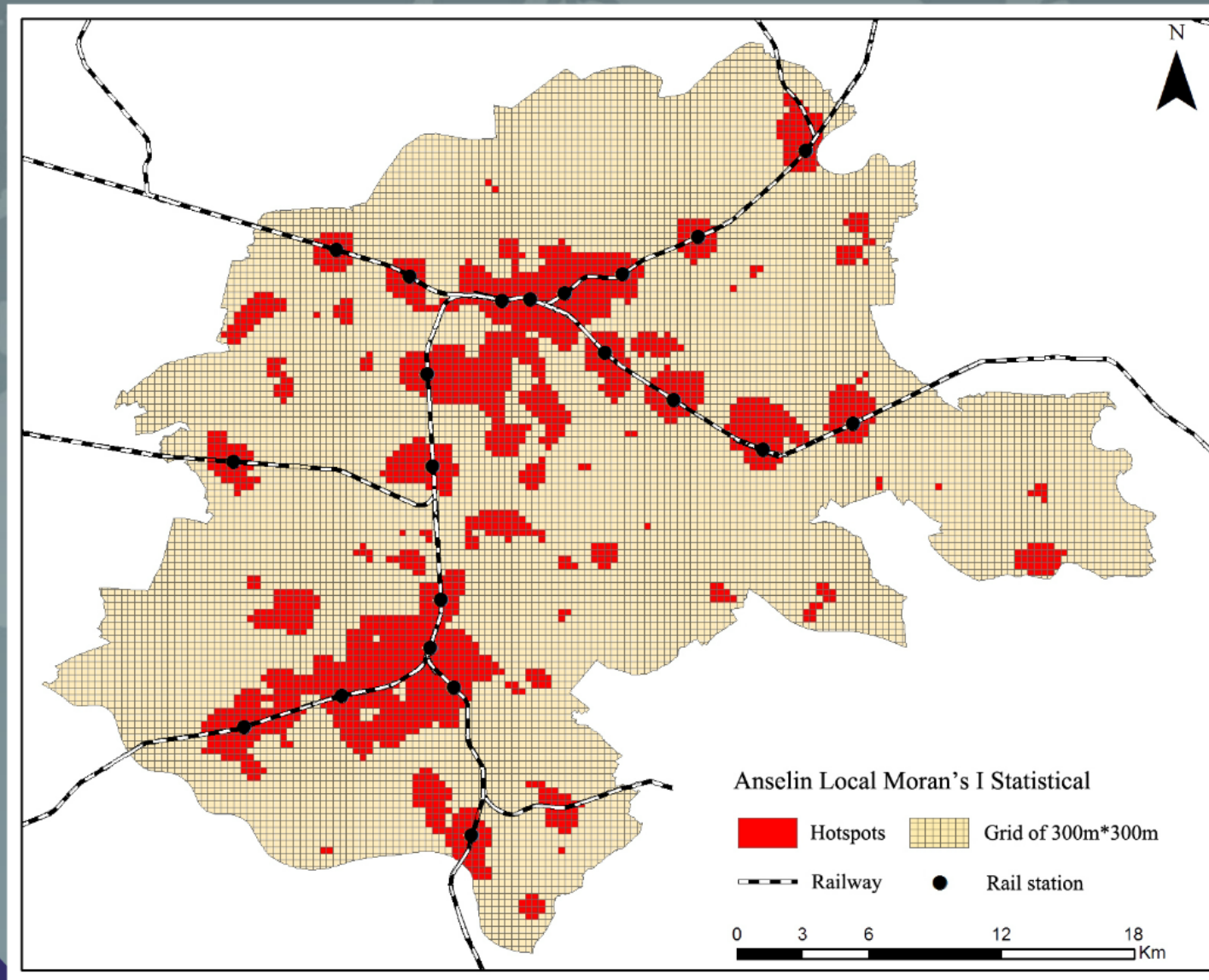
Divided region into grid cells of 300m x 300m - 12,000 grid cells.



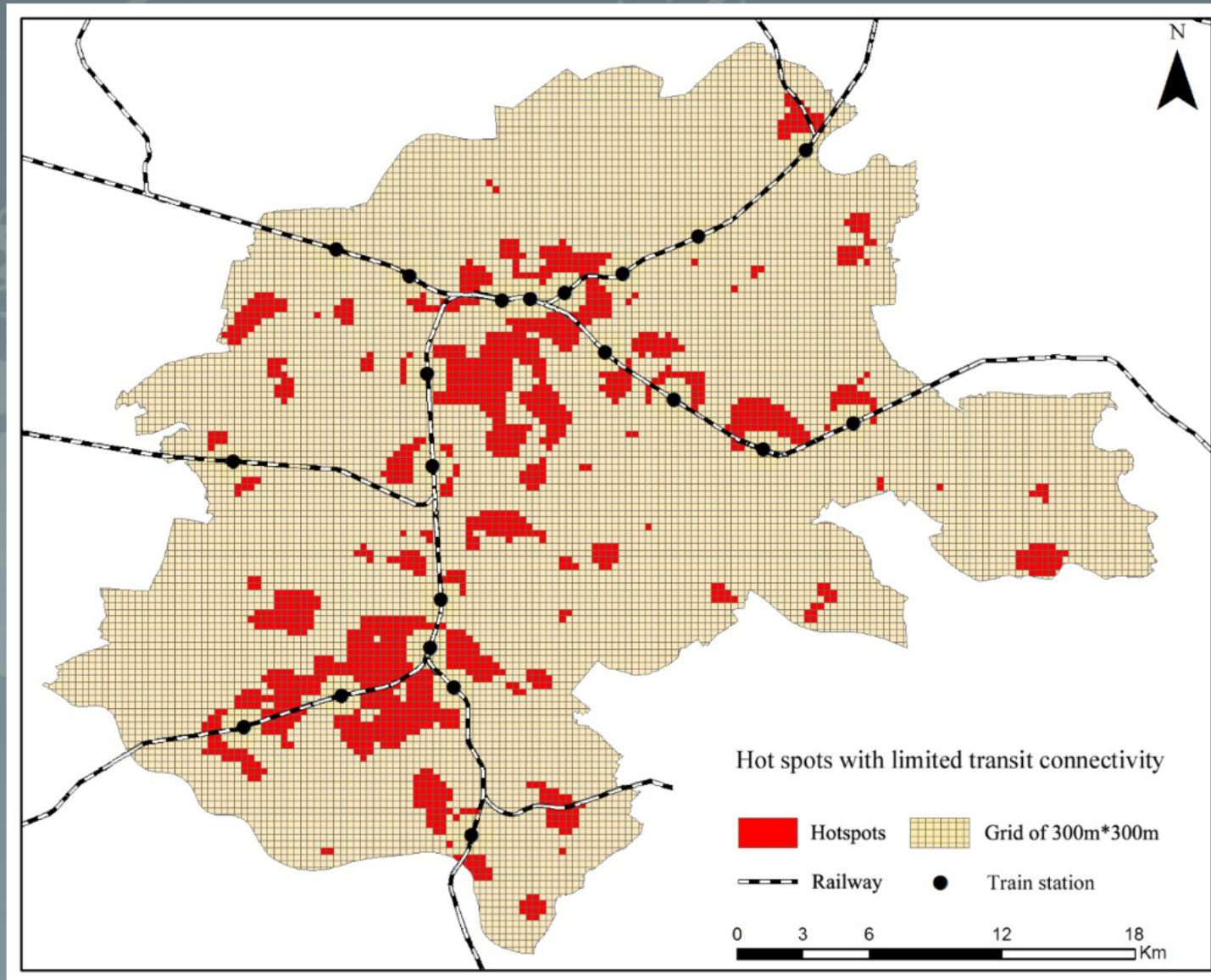
Spread of TOD Index scores for all grid cells in the region. (all scores between 0 and 1)



# Hot-spots of high TOD found using spatial statistics

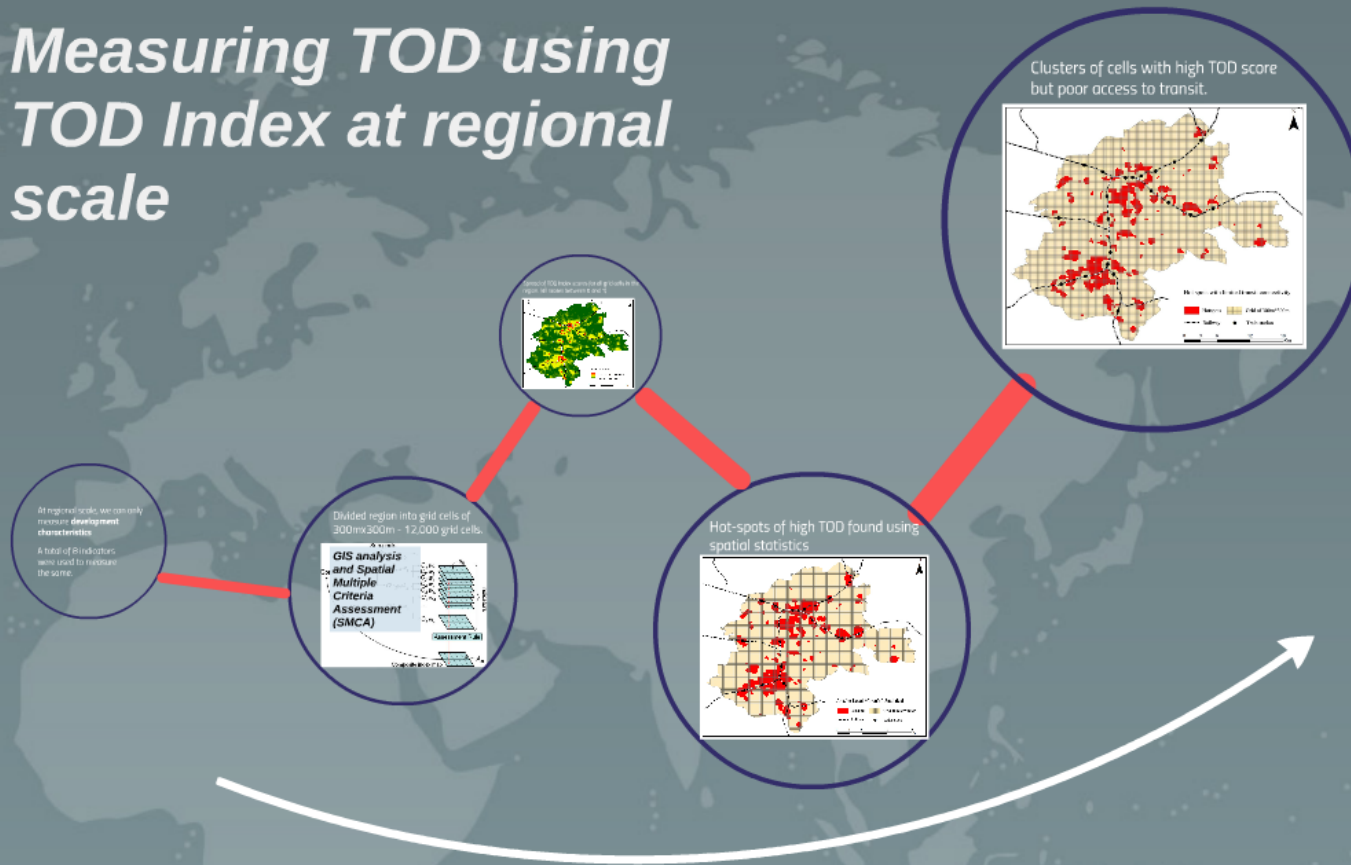


# Clusters of cells with high TOD score but poor access to transit.





# Measuring TOD using TOD Index at regional scale



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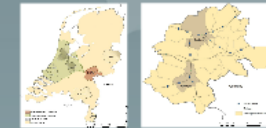
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