Graduation Plan: Urbanism

**Personal information**

<table>
<thead>
<tr>
<th>Name</th>
<th>Yi-Chuan Huang</th>
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<tbody>
<tr>
<td>Student number</td>
<td>4622650</td>
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**Studio**

<table>
<thead>
<tr>
<th>Name / Theme</th>
<th>Delta Interventions</th>
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<tr>
<td>Teachers / tutors</td>
<td>Dr. F. L. Hoimeijer, Dr. ir. T. Kuzniecow Bacchin</td>
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**Argumentation of choice of the studio**

The Delta studio emphasizes a multi-scalar understanding of the dynamic interactions between spatial changes and social development in urbanized delta. The North Sea and coastal urbanization is particularly challenged by climate change and exploitation. To address the complex nature-human coexistence, the Delta Intervention studio provides much insight in systematic and process-oriented interventions.

**Graduation project**

**Title of graduation project**

**Naturally, a Port City often Shrinks - Nature-based adaptation for Wadden Sea coast**

**Goal**

<table>
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<tr>
<th>Location:</th>
<th>Dutch Wadden Sea (macro); Balgzand bay (meso); Den Helder (micro)</th>
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<tbody>
<tr>
<td>The posed problem,</td>
<td>[Problem Field]</td>
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Throughout history, the North Sea has played an important role in European urbanization. Coastal cities thrive on the basis of port economy; but also shrink significantly once the dominated industry depressed. Rapid advance in marine and logistic technology challenges the capability of aged ports. Today, under the threat from climate change, rigid port-dominated development becomes rather vulnerable to external disturbances.

In the Netherlands, the Wadden Sea region is particularly sensitive to environmental change and economic shift, regarding to complex coexistence of protected tidal ecosystem, marine industry and rising flood risk. In Den Helder, the port-city encountering greatest shrinking rate, comprehensive renovation to reinforce economic and environmental adaptability is the primary task towards long-term vitality.

[Problem Statement]

Challenges from economic shift and environmental change are multi-scalar and interdisciplinary. However, on two sides of the dike, two development – urban economy and ecological conservation – are usually segregated. Such defensive relation in Den Helder not only blocks valuable ecosystem services in...
Wadden Sea from urban renewal but also lowers its adaptability to future uncertainty.

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>[Research Question]</th>
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<tr>
<td>&quot;How to adapt shrinking port cities to economic and environmental uncertainties with nature-based solutions?&quot;</td>
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<th>Sub Research Questions</th>
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<tr>
<td>How to facilitate reciprocal collaboration between ecosystem and economy through urban design?</td>
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<tr>
<td>How to employ integrated coastal zone management in coastal urban design?</td>
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<tr>
<td>How to employ Nature-Based Solutions to strengthen adaptability of shrinking Den Helder to flood risks?</td>
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<th>Design Assignment in which these result.</th>
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<tr>
<td>Multi-scalar design: The outcome includes regional planning and urban design across micro-meso-macro scales. The design of urban-coastal transect focuses on the continuous transition from tidal zone, salt marsh, rural to urban in terms of ecology, water system and social programs.</td>
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<td>Integrated coastal zone management: Using DPSIR framework to address flood-risk as trigger for adaptive urban renewal design.</td>
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<td>Landscape infrastructure design: Multi-functional and natural-based landscape intervention to transform coastal-urban transect.</td>
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<tr>
<td>Design fiction: A projection of future scenario bases on environmental analysis, socio-demography trend and local perception.</td>
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<tr>
<td>Evaluation: Ecosystem Services assessment of multi-scalar scenarios.</td>
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[Hypothesis] The coexistence of economic development and environmental conservation should be reinforced, in order to strengthen urban adaptability to future uncertainty.

[Objective] This project is an experiment to integrate urban design and coastal zone management. Based on the premise that risk can be adapted, this project set flood threat as a trigger to raise awareness and to redevelop sea-land transition. In different future scenarios, ecosystem services are maximized to facilitate urban transformation from the domination of marine industry to nature-based vitalization.
Climate change exacerbates the uncertainty of future development. Adaptability relies much on site-based harmonious interactions between nature and urban development. In landscape composition, network layer has been set as the interface to connect nature and social development. As a result, this project highlights the operation of landscape infrastructure to reinforce adaptability in a systematic way.

**Process**

**Method description**

The general theoretical background is based on Landscape Urbanism that regards cities as urbanizing landscape where transcalar, process-oriented and imageability should be emphasized in design process. To reinforce transferability to coastal development, the theory is comprised into Driver-Pressure-State-Impact-Response (DPSIR) framework, which is often applied in Integrated Coastal Zone Management (ICZM) to adapt both environmental and socio-economic changes.

**DPSIR Problem Framing**

DPSIR is a decision-support framework describes interactions between society and the environment proposed by European Environment Agency (EEA, 2007). It is composed as a cycle by driving forces (D), pressures (P), states (S), impacts (I) and responses (R).

The framework understands risks as pressure driving changes on current state to evaluate possible environmental and societal responses to these changes. It is applied in the project to analyze human-environment interactions under risk from climate change and shrinking economy. The responses contain two parts: design leveraging on potentials to adapt risks and constraints in micro scale; and spatial strategy in meso scale to mitigate pressure.

**Transcalar analysis: 3x3x3 Layering Approach**

This systematic model provides a framework to explore interactions between three spatial layers (substratum-network-occupation), three critical periods and three scales (macro-meso-micro). It helps to frame the problem field and research questions that reflect to trans-scalar and process-based intention.

Three active marine times are chosen based on major changes in economic (shipping destination, purpose) and technical background (ship types). This results in distinctive shifts in shipping routes. By overlapping the traced network with substratum and occupation layer, strong correlation is found between natural dynamics (current, wave, sediments) and coastal development (harbors, port cities).

**Imageability: Design Fiction**

This project explores future uncertainty with design fiction and scenarios. An imaginary future scenario is projected as ultimate goal. How to proceed from reality to this vision draws the structure of research.

The story setting is distinctly designed following plausible trends according to policy, environmental and socio-economic analysis. Yet, it is portrayed with provocative image to challenge the status quo with innovative interventions. By immersing readers, stakeholders in a fictional future, the objective is to raise awareness that provokes participation, as well as to incorporate local visions in future development. As a result, narrative collected from on-site interview also plays an important role in the setting.
- **Semi-structured interview**
  
  The interview emphasizes that residents, as key stakeholders, are able to tell the “story” of plausible future, referring to their perception on environmental and economic impacts (Kok et al., 2011). As such, scenarios and ‘What if...’ question can encourage locals to re-image the future and guide the interview process. This approach values more in first-hand qualitative narrative than quantitative investigation. As a result, stories told by 10 random locals on-site are collected and encompassed into the setting of visionary future.

- **Scenario making**
  
  To organize inputs from both official plans and local visions, the *IPCC Emission Scenario* can provide a basic framework. Originally, UN constructed the framework to explore future trends of greenhouse gas emission and urban development (land use) referring to technology and socio-economic development. Four future scenarios are described along two axes: globalization vs regionalization and economic orientated vs. environmental sustainability. In this research, the same structure is adopted with more emphasizes on urban development.

  Among four scenarios, the preferred one is set as the background for the fiction. It challenges the reference scenario which projects where current policies coupled with market trends are likely to lead. Together with the indicators according to policies and interviews, a visionary image of 2116 and a referenced one for 2053 are portrayed. What the comparison revealed creates the field for design intervention.
The design fiction is based on two scenarios and simulation of future extreme flood risk.
Literature and general practical preference.
The theoretical background: Landscape Urbanism

The idea that city as an urbanizing landscape features open spaces as a medium linking cities with nature system, offering a synthetic, coherent and stable surface for urban environment (Waldheim, 2006). Multiple impacts of landscape characters on urbanization are highlighted, which can be summarized as multi-scales (openness and transection), functions (ecologies and economies), formal and spatial attributes (both natural and cultural organizations, systems, and formations), and processes (temporal qualities) (Cezerniaik, 2006). In James Corner's publication - Terra Fluxus – the theory is conceptualized in four operational principles - processes over time, staging of surfaces, operational method and the imaginary.


Processes over time and staging of surfaces

Urbanizing landscape highlights the process-oriented approach representing the temporal, systematic characters of landscape ecology. City composition is interpreted as process of interactions between different sub-systems at multi-scales and different speeds (Holling, 2001). These dynamic systems can be organized into three layers (Meyer and Nijhuis, 2016): substratum layer of ecology and environment, network layer of infrastructure, occupation layer of settlements and industry. Accordingly, the 3x3x3 analysis further provides insights into inter-correlations between spatial layers, time and scales.


Operational method

The ground of landscape is prominent as a "field of action". The design of infrastructure matrix of urban surfaces is featured with uncertainty and is described as "irrigation of territories with potential (Koohaas, 1995)". The theory further contributes to Landscape Infrastructure concept (and similar concepts such as green infrastructure, ecological-based infrastructure) which focuses on operating landscape as infrastructure that conserves and delivers ecosystem services into urban environment. In Den Helder and Marsdiep region, three infrastructural systems – flood defense, transport and water are identified critical.

Imageability

In The Image of City, Kevin Lynch reinforced the linkage of 'imageability' and 'quality' of spatial elements that evokes perception. The quality of public space is credited to activate individual imagination and further collected as urban identity. According to James Corner, the 'imageability' is the key factor for rooting values from environment to social content, such as cultural image, but also to raise environmental awareness.

To facilitate the imagination of a social-environmental collaborating future, this project is elaborated through a Design Fiction approach. The buildup of fictional future involves semi-structured interview to collect local perception on environment and urban development, which is organized into scenarios in the reference of IPCC Emission Scenarios. This strengthens the linkage between design output, social content and cultural ecosystem services.

- IPCC, 2000 - Nebojsa Nakicenovic and Rob Swart (Eds.) Cambridge University Press, UK.

[Hypothesis: Environmental Kuznets Curve (EKC)]

The curve is a hypothesized relationship between environmental quality and economic development. Although economic development initially leads to environmental deterioration, but after a certain point of economic growth, the environmental degradation tends to be reduced. Environmental quality can benefit from economic growth that renewable energy, green technology and de-industrialization are often regarded promising.

Based on EKC hypothesis, this project explores possible interventions that can facilitate the turning point.

- D. Stern (2004). The Rise and Fall of the Environmental Kuznets Curve. Rensselaer Polytechnic Institute, USA.

[Evaluation: Ecosystem services assessment]
Ecosystem Services (ES) imply “the functions and products of ecosystems that benefit humans, or yield welfare to society”. A monetary assessment on demands for and supply of natural services is promoted to raise environmental awareness. The concept becomes a critical role in reconnecting socio-economy to biosphere in terms of environmental quality and human well-being.

According to the classification by Millennium Ecosystem Assessment (MA 2005), ES are most often being categorized into four aspects: regulating services, provisioning services, supporting services and cultural services. Depending on different site and goal, monetary values are assigned to these services, and together determine the benefits to human well-being.


![Fig. Valuation of ecosystem services.](image)

**Reflection**

**Relevance**

- Integrated social and scientific relevance

The Delta Intervention is an interdisciplinary studio explores comprehensive transformation of the delta. This project dedicates in integrating cross-disciplinary knowledge of urbanism, environmental engineering and risk management through design process. Design is explored as a tool to express scientific analysis, technical intervention and local perception into a roadmap toward possible future. Such open-ended design by research approach provides better adaptability to future uncertainty based on inputs from social and scientific domains.
Integrated natural and social development

Adaptive transformation through Nature-based intervention is set as the hypothesis of this project. This is referred to current European Union ‘Horizon 2020’ research and innovation policy agenda (EC 2015), in which the concept ‘Nature-Based Solutions’ (NBS) is propagated and defined as approaches ‘inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience’.

Conservation of natural capital becomes a mean to address environmental and societal challenges simultaneously. In one of the identified goals: *climate change mitigation and adaptation in urban areas*, four principles are considered crucial. This project refers the design outcome to these indicators in order to enhance the relevance with current policy. In below framework, each indicator is interpreted by ecosystem services assessment that is applied in evaluating design outcome from different scenarios.

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<tr>
<th>Indicators</th>
<th>Description</th>
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<tr>
<td>Integrated environmental performance</td>
<td>The performance is usually evaluated by regulating ecosystem services, such as regulation and mitigation benefits in climate change, flood control.</td>
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<tr>
<td>Human health and well-being</td>
<td>The benefits for human well-being are often calculated by four aspects of ecosystem services using the framework proposed by Millennium Ecosystem Assessment</td>
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<td>Citizen involvement</td>
<td>In ES framework, the ultimate benefit in human well-being is the freedom of choice and action, which indicates the inclusiveness of citizens in application process</td>
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<tr>
<td>Transferability</td>
<td>Monetary value can be assigned to ecosystem services, allowing cost-benefit assessment in social domain.</td>
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**Time planning**