Resilience and Local Climate Adaptation

Exploring governance arrangements to adapt to the risk of flash flooding in the city of Arnhem, the Netherlands.

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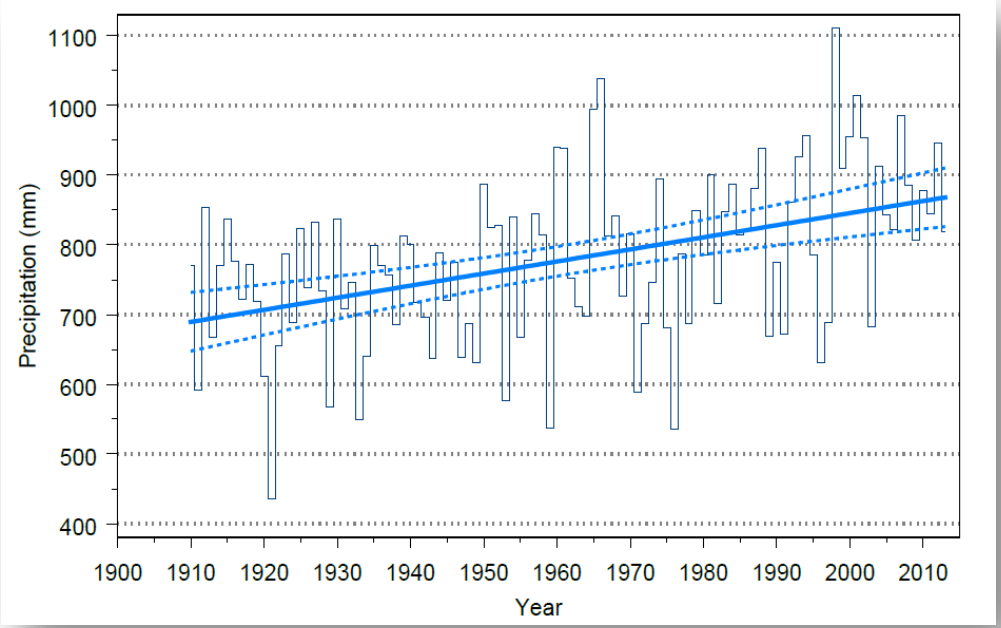
Urban flash flood risk in Dutch cities…



ANNUAL PRECIPITATION IN THE NETHERLANDS BETWEEN 1910-2013 (MEAN OF 102 STATIONS).

Urban flash flood risk in Dutch cities…

- … is growing

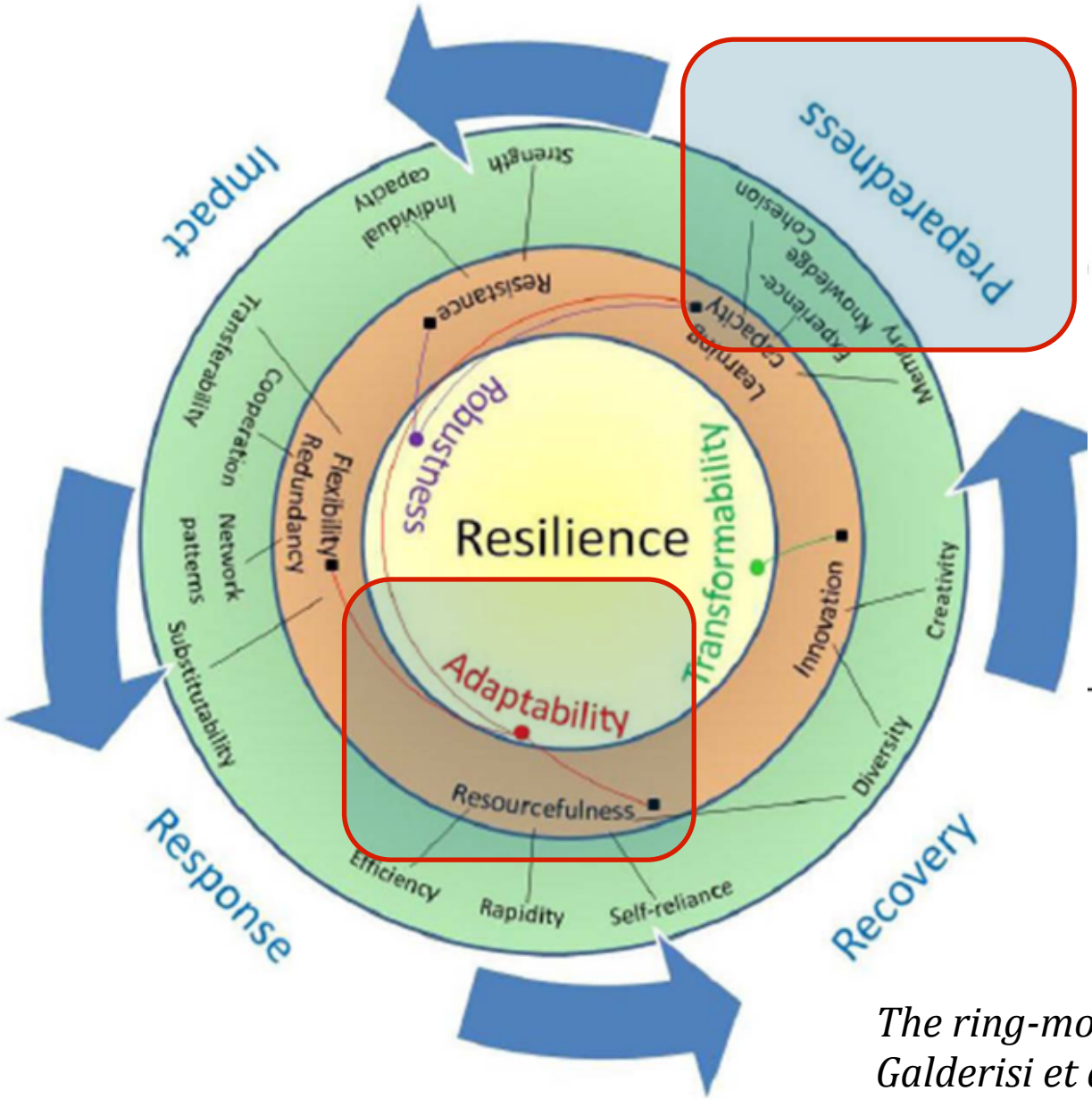
- A knowledge gap in understanding:
  - the *complex social systems* in which climate adaptation occurs,
  - the related *governance arrangements* which could be most suitable to steer adaptation to growing flash flood risk,
  - *resilience to flash flooding* on the local scale.

Governing for resilience in Arnhem

- Which governance arrangements are most suitable to steer effective adaptation to growing flash flood risk on the *local scale* of the city of Arnhem?

- How does *adaptive capacity of key actors* influence the governance of flash flood adaptation in Arnhem?

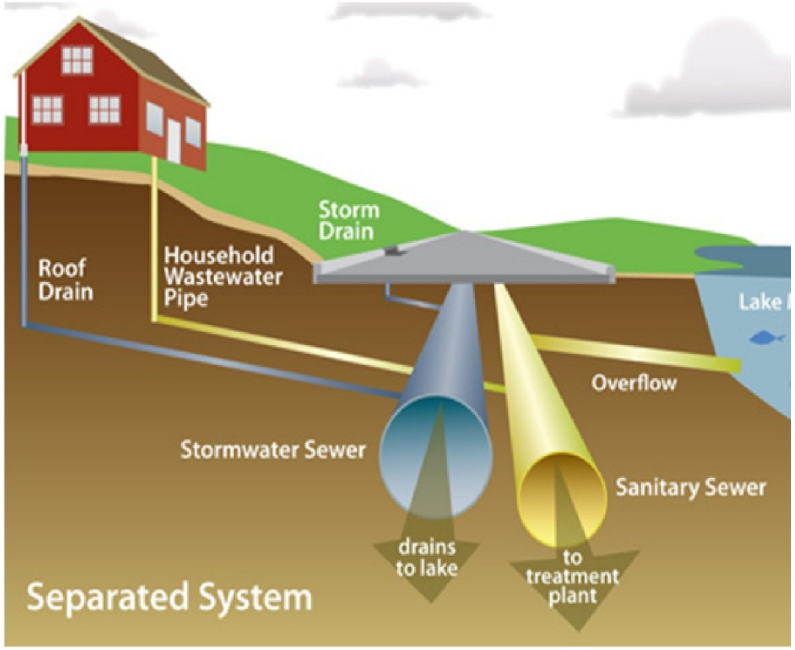
- How do existing *interactions and interdependencies* influence the governance of flash flood adaptation in Arnhem and (potentially) contribute to *resilience*?



The ring-model of resilience by Galderisi et al. (2010)

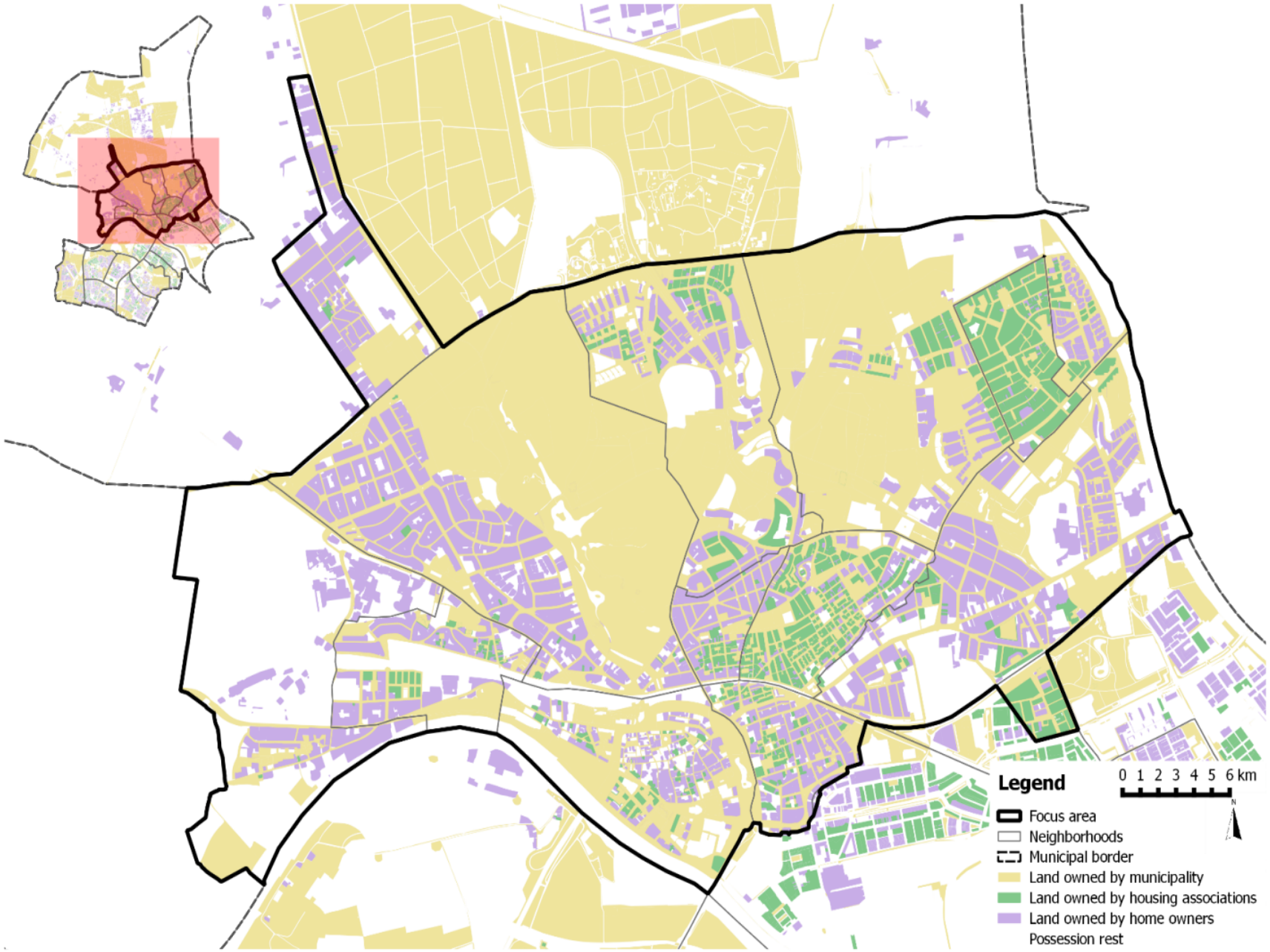
Understanding resilience to flash flooding

- Traditional approach -> under ground; technical measures; increasing capacity / separation; costly.
- Emphasis -> robustness

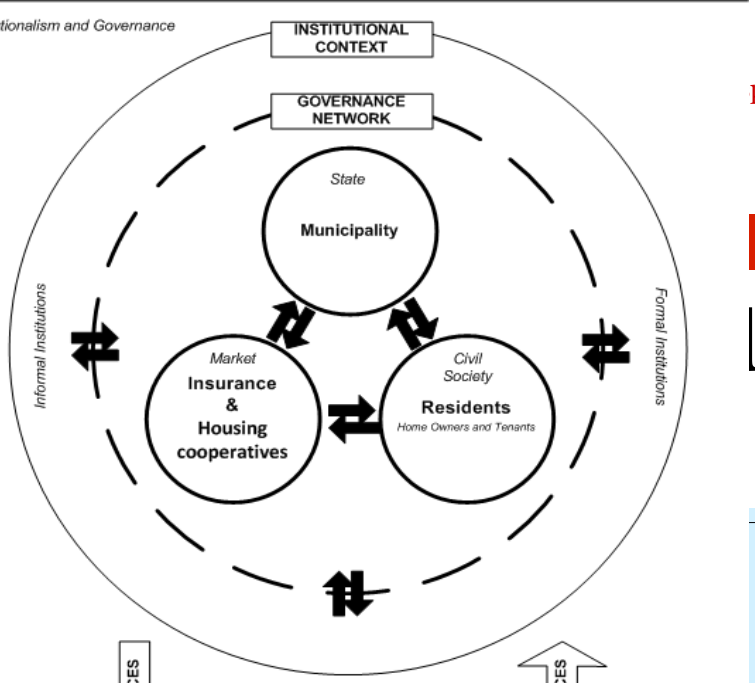


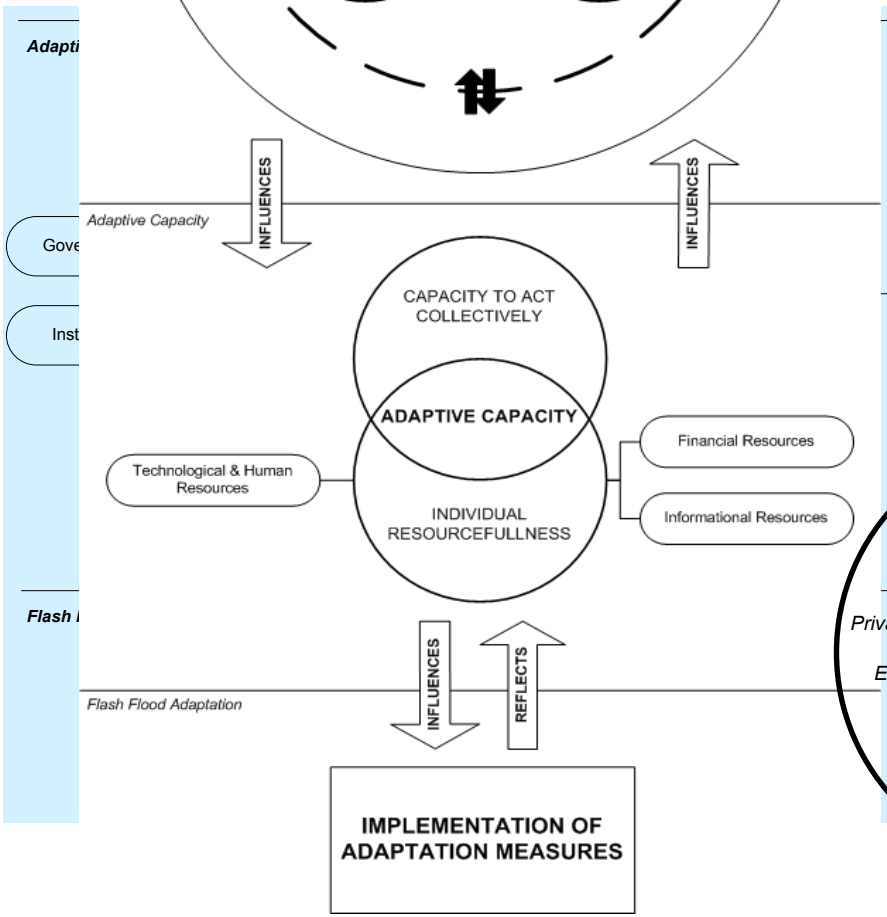
Understanding resilience to flash flooding

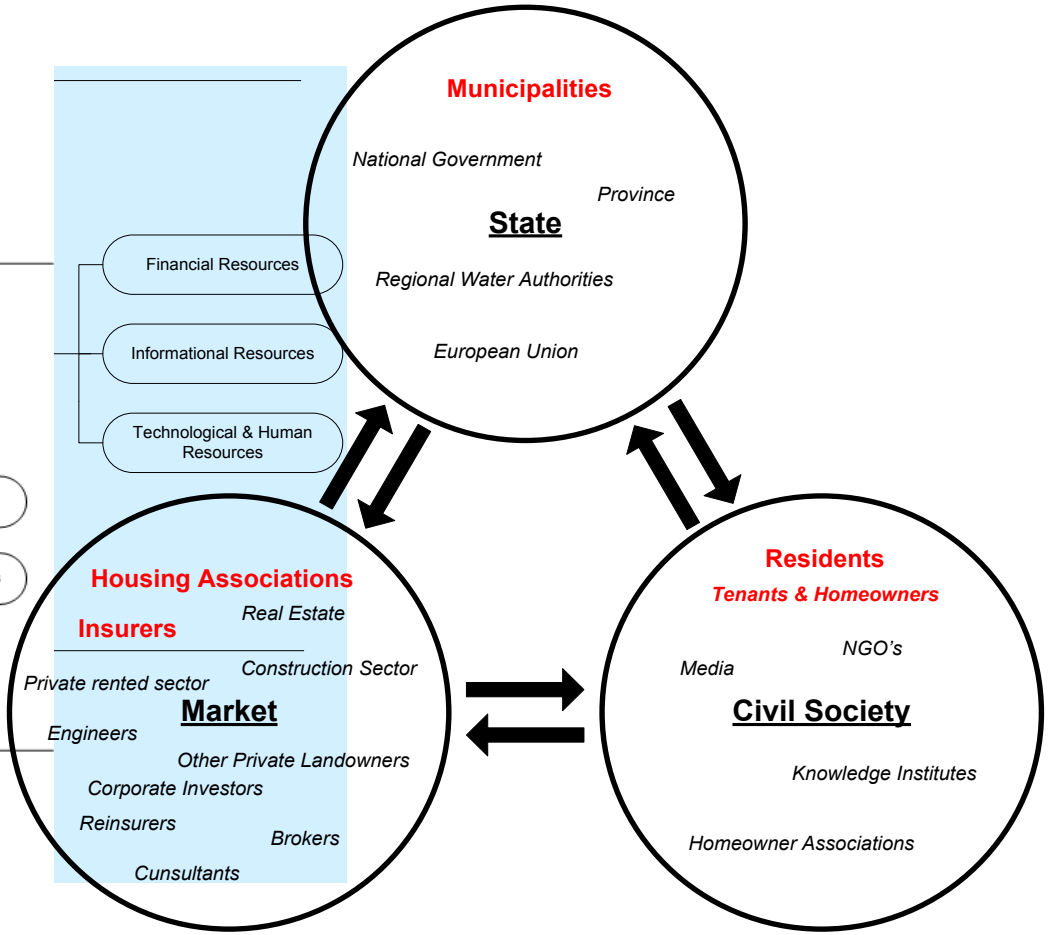
- 'New' approach -> shift in focus: 'above-ground'; adaptive measures
- Greater role for spatial planning (measures)
- Adaptive capacity -> physical and social measures
- Emphasis -> key actors: interdependencies, interactions -> (collective) adaptive capacity (but also increased complexity)


Legend
0 1 2 3 4 5 6 km
N
Focus area
Neighborhoods
Municipal border
Land owned by municipality
Land owned by housing associations
Land owned by home owners
Possession rest

governance network

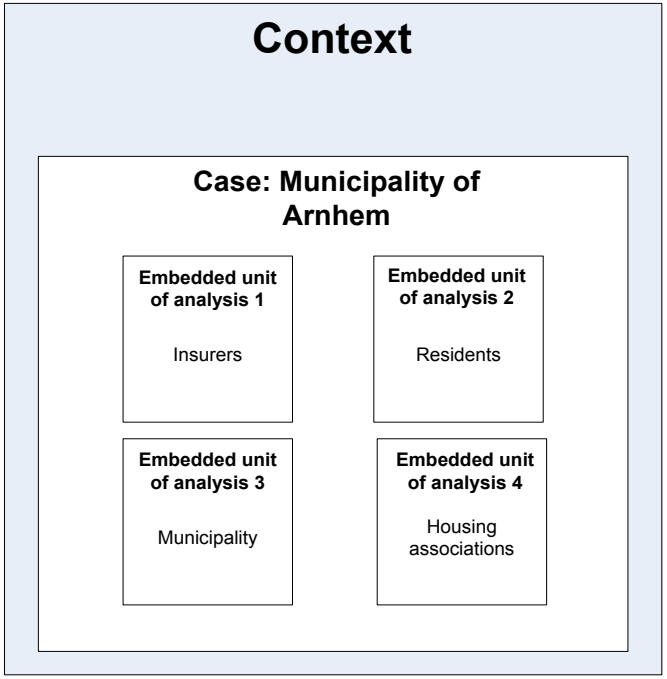






Methods and Research context

- Research & data collection:
  - September 2014 –> August 2015



- Methods:
  - Case study approach;
  - Document analysis
  - Semi-structured interviews (key actors, n=8);
  - Questionnaire (residents, n=125);
  - GIS analysis (land ownership; land use & vulnerability)


2014 ©

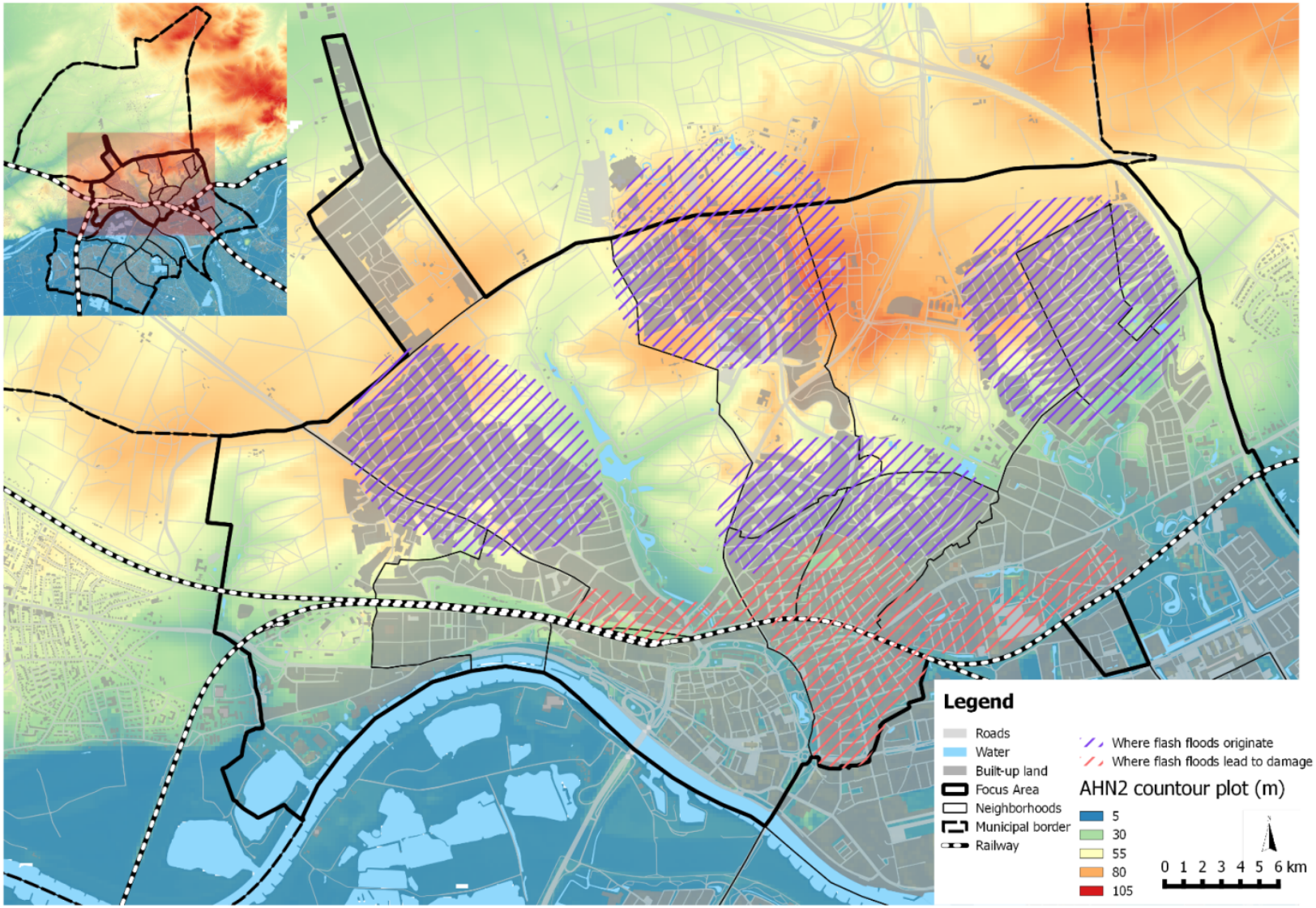
P@tje


Antwerp
Roermond
Gent
Schelde
BELGIUM
51°
Leie
Meuse
Sittard
Heerlen
Brussels
Maastricht
Aachen

Arnhem, NL

- Provincial capital
- Population: ~ 153 000
- Located on a gradient of Veluwe lateral moraines, river valley and polder areas

- 28 July 2014: 80-120 mm rain in less than 3 hours
- *'the wettest place in the Netherlands'* (Dutch Meteorological Office, 2014)
- All damage (2014) occurred in the North of the city -> case study area for this research
- Combined (traditional) sewer system -> necessity for above ground solutions



Combined data on surface elevation, built-up land and flash flooding in Arnhem (source: authors)

Flash flood governance in Arnhem

institutional context:
roles & responsibilities
perceptions & actions
resourcefulness

1. Municipality
2. Housing associations & insurance companies
3. Residents (tenants & home-owners)

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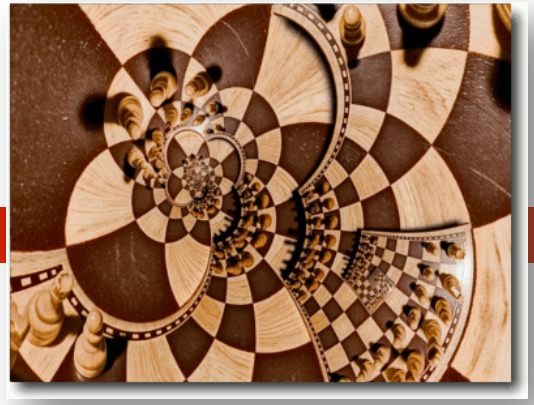
GEMEENTE Arnhem

Municipality

- Municipalities play a key role in adaptation as adaptation practices occur on the local level (Termeer et al., 2011); key influence on local spatial planning.
- Municipal Water Action Plan – platform for interaction

  - *Legal responsibilities*:
  - ✓ collecting and processing rainwater & preventing structural groundwater flooding on public land (The Water Act);
  - ✓ collection and discharge of sewage water (Environmental Management Act);
  - ✓ duty of care (Municipal Sewage Plan; Sewage tax; Water, rain, surface water tax)



Municipality

- *"It ['rainproofing' a city] is like playing chess on multiple boards. You cannot be dependent on a single actor if you really want to be adaptive… I think if you do not focus on a wide diversity of actors you will miss relevant opportunities in making a city rainproof"* (Interviewee municipality D 2015)

- *"Flash flood adaptation is a shared responsibility, technically oriented approach of increasing sewage capacities is financially unrealistic"* (Interviewee municipality B 2015, 1 May)

- Lack of specific expertise hampers a more detailed understanding of flash flood vulnerability and damage (Interviewee municipality B 2015, 19 May).

Housing associations

- Own ~ 30% of the total Dutch housing stock (CBS, 2014)

- *Legal responsibilities:*

✓ landowners are primarily responsible for processing rainwater that falls on their land (the Water Act)

✓ Measures that landowners can reasonably be expected to take are defined in the municipal sewage plan (valid from 2009 onwards, not enforced retrospectively)

Housing associations

- No clear / strong trigger to participate; not a part of their policy; reactive approach; municipality as the sole responsible actor; need for incentives.

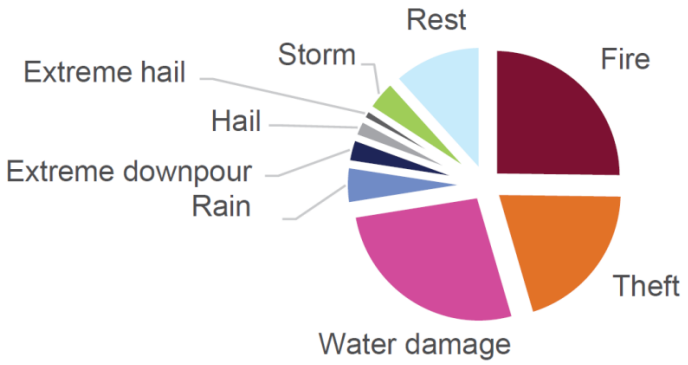
- Hierarchy of motivations: save the planet vs. affordability (Interviewee housing association I 2015, 22 May)

"We are very much in favor of sustainability and building energy neutrally. That is because of two reasons. The first is what I always call ***save the planet.*** *And the second, being much more important for us, the* ***affordability.*** *Housing costs consist of rent but also the energy bill…. And by applying insulation and that kind of stuff we can lower the energy costs. I use this example because it shows a* ***clear trigger*** *for us to invest in sustainability…"*

Insurance companies

- Damage by rainwater covered by **(home) building insurance** [*opstalverzekering*] and **household insurance** [*inboedelverzekering*] -> short term contracts, premiums regularly updated based on claim patterns

- No strict obligation to insure flash flood damage; no formal institutional requirements to promote adaptive measures.



Insurance companies

- **Awareness/Technological resourcefulness:** *"We know the economic damage, the economic effect of downpours, we have that data, we are able to visualize that - in this neighborhood we paid for this amount of damage. And with that location specific information we can see what certain adaptation measures would mean for future damages based on the KNMI scenarios…"* (Interviewee insurance A, 2015, 28 April).

- **Lack of urgency vs. social responsibility:** *"I see it as our job to work together with stakeholders. And use our knowledge. Because we know what the economic damage is of an extreme downpour… I will never be able to prevent rising burden of claims. I will only be able to soften the rise with large scale collaboration on innovative prevention"* (Interviewee insurance F 2015, 19 May).

Residents (tenants and homeowners)

- *Legal responsibilities*: primarily responsible for processing surface runoff from their parcel (the Water Act)
- Lower-lying parcels obliged to process natural runoff from higher areas (Civil Code of the Netherlands)
- Main responsibility for preventing damage to property
- Tenants, unlike homeowners, need approval of landlord to take (certain) adaptation measures.

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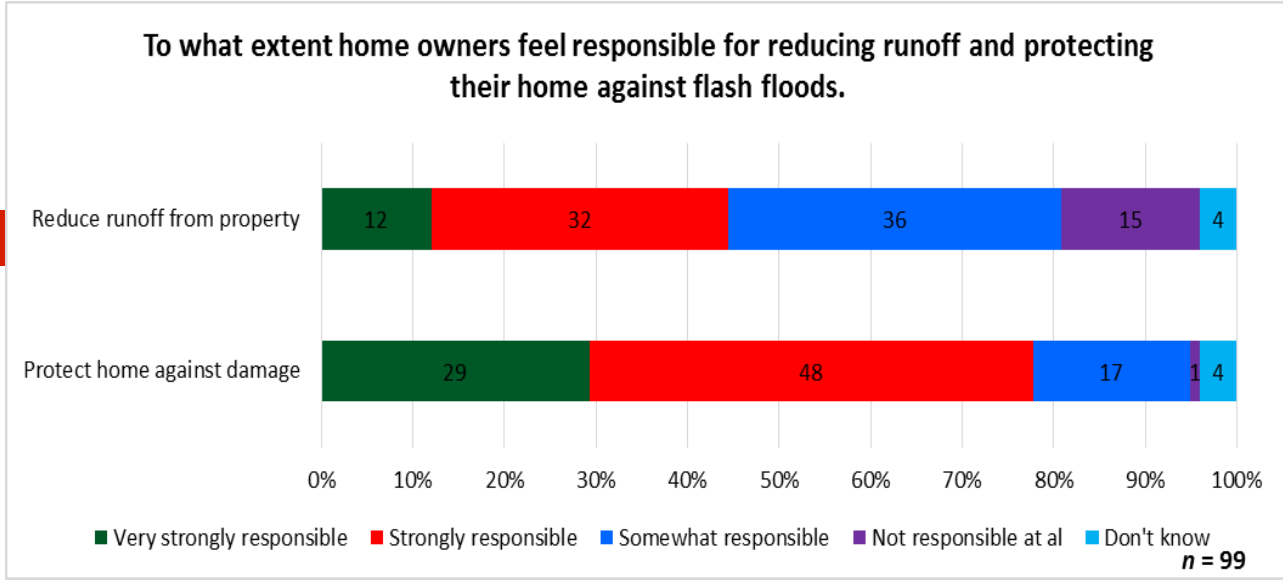
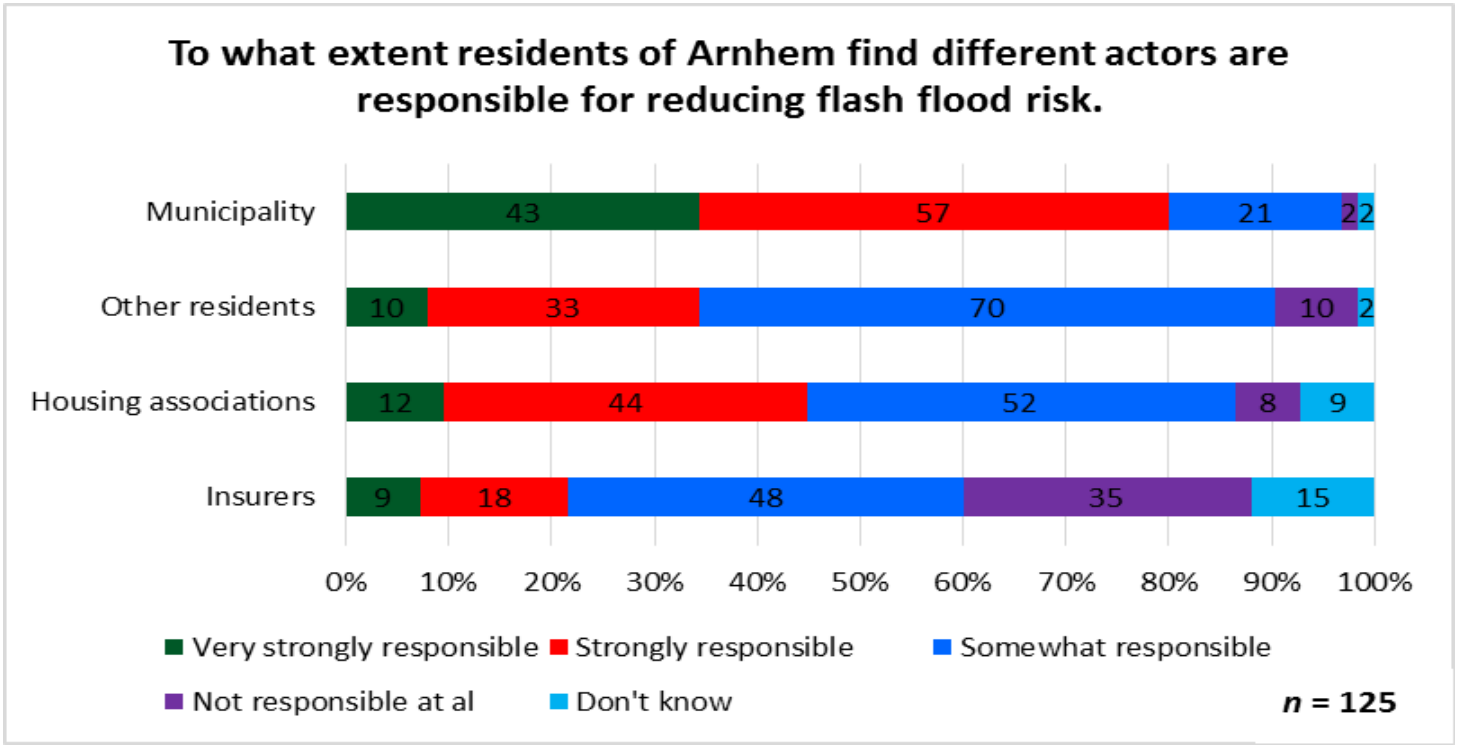
Residents





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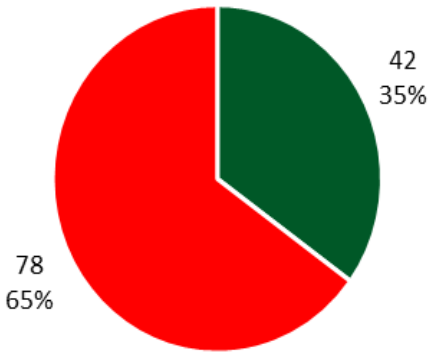
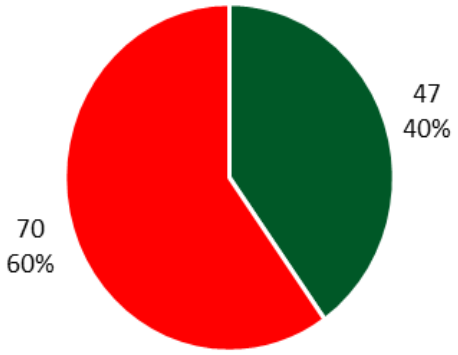
Residents

Do you have enough knowledge to take effective and efficient flash flood adaptation measures?



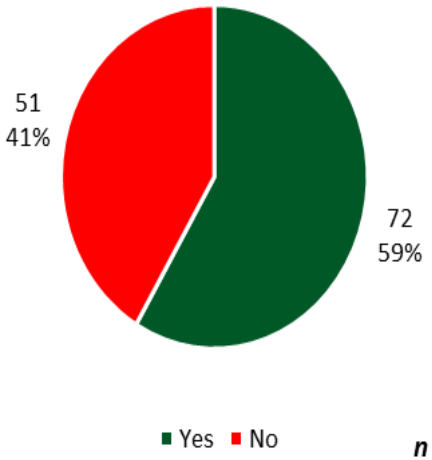
n = 120

Does a lack of knowledge withold you from taking flash flood adaptation measures?



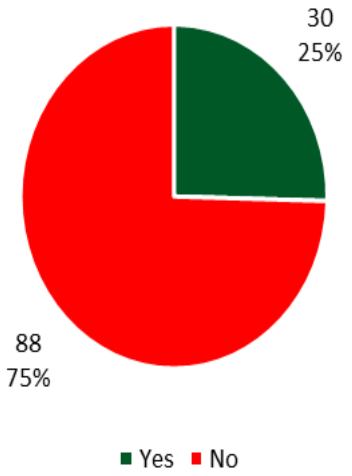
n = 117

Do you have enough financial resources to take flash flood adaptation measures?



n = 123

Does a lack of financial resources withold you from taking flash flood adaptation measures?



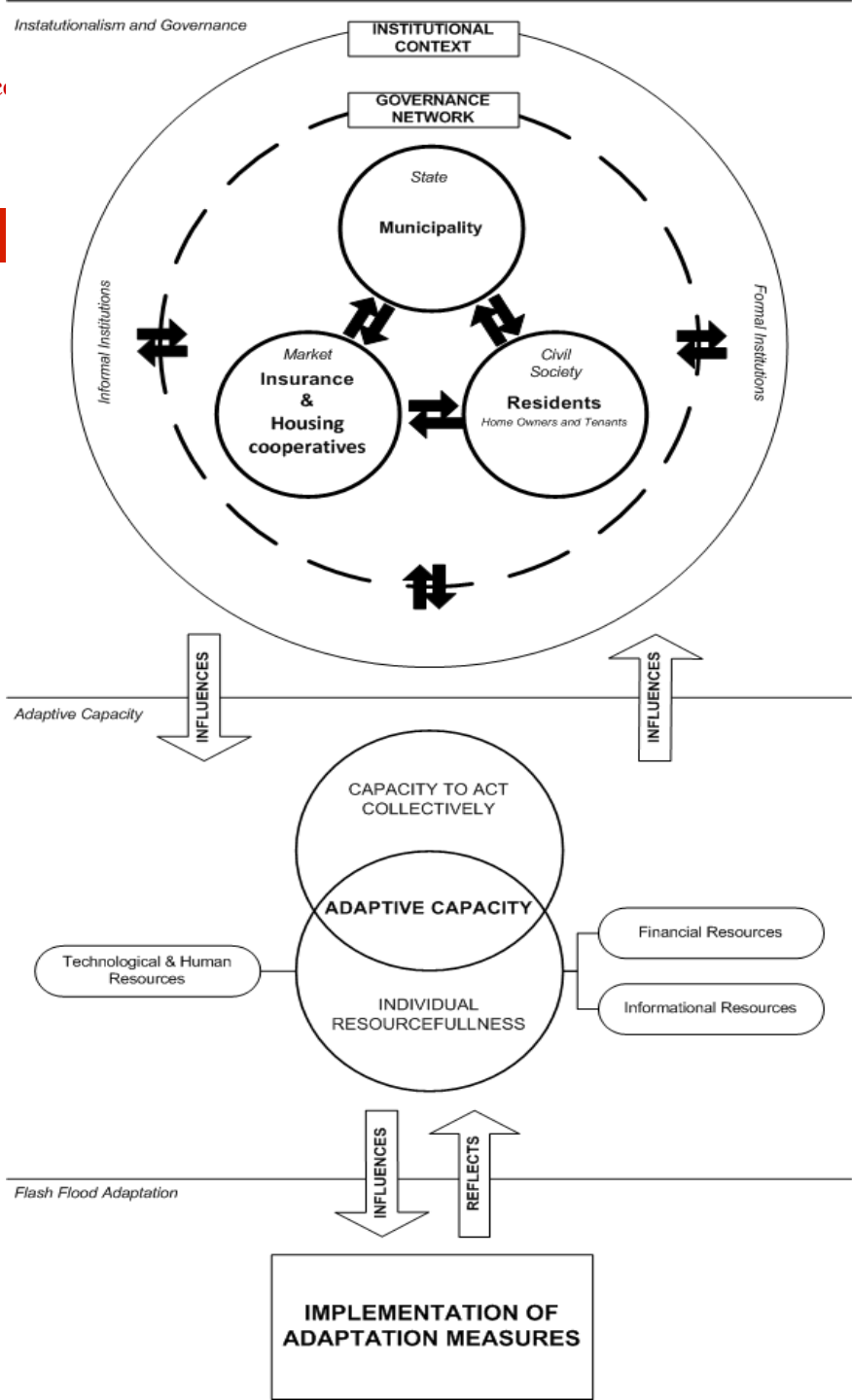
n = 118

Synthesis

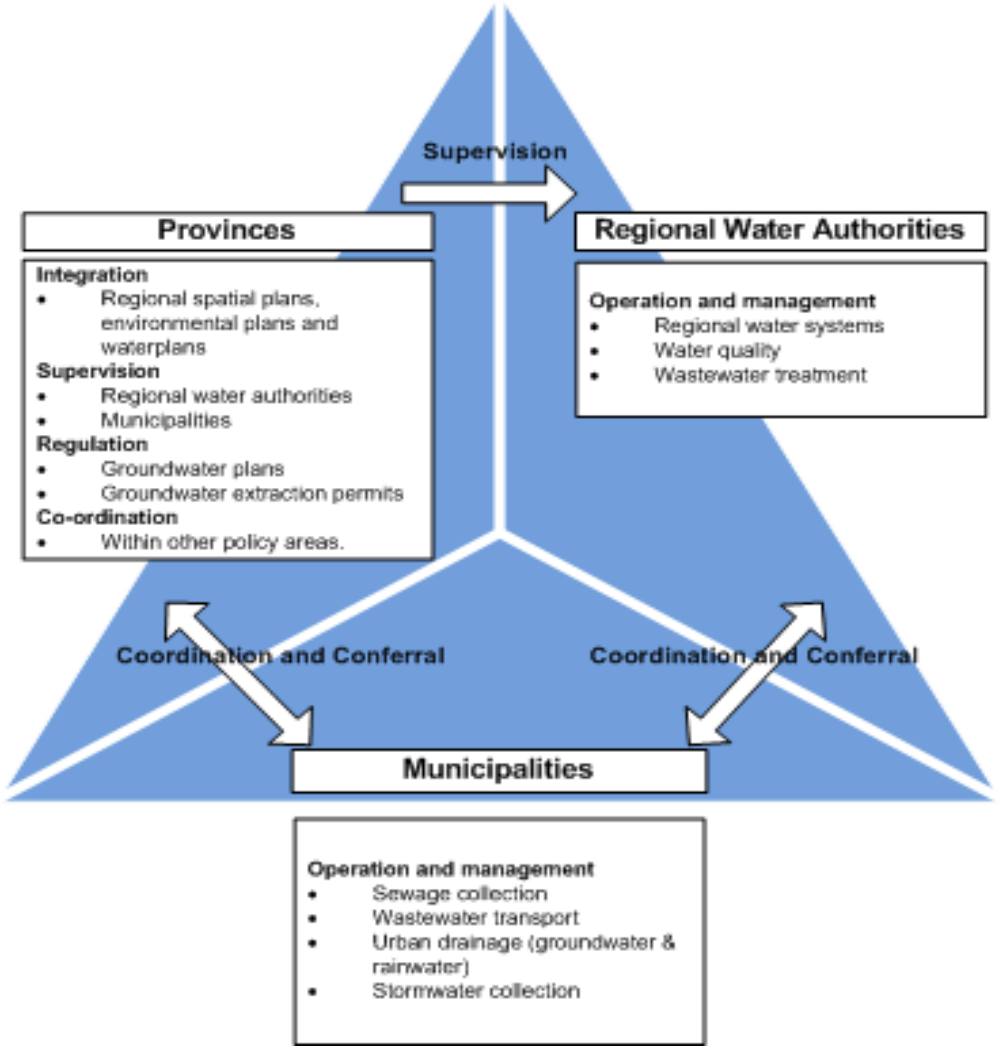
- Amongst all four key actors there is a general consensus that flash flood adaptation *should be done in collaboration*.
- Disagreement on the *distribution of roles and responsibilities* hampers successful collaboration / interaction
- *Limited interactions* between key actors confine the potential exchange of resources
- Lack of individual resourcefulness creates *interdependencies that can trigger interaction* (exchange of resources) (Kooiman et al., 2005)
- Collective action needs *a platform* around which interactions can emerge (e.g. Water Action Plan) -> sense of urgency & problem recognition
- *Weak formal institutional incentives* to get involved in flash flood adaptation (for housing associations as well as insurers)

Resilient

Rainproof Arnhem



Thank you!



Mutual dependencies across three public components in water management (based on: OECD, 2014).

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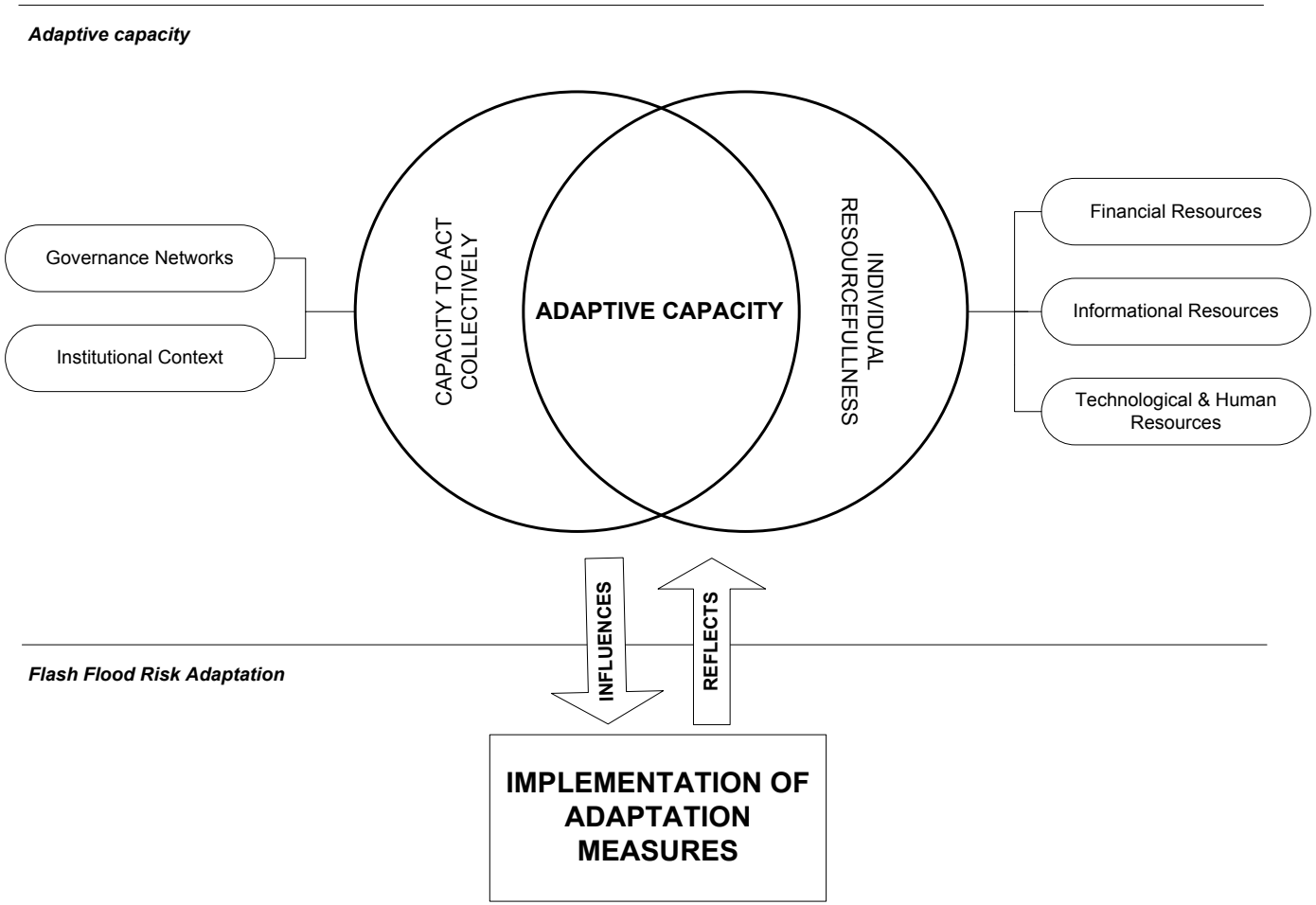
Governance in the context of flash flood adaptation in The Netherlands

The totality of interactions between state, market and civil society actors in realizing the collective goal of adaptation to growing flash flood risk. Due to interdependencies between different actors, networks emerge around specific flash flood issues. Although these networks are mainly horizontally oriented, local governments are also dependent on higher governmental layers.

Operationalizing (flood) resilience



(by Britta Restemeyer)

social-ecological systems

ability
i) to absorb disturbance
ii) of self-organisation
iii) to learn and adapt

system's theory

Relationships and interaction