Paving the way for autonomous cars

Current projects and challenges in the Netherlands

Iris Ruysch
Faculty of Architecture
Master track: Management in the built Environment

Main mentors:
Aksel Ersoy
Javier Espinosa Oviedo

Introduction

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Nearly

1.3 MILLION

People die in road crashes each year

90%

Involves human intervention

Also, congestion, less space for greenary…

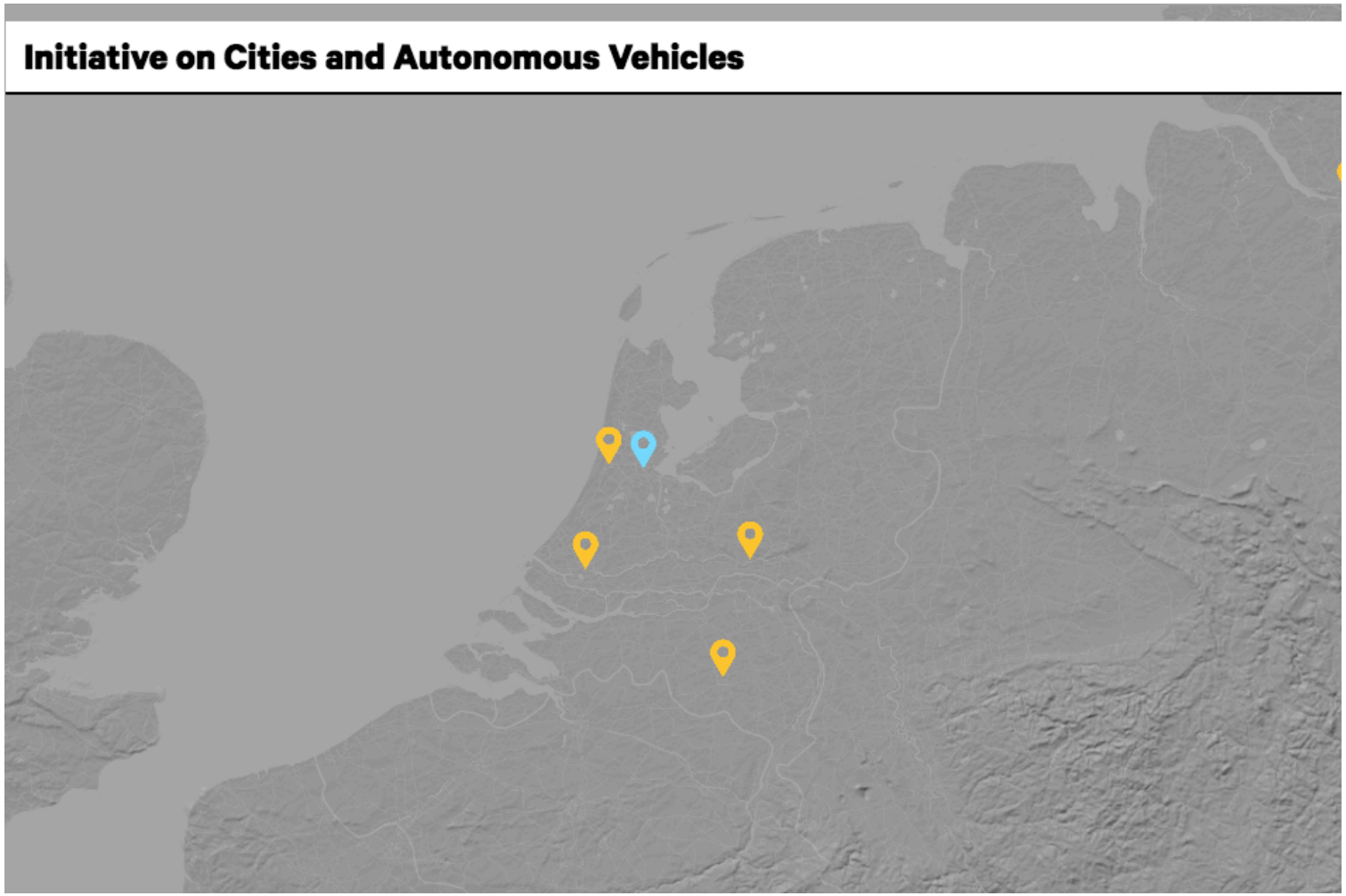
3

(Source: Association for safe international road travel (2018).

Autonomous cars are only futuristic

Introduction

'How have autonomous cars been integrated during the autonomous vehicle transition in the Netherlands?'



(Source: Bloomberg Philanthrophies (2018)

Outline

1. Introduction
2. Methodology
3. Literature review
4. Case studies
5. Analysis framework
6. Conclusion

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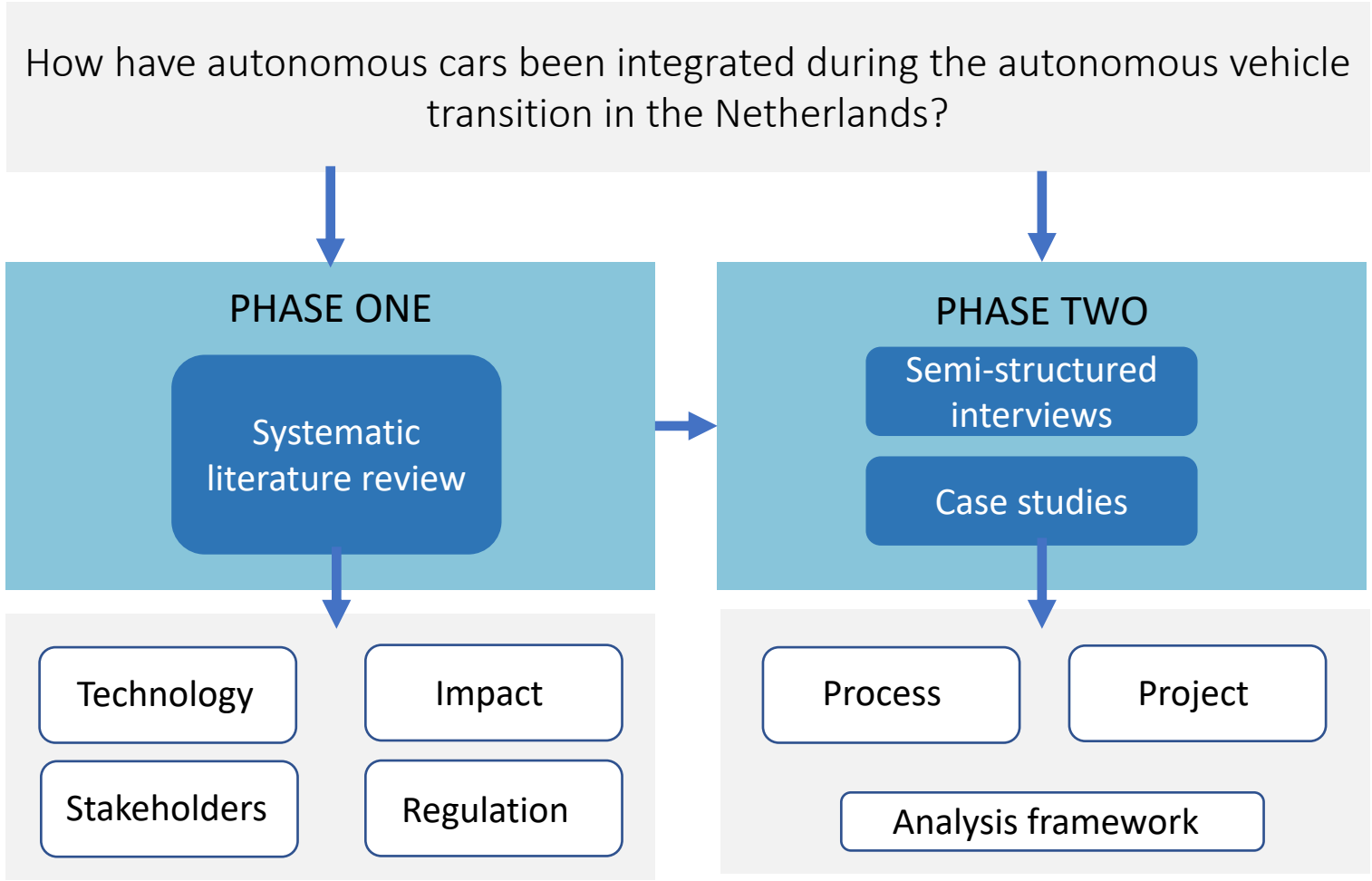
Methodology

- What is meant by the term autonomous car?
- What is the impact on the built environment?
- Who are the critical stakeholders?
- What are the main policies when integrating autonomous cars?



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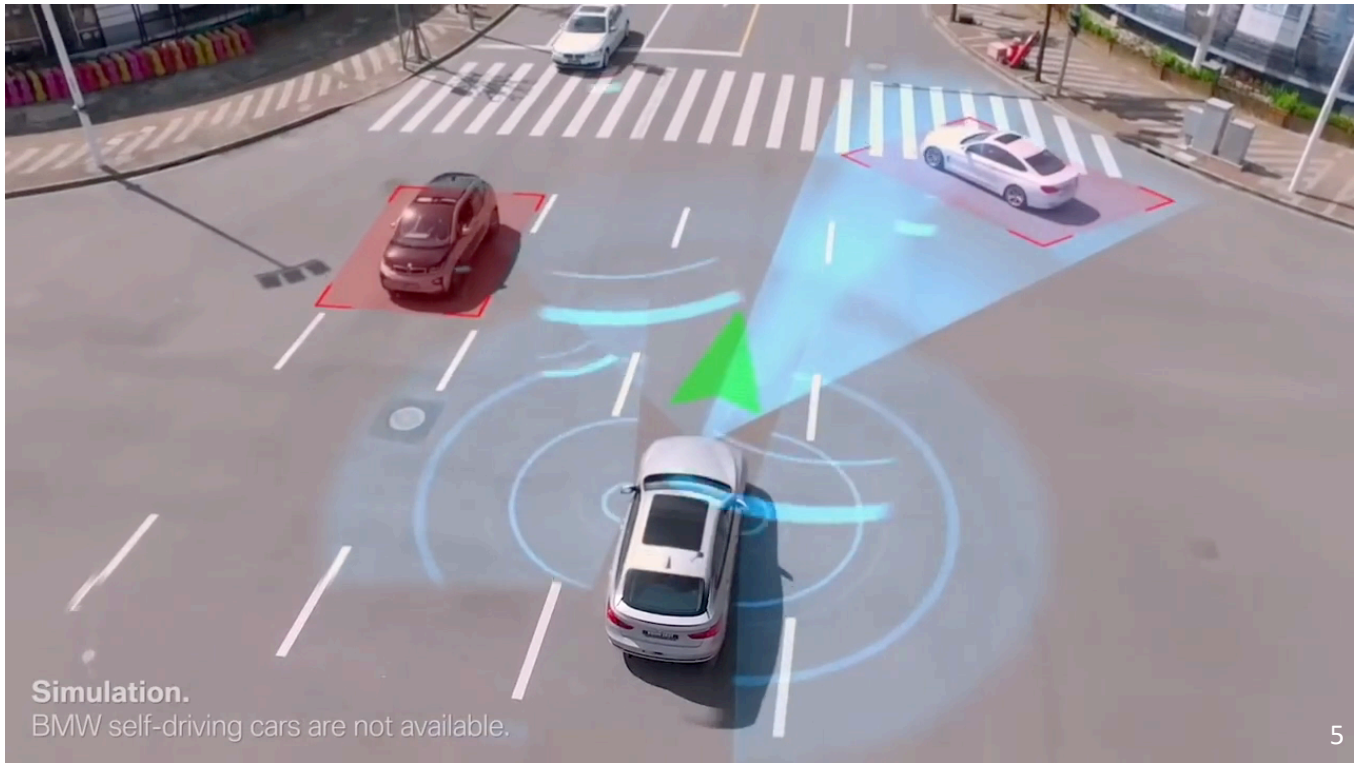
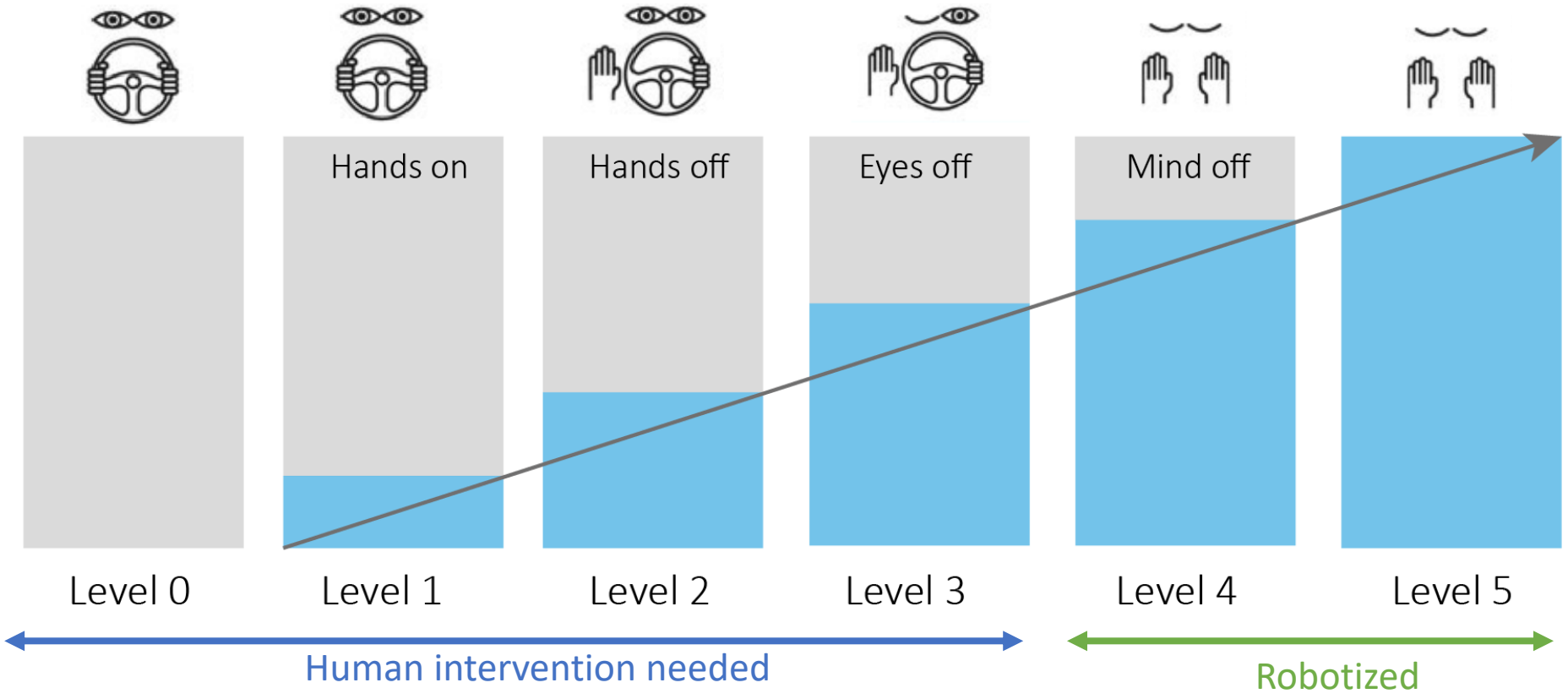
The autonomous car

- The same looks as a regular car
- Around 17 sensors
  - 6 Lidar: 360 degrees object detection
  - 7 Radar sensors
    - Long range
    - Medium range
  - 4 Cameras: image processing

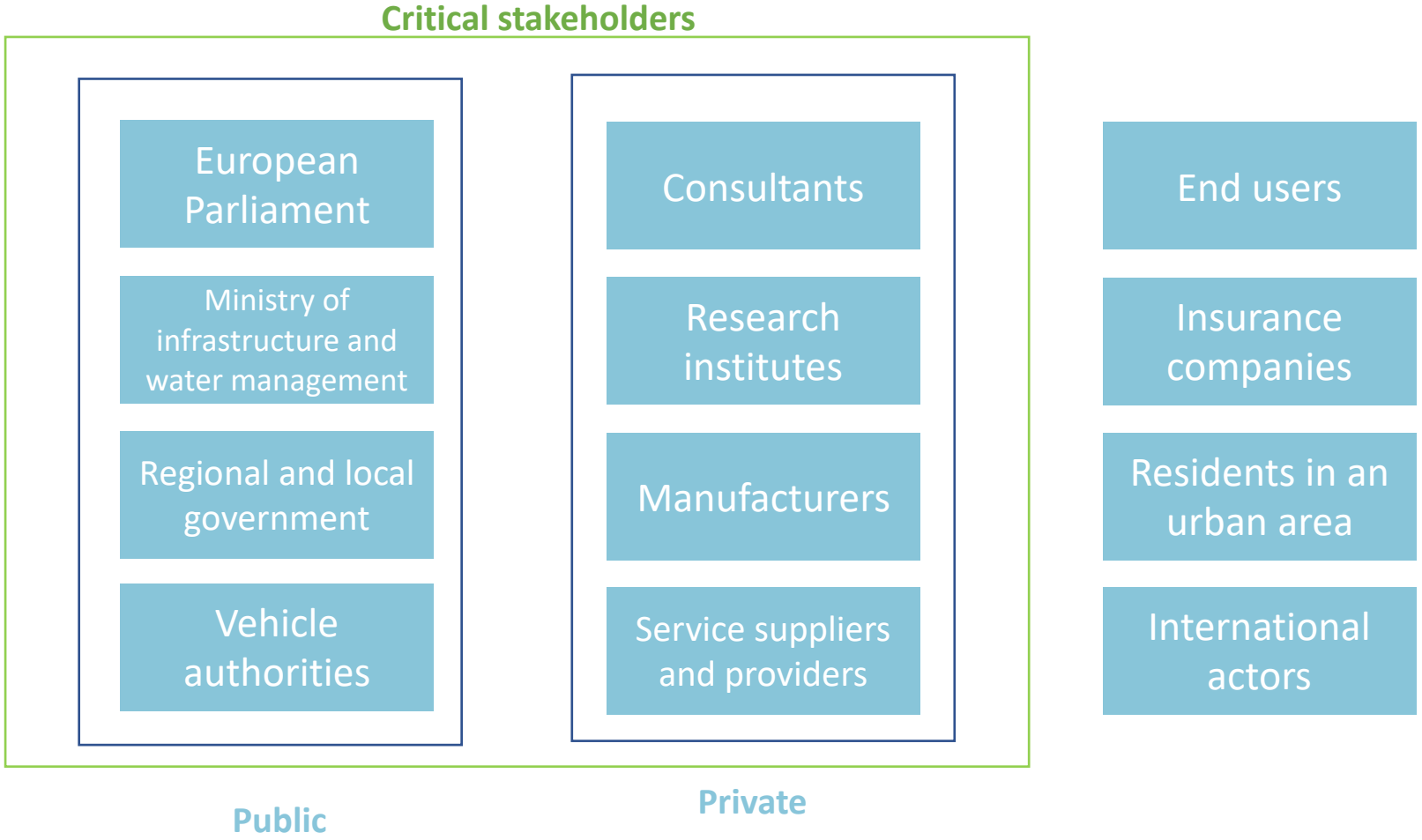


Six levels of autonomy

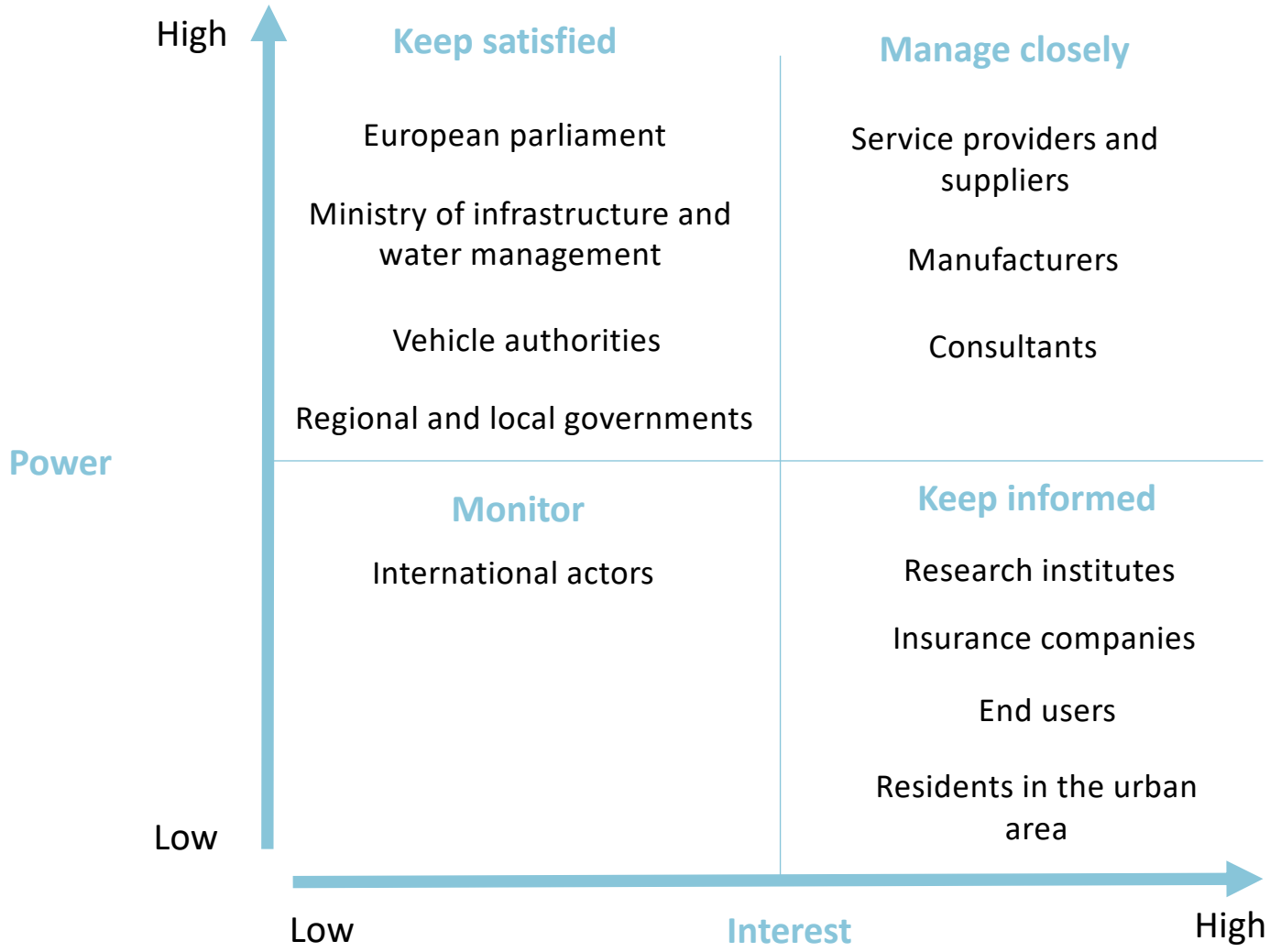


(National Highway Traffic Safety Administration, 2013; Society of Automotive Engineers, 2018).

Stakeholders



Power versus Interest matrix



(Based on : Bryman, 2004)

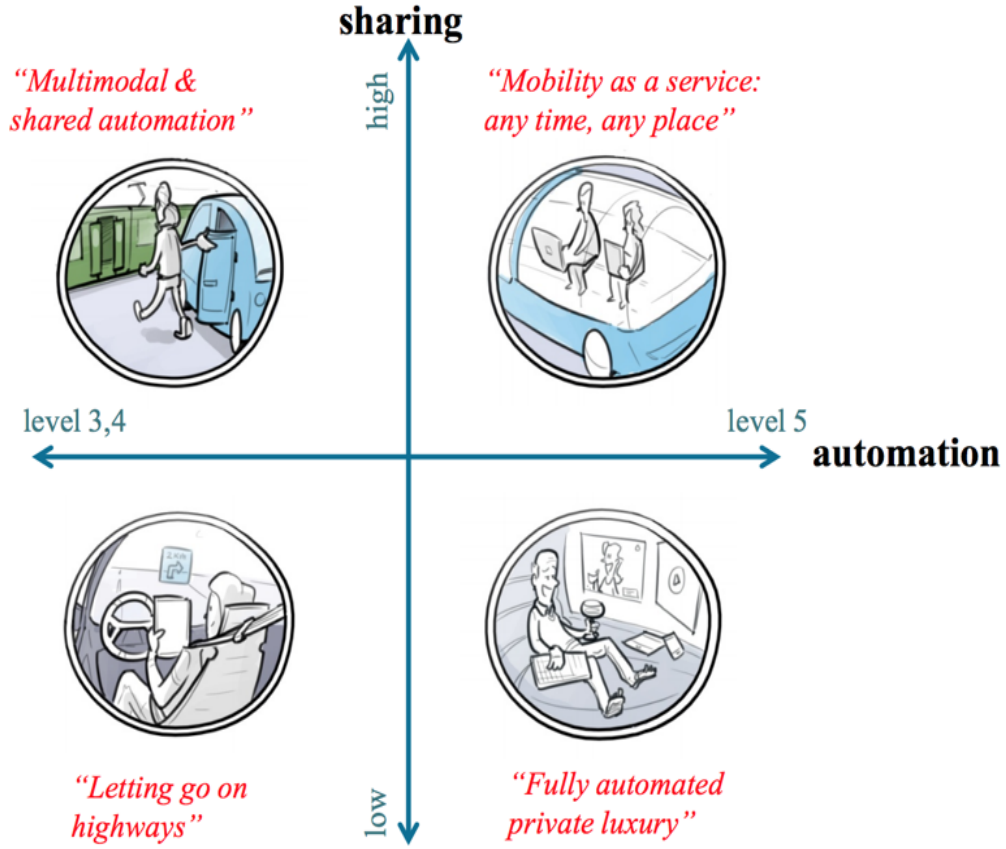
Regulation

European Parliament	• Increasing the safety • Safeguarding consumer rights • Creating knowledge by stimulating real life testing
House of representatives	• Aprove or reject proposals • Rejected the experimental bill in April 2018
Regional and local government	• Aprove or refuse pilot projects • Grant subsidies to facilitate projects
Vehicle authorities	• Dutch law: Every vehicle needs to have a steering wheel • Exemption on the road traffic act 1994 • Application procedure (12 weeks)

(Sources: European Parliament, 2019; Ministry of Infrastructure and Water Management, 2017; Boersma, Van Arem & Rieck, 2018; RDW, 2017)

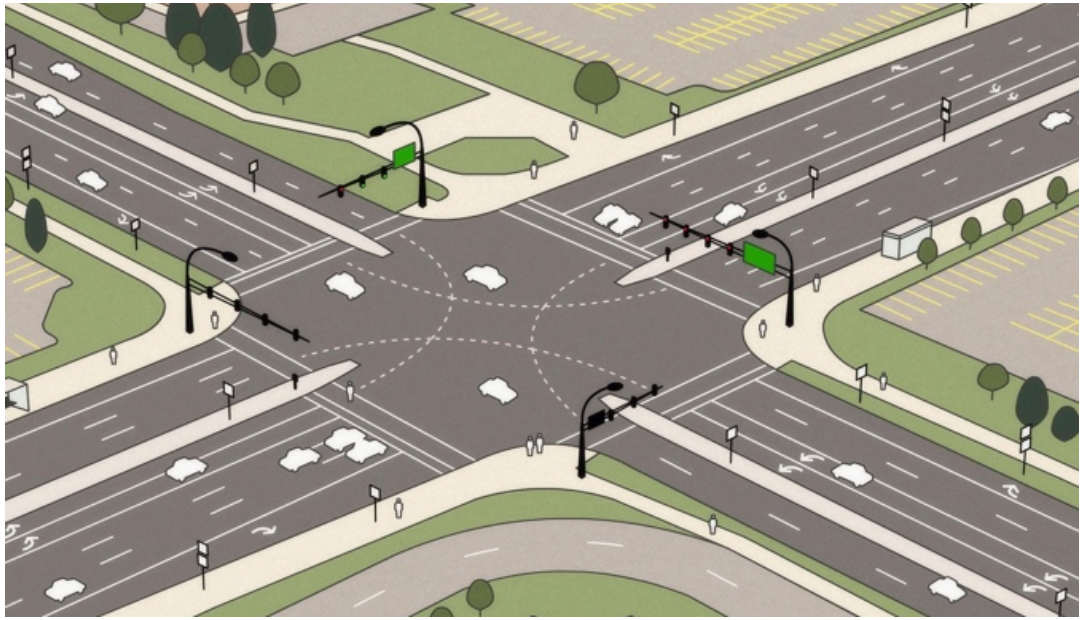
The expected impact on the built environment

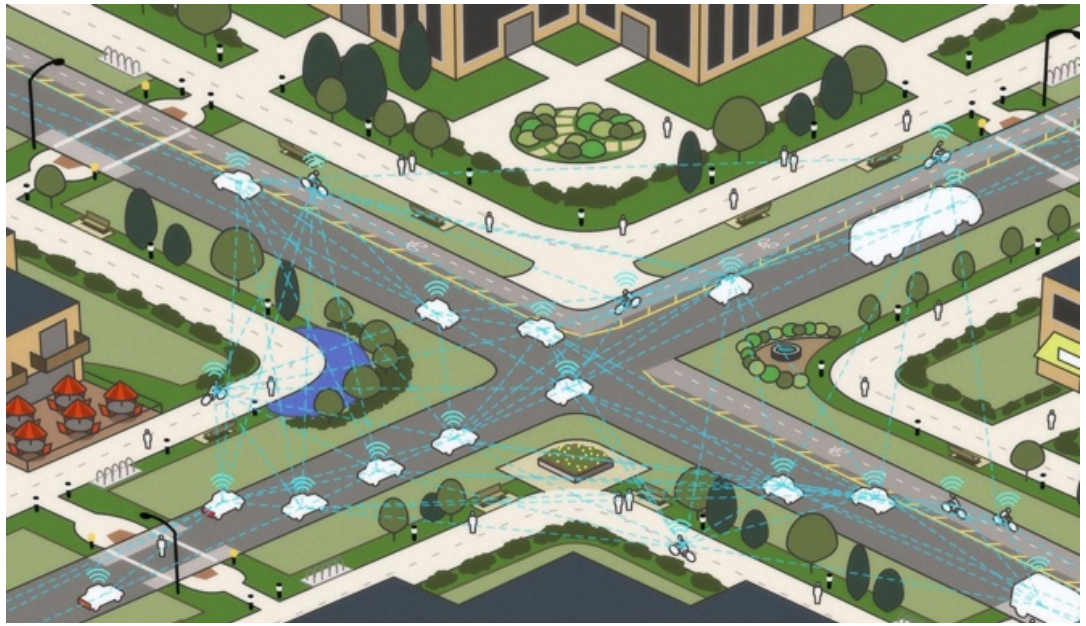
- Scenario analyses to identify the impact
- Depends on:
  - development of the technology
  - behavior of society
- Researchers from MIT's senseable city lab
  - Carlo Ratti: architect, engineer, director of MIT
  - Fábio Duarte: research scientist and professor, director of MIT
  - Assaf Biderman: CEO of superpedestrian, associate director of MIT
- Other research
  - Sohrweide: SEH research institute



(Source: Ministry of infrastructure and water management, 2015)

The expected impact on the built environment





(Source: Sohrweide, 2018)

- Adapted infrastructure (Sohrweide, 2018)
- Number of cars in cities will probably decrease, depends on social aspects (Duarte, F., & Ratti, 2018)
- Less parking in urban areas (Duarte, F., & Ratti, 2018; Fitt et al., 2018).
- Change in urban structure, other functions (Ainsalu et al., 2018; Duarte, F., & Ratti, 2018).

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Case study selection

- Phases
- Area type
  - Urban
  - Rural
- Information available
- Appelscha
- Scheemda
- Haga
- Esa Estec
- Bourtange

Autonomous shuttles

- Addition to public transport
- Smaller scale
- Financial feasibility in rural areas
- High costs for drivers in general
- Innovation
- MaaS
  - Extra service: first or last mile

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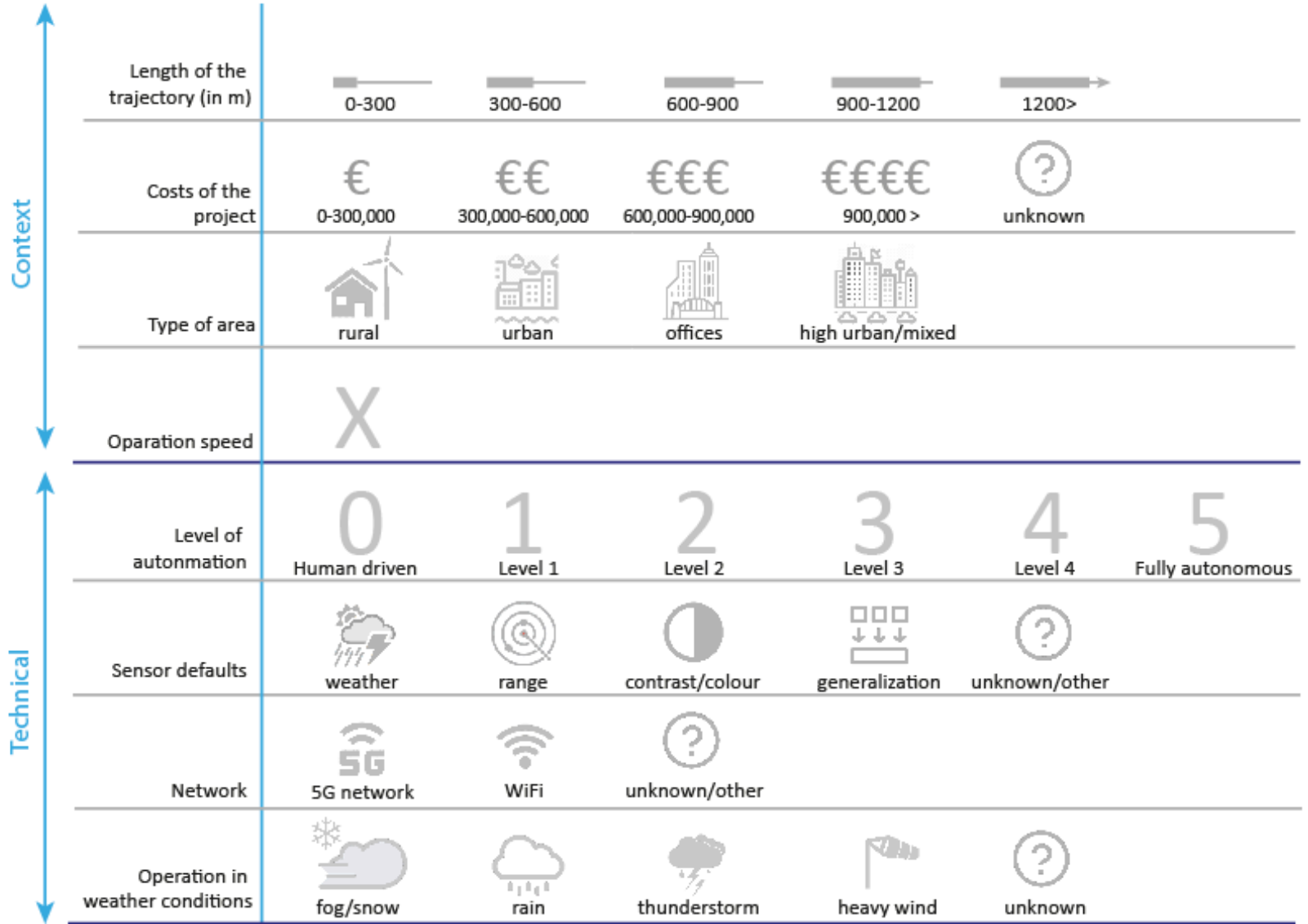
Analysis framework

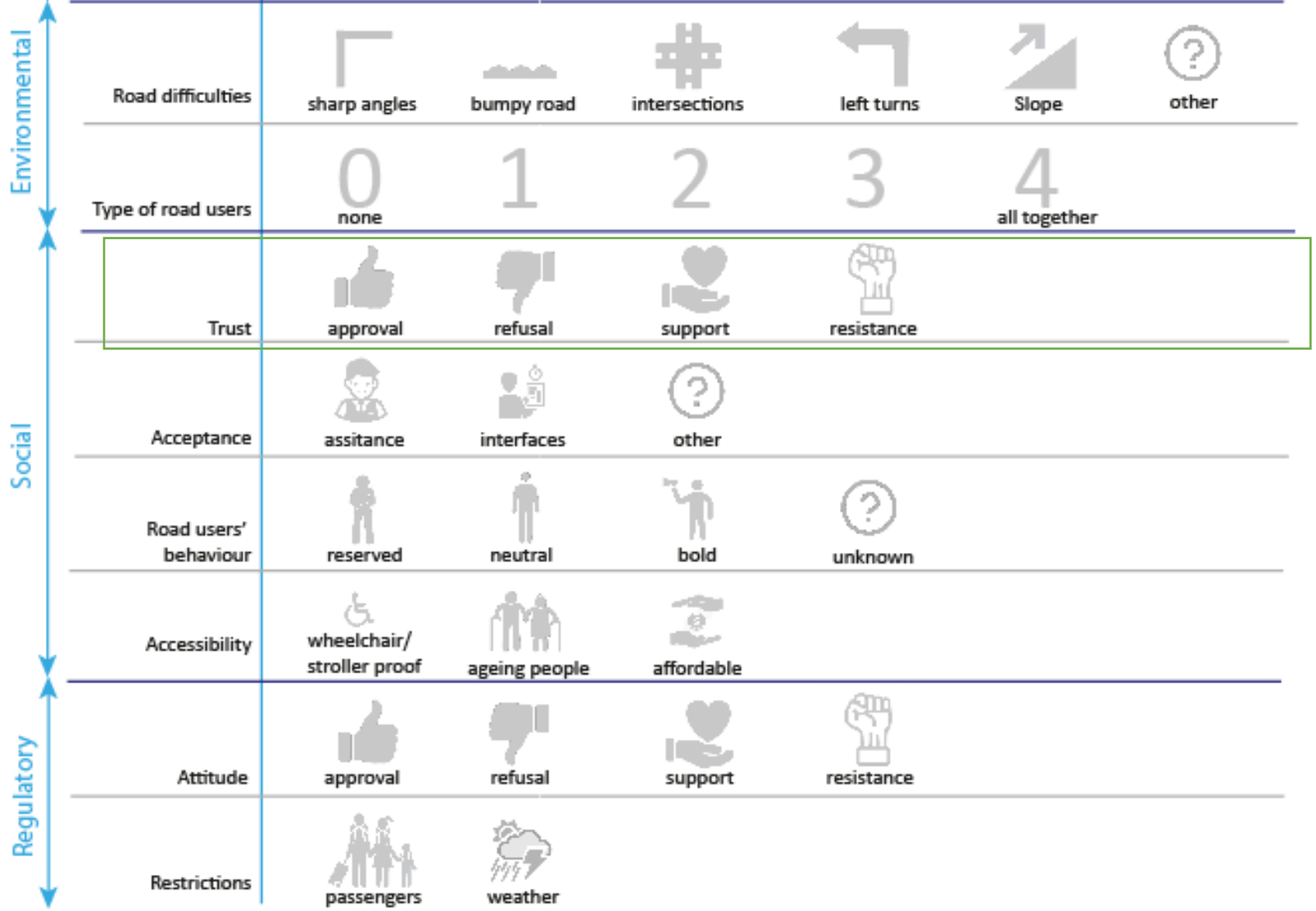
- Context
- Technical challenges
- Environmental challenges
- Social challenges
- Regulatory challenges

Analysis framework



TU Delft

Challenge the future



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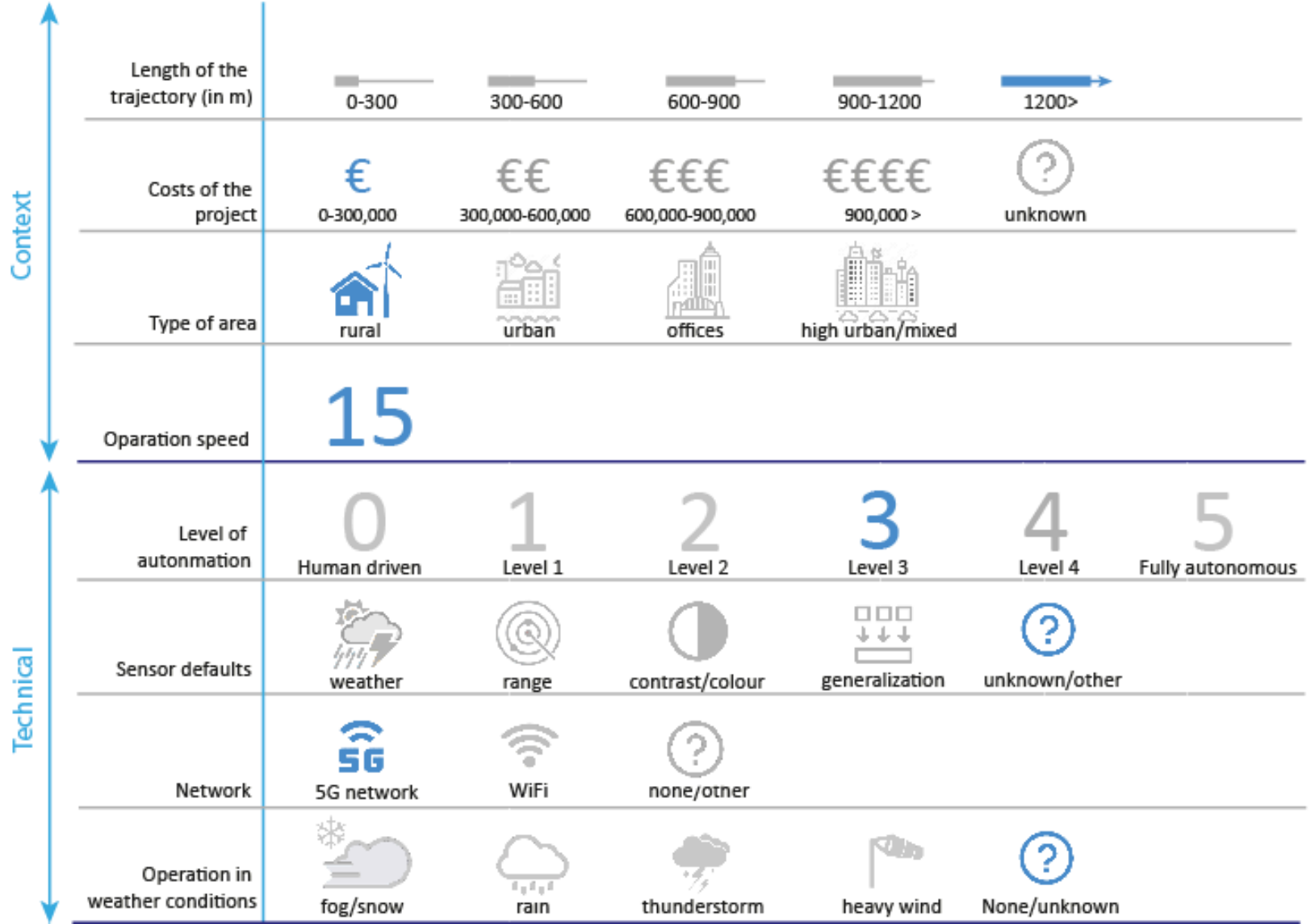
Challenge the future

Example case

Example case



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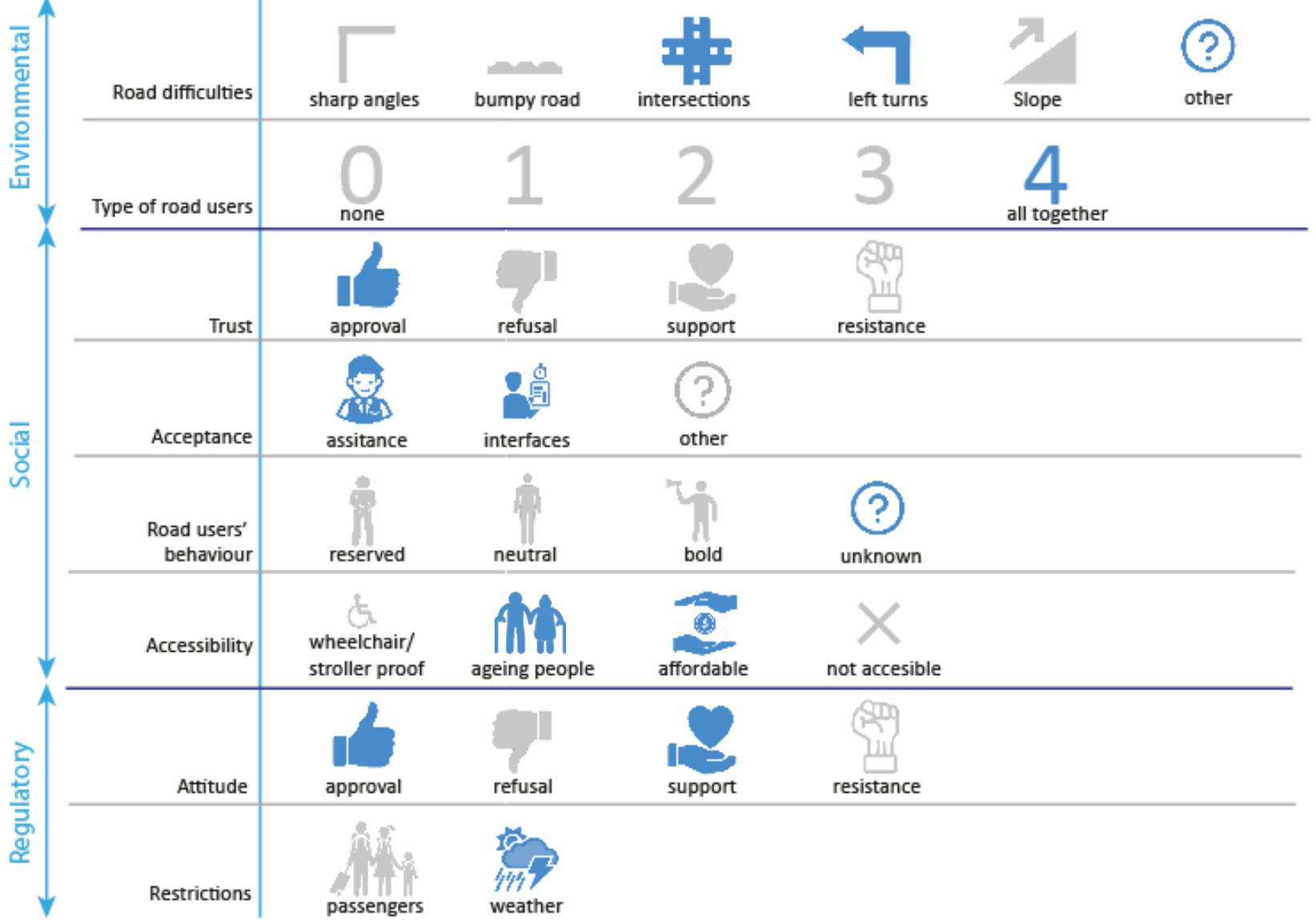

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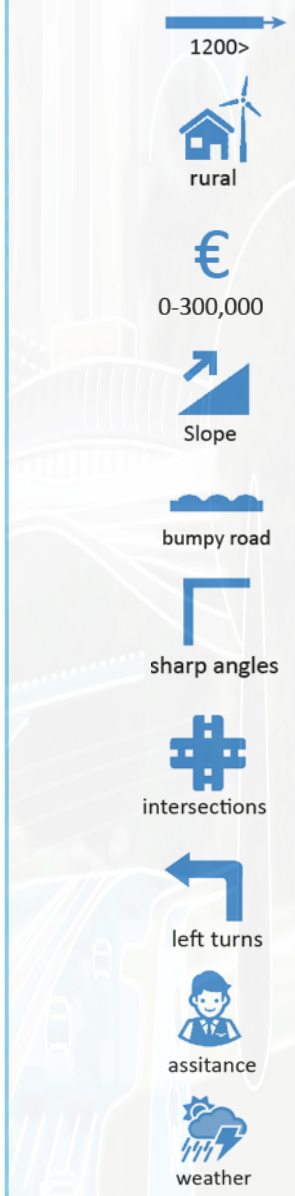
Challenge the future

Main challenges

- Technical
  - Passing obstacles
  - Communication between the vehicle and the other road users
  - Connect to the public transport service
- Environmental
  - Left turns, intersections
  - Many road users
- Social
  - Communication between critical stakeholders and external stakeholders
  - When to exclude the steward?
  - Accesibility to people in wheelchairs/strollers
- Regulatory
  - Over-regulating → uncertainty of operation during heavy weather conditions

Main findings cross-case analysis

- Rural areas: smaller trajectories
- Rural areas: more expensive
- Many technical challenges related to the urban environment:
  - Inability to pass road obstacles
  - Unsignalised intersections, roundabouts and left turns
- Over-regulating leads to less room to experiment
  - Uncertain trust and aceptance level when excluding the steward?
  - Operation during heavy weather conditions?



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Conclusion

'How have autonomous vehicles been integrated during the autonomous vehicle transition in the Netherlands?'

- Technology: Level of autonomy: three (still some human intervention needed)
- Society: Eight critical actors, both public and private
- Environment: Effects on the built environment
  - Adapted infrastructure
  - Number of cars in cities will probably decrease, depending on social aspects
  - Less parking in urban areas
  - Change in urban structure, more dense?
  - More space for other functions
- Regulation: Exemption needed to test autonomous cars
- Case studies & interviews: Main challenges are:
  - to pass road obstacles (technical)
  - When to exclude the steward (environmental and Social)
  - to deal with over-regulating, experimental law rejected..

  Many projects planned, much to learn

Perspectives

- For future research
  - Keep reflecting on the planned projects
  - Adjust or extend the framework
  - Extend the number of interviews
  - Compare with international cases (particularly in relation to the public involvement)
  - Ageing people vs young adults
  - Geography vs complexity
- For future projects
  - Test on private grounds more often and document the results
  - Create an up-to-date database to share knowledge
  - Keep communicating

Master the transition to driverless vehicles

Questions?