Preliminary study for an Environmental Impact Assessment of Floating Cities

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Bachelor thesis
URBAN DEVELOPMENT AND CLIMATE CHANGE

- sea level rise
- subsidence (3-4 mm/yr.)
- changed behaviour of the Rhine: greater extremes in discharge volumes (620 m³/sec - 18,000 m³/s)
- floods
- salinization of surface water
CLIMATE PROOF BUILDINGS

Floating Pavilion, Rotterdam (Deltasync and PublicDomain Architects)

Source: Rotterdam Marketing

FLOATING DEVELOPMENT
FLOATING DEVELOPMENT: ENVIRONMENTAL IMPACT?

...what about the impact on the ecosystems?

Source: Flickr

ENVIRONMENTAL IMPACT OF FLOATING DEVELOPMENT: STATE OF THE ART

Currently, little knowledge is available.

• floating developments are still an innovative solution
• research on the impacts of floating structures on the environment is at its beginning

Source: Deltasync

Floating houses in Lelystad
ENVIRONMENTAL IMPACT OF FLOATING DEVELOPMENT: RESEARCH OBJECTIVES

In this research, a preliminary analysis of potential environmental impact of floating developments is carried out. With the following objectives:

• gain insight on the potential impacts of these new types of developments
• provide a framework to assist the design, minimizing negative impacts and challenging to achieve positive ones
• give a first advice for choosing suitable locations
• for a delta city that is planning new developments, to evaluate the possible impacts of developments on water in comparison with developments on land.

ENVIRONMENTAL IMPACT OF FLOATING DEVELOPMENT: COMPARISON WITH LAND DEVELOPMENTS

• What are the environmental impacts of urban development on land and on water?
• To which extent do they differ?
METHOD: IMPACT ANALYSIS

Common impacts
(Chemicals, noise, light and thermal pollution, invasive species, ecological traps...)

<table>
<thead>
<tr>
<th>Land-specific impacts</th>
<th>Water-specific impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF SPACE AND SURFACE</td>
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</tr>
<tr>
<td>HUMAN PROTECTION MEASURES</td>
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</tbody>
</table>

1) Impacts resulting from the use of space and surface
2) Impacts caused by protection measures

IMPACT ANALYSIS – PART 1
Impacts resulting from the use of space and surface

Source: Flickr
IMPACT ANALYSIS – PART 1
Impacts resulting from the use of space and surface

- habitat loss and fragmentation
- loss of soil functions
- changed microclimate; heat island
- additional soil sealing for lanes

IMPACT ANALYSIS – PART 2
Impacts of human safety measures against environmental hazards

### IMPACT ANALYSIS – PART 2

**Impacts of human safety measures against environmental hazards - LAND**

<table>
<thead>
<tr>
<th>Environmental hazards</th>
<th>Safety measures</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>Dams, canalisations</td>
<td>On riverine and riparian ecosystems, reducing biodiversity</td>
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<tr>
<td>Erosion</td>
<td>Hard coastal defence structures</td>
<td>Tidal habitat is lost</td>
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<tr>
<td>Fire</td>
<td>Vegetation removal</td>
<td>Change of important habitat features, fires of higher intensity</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Earthquake-resistant structures</td>
<td>Additional resources and energy needed</td>
</tr>
</tbody>
</table>

### IMPACT ANALYSIS – PART 2

**Impacts of human safety measures against environmental hazards - WATER**

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<tr>
<td>Earthquake</td>
<td></td>
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<tr>
<td>Waves</td>
<td>Wave breaker</td>
<td>Change in the coastal ecosystem</td>
</tr>
</tbody>
</table>
CONCLUSION: BUILDING ON WATER IS AN OPTION THAT SHOULD BE CONSIDERED

• When looking for solutions for future developments of delta cities, it is important to consider alternatives to traditional ones.

• This research offers a framework to evaluate two options, urban development on land and on water, from the environmental impact point of view.

• Both options have impacts. The best solution should be assessed for each specific location.

• Challenges for future developments are also to reduce the pressure on ecosystems, which provide important services supporting human life.

Join our workshop “Creating floating cities”

Thursday 25th, 13:30-15:15
Penn Room 1

To know more on this research and on floating development, visit www.deltasync.nl