

Data and Society in the energy transition

Devin Diran & Tara Geerdink – TNO, Strategy & Policy

Presentation for the SIET Platform at TU Delft | March 26 2021

› OUTLINE PRESENTATION

1. Introduction TNO
2. Energy transition
3. Information need
4. Experimenting with Data driven Energy Policy Making
5. The way forward
6. Discussion



TNO, INNOVATION FOR LIFE

TNO CONNECTS PEOPLE AND KNOWLEDGE TO CREATE INNOVATIONS THAT BOOST THE SUSTAINABLE COMPETITIVE STRENGTH OF COMPANIES AND THE WELL-BEING OF SOCIETY. THIS IS OUR MISSION AND THIS IS WHAT WE PURSUE WITH OUR KNOWLEDGE AND EXPERIENCE FOR OVER 80 YEARS.

SMART SOLUTIONS FOR CLIENTS & PARTNERS



LOCATIONS IN THE NETHERLANDS



› INTERNATIONAL PROFILE



PROJECTS IN
40+ COUNTRIES

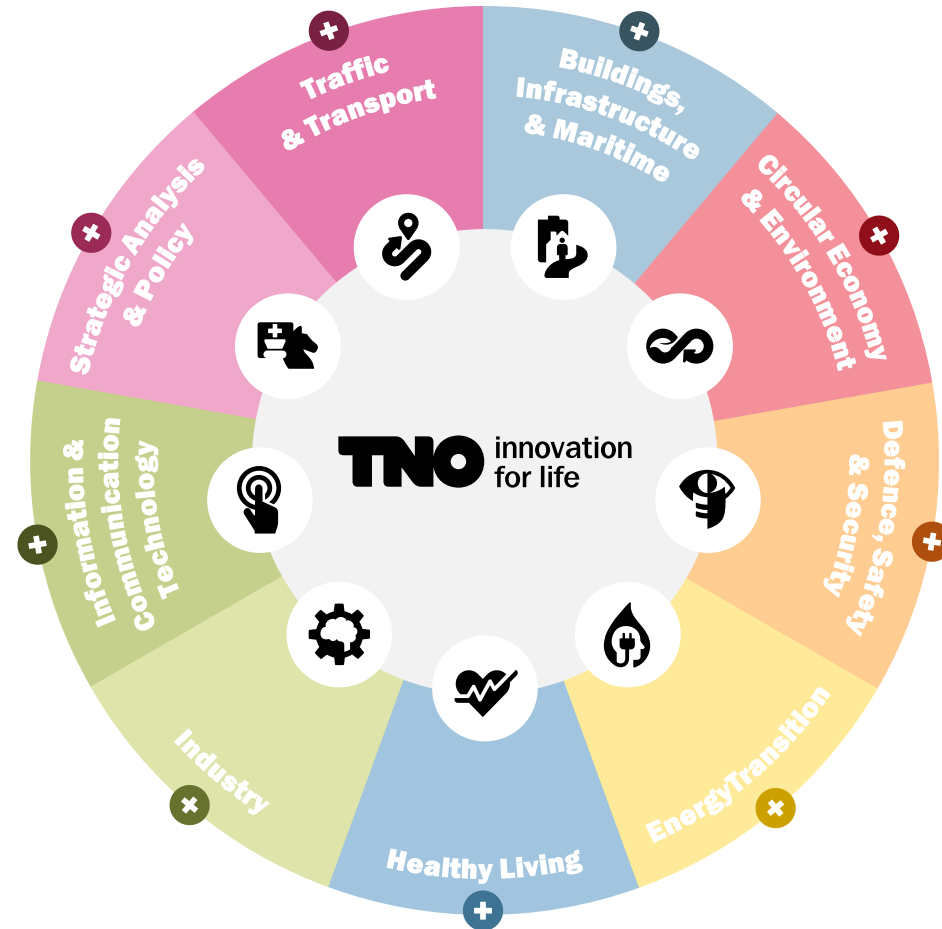


30+ NATIONALITIES
WORKING WITHIN TNO



INTERNATIONAL JOINT
VENTURES

WE DO THIS BY TAKING A MULTIDISCIPLINARY APPROACH



› UNIT STRATEGIC ANALYSIS & POLICY

STRATEGY AND POLICY – EXPERTISE GROUP

'Turning complex issues into sustainable innovations'

How can we accelerate the energy transition?

How can the use of data help us address societal challenges?

Team Environmental Planning

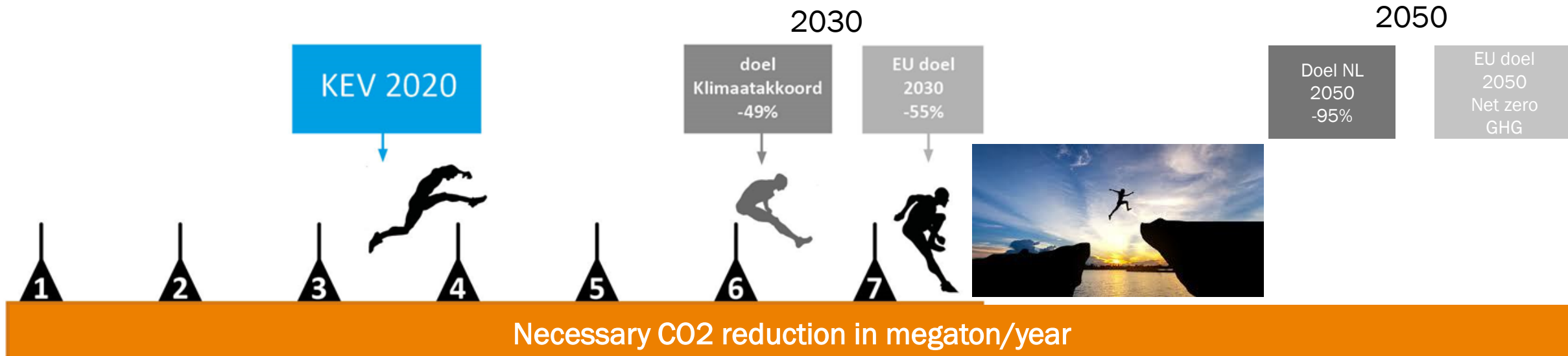
- Enhancing strategic decision-making on sustainability and spatial development;
- Studying the interaction between knowledge, people and the environment;
- Investigate the (knowledge) transfer and implementation of new technical solutions;
- Aimed at making the energy supply, mobility flow and urbanisation more sustainable;
- And embedding and justifying the technological approach in respect of new problems faced by society

▶ **ENERGY TRANSITION
OBJECTIVES AND CHALLENGES**

CLIMATE AND ENERGY OBJECTIVES

Nog enkele sprongen te gaan

PBL: helpt benodigde reductie klimaatakkoord gehaald.



bron: Klimaat- en Energieverkenning (KEV) 2020, PBL, visualisatie NVDE okt 2020

34 Mton reduction extra necessary for the CO2-reduction target of -49%.

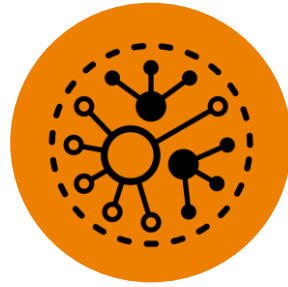
The target for 14% sustainable energy in 2020 is not achieved, in 2018 NL has the lowest share with 7,4% in the EU

47 Mton extra CO2-reduction needed for the CO2- reduction target of -55%

SYSTEM CHALLENGES IN THE ENERGYTRANSITION



Information overload and knowledge gaps



Decentral and central



Grid stability in a diverse energy system



Increasing energy demand and grid limits

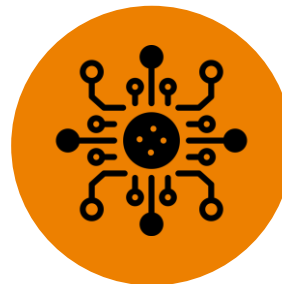


Sector coupling



Ownership of (significant) costs

Digitalisation is essential to keep this increasingly decarbonised, decentralised energy system running in a stable and affordable way.



Digitalisation as driver

› SOCIETAL CHALLENGES



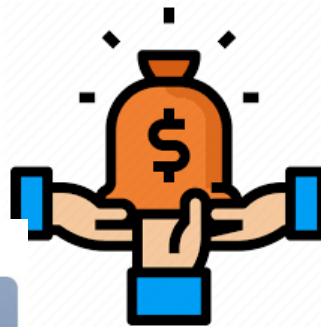
Resistance from society



1 Waaron houdt niemand van de #Noordzee? Waaron fungeert onze zee als dumpplek van alles wat we niet op het land willen hebben? sywynia.nl/de-democratie-... #VolgWyniasWeek



11 47 72



How to socially embed sustainable energy innovations?



Lucas Hartong - De #Noordzee wordt bedreigd door windmolens
tpo.nl/2019/09/22/luc... via @TPOnl
@dekoran1 @rinsjan



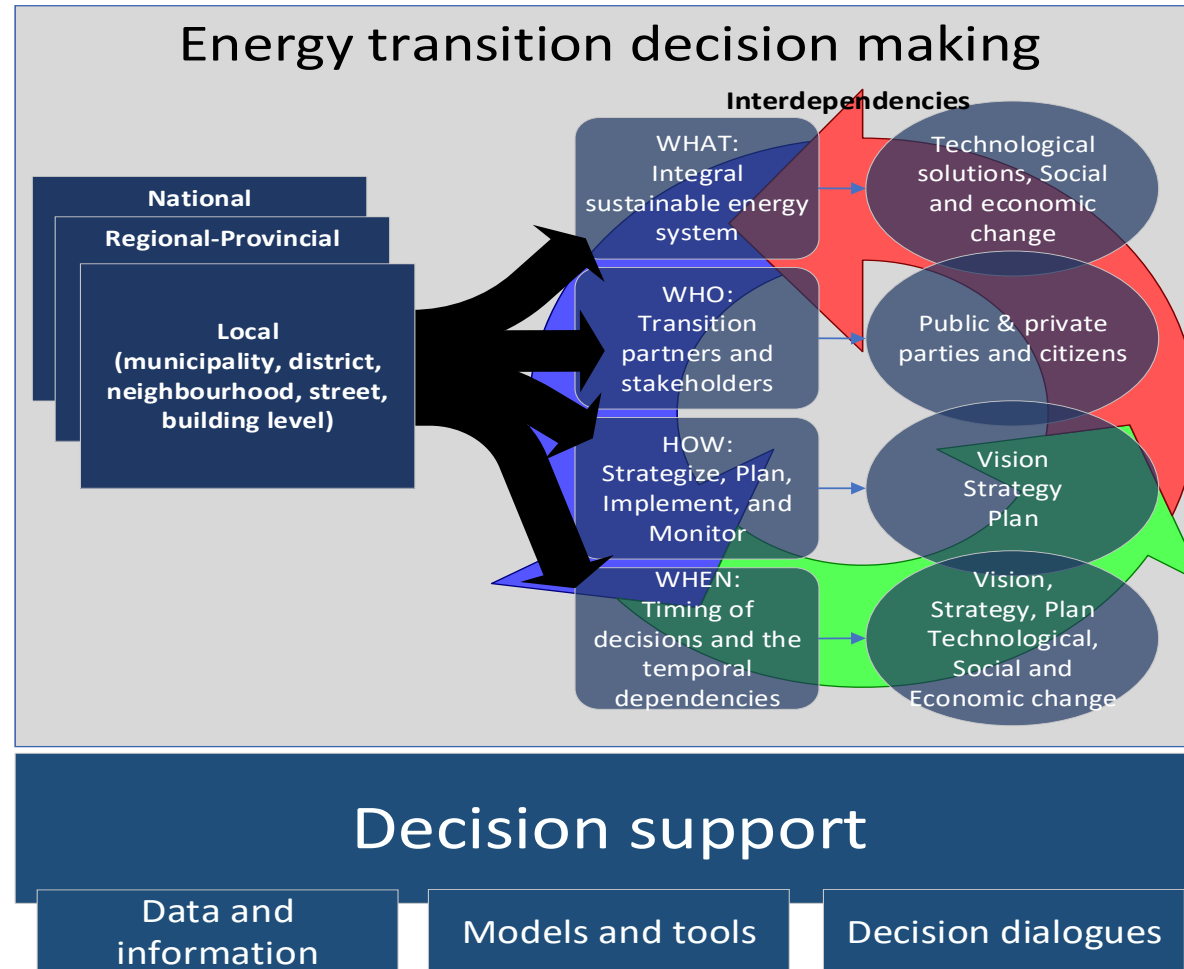
Lucas Hartong - De Noordzee wordt bedreigd door windmolens | TheP...
Het kabinet drukt ondertussen de aanleg van de gigantische windmolenparken gewoon door
tpo.nl

3

INFORMATION NEED FOR THE ENERGY TRANSITION

ENERGY TRANSITION DECISION MAKING

INFORMATION NEEDS

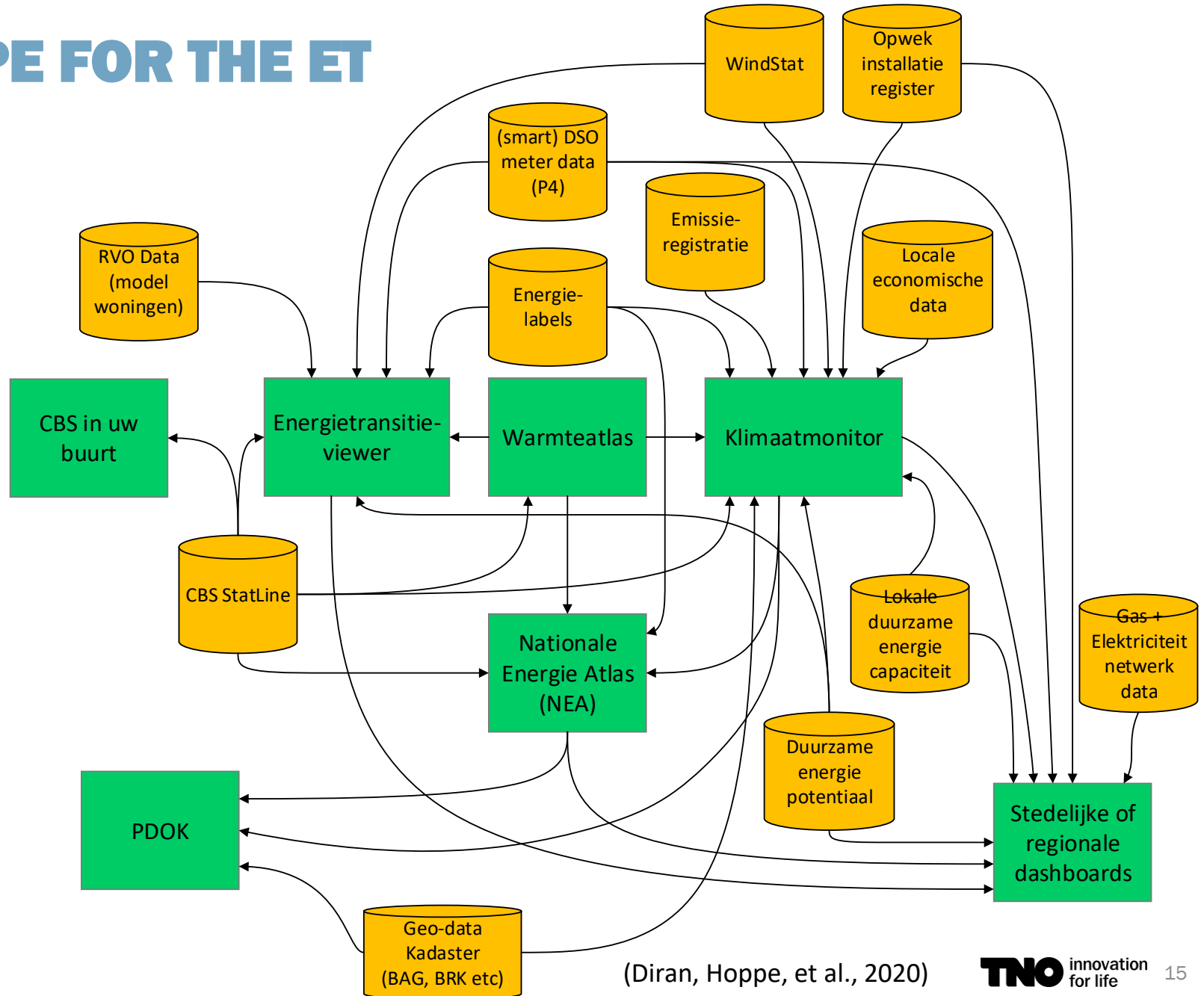


(Diran, Henrich, & Geerdink, 2020)

THE DATA LANDSCAPE FOR THE ET



Where is the knowledge related to citizens? Their preferences and drivers?



(Diran, Hoppe, et al., 2020)

DATA NEEDS AND CHALLENGES FOR THE ENERGY TRANSITION

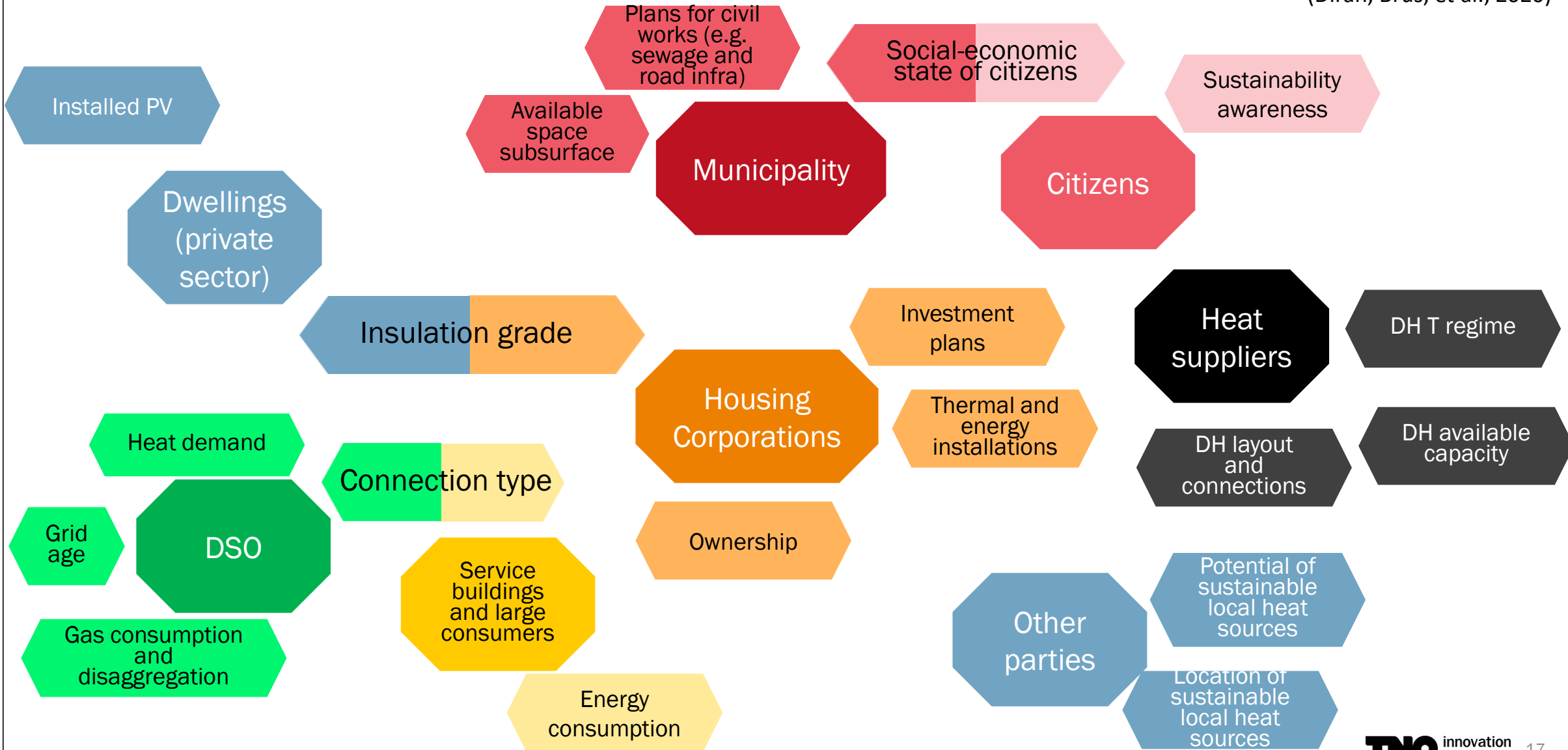


RESEARCH AMONG 8 FRONTRUNNER MUNICIPALITIES AND 3 IMPORTANT DATA SUPPLIERS IN THE NETHERLANDS RESULTS IN:

- 1) THE DATA NEEDS FOR THE TRANSITION VISION HEAT AND IMPLEMENTATION PLANS
- 2) CHALLENGES FOR UTILIZING DATA IN THE SUPPORT OF ENERGY TRANSITION PLANNING












REMAINING INFORMATION NEEDS FOR ET

(Diran, Brus, et al., 2020)



CHALLENGES - DATA FOR THE ENERGY TRANSITION

RESEARCH AMONG 8 FRONTRUNNER MUNICIPALITIES


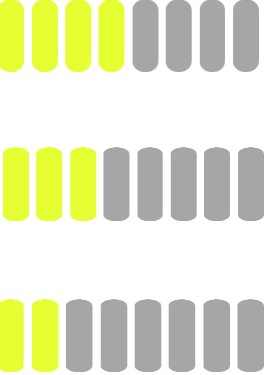

Challenge	Data access, collection and processing (experienced by x of 8 municipalities)	Data analysis, visualization and reporting (experienced by x of 8 municipalities)
It is a resource (time and cost) intensive process		
Strongly scattered data supply <i>Many different formats and standards</i> <i>Bad findability of data</i> <i>Lacking access to data</i>	   	
Data quality, timeliness and detail level <i>Missing and incomplete data</i> <i>Data not up to date</i> <i>Data not validated</i> <i>Data lacking detail level</i>		    

(Diran, van Veenstra, & Geerdink, 2021)

CHALLENGES - DATA FOR THE ENERGY TRANSITION

RESEARCH AMONG 8 FRONTRUNNER MUNICIPALITIES

(Diran, van Veenstra, & Geerdink, 2021)

Challenge	Data access, collection and processing	Data analysis, visualization and reporting
<p>A lack of expertise and capacity at the municipalities</p> <p><i>The lack of supporting tools or the lack of efficacy of available tools</i></p> <p><i>Difficult to link, analyze and visualize data</i></p> <p><i>Limits to the amount of data that can be processed in the available hardware and software</i></p>		
<p>Legal aspects (AVG, E-wet, etc.)</p> <p><i>AVG: Proper organization and safeguarding of data protection takes a lot of time and legal expertise. (KLIC Data, Type of connections)</i></p> <p><i>Legal restrictions on the exchange and use of data (Electricity and Gas Code)</i></p>		

▶ **EXPERIMENTING WITH DATA DRIVEN POLICY**

› DIGITALIZATION IN OUR HOMES



› THE TRANSITION OF OUR HOMES



› THE TRANSITION OF OUR CITY



› POLICY LAB APPROACH TO EXPERIMENT WITH DATA DRIVEN POLICY MAKING



- Methods & Models
- Experimentation & Co-creation
- Impact & Learning

(van Veenstra & Kotterink, 2017)

Goal: to design, implement and scale up data experiments by governments and their stakeholders, where new data sources and methods of analysis are utilized.

- Exploring new data sources and technologies with an impact on policy.
- Setting up experiments to test these new technologies, methods and policy models.
- Implement and monitor this policy; formulating possibilities for upscaling.

This involves building up knowledge about the methods and preconditions for collecting, storing and analyzing data about the different phases of the policy-making cycle.

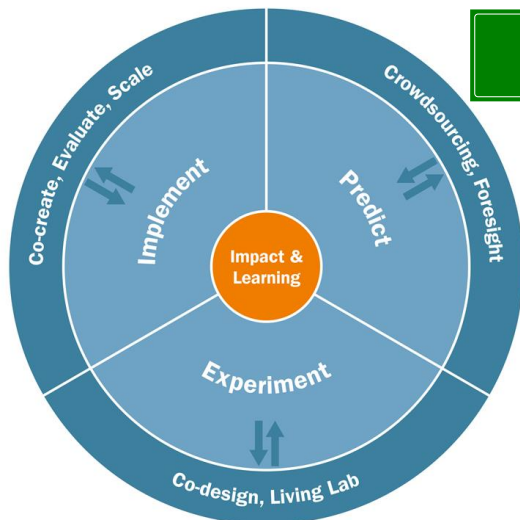
› POLICY LAB EXPERIMENT

NATURAL GAS FREE NEIGHBOURHOODS



Praktijk case

Methodologie



★ › Results

- Knowledge gaps for a socially inclusive heat transition
- Challenges faced by local governments to acquire data, process and analyse data, and guarantee privacy and security
- The importance of multi-disciplinary teams
- A method to derive, store, process, share and analyse data in support of decision making
- Data-driven -> Hybrid <- Expert-driven
- Build from the strength and familiarity of the municipality

(Diran, van Veenstra, Geerdink & Steenmeijer, 2021), research publication pending

› THE ROLE OF AI FOR LOCAL GOVERNMENTS

- › Supporting the exploration of an ever increasing solution space
- › Evidence based underpinning of mental models and discourses
- › Connecting domains and sectors
- › Improving efficient and effective data acquisition strategies
- › Empowering citizens and stakeholders
- › Facilitating robust decision making by means of uncertainty management

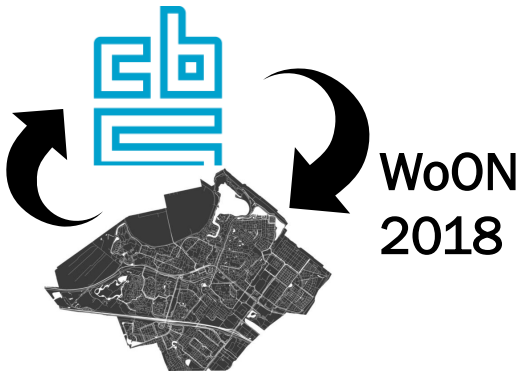


DATA ANALYTICS: MACHINE LEARNING

RANDOM FOREST FOR THE SATISFACTION WITH THE LIVING ENVIRONMENT

Various algorithms have been implemented and compared with each other on performance, explainability and transparency. The first implementation was a Random Forest model, which is considered suitable in this experiment for several reasons, namely:

- high prediction accuracy and interpretability of results,
- gaining insight into the most relevant variables for this task, through their predictive power,
- robustness against over-fitting, and
- suitability for datasets with many variables and not necessarily much data.



Attractive dwellings in the neighbourhood

Problems and nuisance in the neighbourhood

Satisfaction in the region

Feeling at home in the neighbourhood

Possibilities to relocate

Good relationship with neighbours

Attached to the neighbourhood

Well maintained dwellings

Contact with direct neighbours

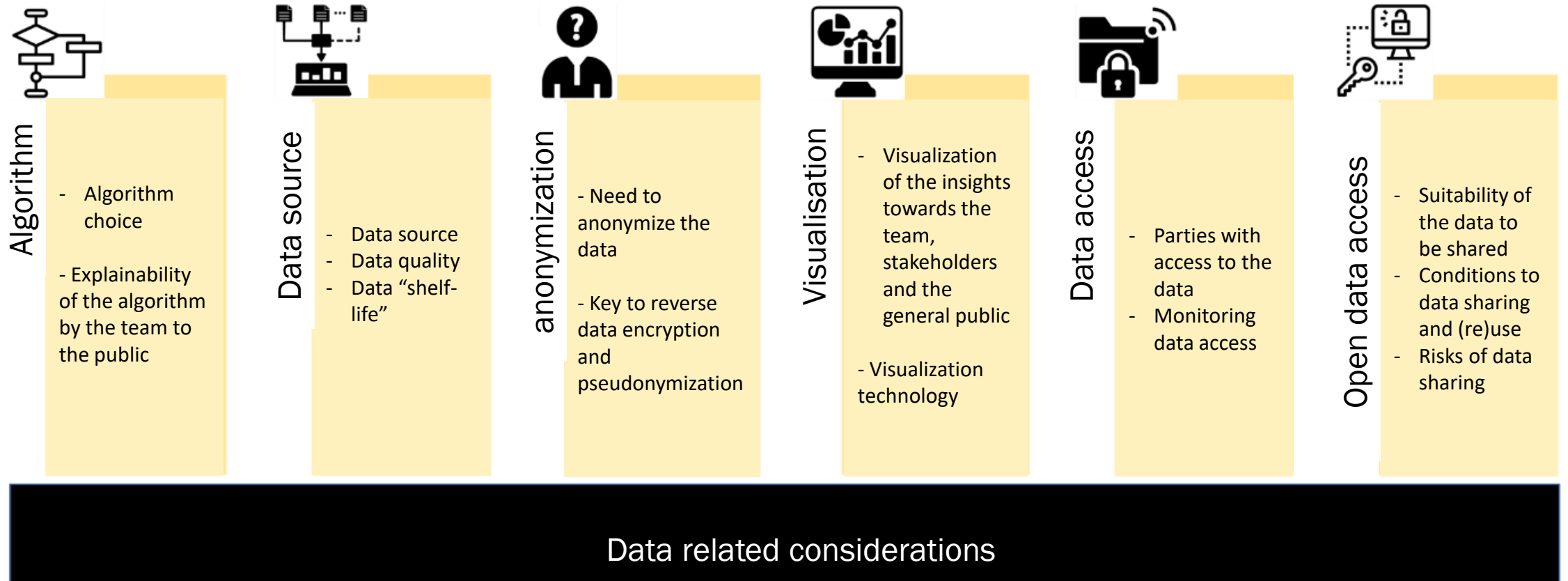
Satisfaction with the population composition

Fun and social neighbourhood

(Diran, van Veenstra, Geerdink & Steenmeijer, 2021), research publication pending

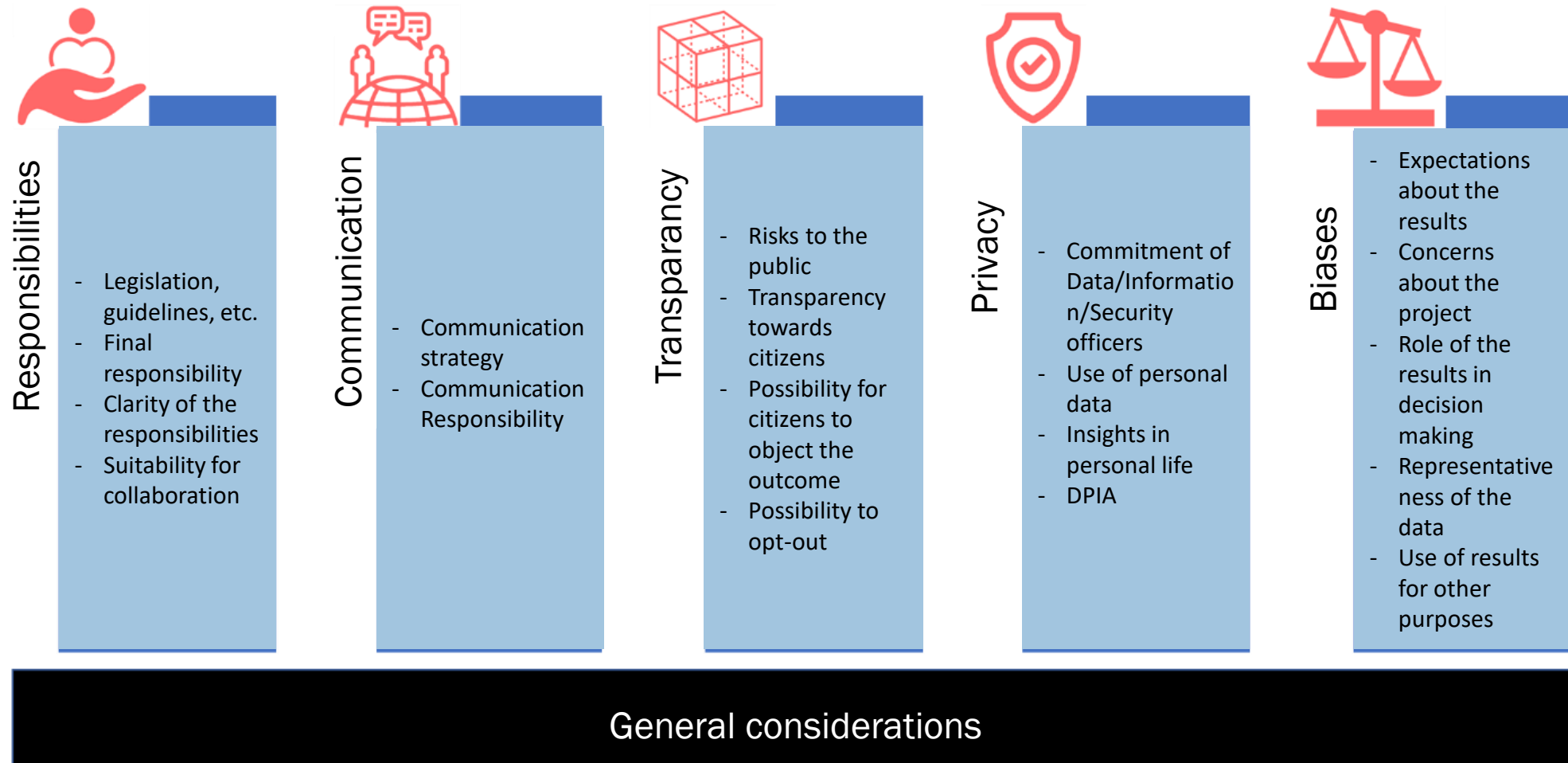
* Permutation score: the degree to which the predictive power of the model decreases when variable x is removed.

› A CHECKLIST FOR DATA ETHICS



Based on “De Ethische Data Assistent” by (Utrecht Data School, 2019) and (Diran, van Veenstra, Geerdink & Steenmeijer, 2021), research publication pending

› A CHECKLIST FOR DATA ETHICS



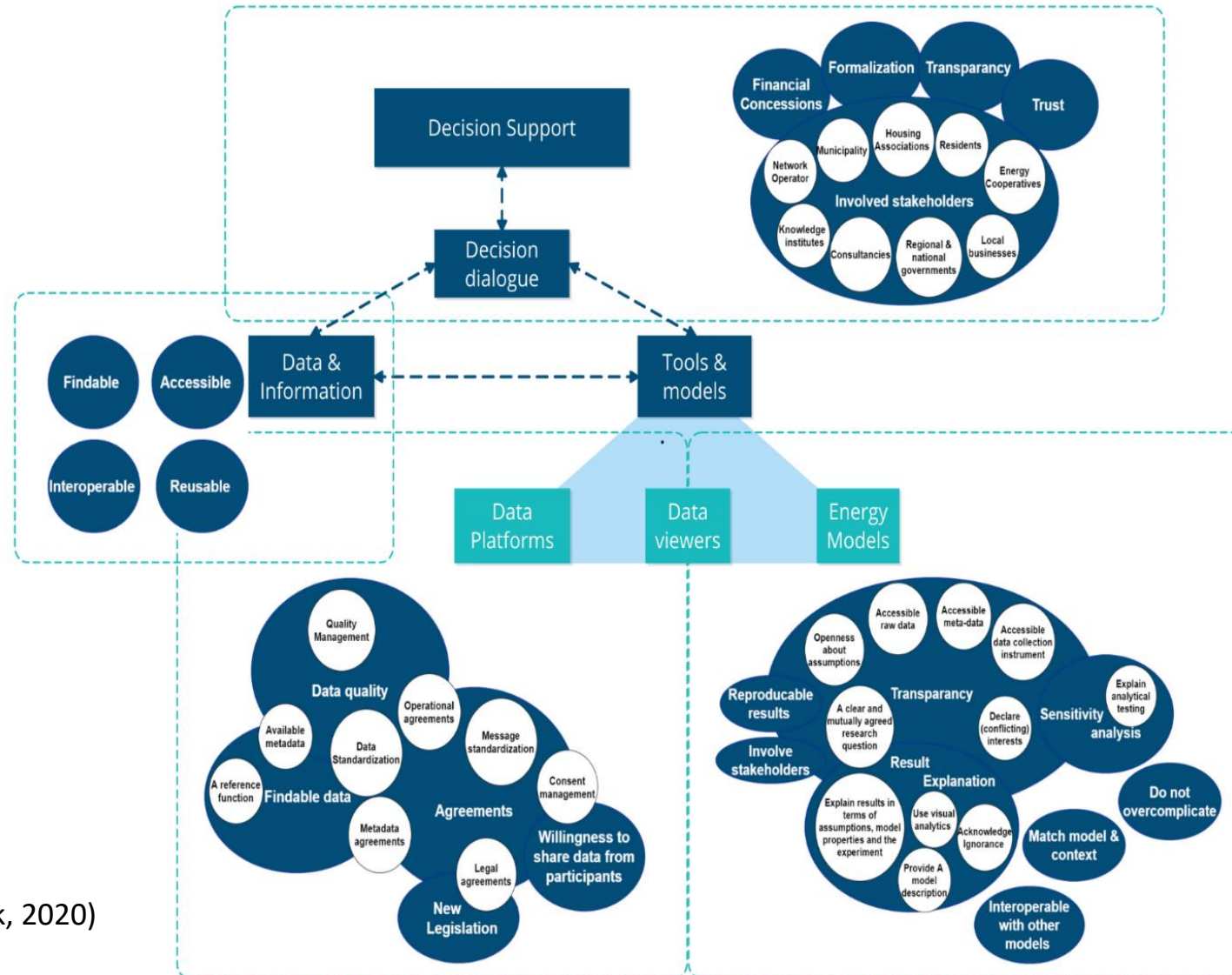
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› THE WAY FORWARD



OVERVIEW INFORMATION SUPPLY AND UTILIZATION

AN INTEGRATED APPROACH FOR ENERGY TRANSITION DECISION MAKING



(Diran, Henrich, & Geerdink, 2020)

› RESPONSIBLE AI FOR A SOCIALLY INCLUSIVE ENERGY TRANSITION

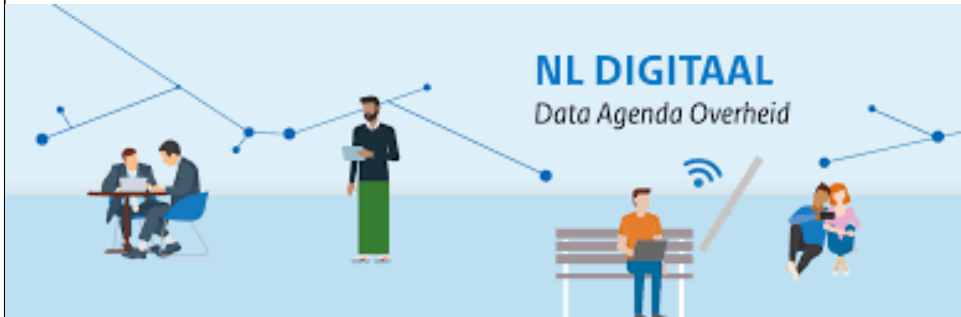
MIRANDA: A TNO X CBS COLLABORATION

A socially inclusive energy transition in which citizens are involved within their capacity and decision-making is tailored to the wishes and capabilities of the citizens.

Call for participation!



DATA AGENDA AND PROGRAMMES

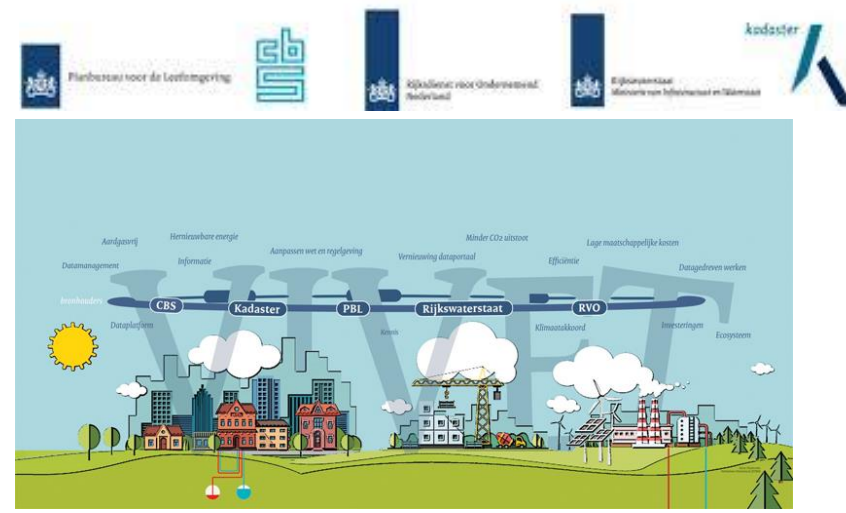


Aan de slag met data

- 1 Maatschappelijke problemen oplossen met datagedreven werken
- 2 Aandacht voor wetgeving en publieke waarden
- 3 Overheidsdata kwalitatief verbeteren en efficiënter benutten
- 4 Kennis over datagedreven werken verzamelen en delen
- 5 Investeren in mensen, organisatie en cultuurverandering

VIVET

Verbetering Informatievoorziening Energietransitie



TNO innovation
for life

**THANK YOU FOR
YOUR TIME**

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› REFERENCES

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- › Diran, D., Geerdink, T., van Veenstra, A. F., & Steenmeijer, B. (2021). *Data-gedreven beleidsmodel en aanpak voor sociale opgaven in de warmtetransitie: Policy Lab experiment Aardgasvrije wijken Zoetermeer*.
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