

Integrating physical climate risks in real estate development

A systematic analysis of Dutch developer decision-making

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2. Methodology
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Definitions

Climate risks	The potential negative impacts of climate-related hazards such as flooding, heat stress, drought, or land subsidence. This study focuses on physical risks, as opposed to transitional or liability risks.
Climate adaptation	This includes actions designed to reduce or prevent the negative effects of current and future climate conditions on human activities, nature, or property (European Commission, 2021).
Climate mitigation	This refers to measures aimed at reducing or preventing the emission of greenhouse gases, with the goal of limiting global warming (European Commission, 2021).
Climate risk integration in real estate development (CRiRED)	Using the knowledge of climate risks to guide the process of planning, financing, and constructing new buildings or redevelopment projects.

1.

INTRODUCTION



CLIMATE
RISKS



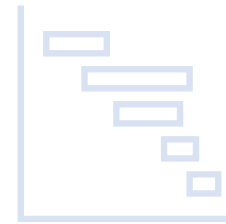
IMPACT ON
REAL ESTATE



STRICTER
REGULATIONS



MARKET
PRESSURE



EARLY PHASE
POTENTIAL



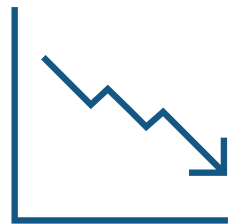
SHORT-TERM
FOCUS



UNCLEAR
MOTIVATIONS



CLIMATE
RISKS



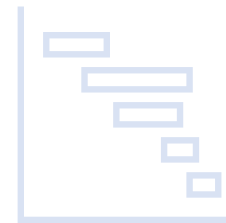
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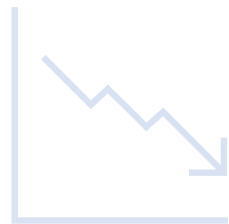
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MOTIVATIONS



CLIMATE RISKS



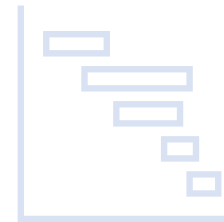
IMPACT ON REAL ESTATE



STRICTER REGULATIONS



MARKET PRESSURE



EARLY PHASE POTENTIAL



SHORT-TERM FOCUS



UNCLEAR MOTIVATIONS



CLIMATE
RISKS



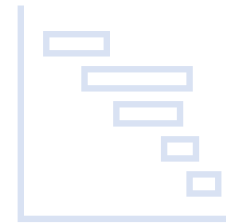
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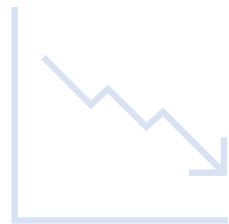
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CLIMATE RISKS



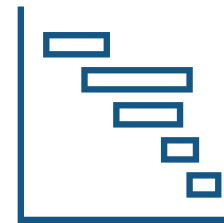
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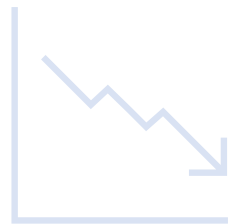
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CLIMATE
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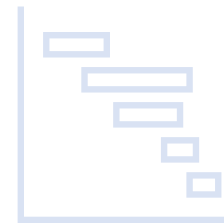
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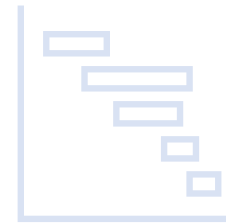
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MOTIVATIONS

Problem statement

Climate risks are increasingly affecting real estate value and operations in the Netherlands. Although regulations and financial institutions are increasingly looking at physical climate risks, and climate data is becoming more accessible, it remains unclear how and to what extent developers integrate climate risks into decision-making, and which factors influence these choices.

Research questions

“To what extent do physical climate risks influence decision-making in real estate development?”

RQ1 – What physical climate risks are most relevant for real estate development in the Netherlands?

RQ2 – Which actors play a role in integrating climate risk into real estate development?

RQ3 – How do developers address physical climate risks in real estate development?

RQ4 – What leverage points exist to enhance climate risk integration in real estate development?

2.

METHODOLOGY

Research approach

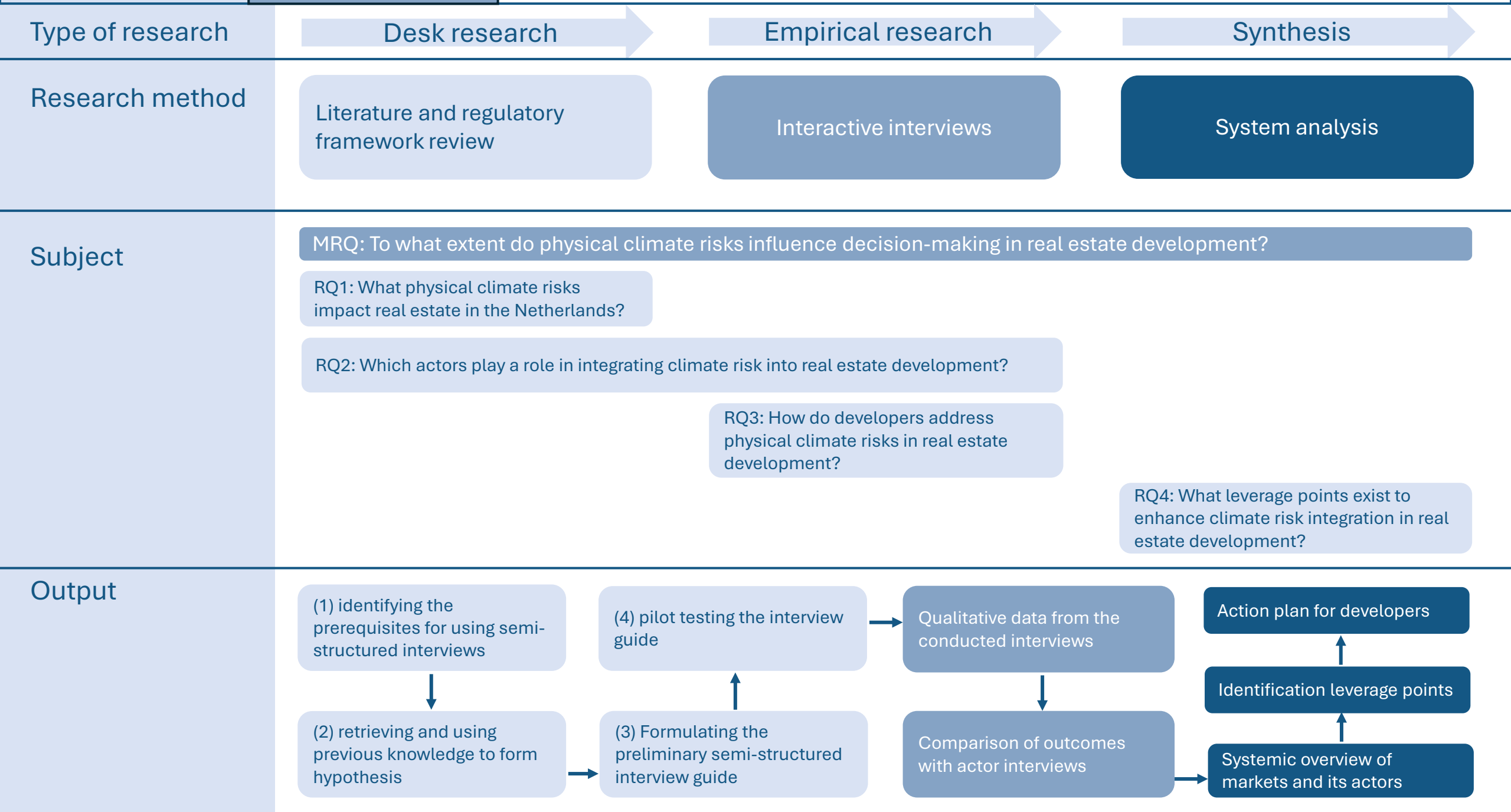
Objective: understand how developers integrate physical climate risks in real estate development decisions

Approach: Qualitative & explorative, interpretative (tacit, iterative, context-driven decisions)

Three-phase structure:

1. Desk research → Literature & regulation scan on risks, actors and mechanisms
2. Empirical research → Semi-structured interviews with developers & other actors
3. Synthesis → Actor-based system analysis

2. Methodology



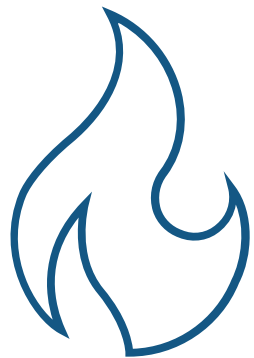
3.

DESK RESEARCH

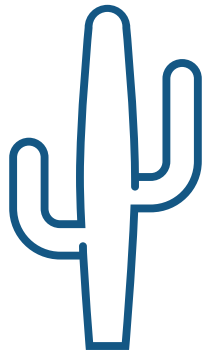
1. Physical climate risks for real estate

The Netherlands is vulnerable due to its geography (van Gaalen, 2024)

4 main physical climate risks:



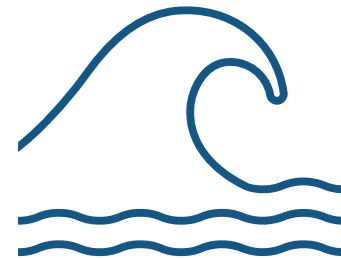
Heat



Drought



Water nuisance



Flooding

2. Climate risk data & disclosure

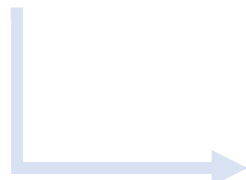
Data



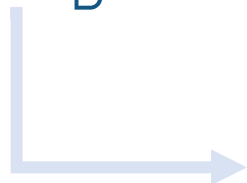
KNMI: measurement of the weather



KNMI: climate scenario's (van Dorland et al., 2023)



Klimaat-effectatlas: open format with data from multiple sources (e.g. KNMI, Deltares, Rijkswaterstaat)



Black box of climate services: no standardisation (Hubert et al., 2021)

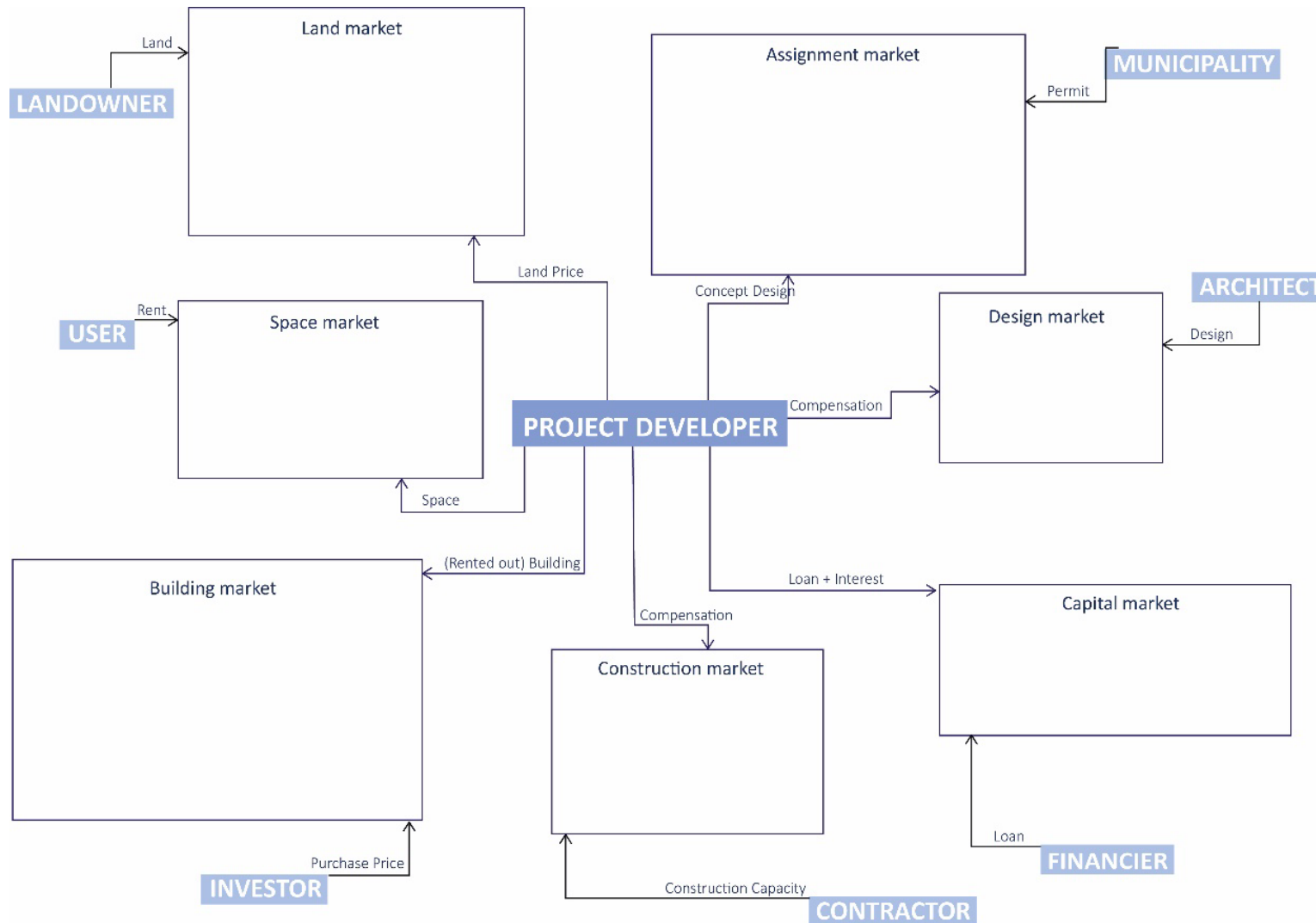
2. Climate risk data & disclosure

Disclosure



3. Real estate development

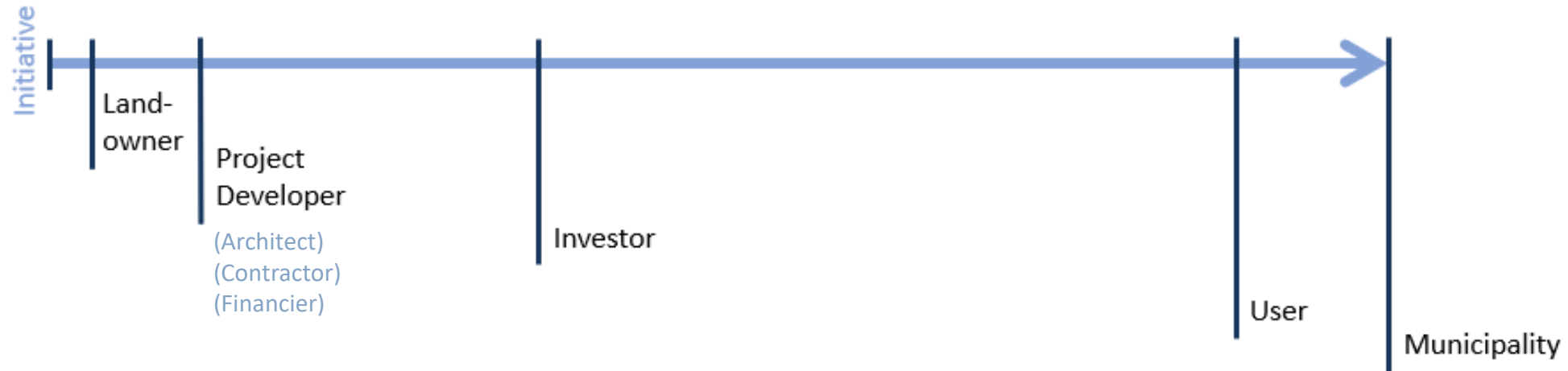
Development market structure



Project development market structure based on Peek and Gehner (2018)

3. Real estate development

Development market structure



Stakeholder timeline sketch (own work, 2025)

3. Real estate development

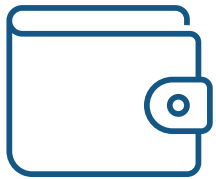
Types of developers

<i>Type of developer</i>	<i>Characteristics</i>
<i>Independent Developers</i>	Small-scale firms focusing on niche markets like housing, offices, or retail. Successful ones may be acquired by larger construction firms.
<i>Developers Related to Construction Firms</i>	These developers have a strong link to the construction sector and prioritize continuous cash flow to maintain operations.
<i>Developers Related to Investors</i>	Primarily develop or acquire properties for institutional investment portfolios. Their focus is on long-term value growth and maintaining steady cash flow, often with end-user involvement.
<i>Developers Related to Banks</i>	Large-scale firms linked to banks that act as financiers. With strong access to capital, these developers have historically acquired significant land holdings.
<i>Other Developers</i>	Companies from different industries, such as railways or retail, which engage in real estate development due to business opportunities related to their core activities.

Different types of developers (Heurkens, 2012)

3. Real estate development

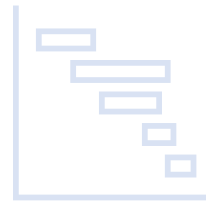
factors impacting climate adaptation (Shearer et al., 2013)



Financial capacity



Risk exposure



Project timelines



Market position



Innovation & adaptability



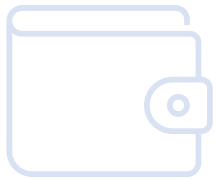
Regulatory compliance



Land banking

3. Real estate development

factors impacting climate adaptation (Shearer et al., 2013)



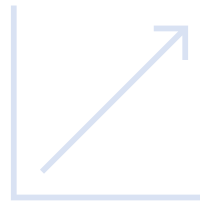
Financial
capacity



Risk
exposure



Project
timelines



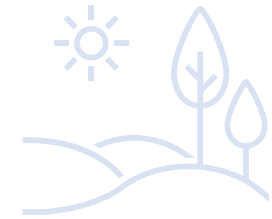
Market
position



Innovation
&
adaptability



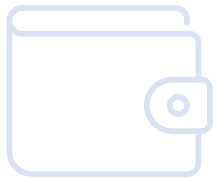
Regulatory
compliance



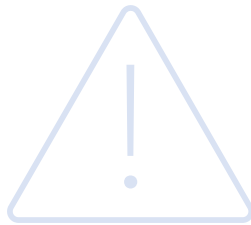
Land
banking

3. Real estate development

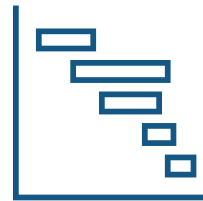
factors impacting climate adaptation (Shearer et al., 2013)



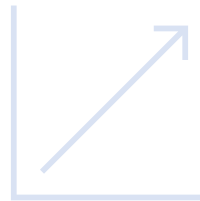
Financial
capacity



Risk
exposure



Project
timelines



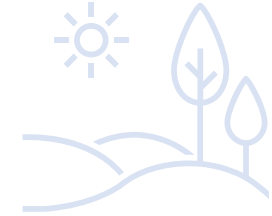
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banking

3. Real estate development

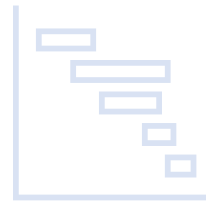
factors impacting climate adaptation (Shearer et al., 2013)



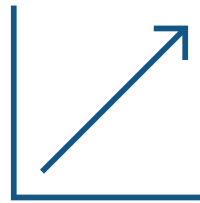
Financial
capacity



Risk
exposure



Project
timelines



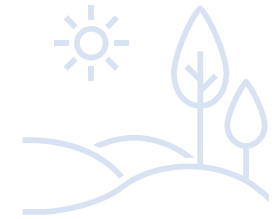
Market
position



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&
adaptability



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compliance



Land
banking

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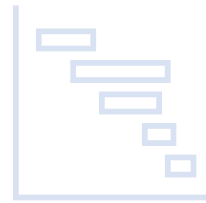
factors impacting climate adaptation (Shearer et al., 2013)



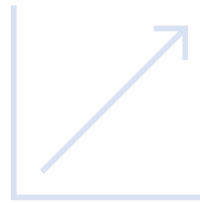
Financial
capacity



Risk
exposure



Project
timelines



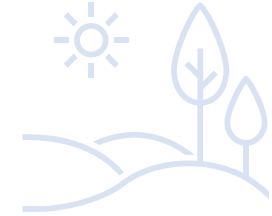
Market
position



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compliance



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banking

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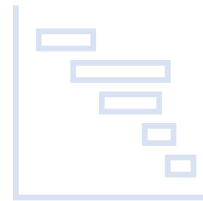
factors impacting climate adaptation (Shearer et al., 2013)



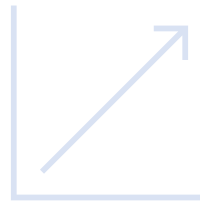
Financial capacity



Risk exposure



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Market position



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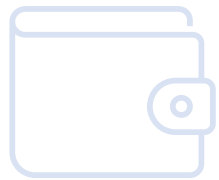
Regulatory compliance



Land banking

3. Real estate development

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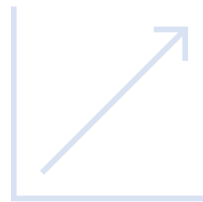
Financial capacity



Risk exposure



Project timelines



Market position



Innovation & adaptability



Regulatory compliance



Land banking

4.

EMPIRICAL RESEARCH

Interview

results: developers

Layer 1: Investment criteria

Climate risks rarely impact development choices

Layer 2: Risk integration

Awareness growing, but ad hoc

Layer 3: Market & regulation

Current pressure = mostly mitigation

Layer 4: Risk label views

Label may help dialogue

Layer 5: Behaviour & barriers

Developers act if market rewards it

Cross-analysis with Layer 0: organisational context

- Larger firms use structured tools
- Smaller firms rely on experience
- Listed firms feel pressure from shareholders
- Corporate owned firms have little external pressure
- Independent developers act more opportunistically
- Large-scale projects = more room for adaptation
- Small inner-city sites = limited options, often tension with mitigation

Interview

Other market players

Investors (2x)

1. Conduct climate scans (flooding, heat, subsidence) at address level
2. Focus mainly on local/asset-level risks, not systemic (e.g. river flooding)

Banks (1x)

1. Adaptation less embedded than mitigation
2. Focus on risks for asset safety, (e.g. flooding and land subsidence)

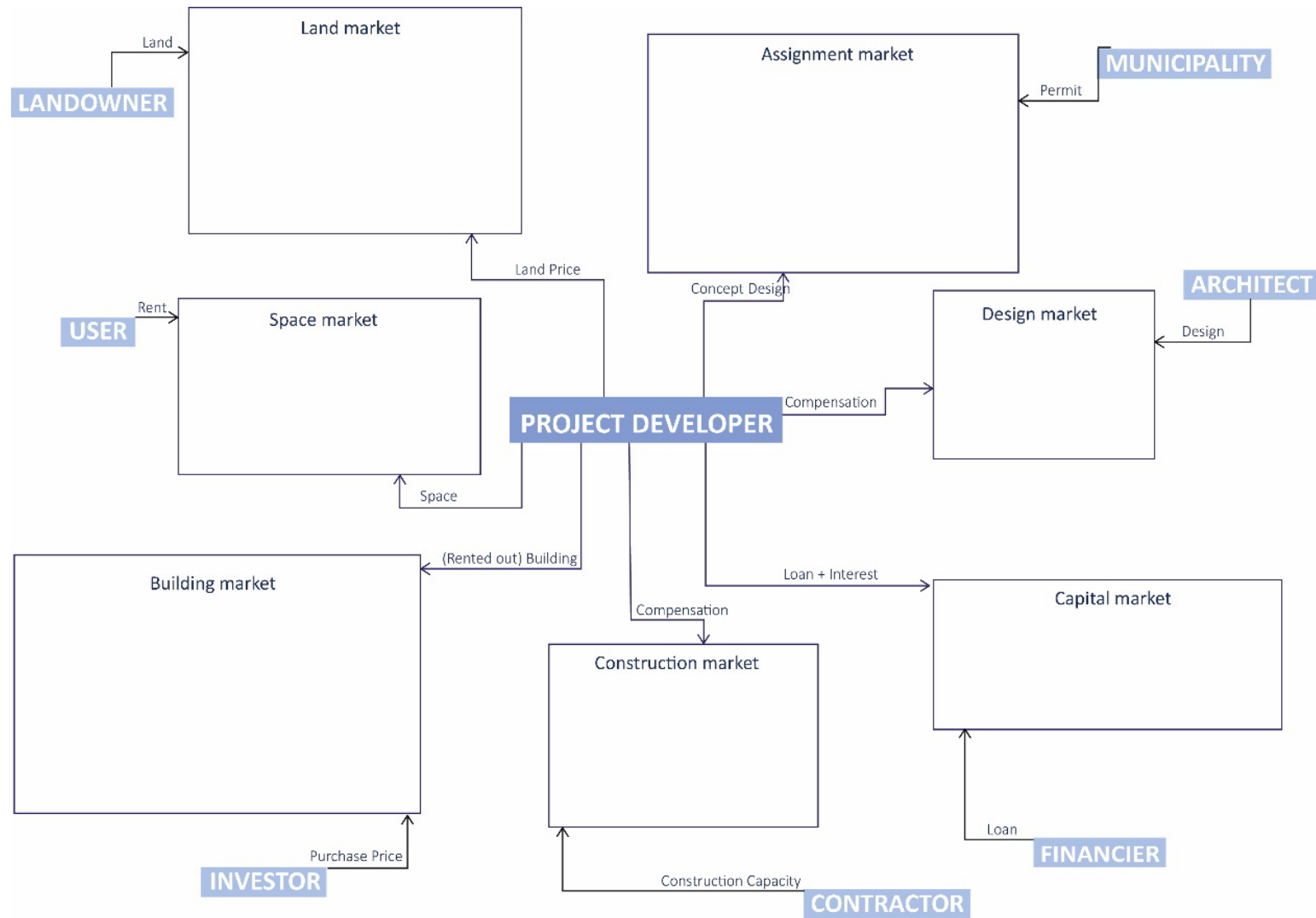
Municipalities (1x)

1. Land and development department limited influence
2. Focus on liveability

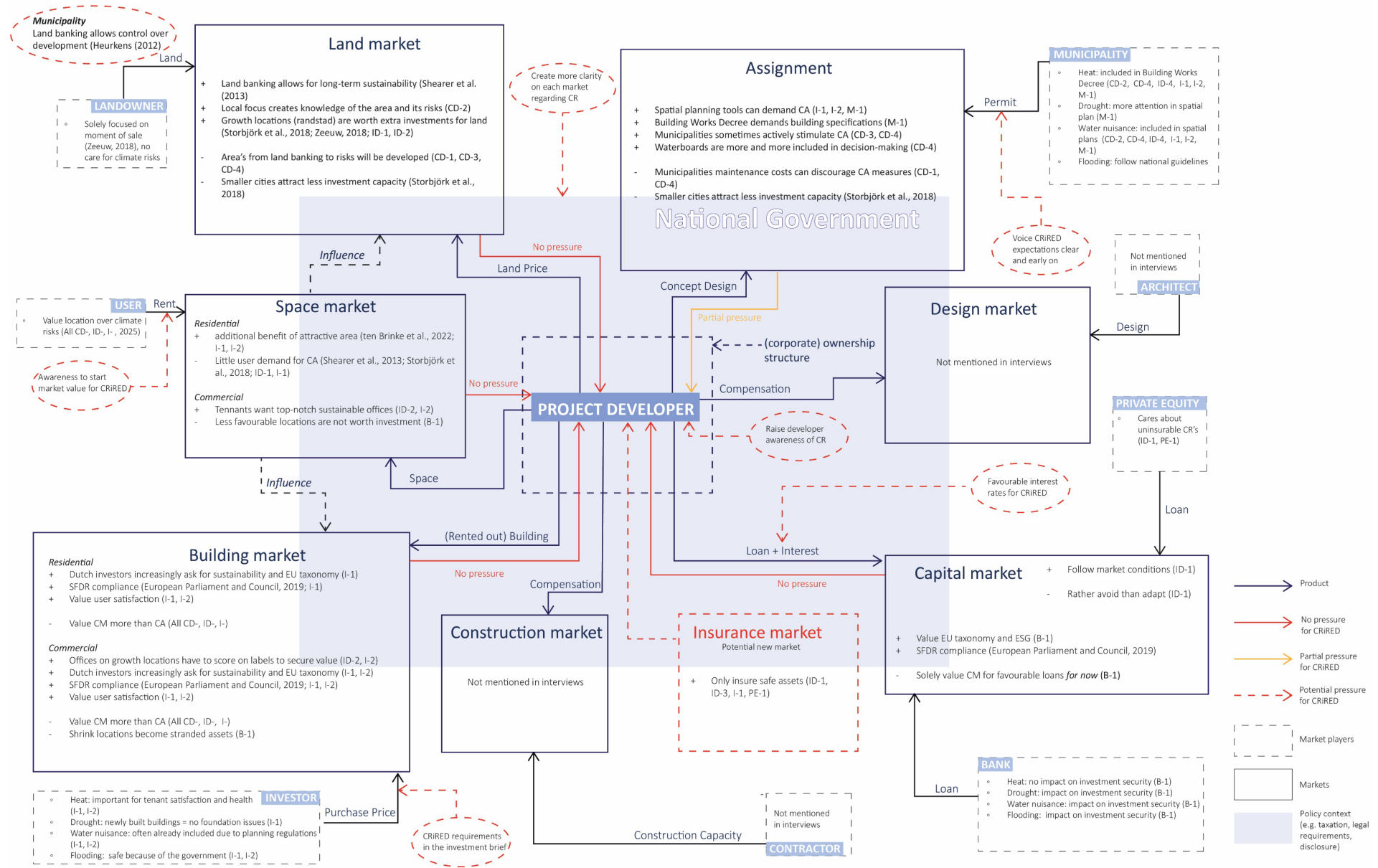
5.

SYNTHESIS

Synthesis

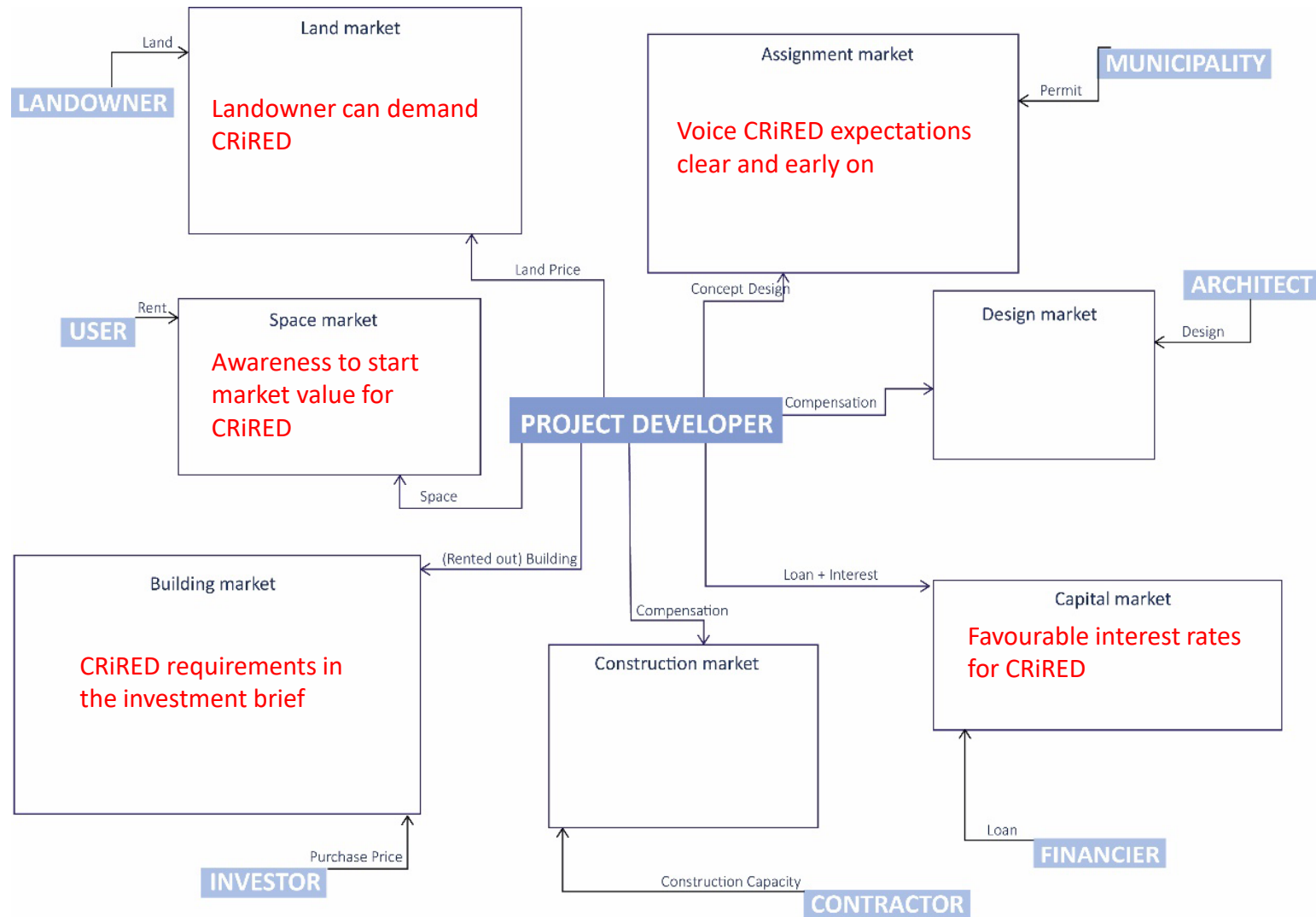


Synthesis

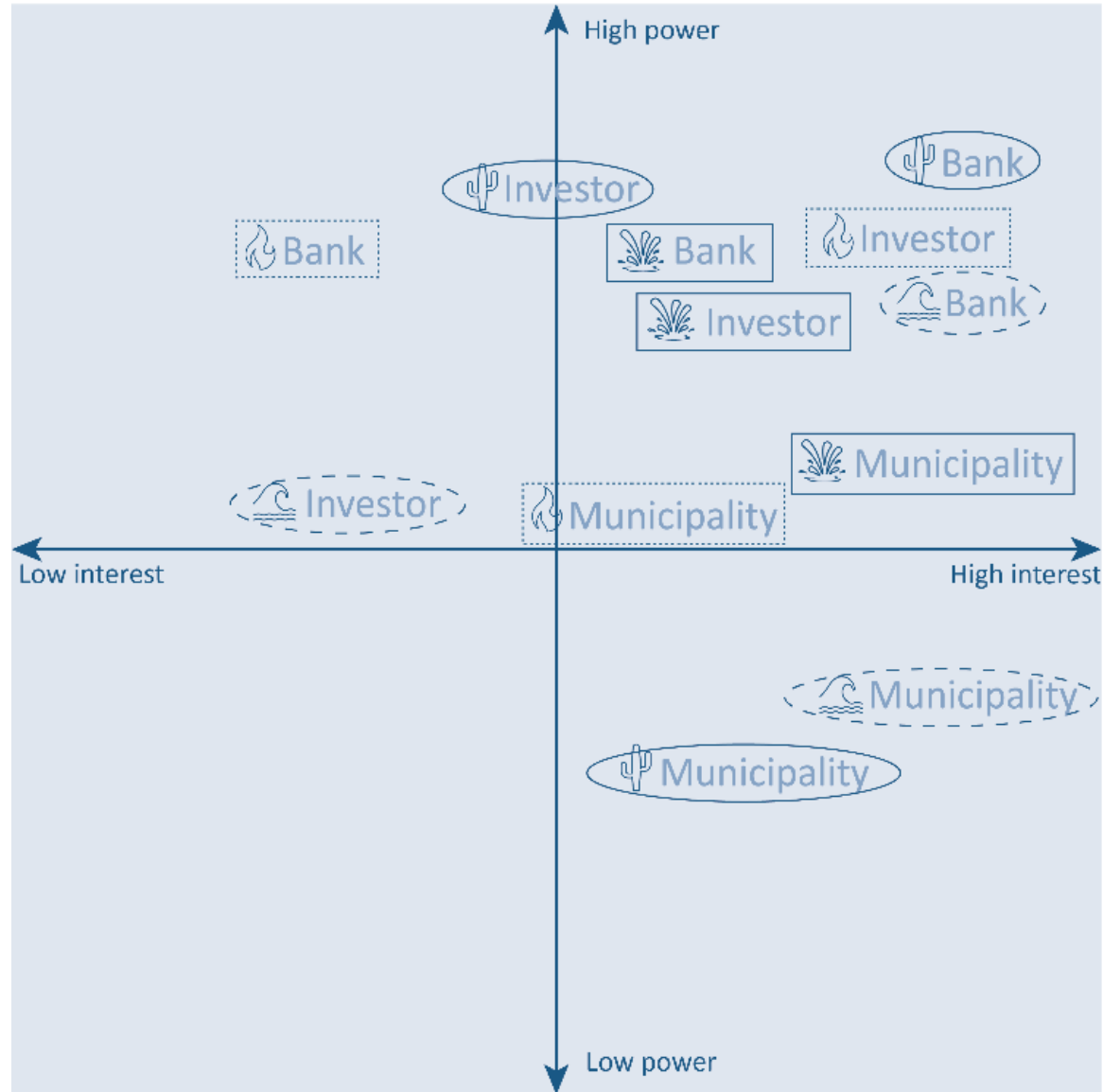


Systemic overview of markets and its actors influencing developers' climate risk integration

Synthesis



Synthesis



LEGEND



Heat stress



Foundation issues



Water nuisance



Flooding

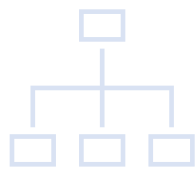
6.

DISCUSSION & CONCLUSION

Discussion



Organisation
type



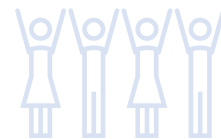
Ownership
structure



Investor
expectations



Regulatory
influence



Stakeholder
priorities



Timing of
involvement



Climate risk
label

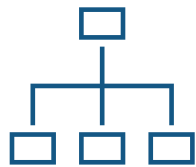


Financial
leverage

Discussion



Organisation
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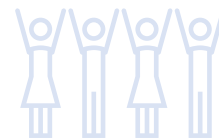
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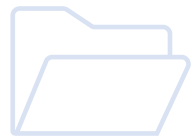


Climate risk
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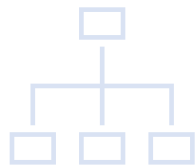


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Discussion



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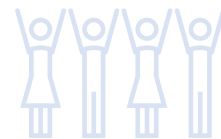
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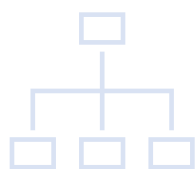


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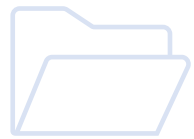


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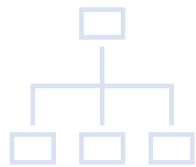


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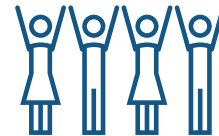
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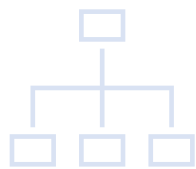


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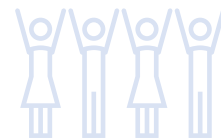
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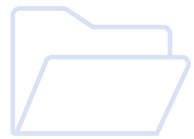


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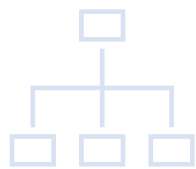


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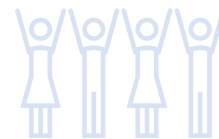
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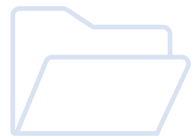


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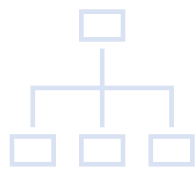


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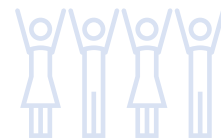
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label



Financial
leverage

“Money will set a lot in motion”

Conclusion

subquestions

RQ1: What physical climate risks are relevant for real estate development in the Netherlands?

- Heat stress, water nuisance, soil subsidence, drought, flooding
- National flood risk seen as “covered” by protection systems
- Each stakeholder prioritises risks differently

RQ2: Which actors play a role in integrating climate risks into real estate development?

- Developers, financiers, investors, governmental bodies
- Additional: end users & insurers (emerging role)
- Incentives are effective when clear, enforceable, or financially attractive

Conclusion

subquestions

RQ3: How do developers address physical climate risks in real estate development?

- Climate risks are not of influence in development decisions
- Climate adaptation is integrated in some projects (often externally obligated)
- Large-scale or internal ambitions lead to more climate adaptation in projects
- Adaptation still < mitigation

RQ4: What leverage points exist to enhance climate risk integration in real estate development?

- Capital market: favourable financing conditions for addressing climate risks
- Building market: investors requirements being communicated to developers
- Assignment market: include climate risks in zoning & public tenders, develop national regulations
- Space market: awareness under users could create market demand
- Insurance market: insurability decides whether a project is financially attractive

Conclusion

main research question

“To what extent do physical climate risks influence decision-making in real estate development?”

- Climate risks are rarely addressed structurally
- Land banking leads to risk-vulnerable locations being developed
- Risk assessments = reactive, fragmented, and unstandardised
- Developers follow external demands, especially when financing is involved
- Larger, integrated firms respond more systematically
- Inner-city plots less climate risk integration than large area projects

Recommendations

Research recommendations

- Quantitative validations of findings
- Researching leverage points
- The emerging role of the insurance market
- Regional differentiation beyond the Randstad
- The influence of government protection narratives
- Land banking and risk integration

Practical recommendations

- National government: long-term, climate-informed spatial guidance
- Municipalities: embed adaptation requirements in planning tools
- Banks: move from portfolio-level to asset-level risk assessments
- Institutional investors: align acquisition criteria with adaptation goals
- Developers: build internal tools to evaluate climate risks early and project-specifically

Recommendations

Research recommendations

- Quantitative validations of findings
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Practical recommendations

- National government: define development zones
- Municipalities: embed adaptation requirements in planning tools
- Banks: move from portfolio-level to asset-level risk assessments
- Institutional investors: align acquisition criteria with adaptation goals

Recommendations Developers

1. Strengthen internal assessment

- Use open-source tools (Klimaateffectatlas)
- Internal ESG teams, or external consultants
- Make climate risk a standard design input

2. Align with stakeholder priorities

- Stakeholders value different risks
- Use these differences to initiate partnerships

3. Embed risks from the start

- Early inclusion improves budget control
- Enables integrated design
- Avoids costly fixes later

4. Initiate external dialogue

- With risk insights, lead discussions with other stakeholders
- Proactive stance may offer a competitive edge as climate risks gain weight in valuation

QUESTIONS?