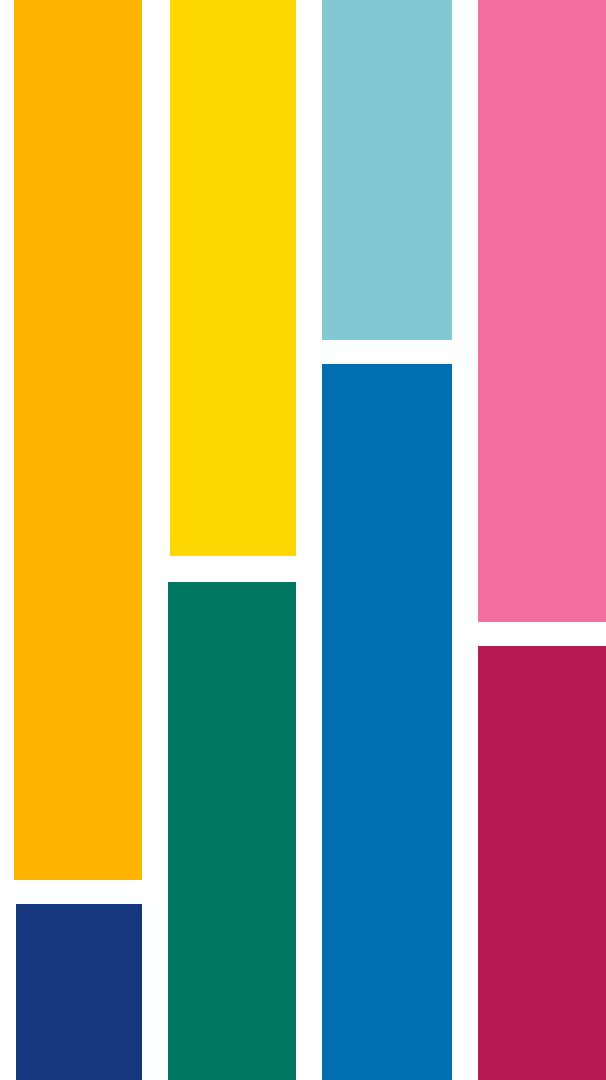


Defining the need: why using an urban digital twin?



Session goals

- Understanding the urban challenges UDTs can contribute to solve
- Understanding the added value of UDTs, and in particular for community engagement
- Developing a framework to evaluate the need for a digital twin

Agenda

1. Intro exercise: defining the need for an UDT – building a framework
2. Roles and functions of UDTs
3. UDTs added value
 - Exercise – Added value: expectations vs. reality
4. UDTs added value: decision-making and community engagement
 - Case study of Kera district (Espoo, Finland)
 - Exercise: UDTs for community engagement (applied to action plans)
5. Re-visiting our framework
6. Takeaways and conclusion

Defining the need for an UDT

- Form 2 groups: use case and no use case
 1. No use case:
 - Each participant: identify 3 reasons that make you think your city needs an UDT
 - Discuss in group
 2. Use case:
 - Each participant: identify 3 elements of your use case that made a difference to prior situation
 - Discuss in group
 3. As a group, identify key elements that define the need for an UDT

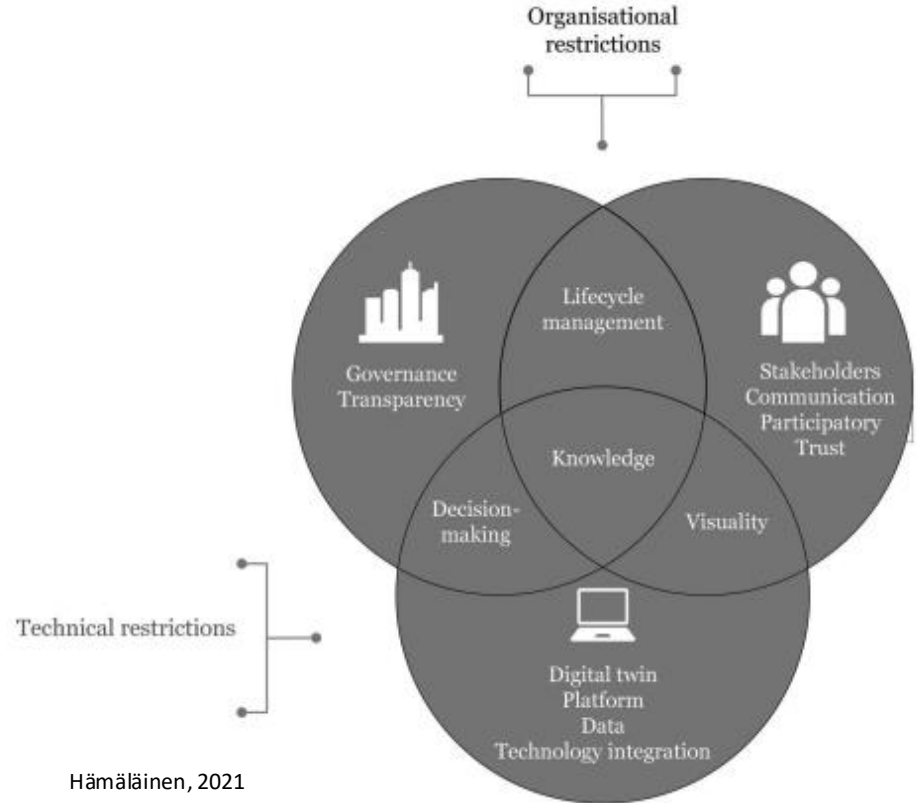
Role and functions of UDTs

Role of UDTs:

- Data-driven decision-making
- Experiential learning and simulation
- Public service improvement
- Co-creation and collaboration

Core functions:

- Data integration
- Dynamic monitoring
- Enhanced transparency and accountability



Hämäläinen, 2021

UDTs added value

Added value vs 'classic' modelling:

1. Real-time data and feedback loops -> real-time responses
2. Interactive and adaptive visualisation -> allow users to interact with different scenarios
3. Contextual awareness -> linking multiple data to physical spaces

This results in enhanced predictive and adaptive capabilities for city governments:

- Virtual experimentation and scenario testing
- Optimised resources allocation
- Risk mitigation
- Citizen participation and collaboration between stakeholders (consensus-building)

UDTs added value: decision-making and community engagement

Decision-making – *Helsinki, Finland (Hämäläinen, 2021)*

- “If you make an analysis, you are able to visualise and illustrate things and build up certain services so that one can understand big and small issues and their relations and connections”
- “As an example, the large-scale urban development case X contains multiple decision-making points. For the members of the local urban planning committee, who are mostly laypeople, this is a highly visual presentation of the subject matter on which they should make a decision during the meeting. [For them it is easier] to evaluate whether we should vote for this city plan/scenario or another. And if it is possible to enter financial information, timetables and environmental implications [into 3D city model], then that is better.
- “With visual analysis, we are able to illustrate how [different alternatives and scenarios] influence real views, wind, microclimate, services, traffic etc. We are able to depict the case in more detail and avoid emotional assessments.”

Citizen engagement – *Herrenberg, Germany (Dembsky et al., 2020)*

- “Situations/circumstances can be presented in many perspectives.”
- “Better imagination of consequences/implications.”
- “Complex planning processes can become more concrete.”
- “One can better imagine the spatial impact.”
- “Simple presentation, everyone can imagine the plans better.”

UDTs for consensus-building: Kera district (Espoo, Finland)

Co-creation of urban district (Kera) through a digital twin, as a means to bridge planners' 'grand design' and grass-root level participation.

- Kera: old brownfield area. City of Espoo wanted to develop it into a sustainable and smart city district (carbon-free, circular economy, positive energy district).
- Land is privately owned. Multiple stakeholders: landowners, construction companies, service providers, local businesses and future residents.
- Collaboration between stakeholder is key for energy savings and efficiency: planning, construction, production and management phases.
- Kera digital twin as a tool for collaboration and communication among stakeholders and decision-makers



Figure 1. The Kera area. Sources: City of Espoo (left), authors (right).

Tartia and Hämäläinen, 2024

UDTs for consensus-building: Kera district (Espoo, Finland)

- Kera digital twin as a tool for collaboration and communication among stakeholders and decision-makers
- 3D model (produced by City of Espoo) enriches with data -> evaluation and visualization of sustainable urban solutions
 - Calculating CO2 emissions and identifying carbon sinks in the district
- xD Twin™ selected: cloud-based platform to manage urban development phases in built environment
- Communication features:
 - Feedback collection
 - Resident engagement
 - Stakeholder collaboration
- 6 months experimentation: October 2022 to March 2023.

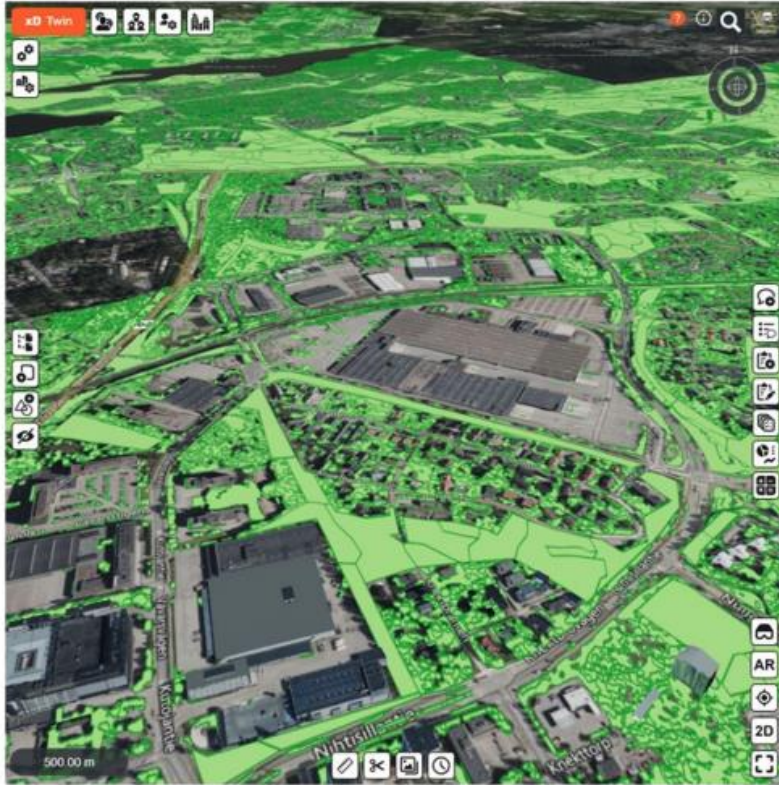


Figure 2. Kera digital twin in the xD Twin platform. Source: authors.
Tartia and Hämäläinen, 2024

UDTs for community engagement: Kera district (Espoo)

Steps of a co-creation process	UDT application
1) Identification of development need and stakeholders	Visualization of local upcoming development projects Platform for suggesting new actions Connecting the different stakeholders through the platform
2) Mapping of the current situation and needs assessment	Platform for preliminary data collection and current state key indicators Platform for showcasing development needs from different stakeholders
3) Objective setting	Showcasing different scenarios for development Setting and coordinating selected objectives
4) Solutions identification	Identification of potentials and barriers of different solutions in different scenarios
5) Project planning	Showcasing the lifecycle and development of the district, visualisations Presenting and syncing plot level data and details for the district-level presentation Citizen engagement tools
6) Implementation and deployment	Dynamic visualization of the district's lifecycle, updated to reflect changes in plans and processes Collecting real-time data (e.g. travel behaviour) Citizen engagement tools and interaction Dissemination and communication

UDTs for community engagement

1. Individual work:

- Can the UDT be a tool for community/stakeholder engagement in my use case? In what stage of my use case?
- What stakeholders should be considered?
- What role for the UDT?

2. Quick round and open discussion

Re-visiting our framework

- Have a look at the framework we started to build at the beginning of the session.
 - Is there anything that needs to be added/changed?

References

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