FLOOD RESILIENCY IN URBAN AREA DEVELOPMENT

The effectiveness of policy instruments in building flood resiliency of urban areas
A comparative study of Rotterdam and New York City

E Gaaff

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Urban Adaptation Strategies Graduation Laboratory
Hurricane Sandy, NYC, October 2012
Overview

1. International comparison

2. Research Approach
   I. Questions
   II. Design
   III. Methodology

3. Theoretical framework
   I. Paradigms & theoretical strands
   II. Models

4. Case studies
   I. Background
   II. Results
   III. Findings

5. Conclusions
   I. Answers to research questions
   II. Recommendations
   III. Reflection
Delta cities
Delta cities

Sea Level

Precipitation

Fluvial Discharge

Groundwater/Land Subsidence
1. International comparison
NYC & Rotterdam

Similarities

a. Western democracy
b. Technologically advanced
c. Taking action
d. Leading & learning
e. Realization hampering
Focus
Focus

[Image: A dollar sign with an 'X' through it]
Focus
Governance
Research goals
Research goals

Compare Rotterdam and NYC to:

I. assess the **effectiveness** of current policy instruments in building flood resiliency of urban areas

II. identify characteristics of institutional landscape that **influence** the effectiveness of these policy instruments
2. Research Approach

I. Questions
II. Design
III. Methodology
I. Questions – Conceptual model

Institutional Landscape

Policy instruments

Flood resiliency

Urban area development
I. Questions

Comparing practices of urban area development in Rotterdam and NYC

I. What are the main characteristics of the institutional landscape in building flood resiliency?

II. Planning policy
   a. What policy instruments are currently deployed to build flood resiliency in vulnerable areas?
   b. To what extent are these policy instruments experienced by local actors?

III. Flood resiliency
   a. How is flood resiliency currently assessed in vulnerable areas?
   b. What aspects of building flood resiliency should be strengthened?

IV. What is the effectiveness of current policy instruments on building flood resiliency?

V. What is the influence of the institutional landscape on policy effectiveness?
I. Questions - Hypotheses

For both Rotterdam and NYC the following statements are tested:

1. The building of flood resiliency in urban area development is hampered.

2. Public policy instruments that are currently employed are not effective.

3. Institutional landscape influences this effectiveness.
III. Methodology

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<td>Actors issuing public policy</td>
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<td>Actors responding to public policy</td>
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</tbody>
</table>
III. Methodology – data gathering & documentation

30 interviews

Transcriptions

SUNSET PARK ACTOR INTERVIEW

1. Do you believe in climate change and, more specific, increased flood risk for NYC due to weather events and sea-level rise?
2. Do you have a clear view on the current flood risk in Sunset Park?
   • Do you think this has improved?
   • How and why?
3. Do you think there’s a good understanding of future threats for Sunset Park?
   • Do you think this has improved?
   • How and why?
4. In the development of Sunset Park, have lessons from previous flooding experiences been considered?
   • If so, what lessons?
   • What flooding experiences?
   • What kind of results?
5. When it comes to building flood resiliency of Sunset Park, do you think clear goals for the development of Sunset Park?
   • What goals?
   • By whom? Who’s responsible for realization?
   • How are these determined and recorded?
6. Are you aware of any action being taken on realizing flood resilient measures in the area?
   • What kind of actions?
   • What kind of measures?
   • By whom?
7. Is the public/local community involved in building flood resiliency of the area?
### III. Methodology - Scoring

**Processing: scoring mechanism**

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
<th>Score</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1a. Do you believe in climate change and, more specific, increased flood risk for NY?</strong></td>
<td>Yes, a</td>
<td>10</td>
<td>68</td>
</tr>
<tr>
<td><strong>Do you think this has improved?</strong></td>
<td>Yes</td>
<td>7</td>
<td>43</td>
</tr>
<tr>
<td><strong>How and why?</strong></td>
<td>Also b</td>
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<td>0</td>
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<tr>
<td><strong>1b. Do you have a clear view on the current flood risk in Sunset Park?</strong></td>
<td>Yes, b</td>
<td>9</td>
<td>60</td>
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<td><strong>Do you think this has improved?</strong></td>
<td>Yes, c</td>
<td>8</td>
<td>60</td>
</tr>
<tr>
<td><strong>How and why?</strong></td>
<td>On th</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td><strong>1c. Do you think there's a good understanding of future threats for Sunset Park?</strong></td>
<td>Yes, d</td>
<td>9</td>
<td>53</td>
</tr>
<tr>
<td><strong>What kind of experiences?</strong></td>
<td>No, e</td>
<td>4</td>
<td>47</td>
</tr>
<tr>
<td><strong>How and why?</strong></td>
<td>We've</td>
<td>6</td>
<td>38</td>
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<tr>
<td><strong>1d. In the development of Sunset Park, have lessons from previous flooding events?</strong></td>
<td>Yes, f</td>
<td>9</td>
<td>38</td>
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<tr>
<td><strong>What kind of results?</strong></td>
<td>Sandy</td>
<td>7</td>
<td>50</td>
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<tr>
<td><strong>What kind of services?</strong></td>
<td>Equip</td>
<td>-</td>
<td>7.0</td>
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<td><strong>1e. When it comes to building flood resilience, do you think clear goals have been set?</strong></td>
<td>Yes, g</td>
<td>8</td>
<td>40</td>
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<tr>
<td><strong>What kind of actions?</strong></td>
<td>More</td>
<td>6</td>
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<tr>
<td><strong>By whom?</strong></td>
<td>The tr</td>
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<td>40</td>
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<tr>
<td><strong>Who's responsible for realization?</strong></td>
<td>Busin</td>
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<td>40</td>
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<tr>
<td><strong>1f. Are you aware of any action being taken on realizing flood resilience in the area?</strong></td>
<td>Yes, h</td>
<td>8</td>
<td>36</td>
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<tr>
<td><strong>What kind of measures?</strong></td>
<td>Apart</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td><strong>By whom?</strong></td>
<td>UPRO</td>
<td>-</td>
<td>36</td>
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<tr>
<td><strong>1g. Is the public/local community involved in building flood resilience of the area?</strong></td>
<td>Yes, i</td>
<td>8</td>
<td>32</td>
</tr>
</tbody>
</table>
3. Theoretical framework

I. Paradigms & theoretical strands
II. Models
I. Paradigms and theoretical strands – Network society

(Florida, 2002; Castells, 1996)
I. Paradigms and theoretical strands – Institutions theory

I. **Formal** - Range of accepted modes of governance; formal rules, laws, regulations

II. **Informal** - Generally respected social norms agreements, convenants, contracts, rules, relations

III. **Symbolic** - Communicative systems, paradigms, moral frameworks, norms and values, networks and coalitions, language

IV. **Processes** - Actor interaction, means and outcomes, roles, strategies, interests

(Scharpf [1997], Healey [2007], Koppenjan & Groenewegen [2005])
I. Paradigms and theoretical strands – Institutions theory

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(Scharpf [1997], Healey [2007], Koppenjan & Groenewegen [2005])
II. Models – Institutional landscape

1. Norms and values
2. Interests of actors
3. Institutional arrangements
4. Institutional structure
5. Institutional rules and policies

(Inam [2007])
II. Models – Flood resiliency

Resilience as the rate of recovery and restoration

Threshold beyond which the organization loses function and control and cannot recover from impacts

Impact Resistance

Growth (r) Conservation (K) Collapse (Ω)

Recovery and reorganization (ω), leading to further growth and exploitation

Future state

Source: Linnenluecke & Griffiths, [2010] in Lu [2011]
II. Models – Flood resiliency

(Foster [2006], Lu [2011])
II. Models – Flood resiliency

(Foster [2006], Lu [2011])
How to assess preparedness of an urban area:

1. Considering the current situation
2. Examining trends and future threats
3. Learning from previous experience
4. Setting goals
5. Initiating actions
6. Involving the public

(Tasan-Kok, Stead, and Lu (2013) and Lu (2014))
II. Models – Planning policy instruments

Shaping

Regulating

Stimulating

Capacity building

Tiesdell and Allmendinger (2005)
## II. Models – Planning policy instruments

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<th>Influence on market actors</th>
<th>Typical sub-types</th>
<th>Examples</th>
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<td><strong>Shaping</strong></td>
<td>Shaping the decision environment or context</td>
<td>Development plans</td>
<td>Public infrastructure investment plans</td>
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<td></td>
<td></td>
<td>Regulatory plans</td>
<td>Statutory plans and strategies; national planning policy and development plans</td>
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<td></td>
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<td>Indicative plans</td>
<td>Non-statutory plans, strategies and advise; spatial visions, research reports</td>
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<tr>
<td><strong>Regulation</strong></td>
<td>Defining parameters of the decision environment</td>
<td>Public law</td>
<td>National regulations and legislation</td>
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<td></td>
<td></td>
<td>Private law</td>
<td>Contractual (or bi-lateral) regulation; restrictive convenants attached to land transfers</td>
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<tr>
<td><strong>Stimulation</strong></td>
<td>Restructuring the contours of the decision environment</td>
<td>Indirect/fiscal measures</td>
<td>Subsidies, tax (breaks), grants</td>
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<td>Direct public action</td>
<td>Land expropriation</td>
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<td>Joint ventures</td>
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<td>Project investment/realization</td>
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<tr>
<td><strong>Capacity building</strong></td>
<td>Developing actor’s ability to identify and/or develop more effective/desirable strategies</td>
<td>Initiating actor-network relationships</td>
<td>Arenas for interaction</td>
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<td></td>
<td></td>
<td>Building social capital</td>
<td>Collaborative partnerships</td>
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<td>Shaping cultural perspective</td>
<td>Application of innovative solutions</td>
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4. Case studies

I. Background
II. Findings
I. Background – Sunset Park
II. Findings – Actors NYC

Diagram showing various actors and organizations involved in flood resilience and urban development in Sunset Park, NYC.
II. Findings – Actors NYC

[Diagram showing various actors and organizations involved in the New York City area, including public agencies like DCP, Mayor’s offices, Parks, DoB, EDC, EPA, DEC, City, and federal agencies like HUD, FEMA, USACE, State/regional agencies like NYS DOS, NYS DEP, PANYNJ, and non-profit organizations like SBIDC, Community Board, UPROSE, MAS, MWA, BGI, Private Foundations, and external stakeholders like Planning/water consultants, Research Institutes.]
II. Findings – Actors NYC
II. Findings – Actors NYC

- Conflicting regulations
- Limited collaboration

- Public agencies
  - DCP
  - EPA
  - City
  - State/regional
    - NYS DOS
  - Federal
    - HUD
  - USACE

- Mayor's offices
- Parks
- DoB
- EDC

- Non-profit organizations
  - City/regional non-profits
    - MAS
    - MWA
  - Private Foundations
    - BGI

- Local community
  - SBIDC
  - Community Board
  - UPROSE

- Local
  - Borough President
  - Congressional Representative District

- Development actors
  - Private developers
  - Designing/constructing firms

- External stakeholders
  - Visitors/transpassants
  - Planning/water consultants
  - Insurance companies
  - Research Institutes
II. Findings – Actors NYC

![Diagram showing the interconnections between public agencies, plan development, strong dependency on non-profits, policy proposal & effectuation, and non-profit organizations.](image-url)
II. Findings – Actors NYC
II. Findings – Actors NYC
II. Findings – Actors NYC
II. Findings – Actors NYC

- Task forces decommissioned
- Slight shifts in boundaries
## II. Findings – Policies NYC

<table>
<thead>
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<th>Instrument Intention</th>
<th>Policy</th>
<th>Main Issuing Agency</th>
<th>Level</th>
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<td><strong>Shaping</strong></td>
<td>SIRR report</td>
<td>ORR</td>
<td>City</td>
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<td>Vision 2020</td>
<td>EDC</td>
<td>City</td>
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<td></td>
<td>PlaNYC</td>
<td>ORR, OLTPS</td>
<td>City</td>
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<td></td>
<td>Flood &amp; elevation maps</td>
<td>FEMA</td>
<td>National</td>
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<tr>
<td><strong>Regulation</strong></td>
<td>Building codes</td>
<td>HUD, NYS, DoB</td>
<td>National, State, City</td>
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<td>Zoning plans</td>
<td>DCP</td>
<td>City</td>
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<td></td>
<td>Environmental protection legislation</td>
<td>NYS</td>
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<tr>
<td><strong>Stimulation</strong></td>
<td>Sandy recovery funds</td>
<td>FEMA</td>
<td>Federal</td>
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<td></td>
<td>Community Block Grant</td>
<td>HUD</td>
<td>Federal</td>
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<td>NFIP</td>
<td>FEMA</td>
<td>Federal</td>
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<td>BOA Program</td>
<td>DOS, DEC</td>
<td>State</td>
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<td>Rising Small Businesses Program</td>
<td>NYS OSR</td>
<td>State</td>
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<td>Game Changer competition</td>
<td>HUD</td>
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<td>New York Rising programme</td>
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<td><strong>Capacity Building</strong></td>
<td>Community workshops</td>
<td>DCP, PANYNJ</td>
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<td>Rebuild by Design</td>
<td>HUD</td>
<td>Federal</td>
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</table>
II. Findings – Policy instruments NYC

New York State Flood Protection Projects & Regions / Counties

Design guidelines

- Common Area Faucets
  - Natural pressure in the city’s water mains provides water for a common area faucet, even if a blackout disables the water pump.

- Roof Top Pavers
  - Unlike small gravel, heavy pavers will not become airborne during high winds.

- Secure Loose Outdoor Items
  - Tie down furniture and plants or move them indoors to prevent wind damage.

- Operable Windows
  - Open windows help buildings remain habitable during summer power outages.

- Cogeneration System
  - Provides cost-effective hot water and electricity, and backup power for fire alarms, lighting, and water pumps.

- Elevated Equipment
  - Raising building equipment to a higher floor ensures it will not be damaged by floodwaters.

- Insulated Walls
  - Walls, windows, and roofs that are sealed and insulated keep heat in during winter and out during summer — especially important during blackouts.

- Slotted Sidewalks & Tree Pits
  - Sidewalks slotted into tree pits allow rain, reducing flooding from rainstorms.

- Salt-Tolerant Trees
  - Trees planted in flood zones should be salt-tolerant and pruned regularly.

- Sewage Valves
  - Valves prevent sewage backflow into basements during rainstorms and floods.

Move Cars from Flood Zones
- Park vehicle elsewhere to prevent damage and costly cleanup from leaked gas and oil.

Sandbags
- Part of a building’s emergency preparedness plan, sandbags are an inexpensive way to protect against flooding.
II. Findings – Arrangements & structure NYC

NGO's

Public agencies

Foundations

Local community organizations
II. Background – Actors Rotterdam
II. Findings – Actors Rotterdam

Public agencies
- National
  - IENM
  - Rijkswaterstaat
  - Delta Commission
- Regional
  - Province of South-Holland
  - DCMR
- Safety region
- Waterboards

Local
- District Committee Delfshaven
- Deltaline

Portactors
- Port of Rotterdam
- Planning/water consultants

External stakeholders
- Research Institutes
- Housing associations
- Visitors/transpassants
- Residents/employees

City
- DoCM
- AMT M4H
- DoCD

Located in the area
Merwe-Vierhavens

Development actors
- Tenants
- Private Investors
- Private developers
- Designing/constructing firms
II. Findings – Actors Rotterdam
II. Findings – Policy instruments Rotterdam
II. Findings – Arrangements & structure Rotterdam

![Diagram showing arrangements and structure of Rotterdam with key stakeholders such as Cleantech Delta, Stadshavens, Waterboards, Rijkswaterstaat, Provinces, Municipalities, Port of Rotterdam, and other entities.]

- Cleantech Delta
- Stadshavens
- Port of Rotterdam
- Waterboards
- Rijkswaterstaat, Provinces, Municipalities
- Research institutes, engineering consultants

- Innovation Quarter
- Rotterdam Partners
- Deltalings
- DCMR
II. Findings – Actors Rotterdam
II. Findings – Actors Rotterdam
II. Findings – Actors Rotterdam

Consencus, integration

Planners & Experts

Community

Strong dependency on government
>> lack of awareness
## II. Findings – Policies Rotterdam

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<tr>
<th>Instrument</th>
<th>Policy</th>
<th>Main issuing party</th>
<th>Level</th>
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<td>Shaping</td>
<td>Rotterdam Climate Proof</td>
<td>RCI</td>
<td>City</td>
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<td>Waterplan I &amp; II</td>
<td>Municipality of Rotterdam</td>
<td>City</td>
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<td>Deltaprogram</td>
<td>Deltacommission</td>
<td>National</td>
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<td>Structure Visions &amp; PIP</td>
<td>Provincie Zuid-Holland</td>
<td>Regional</td>
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<td>Pilot projects</td>
<td>Municipality of Rotterdam</td>
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<td>Regulation</td>
<td>Building codes</td>
<td>Ministry of IenM</td>
<td>National</td>
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<td>Zoning plans</td>
<td>Municipality of Rotterdam</td>
<td>City</td>
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<td>Watertest</td>
<td>Delfland Waterboard</td>
<td>Local</td>
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<td>AMvB Ruimte</td>
<td>Ministry of IenM, Provinces, VnG</td>
<td>National</td>
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<td>Legger and Keur</td>
<td>Waterboards</td>
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<td>Stimulation</td>
<td>Deltafund</td>
<td>Deltacommission</td>
<td>National</td>
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<td>Infrastructure maintenance</td>
<td>Ministry of IenM</td>
<td>National</td>
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<td>Land sellings and development tenders</td>
<td>Municipality of Rotterdam</td>
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<td>Capacity building</td>
<td>Keiletafel</td>
<td>Stadshavens</td>
<td>City</td>
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</table>
5. Conclusions

I. Answers to research questions
II. Recommendations
III. Reflection
I. Answers to research questions - Questions

Comparing practices of urban area development in Rotterdam and NYC

a. What are the main characteristics of the institutional landscape in building flood resiliency?

Public planning policy
   a. What policy instruments are currently deployed to build flood resiliency in vulnerable areas?
   b. To what extent are these policy instruments experienced by local actors?

Flood resiliency
   a. How is flood resiliency currently assessed in vulnerable areas?
   b. What aspects of building flood resiliency should be strengthened?

Effectiveness & institutional landscape influence
   a. What is the effectiveness of current policy instruments on building flood resiliency?
   b. How can the findings on policy effectiveness be explained by the characteristics of the institutional landscape
I. Answers to research questions - Hypotheses

For both Rotterdam and NYC the following statements apply:

• The building of flood resiliency in urban area development is hampered.

• Public policy instruments that are currently employed are not effective.

• Institutional landscape influences this effectiveness.
What are the main characteristics of the institutional landscape of flood resiliency in urban area development

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>NYC</th>
<th>Rotterdam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norms and values</td>
<td>Freedom of the individual, opportunistic, result-driven, ideology, diversity</td>
<td>Collaboration, concensus, equality, integration, redistribution, Process-driven</td>
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<tr>
<td>Interests of actors</td>
<td>Strong, directly related to actor behavior/policy</td>
<td>Flexible, intertwined, loosely defined</td>
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<td></td>
<td>Often economic focus, local and short-term scope</td>
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<tr>
<td>Arrangements</td>
<td>Stand-alone, dynamic, project-based</td>
<td>Traditional, long-term, inclusive</td>
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<td>Strong politically driven, responding to external forces (task-forces)</td>
<td>Planning and procedure-based, ongoing processes,</td>
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<td>Strong administrative driver; based on internal forces within government</td>
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<td>Structure</td>
<td>Hierarchical in vertical relations, panarchy on horizontal level</td>
<td>Oligarchy (water management level) Network (spatial planning)</td>
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<td></td>
<td>Significant role of community organizations, NGO’s, private sector</td>
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<tr>
<td>Rules and policies</td>
<td>Functionally defined – jurisdictions determine spatial projects</td>
<td>Spatially defined – spatial characteristics determine projects and jurisdictions</td>
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<tr>
<td></td>
<td>Overlapping and conflicting</td>
<td>Overlapping and aligned</td>
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What public policy instruments are deployed to build flood resiliency of the urban environment?

Issued policy instruments

- Shaping
- Regulating
- Stimulating
- Capacity building

Rotterdam
NYC
i. How is flood resiliency assessed by local actors?

- Considering the current situation
- Examining trends and future threats
- Learning from previous experience
- Setting goals
- Initiating actions
- Involving the public

Rotterdam
NYC
What is the effectiveness of these policy instruments?
ii. What policy instruments are experienced to improve the building of resiliency?
What is the effectiveness of these policy instruments? iii. How is actor behavior influenced by public policy instruments?

NYC
• Plans developed by local actors, but not realized due to lack of funding and political cooperation
• Public parties are limited taking action in public space construction works
• Individual property owners are taking measures on building level
• Local actors are trying to take initiative in organizing workshops, making plans etc.
• Grants on building level as well as area-wide projects hampered

Rotterdam
• Plans developed by public agencies, local parties not involved
• Public parties are taking mainstreaming action in public space construction works
• No measures on building level
• Local actors are working together on business and economic development of the area
• Grants on building level approved
What is the effectiveness of these policy instruments?
iv. What policy instruments are necessary to stimulate collective actor behavior?
How can the findings on policy effectiveness be explained by the characteristics of the institutional landscape?
How can the findings on policy effectiveness be explained by the characteristics of the institutional landscape

NYC
- Conflicting policy and limited collaboration public bodies
- Responsive, short-term planning

- Individual, practical and small-scale measures
- High awareness and independent acting communities
- Involvement private funding and political goodwill

Rotterdam
- Clear responsibilities public bodies in water safety
- Anticipating, long-term planning

- Consensus culture
- Integrativeness spatial design
- Lack of awareness population
How can the findings on policy effectiveness be explained by the characteristics of the institutional landscape?
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How can the findings on policy effectiveness be explained by the characteristics of the institutional landscape?
III. Recommendations - Rotterdam

- policy limitations, development drivers and key actors

Connection local community

€i Economic/innovation interest
III. Recommendations - Rotterdam
III. Recommendations - Rotterdam

- Full integration spatial and water-management legislation
- More attention responsive capacity
- Lower boundaries public domain
  - Raise awareness on flood risks and water management
  - Involve local communities
    - Plan development
    - Mainstreaming 2.0
    - Collaborative Funding
  - Approach market parties more actively
    - Developing parties
    - Broad scope: Investors, (re-) insurers, knowledge institutes, consulting firms, industries housed in the wider region
III. Recommendations - NYC

- policy limitations, development drivers and key actors
III. Recommendations - NYC
III. Recommendations - NYC

• Lower boundaries between government agencies
  – Align regulations
    • Between government layers
    • Between agencies in specific domains
  – Regional collaboration & strategies
  – Money

• Empower local actors
  – Provide directly applicable information
  – Connect to private foundations and political champions
  – Give room to community initiatives and plan proposals
III. Recommendations – Delta cities

1. Consider institutional landscape characteristics
2. Define policy limitations, development drivers and key actors
   - Leadership (capacity building)
   - Knowledge (shaping)
   - Financial means (stimulation)
   - Political authority (regulation)
3. Prioritize flood resiliency aspects
4. Select policy instruments to match means actors with goals
III. Recommendations – Further research

• The effect of risk awareness on actor behavior
• Adaptive capacity as a result of institutional landscape characteristics
• Emphasis responsive/protective resiliency in relation to inst. Landscape
• Longer term studies
  – Assess realization process
  – Assess responsiveness
• Examine more cases, other cities, other countries etc.
III. Reflection

Compare Rotterdam and NYC to:

I. assess the effectiveness of current policy instruments in building flood resiliency of urban areas

II. identify characteristics of institutional landscape that influence the effectiveness of these policy instruments
III. Reflection

Flood resiliency alleen maar aantonen verschillende cultuur en daarmee omgang ruimtelijke ordening internationaal

Effective policy not directly transferable to other system. Depends on institutional landscape for implementation and answering to specific needs
Key lessons

• Lack of information/technology/funding not problem
• Institutional landscape influences policy effectiveness
• Flood resiliency ≠ physical interventions
Questions

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