LIVING-IN.EU

Education & Capacity Building sub-group

WEBINAR

Building Smarter Communities: Empowering User Participation in Digital Twin Design

9 May 2023

14:00 – **15:30** CET

Online

Funded by the European Union

Go Li.EU is funded by the European Union Digital Europe Work Programme 2021-2022 under Grant Agreement No. 101083615

PARTICIPATION GUIDELINES

1. KEEP YOUR MICROPHONE MUTED WHEN NOT SPEAKING
2. CLICK ON THE „PARTICIPANTS" BUTTON AT THE BOTTOM BAR OF YOUR ZOOM WINDOW, RENAME YOURSELF WITH YOUR NAME, FOLLOWED BY (ORGANISATION)

3. OPEN THE CHAT TO ASK QUESTIONS
4. THE PRESENTATIONS WILL BE SHARED AFTER THE WEBINAR

THIS SESSION IS RECORDED

By continuing to be in the meeting, you are consenting to be recorded

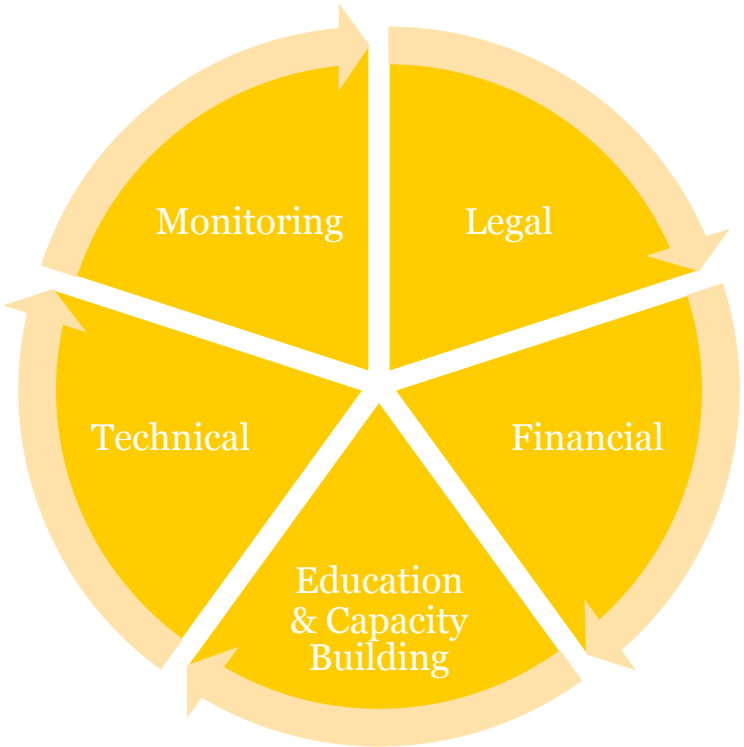
Agenda

Time	*Agenda Point*	*Speakers*
14.00 - 14.05	Welcome & objectives of the webinar	*Martina Desole – European Network of Living Labs*
14.05 - 14.15	Presentation of the topic and overview of Local Digital Twins	*Giacomo Lozzi – European Network of Living Labs*
14.15 - 15.00	Presentation of case studies and examples of user engagement in Digital Twin design	
	Urban digital twins for citizens?	*Juho-Pekka Virtanen, Forum Virium Helsinki (FVH)*
	Dynamic Visualizations to Enhance Citizens Engagement: the experience of DVECE project	*Maria Konstantinidou – Centre for Research and Technology Hellas (CERTH)*
	Scoping urban digital twins via imec's co-creative innovation management approach: PRECINCT, Bruges & City of Brussels use cases	*Dimitri Schuurman – imec*
15.00 - 15.25	Interactive roundtable with Q&A and comments from the audience	*Juho-Pekka Virtanen – VFH* *Josep Maria Salanova Grau – CERTH* *Maria Konstantinidou – CERTH* *Dimitri Schuurman – imec* *Participants from the audience*
15.25 - 15.30	Wrapping and conclusion	*Giacomo Lozzi –European Network of Living Labs*

Aim of today's webinar

To equip participants with practical methods and successful case studies of user and citizen involvement in the design, development, and use of Digital Twins.

Living-in.EU: 5 sub-groups



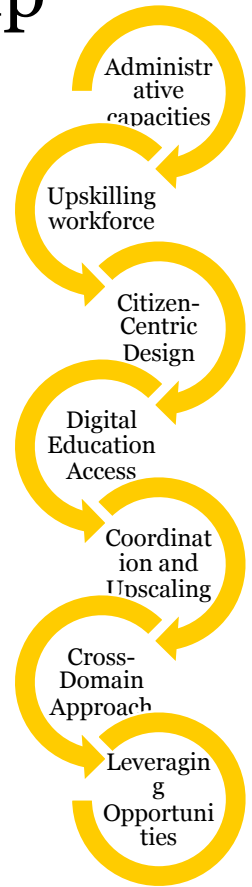
LIVING-IN.EU

Education & Capacity Building sub-group

Led by the European Network of Living Labs (ENoLL)

Empowers innovation through education and capacity building

Leverages skills and methods for effective digitalization



LIVING-IN.EU

Education & Capacity Building
Work Plan Priorities 2023

TODAY

Increase skills of public administrations on user involvement in Digital Twins Design

Support public administrations to identifying funding resources and increase levels of implementation

Assess & Review the inventory of tools of Go Li.EU

Empowering User Participation in Digital Twin Design

LIVING-IN.EU

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Interactive roundtable

Juho-Pekka Virtanen – VFH
Josep Maria Salanova Grau – CERTH
Maria Konstantinidou – CERTH
Dimitri Schuurman – imec

Participants from the audience

Next steps

Join the Living-in.EU movement by **signing the declaration**

Register here for the first Living-in.EU **Mayors Digital Assembly** on June 15, 2023

Interested in steering the activities of this sub group? **We are looking for a chair**!

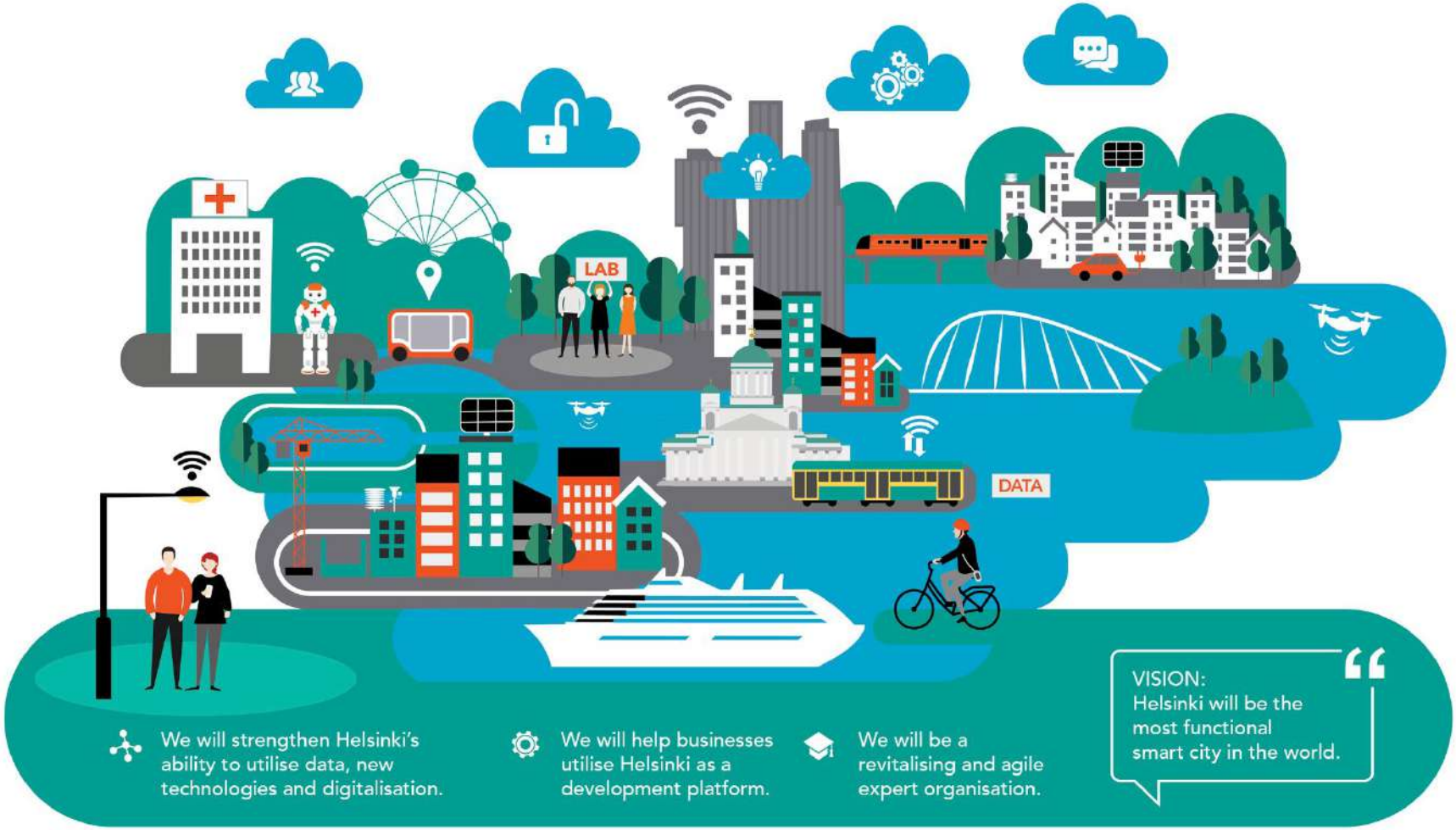
FORUM VIRIUM HELSINKI

Urban digital twins for citizens?

Juho-Pekka Virtanen

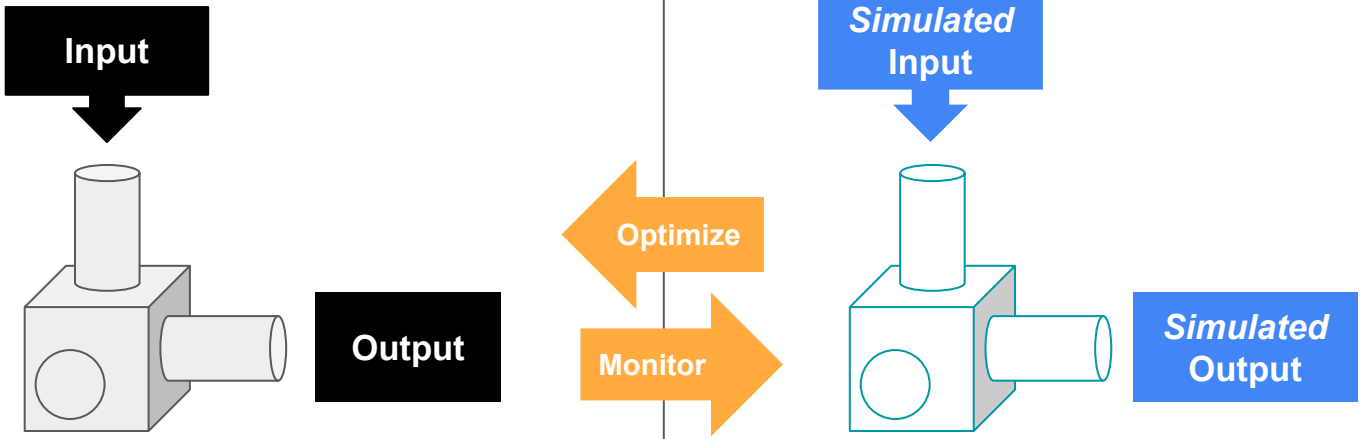
What is Forum Virium Helsinki?

- A non-profit innovation company of the City of Helsinki
- established in 2005.
- Three programmes: smart city, smart mobility and data.
- Employs 60 top experts.
- Annual project funding of EUR 6–10 million.
- The company is financed by the City of Helsinki and the EU.
- Customer satisfaction 4.4/5.
- Impact:
  - New companies
  - Smart Kalasatama
  - Open data


LAB
DATA
We will strengthen Helsinki's ability to utilise data, new technologies and digitalisation.
We will help businesses utilise Helsinki as a development platform.
We will be a revitalising and agile expert organisation.
VISION:
Helsinki will be the most functional smart city in the world.

Recap:
What is an urban digital twin?

What is a digital twin?
The "traditional" definition

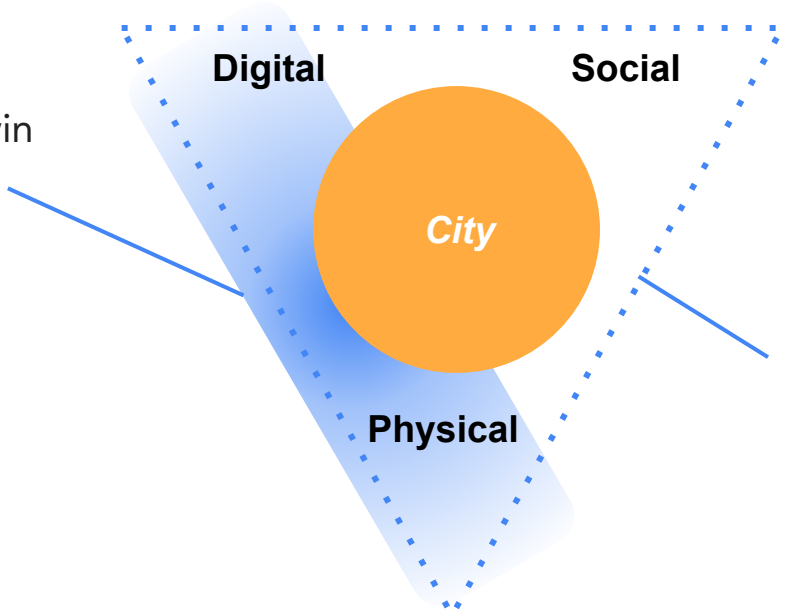


An industrial component
Pumps, drives, valves, meters...

Digital Twin
CAD-model, flow-rate equations, simulation models, noise & emission functions etc...

A digital twin of a city

In industry, the digital twin reflects physical entities in a digital form



The digital twin of the city should also include urban processesses and human behaviour

Adapted from: Suomisto & Autio, Helsingin kaupunki

A system of systems

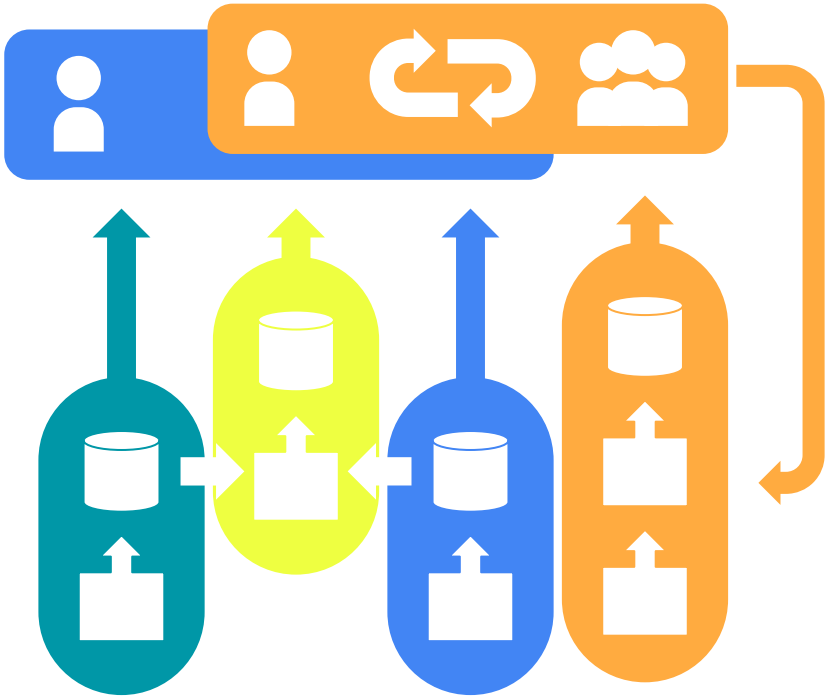
FORUM VIRIUM HELSINKI

Digital twin tools, users and processes
Online participation tools

Standardized APIs
3D Tiles

Individual systems and data
3D City model

Processes & roles
Base mapping

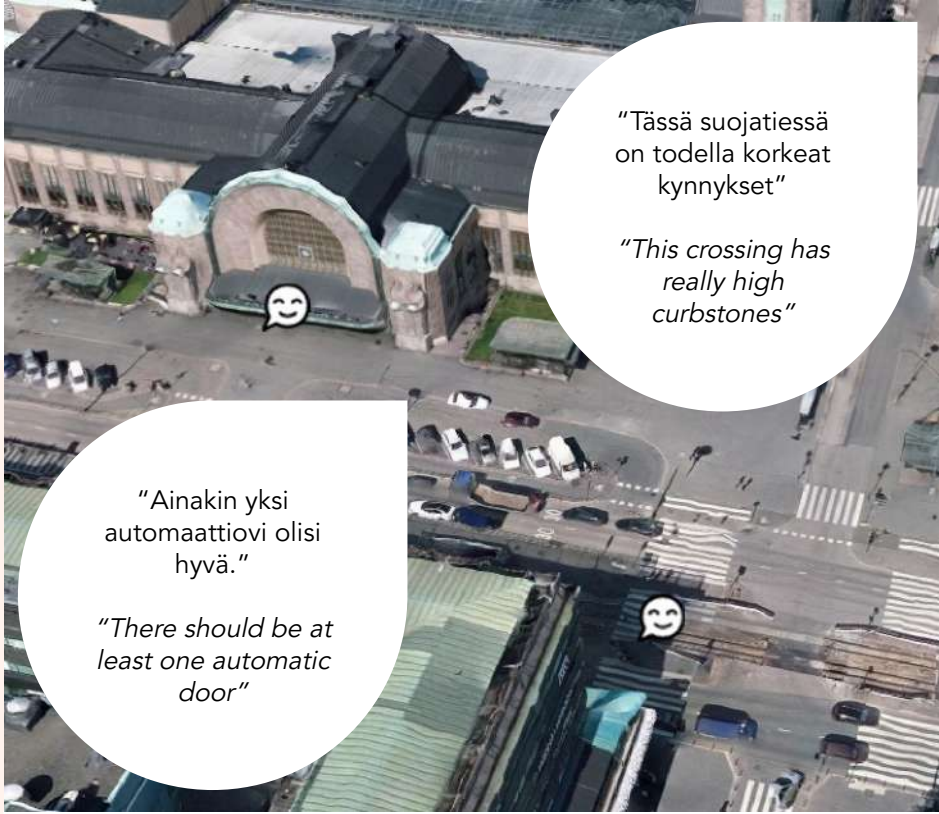


"Loop of returning data"
Feedback points

How are urban digital twins connected with citizens?

Platforms for feedback & participation

- Visualization on the existing and *proposed* urban environment
- Multiple tools available for facilitating participatory actions with 3D city models
- Already an existing action in city planning organizations
- Feedback can be cycled back to design process as data asset



Kuva: xD Twin / xD Visuals

eit Urban Mobility
Co-funded by the European Union
DYECE

Understanding the urban environment

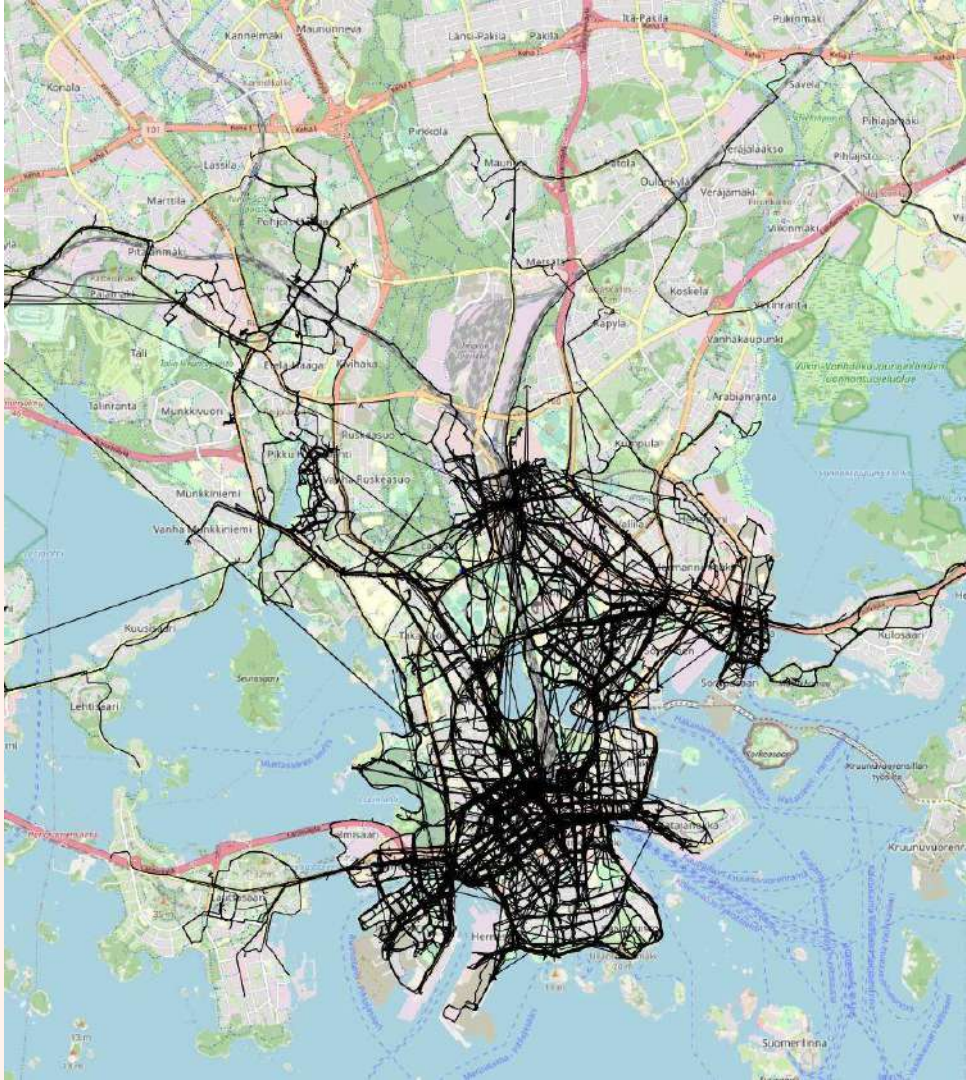
- Holistic analysis from a combination of data sources
    - Both spatial and semantic properties
- Towards the urban experience: *e.g. walkability, green comfort*
- Human interpretation of analysis results in rich context

Combining social and spatial factors

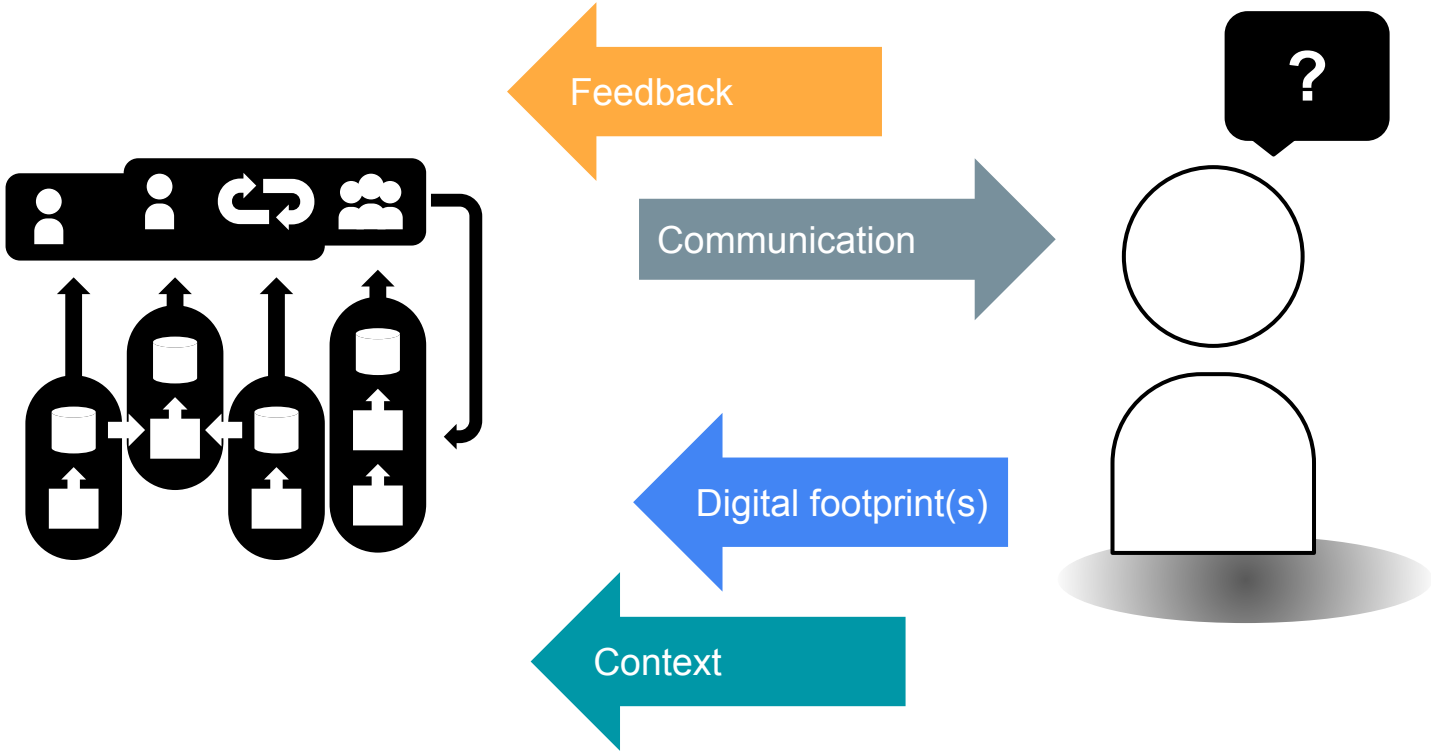
- Interpreting combinations of physical and social properties:
  E.g. vulnerability to extreme heat
- Understanding the context and implications of analysis results
- From physical phenomena (urban heat island) to effects and mitigation

High resolution multitemporal data

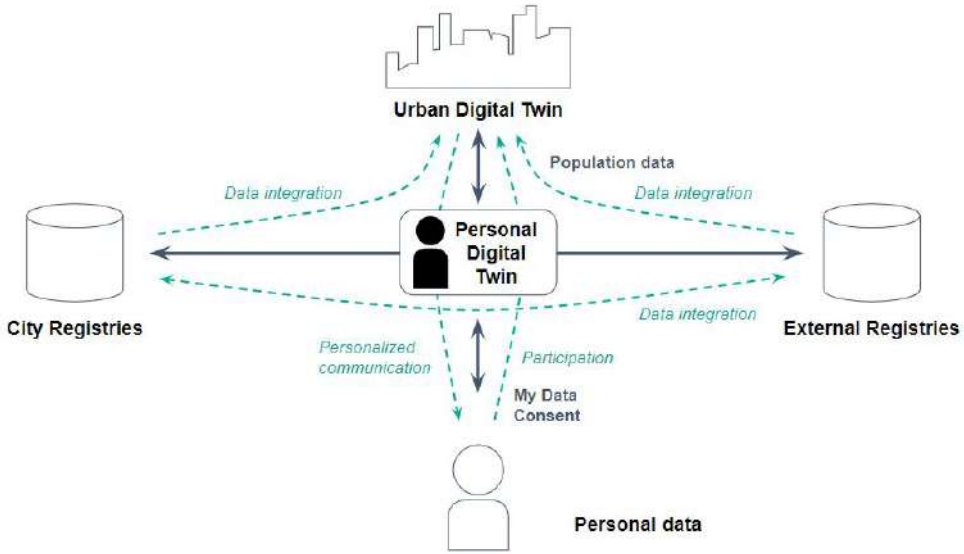
- Increasing data availability for multitemporal data - *“our digital footprints”*
  - Occupancy
  - Mobility
  - Service use
- Towards individual-oriented data
- Unanswered questions concerning privacy & generalization



Summary



Conclusion: *"Social dimension of digital twin"*



Conceptual links between a personal digital twin and city data still to be discovered

Data sources depicting social processes and artifacts

- Feedback
- Participatory activities
- Urban Experience

DT as channel for gathering, storing and distributing feedback data

Calibrated synthetic populations in DT

Join us in co-creating urban futures!

FORUM VIRIUM HELSINKI

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Dynamic Visualizations to Enhance Citizens Engagement: the experience of DVECE project

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CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

CERTH/HIT
Hellenic Institute of Transport

DVECE project - Dynamic Visualizations to Enhance Citizens Engagement

Modern technology provides new opportunities in reaching citizens and improving efficiency of co-creation processes. **DVECE tested innovative applications of dynamic visualizations, to enhance citizens engagement in the mobility context.**

The objectives of DVECE were:

- ✓ to achieve higher citizens engagement by using dynamic visualization tools in co-creation process;
- ✓ to generate project knowledge on how to update and bring designs from the mobility plans and citizens opinions into the dynamic visualization tools - Digital Twins
- ✓ to utilize DigiTwin in citizens engagement for 3 pilot locations
- ✓ to understand how these processes can be integrated in the best ways to citizens engagement platform creating a bridge between Decidi(U)M and Digital twin

CERTH/HIT Hellenic Institute of Transport
FORUM VIRIUM HELSINKI
Breda University OF APPLIED SCIENCES
eit Urban Mobility
Co-funded by the European Union

Methodological approach

Through a series of ideation, co-creation and validation/evaluation workshops within 3 living labs, DVECE collects, prioritizes and matches mobility needs set by different groups of **vulnerable users** in a **neighborhood**, with policy plans and real time data incorporated in Digi Twins. The verification of the usability of the dynamic visualization tools for and within Dicidi(U)M, performed in Helsinki, is a next milestone in the platform development.

- **Ideation workshops**: neighborhoods are the key element of this step. Interactive discussions to collect all "subjective" and mobility "user needs" information of the target groups in their neighborhoods are organized.

- **Co-creation workshops**: Feedback of the citizens on the results of the incorporation of their views with policy plans for their neighborhood within Digi twin environment. Together with citizens **a set of impact scenarios** is developed and visualized using digital twin to provide enhanced information about the impacts of the specific measures they want to see and the impact of mobility policy plans on their neighborhoods.

- **Validation workshops**: Feedback of citizens and stakeholders on the final results, the DVECE approach and their participation experience

THESSALONIKI

Target Group: pedestrians

Neighborhood: Egnatia road. Due to high levels of congestion, the lack of parking slots and insufficient infrastructure (e.g inconsistencies in ramp corridors) it is one of the most challenging areas for pedestrians and vulnerable groups

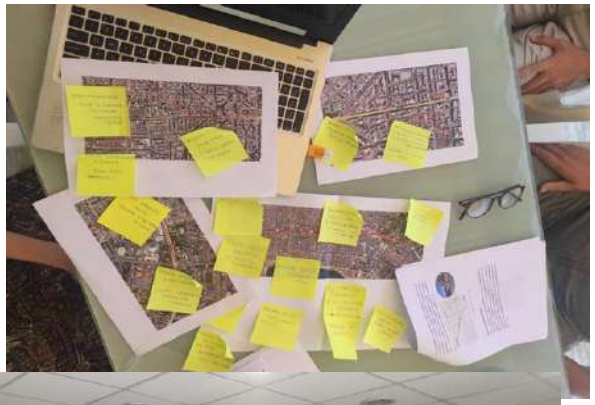
IDEATION workshop

- ✓ A list of clustered problems in the examined area was created: **Pedestrian crossings, Pavement condition and geometric characteristics, Obstructions and illegal parking, Infrastructure for disabled people, Signing**

https://www.youtube.com/watch?v=37OpFAR9Zho

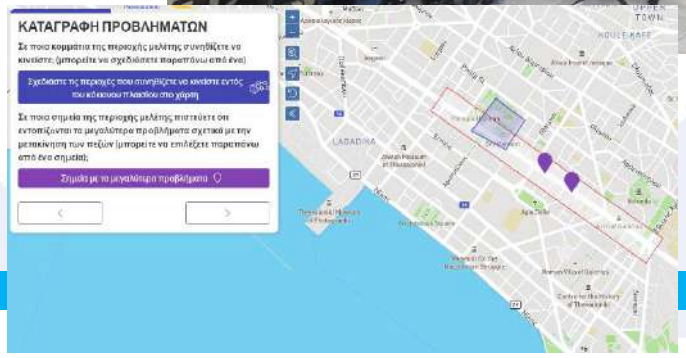
COCREATION workshop

- ✓ Impact scenarios
- ✓ Specific measures of high importance were suggested: **measures for intersections, policy measures, infrastructure related measures and multimodality measures.**



VALIDATION/EVALUATION workshop

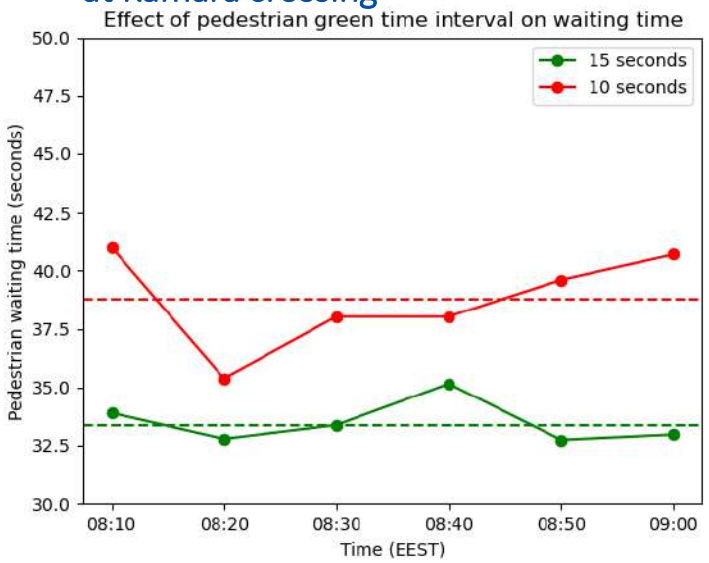
- ✓ **Visualizations** of implemented measures in Digital twin and **charts with the related impacts**
- ✓ Introduction to the **participatory platform Maptionnaire.**

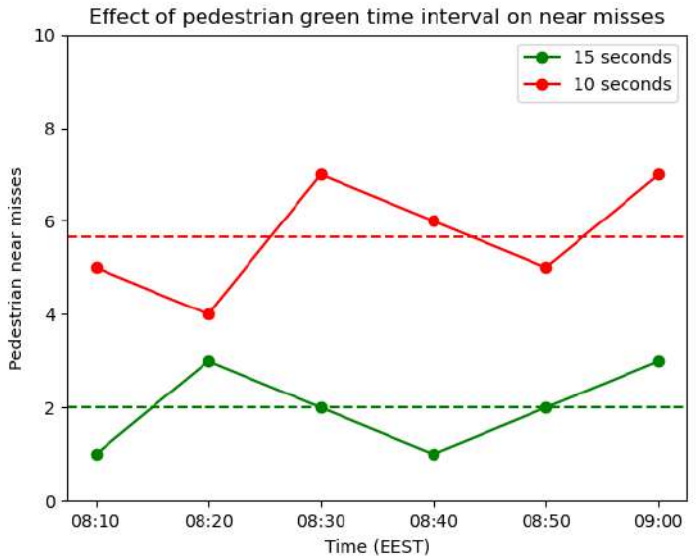


THESSALONIKI VALIDATION/EVALUATION workshop

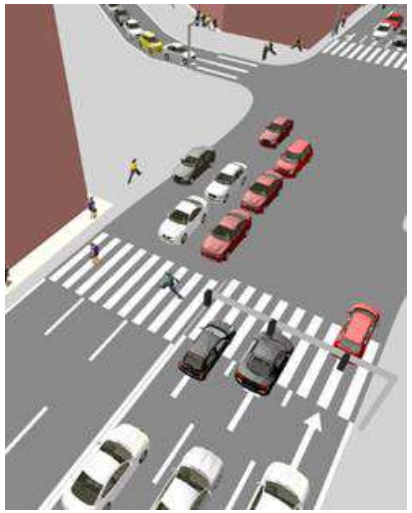
Increasing the green interval of the traffic lights for pedestrians at Kamara crossing

Effect of increasing pedestrian green time interval on waiting time and near misses at Kamara crossing

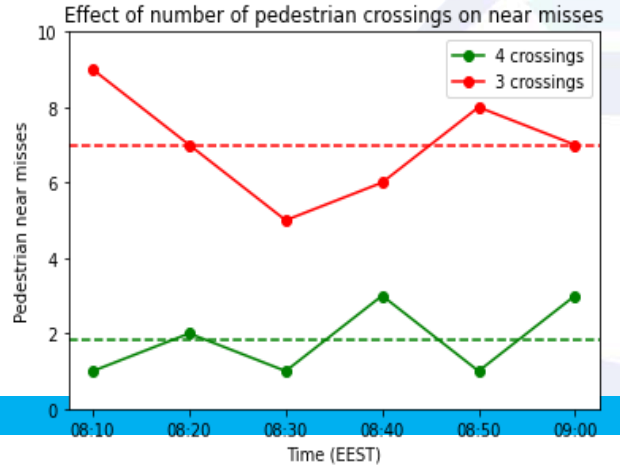


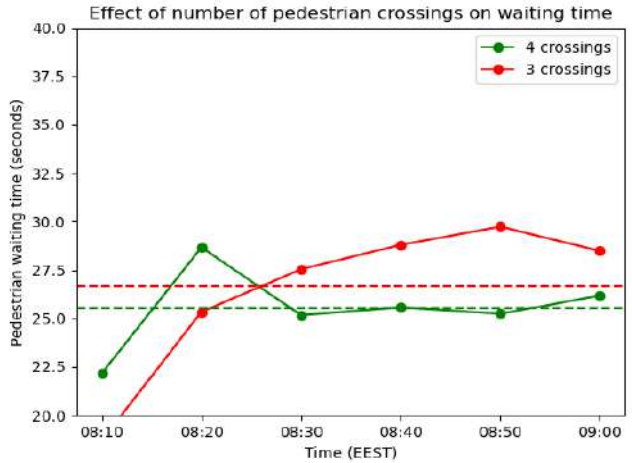


Adding a 4th pedestrian crossing at Iasonidou and Egnatia intersection



Effect of adding a 4th pedestrian crossing on waiting time and near misses at Iasonidou and Egnatia intersection





BREDA

Target Group: inhabitants from the Hoge Vucht.

Neighborhood: Hoge Vucht neighbourhood in the north-east part of the city, with relatively significant numbers of social housing, people with low incomes, low levels of education, health issues and limited life expectancy.

IDEATION workshop

- ✓ A group of local residents joined the first workshop, **presenting their views on the assets and issues in the neighborhood** and placing their concrete experiences on the maps that were later translated into the Digital Twin environment.

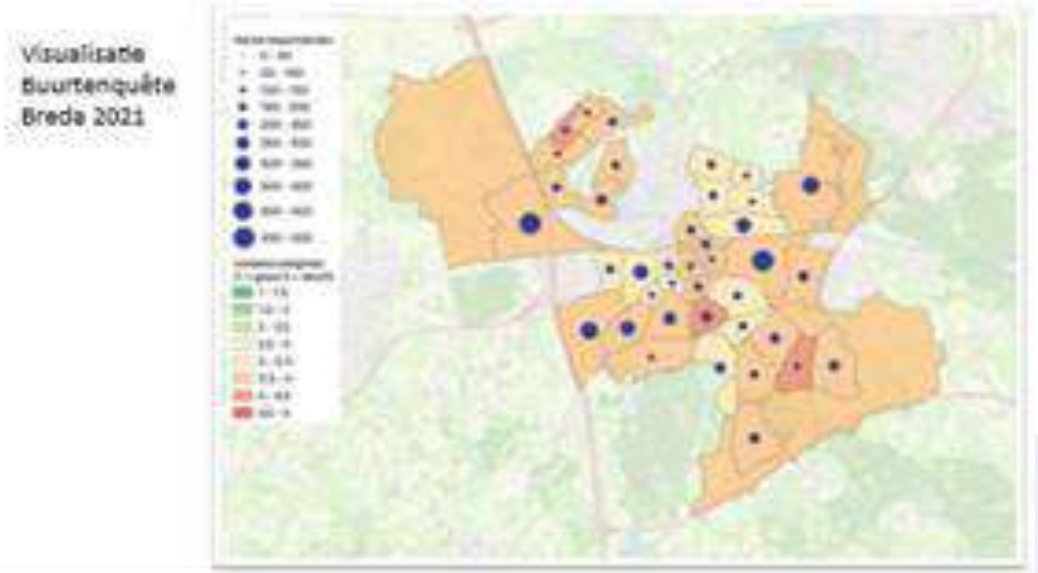
COCREATION workshop

- ✓ Open discussion with stakeholders about the **integration of crowdsourced citizens data** into the digital twin and the **usefulness of digital twin as** tool in citizens engagement

VALIDATION/EVALUATION workshop

- ✓ **Other categories of the Hoge Vucht urban space users**, such as representatives of the local business and schools;
- ✓ Discussion on potential **usability and connection** to the existing neighbourhood activities and **local online citizens engagement platform**

BREDA



The workshops illustrated that different neighborhood stakeholders are interested in the tool. However, to confirm their interest they need to see clear added value additionally to the available engagement methods as well as to experience it themselves.

HELSINKI

Target Group: vulnerable user groups

Neighborhood: four neighbourhoods in Helsinki and the city center (accessibility issues)

IDEATION workshop

- ✓ The participants were asked to share their thoughts on the **mobility-related issues in their own living environment with regards to accessible routes.**

COCREATION workshop

- ✓ Test of the online **feedback channel**

VALIDATION/EVALUATION workshop

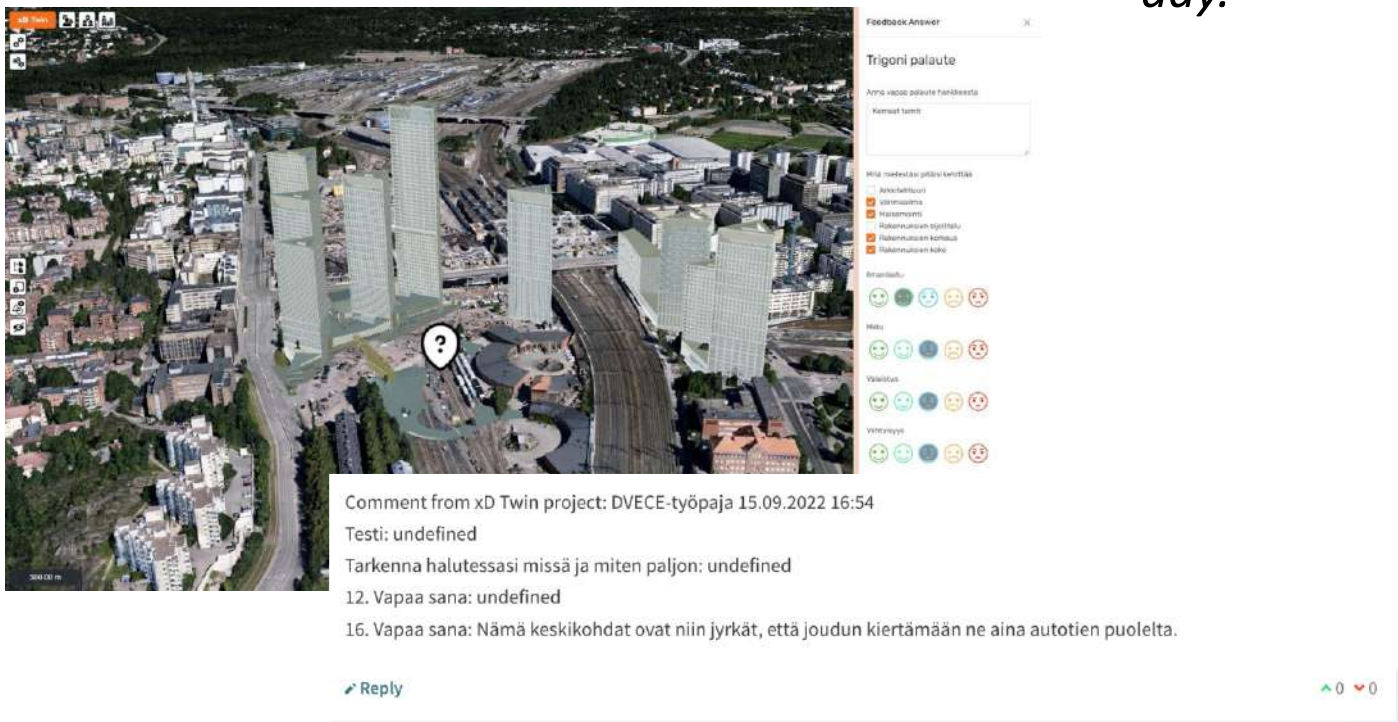
- ✓ **Validation of the results** with stakeholders
- ✓ Discussion about the **possible use cases of the digital twin in citizen engagement**

HELSINKI

“Innovative solution. This is much needed.”

“Giving feedback was very easy.”

“With this type of a tool, the collection of information would be improved. I hope it’ll be available one day.”



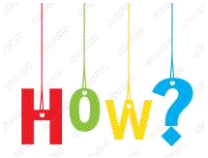
- **better understanding of the city when the city can be looked at from all angles in 3D and 4D**.
- allows **accurate location data** for any feedback and the tool available **24/7 to all online** users
- numerous possibility for visualisation of complex interdependencies
- **engagement and communication to many directions**: from citizens to citizens and to the city, from the city to the citizens

The xD Twin platform collects user feedback that is visible on the Digital Twin for all users to read. **The comments and answers to these questions were transferred through an API to the Decidim test environment.**

Lessons learnt and recommendations

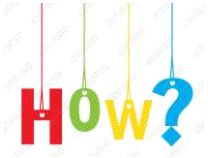
Citizens' engagement in activities and projects such as DVECE is a critical point in order the policy makers to be able to address the mobility challenges in local scale.

- ✓ **Cooperation of all related stakeholders and citizens:**



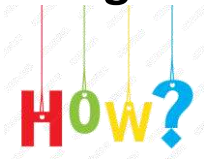
  - ➢ Establishment of a regular dialogue and communication
  - ➢ Incentivize citizens to participate in planning processes
  - ➢ All citizens should be informed about the opportunity to visualize the impact of their decisions through Digital Twins actively participating in decision making.
  - ➢ Introduction of crowdsourced citizen data (need of location based feedback)

- ✓ **Digital Twin as an engagement tool accessible to all**



  - ➢ Give voice to different user groups to mobility planning; when planning the city's mobility solutions, it's important to include persons with mobility impairments or from different social backgrounds
  - ➢ Further developments are required in order for the digital twin to become an engagement tool accessible to all (e.g. visually impaired persons)

- ✓ **Digital Twin as a part of the participatory democracy processes in Decidim.**



  - ➢ The integration of Digital twin with Decidim platform was achieved in test scale in Helsinki pilot. However, its further development and scalability depends on ownership, management, and marketing aspects.

Thank you!

Visit us!

- HIT: imet.gr
- Lab: smartmlab.imet.gr/
- Dashboard: thessmd.imet.gr/
- Open data portal: opendata.imet.gr/

thessaloniki smart mobility living lab

European Network of Living Labs

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CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

CERTH/HIT Hellenic Institute of Transport

Innovation Management for scoping DT use cases

Dimitri Schuurman (PhD)

Innovation Expert

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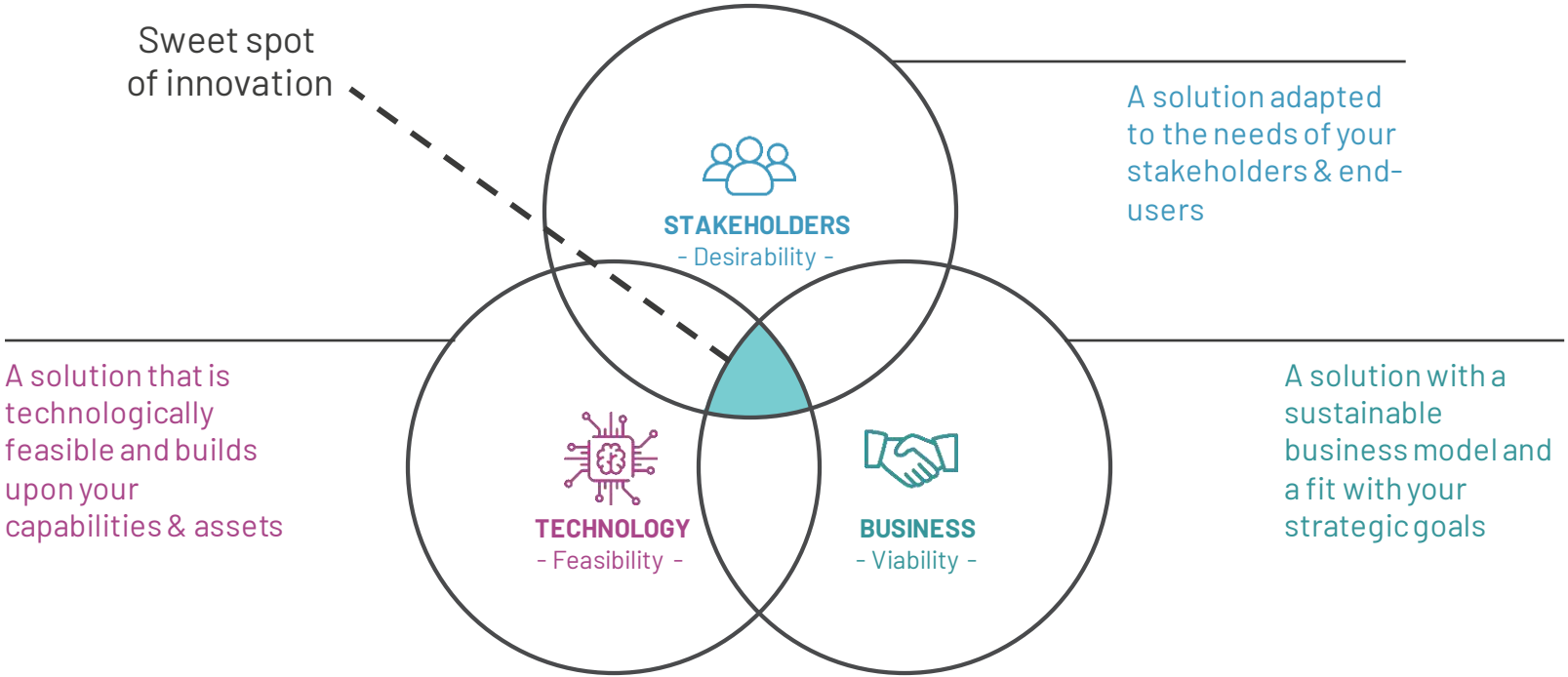
Three elements of (data) solutions



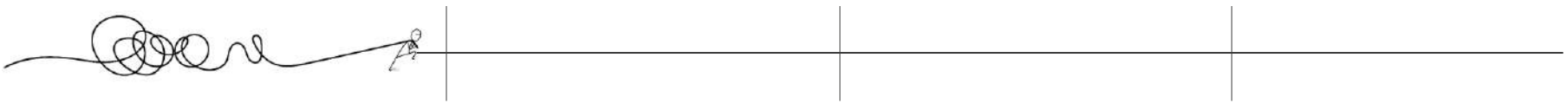
Imec's innovation management process

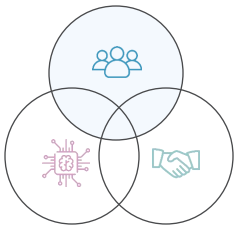
WHAT IS YOUR PROBLEM?
EXPLORING

CAN YOU SOLVE IT?
CO-CREATING

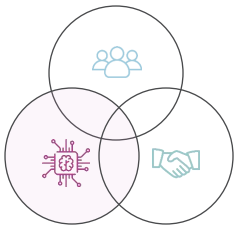
CAN YOU MAKE IT?
DEFINING

DOES IT DELIVER?
PROTOTESTING

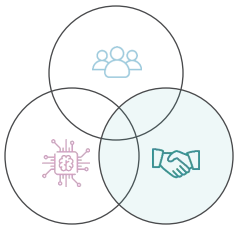




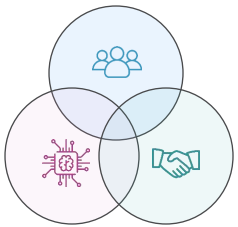
Define main problems, problem owners & future DT users



Involve primary user(s) to co-create & test DT mock-ups



Define relevant tests & test-users based on the DT scope



Iteratively test & validate new developed DT functionalities

IDENTIFYING & TESTING ASSUMPTIONS

INNOVATRIX

Stakeholder (incl. SDP role)				
Needs / Opportunities				
Current Practices				
Currents Datasets / Models				
Jobs-to-be-done				
Value Creation				
Key Resources				
Trustworthiness Requirements				
Barriers				

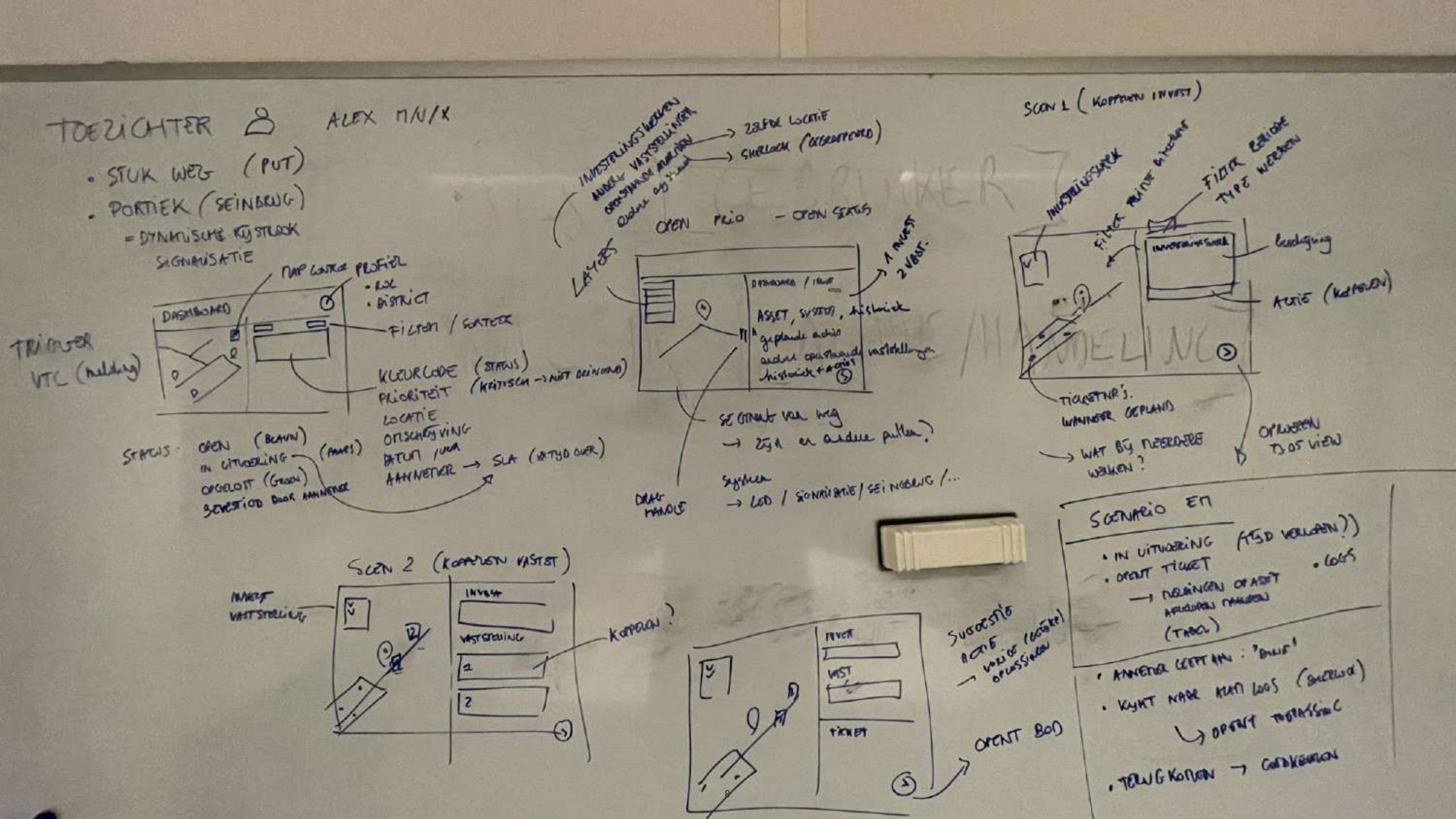
SMART DATA USE CASE CANVAS

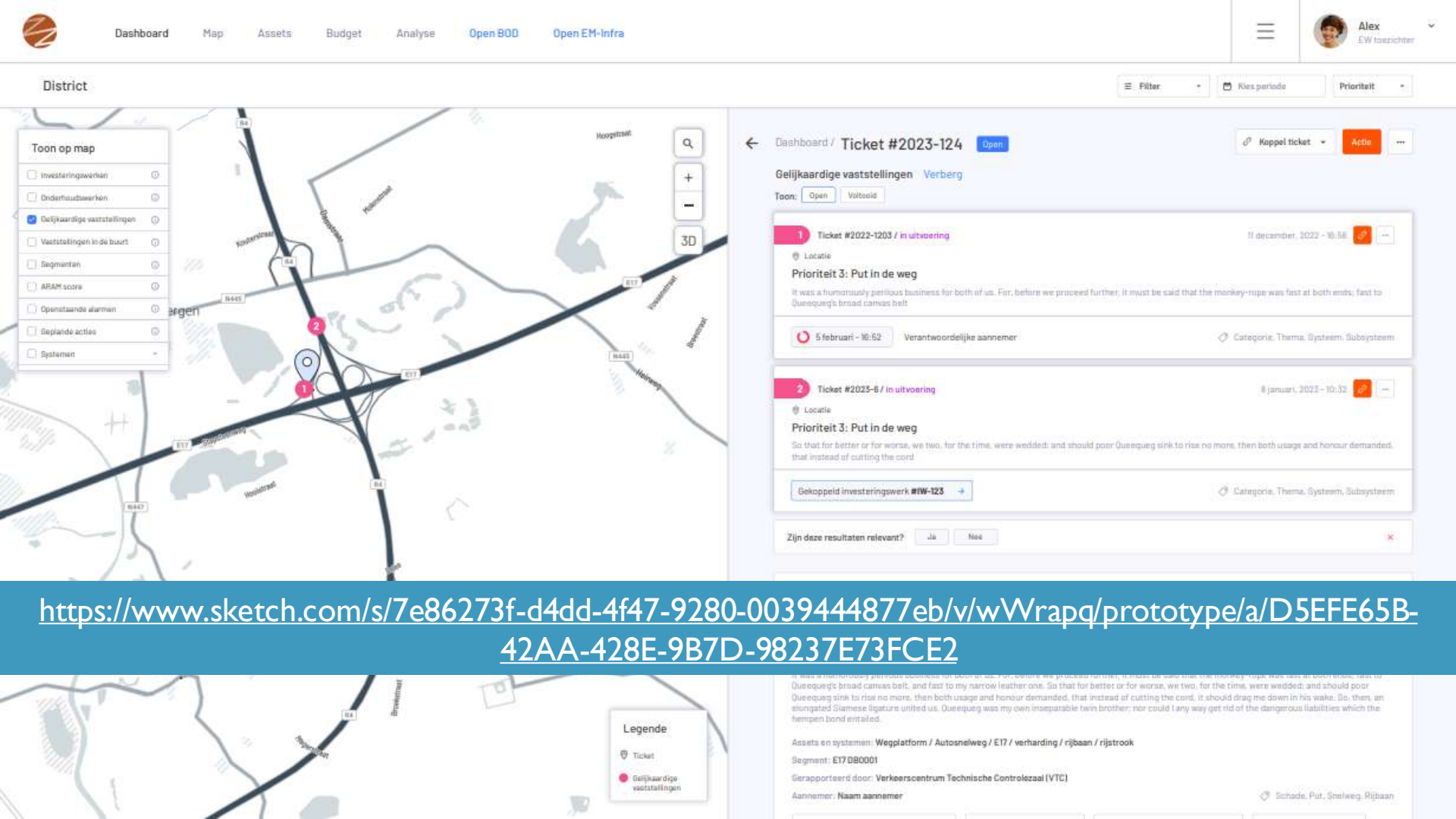
imec

EXAMPLE 1: PREDICTIVE MAINTENANCE OF ROAD ASSETS (FLEMISH DEPARTMENT OF MOBILITY)


TOEZICHTERS
EM-TOEZICHTERS
EW-TOEZICHTERS
75% BUDGET SCHADEGEVAL
VEEL DATA VEEL APPLICATIES ⇒ PERSOONSGEBONDEN KENNIS
INNOVATIEMOEHEID
PERSOONSGEBONDEN BESLISSINGEN!
≠ NODEN PER PERSOON
OMGEVINGSPARAMETERS (QUASI) NIET MEEGENOMEN
GROENONDERHOUD VIA VASTE AANNEMERS
KENNIS PATRIMONIUM ⇒ GEEN SYSTEEMDENKEN!
TAAKGEBONDEN INFO / NUT
OVERBEVRAAGD - ADMIN LAST
CHANGE MANAGEMENT!
KWALITEIT DATA & INVENTARIS WISSELEND
INNOVATIE MOEHEID
TE WEINIG CONTROLE BIJ INSTALLATIE
SAMENWERKEN MET OVERHEDEN ONDERAANNEMERS
HISTORIEK SLECHTE ERVARINGEN
TE WEINIG TERUGKOPPELING BIJ MELDINGEN
VERSNIPPERING DATA & KENNIS
"LINTJES POLITIEK"
DATA ZIT VAAK 'VAST' IN APPLICATIES
TE VEEL ADMINISTRATIE ⇒ MANUELE TESTEN
MINDER DRINGENDE MELDINGEN ⇒ BACKLOG!!!
BUDGET!!!
DISTRICTSCHEF
VERKEERSCENTRUM
TE WEINIG SYSTEEMDENKEN
TE WEINIG LIFE CYCLE APPROACH
CRITERIA VOOR PRIORITERING
SHERLOCK-TOOL ⇒ ALARMEN REACTIE
HEEL VEEL TOOLS & DATABANKEN
OPERATOR NOTEERT EERST OP PAPIER
TE VEEL & TE ONDUIDELIJKE ALARMEN AFSTANDSBEWAKING!
LEVENSDUUR NIEUWE INFRA NIET GEKEND
KLIMATOLOGISCHE NIET PRIORITAIR
HEEL VEEL DATAPUNTEN!
MANAGEMENT
PARAMETERS: 1) VEILIGHEID 2) LAAGSCHADE
TE VEEL BUDGET INVESTERING, TE WEINIG ONDERHOUD
WEG: CYCLISCH EM: PRIORITAIR
GEEN MARGE MEER
OBJECTIEF CIJFERMATERIAAL HELPT!
NODEN OVERAL HOOG → MOTIVATIE
OBJECTIVERING STAAT ASSETS NODIG
ONDERHOUDSBUDGET STIJGT NIET, PATRIMONIUM WEL
VERBORGEN WAAR ONDERHOUD


2.04
Vergaderzaal
Quinten Matsijs


TOEZICHTER
ALEX M/V/X
• STUK WEG (PUT)
• PORTIEK (SEINBRUG)
= DYNAMISCHE RIJSTROOK SIGNALISATIE
MAP CONTROL PROFIEL
• ROL
• DISTRICT
DASHBOARD
TRIGGER
VTC (melding)
FILTER / SORTEER
KLEURCODE (STATUS)
PRIORITEIT (KRITISCH → NIET DRINGEND)
LOCATIE
OMSCHRIJVING
DATUM / UUR
AANNEMER → SLA (TIJD OVER)
STATUS OPEN (BLAUW)
IN UITVOERING (ORANJE)
OPGELOST (GROEN)
BEVESTIGD DOOR AANNEMER
INVESTERINGSWERKEN
ANDERE VASTSTELLINGEN
OPENSTAANDE MELDINGEN
→ ZELFDE LOCATIE
→ SHERLOCK (GEKOPPELD)
LAYERS
OPEN PRIO - OPEN STATUS
DASHBOARD / ISSUE
ASSET, SYSTEM, historiek
geplande acties
andere openstaande vaststellingen
historiek + acties
1 INVEST
2 VAST.
SEGMENT van weg
→ zijn er andere putten?
Systeem
→ LOD / SIGNALISATIE / SEINBRUG / ...
DRAG HANDLE
SCEN 1 (KOPPELEN INVEST)
INVESTERINGSWERK
FILTER
FILTER PERIODE TYPE WERKEN
INVESTERINGSWERK
beschrijving
ACTIE (KOPPELEN)
TICKETNR'S.
WANNEER GEPLAND
→ WAT BIJ MEERDERE WERKEN?
OPWERPEN TIJDS VIEW
SCEN 2 (KOPPELEN VASTST)
INVEST VASTSTELLING
INVEST
VASTSTELLING
1
2
KOPPELEN?
INVEST
VAST
TICKET
SUGGESTIE ACTIE
→ VORIGE (LOKALE) OPLOSSINGEN
OPENT BOD
SCENARIO EM
• IN UITVOERING (TIJD VERLOPEN))
• OPENT TICKET
• LOGS
→ MELDINGEN OP ASSET AFLOPEN MAKEN (TABEL)
• AANNEMER GEEFT AAN: 'BLIJF'
• KIJKT NAAR MAN LOGS (SHERLOCK)
↳ OPENT TOPTRAFFIC
• TERUGKOMEN → GOEDKEUREN



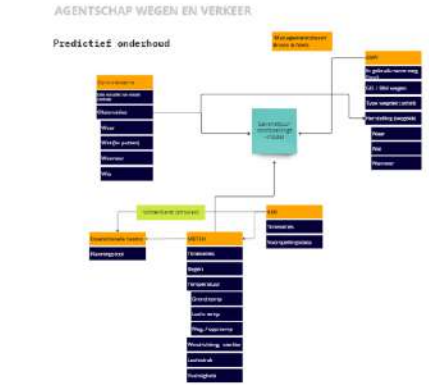
https://www.sketch.com/s/7e86273f-d4dd-4f47-9280-0039444877eb/v/wWrapq/prototype/a/D5EFE65B-42AA-428E-9B7D-98237E73FCE2

WHAT IS YOUR PROBLEM?
EXPLORING

CAN YOU SOLVE IT?
CO-CREATING

CAN YOU MAKE IT?
DEFINING

DOES IT DELIVER?
PROTOTESTING



- In the first stage, mainly 'deciders' were involved
- Their (too) high ambitions were challenged in later stages challenged by the operational complexity

Lesson learned: in the earlier stages of the Digital Twin use case scoping process, typically data quality & availability are overestimated and the barriers for adopting new ways of working are underestimated

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EXAMPLE 2: PRECINCT – EU PROJECT

Preparedness and Resilience Enforcement for Critical INfrastructure Cascading Cyberphysical Threats and effects with focus on district or regional protection

4
Living Labs

3
Transferability

1
PRECINCT

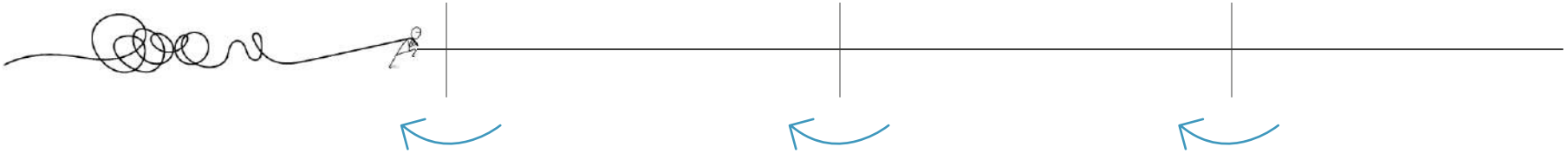
40
Partner

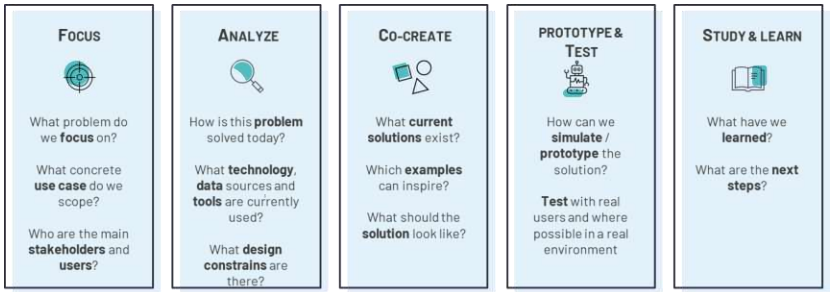
WHAT IS YOUR PROBLEM?
EXPLORING

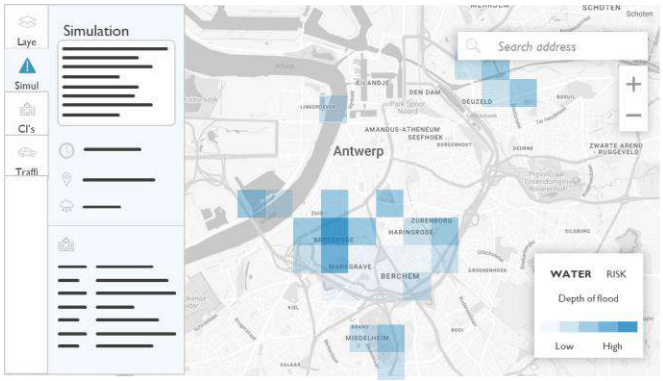
CAN YOU SOLVE IT?
CO-CREATING

CAN YOU MAKE IT?
DEFINING

DOES IT DELIVER?
PROTOTESTING







- Digital Twin scoping sprint involving Antwerp police in the sprint team & other users during interviews & testing
- Train-the-trainer approach for the other cities

Lesson learned: when deeply involving the end-users of your Digital Twin in exploring & co-creating your DT use cases, the outcome can differ from what you were planning to do in the proposal...

EXAMPLE 3: DT BRUGES

Digital twin van de stad Brugge, demovideo | imec Vlaanderen on Vimeo

▲ Maandag was er nog protest tegen het circulatieplan op de Burg in Brugge © Benny Proot

Dan toch geen eenrichtingsverkeer in Vijversdreefwijk na protest van buurtbewoners

DE TIJD

Nieuws Markten Netto

Chatbot van OpenAI jaagt Elon Musk angst aan

Markt tweedehandsauto's komt weer op gang

Computer says yes: Brugge bouwt digitale tweeling

STEPHANIE DE SMEDT | 07 februari 2021 08:00

Brugge bouwt tegen eind dit jaar samen met het onderzoeksinstituut Imec zijn digitale even-beeld, om het verkeer beter te sturen en de luchtkwaliteit te vrijwaren. Een belangrijk piloot-project voor het enorme potentieel van digitale tweelingen, een technologie die oprukt.

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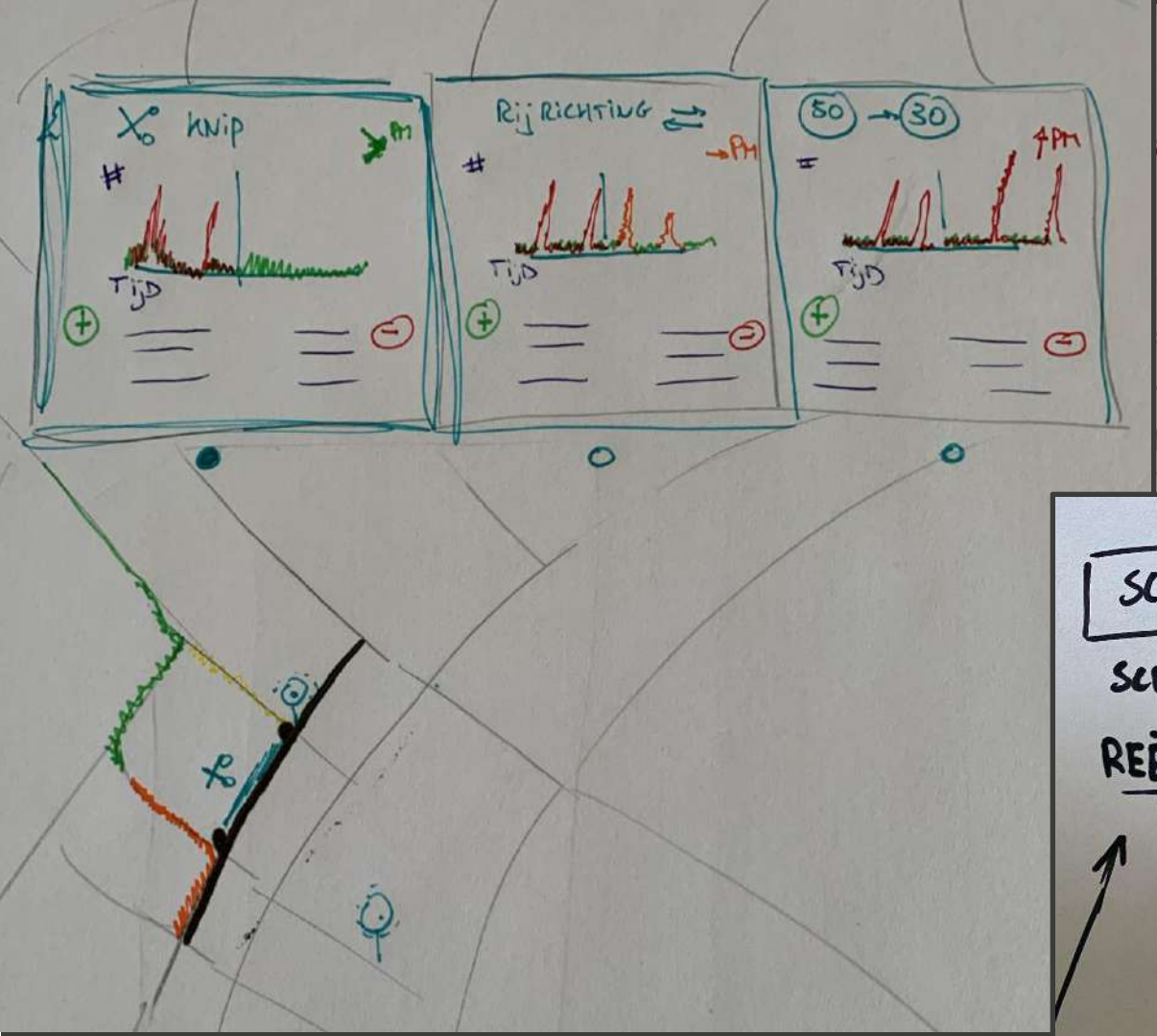
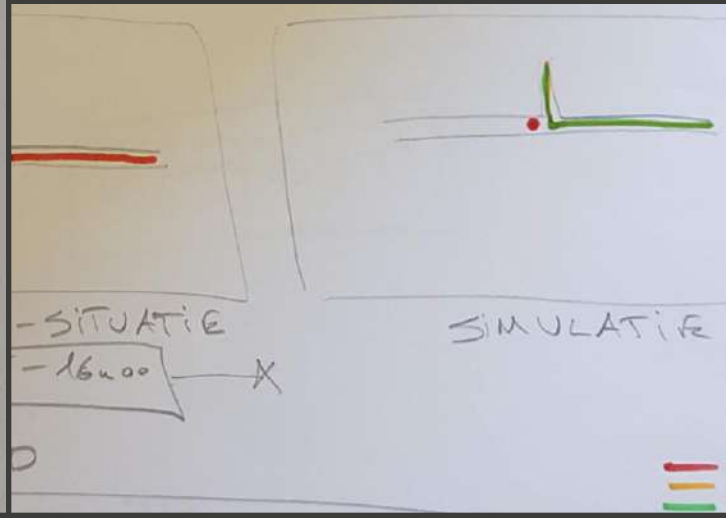
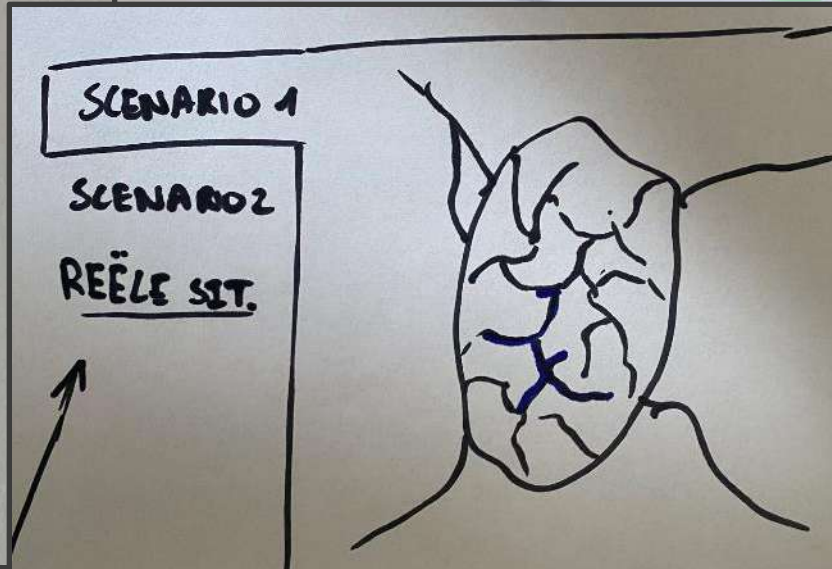
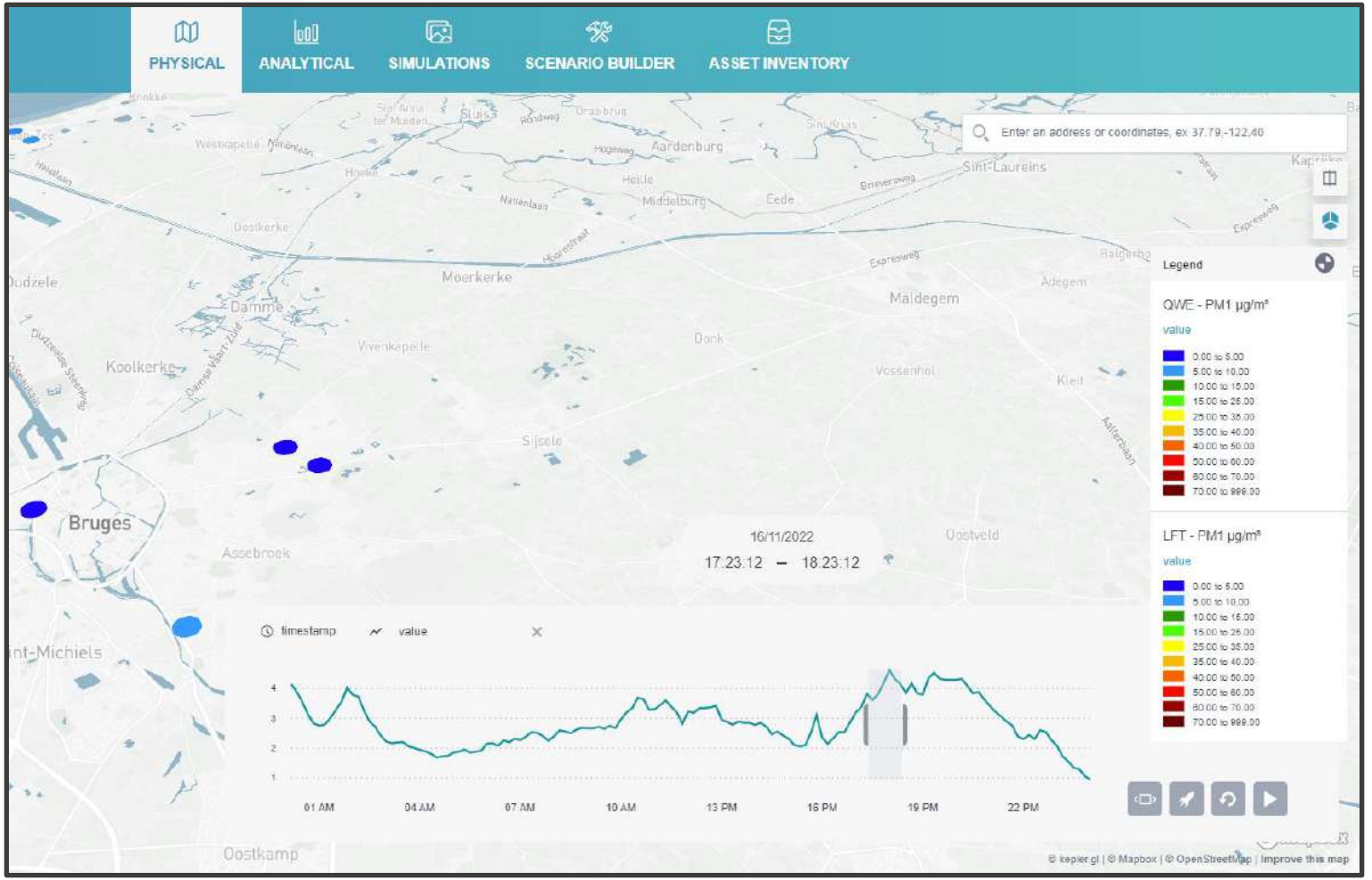
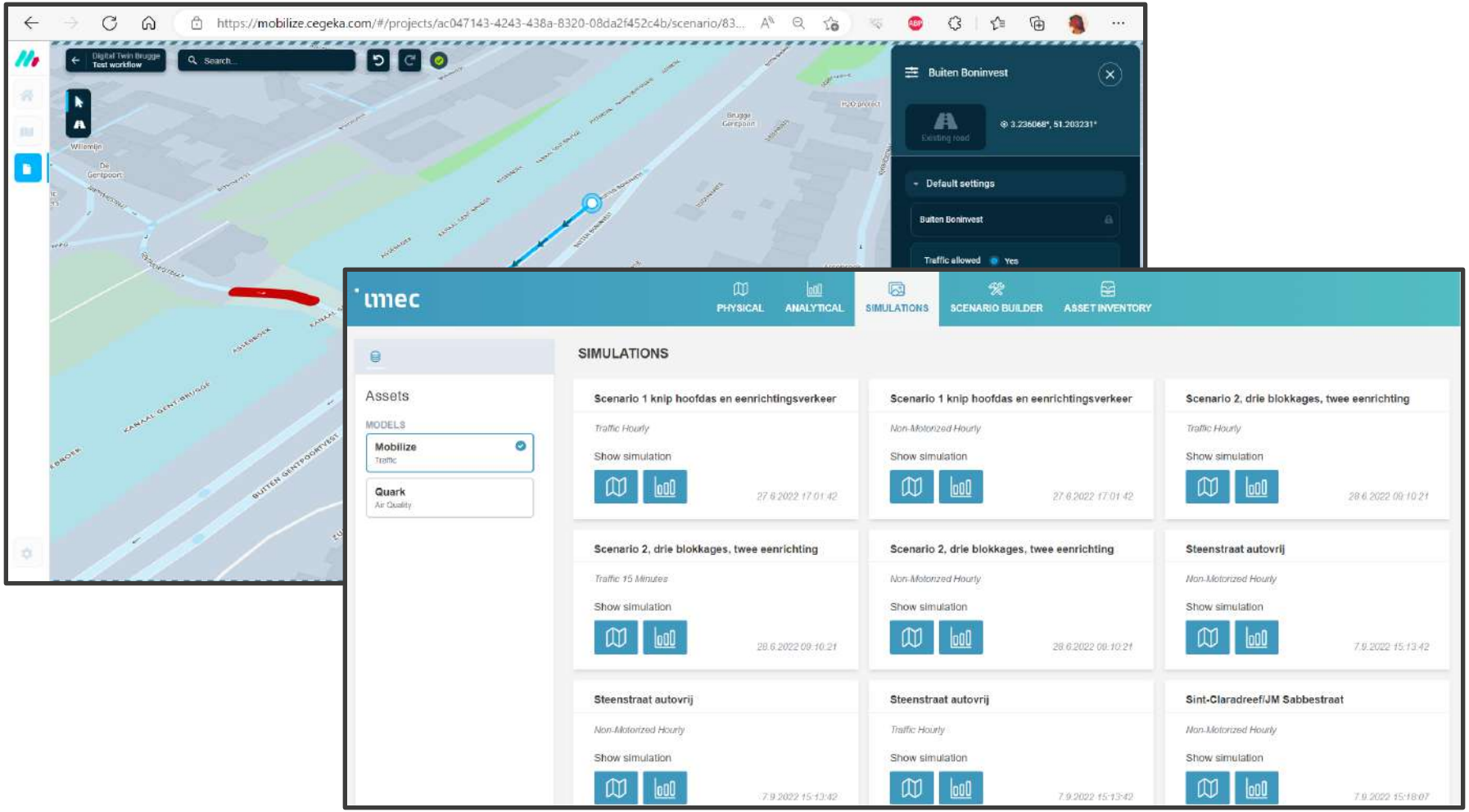

KNIP
TIJD
RIJRICHTING
TIJD
50
30
TIJD

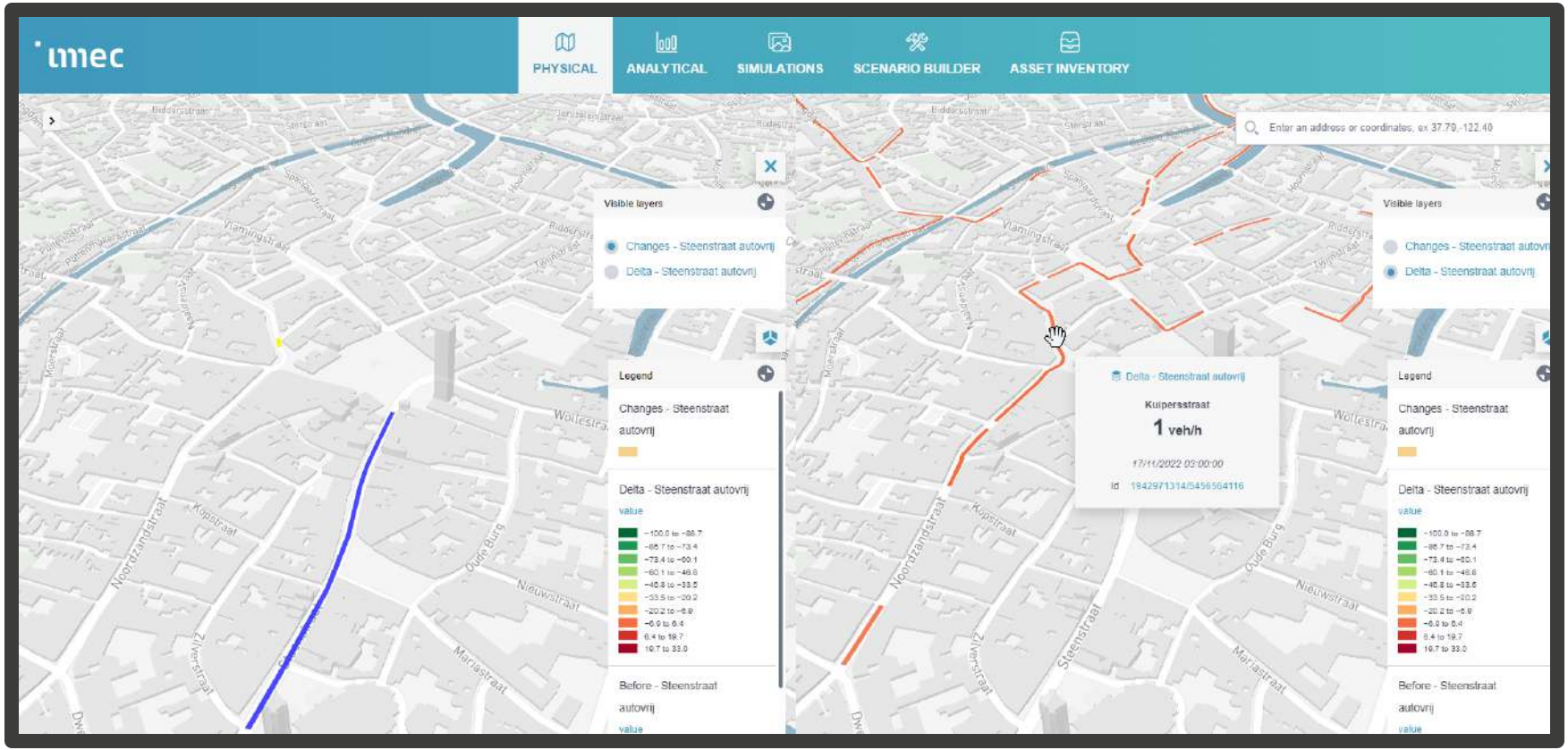

-SITUATIE
-16u00
SIMULATIE

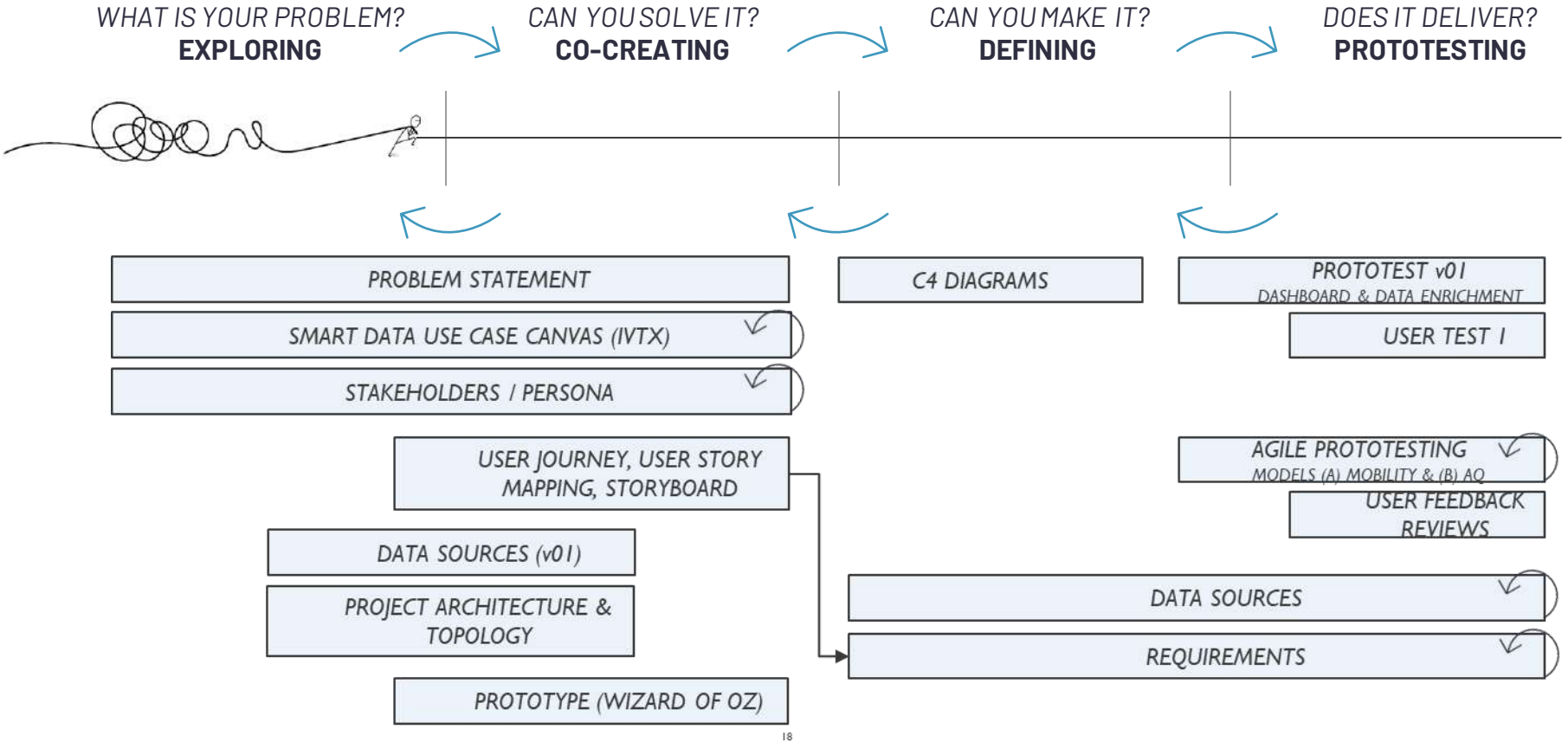

SCENARIO 1
SCENARIO 2
REËLE SIT.


PHYSICAL
ANALYTICAL
SIMULATIONS
SCENARIO BUILDER
ASSET INVENTORY
Enter an address or coordinates, ex 37.79,-122.40
Legend
QWE - PM1 µg/m³
value
0.00 to 5.00
5.00 to 10.00
10.00 to 15.00
15.00 to 25.00
25.00 to 35.00
35.00 to 40.00
40.00 to 50.00
50.00 to 60.00
60.00 to 70.00
70.00 to 999.00
LFT - PM1 µg/m³
value
0.00 to 5.00
5.00 to 10.00
10.00 to 15.00
15.00 to 25.00
25.00 to 35.00
35.00 to 40.00
40.00 to 50.00
50.00 to 60.00
60.00 to 70.00
70.00 to 999.00
16/11/2022
17:23:12 – 18:23:12
timestamp
value
01 AM
04 AM
07 AM
10 AM
13 PM
16 PM
19 PM
22 PM
Bruges
Damme
Moerkerke
Maldegem
Eede
Middelburg
Aardenburg
Sijsele
Oostkamp
© kepler.gl | © Mapbox | © OpenStreetMap | Improve this map


Airquality / Luftdaten
2022-03-24 00:00:00 to 2022-03-24 23:59:59
Pollutant
All
Location ID
6970
Device profile window
2w
Device profile - PM1
150 µg/m³
125 µg/m³
100 µg/m³
75 µg/m³
50 µg/m³
25 µg/m³
0 µg/m³
00:00
02:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
extreme
high
2022-03-24 02:35:00
extreme 51.2 µg/m³
high 30.3 µg/m³
median 19.2 µg/m³
low 8.95 µg/m³
current 54 µg/m³
PM1
value
2022-03-24 02:37:22
value 54 µg/m³
Device profile - PM2.5
80 µg/m³
60 µg/m³
40 µg/m³
20 µg/m³
0 µg/m³
2022-03-24 02:35:00
extreme 35.7 µg/m³
PM2.5
2022-03-24 02:37:22
value 33.4 µg/m³







Lesson learned: involving end-users from the start resulted in a functional and adopted Digital Twin use case, however switching back from prototesting to co-creating should be possible

Further reading...

- Innovatrix: https://timreview.ca/article/1225
- Living Labs for scoping Digital Twins: https://openlivinglabdays.com/wp-content/uploads/2022/12/OLLD-2022-Proceedings.pdf
- Testing: https://timreview.ca/article/1204
- Living Lab methodology: https://timreview.ca/article/956
- PhD on Living Labs: https://biblio.ugent.be/publication/5931264/file/5931265.pdf

OUR OWN INNOVATION MANAGEMENT TOOL

INNOVATRIX

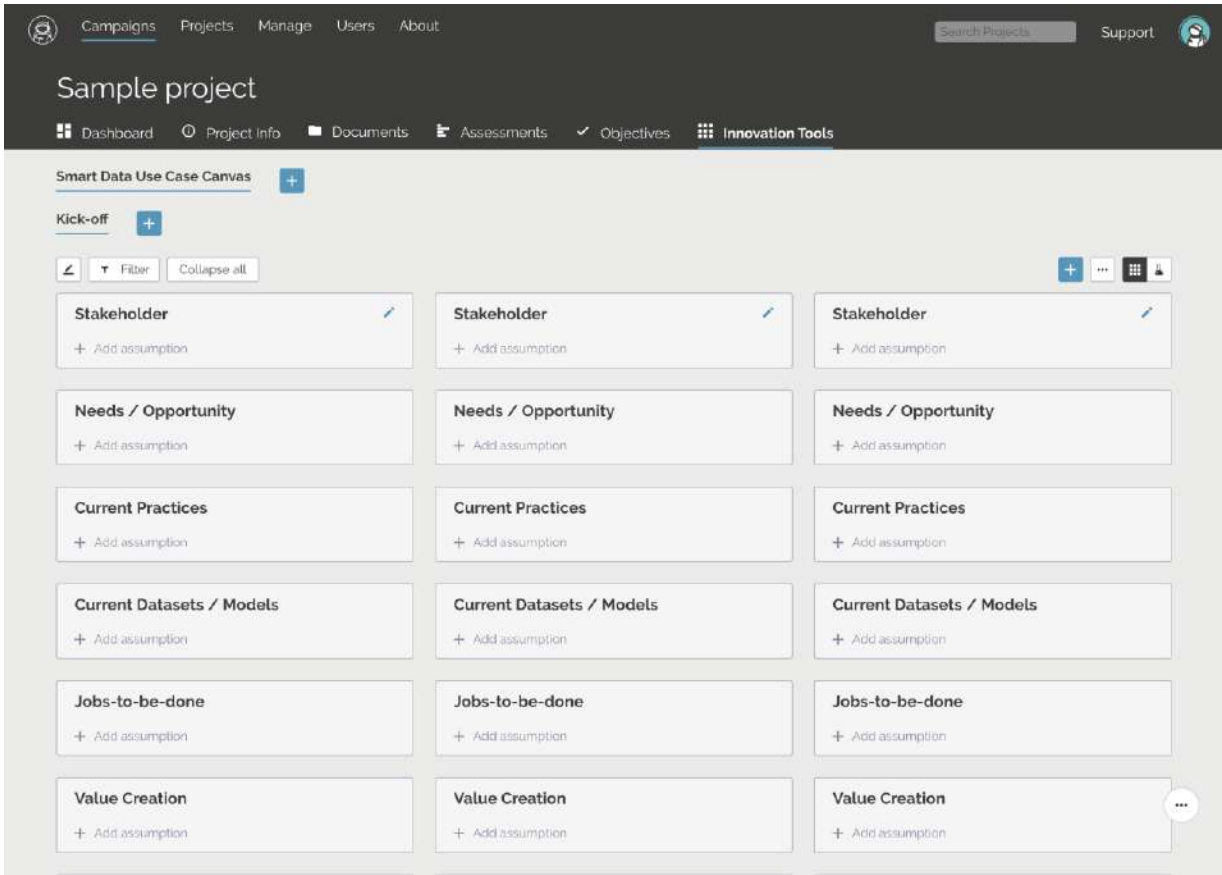
INNOVATRIX.BE

Imec's platform for innovation and venture coaching: https://imec.innovatrix.be

Assumption-based approach to innovation

- Map assumptions
- Validation activities
- Update board

✓ Learn more via these articles



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embracing a better life