From Knowledge to Action

A transdisciplinary approach to bridge research and practice

CITY OF DORDRECHT MECANOO RESILIENT DELTA INITIATIVE

Transdisciplinarity in practice

Transition to Transdisciplinary Science 2024

Key items

The Gluon researcher – integration specialist
Framework for transforming knowledge into action
What does a transdisciplinary way of working look like?
The added value of knowledge integration

Resilient Delta

Innovation | Solutions | Partnerships

Tackling today's global societal challenges requires resilience, especially in the delta regions, which are home to more than two-thirds of the world's largest cities and are at risk from rising sea levels owing to their geographical location. Within Resilient Delta we work in an interdisciplinary way in the academic field, collaborating with societal partners to design resilience solutions in the real-world dynamics of our living lab, the Rotterdam delta.

TU Delft

Erasmus MC

Erasmus University Rotterdam

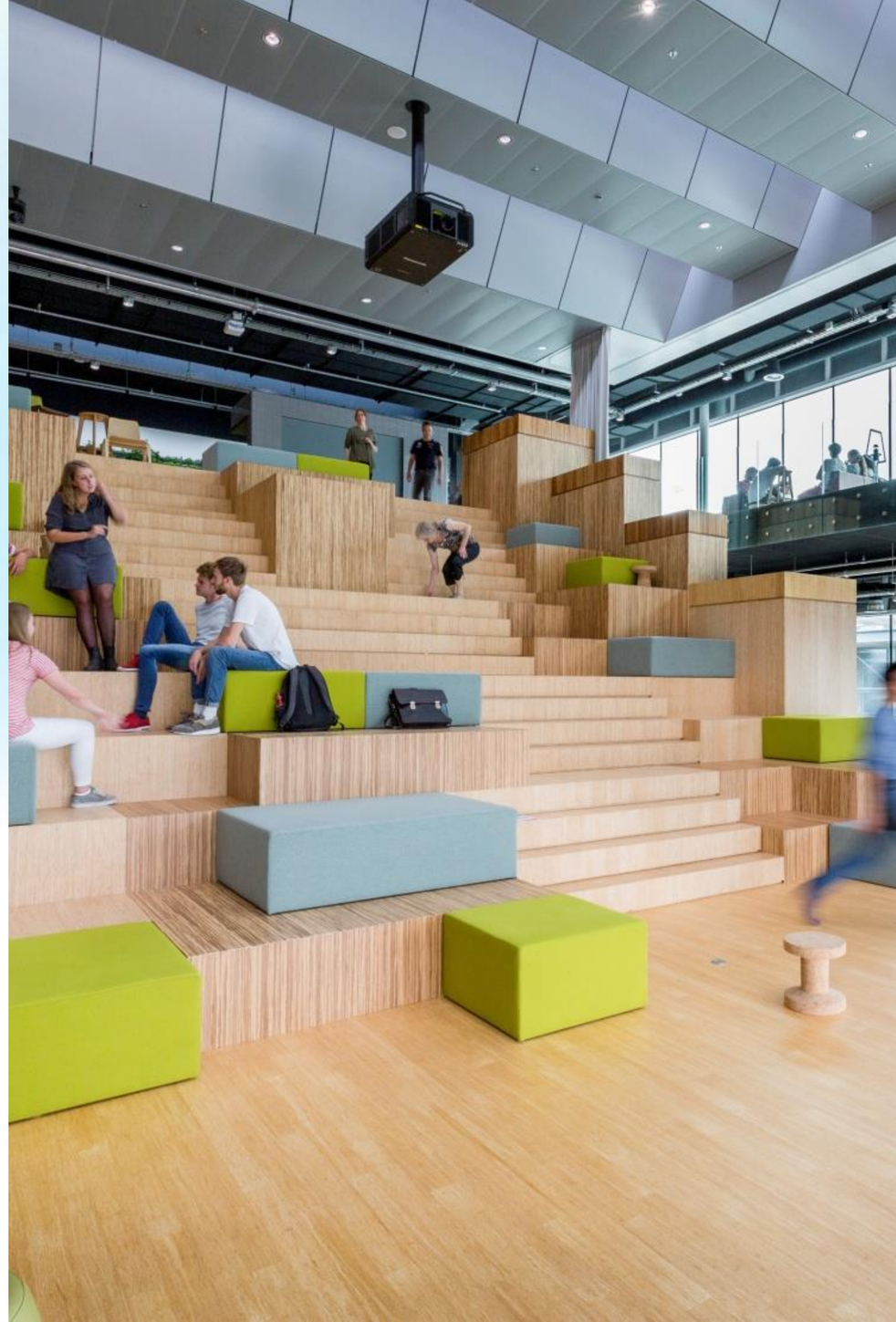
Established academic knowledge production creates **deep but ‘siloed’ expertise**. As a side-effect, this produces **solution and/or problem-bias** for complex societal challenges

The Gluon Approach

Key principles of the experiment

- **Leadership** (integration specialist), effective division of tasks in groups
- **Diversification** of academic products
- **Collective validation** (in the collaborative procedure), transformative learning
- **'Conscious integration'**, tailor-made approach
- **Accelerated** collaborative learning

Departs from design- and engineering thinking at TU Delft, complemented with expertise from the ITD-field (mostly social sciences)

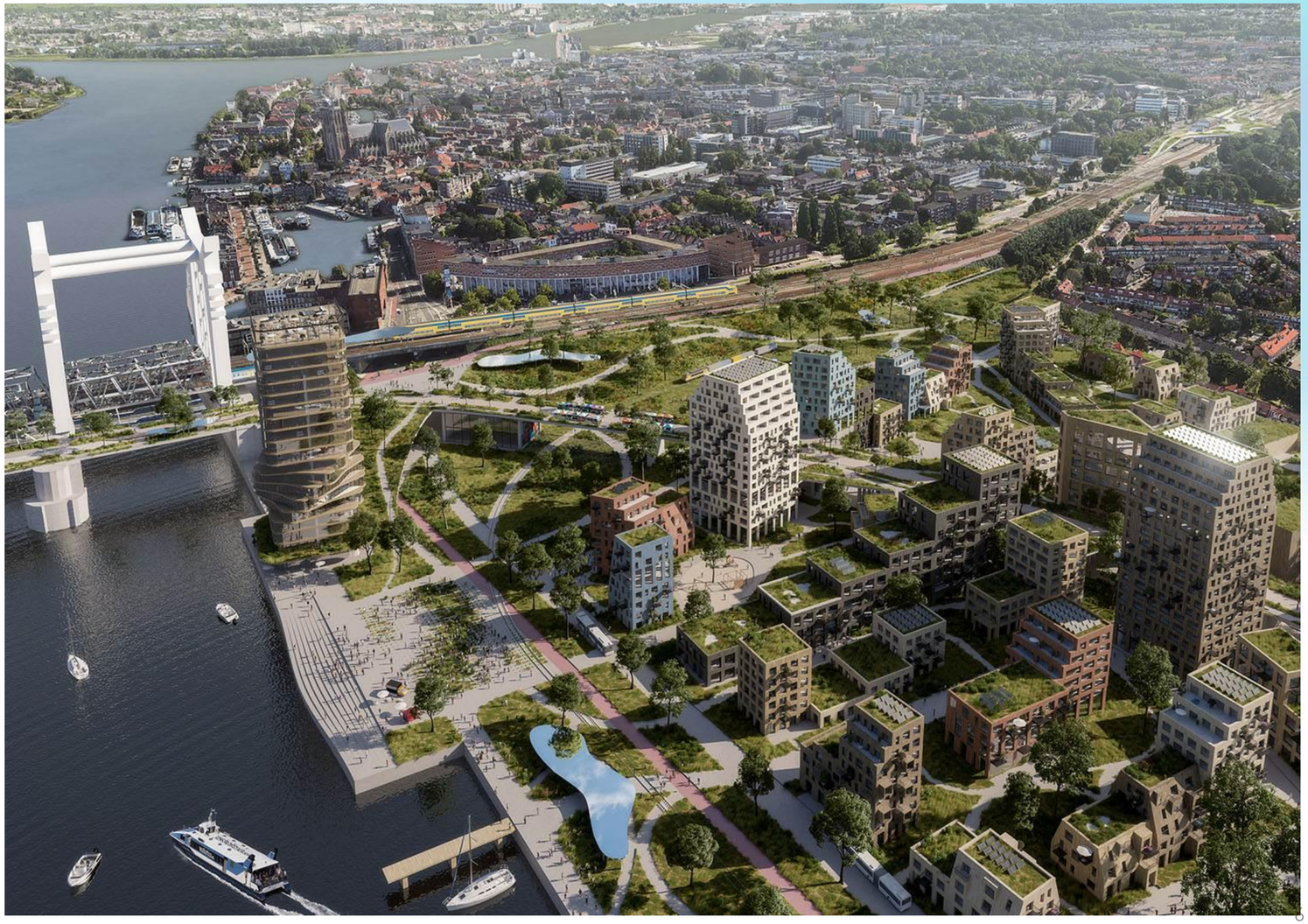


Managing the integration deficit

Maasterras, Dordrecht

Maasterras as a future-proof shelter area

How to address the complexity of the Maasterras to help inform its future development as self-sufficient shelter area?



Action-oriented knowledge integration

Resilient Delta Initiative

Transdisciplinary Knowledge Integration Framework

Outcomes

Action-oriented insights for spatial development

Outputs/Contributions

1. New insights for Maasterras masterplan

2. Program Requirements (Programma van Eisen)

3. Methodology for action-oriented knowledge integration

Knowledge Integration

Process and impact

Knowledge Integration Methodology

Ambitions:

- Foster a **productive dialogue** between a wide range of disciplinary expertise
- Translate **expertise into action**-oriented knowledge
- Stimulate an **iterative production of knowledge** between city, experts and designers
- Generate **innovative and integrated requirements** for the development of the Maasterras
- Bridge new interdisciplinary perspectives to **concrete spatial design and actions**

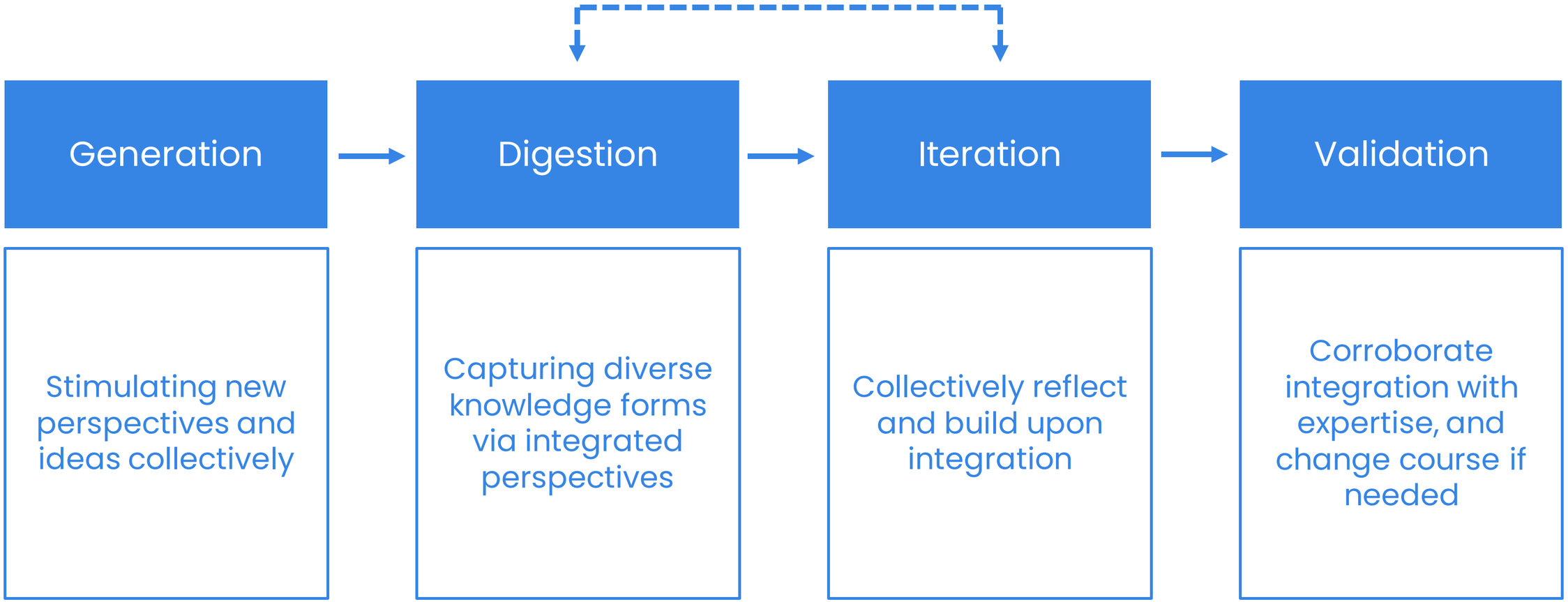
Knowledge Integration Methodology

Addressing complexity by bringing together a diverse range of disciplinary expertise

Alex Stefanov (Intelligent Electric Power Grids - TUD), Audrey Esteban (Urban Development Management & Social Cohesion - TUD), Arjan van Timmeren (Environmental Technology and Design - TUD), Bas Kolen (Safety & Security Science - HKV), Chuma Mbambo (Environmental behaviour and Design - TUD), Doris van Halem (Drinking Water Quality and Purification - TUD), Fransje Hooijmeijer (Delta Urbanism - TUD), Giuliano Mingardo (Urban Transport - EUR), Irene Luque Martin (Urban Design - TUD), Jelle Burger (Urban Innovation - TUD), Joep Storms (Sedimentary Geology - TUD), Johnathan Subendran (Urban Design - TUD), Jules van Lier (Wastewater Treatment/Environmental Engineering - TUD), Maaike Snelder (Transport & Planning - TUD), Mar Palmero Parada (Water Management & Sanitary Engineering - TUD), Merten Nefs (Spatial Analysis and Planning - EUR), Nikki Brand (Resilient Delta Methodology - TUD), Pavol Bauer (DC Systems, Energy Conversion and Storage - TUD), Peter Pelensky (Intelligent Electric Power Grids - TUD), Qian Ke (Urban Sustainability and Climate Change Resilience - IHS), Serge Hoogendoorn (Multi modal traffic management & active transportation - TUD), Taneha Kuzniecow Bacchin (Delta Urbanism & Urban Design - TUD), Ted Veldkamp (Climate and Water - HGR), Tina Comes (Designing Resilience - TUD), Yirang Lim (Governance and Resilient Infrastructure - TUD), Zac Taylor (Urban Climate Finance & Governance – TUD

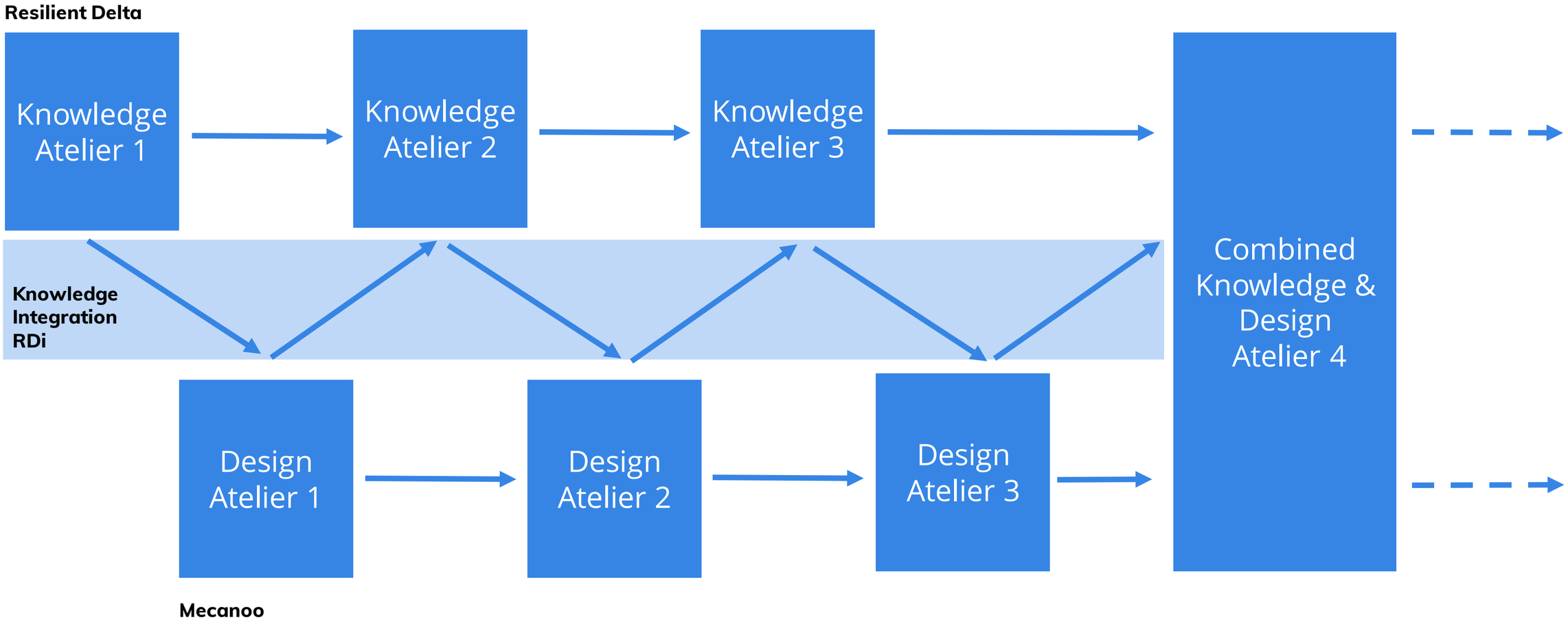
Knowledge Integration Methodology

How to transform expertise into action-oriented knowledge that can inform spatial development?



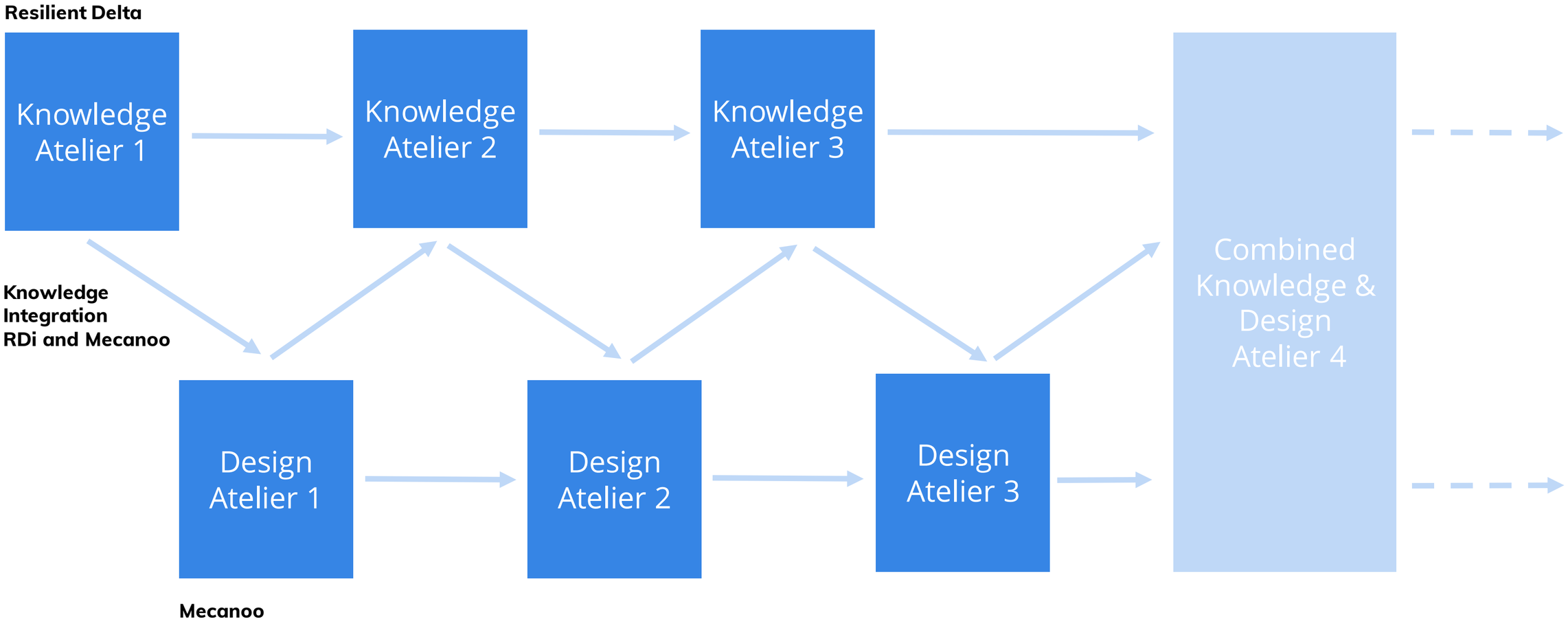
Knowledge Integration Methodology

Generation | Digestion | Iteration | Validation



Knowledge Integration Methodology

Generation | **Digestion** | **Iteration** | **Validation**

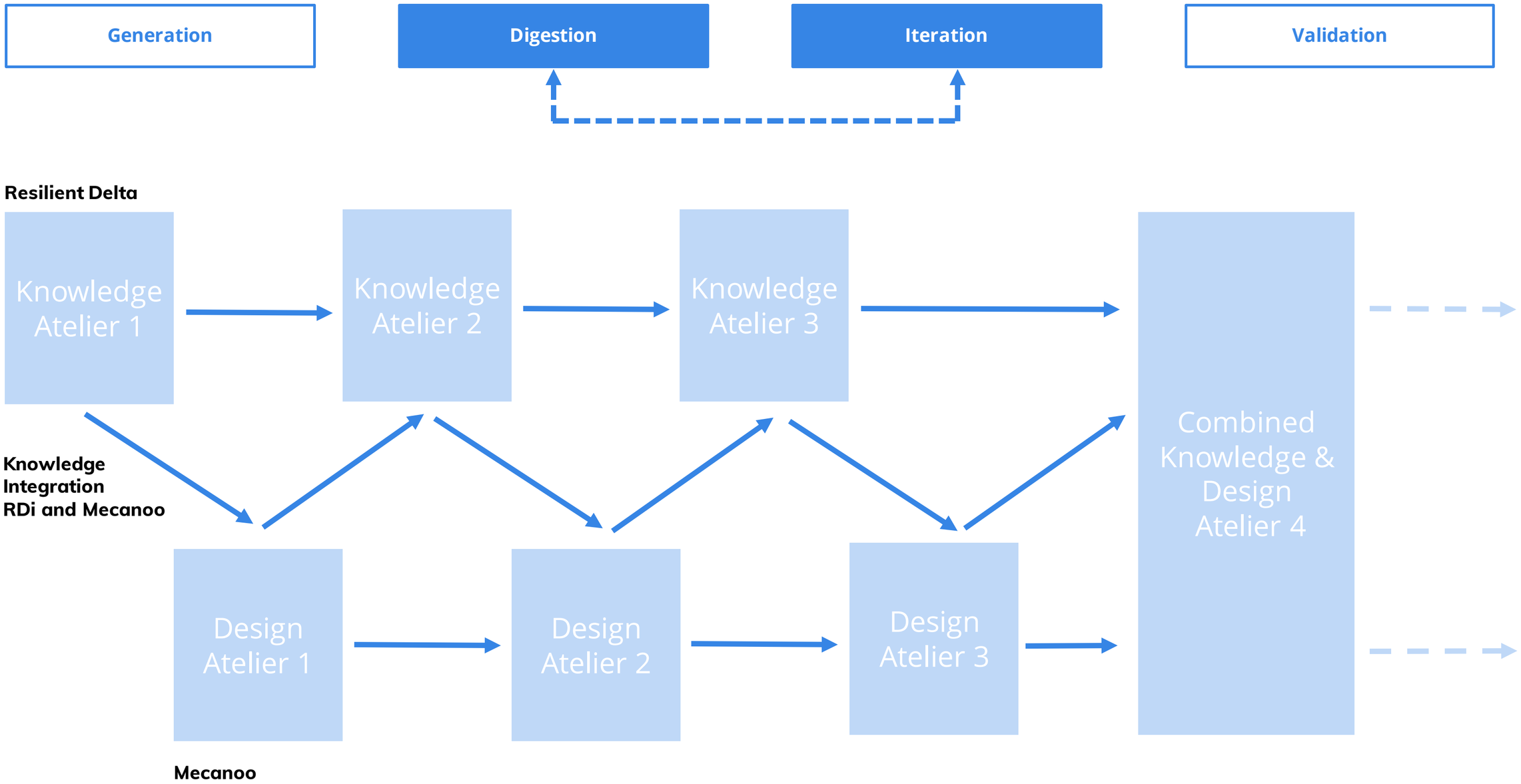


Knowledge Integration Methodology

Generation | Digestion | Iteration | Validation

- Collection of over fifteen disciplinary perspectives
- Interactive dialogue between experts and participants through sandpits
- **Key outcomes: Innovative ideas on spatial development, governance and resilience, natural systems and finance**

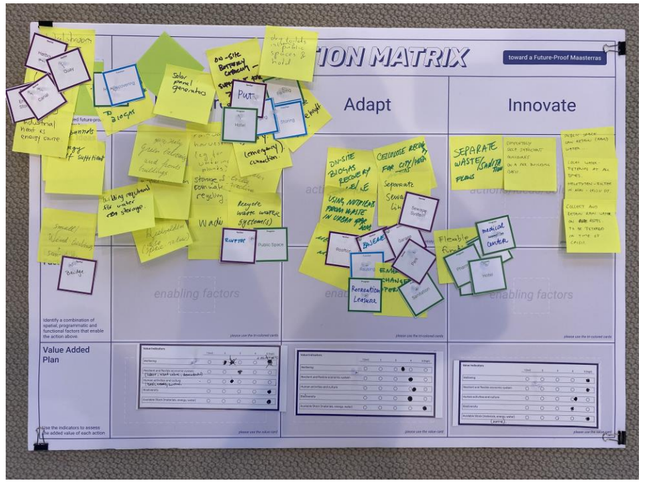
Knowledge Integration Methodology



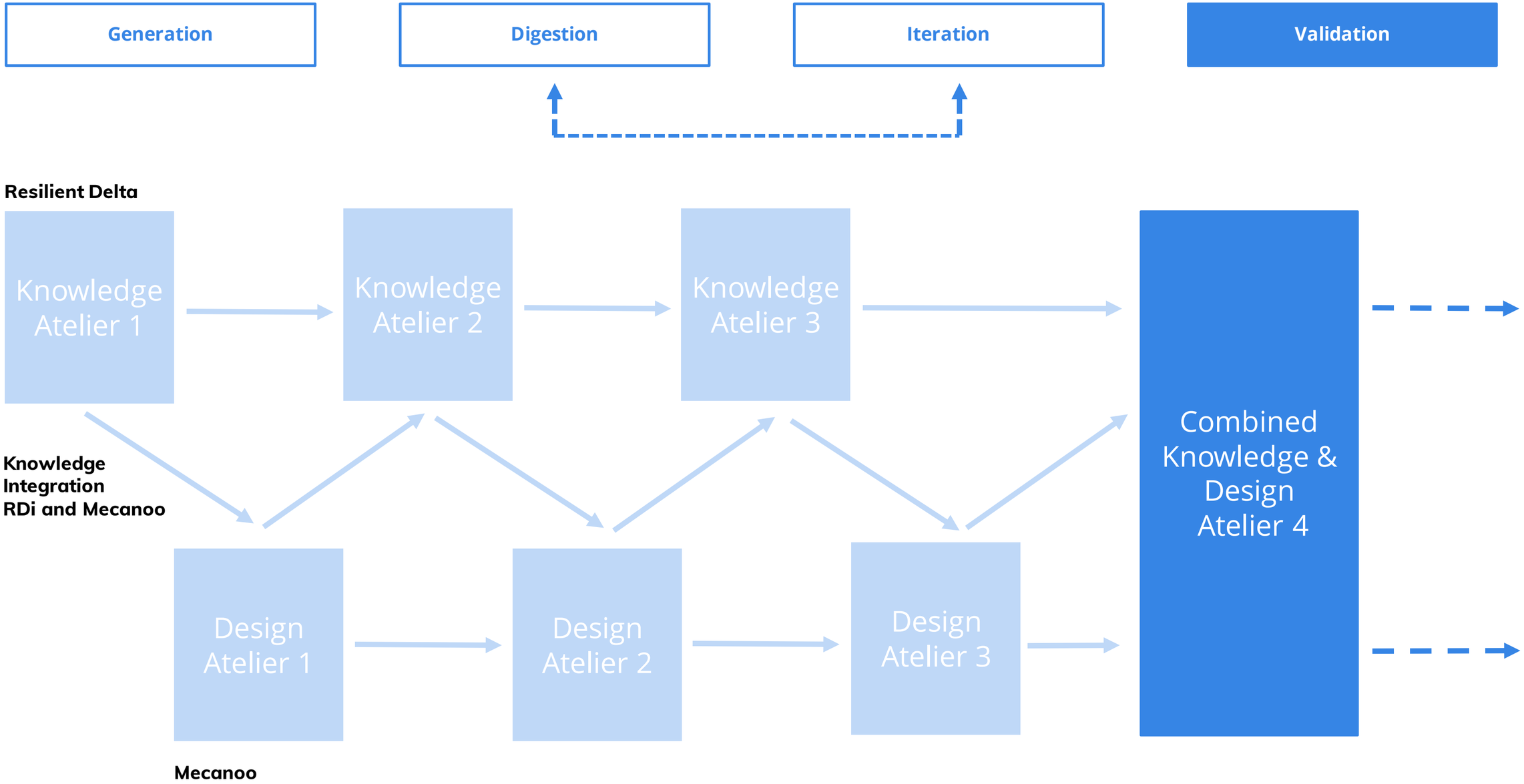
Knowledge Integration Methodology

Generation → Digestion → Iteration → Validation

- Combining various knowledge forms into integrated and holistic perspectives
- Capture insights for next round of workshops
- **Key outcomes: Identification of strategic principles for spatial development**



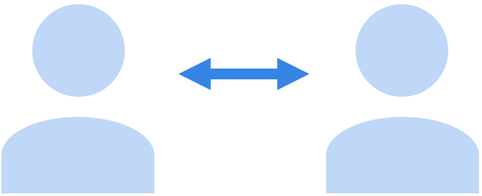
Knowledge Integration Methodology



Knowledge Integration Methodology

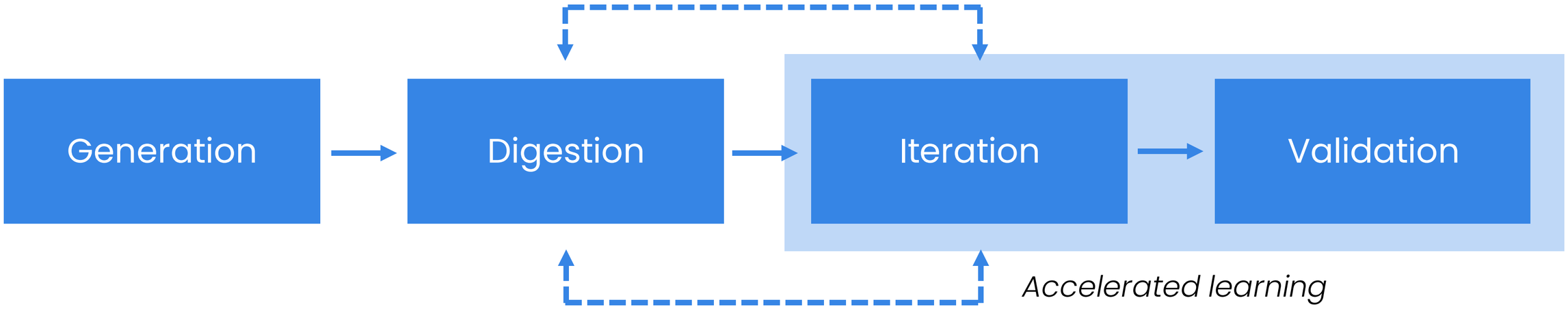
Generation | Digestion | Iteration | **Validation**

- Validation of spatial concepts and ideas with designers
- Spatial exploration of integrated perspectives
- Validation of program and spatial requirements with technical experts
- **Key outcomes: Validated concepts and perspectives for the program of requirements and design**



Expert Interviews

Knowledge Integration Methodology



Impact

Added value and outcomes

Knowledge Integration Methodology

Resilient Delta Initiative

Interdisciplinary Knowledge Integration Framework

Outcomes

Action-oriented insights for spatial development

Outputs/Contributions

1. New insights for Maasterras masterplan
2. Program Requirements (Programma van Eisen)
3. Methodology for action-oriented knowledge integration

Impact

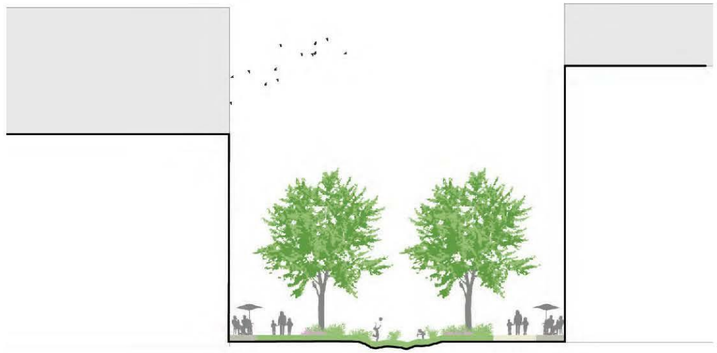
New insights for the Maasterras masterplan design

- What spatial interventions are required
- Integrating shelter function in overall urban design
- Combining day-to-day with shelter functions
- ‘Building in’ measures that adapt to uncertainty

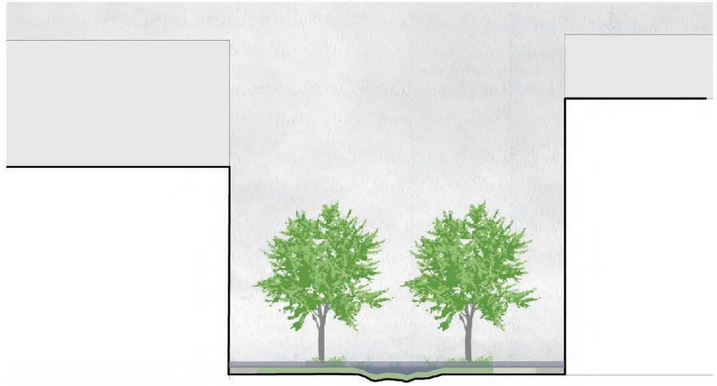
Dordtse greppels - Snel droge voeten

Netwerk van greppels

- Greppels zorgen voor een snelle afwatering gedurende zeer uitzonderlijke situatie dat het Maasterras (tijdelijk) onder water zou komen te staan
- Tijdens extreme (piek)buien wordt water middels dit netwerk afgevoerd richting het oppervlakte water (conform beleid)
- Greppels vormen een zichtbaar element waarmee bewustwording wordt gecreerd. Dit kan met ruimtelijke elementen, zoals stepping stones, bruggen of beplanting
- Netwerk vormt daarnaast een groot speelnetwerk



Normale situatie - greppels onderdeel van groenstructuur en speelplek



Greppels voeren water snel af richting rivier

Impact

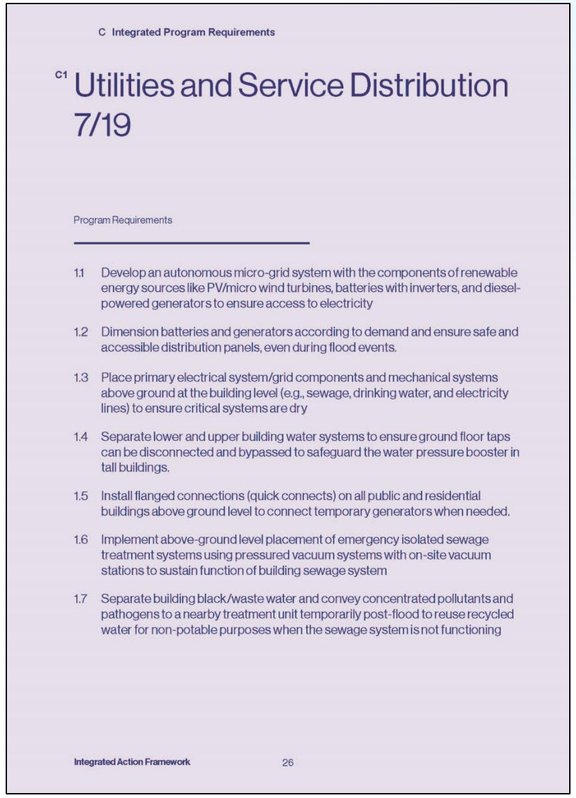
Integrated and Innovative Program Requirements (Programma van Eisen) for a safe, self-sufficient, and climate-adaptive Maasterras – bridging research and practice/policy, transforming knowledge into concrete actions

6

Integrated strategies

19

Program Requirements



C Integrated Program Requirements

C1 Utilities and Service Distribution
7/19

Program Requirements

1.1 Develop an autonomous micro-grid system with the components of renewable energy sources like PV/micro wind turbines, batteries with inverters, and diesel-powered generators to ensure access to electricity

1.2 Dimension batteries and generators according to demand and ensure safe and accessible distribution panels, even during flood events.

1.3 Place primary electrical system/grid components and mechanical systems above ground at the building level (e.g., sewage, drinking water, and electricity lines) to ensure critical systems are dry

1.4 Separate lower and upper building water systems to ensure ground floor taps can be disconnected and bypassed to safeguard the water pressure booster in tall buildings.

1.5 Install flanged connections (quick connects) on all public and residential buildings above ground level to connect temporary generators when needed.

1.6 Implement above-ground level placement of emergency isolated sewage treatment systems using pressured vacuum systems with on-site vacuum stations to sustain function of building sewage system

1.7 Separate building black/waste water and convey concentrated pollutants and pathogens to a nearby treatment unit temporarily post-flood to reuse recycled water for non-potable purposes when the sewage system is not functioning

Integrated Action Framework 26

C Integrated Program Requirements

C2 Built environment, Urban Design, Public Space, and Landscape
5/19

Program Requirements

2.1 Integrate nature-based water management techniques in urban, public spaces, and landscape design to enhance water retention and infiltration.

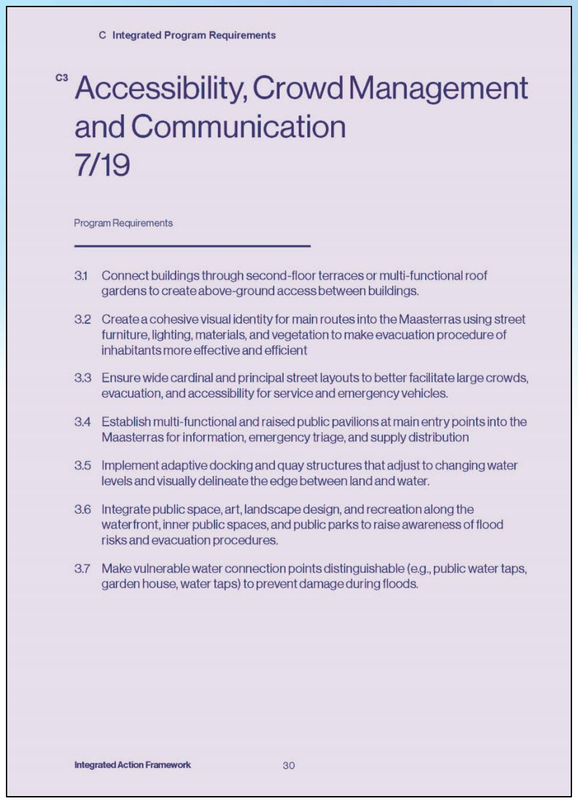
2.2 Reduce obstructions in movement by minimising major elevation changes in the public realm to allow for broader space usability (e.g., setting up tents).

2.3 Using streets and the road network as dikes from adjacent low-lying block levels to ensure capacity for evacuation and managing evacuees during floods.

2.4 Design multi-level and multi-functional inner public spaces, including storage, logistic access points, and above-ground level access to buildings to facilitate access to outdoor spaces and emergency supplies during crises

2.5 Include a helicopter landing pad on at least one building roof within each block to ensure emergency access to supplies and service

Integrated Action Framework 28



C Integrated Program Requirements

C3 Accessibility, Crowd Management and Communication
7/19

Program Requirements

3.1 Connect buildings through second-floor terraces or multi-functional roof gardens to create above-ground access between buildings.

3.2 Create a cohesive visual identity for main routes into the Maasterras using street furniture, lighting, materials, and vegetation to make evacuation procedure of inhabitants more effective and efficient

3.3 Ensure wide cardinal and principal street layouts to better facilitate large crowds, evacuation, and accessibility for service and emergency vehicles.

3.4 Establish multi-functional and raised public pavilions at main entry points into the Maasterras for information, emergency triage, and supply distribution

3.5 Implement adaptive docking and quay structures that adjust to changing water levels and visually delineate the edge between land and water.

3.6 Integrate public space, art, landscape design, and recreation along the waterfront, inner public spaces, and public parks to raise awareness of flood risks and evacuation procedures.

3.7 Make vulnerable water connection points distinguishable (e.g., public water taps, garden house, water taps) to prevent damage during floods.

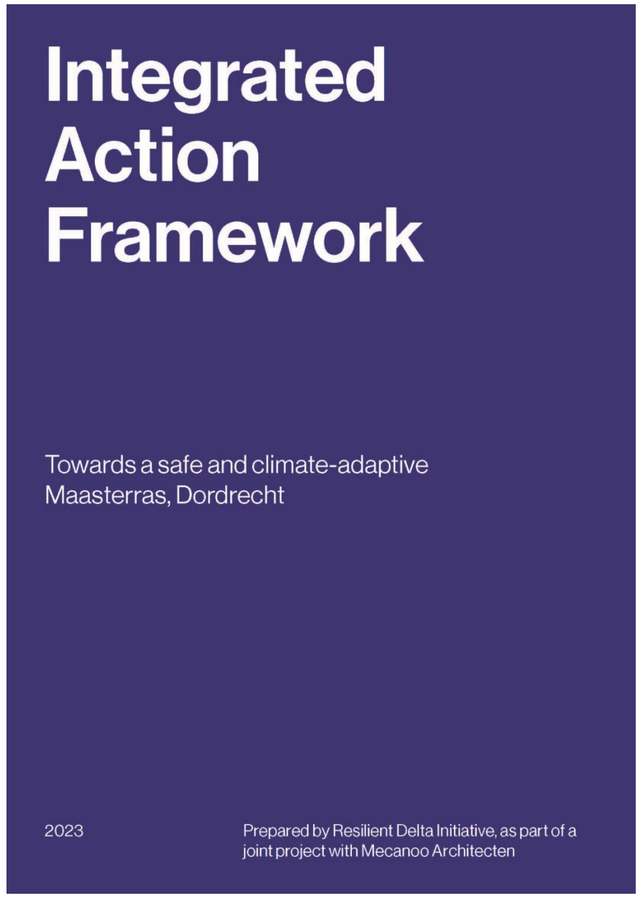
Integrated Action Framework 30

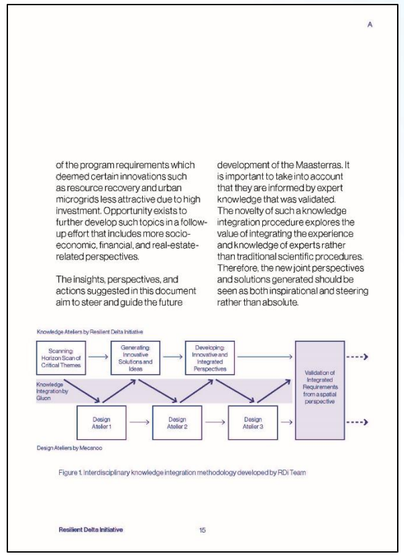
Impact

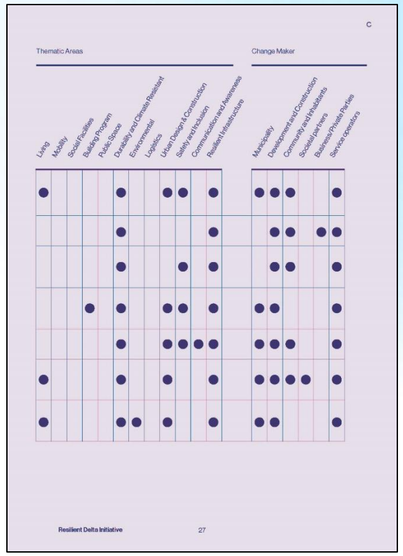
Fostering buy-in and incentivizing innovation – workshops and integration process helped to make the ‘Maasterras as a shelter’, an attractive development ambition

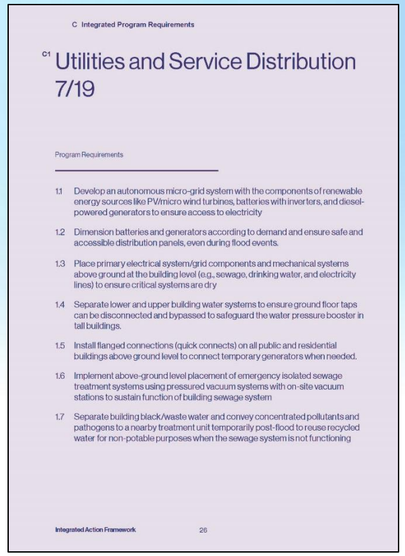
Impact

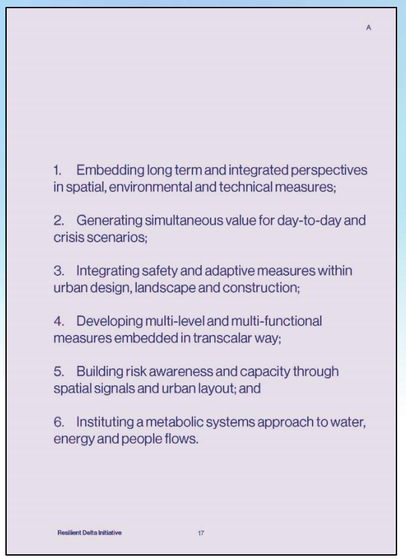
Integrated Action Framework – methodology for knowledge integration, to connect research and practice, and operationalizing interdisciplinarity in a real cases.











Key takeaways

Complex area development demands an **integration of different/diverse forms of knowledge** to adequately address the multi-dimensional challenges and uncertainty posed by climate change.

Continuous experimentation of integrating different expertise and sectors in an transdisciplinary way could enable **accelerated and transformative learning**.

The results and insights from using such an approach can help **build buy-in and incentivize stakeholders** to consider developing in unembanked and other overlooked areas.

The success of such an approach relies on **recognizing** the **importance of holistic, system-based, and integrated thinking.**

Combining a diverse range of knowledge **requires several rounds of digestion and iteration**. Medium to long-term commitment is important.

It begins with transdisciplinarity but doesn't end there – **feeding back into silos or status quo** helps enable change that is grounded in reality

From Knowledge to Action

An transdisciplinary approach to bridge research and practice

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