TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Transport and Traffic Sciences „Friedrich List“

Transport and Infrastructure Planning
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vip

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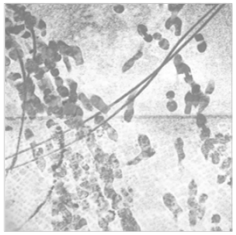
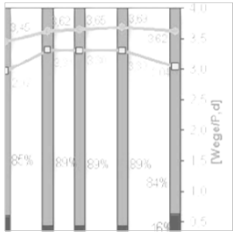
Sensitivity Analysis to Estimate the Potential of Cycling to Reduce Emissions in Road Transport



Mobilität in Städten 2013



Perugia, 29 November 2012

DRESDEN concept
Exzellenz aus Wissenschaft und Kultur

01 Introduction

Topic‘s meaning and classification

- Reduction of greenhouse gas emissions (GHGs) necessary, transport‘s contribution not insignificant
- The extent to which cycling transport can deliver a *substantial* climate contribution (shift potential) not yet fully clarified
- Studies of cycling transport‘s potential mostly qualitative in nature
- Modelling of measures‘ impacts extremely difficult and often not transparent
- Contribution to making the discussion of shift potential through the promotion of cycling more objective

01 Introduction

What is a sensitivity analysis?

= „...the determination of parameters‘ sensitivity in a (model) solution...“
(SCHWARZ (2004): „Sensitivity Analysis and Optimisation in Nonlinear Structural Behaviour“. p. 55)

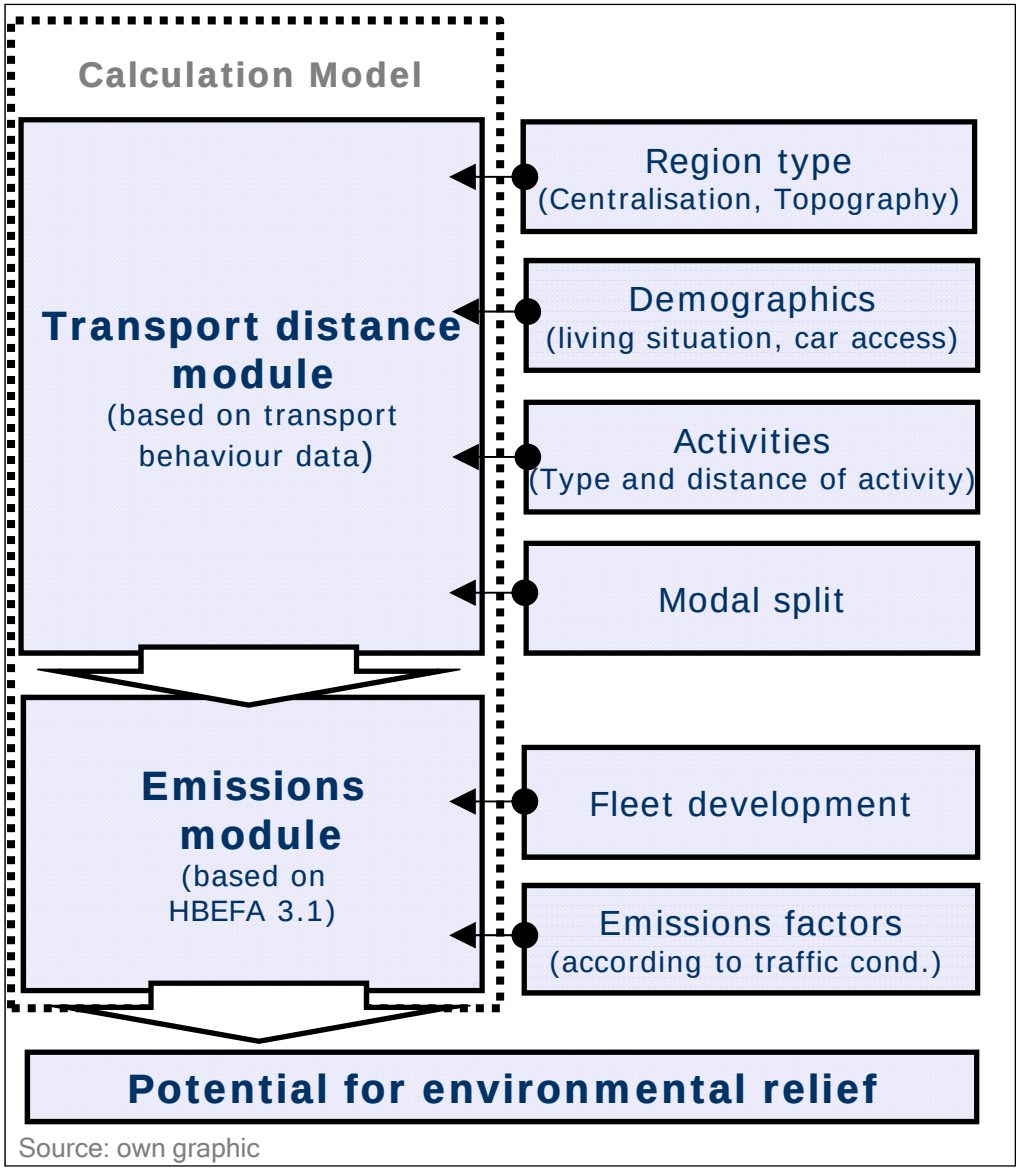
= “... sensitivity analysis studies the relationships between information flowing in and out of the model...”
(SALTELLI (2000): “Sensitivity Analysis”. John Wiley & Sons.)

- Study of the influence of input factors (individually or combined) on certain results under **„ceteris paribus“-conditions**
- Serves to identify relationships between a model‘s input data and desired outcome
- Tool for determining a system‘s responsiveness as a building block for developing **scenarios**

02 Project Idea and Problem Definition

Concept

- Model-based estimate of transport's effect on emissions situation
- Premise: coherent model development
- Sensitivity analysis: assumption of hypothetical effects (variations modelling)
- Assessment of results and ability to fully realise potential with the help of experts and scenario building



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02 Project Idea and Problem Definition

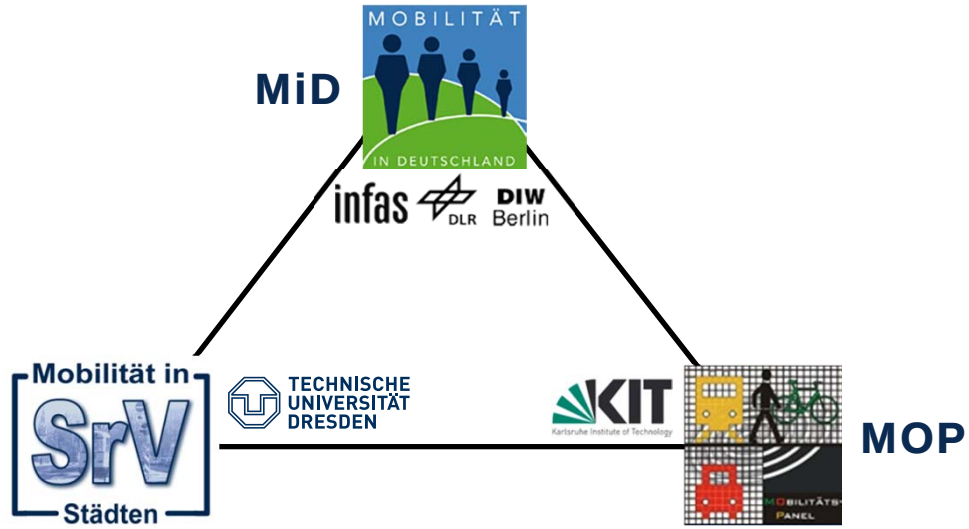
Data basis

- **MiD, SrV, MOP** (National and local household surveys, cross-section and longitudinal)
- HBEFA V 3.1
- Municipal Statistics, 12th coord. population projection up to 2060

Data sets to be compiled:

- Topography data (sub-project): „Classification of gradient conditions in the German main road network at municipal level“

Basis for transport data



Base data/identification of environmental effects

Image source: http://www.umwelt-bundesamt.at

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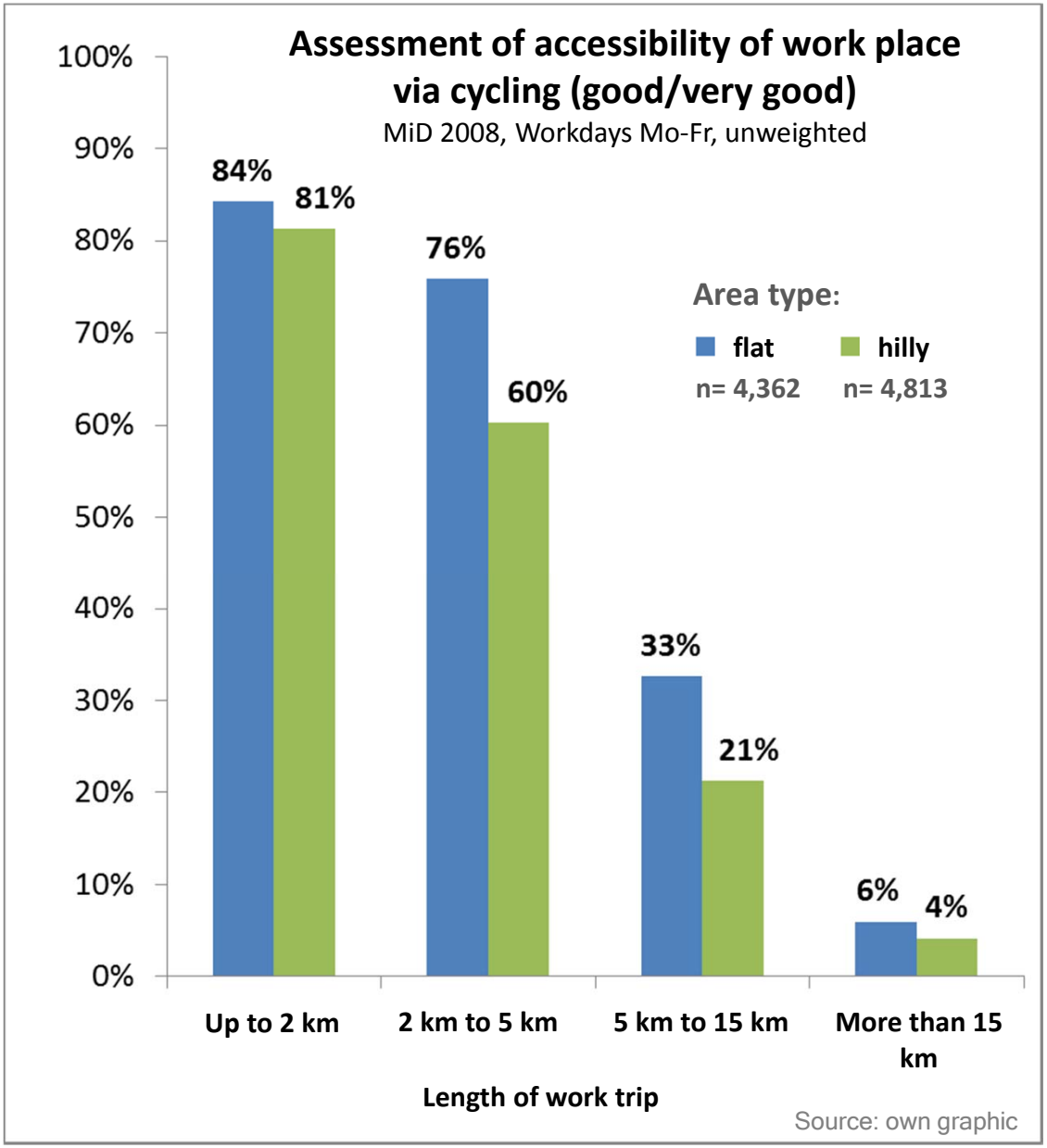
02 Project Idea and Problem Definition

Why use topography data?

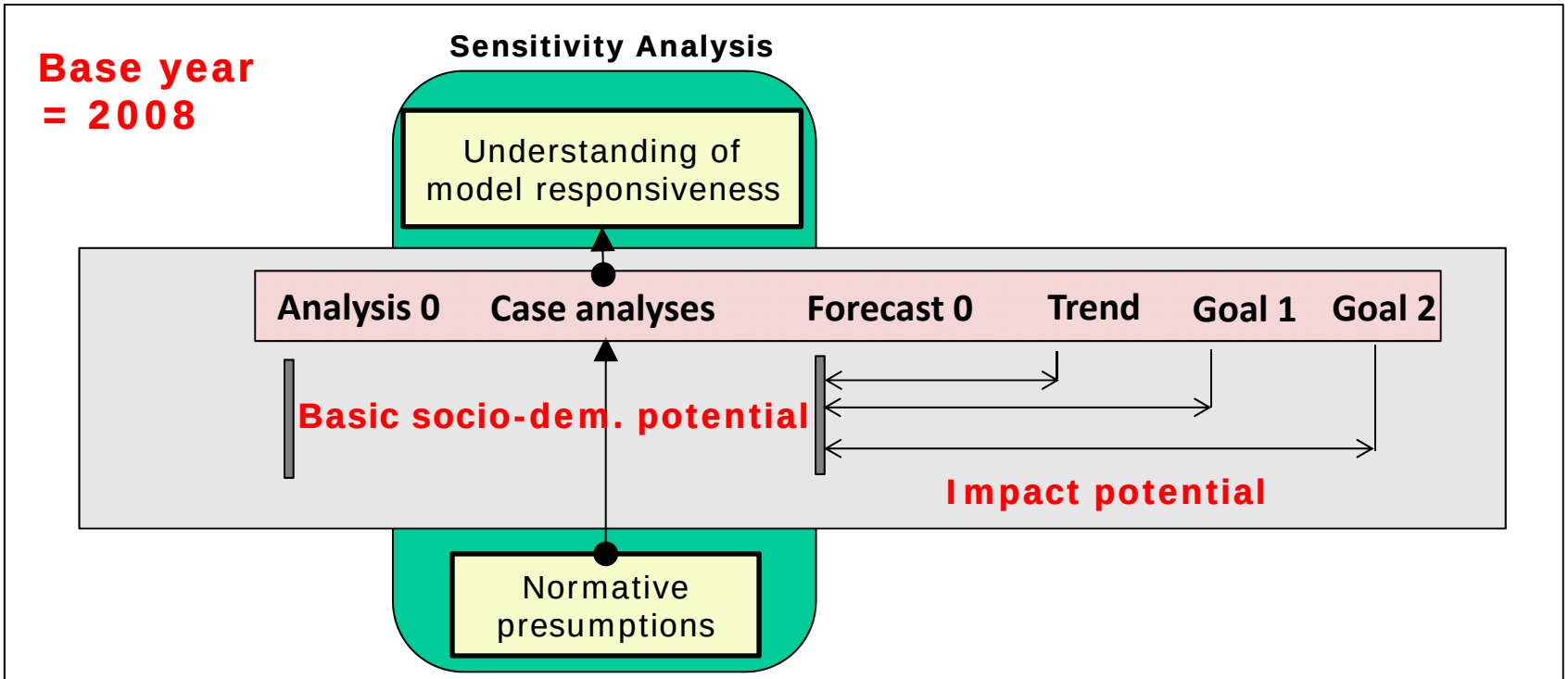
Perceived sense of distance

- Topographical influence subjective *(perceived ability to reach destinations by cycling)*
- Differences in subjective rating according to topography clearly smaller than in real behaviour



03 Variations Modelling

Classifying the method of calculation



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03 Variations Modelling

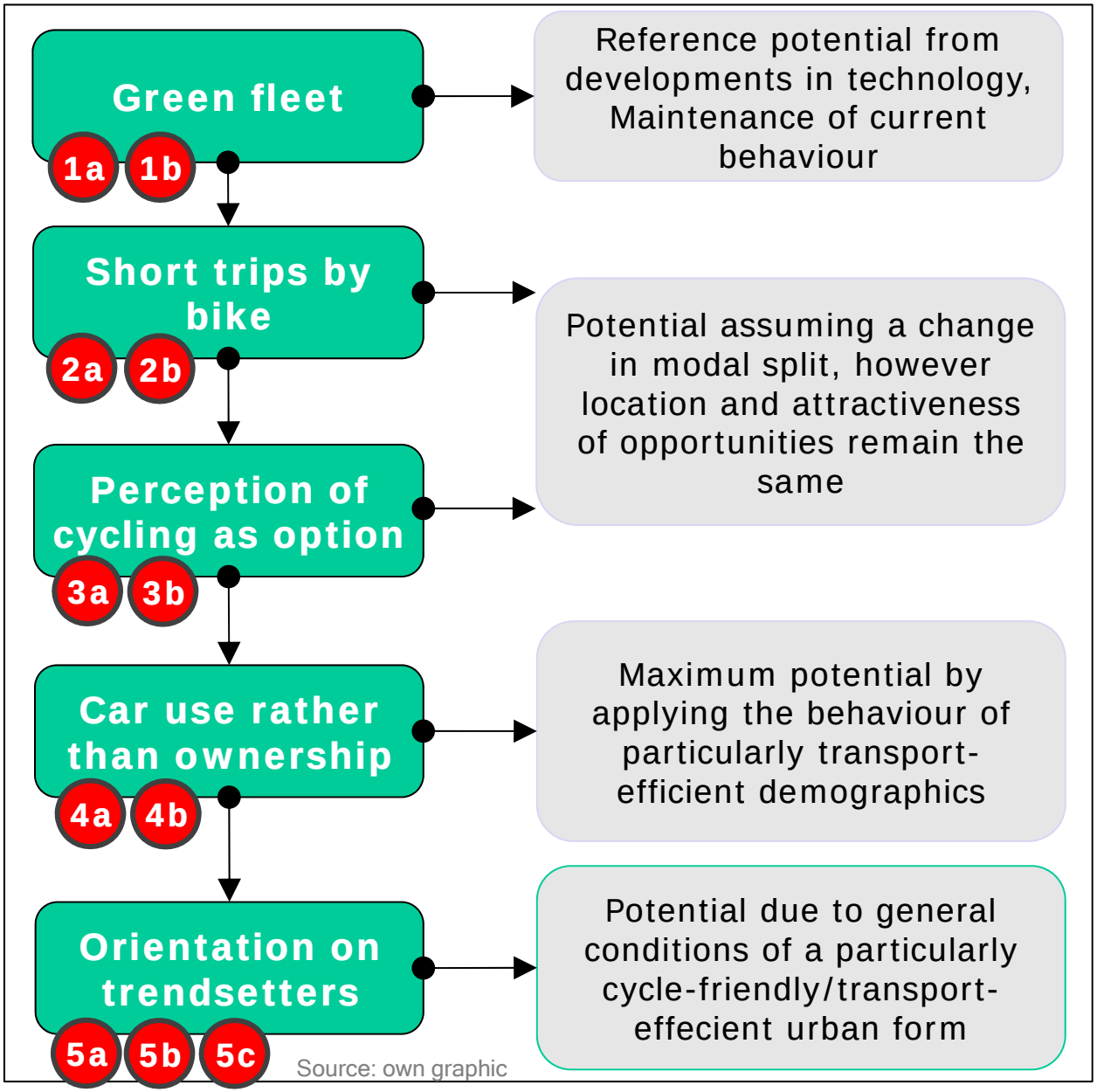
Analytical approaches

Primary effective principle of measures:

(1) Effect of vehicle technology

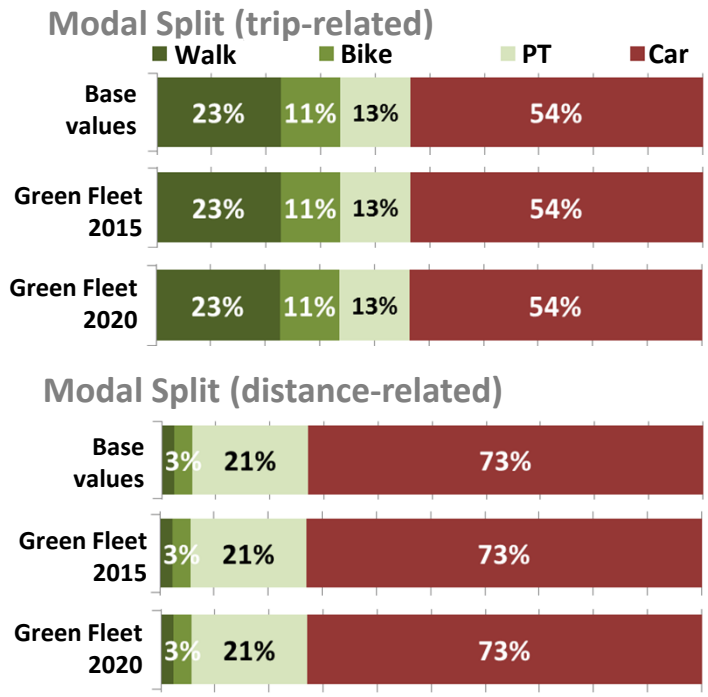
(2) Effect from
(3) modal shift

(4) Effect of shifting
(5) and avoiding



03 Variations Modelling

Green fleet



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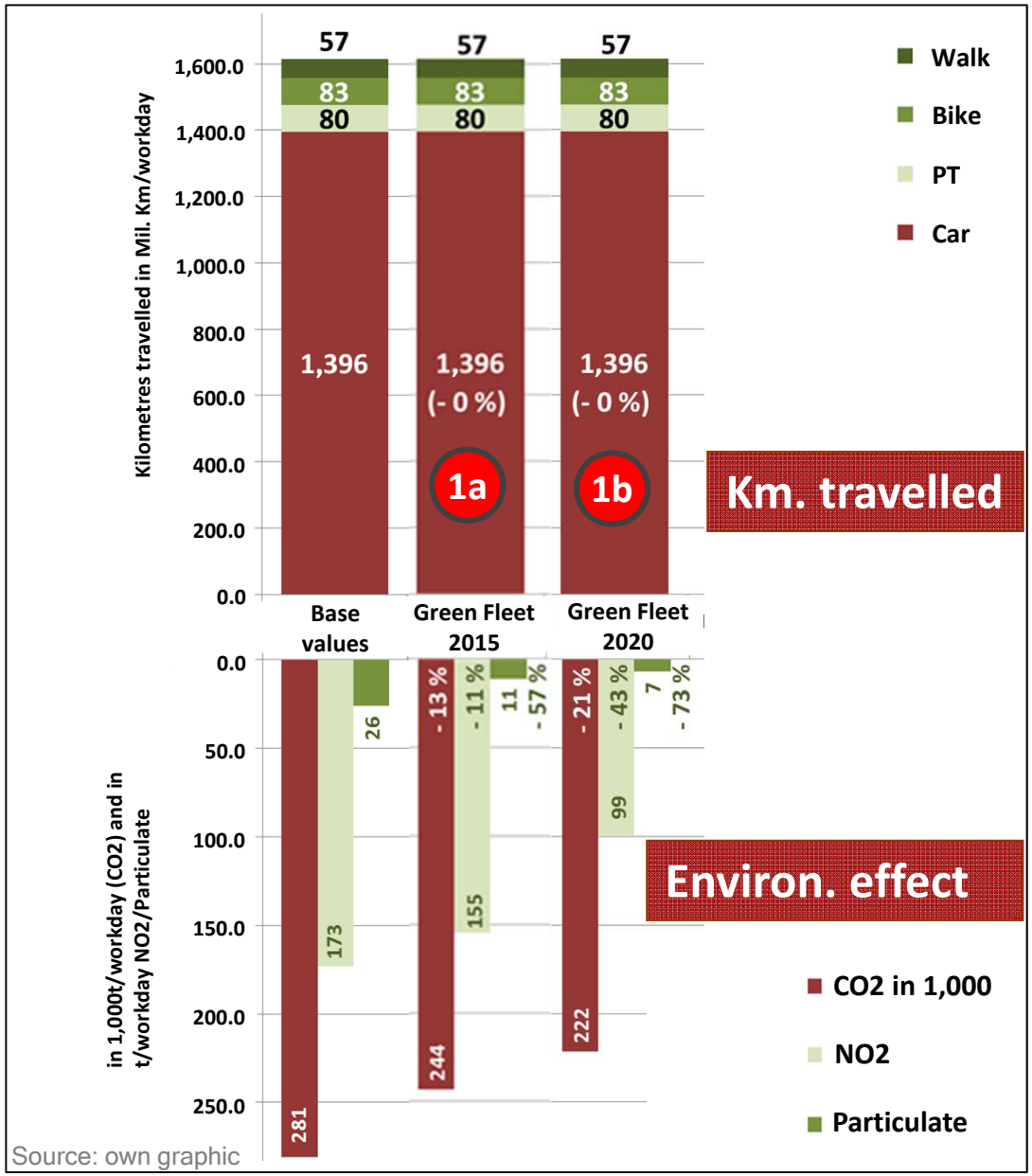

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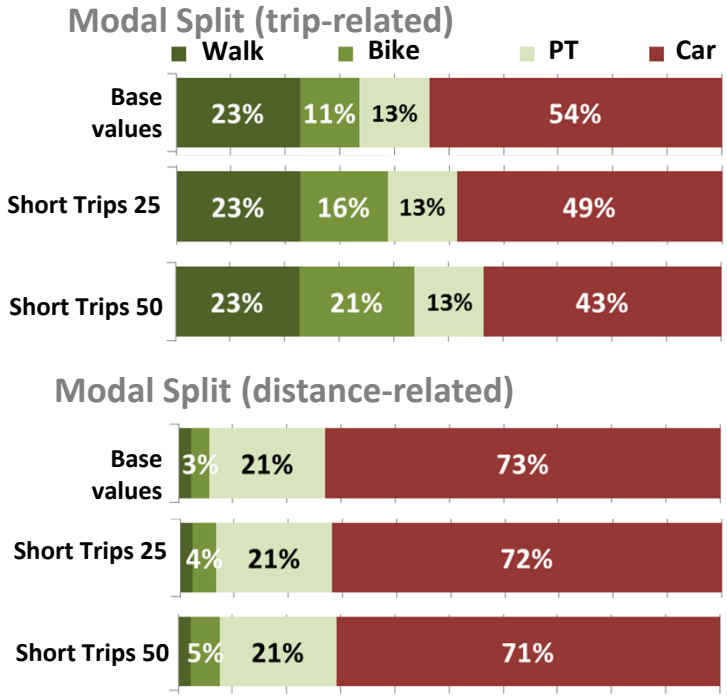
03 Variations Modelling

Short trips by bike

25 % and 50 % of car trips < 5 km to bike



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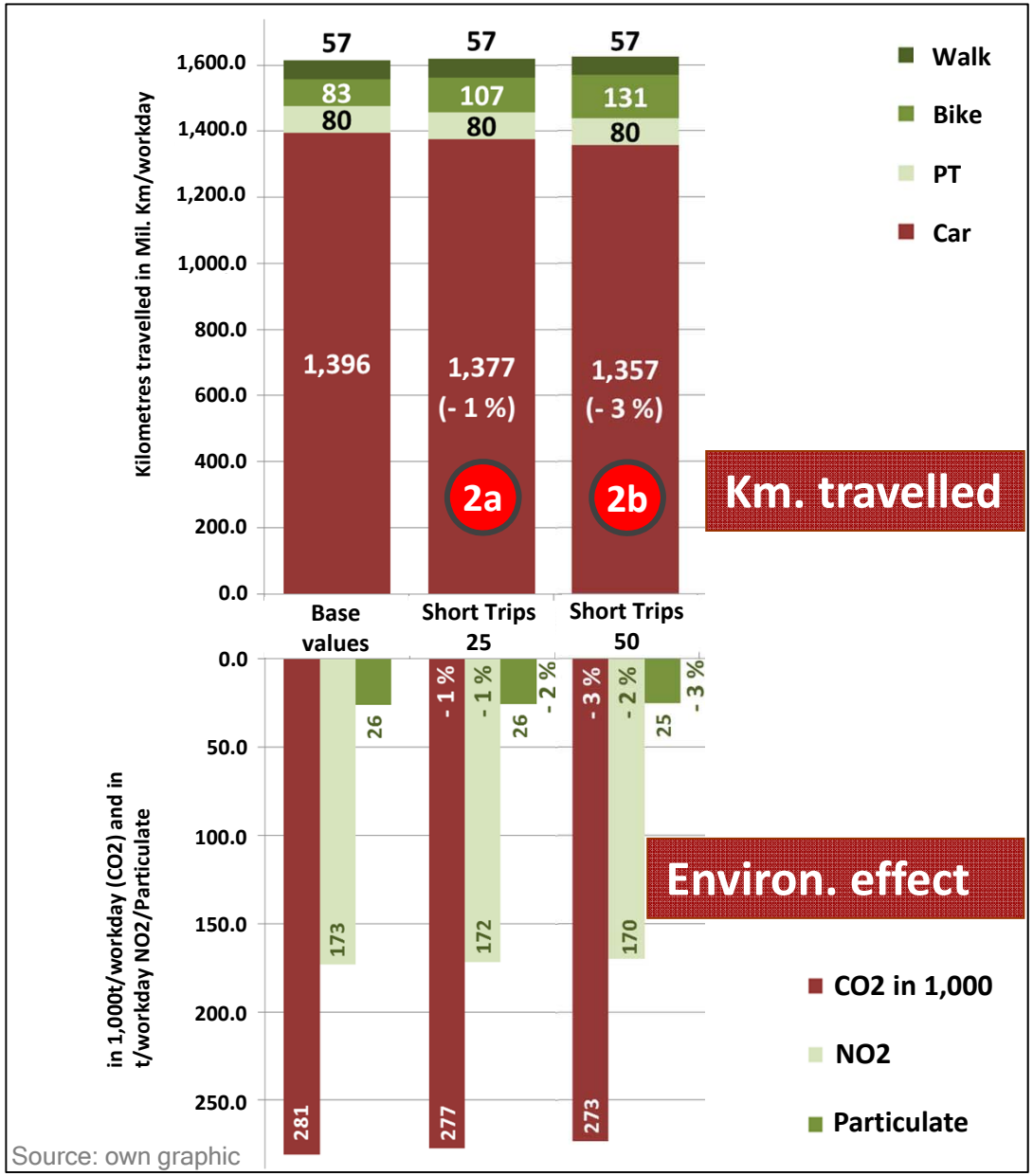

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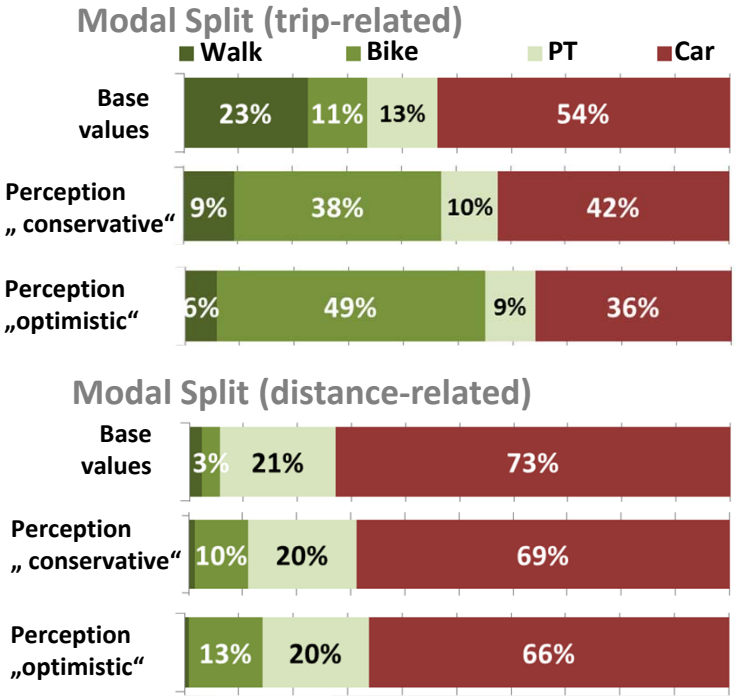
03 Variations Modelling

Perception of cycling as option



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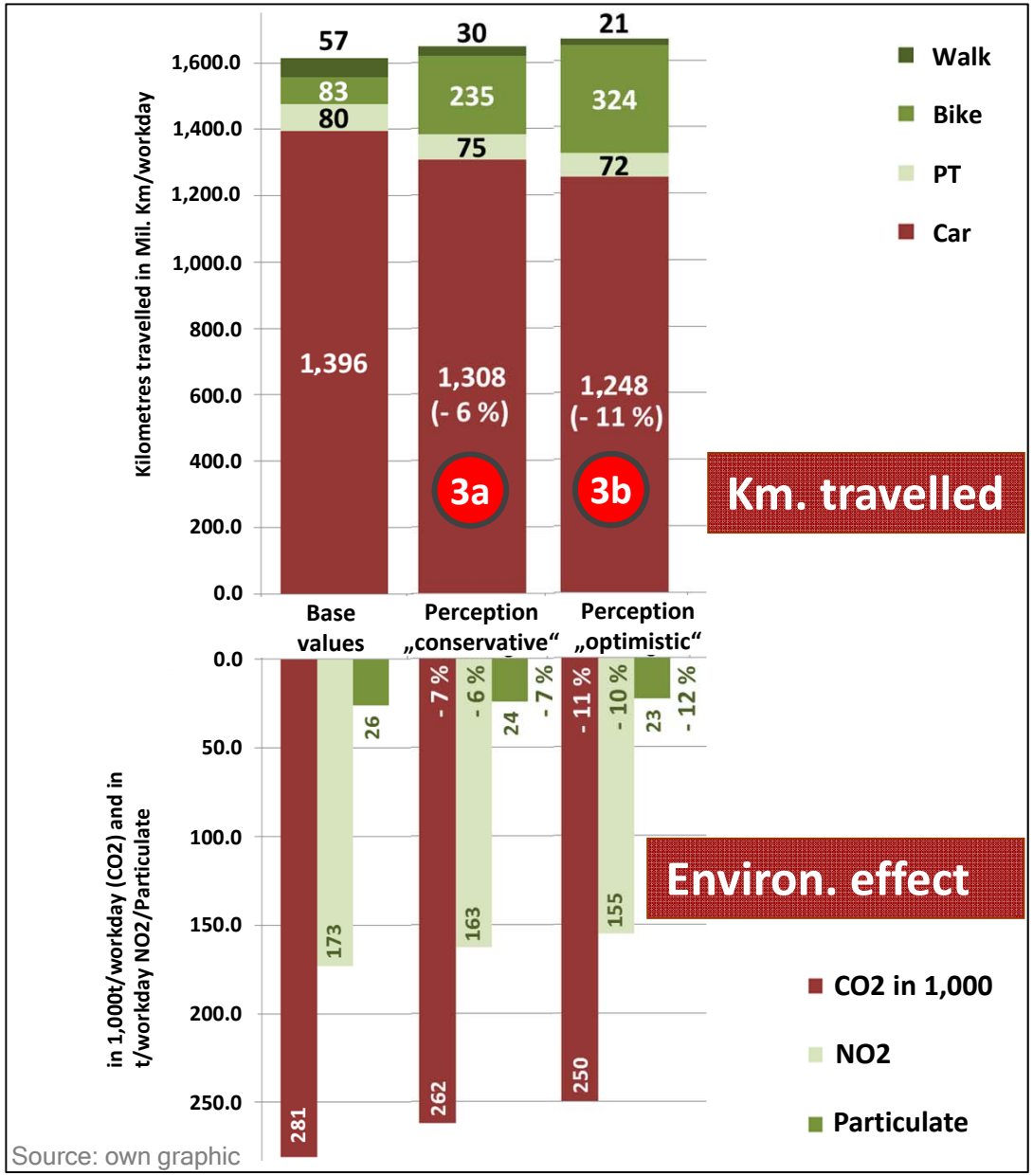

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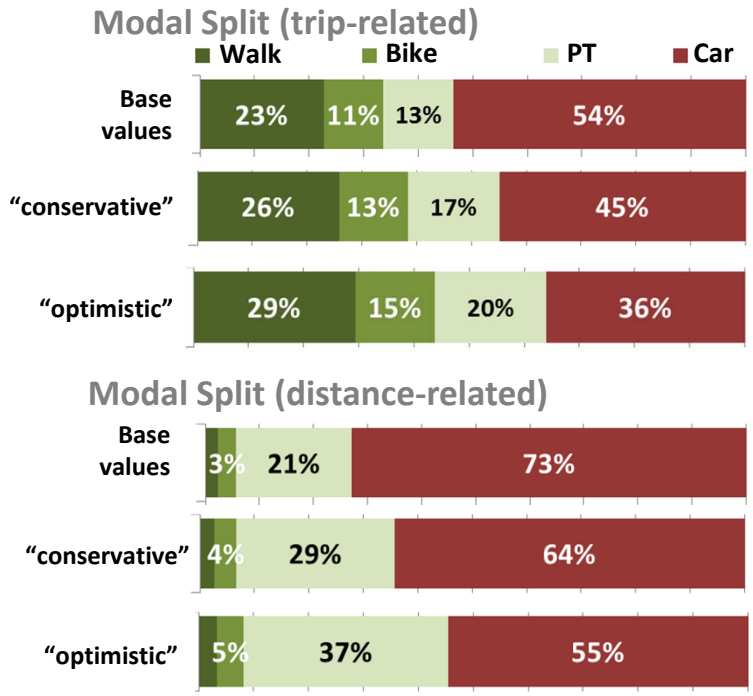
03 Variations Modelling

Car use rather than ownership



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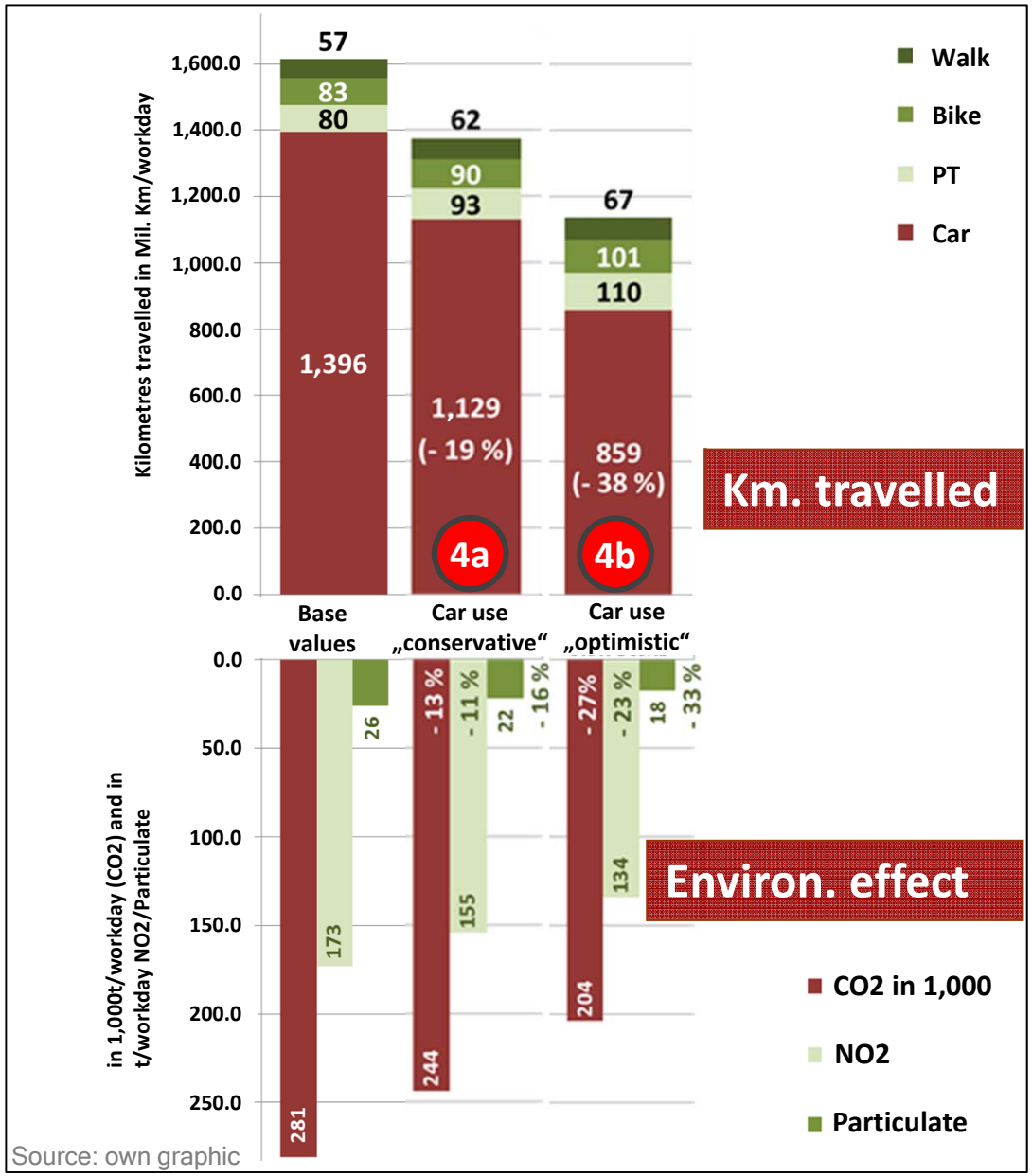

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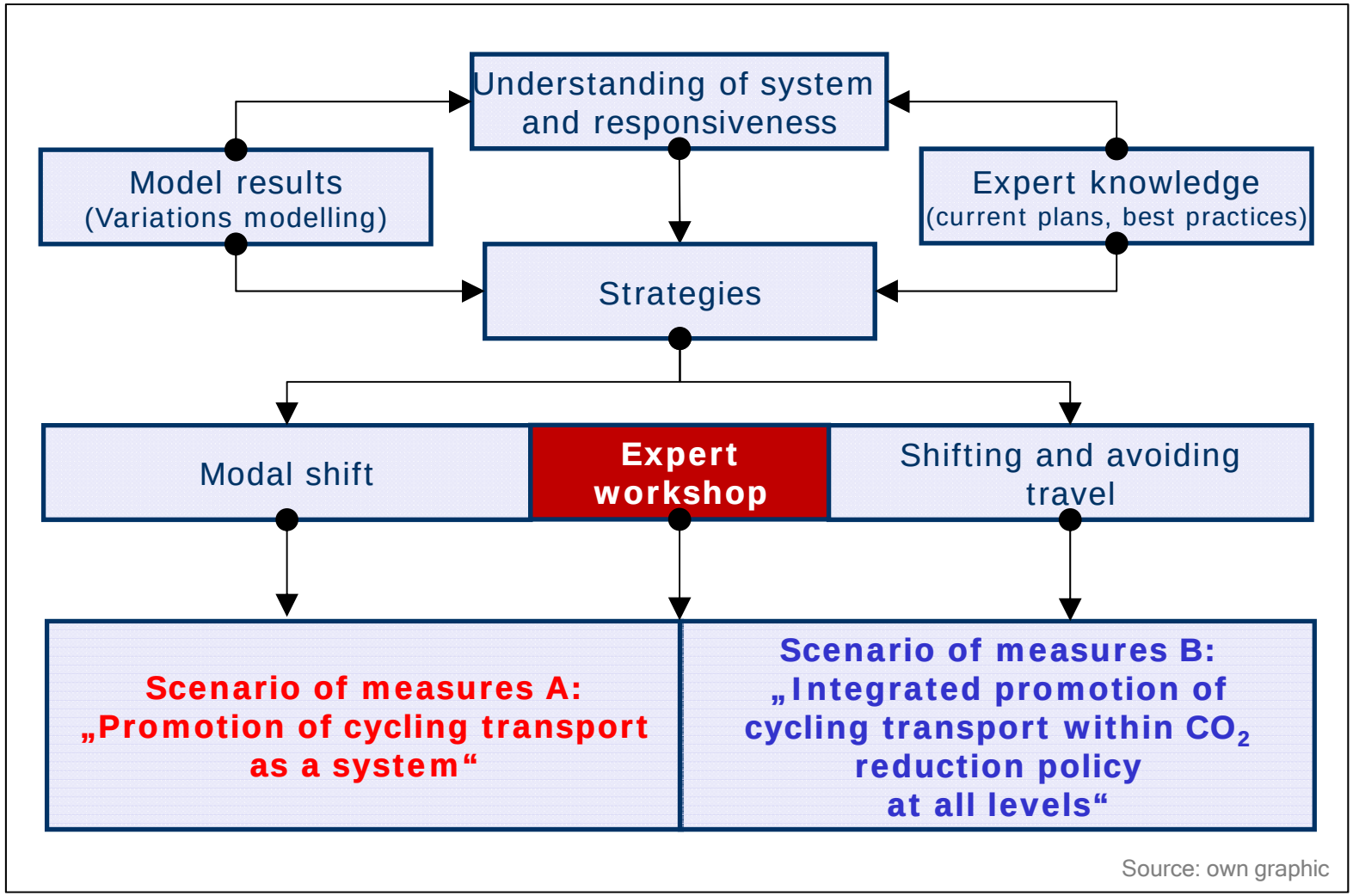
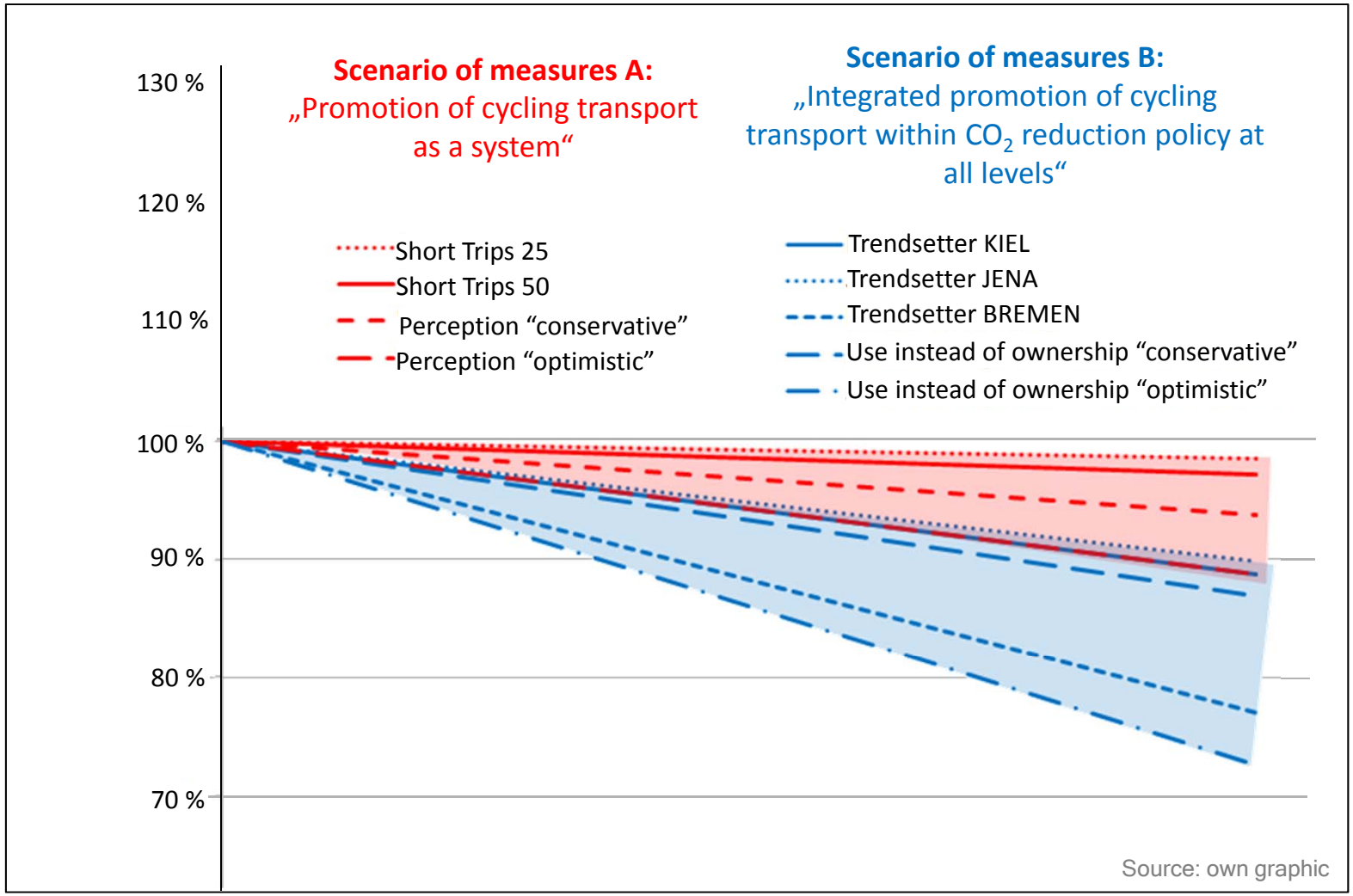


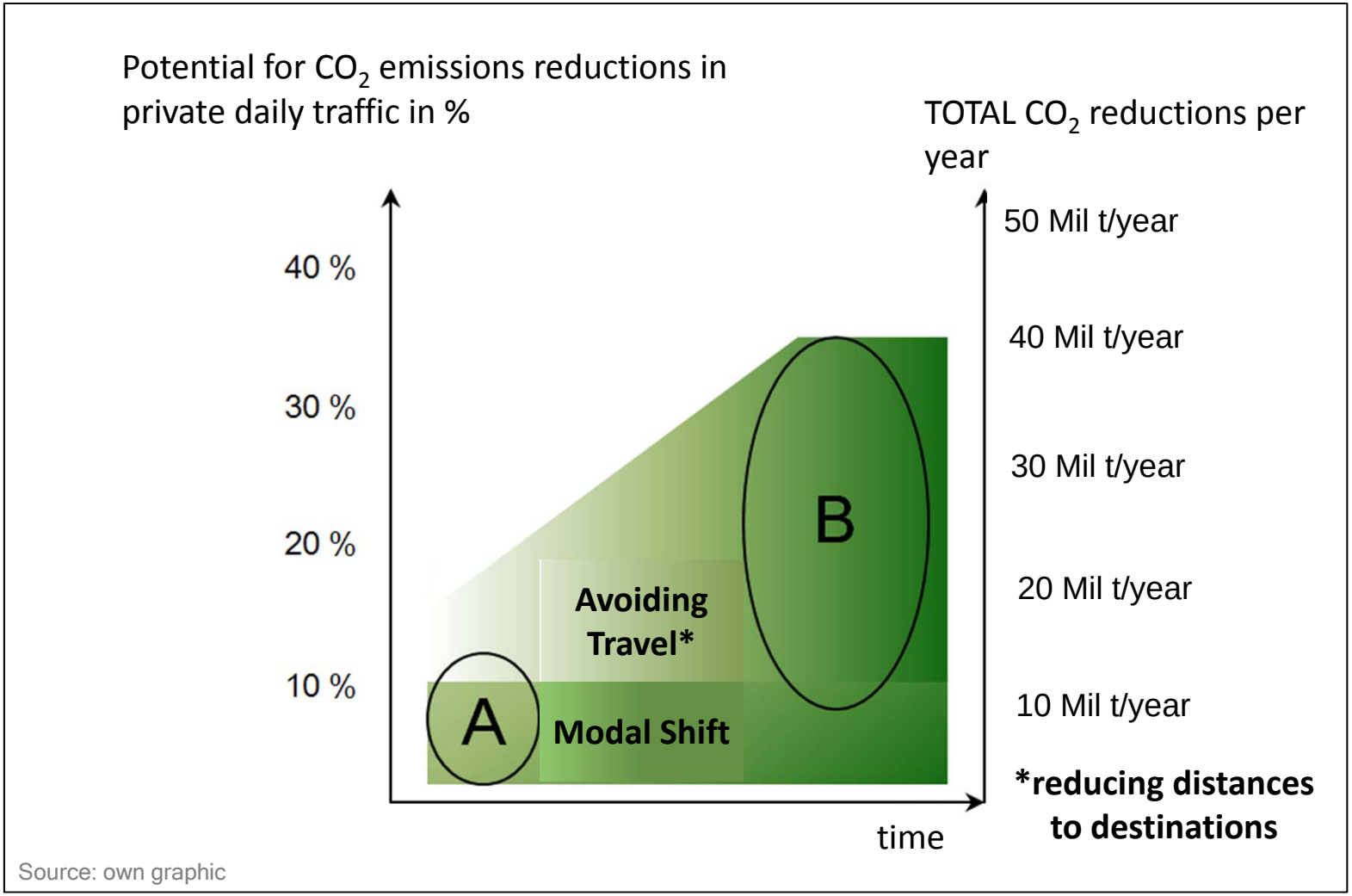
04 Conclusion and Findings

From the sensitivity analysis to scenarios of measures



04 Conclusion and Findings

Combining the model results - potential for CO_2 emissions reductions (indexed representation)



04 Conclusion and Findings

Summary and discussion of the results (Expert workshop, DELPHI-Method)

»Knowledge creates Fascination«