100 CLIMATE NEUTRAL CITIES & ON THE MOVE: PARTICIPATORY MODEL BUILDING TO ACCELERATE A TRANSITION TOWARDS CLIMATE NEUTRALITY

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K. Führer & P. Jittrapirom

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SUMMARY

In these two workshops, we explore a participatory process to accelerate a transition towards climate neutrality for the city of the Hague with a focus on its urban mobility system. The process facilitated participants to clarify the vision, goals, and objectives of a climate-neutral city. It also helped them to formulate the shared system perspective of the transport system and the related systems (e.g., energy system). The knowledge was then used to identify interventions to achieve the vision, the goal, and the objectives. The possible impacts of future trends and events on the interventions were also explored. The results of these workshops provide useful insights in the interconnections of different parts of the mobility system and the way scaling aspects up or down influence the system and climate neutrality objectives. The workshops took place on 8th May and 5th June 2023, on municipal premises. A total of 9 participants joined each meeting.

Contact: Karoline Führer K.J.Fuhrer@tudelft.nl, On the Move Project www.onthemoveproject.nl

1 BACKGROUND AND AIM

The workshops are a collaboration between the On the Move Project and the Municipality of the Hague. The aim is to pilot a participatory process that would contribute to accelerating the climate transition focusing on mobility, by providing new insights on cause, effect, and interconnectedness.

1.1 BACKGROUND

The municipality of The Hague seeks to reduce emissions in all sectors, including mobility. However, owing to the complexity of the mobility system, identifying effective policy levers in the current system (levers of change) is challenging. There are many potential projects, many involved stakeholders, and the mobility system interacts with other responsibilities of the municipality (including but not limited to the housing sector, or spatial development). We support the municipality in this through organizing two workshops to deepen shared system understanding, leaning on methods such as modelling and stakeholder engagement. The idea is that engagement workshops can elicit expert knowledge, thus facilitating knowledge co-creation, a shared system understanding, and/or create consensus amongst participants. Throughout this process, we aim to embrace uncertainty. Uncertainty arises when we cannot know or cannot agree on certain parts of the system. By identifying uncertainties and their impacts, we seek to identify actions that are robust to many potential different futures. Understanding a system and the uncertainty surrounding it can help in identifying chances and knowing how to act.

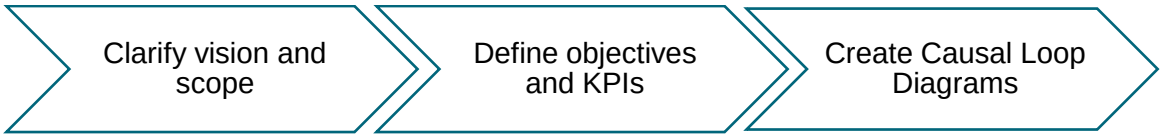
1.2 AIM OF THE WORKSHOPS

The overall aim is to accelerate a transition towards climate neutrality of the Hague city with a focus on the urban mobility system by involving members of the municipality in a participatory model building exercise to create a systems understanding of the climate transition and facilitate cross-departmental collaborations leading to effective interventions. The workshops aim to achieve the following objectives:

A. define and clarify the exact problems, objectives, desirable future states (visions), and barriers to achieving them
B. elucidate the current understanding of the system (in this case transport system) and the relationships with other systems (scoping)
C. explore different options (of actions and measures) that contribute toward realizing the objectives and visions
D. Identify different possible futures and uncertainties that can influence actions and preferences on different courses of actions

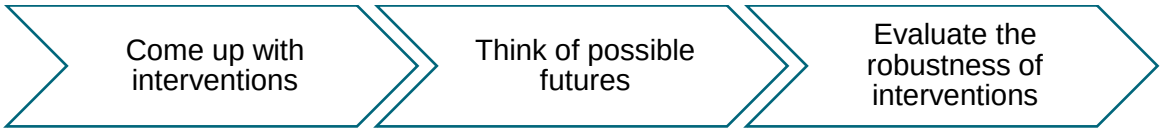
2 WORKSHOP STEPS

The **first workshop** followed these steps.



In between the workshops, we summarized the goal, objectives and KPIs. Further, we compiled the insights from the Causal Loop Diagrams into one high-level version.

The **second workshop** followed these steps:



3 OUTCOMES OF THE WORKSHOPS

3.1 VISION AND SCOPE

Vision is highly important in policy-making process, as it can guide and mobilize the efforts required to realize the desirable future. The objective of this activity was to clarify the vision and scope of the project and to derive a goal and set of objectives to realize the vision.

The first question the participants answered was 'What images of the future mobility system does the goal suggest?' A full overview of the answers can be found in Appendix A. We formulated the following overall goal that will realize the vision for the city to become climate-neutral:

> *"A healthy, clean, safe, inclusive, and climate neutral transport system that provides diverse selections of sustainable mobility options, accessible and affordable to all travelers by 2030"*

The scope of the goal was defined along the following dimensions:

- *Spatial*: Neighborhood, city, Rotterdam-The Hague metropolitan area (depending on the measure)
- *Temporal*: pilots and temporary measures as soon as possible, climate neutrality by 2030, national goals by 2050
- *Juridical*: all levels incl. national and EU

3.2 OBJECTIVES AND KPI'S

The participants were asked to identify specific objectives that can be set to realize the goal. The aim was to elicit measurable actions to achieve the goal. A full overview of all the objectives that were named can be found in Appendix B. We summarized the objectives and associated KPIs in the table below:

Table 1: Objectives and KPIs

Objectives	***KPIs***
Walking and Cycling Increase % of walking and cycling trips	• % of walking and cycling trips • Amount of walking and cycling infrastructure
Public transport and shared mobility Increase usage of public transport and shared mobility services by providing associated infrastructure and ensures their affordability	• % of public transport and shared mobility trips • Availability of public transport and shared mobility • Attractiveness and affordability of public transport and shared mobility • Effectiveness (resource/output)
Energy use and emission of the transport sector Transition energy source for transport sector toward sustainable sources	• Net GHG emission of the sectors • % of energy used by the transport sector from sustainable sources • % of fossil fuel cars • amount of charging infrastructure
Land use, and access to facilities and green space Adjustment of land use and transport services to minimize trip distance and maximize accessibility and livability	• % of areas with access to different services and facilities according with the 15-min City concept • amount of green space • % of areas with access to public transport services and mobility hubs • % of area with potential for heat stress
Private vehicles and associated externalities Reduction of personal vehicle use and associated externalities	• Number of (individual and fossil fuel) cars • space dedicated for Car spaces • % of short car rides • Private car ownership
Implementation process and collaborations	• Number of pilot projects and collaborations with stakeholders that are successfully carried out

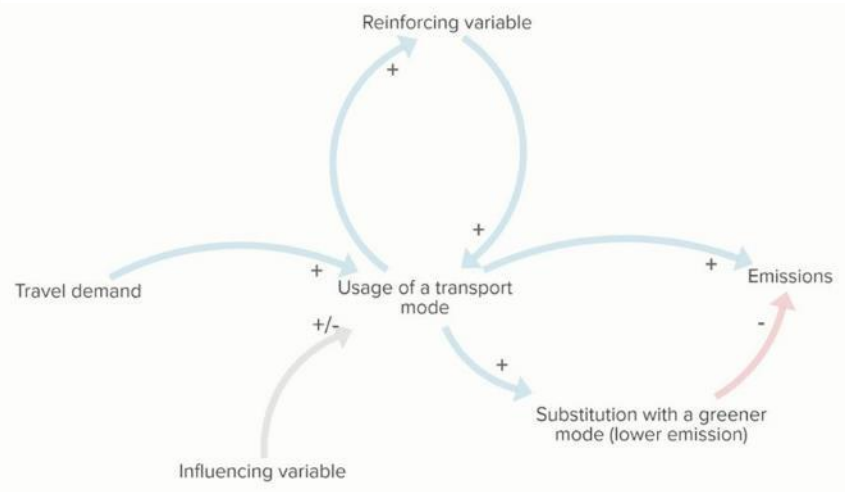
3.3 CAUSAL LOOP DIAGRAMS

We use a Causal Loop Diagram (CLD) to illustrate complex relationships between variables that influence the usage of different modes of transport (e.g. bicycle, public transport, personal car, and shared cargo bike). The arrows depict causal relationships between each entity. A positive relationship (+) means that more of variable A yields more of variable B and a negative relationship (-) means more of variable A yields less of variable B.

In the workshops, participants created several Causal Loop Diagrams for different modes of transport. This was done for the sake of simplicity during the creation. In order to do that, we first elicited all modes of transport and then voted on which ones to create Causal Loop Diagrams for. All diagrams created in the workshop can be found in Appendix C. (also see https://kumu.io/peraphan/visioning-exercise)

The main insights synthesized from the workshops help to understand the underlying factors that affect the usage of a transport mode and to identify/classify possible actions and policies that will influence the usage. The usage of a transport mode is initiated by ***Travel demand*** and can be affected by ***Influencing variables*** *(e.g.,* Cost, availability of the mode and alternatives, parking facilities, and frequency of the service). These factors can increase or decrease the usage of a mode. The usage can be further influenced by ***Reinforcing variables*** *(e.g.,* Ownership, perceived safety, space, convenience, and habit).

Figure 1: Causal Loop Diagram with synthesized insight



Reinforcing variables are part of a loop that links back to the variable and further exacerbates the effect. The usage of these modes will generate ***Emissions*** which can be reduced by a ***Substitution with a greener mode with lower emissions***.

For example, the usage of bikes is directly influenced by whether a bike path is available. This is a positive relationship, the assumption is that more bike paths lead to more bike use. A reinforcing variable in this case is for example bike ownership; a high bike ownership leads to more bike usage and a high bike usage can lead to a further increase in bike ownership. Knowing these variables and their relationship can help identify interventions (measures and policies) to influence the usage and ownership of a transport mode.

3.4 INTERVENTIONS

The goal of this activity was to elicit concrete interventions that help to reach the goal. For each intervention, participants answered the following questions:

- What would be done?
- Which mode will be affected?
- What type of intervention is it? (For example, infrastructure, financial incentives, rules, new technology, changing values and paradigms, etc.)
- Who would be responsible?
- Over what time horizon does it take effect?
- Which objective does it contribute to?

The activity yielded a list of diverse interventions, the full list can be found in Appendix D. Participants then voted on the most promising interventions to continue with for the following exercises.

3.5 FUTURES

To stress-test the interventions under different futures, a wide selection of futures was conceived. We used the STEEP framework as a guide to get a varied selection. It provides five categories: social, technological, economic, environmental, and political. Common themes include AI and data, pandemics, and a shift in social awareness. In the elicited futures, negative futures are mainly shocks, whereas positive futures are mainly trends. The full list of futures can be found in Appendix E.

3.6 ROBUSTNESS

Participants identified four interventions that will help to achieve the goal and objectives above. The consequences of the interventions to the transport system are described. For each intervention, a set of possible future events/trends are selected and their impacts to the interventions are assessed. These impacts might be positive or negative with regard to the goal and objectives. The assessments help to determine the necessity for additional actions to safeguard the interventions should these futures occur, making the interventions more robust (i.e. the interventions are effective in any given future).

Intervention 1: Making routes for walking and cycling to core facilities easily accessible and attractive (i.e. 15-minute city concept)

Consequences to the transport system	
Increase % walking and cycling trips; Decrease % short car trips Improved air quality and health Efficient use of space; More space for climate adaptation measures More social interactions; Increase in safety; Less stress Affordable for many to use & a general increase in accessibility	
Futures that may affect the intervention and their impacts to the intervention	
Increase population (+100.000 in 2040)	More desirable as not enough space for a car for everyone
High electricity demand	More desirable as almost no electricity is needed by the intervention
High poverty rate	More desirable as they are the cheapest and healthiest way of traveling
Extreme weather	It may become too hot, too wet to travel by foot or bike
Acceptance due to climate change	People feel the need to change their travel behavior

Intervention 2: On all non-main roads, the standard is "cars are guests"

Consequences to the transport system	
Increase safety for all users/modes; Lower max speed More space for pedestrians and cyclists, more attractive Less cars in the city; Increased health, less stress	
Futures that may affect the intervention and their impacts to the intervention	
Extreme weather events	Less attractive to bike or walk, more attractive to use car, more traffic jams due to infrastructure changes
Complete stop on all emissions	Public space/infrastructure has already been changed and prepared
No more privately owned vehicles in the MRDH	Infrastructure is already prepared
More populism in politics	Lower success rate of implementing this policy/intervention

Intervention 3: Free public transport during rush hours and the whole day for lower-income citizens

Consequences to the transport system	
A large increase in the use of public transport Usage is more spread out throughout the day Less use of cars but also bikes/walking Costs (where will it come from?) and certainty of costs for transport and mobility; Lowering the income cap	
Futures that may affect the intervention and their impacts to the intervention	
More inhabitants	Not enough capacity of public transport. Investments will be needed (to ensure PT is cheaper than car use). More income & profitability of the service and therefore more certainty More people = investment goes up
Climate change (Heat & extreme weather, sea rise)	Public transport becomes more desirable in hot & cold weather, than bike/scooter/walk Less cars, less emissions, less climate change More acceptance due to the knowledge of climate change
Public transport becomes privatized and more unreliable & more expensive	Unreliable, especially in rural areas People will use it less, especially the disabled inhabitants
A shift to public right	Intervention stops if funding is cut
Increasing data use in the future	Privatization can be desirable for data Payment through the use of data Combination of PT energy infrastructure for other electric modes

Intervention 4: Using GPS to automatically limit the speeds of electric vehicles

Consequences to the transport system	
Increase safety for all traffic participants and lower the threshold for participation in a public place (More equality); Less fine particles; Increase more incentive to not use electric vehicles, so it may need to be implemented when electric vehicles usage are the norm	
Futures that may affect the intervention and their impacts to the intervention	
No more privately owned vehicles in the city	Investment in promising modes other than privately owned vehicles on a small scale Possibility to monitor the shared vehicles more than private ones
All cars in the city become electric cars by 2030	Prerequisite to expand this to cars Potential framing possible positive car ownership People held on to gas/diesel cars
AI doomsday	The intervention is no longer feasible, Not enough knowledge on AI to properly use it
Data focus & availability	Microfocus etc. clearly visible and addressed Not knowing what to do with data Privacy concerns
Fascism (extreme right parties come into power)	Plug pulled Data can be mishandled

4 REFLECTION AND NEXT STEPS

The protocol and the results of these workshops can be applied to support cities with ambitions to transition toward a more sustainable state. The process provides a structure to facilitate stakeholders in identifying goals, objectives, and possible interventions. The participatory process also facilitates participants to build a shared understanding of a complex system (e.g. transport system) that can help mobilize support and enhance acceptance of the solution. The process also examines how uncertainty (future trends and events) can affect the interventions explicitly, thus improving implementation success.

Appendix A: Images of the future mobility system

A summary of the answers on the individually written sheets (in brackets: number of times this was named):

- Emissions
  - Pollution free (1)
  - No emissions (2)
  - As sustainable as possible (1)
- Energy sources
  - Sustainable (renewable) energy sources (1)
- Innovations & Sharing
  - Connectedness between different modalities (MaaS) (3)
  - Focus on shared instead of owned (3)
  - Innovative mobility solutions (like scooter/bike-sharing and other innovations) (1)
  - Pilots (1)
  - Diverse selection of mobility options (1)
  - Connected (1)
  - Shared mobility in the whole city (1)
- Smart city
  - Optimized for using all opportunities, e.g. smart energy grids (1)
  - Data-driven factual insights (1)
- Cars
  - Fossil fuel car out of the city (3)
  - Less cars (3)
  - Increased safety through move away from car centric design (1)
  - Electric vehicles only (2)
  - More autonomous cars and vehicles (1)
- Biking & Walking
  - More bike and pedestrian priority, walkable city (5)
- Public transport
  - Electric public transport w densified network (1)
  - Easy access and high quality public transport (3)
  - More public transport (3)
- Land use
  - Facilities close by (1)
  - Less parking space (1)
  - Park and ride for electric cars (1)
  - More green spaces instead of roads for motor vehicles (3)
  - Underground solutions such as metro (1)
  - 15 minute city (1)
- People
  - Welfare and health central (2)
  - Inclusivity (1)
  - People want to be climate neutral (or laws and enforcement) (1)
  - No mobility scarcity (1)
  - Healthy and clean (1)
- Infrastructure
  - No overuse of infrastructure (1)

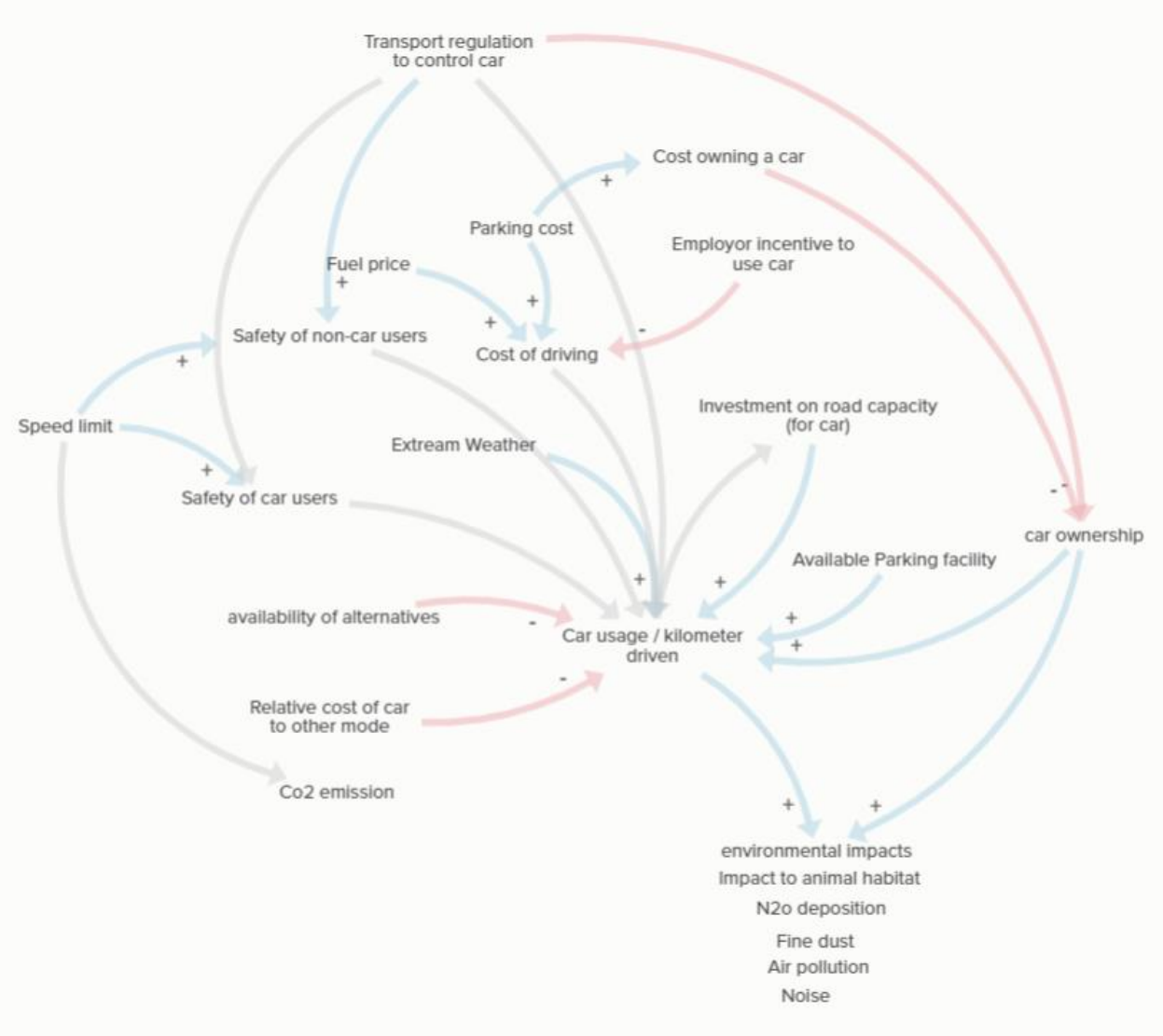
Appendix B: Objectives

A summary of the answers on the individually written sheets (in brackets: number of times this was named):

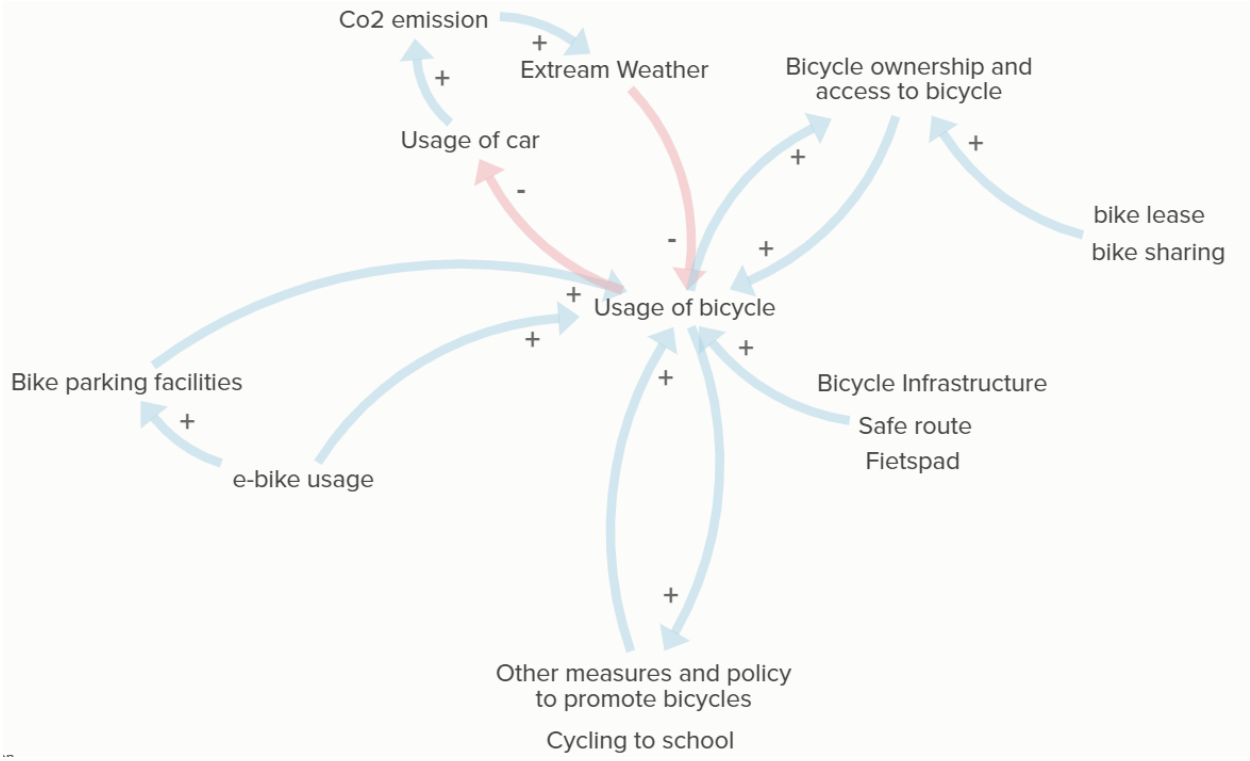
- Maximize
  - Amount of walking (3)
  - Amount of cycling (3)
  - Use of public transport (4)
  - Amount of shared mobility (2)
  - Collective charging (2)
  - Charging infrastructure (1)
  - Use of sustainable energy sources (1)
  - Green space (3)
  - Transport options (1)
  - Amount of residents living in a 15 min city (1)
  - Traffic safety (1)
- Minimize
  - Amount of (individual and fossil fuel) cars (5)
  - Car spaces (4)
  - Short car rides (1)
  - pollution (1)
  - cost of shared and public transport (1)
  - option to take unsustainable modes (1)
  - Heat stress (1)
  - Time that cars are unused (1)
- Improve
  - Walking lanes (1)
  - cycling lanes (2)
  - Public transport corridors (1)
  - Effectiveness of public transport (1)
- No more
  - Private car ownership (1)
  - Fossil fuel cars (1)
  - Parking in OR (1)
- Others
  - Zero CO2 emissions (1)
  - 1 hub for every 100m of street (1)
  - Everyone 5 minutes away from the tram, train, or metro (1)
  - 15-minute city (2)
  - In 2030, 100% of new cars electric, cars that are >10 years old get scrapped (1)
  - Attractive and affordable public transport (1)
  - Partner with other projects for pilots (1)
  - Space for neighborhood initiatives (2)
  - Strategic pilots to test bigger issues (1)
  - Make sure facilities are close by (1)
  - Special lanes for autonomous vehicles (1)
  - Neighborhood hubs (1)

Appendix C: Causal Loop Diagrams

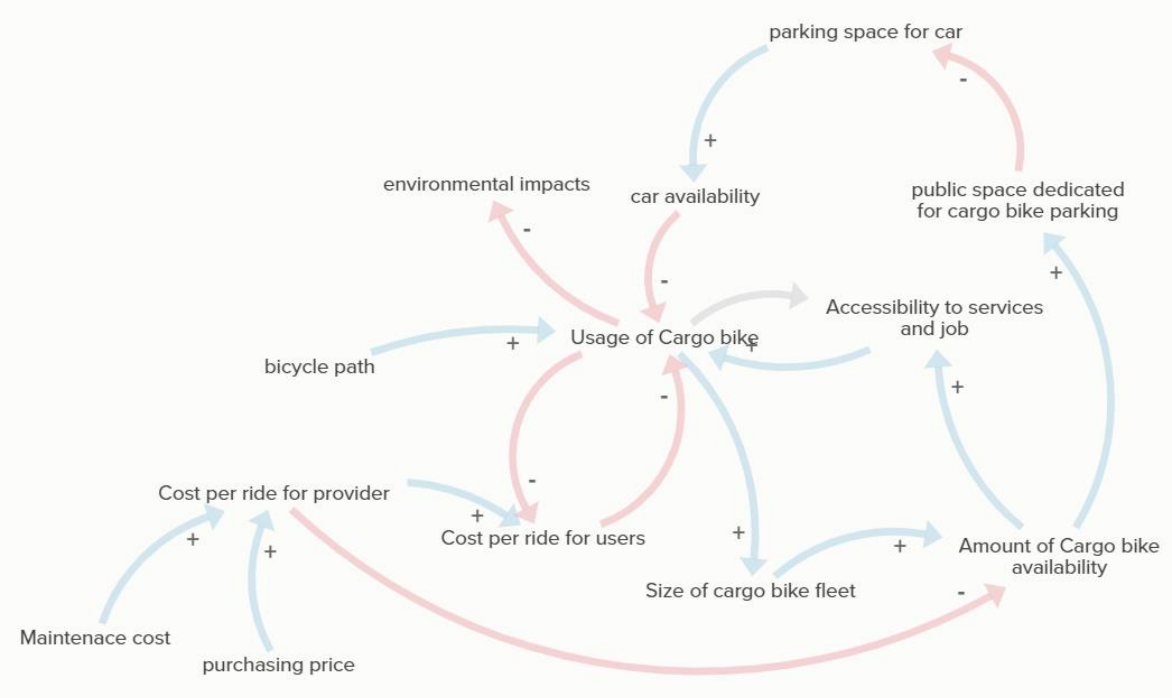
Usage of Car



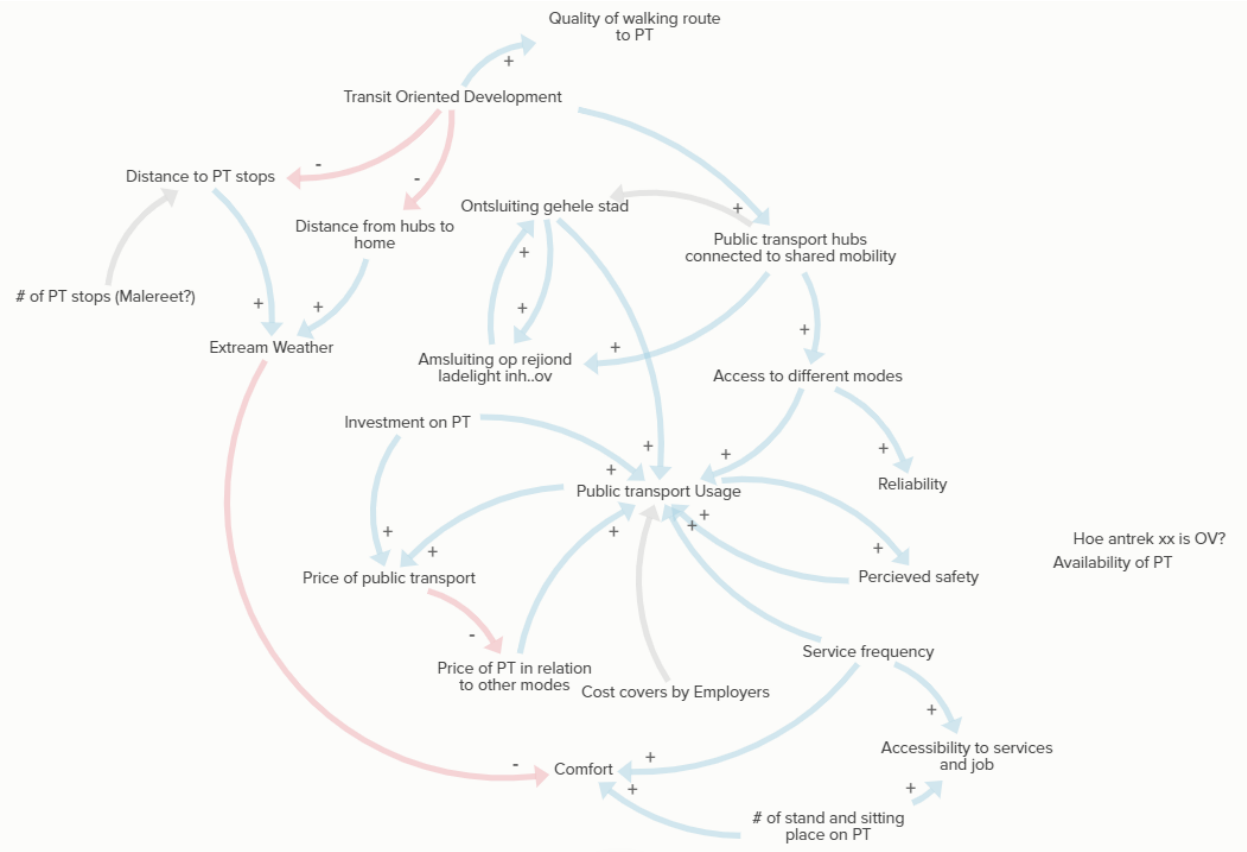
Usage of Bicycle



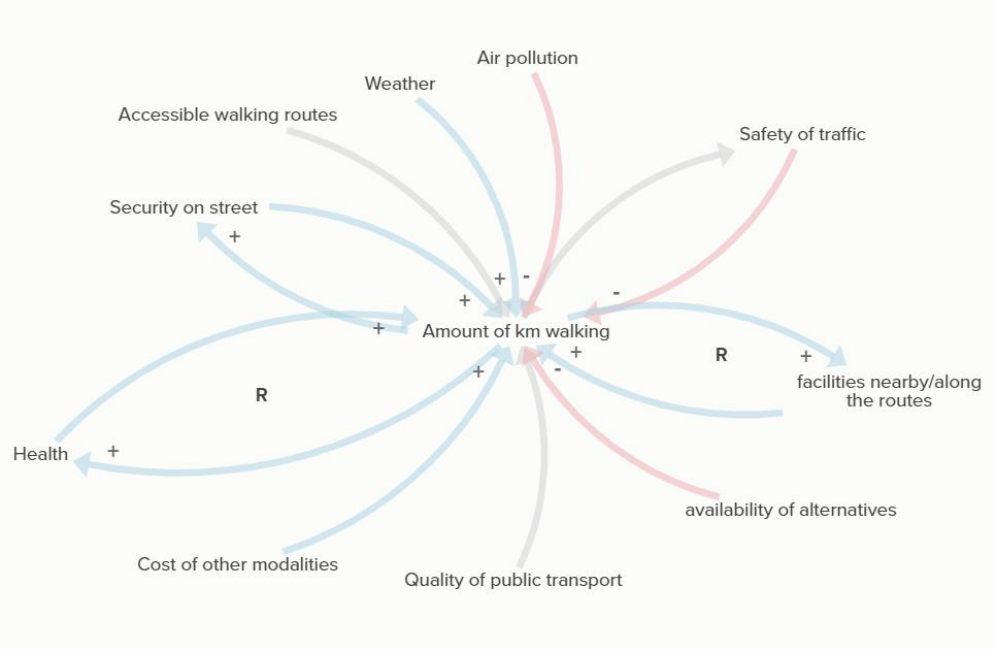
Usage of Cargo Bicycle



Public Transport (PT) usage



Walking



Appendix D: List of interventions

	What?	Mode	Type	Who?	When?	Objectives
1	On every street a shared electric car	Electric car	Land use	Municipality	2030	Less private cars --> less space for cars --> more green (space for other things)
2	Zero emission zone in the city center and the coast	Logistics	Rule	Municipality, logistic companies, and businesses	2025	Lower emissions of the transport sector
3	A cargo bike on every street	Cargo bike	Incentive	Municipality and cargo bike suppliers	2023 - 2026	Higher % of shared mobility Land use
4	Electric public transport only in the city center (non-gasoline) in combination with stops/parking for the last mile	Public transport	Infrastructure	Municipality	2030	Easy connections
5a	Free public transport in The Hague (bus, tram)	Public transport	Financial	Municipality, HTM, all citizens in The Hague	2028	Reduction of personal vehicle use + increase usage of public transport, accessible for everyone
5b	Providing free public transport to citizens with an 'ooievaarspas' for example 200 trips per year	Public transport	Financial	Municipality and the public transport providers	Starting from 2025	Public transport Private vehicles
5c	Free public transport	Public transport	Financial incentive	National government + Municipality	2028	Attractiveness & accessibility of public transport increases
5d	Flat rates for public transportation outside of main rush hours (e.g. 10/15/25 euro a month)	Public transport	Financial incentive	MRDH + Municipality	Pilot in fall 2023	Utilizing existing public transport infrastructure more efficiently by incentivizing using it at low-density time slots
6	Core facilities (work/health/social/education) are max. 10-15 min. walking or cycling away.	Walking	Urban planning, environment, Infrastructure	Municipality Companies Het Rijk	-	% walking and cycling trips % of areas with access to diff. services and facilities % of short car rides
7	Improve biking infrastructure, make The Hague a bike-friendly city. Standard = 'Auto te gast'	Cycling and walking	Infrastructure	Municipality, MRDN	2023 - 2030	Increase % of bike usage
8	Increasing the amount of safe, spacious and accessible bike paths (%sidewalks). Every street should have a	Cycling	Infrastructure	Municipality	Right away and beyond 2030	Walking & Cycling

	better cycling place then car. So spacious & safe from cars. Bikes should get priority at stoplights					
9	Convenient and safe, green routes to schools	Cycling and walking	Infrastructure	Municipality, schools	Pilots by end of 2023	Increase of walking, no (less) emissions, land use --> choices for 'no car' for example, implementation process (pilot, choices in space use)
10	Advertise & normalize walking and bike use on a national level. Car use should be the new smoking	Car	Values	National government	Now	Walking & Cycling
11	Automatic limit speed of electric vehicle (city center, Scheveningen area, around schools)	Car	new technology, new values	Municipality, innovators	Pilot asap	Safety, equality in traffic
12	Making owning a big car much more expensive than owning a small car	Car	Incentives	Municipality	-	Reduce car ownership, making space
13	Introduce more car free zones (pedestrian and bike focused areas)/ ban all cars from city center (exception for emergency vehicles & transport for elderly etc.)	Car	Rules	Municipality	-	Increase % of walking and cycling trips
14a	Abolish unjustified private car ownership. No more new cars in the city	Private & shared cars	Rules	Municipality	2030	Reduction of private vehicle use - private car ownership
14b	Decrease the amount of parking spaces and the amount of parking permits in The Hague	car	Rules	Car users/owners, Municipality	Gradual process	Reduction of personal vehicle use. Reduction of space used by cars, create space for other uses
15a	Increasing parking costs in the whole city. The owners permit should increase by 200% and only 1 car is allowed per household. Visiting permits should be reduced	Private car	Rule	Municipality	From 2025	Private vehicles
15b	All 50 km/h roads --> 30 km/h roads and all 30 km/h roads --> 15 km/h	Private vehicles	Rules, Infrastructure & values	Municipality	2026	Reduce % short car rides
16a	Replacing parking (car) places with greenery & bike parking when construction starts in a street	Car	Infrastructure, land use (space)	Municipality	Starting now until 80% of parking is replaced in 2030	Private vehicles Land use, access to green space Walking & cycling
16b	Offering residents + local businesses (+making it easy) to	Car	Infrastructure, space	Municipality & locals	experiment till summer --> expand	Reduce car use/parking, Increase bike

	swap parking spots for bike spots / spots for shared micro-mobility / green spaces / terraces				through seasons	accessibility, Increase recreational functions on/near streets and walkways
17	Close streets for cars to make more safe routes for 'slow traffic' --> example Berlin --> monitoring	Car, bike, pedestrian	Land use	Municipality together with neighborhoods	By the end of 2023 set of pilots / experiments min 1 yearlong, monitoring	Land use / private vehicles --> choices made Walking & cycling
18a	(Experimenting with) car-free days (exception: first response vehicles, buses, etc..) (could be in comb. with reduced PT rates)	Multi-modal; mostly: car, bikes, walking	Changing values	Municipality	One Sunday a month (to begin with)	Getting people used to a carless day, Elimination GHG emissions from motor vehicles 1/30th of the time (roughly)
18b	Cars as guests as the norm in all inner city streets (cyclist + pedestrians + neighborhoods in narrow streets)	Cars mostly	Changing values	Municipality	Starts in warm season to increase positive perception	Increased safety for cyclists + pedestrians, lowered incentive for cars/drivers to drive through inner city etc..
19	Bikes in trams and trains --> train carrier w/ only folding seats to accommodate bikes --> part of tram 'empty to --> all day possible	Multi-modal	Infrastructure	HTM, NS, ProRail, City, Overheid/Rijk	Pilots in 2024	To make bike use more comfortable, for longer distances
20	Substitution of car trips of employees of companies at all business areas	Multi-modal	Incentive	Employers, government, municipality and ministry of infrastructure	From 2024	Walking and cycling, Public transport and shared mobility
21	Easier planning of public transport and shared mobility trips (Maas-mobility as a service)/ Provide one integrated trip planner for all PT and shared mobility	Multi-modal	Technological	PT providers and shared mobility providers need to supply data, National government need to integrate	Mobility date must be provided by end of the year, Integrated planning app by mid-2024	% of public transport and shared mobility trips

Appendix E: List of Possible Futures/Trends

Social

- Deurbanization - migration of the population away from the city
- Peak car - the young generation no longer feels the need for a private car
- Increased population (100,000 more inhabitants by 2040)
- Mass migration is driven by extreme climate change
- Individualized society - a decrease in social cohesion and community
- Deurbanization - migrating of the population away from the city
- Sharing society - increase in values, habits and acceptance to share resource
- Increase of norm to own big cars (SUV)
- Elimination of private vehicles in city
- Awareness of climate change becomes more prevalent

Technology

- Wide use of Drones for logistic
- Wide use of self-driving vehicle
- Discovery of new technology or types of resources that revolutionize energy system
- Widely use energy sharing and optimizing system
- High electricity demand leads to congestion on the electric network
- Widely use of AI in mobility sectors
- Limited use of AI in mobility sectors
- High use of Data and information to support decision making

Environment

- Intensive and frequent flooding
- Outbreaks of bird flu or other pandemics
- Rising sea level
- Climate change and extreme weather
- Higher prevalence of viral diseases due to warm climate and continued high density of bioindustry

Economic

- Real costs (for transport) are being considered instead of economic costs - take into account the environmental /social cost
- Cost for public transport use or biking(km) are pay fully by employer (eliminate car subsidy)
- Higher poverty rate
- Localization in product consumption leads to reductions in imports
- Shortage of raw material leads to more circularity
- Public transport become more unreliable because of privatization and shortage of investment
- Ceases of Dutch fishing industry

Political

- Increase in acceptance and support for climate-related restrictions and interventions
- Rise of populism
- Shift to the radical right (may lead to reductions of social funding and public transport projects)
- Phasing out of Internal Combust Engine and all new cars to be electric in 2030
- Complete stop of emission on a national level - cars suddenly not allowed anymore