R.R. Gorter – MBE Graduation lab P5

Flood risk labels

An investor's perspective



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By

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Abstract

The debate on climate risk labels in the Dutch housing market is gaining momentum, with opinions divided on their potential benefits and drawbacks. This thesis delves into the impact of flood risk labels on the housing market, focusing on residential real estate owned by professional investors. By adopting an investor's perspective, the study examines the implications of various flood risks, including those from main water systems, regional areas, and heavy rainfall. The research design incorporates a literature review, a questionnaire, and an expert discussion to validate the findings. The literature review explores the investment landscape in the Netherlands, existing labels in real estate, and sustainability reporting. The empirical research involves a questionnaire distributed to professional investors, followed by an expert discussion to validate the results. The study aims to understand how flood risk labels influence investment strategies and climate mitigation efforts. The findings reveal that flood risk labels somewhat benefit the decision-making process of professional real estate investors in the Netherlands. Investors consider flood risk labels as a valuable tool for risk reporting and guiding investment decisions in the face of climate change. The study contributes to the ongoing discussion on the necessity and design of climate risk labels, providing insights into their potential to improve housing valuations and investment strategies. Keywords: Housing labels, Flooding, Risk perspective, Residential investment, Climate risk

Preface

The Dutch have long specialised in water and flood management. This motivated me to study civil engineering in the Netherlands and later pursue Management in the Built Environment. Recognising the significance of maintaining our society as safe and accessible has been a primary focus throughout my studies. This research is a product that perfectly highlights my passion in both water safety and urban context. Converting technical issues into financial solutions using available resources. A flood label could be one of the next.

Finding a perfect label might not exist, as there is always someone who benefits less than others. It is therefore crucial to understand how labels impact us. Not only financially, but also social and environmental impacts have to be considered. Only when a balance between these impacts has been found, and do not irreversibly neglect members of our society, will a label benefit society. The aftermath of disadvantages and how we deal with them are equally important. It can be argued that the residents of Groningen have not fully recovered from the significant interventions that occurred during the gas drilling activities in the area. A similar situation should be avoided when addressing climate risks. This is why this topic is of such importance to me.

Fortunately, I have been supported by a team of highly intelligent individuals who have assisted me in navigating this complex puzzle, which contains numerous components that require resolution. I would like to extend my gratitude to Zac for dedicating his valuable time to guide this process and helping me comprehend the complexities of the subject. I would also like to extend my gratitude to Maria and Michaël for their guidance on the financial domain. It has been a pleasure working with you.

In addition, I would like to thank Juul, who has mentored me during my internship at Akro Consult. The company did not influence this research, but her guidance as an alumna has been excellent from the start.

Finally, I would like to thank my family and friends. My girlfriend, Fleur, has always listened to me when discussing new insights. The same applies to my parents and colleagues, Paul and Kenrick, with whom I have shared many academic discussions during my studies.

It has been a pleasure.

Sincerely,

Rick Gorter Curaçao, Willemstad January 2025

Executive summary

Climate change is bringing many complications to our society and the built environment. Within the Dutch real estate sector, several climate change events arise, including flooding, heavy rain, and extreme groundwater levels. The significance of these risks is being demonstrated as 59 percent of the Dutch surface area is vulnerable to flooding. The focus is laid on flooding where water is flowing into the building from the outside surface when the water's origin is a body of surface water or rain. Investors in Dutch residential real estate are troubled by the increase in flood risks because of several factors. The combination of unreliable data, unclear action perspective and different stakeholder values drive the concerns for investors. One possible solution to increase flood risk transparency is the use of climate-risk labels. A climate risk label should provide standardised climate risk information for each property in the Netherlands in an easily comprehensible format and consists of multiple risk indicators. What these labels should look like remains unclear. This thesis delves into the impact of flood risk labels on the Dutch housing market, focusing on residential real estate owned by professional investors. The study aims to understand how these labels influence investment strategies and climate mitigation efforts. By adopting an investor's perspective, the research examines the implications of various flood risks, including those from main water systems, regional areas, and heavy rainfall and examines the following research question:

How do flood risk labels impact the decision-making process of professional investors in residential real estate in the Netherlands?

The study exists out of two parts. The theoretical study has been conducted using a literature review on the investment landscape in the Netherlands, the decision-making process, existing label, sustainability reporting and water governance in the Netherlands. The empirical study exists out of a 15-minute questionnaire covering responsibility, motivation for assessments, label elements and action perspectives. An expert meeting has been arranged to validate the findings.

Findings

The findings suggest that while flood risk assessments and building characteristics are recognized as important, there is a reliance on external sources and consultants. Additionally, there is a positive outlook on the utility of flood risk labels, though some concerns regarding costs and public investment remain.

For instance, most respondents indicated that they outsourced flood risk assessments, with only one organization in each investor group conducting in-house assessments. This outsourcing might lead to a lack of awareness among investors about the methods, metrics, and data used. When respondents were knowledgeable, they pointed to specific methods and metrics, notably the Framework for Climate Adaptive Buildings (FCAB) part 1 by the Dutch Green Building Council (DGBC) and the NL Greenlabel Quickscan. Commonly mentioned metrics included door sill

height combined with inundation depth, expected loss in value, chance of flood development, and land subsidence. Data sources included Klimaateffectatlas (KEA), Climate Adaptation Services (CAS), and Sweco, with site inspections also playing a role.

Moreover, the physical attributes of buildings were assessed separately from flood scenarios, focusing on structure, layout, and finishing. Out of all respondents, only ten actively evaluated these characteristics. The DGBC's FCAB part 2 was frequently referenced. In these assessments, the use of consultants and communication with technical staff such as asset and technical managers, as well as documents like floor plans, were common practices.

Finally, investors generally held a positive view towards flood risk labels, especially among insurance companies. Respondents agreed that flood labels help in climate risk reporting and acknowledged their potential to improve investment decisions and inform mitigation efforts. Nevertheless, there were varied responses, with some investors expecting higher operating costs and increased public investments to support flood-prone areas.

Discussion

Flood Risk Identification

In the realm of real estate investment, accounting for various risks, including flood risks, is a standard practice. However, investors face challenges in accurately quantifying flood risks due to their complex origins. Typically, these risks are assessed by consultants using detailed topographic data and maps. The research highlights that flood risks are identified in high-risk areas, but there is a lack of focus on spatial elements in urban areas, which is essential for effective flood risk management. A proposed uniform label aims to translate urban context into a risk classification understood by financial institutions, increasing awareness and mobilizing stakeholders. Although the label assists in risk reporting and financial impact consideration, it does not directly address flood risk management, suggesting an indirect effect on market valuations over time.

Risk Response & Mitigation

Historically, flood risk management has been a national responsibility in the Netherlands, with water boards and municipalities playing crucial roles. The thesis reveals that investors recognize increased flood risks and believe that the national government, municipalities, and water boards are primarily responsible for adaptation. Investors incorporate flood risks into their investment decisions, considering factors like expected outgoings and required rates of return. While flood risks impact the property market, particularly in low-income areas, the introduction of flood labels could lead to higher operating costs and rents, raising concerns about housing affordability and the wealth gap. The thesis underscores the importance of balancing risk mitigation with housing affordability to ensure fair and sustainable urban development.

Conclusion & Recommendations

In order to answer the research question, flood risk labels impact the decision-making process by having some benefits towards investors. A flood risk label can help with:

- Risk reporting
- Making better investment decisions
- Anticipating higher operating costs over investments
- Communication with stakeholders

When a "risky" label score is assigned, investors often consider higher anticipated costs for mitigation efforts and insurance premiums, take future insurability into account, and further diversify their portfolio. Investors are not expected to discount the rent over investments or refinance their investments.

This study contributes to the ongoing discourse on the necessity and design of climate risk labels. For flood risk labels to be effective, certain preconditions must be satisfied. Furthermore, the study addresses the potential conflicts with other aspects of the built environment, such as housing affordability, liveability, and the possibility of unfair disadvantages resulting from risk labelling. Therefore, policy recommendations have been made.

- Update weather models regularly for real estate investors.
- Collaborate on unit measurements for better communication.
- Develop flood mitigation strategies with municipalities and water boards.
- Consider the impact of new developments on flood risks.
- Provide financial incentives to support investment in low-income areas.
- Avoid pricing flood risks on individual assets to prevent unfair disadvantages.

List of abbreviations

AFM	The Netherlands Authority for the Financial Markets
AHN	Algemeen hoogtebestand Nederland
CAS	Climate Adaptation Services
CRSD	Corporate Sustainability Reporting Directive
DGBC	Dutch Green Building Council
DNB	De Nederlandsche Bank
EFRAG	European Financial Reporting Advisory Group
ESG	Environmental, Social, and Governance
ESRS	European Sustainability Reporting Standards
I&M	Ministry of Infrastructure and the Environment
IPCC	Intergovernmental Panel on Climate Change
NAS	National Adaptation Strategy
NFRD	Non-Financial Reporting Directive
PBL	Plan Bureau Leefomgeving
SEC	Securities and Exchange Commission
SFDR	Sustainable Finance Disclosure Regulation
SMEs	Small and Medium-sized Enterprises
TCFD	Task Force on Climate-related Financial Disclosures

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1 Introduction

1.1 Problem statement

Urgency of addressing climate-related risks

Climate change is bringing many complications to our society and the built environment. Within this broader context of climate risks, addressing flood-related risks in real estate has become increasingly urgent due to the growing need for a better understanding of environmental changes in urban development (Daamen & Taylor, 2022). Within the Dutch real estate sector, several climate change events arise, including flooding, heavy rain, and extreme groundwater levels. The significance of these risks is being demonstrated as 59 percent of the Dutch surface area is vulnerable to flooding. Understanding the different types of flooding is crucial for assessing the associated risks and insurance implications. Flooding can occur due to various reasons, such as main water systems, regional areas, and heavy rainfall. Each type of flooding presents unique challenges and impacts on real estate investments. It is important to note that not all types of flooding are covered by standard insurance policies (Deltares, 2018). Primary floods are floods that originate from primary water bodies such as the sea, main rivers and lisselmeer. Secondary floods subsequently originate from connecting water bodies and are protected by secondary flood defences. Since the national government is responsible for primary flood defences, insurance policies exclude damages caused by primary floods (AFM, 2021). Secondary flood damages are insured in most cases. Additionally, to that, the heavy flooding in Limburg in 2021 is an example of the destruction flooding can cause and was a mixture of primary and secondary flood systems. In such a scenario, the flood is treated as a primary flood. This distinction is vital for investors to make informed decisions and to ensure that their properties are adequately protected against all potential flood risks.

Some effort has been made to prepare the real estate sector for dealing with climate risks. The first Dutch national climate risk analysis has been made in 2015 (PBL, 2015a, 2015b). This has been part of the national climate adaption strategy (NAS) in 2016 (I&M, 2016). The Netherlands Authority for the Financial Markets (AFM) highlights the potential damage homeowners and investors may face due to climate change, which is not reflected in housing prices. The AFM is the financial services regulatory authority in the Netherlands, comparable to the SEC in the United States. The lack of awareness about climate-related risks can have severe financial consequences for both homeowners and investors, underscoring the necessity for a deeper understanding of the actual risks and strategies to navigate them. This creates an urgency to create more transparency and collaboration of the risks involved and how to deal with them.

Challenges in investment decision-making

Before an investment decision is made, multiple factors are assessed that consequence the risk of the investment. Flooding risks might just be part of that assessment. Investment decision making is dominantly affected by the risk & return of the investment opportunity (Bispinck, 2012; Farragher & Savage, 2008; Gehner, 2008; Virlics, 2013). Building on the principles of risk & return, a balance is desired between the starting capital given and the profit in return (next to additional objectives). At the same time, investors are confronted with flooding risks, challenging investment decision-making even more. This is a result of three main factors.

1. Unreliable climate risk data

Firstly, determining flood-risk is difficult when data is perceived as "unreliable", and "outdated", as well as simulation models are "flawed" and the output is "unsuitable" for specific uses (AFM, 2023; Bani et al., 2024; Bin & Landry, 2013; Votsis & Perrels, 2016; Zhang & Leonard, 2019). This indicates the possibility that there is no clear indication what data can be used for what method. If this is true, data used for flood risk assessments is equivocal as it can be open to multiple interpretations. There still needs to be clarity on what data is used, and what the data is used for.

2. Lack of clear action perspective

Secondly, there is no clear action perspective for investment decision makers on how to navigate the climate risks (Bani et al., 2024). This can vary among different strategic levels, being Portfolio & investment management, asset management or facility management (Autio et al., 2023). Risk & return is the primary driver for investor real estate management and climate risks are opening an entire new playing field. For investors, climate change can significantly increase the physical risk profile of investments. Failure to effectively combat future climate risks can eventually result in financial damage to businesses, industries, infrastructure and society generally (Attoh et al., 2022). However, studies have shown that companies do not report the costs of physical climate change consequences or often underestimate them (Goldstein et al., 2019).

Apart from not clearly knowing the consequences of physical or transitional climate risks, it is also difficult to model the benefits of adaptation measures in quantitative terms. This is because it involves reductions in consequences that are sector-, location and context-specific (Sanderson & Stridsland, 2022). Different models, used by different actors, can work in a certain situation and fail in another. Being unable to measure the benefits of such adaptations, it becomes difficult to justify the expenses made in the investment returns. Pressure is growing on investment decision-makers as flooding risks are increasing but not identifiable through a constant price reflection. This makes it rather difficult to predict a clear action perspective for investors. There needs to be more clarity on how investors perceive flood risks and how this influences their behaviour when making investment decisions.

3. Different investor values

Thirdly, decision-making is affected by what type of investors are involved, as they each carry different values and responsibilities. Multiple investors are included in the value chain of (urban) developments. More importantly, different financiers of investment capital each have their own characteristics, risk & return preferences and investment horizon (Heurkens et al., 2020). How these actors perceive climate risks and engage in the decision-making process, differs from another as they each have a different risk & return balance to maintain. More clarity is needed about how the different type of investors perceive flood risks.

The combination of these three factors is what makes decision-making under increased flood risks challenging to grasp. There currently is no one way to understand and define the "risk". One possible solution to increase flood risk transparency is the use of climate-risk labels. A climate risk label should provide standardized climate risk information for each property in the Netherlands in an easily comprehensible format and consists of multiple risk indicators. This information stimulates preventive action and ensures a better reflection of climate risk in housing prices (Bani et al., 2024). By addressing possible risks, the label helps investors making a well-considered investment decision.

Challenge of Investment decision-making



Figure 1: Challenges of flood-risk decision making

The climate risk label

The discussion around climate risk labelling on real estate is catching momentum as the AFM mentions the need for reflecting climate risks in housing prices (AFM, 2023). National banks expand on this by suggesting policy interventions (Bani et al., 2024). Some reports have covered the effects of climate change in the Netherlands (lenM, 2016), it's exposure namely on financial institutions (DNB, 2021), and possible transition risks (DNB, 2022). None have covered the effects of climate risk labels within decision making. Deltares has explored some opportunities and challenges regarding water labels (Deltares, 2023). This gives us insights into what is known about climate labelling and how the market may navigate the climate effects, such as waterlogging, heatwaves, and prolonged drought. Among these risks are water-related issues such as pluvial and groundwater flooding (CAS, 2019). For this thesis the focus is laid on flooding where water is flowing into the building from the outside surface when the water's origin is a body of surface water or rain.

The relative new discussion surrounding the need for a climate risk label needs better understanding of the full effect of risk labels. The challenge in forming a clear action perspective for investors in the residential sector within the Netherlands remains (Bani et al., 2024). Labels are supposed to make decision-making easier, but there is no clear layout of the label yet. The letter by the banks, the AFM, DNB and Deltares have all touched on the subject of climate labels in the context of the homeowner, -buyer and -seller. These self-occupied investors make more emotional decisions, while professional investors, such as real estate investment funds, housing corporations, banks or other institutional investors, base decision-making on more rational choices (Özogul & Tasan-Kok, 2020). This is what creates the differences between how selfoccupied investors and professional investors respond to labels. One simple example is that selfoccupied investors want to live nearby family and friends while professional investors might have never seen the area.

The social effects of the climate label are equally, if not more important to the discussion. The debate revolves around the housing market getting shocked with price discounts and whether this is just. It will create commotion about the data being used, if it's accurate and if the ones making

the label are doing so in a fair way to the homeowner. This is outside the scope of this thesis, but important to take into account when drawing conclusions.

To conclude, there is a discussion on whether climate risk labels are needed to make more effective investment decisions and create better housing valuations with reflected climate risks. What these labels should look like remains unclear. This thesis strives to answer on how professional investors will respond to the introduction of climate risk labels, specifically the flood risk labels. We want to know what could be expected from investors and how this could impact (area) developments. For this an answer is needed on what motivates investors to assess flood risks, what data is used, how this data is used and if data presented within a label provides enough information to make a well considered investment decision.

1.2 Research gap

Literature has been done to decision-making strategies within real estate, including risk management and adaptation strategies (Gehner, 2018; ULI, 2022; Virlics, 2013). Part of that research also introduces climate-risk vulnerabilities but mention the lack of reliable data (Bani et al., 2024; Bin & Landry, 2013; Votsis & Perrels, 2016; Zhang & Leonard, 2019). Nevertheless, risk premiums have been identified and some price changes to coastal, flood-plains or metro areas have been found (Clayton et al., 2021; Fu et al., 2016; Meier et al., 2021). This demonstrates that flood events do have an effect on real estate valuations.

However, very little research has been done on the labelling of risks in real estate properties. What has been written about concerning the reflecting of climate risks within housing values has only been done in the context of homeowners. While risk-labels do not increase the actual risk on real estate, it is intended to increase transparency and thus makes risks more visible to investors. It would be beneficial to the discussion of the risk label to discover how real estate investors respond to the label in terms of physical and transition risks. The risk label should guide the investor in the decision-making process, but does it? And if so, how does it help?

1.3 Research objective and questions

The goal of this thesis is to understand how flood risk labels are used by real estate investors, which data is used and what metrics or methods are used for flood risk assessments. The research problem is focused on the influence of the flooding related part of the climate risk labels. For these labels, it focusses on the investment decision-making process in investor's residential portfolio in the Netherlands. Where possible, findings that influence housing affordability will be a secondary goal.

1.4 Research questions

Based on the problem statement this thesis is trying to address, the following research question to be examined:

How do flood risk labels impact the decision-making process of professional investors in residential real estate in the Netherlands?

In order to answer this research question, a set of 4 sub-questions are presented:

1. Who are the main professional investors in residential real estate in the Netherlands?

The potential risk label can have a different outcome depending on the stakeholder. Most of the reports that address climate risk labelling are written in the homeowner context. Homeowners could require different information in their decision-making process than professional investors (Özogul & Tasan-Kok, 2020). Getting a better understanding of the differences within the investment landscape can therefore be a good addition to the sub-questions.

2. How are different professional investors in Dutch residential real estate motivated to assess flood risks?

After discovering who the professional investors are, their decision-making process can be further explored. To be more precisely, why different investors assess flood risk can be explored. The idea is that flood risk is interpreted differently. The question remains if this is related to the type of investor.

3. Why, how and to what extend are professional investors taking flood-related risks into account during the decision-making process?

To make good real estate investment decisions, experience, good judgement and creativity need to be applied in a sophisticated decision-making process (Farragher & Savage, 2008). Within this decision-making process, an evaluation of risks and returns is common. Investor decision-making is a well-known topic, but are climate risks also involved? To find an answer to this question it is necessary to know the context surrounding the decision-making process of the investor.

4. How can a flood label help investors navigate climate adaptation over their investment portfolio?

A growing number of institutional investors are prioritizing ESG sustainability in their portfolio allocation (Giglio et al., 2021). The importance of sustainability and climate-integrated portfolios has been emphasized by BlackRock for achieving better risk-adjusted returns. ESG in finance is mainly being used for reflecting regulatory and market risks associated with high carbon footprints, but climate change is increasingly seen as a source of financial instability too (DNB, 2022). The paper by Giglio et al. also further elaborates on EU-taxonomy as it is supposed to help investors identify and prioritize investments aligned with sustainable goals. This is a lead in what professional investors are looking for when assessing their portfolio's exposure to climate risks. We already know that investors are assessing the (climate) risk over their investments, but we do not know the connection between that assessment and the possible label.

1.5 Relevance

This thesis strives to connect new parts of an already very complex puzzle. Finding new and better ways to address climate change effects in the built environment will only become more important. Whether risk labels are part of the solution is yet to be answered. Before this decision can be made, further understanding of the full effects should be reached. This includes the technicalities, financial consequences but even more importantly, social consequences.

1.5.1 Societal relevance

With climate change bringing more intense and more frequent flooding and water damages, and most of our economic activities take place in low-lying cities, it is crucial that we have prepared for the unknown (Deltares, 2018). Given the discussion surrounding the climate label, there are

social implications as it is almost certain that some people may get disadvantaged by its introduction.

This study aims to provide insights into the investment landscape following climate labels to better navigate climate risks for investors. When the objective is set and results of the label are clearer, a more balanced decision can be made following the contents and the implementation of the climate label. The thesis is relevant to society as it provides insights from the investor's perspective to researchers and professionals developing the label. Additionally, valuable insights can be provided to stimulate urban development where climate risks are increasingly present.

1.5.2 Scientific relevance

Following the letter by the biggest national banks (2024) as they urge the implementation of an uniform climate risk label, strong discussions are taking place regarding the contents of the label and if one label is suitable for all climate risks (Deltares, 2023). In the latter source, Deltares has explored applications of existing labels. The AFM (2023) has explored what the pricing of climate risks into housing valuations would mean for the mortgages and lending capacity of homebuyers. However, there remains a gap in understanding how professional investors would respond to the label. This study aims to answer on that matter following the main research question. It also adds to the body of knowledge on the perspective of investors on climate and flood risks.

Chapter 2



Research design Population selection Data collection Data plan Ethical considerations



2 Research Design

The research design has the purpose to discover the effects water risk labels have on the investment decision-making process of Dutch real estate investors. For this research, a multitude of methods are used to answer the sub-questions and main research question. A literature review is part of the theoretical part, while a questionnaire is part of the empirical research. Additionally, an expert discussion is part of the validation of the results. How this connects is shown in Figure 2.



Figure 2: Research design

The next sections describe the theoretical, empirical and validation part of the study. It also describes the selection of interviewees for the study. It finishes with the data plan and ethical considerations for this thesis.

- What can be learned about existing water labels for the context of climate-risk labelling?
- How are professional investors taking water-related risks into account during the decision-making process?

- How can a climate label help investors navigate climate adaptation over their investment portfolio?

2.1 Theoretical research

Starting with the theoretical research approach of this study, main subjects are explored through a literature review. The objective of the literature review is to grasp a better understanding of the related themes relevant to the research questions. These themes are divided in the following.



1. Real estate investment landscape in the Netherlands

Understanding the investment landscape and pinpointing key investors in Dutch residential real estate helps clarify the target groups for data collection. This includes the structure of the Dutch housing market and how ownership is divided as well as a clear understanding of the capital market in the Netherlands. In this theme a clear distinction in different type of investors is expected. Additionally, the characteristics of the different type of investors are expected.

2. Real estate investment decision-making

When the main investors are identified, their decision-making will be explored. This should build on the basics of decision-making theories. This theme explores how investors manage risk and where the decisions regarding risk assessment are expected. The different types of risk assessment tools are also explored. After examining investment decisions, a translation from climate risks to financial risks is reviewed. A study linking these two is expected to do so. This will link flood data and -risks towards actionable financial consequences.

3. existing labels in real estate

The literature review looks at existing label as there currently is no definition of a climate or flood risk label. Some water labels have been identified by Deltares (2023). Possible other labels and frameworks are also expected to be reviewed. International approaches to flood risk labelling and

their related experiences should be examined as well. The goal of this theme is to understand how a risk label is typically formulated and what flood risk elements could potentially be included.

4. Sustainability reporting

Big financial corporations report on climate impact from and towards their business operations. Flood risks are also included making the flood risk label an important instrument to those corporations. The goal within this theme is to understand climate reporting. This includes which parties influence what is and how is reported. Examining this allows to review financial reports from major corporations to understand their climate impact disclosures. This helps understand what corporations are looking for in climate assessments which can be used for questions in the questionnaire to test if other corporations do the same.

5. Water governance in the Netherlands

Ultimately, exploring the context of water management in the Netherlands is crucial for understanding the decision-making process. This is more contextual but necessary to understand the different roles within water governance, where it came from and how it is laid out in current policies. This helps in understanding the expectations investors have for flood risk adaptation efforts being made.

These subjects are addressed to provide insights into the investment decision-making process which is the goal of the theoretical research. Reviewing relevant literature helps in formulating more effective questions for the questionnaire.

The literature review uses sources found through the Scopus database. Additionally, valuable sources used in similar thesis reports are used. Apart from research papers, publications focused on flood-risks in the Netherlands are used such as: the letter by the banks (Bani et al., 2024), the report on water labels by Deltares (Deltares, 2023), the report by the AFM on pricing in flood risks (AFM, 2023) and the report by DNB on climate and transition risks (DNB, 2022).

The review answers on the following three sub questions:

- **SQ 1**: Who are the main professional investors in Dutch residential real estate?
- **SQ 2**: How are different professional investors in Dutch residential real estate motivated to assess flood risks?
- **SQ 3**: How are professional investors taking water-related risks into account during the decision-making process?

2.2 Empirical research

Moving on from theory, the empirical research continues to gain knowledge from experts in the field. The literature review produces the elements to be tested during the questionnaire. The reasoning behind this structure is to provide more meaningful questions for the questionnaire.

With in-depth knowledge gained of the decision-making process of important residential real estate investors, the <u>questionnaire</u> is formed to extend the research into the climate risks domain. The questionnaire is a low threshold that could be easier to gather input from. Data gathered from the questionnaire will be analysed, and a conclusion will be made to answer the research questions. The challenge with questionnaires is the lower level of respondents. While reaching

out to respondents, contact through a phone call could help. This also provides the opportunity to ask if the respondent is willing to participate in the expert discussion in a later stage of the research.

This empirical research will answer the following questions:

- **SQ 3**: How are professional investors taking water-related risks into account during the decision-making process?
- **SQ 4**: How can a climate label help investors navigate climate adaptation over their investment portfolio?
- **MRQ**: How do flood risk labels impact the decision-making process of investors in Dutch residential real estate?

2.3 Validation

Following the empirical research, an effort has been made to answer the main research question. To test the validity of the answer, an expert discussion will be held. The discussion will be organised for 'experts' who are in the middle of the decision-making process as well as well-known with the climate label discussion. The discussion can respond and discuss the results and conclusions from the empirical research.

2.4 Population selection

The objective of the questionnaire is to answer sub questions 3, 4 and the main research question in the empirical part of the study. A long list of possible participants is formed that fit the requirements for the questionnaire. The selection for the expert discussion is narrowed down in a short list of people.

The selection for the longlist is done using selection criteria that fit the relevance of this study. These criteria are listed below.

Questionnaire selection

- **Geographic location**: The investor must be active in the Netherlands.
- Market segment: Residential housing must be part of the investment portfolio.
- **Progress**: Projects must have been in the advanced state already (no newcomers).
- Information: There must have knowledge available about decision-making practices.
- **Collaboration**: Figures must be open to collaborate during the questionnaire.

For the expert meeting, different selection criteria are used. The pool of potential participants is smaller than for the questionnaire and further focuses on the profession of the participant. This can be clarified of the limited knowledge of the subject both in the market and literature. It has therefore been considered to select the same potential participants who have admitted to willingly participate in the questionnaire. The participants' familiarity with the subject and its terminology was beneficial.

Expert meeting selection

• Participation: Admitted having participated in the questionnaire

2.5 Data collection

During the study, different approaches are applied to answer research questions as shown in Table 1. There are different ways to collect the data needed to do so. The objective of the data collection is to provide both research methods with the needed knowledge for execution. For the theoretical research, a literature review is conducted based on available literature. The empirical research is supported by exploratory interviews and a questionnaire, and the expert discussion for validation. The exploratory interviews are only held to get a better understanding of ongoing discussions and context that are relevant to the study and no data will be stored.

Type of research	Data collected method	Amount	Output
Theoretical research	Literature review	Depending on available literature	SQ-1
		3 themes: investment landscape,	SQ-2
		decision-making, and labels	SQ-3
Empirical research	Questionnaire	One questionnaire, two parts	SQ-3
			SQ-4
			MRQ
Validation	Expert discussion	One session, between 3-6 'experts'	SQ-4
			MRQ

Table 1: Data collection methods used

The empirical research exists out of the questionnaire and the expert discussion. The questionnaire will be built up in several parts and the content is fed with output from the literature study. The expert discussion will be conducted by using knowledge and resources of experts in the field of climate labelling. To guide this session, knowledge gained from the questionnaire will be used. The discussion should be constructive, but critical.

2.6 Exploratory interviews

The exploratory interviews provide insights into the themes that have been explored during or after the literature review. The interviews are conducted in an open structure to allow the interviewee to freely move between the subjects. Additionally, the exploratory interviews help to organize the design of the questionnaire and select the population for the questionnaire. The interviews are not transcribed, as the interviews are only used for context. No data is gathered during the interviews. Participating interviewees are listed in Table 2.

Table 2: List of interviewees for exploratory interviews

Interviewee	Organization	Function
1	Bouw Invest	GIS Specialist
2	APG Asset Management	Portfolio manager
3	BPD	Area Developer
4	Deltares	Researcher
5	Waternet	Policy advisor
6	TU Delft	PhD candidate
7	AKRO Consult	Senior consultant

Additionally, an expert meeting was held to provide insights through thematic work groups. Resilient Delta organized the expert meeting. The discussions during the work groups resulted in valuable insights into the debate surrounding the use of climate labels on real estate.

2.7 Questionnaire

The questionnaire is used to gather large data sets. It consists of both multiple-choice and openended questions. The open-ended questions help to explain a certain answer (for example: do you think flooding is a considerable risk over your portfolio? If no, why not?). The questionnaire is divided into four sections. The format of the questionnaire can be found in Appendix A: Questionnaire (English).

Section 0 – Demographics

Short section to make a distinguish in the type of investor who is responding to the questionnaire. The options for this section are based on **SQ-1**. Only the type of investor is asked, as names, roles and responsibilities are irrelevant for the questions. Feedback from exploratory interviews and informal discussions have led to the advice to keep the answers as anonymous as possible. In contradiction to the workgroups at RED&BLUE or the Resilient Delta Initiative, not all investors are willing to share insights into their decision-making. The questions are therefore more focused on the risk perspective and try to grasp only a glimpse of decision-making perspectives.

Section 1 – Responsibility

This section sets a pre-condition to the rest of the questions. There appears to be some debate on insurability (AFM, 2021; Bin & Landry, 2013). For this thesis the influence of insurability on risk perspective could mean that investors are not experiencing flood events as a risk as long as their property is insurable to it. This is why this section asks who the respondent think is responsible for flood risk adaptation efforts and whether they are concerned about flood risks if their assets are insurable.

Section 2 – Financial motives for flood risk assessments

This section answers the why question and aims to understand the motives for investors to seek and use data for flood risk assessments. The motivations can be answered using a slider which indicates the degree of concern the respondent experiences. The different kind of motivations are based on the financial complications defined by Clayton et al. (2021). These effects have also been discussed in Investment decision-making.

Section 3 – Flood label elements

This is the longest section and dives deeper into the flood risk assessment part. When looking into components found in comparable labels as answered by **SQ-2**, there are different kinds of floods to take into account. Labels presented by Deltares (2023), Thidevall et al. (2023), and DGBC (2023) have all shown various sources of flooding. For this thesis the definition of flooding has been water the flows into the building from a surface area that originates from a body of water or rain. This means that a basement leaking groundwater from cracks in the foundation is not considered here. This definition has laid out four scenarios of flood sources.

- 1. Heavy rainfall that accumulates and enters the building through an opening near the surface.
- 2. High water levels at sea or in the rives and lakes.
- 3. Localised flooding due to water accumulation and/or failure of infrastructure over a longer period.
- 4. Rising groundwater and land subsidence increasing the risk of flooding on the property.

Section 4 – Perspective of action

The final section explores if respondent believe they posses' sufficient knowledge, data and/or methods to continue their investment decision-making process. It offers the opportunity to respond to what they feel is missing and if a label containing that information could offer a solution. The questionnaire ends with an attempt to grasp insights into the action perspective of the respondents. To do so, respondents have the option of agreeing or disagreeing with a financial action using a slider. The actions displayed here are in line with the concerns presented in section 1 and are retrieved from the mentioned studies (Clayton et al., 2021; de Wilde & Coley, 2012).

At the end of the questionnaire the respondents are given thanks, and the results are submitted to Qualtrics which safely stores the results. No email is requested from the respondents to keep data anonymous. Instead, the study will be sent to respondents who have responded to the invitation to participate with a message that they would like to receive the results. The combination of section 3 and 4 are the most important in attempt to answering **SQ-3**, **SQ-4** and **MRQ**.

2.8 Expert discussion

Following the preparation of the expert discussion, experts are invited to come together and discuss the gathered knowledge on the flood risk perspective of investors. The purpose of this discussion is to validate the conclusion of the research question best as possible. The discussion exists out of 3 to 5 experts each adding their own contribution to the discussion. At the end of the session a conclusion will be made. The consent form can be found in Appendix B: Consent form expert meeting (NL-EN).

Participants are chosen based on their willingness and availability to engage in the discussion. Additionally, the expert is connected to the subject of climate labelling through research or practise. The discussion is filled with investors or (flood) risk experts. Finding the participants of this discussion is done by connecting through the Resilient Delta programme as well as the RED&BLUE project, as well as the population pool of investors who participated in the questionnaire.

2.9 Data plan

The research data plan describes the many forms of data that are expected to be obtained from the study and provides instructions on how to process and distribute them. Among the expected data are:

- Transcripts and coding of interviews. These include personal information, professional information and sensitive information to the organisation.
- Questionnaires. These include personal information, collected through open and closed questions.
- Expert discussion notes. These are notes for writing a report of the expert discussion.

All participants must give informed consent before to the collection of notes, recordings, and transcripts because human participants are involved in the expert discussion discussions and the interviews, according to the HREC at the TU Delft. The Data management plan can be found in Appendix C: Data Management Plan.

The researcher is the owner of all data, notes and recordings from the questionnaire and expert discussion. The processing, archiving, and distribution of data both during and after the research project is completed are entirely the responsibility of the researcher. The data will be safely kept on Qualtrics for the duration of the study. Notes will be kept privately in the researcher's drive and removed at the end of the study. The completed report will be posted on the TU Delft repository, which is open to the public. When research is done inside a corporation, it could include data or sensitive information that is essential to the thesis. Strict procedures will be put in place in such cases to guarantee that this private data is not revealed to outside parties.

2.10 Ethical considerations

All data gathered for this study is voluntary. Prior to participation, participants must give complete consent, and they are offered the choice to remain anonymous. Strict adherence is made to privacy protection protocols, especially when handling potentially private information. It is crucial to always protect participants' privacy and confidentiality during the research process. It is made sure that the study's goals are not overstated. When presenting the study aims, integrity and transparency are upheld to prevent any misrepresentation of the goals. Upholding ethical behaviour guidelines is the goal of this investigation. These considerations align with principles of ethical considerations outlined by Diener and Crandall (1978):

- Informed consent
- Voluntary participation
- Anonymity
- Avoiding exaggeration of objectives

2.11 Research output

The primary goal of this research is to understand how water risk labels influence the investment decisions of professional investors in residential real estate sector in the Netherlands. These objectives include:

- Identifying key themes and trends related to water risk labels through a literature review.
- Gathering insights from industry experts via explorative interviews.
- Quantifying the consequence of water risk labels through a structured questionnaire.
- Validating findings through an expert discussion.

The main deliverables of this research include:

• Literature Review:

A comprehensive document summarizing the findings from the literature on water risk labels, investment decision-making, and related themes.

• Questionnaire Data Set: Raw data collected from the questionnaire, including responses and initial statistical analysis.

• Expert Discussion Report: A summary of the discussions and conclusions from the expert discussion session.

• Final Thesis Report:

A consolidated document presenting all findings, analyses, and conclusions from the research.

Chapter 3 Literature review

The investment landscape in the Netherlands The Investment decision-making process Existing labels in real estate Sustainability reporting Water governance in the Netherlands

3 Literature review

This chapter contains the literature part of this thesis, containing the literature framework and the review done by desk research. The goal of this chapter is to gain understanding of the context necessary to answer the sub-questions and, subsequently, the main research question. Main themes are further explored, in line with sub-questions 1, 2 and 3. These are:

- 1. the investment landscape in the Netherlands
- 2. the Investment decision-making process
- 3. existing labels in real estate
- 4. Sustainability reporting
- 5. Water governance in the Netherlands

The literature framework is show in Figure 3.



Figure 3: Literature framework

3.1 Investment landscape in the Netherlands

In this paragraph the investment landscape is explored. It is focused on the residential real estate sector within the Netherlands. This paragraph answers the following research question: <u>Who are the main professional investors in residential real estate in the Netherlands?</u>

The Dutch housing market is a unique one considering the strong presence of the social housing sector (Rijksoverheid, 2024a). In general terms, housing tenures are divided in owned and rental sectors, where for the Netherlands the social rented sector also needs mentioning. About 8 million dwellings exist at this current moment of writing. The rental sector is more interesting given the complexity of ownership. About 43% of dwellings are used for rental where 71% is owned by housing associations and 29% is owned by investors. Housing associations are organisations who are driven by social goals with the objective to provide social housing. Social housing is the

regulated part of the rental market where a liberalization limit is set to determine the maximum rental price of a social housing unit. Up until the 1st of January 2025, this limit is set on \in 879,66 (Rijksoverheid, 2024a). Investors on the other hand, are more focused on unregulated markets as institutional investors posses 55% unregulated rental dwellings and private investors 27%. The biggest group of home ownership belongs to the Owner-occupied group, possessing 57% of dwellings in total. An overview of the Dutch housing market is shown in Figure 4.

The division of dwelling ownership does not show the supply and demand of dwellings. It is difficult to draw a clear picture of who provides housing, and how much. Housing is built by contractors, paid for by investors, who either sell them or keep them for rental purposes. The investor perspective is central in this study. As mentioned before, professional investors are distinguished from individuals as there is a significant difference in decision-making by professional factors and emotional factors. One way to better understand the investor's perspective is to look at the capital market of real estate.



Figure 4: Structure of Dutch housing market, adjusted for 2024 (Eichholtz et al., 2014)

The purpose of the capital markets is to distribute financial resources between individuals and businesses looking for funds (Ling & Archer, 2004). This could be used in the context of any asset but is used in the real estate context for this study. Capital is used by those individuals and businesses in investment opportunities where a fee is paid in return on top of the outstanding loan.

The two main sides of the capital markets are debt interests and equity interests. The equity players are typically seen as the "owners of the real estate." The debt players are seen as the lenders of the funds. Both the equity and debt interests can be further divided into private and

public markets. The primary actors within each type of market combination; equity, debt, private, public, can be seen in Table 3.

Market types	Private markets	Public markets
Equity/owners	Individuals, partnerships, limited liability corporations, private equity funds	Public real estate investment trusts (REITs) and real estate operating companies
Debt/lenders	Banks, insurance companies, finance companies, private lenders	Commercial mortgage-backed securities (CMBs) and mortgage REITs

Table 3: Four quadrant of real estate capital markets (Ling & Archer, 2004)

When looking at these type of capital markets it becomes clear that both equity and debt investors play their own role within financing of residential real estate properties. Equity investments include direct property ownership or equity REITs. Funds are acquired through debt investments, so the requirements set for equity investments are highly dependent on the type of debt investor. Among these debt investors, institutional investors are included. Institutional investors can be defined as "financial institutions which as a consequence of their main function secure the disposal of funds which in particular a long-term investment has to be sought" (Conijn & Papa, 1988). With this definition, pension funds, insurance companies, social funds, saving and giro banks and investment institutions are included in the group.

To put this all together, this thesis focuses on investors both in the debt capital market and in the equity capital market who have responsibilities towards investors in the debt capital market. They possess direct ownership of real estate properties and can use multiple management layers to reduce risks.

The total amount invested by professional investors in real estate was 75 billion in 2016 (Klapwijk et al., 2017). These have been laid out in Figure 5. Here it shows the distribution over different actors. Professional investors are defined by Klapwijk et al. (2017) et al. as institutional investors, including mutual funds, foreign firms, both listed and unlisted, insurers, and pension funds. Following this data, the conclusion can be drawn that pension funds are among the most important professional investors as they are responsible for 32% of the total investments. Foreign companies follow with 29%. Furthermore, real estate funds and insurance companies are responsible for 17% and 15% of the total investments.



Figure 5: Size of real estate investments in the Netherlands by professional investors (Klapwijk et al., 2017)

Further literature review should be done to understand the key players in the Dutch capital market for the realisation of residential real estate. Once these players are found, their roles, responsibilities and investment activities should be explored where possible. Finally, new trends in the investment landscape should be explored to determine future relevance of different key players.

3.2 Investment decision-making

As mentioned before, to make good real estate investment decisions, experience, good judgement and creativity need to be applied in a sophisticated decision-making process (Farragher & Savage, 2008). The study by Farragher and Savage (2008) focuses on equity investors in real estate. Different stages of the decision-making process have been defined; setting strategy, establishing return/risk goals, searching for investments opportunities, forecasting expected returns, evaluating forecast returns, assessing risk, adjusting for risk, decision-making, implementing accepted proposals, and auditing operating performance (Farragher & Savage, 2008). The following paragraph is a summary of the results presented by Farragher and Savage (2008). A detailed figure of the process is shown in Figure 6.

Focusing the search for suitable investment opportunities can be achieved by formulating a strategic analysis and establishing strategic investment goals. Most of the respondents in the study by Farragher and Savage (2008) have set strategic investment goals. There are differences in the type of factors that influence the decision-making process. This difference is based on the management scale of the investment process. Strategic factors, portfolio factors and individual project factors each play their own role. institutional investor respondents place greater importance on strategic factors than do private investor and/or developer respondents.

Compared to responders who are private investors or developers, institutional investors give more focus to strategic factors.

Next, investors should establish a minimum rate-of-return and a maximum acceptable risk that are in line with the strategic goals of the organization. While most of the organizations that participated in the study by Farragher and Savage (2008) have set out the minimum required rate-of-return, a much smaller percentage (44%) have quantified a maximum acceptable risk standard. This risk standard is generic and does not have to include climate risks yet. The assumption is that even a lower percentage has set out a maximum acceptable climate risk standard quantitively. Once a strategic fitting investment opportunity arrives, an analyst needs to forecast the amount and timing of the expected returns of the investment. Some respondents may forecast the returns over an expected holding period of the individual investment while others use a standard hold period. institutional investor respondents are more likely to forecast over a standard time frame (Farragher & Savage, 2008). All of the institutional investor respondents respondents (94%) have mentioned that diversification of portfolios is the most important risk reducing strategy option. The geographic location and the property type are the most used diversification factors. Economic locations, tenant type, property size and property age are less important.

Once the rate-of-return and risks are determined, investors evaluate their forecasts. This should be translated into an evaluation measurement. There are measurements based on first year returns and those based on returns over an intended holding period. An assumption here is that climate risks have a higher chance to increase over the years, making quantifiable climate risks more apparent in returns calculated over an entire holding period. The institutional investor respondents mentioned a greater importance on the *equity dividend rate* and *accounting return on investment* measures than private investors and/or developer respondents do (Farragher & Savage, 2008). This could lead to institutional investors holding long-term positions without accounting long-terms climate risks, which is also assumed in this thesis. When investors measure the returns on an investment, it is common to use the *Internal rate of return* and the *net present value*. This is because of the ability to use these units for the return on, and recovery of, investment on a discounted cash flow basis (Farragher & Savage, 2008).

These first steps of the investment decision-making process are concluded as most important among respondents in the Farragher and Savage (2008) study. After that, returns are adjusted for risk. This is because of the uncertainty of returns. The degree of uncertainty should be evaluated using a qualitative or quantitative risk assessment. Simple risk assessment tools are more commonly used like, *debt coverage ratio*, *default ratio*, and *breakeven analysis*. More complex techniques include *sensitivity analysis*, *scenario analysis* and *Monte Carlo Simulation*, however, are rarely used. For institutional investors, two thirds indicate that quantitative risk assessments are required. Quantitative risk adjustment involves adjusting the forecast returns and/or the minimum required rate of return to reflect both the assessed risk and the investor's willingness to handle risk (Farragher & Savage, 2008).

After that, decision-making is done by top management. The naming "decision-making" as part of the decision-making process could be confusing. This part of the process is the go/no-go call, which requires a comparison of the investment attributes. Among these attributes are the expected return and the degree of risk. These should be in line with the investor's strategic, financial and diversification goals (Farragher & Savage, 2008). After deciding to invest in a project, successful implementation is necessary to make sure the investment project is carried out on time, at cost and with the appropriate quality. This is done through the development of an *action plan* and choosing a *project manager* who is responsible for carrying out that plan. There is a possibility for climate adaptation to be part of that action plan but remains unclear in the study.



Figure 6: Stages of the Investment decision-making process (Farragher & Savage, 2008)

Now that the investment decision-making process is laid out, it is possible to see where risks play a role. Risk is being used in three ways; to set a risk profile that fits the strategic investment goals, to assess the maximum acceptable risk of an investment opportunity, and to adjust return evaluations based on a qualitative and/or quantitative risk assessment. The risk profile may vary depending on the investment organization, but also the fund's responsibilities as they differ as mentioned by Conijn and Papa (1988).

From a more operational perspective, there has been a lot of research on risk factors in real estate. One used in this thesis is the study by Clayton et al. (2021), which builds on the research by de Wilde and Coley (2012). The latter study has found implications of climate change on buildings and translate these from environmental effects to impacts on buildings and effects on occupants and/or key processes. Clayton et al. (2021) later divides these effects into four groups being; effects on expected income, outgoings, target return rate and types, and terms of finance as shown in Figure 7.



Figure 7: Classification of financial risks developed with reference to de Wilde and Coley (2012) (Clayton et al., 2021)

Risk management in literature can sometimes imply timelessness to the decision-making problem (Winch, 2009). It is useful to identify the time dimension in the concept of risk. Winch (2009) developed a time-based framework for understanding risk and uncertainty, shown in . The *risk source* is what creates the underlying condition to what causes the *risk event* to occur. A risk source in the context of flooding risk could be high river tides, while the risk event could be pluvial flooding in low laying areas. Using this framework by Winch (2009), investors are presented with the opportunity to respond to a risk source, or plan to respond to a risk event. Given the response an investor may or may not have on a risk source, the risk event is dependent on the chance of happening. This can also be called the *probability* of the risk event. The probability is a factor of the risk event, and not the risk source. This means that the probability of pluvial risks is a determined by the risk response to the high tides, and not by the high tide itself.

3.3 Water governance in the Netherlands

This paragraph presents how water is governed in the Netherlands and how this is becoming more complex. The paragraph discusses the history and policies of water management in the Netherlands. Lastly, this paragraph covers the policy changes in the Netherlands concerning water management and the built environment. The context of water government is important to understand the complexity of water in the Netherlands.

3.3.1 The history of Dutch water management

In the Netherlands, management of water systems is the responsibility of the Minister of Infrastructure and Water Management, provinces, regional water authorities (waterschappen) and municipalities (Rijksoverheid, 2024b). As the Dutch have a long history with water management, a systematic approach to water management began during the Middle Ages. The Dutch reclaimed peat bogs for agricultural purposes. This has been done by digging channels and ditches. The negative effects followed soon as oxidation of peat layers caused the land to subside. To deal with this, dykes and mills were constructed to manage water levels.

These were organised practises of water management even before the creation of the Batavian republic. During the Middle Ages, vast area of rural land was used by communities consisting of early farmers. These settlements were called a *buurschap* or *boerschap* which is an early translation of a neighbourhood (Jonge, 2016). Selected members of this community were designated to manage and protect surrounding land which all member farmers could use. the neighbouring communities gradually developed as a public body, with their own administration and jurisdiction and their own tasks (Wikipedia, 2024a). The principal idea is that public governing bodies were formed to serve and protect the inhabitants and the land within that community. After the Batavian revolution, a new state order was being established. New local governing boards were formed which developed into municipalities. The constitution of 1848 has eventually assigned the task of water management to the water boards. This was mainly done so to prevent water nuisance occurring in municipalities caused by measures in neighbouring municipalities (Wikipedia, 2024b). A higher order of water management was created to control the water levels and all water boards had to present their building- and maintenance plans to what is now the Ministry of the Interior and Kingdom Relations (de Wilt, 2015).

While there were about 2600 water boards halfway through the 20th century, fusions have led to there only being 21 water boards left today (Reijn, 2010). Water boards have grown into large organisations, and it is imaginable that civil society has become less known of water management and its implications. Also important is that the water board elections were not regulated by the Electoral act up until 2014. The first national water board elections were held in 2008. Previously, votes were split equally among land leaseholders, building owners, and companies. In turn, national flood protection is managed by the national government, with the Ministry of Infrastructure and Water Management setting policies and coordinating efforts (Local water management projects in Dutch history were the Zuiderzee project and the Delta project. The latter project was formed in response to the catastrophic flood event of 1953, and has reinforced the reputation of the Netherlands as a nation of expert water engineers (Arnold et al., 2009). The administration of primary flood defences in the Netherlands is characterized by a fairly exclusive setup, engaging a small group of stakeholders with similar attributes (Brugge et al., 2005). The
limited civil participation in national and regional water management may partly explain the low awareness of flood risks in the Netherlands.



Figure 8: Map with waterboards in Overijssel in 1947 (Historisch Centrum Overijssel, 1947)

3.3.2 Policy in Dutch water management

As water governance has become more structured and organized in the 18th century, larger water and flood risk has become an increasing national responsibility, especially after the constitution of 1848. The catastrophic flood of 1953 has led to the Delta project symbolizing an even stronger national response to flood risk adaptation. This was not the only flood event that has led to a national response. High tides in 1993 and 1995 have again caused severe damages with the former leading to several casualties. The only difference is this time it was not the sea but the rivers that led to flooding. These events have initiated a shift in Dutch water management towards integrating water management and spatial planning, leading to the "Room for the River" program. This program was eventually presented in 2007. One of the product originating from this program is seen in Nijmegen where the Waal got more space which was integrated into a recreation landscape, as shown in figures Figure 9 and Figure 10. The program included an integration of innovative architecture, urbanisation, and landscape solutions to build with nature and living with water. It has also inspired the 2012 Delta Act, which led to the creation of the Delta Programme, the Delta Commissioner, and the Delta Fund to address water safety and freshwater supply challenges (OECD, 2014). After making the extra room for the river to flow, new insights led to the realization that the current dykes were insufficiently calculated to future climate scenarios. This led to the High-Water Defence Plan (HWBP). Hundreds of kilometres of dykes, locks and pumps are set to be reinforced with the objective to all be up to standard by 2050 (HWBP, 2024). However, even with the flood events in the past and the current plans to reinforce the water protection system, flood risk perspective remains low. Dutch citizens often feel very safe and trust the government to protect them. However, many are unaware of the actual risks they face (OECD, 2014). This has been justified for a long time as flood risks were well documented and publicly available. The question remains if this is still justified after new climate risk scenario's have been sufficiently modelled into the same flood risks.



Figure 9: The Waal river during high tides (Rijkswaterstaat, 2024)



Figure 10: The Waal river during normal tides (Retrieved from Google Maps)

In 2022, the Dutch government introduced the "Water and Soil-centric" policy to address spatial planning issues by emphasizing the roles of water and soil. The Ministry of Infrastructure and Water Management outlined several guiding principles:

- 1. Avoid shifting problems (e.g., water storage in low polders) elsewhere.
- 2. Acknowledge and prepare for extreme events.
- 3. Use a comprehensive strategy for flooding, drought, and soil management.
- 4. Apply the Multi-Layered Safety Approach.

This policy aims to reduce public costs for risk mitigation and prevent adverse secondary consequences, promoting shared responsibility and sustainable decision-making.

3.4 Existing labels

This paragraph highlights the lessons from existing climate-risk labels, focusing on existing labels that indicate flood risk and water nuisance.

Recent efforts have been made to explore existing (climate) labels by Deltares (2023). Insights from this exploration can provide guidance and information for developing a new label format. The Dutch Green Building Council's Framework for Climate Adaptive Buildings (FCAB) is widely supported by investors, developers, asset-owners, and municipalities to evaluate climate risks on both area and building scales.

Additionally, the NL Greenlabel is another framework that places greater emphasis on a natureinclusive urban living environment (NL Greenlabel, 2024). Finally, some practise from abroad have also been explored where a label format proposal has been made in Sweden (Thidevall et al., 2023).

3.4.1 Deltares report on water labels

In this report on water labels there is a specific focus on flood risk and water nuisance (Deltares, 2023). The report first elaborates on the goals set for labels. These serve three purposes: raising awareness about flood risks, offering stakeholders a perspective on actions, and providing insights into potential adaptation efforts. Examples of raising awareness include the Flemish plot score and BlueLabel, which inform property owners about flood or stormwater risks (BlueLabel, 2024; Coördinatiecomissie Integraal Waterbeleid, 2023). These initiatives aim to raise awareness of the associated dangers and emphasize the owners' responsibility. Some of these labels also include several perspectives of action to mitigate risks, such as permeable paving or raised entrance thresholds. Labels offer frameworks to estimate the amount of water that can be retained by a plot, which provides insights into potential adaptation efforts. This can be seen in the Waterlabel format (Watermaat, 2018).

The use of labels varies in practice. Goals set by labels may be similar, but their measures differ significantly. As mentioned above, the plot score in Belgium is used to increase transparency. This is achieved by implementing an obligation to provide information during real estate transactions. Such measures could incentivize improvements to property features prior to selling.

The practice by BlueLabel involves using high-resolution 3D imaging and linking these labels to policy goals such as reducing water nuisance in Rotterdam. The label in this practice is closely linked to policy goals in Rotterdam instead of a nation-wide approach.

Practices from the US have also been examined. FEMA integrates risk maps directly with insurance categories. This method encourages individuals to be more aware of flood risks and insurances. It aims to support the prevention and recovery of flood-prone areas, though the focus remains on insurability and premiums.

In addition to area or plot scores, there is also a practice of evaluating streets. This comes from the principle that water flooding into buildings originates from water that accumulate on a street level. *Staat van je Straat,* an incentive by Sweco, is recognised for its methodology in assessing the vulnerability of streets (Sweco, 2024). Municipalities utilise this label to increase awareness among residents and to engage them in discussions regarding climate adaptation initiatives.

A central theme of these labelling practices is to increase awareness and mobilise stakeholders into action. The approach to measuring risks, however, varies. The report indicates that current labels could serve as a basis for developing a more comprehensive climate label that encompasses various risks, including heat, extended drought, flooding, and water-related issues. This approach is already exemplified by frameworks such as the DGBC framework and BlueLabel.

The data used in the compared labels primarily use height datasets such *as Actueel Hoogtebestand Nederland* (AHN) and other flood maps. The reliability of these datasets relies on data resolution and quality, a crucial topic within the label structure discussed in the introduction. As there is still significant room for improvement, the current usability of the datasets remains uncertain. Because the situation in the Netherlands is slightly different than other countries, comparing is not so simple. It is commonly believed that everyone is protected by dykes and flood protection in the Netherlands. Therefore, most of the labels, data and methods focus on water nuisance caused by extreme rain (BlueLabel, 2024). The type of climate risk and the scale of the assessment amongst different label approaches is demonstrated in Figure 11.

Label / methode / instrument	Over- stroming	Water- overlast (neerslag)	Droogte (fundering)	Hittestress	Anders	Schaal
Vlaanderen perceel en gebouwscore	×					Woning
UK	X					Woning
VS, FEMA	X					Woning
BlueLabel	X	X focus	X	Х	-	Woning
DGBC klimaatlabel	x	X, en grondwater	X, en Natuur- brand	x	storm	Gebouw
KIM tool		X		Х		Gebouw
Staat van je straat	Х	X	X	Х		Straat
Mijn Waterrisicoprofiel	X	X				'locatie'
Waterlabel.net					Bergend vermogen	Perceel
IkBenWaterproof	X	X				Woning
Energielabel				Х	Energie- verbruik	Woning
Calcasa Woningcheck	X		X			Woning
Fundermaps			X			Woning

Figure 11: Climate label approaches (Deltares, 2023)

3.4.2 Label experience from Sweden

There has been study published recently which examines the possibility of a climate resilience certificate (CRC) for real estate properties in Sweden (Thidevall et al., 2023). The CRC was designed to provide a standard way to assess climate risks at the property level, helping people manage and adapt to these risks better. This is somewhat in line with the motives by the AFM and banking sector in the Netherlands (AFM, 2023; Bani et al., 2024). The major difference in the objective of the certificate, or label, is that its purpose is to aid in preparing for climate threats. The reports by the AFM and banking sector are more aligned with protecting the financial system in the Netherlands.

The formation of the CRC used a variety of data sources to ensure a thorough assessment of climate risks. Threat maps showed flood risks from heavy rainfall and high-water flows, essential for identifying areas prone to flooding and assessing property sensitivity. We also see movements in similar assessments in the Netherlands (DGBC, 2023). Detailed topographic data helped understand how water flows into buildings during heavy rains, highlighting low points and potential water accumulation zones. This partially overlaps with practises used by simpler models in the Netherlands, for example IkBenWaterproof (Deltares, 2023). Information from the stormwater and wastewater pipeline networks was used to understand the risk of backflow into properties during floods. Additionally, data on basements and drainage systems were critical in

assessing the properties' sensitivity to water ingress and backflow. These last two practices is seen less but there has been some coverage (DGBC, 2023). The data was processed through several steps to develop the CRC. An automated preliminary assessment using geographical and topographical data provided a rough classification of properties' risk levels. This can also be understood as screening (Nielsen et al., 2011; Sanderson & Stridsland, 2022). For a more detailed classification, an independent climate expert conducted on-site inspections, collecting specific data about each property's vulnerabilities and threats. The collected data was then integrated into a classification system that ranged from green to red in the preliminary assessment and from A to G in the extended assessment.

Various stakeholders could use the CRC and its underlying data:

- Property owners use it to understand and reduce the specific risks their properties face from climate-related threats.
- Insurance companies use it to better assess and price the climate risks involved in insuring real estate properties.
- Financial institutions evaluate the climate risks in their loan portfolios and make informed lending decisions.
- Government agencies develop policies and provide support for climate adaptation measures at the property level using this data.

The implementation of the CRC had several results mentioned:

- Property owners and other stakeholders gained a better understanding of the specific climate risks faced by individual properties, potentially leading to better decision-making.
- The CRC created financial incentives for property owners to undertake climate adaptation measures, as properties with better classifications could benefit from lower insurance premiums and more favourable lending terms.
- Government agencies could use the data to develop more targeted and effective climate adaptation policies, supporting efforts to make buildings more resilient to climate change.

In conclusion, the experience of forming a climate label through the CRC initiative highlights the importance of sufficient data collection and the integration of multiple data sources to create a reliable and actionable climate risk assessment tool. Forming this CRC would take some effort and time as there are a lot of steps and data sources involved. What the report doesn't cover is the nuance in the certification score. What if two properties score the same score (B) exposed to different threats. Does that imply that they are both carrying financial risks equally? How does that translate into insurance premiums? These are still ongoing discussions even in the Netherlands as experienced in the research groups such as RED&BLUE and Convergence Resilient Delta.

3.5 Climate risk reporting & screening

Big investment funds report on their investment risks, including physical and transition climate risks. This is a recommendation from the Task force on Climate-related Financial Disclosures (TCFD). Financial market participants including financial advisors also must disclose on Sustainable Financial Disclosure Regulation (SFDR) when selling 'sustainable' products. We can

see examples of funds reporting on their methodology for assessing climate risks and opportunities in the Netherlands using financial reports from two major funds: BouwInvest and APG Asset Management.

BouwInvest has set its objective to maintain value for long term strategic investments by making buildings climate resilient, together with other actions. As part of their efforts to better manage risk and generate sustainable, long-term returns, BouwInvest incorporates ESG factors into all its investment decisions. BouwInvest considers five different risk types within ESG risk, including physical and transition risks related to climate change (Bouwinvest, 2023).

APG AM also has its objective set to invest responsibly. Part of it's understanding in responsible investments is the Climate Risk Policy they have introduced in 2019. This policy describes the way APG AM defines, measures, manages and reports on climate related risks and opportunities. In addition, climate-related risks and opportunities are measured in the portfolio using Climate Portfolio Screening (CPS). Investments are classified using the traffic light system where investments in areas with 'high' risk within the investment horizon, require further investigation (APG AM, 2022).

In today's business landscape, the importance of sustainability has emerged as an important element for companies worldwide. Reporting on sustainability risks has become common practise for responsible corporate governance. As stakeholders and investors increasingly demand transparency, companies are compelled to disclose how environmental, social, and governance (ESG) factors impact their operations. This not only helps in assessing the long-term viability and resilience of businesses but also ensures that companies are actively contributing to sustainable development goals. This section explains how European and international standards may lead to corporates assessing climate risks more often.

CSRD

The Corporate Sustainability Reporting Directive (CSRD) represents a transformative approach in the regulation of sustainability reporting for large financial companies within the European Union. The CSRD builds upon the Non-Financial Reporting Directive (NFRD) and significantly expands the scope and depth of sustainability disclosures required from companies (CRSD_Directive, 2022). This new directive mandates that all large companies and small to medium-sized enterprises (SMEs) report on environmental, social, and governance (ESG) performances. The primary goal here is to enhance the consistency, comparability, and reliability of sustainability-related disclosures. By doing so, the CSRD aims to provide stakeholders and investors with essential information to evaluate the social and environmental consequences of a company's operations (European Commission, 2024).

To meet these objectives, companies are required to disclose information based on the European Sustainability Standards (ESRS). These standards, developed by the European Financial Reporting Advisory Group (EFRAG), specify the necessary disclosures regarding material consequences, risks, and opportunities related to ESG matters ("ESRS Delegated Act," 2023). Within these standards, there are several key areas for mandatory disclosures.

Companies must include past, current, and future mitigation efforts to ensure that the company's strategy and business model align with the sustainable economy transitions and the Paris Agreement goals of limiting global warming to 1.5°C and achieving climate neutrality by 2050. Moreover, businesses need to report on the process for identifying climate-related

consequences, risks, and opportunities. They must also include the disclosure of greenhouse gas emission reduction targets, energy consumption, and the consequence of climate-related risks and opportunities on the company's financial position, performance, and cash flows over the short, medium, and long term ("ESRS Climate change E1," 2022). The entire content of the ESRS is displayed in Figure 12.

General Standards	Environment	Social	Governance	
 ESRS 1 General requirements ESRS 2 General strategy, governance and impacts, risks and opportunities management disclosures 	 ESRS E1 Climate Change ESRS E2 Pollution ESRS E3 Water and marine resources ESRS E4 Biodiversity and ecosystems ESRS E5 Resource use and circular economy 	 ESRS S1 Own workforce ESRS S2 Workers in the value chain ESRS S3 Affected communities ESRS S4 Consumers and end-users 	ESRS G1 Business conduct	

Figure 12: ESRS contents (Flagship, 2022)

This is where (flood) risk assessments come in play. An important component of the CSRD is the requirement for companies to perform a materiality assessment. This assessment aims to identify the impacts, risks, and opportunities of the company's business operations on people and the environment, as well as the financial consequence of sustainability issues on the business itself. The concept of double materiality is central here, ensuring that both the effect of the company's operations on the environment and society and the impact of sustainability issues on the company are considered (ToFuAc, 2024). Notably, the section 'ESRS E1 Climate Change' standard mandates detailed disclosures on climate change consequences, including physical and transition risks, and the financial effects associated with these risks ("ESRS Climate change E1," 2022).

TCFD and ESRS

The materiality which is being reported upon following the CSRD is based on the standards laid out in the ESRS but is also influenced by international practises. It is important to note that the CSRD aligns closely with other global sustainability frameworks to reduce complexity and duplication of efforts among investors. For instance, the ESRS and the International Financial Reporting Standards (IFRS) Sustainability Standards share a high degree of alignment, particularly regarding climate-related disclosures. This alignment facilitates better economic and investment decision-making across jurisdictions by streamlining sustainability reporting requirements (IFRS, 2023). The International Sustainability Standards Board (ISSB), established under the IFRS Foundation, seeks to create a global baseline for sustainability disclosures. This baseline integrates different reporting standards, focusing on providing comparable and useful information for investors. One of these standards is the Task Force on Climate-related Financial Disclosures (TCFD). By ensuring alignment with TCFD, the ISSB facilitates consistent and relevant climate-related disclosures that aid in informed investment decision-making (IFRS, n.d.-a). The TCFD emphasizes the reporting of both <u>physical</u> and <u>transition risks</u>. Physical risks include acute threats such as extreme weather events and chronic risks such as rising sea levels and increasing temperatures. Transition risks include the financial and operational challenges associated with transitioning to a lower-carbon economy, including changes in policies, technological advancements, and market dynamics (Stolowy & Paugam, 2023).



Figure 13: Different types of climate risk and financial impacts. Adapted from (TCFD, 2017)

IPCC

The Intergovernmental Discussion on Climate Change (IPCC) is an international body of the United Nations which has the job to progress in scientific knowledge about climate change (IPCC, 2024). Since it's existence they have published a total of 6 extensive reports each adding more up to date knowledge on the matters.

The evolution of the IPCC reports over the years illustrates the growing understanding of climate risks. The latest report, AR6, stands out with its emphasis on practical solutions and its provision of more detailed regional information. Additionally, it also captures more detailed climate risks where there is more attention for acute and transitional risks. When financial corporations screen their portfolio on long term future climate scenarios they should then use the scenario's set by the IPCC (IPCC, 2023).

Label uses

According to the AFM, the use of a label is primarily to increase transparency and provide data to those parties involved in the buying and selling process (AFM, 2023). Practises in Germany have also shown more practical uses of the Floodlabel, where emphasis is put on the measurements to be taken. The use of Floodlabel serves as evidence as to how at risk of flooding the property is and the measures taken to secure against or adapt to it. This is being underpinned as it can be an important issue for insurance in Germany (Meier et al., 2021). Financial institutions are primarily interested in using a label or certification for screening purposes (Sanderson & Stridsland, 2022). To this thesis with the emphasis of the investor's perspective, more context is covered in using label as a screening tool and an incentive to climate action.

Screening

For the head of strategy at a large international real estate investment manager, the climate-risk assessment process begins by screening a portfolio against a suite of climate risks. If investments surpass a predefined threshold of physical risk exposure based on the probability of threats like flooding or wildfire, the investment team begins a more robust process of scrutiny (ULI, 2022).

This process of screening is also seen abroad. Practises in Denmark can be used as an example here. The effects of climate changes have become one of the focus areas for the Danish Road Institute at Danish Road Directorate. The focus of this screening is to minimize the consequences and effects of already experienced and anticipated climate changes by protecting road constructions, equipment and buildings against *collapse*. Tools are needed to help facilitate this process and prioritize the effort when adapting to climate change. The potential high-risk areas are identified by analysing detailed topographic data and material presented on maps. When planning new roads, the map can be applied in the planning phase for determining whether there is a risk in that area (Nielsen et al., 2011).

For this thesis the terminology of the IPCC's AR6 (6th assessment report) are used (IPCC, 2023).

How often the risk occurs
Example: how deeply a building might flood during a flood
What is exposed to the flood event
The level of resistance a building offers against the flood event
The damage to a building or area
Chance x Consequence

Other terms used in documents often are: 'hazard' instead of 'threat', 'impact' instead of 'consequence', and 'vulnerability' instead of 'sensitivity' (Deltares, 2023). Generally spoken, the assessment of risk is defined as a product of chance and consequence. An addition that has not been used often is the exposure. The Dutch Green Building Council have added exposure in their framework for climate adaptive buildings (DGBC, 2023). When reading through the framework, sensitivity and threat are included in further steps of the assessments. This concludes that the DGBC framework is the most developed framework to capture all climate risks in the Netherlands. Chapter 5 of this framework includes an agenda showing what data is furthermore needed to make better investment decisions. In conclusion, data is needed with national maps showing various climate scenario's, additional research in combining sensitivity and exposure into a area-

score, flood-safety in flood maps, validation of the climate risk matrix and a possibility to link a climate risk score (in subject to flooding) to the climate risk diagrams by HKV (DGBC, 2023).

Wrapping up, physical climate risks defined by the TCFD are being projected in multiple countries including the Netherlands. Financial institutions not only have to report on these risks, but also carry a responsibility in raising awareness amongst their stakeholders. To do so, they follow the reporting standards set by the ESRS and the standards recommended set by the TCFD ("ESRS Climate change E1," 2022; TCFD, 2017). The most accessible way to approach flood risk is by mapping chance and threat but a complete way is to map chance and consequence which includes exposure and sensitivity of the building and the area as well. This is also displayed by DGBC in Figure 14. This often requires extra steps and may not be put into a simple map, as site inspections are required (Thidevall et al., 2023). Finally, to form a suitable label covering flood risk information depends on the user of the label. There is still debate on what issue the label should solve and for who it solves this problem. For the purpose of this thesis the perspective from the investor is examined as they have a very strong influence on the value creation of building and areas in the building environment (van Bueren, 2022).



Figure 14: DGBC Climate risk formula (DGBC, 2023)

Chapter 4 Empirical findings

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4 Empirical findings

This chapter presents the findings of the questionnaire and expert meeting and is aimed to answer **SQ-3**, **SQ-4** and the **MRQ**. The layout of the questionnaire is described in paragraph 2.7 of the research design. How the data is stored and processed is covered in Appendix C: Data Management Plan.

The questionnaire consists of four sections, excluding section 0 which covers the demographic information, see figure 15.



Figure 15: Build-up of the Questionnaire

The questionnaire started with the informed consent check, which can be found in Appendix C: Data Management Plan. When participants pressed "I agree" and moved on to the next question, they agreed to set the conditions.

The recorded time the questionnaire took for the respondents to fill in served as a second check. The questionnaire was estimated to take between 10-15 minutes, but fair number of respondents did it within 8 minutes as well. Two respondents completed the survey exceptionally quickly, finishing within one minute. Their responses included identical scores for all slider questions and no text answers to open-ended questions. These responds have been removed from the dataset. One other respond was removed from the dataset as it was only completed for 17%.



4.1 Section 0 – Demographic information

Figure 16: Demographic distribution questionnaire (Dataset)

In the demographic information part, the participant's organization type was asked. This was an initial check since some participants said they were not suited for the questionnaire after reading this question.

Out of 17 respondents in this study, a significant portion of the participants worked for real estate funds. 9 respondents work for real estate funds indicating a possible bias towards the answers in the rest of the questions. These respondents primarily work for fund managers, private wealth managers or real estate funds of banks or developers. 5 respondents work at pension funds and represent the pension funds themselves or fund managers for pension funds. Another large player in the housing market, especially social housing, are the insurance companies. 3 respondents work for insurance companies or are a fund manager for insurance funds. It is expected that this group has more insights into insurability of real estate, which could influence the answers in other sections.

4.2 Section 1 – Responsibility for flood risk

The first section served to set a precondition for the rest of the questionnaire. Respondents were asked who they think carries the greatest responsibility in climate adaptation efforts. After they were asked if they were concerned about flood risks on their assets even if it was insured.

On average, respondents think that the national government (82%), municipalities (65%) and water boards (47) are the main responsible parties for flood risk adaptation. Parties with less representation are individual property owners (24%), NGOs and civil society organisations (12%), investors (29%), private companies (29%), and especially insurance companies (6%). This indicates that most of the respondents think that public parties like the government, municipalities and water boards carry the biggest responsibility, while corporations and households carry less responsibility.



Figure 17: Who investors consider as primary responsible to combat flood risk adaptation in percentage (Dataset)

Secondly, it is notable that there is a stronger belief that public bodies carry the main responsibility to combat climate change effects. There is a general believe that flood adaptation

efforts can not be solved on asset scale. This is what *Vereniging voor eigen huis* highlighted as homeowners do not have the possibility to do something about the flood risks on their house, making the climate label proposition unfair towards them (Vereniging eigen huis, 2024). Respondents did not have the opportunity to respond why they think so. The data tells us that most corporations look at the government for support, but further questions remain on what makes private organizations partly responsible for climate adaptation efforts.

Investors were also asked how concerned they are about flood risks even if their assets could be insured. Although all answers were given, the data shows that majority (65%) are moderately concerned even if their assets are insured. The results are presented in Figure 18.



Figure 18: Investor's sentiment on flood risks regardless of insurability in percentage (Dataset)

There was some confusion on this question as respondents made remarks on the assets being insurable now, but less insurable in the future. Next to that, flood risks are manageable both technically and economically until 2100. Respondents have answered this question in a future context where insurability may become uncertain and flood risks may increase given the changes in climate effects.

Findings

To summarise, section 1 of the study reveals that a significant majority of respondents believe that the national government (82%), municipalities (65%), and water boards (47%) shoulder the primary responsibility for flood risk adaptation. In contrast, private companies, individual property owners, and insurance companies are perceived to have much less responsibility. Additionally, 65% of respondents expressed moderate concern about flood risks to their assets, even if insured, highlighting the anticipated future challenges related to insurability and increasing climate impacts.

4.3 Section 2 – Motivation for flood risk assessments

In this section the respondents were asked how concerned they are about the four financial effects: expected income, expected outgoings, target return rate, and the types and terms of finance.

The question was formulated as a statement and the respondent could answer using a slider between *strongly disagree, somewhat disagree, neither disagree nor agree, somewhat agree and strongly agree*. The scores are translated in a score from 0 to 100 with each step adding another 25 points. The mean score is calculated adding the total score and dividing the total by the number of respondents. The respondents were not able to skip the answer. The average results are presented in Figure 19.



Figure 19: Investor sentiment on financial effects coming from flood risks

The financial effects that investors are most concerned about are the effects on expected outgoings. While results are not dominantly different, effects with a score of 40% are considered low while 80% is considered high. As nearly all investors have indicated some degree of concern regardless of insurability (Figure 18), it was expected to see at least some of this concern reflected in section 2.

Effects on higher insurance premiums is what concerns investors the most (81%). This effect also has the lowest standard deviation indicating less variety in answers by investors. While higher insurance premiums are expected, the insurability of assets may also decline in future scenarios. Reduced insurability, increasing operating costs and mitigation expenditure follow with scores between 63% and 68%.

The concern of reduced insurability is particularly noteworthy due to the high standard deviation (0,32), which shows that investors have varied opinions on this matter. While pension funds and real estate funds are more concerned with insurability of assets, the insurance funds seem to be less concerned. The significance of this data remains unclear because of the low sample size as well as the answers not being too divided. It does however raise the question if insurance companies carry different knowledge on insurability given their profession and with that being less concerned about this subject in comparison to other market parties.

Another interesting point is the low score of 'more security needed to cover risks' being the second lowest of the list. This raises another question on the concerns by the AFM and Dutch banking sector mentioning the risk of security among their mortgage payers, which was also elaborated in the problem statement of this study (AFM, 2023; Bani et al., 2024).

Findings

To summarise, investors are generally more concerned about expected outgoings and their rate of return than their expected incomes or types of financing. The subject of insurability and the premiums that come with are especially noteworthy because of the divided answers and insurance companies being less concerned. Also, the matter of risk on security is unclear as it was mentioned in previous reports but scoring relatively low in this study. The reasoning behind the less concerns on expected incomes and terms of finance remain unknown as this has not been asked in the questionnaire.

4.4 Section 3 – Types of risks assessed and methods used

The third section dives deeper into the risk assessment. The respondents were asked if their organisation assess the scenarios described in paragraph 2.7, section 3. Respondents who have answered "no" or "I don't know" have been left out of this summation. The results are shown in Figure 20.

When respondents indicated that they assessed risks from different flood scenarios, they were subsequently asked to specify the method or metric used to assess these differing flood risks. After, they were also asked where they gathered the data from in order to perform their assessments. If respondents did not assess a certain flood scenario, or used no method/metric, they were asked to elaborate why. A multiple-choice question was presented with the options; *"risk not considered great enough", "methods not sufficient", "data not sufficient", and "other (specify)"*.

As presented in the literature review, paragraph 3, different flood origins exist. The build up in this section is designed in a way that would better reflect the flood label structure, with the goal to identify the scenarios, methods and data that investors mainly use. This provides insight into the extent of investor's concern regarding various flood risks.

Heavy rainfall	14
High water at sea or rivers and lakes	15
Localised flooding due to water accumulation and/or failure of infrastructure	10
Rising groundwater and land subsidence	12
Building characteristics	10

Figure 20: What respondents assess in number of respondents (Dataset)

The first two scenarios are more commonly assessed compared to the last two. This is especially the case among real estate funds who all indicate they assess these two. The reason why just a small number of respondents are able to say they assess the latter two scenarios, is because the risk is not considered great enough or that methods are insufficient to assess. However, the data seems to be there to assess flood risks. This is different from building characteristic assessments.

Only 10 respondents could say their organisation assesses the building based on its characteristics. The reason for that is that methods or data are insufficient.

Findings

Flood scenarios

A majority of respondents indicated that the assessments were outsourced. Only a single organisation for each group of investors has inhouse assessments. The relatively high number of outsourced assessments may be a reason for investors not knowing about methods, metrics or data being used. Nevertheless, when respondents did know, they almost always indicated that specific metrics or methods are used.

For methods, only two different options were mentioned. Most commonly was the <u>Framework for</u> <u>Climate Adaptive Buildings (FCAB) part 1</u> by the <u>Dutch Green Building Council (DGBC)</u>. This framework, covered in the literature review, paragraph 3, includes both water nuisance and flooding. Therefore, it covers most of the scenarios mentioned in this section of the questionnaire. Additionally, the NL Greenlabel Quickscan has also been mentioned. This label is more focused on nature-inclusiveness.

Respondents most frequently mentioned <u>door sill height</u> in combination with <u>inundation depth</u>. These metrics serve as a threshold for determining when a building would be flooded. Additionally, the <u>expected loss</u>, <u>chance of flood development</u> and <u>land subsidence</u> have all been mentioned as a metric to measure flood risks.

Data is most commonly retrieved from <u>Klimaateffectatlas (KEA)</u> and <u>Climate Adaptation Services</u> (<u>CAS</u>). The KEA is coordinated and managed by CAS and is commissioned by the Ministry of Infrastructure and Water Management. CAS collaborates with companies, municipalities, and researchers to map climate risks and promote climate adaptation. Consequently, the data stream originates from similar sources. Furthermore, respondents have also mentioned <u>Sweco</u> as a source of data. Finally, <u>site inspections</u> were also conducted by respondents or their consultants.

Building characteristics

The physical elements of an asset are evaluated separately from flood scenarios. In this context, risk is determined based on the structure, layout, and finishing of a building. When respondents were asked whether they assess these characteristics, only 10 indicated that they actively do.

The framework by DGBC was also used in this assessment. The FCAB part 2 was frequently referenced for evaluating a building's flood risks. For building characteristics, the use of consultants is more common. Additionally, respondents indicated that they have more communication with their technical staff. Asset managers, technical managers and documents like floor plans were commonly mentioned for assessing building characteristics.

4.5 Section 4 – Actions taken based on assessments

The fourth section of the questionnaire involved questions regarding decision-making. Respondents were asked if they think they have sufficient knowledge, data and methods on the

subject of flood risk assessments. There is a general sentiment for tools applicable in assessing flood risks. Respondents believe there is knowledge, data and methods available but not dominantly sufficient. The median for all three questions was 50%, indicating moderate sentiment.

How confident are investors that they possess enough <u>knowledge, data</u> and <u>methods</u> to assess flood risks?



Figure 21: Investor perspective on knowledge, data and methods (Dataset)

Next, the respondents were asked if a flood label would help respondents in their profession based on different decision-making processes. The respondents were asked to indicate their level of agreement with a statement on the flood label as a percentage. These statements are as followed:

- A flood label would help in making better investment decisions when potentially higher flood risks are present.
- A flood label would help in elaborating mitigation measures to my fund owners.
- A flood label would help in making the due diligence process easier/shorter.
- A flood label would help on reporting climate risks.

Insurance companies have a higher positive perspective towards the benefits of a climate label (79,7%) compared to pension funds and real estate funds (62,5%). No investors indicated that a label would not help at all.



How do investors think a flood risk label could benefit?

Respondents primarily agreed that flood risk labels help with reporting on climate risks. The standard deviation is higher in this response so there is some nuance here. A more common understanding of the label could help to make better investment decisions and elaborating mitigation efforts towards fund owners.

Figure 22: Investor perspective on the flood risk label (Dataset)

The questionnaire continued to ask on the action perspective. The actions presented are in line with section 2 and the literature review, see Figure 7. Just like in section 2, higher operating costs are mainly expected and taken into account (76%). An increased discount rate, making buildings more attractive for resale, a more diversified portfolio and more public investments to support the area are generally expected (55%). Finally, rent discounting, investment refinancing and selling existing investments are not expected (30,2%). The results are shown in Figure 23. Notably, there is no significant difference between the different investor groups on their action perspectives.



Figure 23: Action perspective following an identified flood risk (Dataset)

Findings

Section 4 findings highlighted the positive perspective, especially insurance companies, towards flood risk labels. The respondents largely agreed that flood labels assist with climate risk reporting, although there was variability in responses. The potential benefits of flood labels in making better investment decisions and mitigating efforts were also recognized, although with some nuances. Additionally, investors anticipated higher operating costs and increased public investments to support flood-prone areas, while actions like rent discounting and selling existing investments were less expected.

4.6 Validation

4.6.1 Setup expert discussion

The expert discussion was conducted to validate and verify the results of this thesis. The discussion aimed to present and verify the questionnaire results, specifically reflecting on the preliminary conclusions from the data. Each section presented its own data and conclusions, gauging whether the participants recognized the answers given by their peers' experiences.

The discussion took place with two investors who had participated in the questionnaire round. This had two practical reasons. First, the investors already knew all the terminology and technical background used within this study. The participants' identities were kept confidential during the expert discussion due to the limited number of experts, ensuring better anonymity.

Once the results and conclusions were verified, questions were asked about additional requirements for flood risk labels to operate effectively. This aligned with the results from section 4. Understanding the purpose of flood risk labels was crucial for making them effective. This

completed the answer to the main research question. The conclusions were adjusted according to the collected input from participants.

The session was organized as followed:

5 minutes	Introduction expert discussion
15 minutes	Presentation study, findings and conclusions
30 minutes	Discussion about conclusions
10 minutes	Reflection on the discussion (and additional requirements)
5 minutes	Closing

The goal is to finish the session within an hour, but delays of up to 30 minutes are considered.

4.6.2 Findings expert discussion

Understanding 'risk' perception

The key experts offered crucial insights into the complex subject of flood risk assessment and management during the informative expert discussion on flood risk labelling. Significant flood risks in the Netherlands up to 2100 were highlighted, emphasizing that international datasets often misrepresent the country's risk level by not accounting for its advanced dike systems and infrastructure. This misrepresentation can lead to inaccuracies in insurability perceptions and investment decisions. For example, the global perception often places the Netherlands just behind Bangladesh in terms of flood risk, ignoring the robust engineering solutions that have historically protected Dutch lands (source: expert meeting). Additionally, it was noted that in the United States, insurers have collapsed due to flood risks, exemplified by the numerous insurance companies that went bankrupt following major floods, illustrating that insurance alone is not a viable solution for mitigating these risks. Rising insurance premiums and the exclusion of climate risks from coverage are becoming common trends internationally, which directly impact property valuations and, consequently, investment returns. Higher risks result in diminished property values, making it essential for investors to fully understand these dynamics. Investors' concerns are largely based on the possibility of these same circumstances occurring in the Netherlands.

Inaccurate valuations

The importance of incorporating climate risks into property valuations was also stressed, as appraisers often struggle with this task due to a reliance on historical data rather than future risks. This reliance on outdated data fails to account for the increasing frequency and severity of climate events, making property valuations less accurate. It was particularly emphasized that detailed data for assessing risks at the building level, such as energy labels and technical building information, is crucial. However, there is a notable gap in up-to-date data, especially concerning water damage from heavy rainfall, which is becoming more prevalent due to climate change. Current datasets are often outdated and do not represent current climate scenarios, further complicating accurate risk assessment and management.

Complexity of the flood label

There was a consensus on the necessity of updating risk labels regularly to reflect current climate scenarios and effectively support investment decisions. Despite the challenges, the importance of reliable data and consistent methods to mitigate the financial impact of flood risks on property investments was underscored. A proactive approach in climate adaptation and risk assessment

was advocated, emphasizing that better data accuracy and risk perception are crucial for the real estate market's resilience. The contributions during the session provided a comprehensive understanding of the multifaceted nature of flood risk management and the urgent need for improved data accuracy and risk perception in the real estate market. These are the preconditions for a flood risk label to operate properly.

To summarise, the most important statements have been noted:

- Rising insurance premiums and exclusion of climate risks are lowering property valuations abroad and impacting investment returns.
- Appraisers struggle to price in climate risks due to reliance on historical data rather than future risks.
- Investors are more concerned about expenditure impacts, such as insurance premiums and climate adaptation costs, than revenue impacts. But the biggest concern for investors is the possibility of a value correction over their existing portfolio.
- Detailed, up-to-date data on building characteristics, such as energy labels and technical information, is crucial for accurate risk assessment. The underlying technical documentation used for energy labels are often a good starting point.
- The current datasets used for heavy rainfall is outdated and do not represent current climate scenarios, particularly concerning water damage from heavy rainfall.
- Risk labels are positively received by investors but require regular updates to assess the effectiveness of implemented measures.

Chapter 5

Discussion

Flood risk identification Risk response & Mitigation Limitations

5 Discussion

There is a broader problem statement that describes the increased climate risk where more severe weather conditions occur more frequently, eventually leading to more damage to people and property. The focus in this thesis is on the damage to property, because this is directly related to the investment. The problem statement for this thesis specifically is that investment decision-making is increasingly challenging due to climate risks and various factors. The introduction of a uniform label was proposed and the findings from the questionnaire indicated that the label benefits in two ways: considering financial impacts and for risk reporting. This implies that the label does address the problem statement, but to a limited extent. It enables investors to account for their investment-decisions. But since the label does not have a direct impact on the management of flood risks, it remains difficult for investors to mitigate flood risks. Instead, it is expected that, by ongoing risk reporting and improved valuations, flood risk management will be affected indirectly over time. The findings in this thesis can be categorised by risk identification and response.

5.1 Flood risk identification

Within the real estate investment landscape, accounting for risk is common practise. Flood risks are just another risk class that investors have to identify and try to quantify as best as possible. Given the nature of the origins of floods, it's rather difficult to do so. We know that investors find it difficult to effectively take flood risks into account when making an investment decision. Flood risks are indicated in higher risk areas identified by analysing detailed topographic data and material presented on maps (Nielsen et al., 2011). We understand why flood risks are identified and the technical implications of it. Less has been written about how precisely flood risks are analysed. From the questionnaire, it became evident that most assessments were outsourced to consultants. This indicates the expertise knowledge needed to assess flood risks over real estate investments and clarifies why most of the data retrieved to assess data is retrieved from KEA or CAS which both get input from those same consultants. The questionnaire added additional insights as we now know that the door sill height in combination with a building's inundation depth is the most common metric investors are interested in. Since site inspections and building characteristics are less commonly assessed, there is still progress needed to be made in order to effectively adapt a label on real estate objects on its own. The AFM and banking sector want to include flood risks in price valuations (AFM, 2023; Bani et al., 2024). From the questionnaire it became evident that flood risks are typically assessed through mapping in larger areas. This thesis lacks evidence that spatial elements in urban areas are sufficiently considered when assessing flood risk, which is crucial from a flood risk management perspective.

Therefore, a label being proposed would help translate urban context into a risk classification understood by financial institutions. The labels explored in the literature found that central themes of labelling practises were to increase awareness and mobilise stakeholders into account (Deltares, 2023). In contrast, the proposal put forth by the AFM and the banking sector aims to increase transparency and incorporate flood risk assessment into real estate valuation. Additionally, literature concludes that financial institutions are primarily interested in using a label or certification for screening purposes (Sanderson & Stridsland, 2022). The multitude of label purposes distort the understanding of the label itself. The questionnaire asked investors for their opinions on the matter and indicated a slightly positive view toward the label. respondents largely agreed that flood labels assist with climate risk reporting. The expert meeting further elaborated

that investor's would be able to screen their own portfolio and future acquisitions. This is in line with the Sanderson & Stridsland paper (2022). Labels have been discussed multiple times, but mitigation proposals have been lacking. The current understanding of a label does not provide investors or society with a clear perspective on the next steps. The label appears to function primarily as a mechanism for safeguarding the financial system rather than protecting the properties and individuals involved. It would help if a label was also linked to the urban context, such as green spaces in parks and roofs, drainage systems designed to capture, store and release rainwater in pavements or gardens, elevated foundations or the use of floodable parks. Such urban elements are not discussed enough given the complexity of water itself.

Bringing together the careful use of the label and the somewhat absence of urban context, means that the introduction of a label would not have a direct impact on asset valuations and flood risk management. Instead, increasingly more risk reporting would occur, eventually leading to a differentiation in market valuation. This implies that an indirect effect of a label on market valuations and flood risk management is likely, but not confirmed in this thesis. Implications of market valuations are described in the next paragraph.

5.2 Risk response & mitigation

Back in the 18th century, larger water and flood risk management became an increasing national responsibility, especially after the constitution of 1848 (Rijksoverheid, 2024b; Wikipedia, 2024a, 2024b). The water boards were originally organised to keep the land liveable and dry and was elected by land or property owners and businesses. Only recently did the water board election become available to the general public. Flood risk management has always been something taken care of for the general public, as water boards and municipalities served the people. This is evident by the various policies introduced such the "Room for the River" program in 2007. Another important policy introduced was the reinforcement of the dykes. Hundreds of kilometres of dykes, locks and pumps are set to be reinforced with the objective to all be up to standard by 2050 (HWBP, 2024). Dutch citizens often feel very safe and trust the government to protect them. However, many are unaware of the actual risks they face (OECD, 2014). This has been justified for a long time as flood risks were well documented and publicly available. The question remains if this is still justified after new climate risk scenario's have been sufficiently modelled into the same flood risks. The questionnaire revealed that investors do see an increased risk in flooding as 65% of respondents expressed moderate concern about flood risks regardless of insurability of their assets. This tells us that investors are concerned about future flooding scenarios and do not solely rely on the government or insurance companies to cover for them. Investors also believe that the national government (82%), municipalities (65%), and water boards (47%) shoulder the primary responsibility for flood risk adaptation. The responsibility expectation has therefore not changed a lot since the 1800s, but investors do become more aware of flood risks and are willing to take action to reduce those risks. How they eventually reduce risks varies.

When flooding is seen as another risk class, investor's have several ways to account for them. Institutional investors indicate that quantitative risk assessments are required. Quantitative risk adjustment involves adjusting the forecast returns and/or the minimum required rate of return to reflect both the assessed risk and the investor's willingness to handle risk (Farragher & Savage, 2008). From the questionnaire it becomes clear that the expected outgoings are the most important factor when flood risks are considered. This has a direct impact on the forecast returns. Additionally, the questionnaire revealed that the rate of return is also an important factor. There is

no significant conclusion that flood risks have an impact on rent discounting. This suggests that market rents may not always fully reflect flood risks. Flood risks directly affect the expected outgoings (e.g., costs for flood insurance, repairs, or mitigation measures). Higher expected outgoings reduce the net forecast returns unless rental prices are adjusted upward. Investors may demand a higher rate of return to compensate for the additional risk associated with a flood-prone location. This could pressure landlords to increase rental prices to meet these demands.

So, when a risky label presents itself, investors can be expected to account for higher operating costs and future insurability and not discount the rent or sell existing investments. This principle raises concerns about potential negative impacts of flood labelling on the property market, particularly in low-income areas. Will investors prioritise risk mitigation while increasing the rent? Or will investors choose to invest elsewhere, making the risky areas less attractive for new investments? This trade-off can be described as risk mitigation versus risk avoidance. Land and properties in high-risk areas may experience a decline in value if investors choose to avoid these risks and diversify their portfolios instead. This is particularly concerning for low-lying neighbourhoods in cities like Rotterdam, Dordrecht, or The Hague, which have more low-income households. Ignoring flood risks makes neighbourhoods less liveable but mitigating them may raise rent. This could raise concerns about housing affordability if new policies require mitigation measures for residential real estate, potentially leading to unfair disadvantages to individuals who have limited or no influence on the value of their area or property. Individual homeowners are facing a risk of their property decreasing in value without having sufficient tools to mitigate them. It may also increase the wealth gap when low-income households are more likely to be confronted with floodings in the future. This is perhaps the most important topic when discussing the use of flood labels and is certainly a political debate as well, exceeding the scope of this thesis but important to society as a whole.

5.3 Limitations

Like any research, this study has its limitations. There is but one way in which climate effects can be approached. Assessing the perceived risk can therefore be done with multiple methods. The defined terminology in this research is sufficient to directly approach investors with. Meanwhile, additional research by other researchers may provide further insights into the topic. Reports, publications and research papers were acquired until September 2024.

The methodology also has limitations, as there was debate about whether interviews or questionnaires were more suitable. The use of questionnaires provided anonymous data, which made investors more willing to participate, but the limited number of participants affects the trustworthiness of the data. Additionally, the interpretation of questions within the questionnaire can vary among respondents, further impacting the reliability of the results. While this approach made the study more practical, it left data interpretation uncertain. There was also no way to ask additional questions between the researcher and the respondent. This made the expert discussion very important. The way the expert discussion was set up was to provide validation on the data interpretation and preliminary conclusions that were drawn. Because there was no possibility to ask respondents additional questions, there was no opportunity to have an expert discussion on more contextual topics such as insurability, housing affordability, climate gentrification or social effects resulting from the introduction of a climate label. The participants in the expert discussion were from the same group of participants in the questionnaire. This could create bias in the data interpretation but was necessary to keep the validation process feasible.

One hour was reserved for the expert meeting with a minimum of three participants. The data validation could have been more extensive if it had been divided between two sessions or with more participants. To limit the possible bias, the participants were asked to respond to the clarity and relevance of the questions, respond to the results and provide insights into any blind spots that have not been taken into account.

Chapter 6

Conclusion

Literature review Questionnaire

10

6 Conclusion

The goal of this thesis was to understand how flood risk labels were are by real estate investors, which data were used, and what metrics or methods were used for flood risk assessments. The research focused on flood risks within climate risks, which was closely tied to water nuisance. The combination of different stakeholder values, unreliable data, and unclear action perspectives made it more difficult to have effective investment decision-making.

The societal relevance of this study was to create a better understanding of the usage of a potential label. The study aimed to understand how investors navigated climate risks post-label introduction. When the objective was set and results of the label were clearer, investors could make a more balanced decision following the contents and the implementation of the climate label. This, in turn, helped policymakers create a more balanced climate label proposal and helped investors understand how their counterparts acted and reacted to certain flood risks.

The scientific significance of this study was about the ongoing discussion about climate labelling. Not only did the banking sector urge the implementation of a label, but also insurance companies and the AFM. However, they were still uncertain about the label contents. There remained a gap in understanding how professional investors would respond to the label. The study concentrated on the investor's perspective due to their role in the development of value in the urban context. As a result, the study answered the following main research question:

How do flood risk labels impact the decision-making process of professional investors in residential real estate in the Netherlands?

6.1 Literature review

The objective of the literature review was to identify important findings related to the subject and to outline theoretical approaches about the following topics:

- 1. the investment landscape in The Netherlands
- 2. the investment decision-making process
- 3. existing labels in real estate
- 4. sustainability reporting
- 5. water governance in The Netherlands

Furthermore, it answers the following research questions:

- SQ 1: Who are the main professional investors in Dutch residential real estate?

This thesis focused exclusively on professional investors and did not include individuals in its analysis to distinguish between professional and non-professional investors. The reason for excluding individual investors was to differentiate between decision-making driven by emotional factors versus rational factors. Professional investors in Dutch residential real estate included pension funds, insurance companies, real estate funds, and foreign private parties (or foreign REITs), who collectively accounted for €75 billion. These professional investors operate in both the equity market (where they held ownership of real estate) and the debt market (where they acted as lenders). Examples of lenders included banks, insurance companies, financial institutions, and private lenders. This study focused on investors both in the debt capital market and in the equity capital market who possessed direct ownership of real estate properties and were able to use multiple management layers to reduce risks.

- **SQ 2**: What can be learned about existing water labels for the context of climate-risk labelling?

Although the discussion about implementation of a climate risk label on real estate was relatively recent, there had been some prior experience in this area, including international practices. In the Netherlands, there was a strong belief in government backing in the case of catastrophic events. Also, there was more focus on water nuisance and localized flooding. The goal of flood risk labels had been to raise awareness, provide perspective of action, and offer insights into climate adaptation efforts. The examined labels often had the same goals but differed in what they assessed. Within the Netherlands, it was common for labels to use height and flood maps assessed on plot, area, or street scale. The origin of flood types was often not defined, making the labels unusable to cover all flood risk types. This was also a widely recognised discussion point in the built environment. Additionally, some labels covered more building-specific characteristics, such as the door threshold height. The most complete developed framework in the Netherlands was the Framework for Climate Adaptive Buildings (FCAB). This framework covered most of the flood origins and risks as well as building characteristics. It was also a framework built upon pre-existing labels.

- **SQ 3**: How are professional investors taking water-related risks into account during the decision-making process?

This question combined what had been found by answering sub-questions 1 and 2. The risk factor from flood events had been incorporated into investment decision-making using a basic theory on investment risks, which stated that investors should define a minimum rate of return and maximum acceptable risk aligned with organizational goals. While many set a minimum rate of return, fewer quantified maximum risk, especially regarding climate risks. Returns were evaluated using tools like internal rate of return (IRR) and net present value (NPV), with institutional investors emphasizing long-term metrics but often neglecting climate risks. Risk assessments adjusted forecasts for uncertainty, using simple methods like debt coverage ratios or advanced techniques like Monte Carlo simulations, though the latter were rare. Flood risks could be translated into four types of financial risks: effects on income, effects on outgoings, effects on financing, and effects on the target rate of return. Financial institutions within the EU were obligated to report on the risk their business had on the environment and vice versa by the EU taxonomy and recommendations by the TCFD. This further pushed organizations to develop their understanding of climate risks. The type of flood risks investors took into account and how this was done was further explored in the empirical part of this thesis.

6.2 Empirical research

The objective of the empirical study is to provide answers not yet covered by literature. It builds on the theory found in the previous chapters and is used to answer the main research question. The empirical research has been conducted using a questionnaire sent to various professional investors in Dutch real estate. Data has been gathered from a total of 17 respondents. The questionnaire consisted of 4 sections excluding a demographic section to classify the respondents.

The empirical research answers the following research questions:

- **SQ 3**: How are professional investors taking water-related risks into account during the decision-making process?

This question has already been partly answered in the literature review but lacked a more specific indication of what investors assess and how they do so. This is answered using the questionnaire.

Investors consider public agencies like the central government, municipalities, and water boards responsible for managing climate risk adaptation. However, investors still evaluate flood risks for their investments since not all damage is covered by the government. While primary floods are covered by the government, secondary floods are typically insured. Investors remain concerned about increasing flood risks and potential rises in insurance costs in the future. Their main concerns include effects on outgoings such as mitigation costs or maintaining the building's attractiveness for resale. Insurability and insurance fees are also significant considerations for most investors. They are less concerned about impacts on income or the need to refinance the investment. Heavy rainfall and high-water levels at sea, rivers, and lakes are most commonly assessed. Localised flooding caused by infrastructure failure and rising groundwater is assessed less frequently due to a lower perceived risk. Building characteristics are also not always assessed due to the insufficiency of methods or data for evaluation. This highlights the necessity for a more thorough evaluation of building characteristics to accurately determine flood risks. To conclude sub-question 3, a lot of flood types are assessed but not by each investor because of a lower perceived risk. There is data available to assess flood risks but a need for better methods. Building assessments are important but need more data and methods. Flood risk assessments are part of investment decisions, typically conducted during risk screening to diversify future investments and to report on the climate risk over investments.

- **SQ 4**: How can a climate label help investors navigate climate adaptation over their investment portfolio?

Following a scenario where a label indicated an increased flood risk, investors generally expected a rise in their internal rate of return. Investors also anticipated a need to make buildings more attractive for resale, the need for a more diversified portfolio, and more public investments to support economic activity in an area. Investors were not expected to discount the rent, refinance the project, or sell ongoing investments. This was in line with sub-question 3. Additionally, investors were mildly positive about the use of a flood label as it could primarily aid in reporting climate risks over their portfolio. This was further supported by the investors' indication that there was not enough convincing data, methodologies, or expertise available to evaluate future flood risks effectively. There was little to no significant data that indicated a difference in label usage or benefits for different types of investors.

- **MRQ**: How do flood risk labels impact the decision-making process of investors in Dutch residential real estate?

Implementing a flood risk label on existing real estate has some benefits towards investors in Dutch real estate. The label is used to provide information related to the building and its surroundings. Investors can utilize their preferred label score to filter out investments that do not align with their organization's risk profile. This approach streamlines the decision-making process by eliminating the need to assess each building individually. Additionally, the implementation of a risk label simplifies reporting processes.

However, for the risk label to function appropriately, certain preconditions must be met. First, it must contain information from up-to-date datasets which are updated regularly. Second, the label should have an impact on the valuation of the building to prevent market shocks. Third, the

label should contain all the information necessary for a complete flood risk assessment and the different kind of reporting standards.

Based on a specific score indicated on the label that prompts the investor to act, several anticipated actions can be expected. The investors are expected to take more expected outgoings into account. These are primarily to pay for mitigation efforts and increase insurance premiums. Insurability is a concern seen on a global scale but expected to be manageable in The Netherlands. International experiences illustrate potential future scenarios for the Netherlands as climate effects become more severe.

Meeting the stated preconditions involves challenges and is partly subject to political discussion. There remains a question to who should define the label and manage its data. Additionally, there are more technical limitations such as regularly updating rainfall datasets. Valuations also require a different approach to determine a *correct* price on assets. These are merely a few examples whose feasibility has not been evaluated in this study.

6.3 Validation

The validation paragraph in the findings revealed a conflict with the findings from the questionnaire as it underscored the lack of specific data, namely rainfall data, necessary for accurate future flood risk evaluations—a point also indicated by the investors who expressed mild positivity towards a flood label for reporting climate risks over their portfolios. This resemblance was seen in the shared acknowledgment of insufficient resources to evaluate future flood risks effectively. However, the validation paragraph diverged by emphasizing the broader implications of these deficiencies on the decision-making process, while the questionnaire results focused more on current practices and concerns among investors, such as insurance costs and the necessity for better building assessments. However, both underscored the prevalent uncertainty and the need for improved methods in flood risk assessment.

The biggest concern for investors in Dutch residential real estate was the risk of property values decreasing. This was not taken into account during the questionnaire as it focused on decision-making for new acquisitions, rather than existing stock. The main reason for price valuations to not take climate risks into account was the nature of taxations, being done based on historical data. It was assumed that a repeated catastrophic event could send price shocks throughout the market. While cash flow was important for funds in order to pay out their dividends, pensions, or insurances, the total value of the fund was equally important. This was an important addition to the questions asked in the questionnaire.

6.4 Policy recommendations

Following the findings from this research, policy recommendations can be made to be considered when moving forward with the subject of flood risk labelling. The goal of this study was to explore the practises of flood risks on real estate investments, why and how it was measured, what actions may follow and how investors would feel about the implementation of a flood risk label. Additionally, it discusses tensions surrounding the subjects that are important to the built environment.

Investors are confronted with increasing flood risks over their investments and are looking for better ways to measure those risks and account for them. Pluvial flood risks from heavy precipitation are mainly a concern due to outdated datasets. *To reduce the uncertainty towards investors, it is recommended that institutions such as the KNMI produce regularly update weather models for real estate investors to follow.* It would be in favour of investors to have those datasets, so a financial contribution from both public and private funds are reasonable. Not only can investors contribute financially. They can also collaborate with the type of unit measurements they need to effectively communicate with other stakeholders in the built environment and investment landscape. This decreases the chance of datasets proving not to be useful. It also increases the chance of successful collaboration with municipalities, water boards and other market segments since they would be using the same data, which is more suitable for a uniform flood risk label.

Apart from usable data, it is important that follow up actions are recognised by all parties involved. Also, the limits of flood risk mitigation should be acknowledged. This helps to prevent investors and their stakeholders from being surprised by sudden flood scenarios they are unable deal with. *It is recommended that investors collaborate with municipalities, water boards and ministries to develop flood mitigation strategies that reduce risk to all parties involved*. Understanding proper mitigation actions and their limits ensures sustainable new investments without future flood burdens. Also, the effect of new developments on flood risks should be taken into account. This makes flood mitigation efforts fair towards new and existing properties and their inhabitants.

Additionally, there are still tensions in the built environment regarding climate risk labelling. The implementation of labels has been discussed before this thesis and will continue long after. Concerns about liveability, housing affordability, and unfair label disadvantages drive these tensions. Institutional investment funds are responsible for ensuring safety for renters and homeowners, but face challenges when prioritizing risk avoidance over risk mitigation. *It is recommended that public parties support investors continuing to develop in low-income areas by offering financial incentives such as tax breaks, subsidiaries or low-interest loans.* This stimulates housing affordability and liveability in low-income areas and is crucial for maintaining these areas safe towards tenants.

Finally, label scores creating unfair disadvantages towards individual homeowners should be acknowledged. This is an ongoing and crucial political debate. The choice between label practises on individual assets or areas as a whole should be considered on a national level. Given the history of water management in The Netherlands, it is common practice that flood risks are assessed and valued over an area and that risks are collectively borne by the relevant public parties, investors, and individuals. *To prevent unfair disadvantages, it is recommended not to price flood risks on individual assets*.

6.5 Research recommendations

1. Future Insurability

Research Question: How do climate risks impact future insurability of real estate?

As climate change continues to elevate the frequency and severity of natural disasters, the insurability of real estate becomes a pressing concern. This study highlights the increasing risks posed by flooding, which not only endanger properties but also affect their market values and the feasibility of obtaining insurance. Exploring this topic further is essential to understand how insurance models can adapt to these evolving risks, ensuring that homeowners and investors are adequately protected. The findings suggest that without effective mitigation strategies and updated data, properties may become uninsurable, leading to significant economic repercussions.

2. Strategic versus Operational Risk Management

Research Question: How do investors consider strategic and operational risk mitigation efforts?

The differentiation between strategic and operational risk management is crucial for investors in the real estate sector. Strategic risk management involves long-term planning and policymaking, while operational risk management focuses on day-to-day measures. This study indicates that investors are aware of the need to integrate both approaches to manage flood risks effectively. By exploring this topic, further research can provide insights into how investors balance these two aspects, ensuring both immediate protection and long-term sustainability. This is vital for creating resilient investment portfolios that can withstand climate-related challenges.

3. Investor Participation in Urban Development

Research Question: How can investors participate in urban development to mitigate risks?

Investors play a pivotal role in shaping urban landscapes and implementing flood risk mitigation measures. This study highlights the necessity for investors to collaborate with municipalities, water boards, and other stakeholders to develop comprehensive flood mitigation strategies. Investigating this topic further can reveal best practices and innovative approaches for investor involvement in urban development. Such participation is crucial for creating safer, more sustainable communities that are better equipped to handle future flood risks. By contributing financially and strategically, investors can help ensure that urban development projects are resilient and beneficial for all stakeholders.

4. Budget Deficits in Climate Adaptation Efforts

Research Question: What budget deficits exist among different households to mitigate flood risks?

The financial burden of climate adaptation is not uniformly distributed among households, creating disparities in their ability to implement flood risk mitigation measures. This study highlights the need for more fair financial solutions to ensure that all households, regardless of income, can protect their properties from flooding. Further research into this topic is essential to identify the budget deficits faced by different households and develop policies that provide

financial assistance where needed. Addressing these deficits is critical for fostering inclusive climate resilience and preventing vulnerable populations from bearing the brunt of climate impacts.

5. Flood Risks versus Other Climate Risks

How does flood risk mitigation conflict with other mitigation efforts?

While flood risks are a significant concern, they are just one facet of the broader spectrum of climate risks. Potential conflicts between flood risk mitigation and other climate adaptation measures may occur, such as those addressing heatwaves or droughts. Exploring this topic further can help identify synergies and trade-offs between different mitigation efforts. Understanding these interactions is crucial for developing integrated climate adaptation strategies that address multiple risks simultaneously without causing unintended consequences. Such comprehensive approaches are necessary for building resilient communities that can withstand a range of climate-related challenges.

7 Reflection

7.1 Design & Context

Despite the study's use of a questionnaire methodology, the thesis maintains a qualitative approach. This is because of the small sample size used for the questionnaire as well as the manual and qualitative approach to data analysis. The P2 presentation concluded with approval to proceed with the research, despite method uncertainty. There has been a lot of debate on how to continue which eventually continued over the summer. Opting for the questionnaire made the research more feasible to conduct but required a lot of preparation. Designing the questionnaire has proved to be a challenging and iterative process and required several feedback sessions from supervisors. The questionnaire data offered insight into how investors perceive flood risks but lacked detailed reasoning. Simultaneously, this research is exploratory and builds upon a limited body of knowledge when it comes to climate labels.

The goal for the questionnaire was to receive around 20 responds. The distribution of the questionnaire posed a challenge as nearly all financial institutions are only approachable through customer service. The use of a networking proved to be very important to gather contact information of relevant people. The use of the RED&BLUE symposium as well as the Resilient Delta Convergence expert meeting were useful for this. Fortunately, most investors were very open to participate with the questionnaire given the relevance of the topic. Another drawback of the questionnaire is that questions already asked cannot be changed. This scenario is common with interviews, which are the preferred choice for most students. The questionnaire included follow-up questions for respondents who answered "no," but not for those who answered "yes." It would have been beneficial to also understand the reasoning behind respondents' assessments of certain flood situations. This has therefore been one of the validation questions during the expert meeting finalised the study and proved to be a good opportunity to ask questions that were missing during the questionnaire.

To outsiders, the relationship between climate effects and real estate finance may seem distant. However, they both have a very close relationship to the development of our built environment. It is important for future developments and the existing building stock to increasingly take climate risks into account. Not only have financial institutions become obliged to follow climate risk reporting recommendations, but they also mirror their practices throughout the entire supply chain. Both on a strategic and operational scale are investment-decisions to be made that make the built environment safer and accessible to all of us. This is why the thesis subject fits so well with the master's program in Architecture, Urbanism, and Building Sciences. Reflecting on and responding to current issues while considering future implications is an essential aspect of this study.

7.2 Personal reflection

I found that defining a structured, relevant and clear problem statement to be the most challenging part of the thesis. The process of doing so endured longer than the preparation towards the P2 presentation. The complexity of water makes it easy to touch upon many different problems to different stakeholders in the built environment. My interests lie within urban developments and climate adaptation given my study at the MBE and previous bachelor within Civil Engineering. While students within Management in the Built Environment master track are
taught to explore different stakeholder perspectives, this study required a clear problem to a clear target group. This became increasingly challenging when limitations to the research methodology raised as data had to be anonymous. It was very helpful to have Zac as a thesis supervisor as he was already so closely involved to the research topic. After the summer break, I felt more confident as the problem statement became clearer and more structured.

Working towards the P4, I started to question if the discussion surrounding the need of a uniform climate label was more focused on protecting a financial system rather than protecting the built environment and its people. When catastrophic events are excluded, most flood risks are both economically and technically manageable, and do not pose life-threatening situations. However, I feel a very thin connection between the label concept and the social wellbeing of individuals. When I started the thesis, I feared for the affordability of climate adaptation in economically poor neighbourhoods. Due to the lack of existing literature on the effects of a climate label on inhabitants, this aspect was not included in the study. This area remains unexplored at this time and my worries remain. I also started to question why financial institutions felt the need for more data and methods. I assume that they posses the best data and methods available already as their profession is based on risk and return estimates and calculations. However, for the rest of society to expect the government to handle all risks and damages from flood situations is unrealistic. I started to understand the complexity of financing climate adaptation while exploring climate labels. The results in this study have some interesting leads that are relatively simple to understand.

Reflecting on the process, I found it valuable, and time went by quickly. The whole process of researching a specific topic took more time than I originally thought but was fun to do so. Due to the uncommon nature of the topic, I frequently felt isolated and had to independently explore many aspects. Thankfully I had great supervisors to guide me through the process. In the end it feels rewarding coming to the conclusions of this thesis. I have also improved my academic writing skills, which was not one of my strongest areas, but will be valuable throughout my career.

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9 Appendix

Appendix A: Questionnaire (English)

Flood risk labels - questionnaire

Introduction:

This questionnaire is part of Rick Gorter's Master's thesis at TU Delft, Faculty of Architecture, focusing on flooding risks in residential real estate in the Netherlands. With increasing attention to climate labels and their role in climate change risks, this research aims to explore how flood risk labels are understood and used by real estate investors. The data gathered will be validated through an expert meeting.

Main Research Question:

How do flood risk labels impact the decision-making process of professional investors in residential real estate in the Netherlands?

Purpose:

This questionnaire aims to understand how investors perceive different types of flood risks and the information they find most valuable. The results will help bridge the gap between research and practice in real estate investments, potentially contributing to the development of better flood risk labels for informed decision-making.

Instructions:

The questionnaire has 4 sections:

- 1. Responsibility for flood risk.
- 2. Motivation for risk assessments.
- 3. Types of risks assessed and methods used.
- 4. Actions taken based on assessments.

Please answer based on your organization's perspective. An open question is provided at the end of each section for additional comments. To receive study results, you may provide your email, which will be stored separately to ensure anonymity.

Section 0 – Demographic information

This section collects basic information about the respondent. This information is used to understand the respondent's background and context.

- Type of investor
 - Sector
 - Size
- Type of investments
 - Rental/Buy
 - Typologies

- Residential/Retail/Logistic/Public

Section 1 – Responsibility

1.1 Who do you believe should take primary responsibility for flood risk adaptation efforts?

Select all that apply.

- National Government
- Municipalities
- Private Companies (e.g., real estate developers, industrial sectors)
- Insurance Companies
- Investors (e.g., institutional investors, asset managers)
- NGOs and Civil Society Organizations
- Individual Property Owners
- Other (Please specify):

1.2 Are you concerned about increasing flood risks as long as assets are insurable?

- Yes
- No
- Maybe (Please specify)

1.3 Additional remarks

Do you have any additional remarks for this section?

Section 2 – Motives for Flood risk assessments

This section aims to understand the motives for investors to seek and use data for flood risk assessments on residential real estate investments in the Netherlands. This is considered the Why question.

2.1 In your profession, what are your concerns following flood risks on real estate investments?

To answer in a scale from Agree to Disagree.

Effects on expected income

I am concerned about reduced rent, because of fall in demand for locations with flood risks. I am concerned about reduced rent, because of assets being less resilient to flood risks. I am concerned about the ability to pay rent after the event of a flooding. Effects on expected outgoings

I am concerned with increased operating costs for building services or repair/restauration. I am concerned with higher insurance premiums or higher property taxes. I am concerned with higher expenditure on mitigation measures.

Effects on target return rate

I am concerned with greater physical risks to structure and site. I am concerned with greater cash flow volatility. I am concerned with reduced insurability of assets.

Effects on types and terms of finance

I am concerned with higher margins stemming from an increased risk profile. I am concerned with fewer potential equity partners or reduced willingness to lend in a location. I am concerned with needing more security to cover for loan.

2.2 Additional remarks

Do you have any additional remarks for this section?

Section 3 - Flood label elements

This section provides several types of hazards caused by flooding. The aim of this section is to understand what type of flood hazards are considered a risk on investments in the Netherlands.

- (1) Frequency of event events more likely to occur
- (2) Intensity of event can be more extreme(3) Scale of event larger area affected
- (3) Scale of event larger area affected
 (4) Type of event did not previously occur in location

3.1 In your organisation, do you assess the described event as a risk to residential real estate investments?

Heavy rainfall that accumulates and enters the building through an opening near the surface.

If yes

- 3.1.1 Who does this assessment?
 - a) Inhouse
 - b) Outsourced
 - c) Other (describe)

3.1.2 Does your organization use a specific metric or method to assess this hazard?

- a) Yes, specify
- b) No; why not?
- c) Don't know

3.1.3 Where does your organization get the data from to assess this hazard? (self assessments, consultants, public available data, etc.) *Open question*

If no 3.1.4 Why not?

- a) Risk not considered great enough
- b) Data not sufficient to assess
- c) Methods not sufficient to assess
- d) Other (Please specify)

3.2 In your organisation, do you assess the described event as a risk to residential real estate investments?

High water levels at sea or in the rivers and lakes.

If yes

3.2.1 Who does this assessment?

- a) Inhouse
- b) Outsourced
- c) Other (Please specify)

3.2.2 Does your organization use a specific metric or method to assess this hazard?

- a) Yes; specify
- b) No; why not?
- c) Don't know

3.2.3 Where does your organization get the data from to assess this hazard? (self assessments, consultants, public available data, etc.) *Open question*

If no

3.2.4 Why not?

- a) Risk not considered great enough
- b) Data not sufficient to assess
- c) Methods not sufficient to assess
- d) Other (describe)

3.3 In your profession, do you assess the described event as a risk to residential real estate investments?

Localised flooding due to water accumulation and/or failure of infrastructure.

If yes

3.3.1 Who does this assessment?

- a) Inhouse
- b) Outsourced
- c) Other (describe)

3.3.2 Does your organization use a specific metric or method to assess this hazard?

- a) Yes; specify
- b) No; why not?
- c) Don't know

3.3.3 Where does your organization get the data from to assess this hazard? (self assessments, consultants, public available data, etc.) *Open question*

If no

3.3.4 Why not?

- a) Risk not considered great enough
- b) Data not sufficient to assess
- c) Methods not sufficient to assess
- d) Other (describe)

3.4 In your profession, do you assess the described event as a risk to residential real estate investments?

Rising groundwater and land subsidence increasing the risk on flooding.

If yes

3.4.1 Who does this assessment?

- a) Inhouse
- b) Outsourced
- c) Other (describe)

3.4.2 Does your organization use a specific metric or method to assess this hazard?

- a) Yes; specify
- b) No; why not?
- c) Don't know

3.4.3 Where does your organization get the data from to assess this hazard? (self assessments, consultants, public available data, etc.) *Open question*

If no

3.4.4 Why not?

- a) Risk not considered great enough
- b) Data not sufficient to assess
- c) Methods not sufficient to assess
- d) Other (describe)

3.5 In your profession, do you assess the building characteristics within flood risk assessments?

With building characteristics, any physical distinction of a building is implied. You can think of the entry points, type of building or materialization.

If yes

3.5.1 Who does this assessment?

- d) Inhouse
- e) Outsourced
- f) Other (describe)

3.5.2 Does your organization use a specific metric or method to assess building characteristics? (*examples: inflow height, material type, construction type, basement, water and sewage installations*)

- a) Yes; specify
- b) No; why not?
- c) Don't know

3.5.3 Where does your organization get the data from to assess building characteristics? (examples: site inspections, consultant, floor plans) *Open question*

If no

3.5.4 Why not?

- a) Risk not considered great enough
- b) Data not sufficient to assess
- c) Methods not sufficient to assess
- d) Other (describe)

3.6 Additional remarks

Do you have any additional remarks for this section?

Section 4 – Perspective of action

After questions about the motives and elements of flood risk assessments, this section explores if respondents believe they posses' sufficient knowledge, data and methods to continue.

4.1 After thinking about flood risk assessments, to what extent do you agree with the following statements:

4.1.1 Tools for assessing flood risks

- I believe that I have sufficient knowledge to perform a flood risk assessment.
- I believe that I have sufficient data to perform a flood risk assessment.
- I believe that I have sufficient methods to perform a flood risk assessment.

4.1.2 Benefits of the label

- A flood label would help me in making better investment decisions when potentially higher flood risks are present.
- A flood label would help me in elaborating mitigation measures to my fund owners.
- A flood label would help me in making the due diligence process easier/shorter.

4.1.3 Follow-up actions

To decrease investment risk, I believe:

- The rent discount should be increased.
- The discount rate should be increased to account for higher cash flow volatility.
- The investment should be refinanced if possible.
- Higher operating costs (repair costs, capital expenditure, insurance premiums, taxes) should be taken into account when new investments are made.
- Buildings should be made more desirable to tenants or other investors in the event of a resale.
- New investments should be more diversified across the entire portfolio.
- Existing investments in 'risky' areas should be sold.

• Public investments should be made to support the economic activity of the area.

4.2 Additional remarks

Do you have any additional remarks for this section?

End of questionnaire.

Appendix B: Consent form expert meeting (NL-EN)

Consent form

You are being invited to participate in a research study titled Flood risk labels: An investor's perspective. This study is being done by Rick Gorter from the TU Delft.

The purpose of this research study is to explore the investor's understanding of flood risks and the benefits of a flood label. The expert meeting will be held in two parts and should take 1-2 hours to complete.

Data will be gathered through taking notes. No citations will be used for the study. A recording will be proposed to help during the report writing and will be deleted after. The data will be used to validate conclusions made following the questionnaire in an earlier stage of the study. These conclusions will be discussed during the expert panel.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by only using a record of the discussion and using no names, emails or organisations when writing the report.

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions. After completion, data can not be removed from the dataset as the data remains anonymous.

For any questions, feel free to contact r.r.gorter@student.tudelft.nl

By entering this expert meeting, you accept to participate, and the data being used confidentially.

Toestemmingsformulier

U wordt uitgenodigd om deel te nemen aan een onderzoek met de titel Overstromingsrisicolabels: het perspectief van een investeerder. Dit onderzoek wordt uitgevoerd door Rick Gorter van de TU Delft.

Het doel van dit onderzoek is om het begrip van investeerders over overstromingsrisico's en de voordelen van een overstromingslabel te verkennen. De expertbijeenkomst zal in twee delen plaatsvinden en zal 1-2 uur duren.

Gegevens worden verzameld door middel van notities. Er zullen geen citaten worden gebruikt voor het onderzoek. Een opname zal worden voorgesteld om te helpen bij het schrijven van het rapport en zal daarna worden verwijderd. De gegevens zullen worden gebruikt om de conclusies te valideren die in een eerdere fase van het onderzoek zijn getrokken. Deze conclusies zullen worden besproken tijdens het expertpanel.

Zoals bij elke onlineactiviteit is het risico op een inbreuk altijd mogelijk. Naar beste vermogen zullen uw antwoorden in dit onderzoek vertrouwelijk blijven. We zullen de risico's minimaliseren door alleen gebruik te maken van een verslag van de discussie en geen namen, e-mails of organisaties te gebruiken bij het schrijven van het rapport.

Uw deelname aan dit onderzoek is geheel vrijwillig en u kunt zich op elk moment terugtrekken. U bent vrij om vragen over te slaan. Na voltooiing kunnen gegevens niet uit de dataset worden verwijderd omdat de gegevens anoniem blijven.

Voor vragen kunt u contact opnemen met r.r.gorter@student.tudelft.nl

Door deel te nemen aan deze expertbijeenkomst accepteert u om deel te nemen en dat de gegevens vertrouwelijk worden gebruikt.

Appendix C: Data Management Plan

Plan Overview

A Data Management Plan created using DMPonline

Title: Flood risk labels: An investor's perspective

Creator: Rick Gorter

Affiliation: Delft University of Technology

Template: TU Delft Data Management Plan template (2021)

Project abstract:

There is a fast moving debate surrounding the introduction of climate risk labels on the housing market in the Netherlands. Some argue it would improve transparency on the risks while other are more concerned about the market disruptions this would bring. This thesis further explores the effects of flooding risk labels on the housing market, looking at the owned, private rental and social rental markets. To do so, the actions perspectives are put from an investors point of view. Through interviews and expert panels with professionals, the considerations of the climate risk label becomes clear on what the risks are truly about as there are many forms of flood risks; from main water systems to regional in protected or unprotected areas and simply through heavy rainfall. Based on what water labels that have already been explored, an expectation can be formed on the possible risk label we could see in the future, and what the investor's driver would be to adapt to climate risks. When climate changes and it's flooding risks, housing labels and the effects on housing affordability has been explored, the research question may be answered: How do water risk labels impact the decision-making process of main real estate investors their investment strategy for investments in residential real estate in the Netherlands?

ID: 159378

Start date: 14-09-2024

End date: 14-01-2025

Last modified: 02-10-2024

0. Administrative questions

1. Name of data management support staff consulted during the preparation of this plan.

My faculty data steward, Janine Strandberg, has reviewed this DMP on 26 September 2024

2. Date of consultation with support staff.

2024-09-26

I. Data description and collection or re-use of existing data

3. Provide a general description of the type of data you will be working with, including any re-used data:

Type of data	File format(s)	How will data be collected (for re-used data: source and terms of use)?	Purpose of processing	Storage location	Who will have access to the data
Contact information of potential respondents (email, names, phone numbers)	.cvs files	Contact information is gathered by sending emails to info/websites or via phone calls. Also, references from supervisors can be used to contact participants.	Communication	Project storage	The researcher (Rick Gorter)
Questionnaire dataset	Qualtrics, .cvs files	Qualtrics questionnaire	Analysis of data, report conclusions	Qualtrics, Project storage	The researcher (Rick Gorter), Supervisors (Zac Taylor, Michaël Peeters)
Notes of expert meeting	.doc files	Writing, typing, discussions. These are notes based on findings by "experts". The expert group will not be from the same pool of participants as the survey.	report conclusions	Project storage	The researcher (Rick Gorter), Supervisors (Zac Taylor, Michaël Peeters)

4. How much data storage will you require during the project lifetime?

• < 250 GB

II. Documentation and data quality

5. What documentation will accompany data?

• Methodology of data collection

The methodology of data collection is described in the thesis.

III. Storage and backup during research process

6. Where will the data (and code, if applicable) be stored and backed-up during the project lifetime?

- Another storage system please explain below, including provided security measures
- SURFdrive

Project storage drive and Outlook servers (TU Delft accounts).

IV. Legal and ethical requirements, codes of conduct

7. Does your research involve human subjects or 3rd party datasets collected from human participants?

• Yes

8A. Will you work with personal data? (information about an identified or identifiable natural person)

If you are not sure which option to select, first ask you<u>Faculty Data Steward</u> for advice. You can also check with the <u>privacy website</u>. If you would like to contact the privacy team: privacy-tud@tudelft.nl, please bring your DMP.

• No

8B. Will you work with any other types of confidential or classified data or code as listed below? (tick all that apply)

If you are not sure which option to select, ask your<u>Faculty Data Steward</u> for advice.

- Yes, data which could lead to reputation/brand damage (e.g. animal research, climate change, personal data)
- Yes, data related to competitive advantage (e.g. patent, IP)
- Yes, confidential data received from commercial, or other external partners

9. How will ownership of the data and intellectual property rights to the data be managed?

For projects involving commercially-sensitive research or research involving third parties, seek advice of your<u>Faculty</u> <u>Contract Manager</u> when answering this question. If this is not the case, you can use the example below.

Data received from the questionnaire is bundled in type of organisation. Email adresses will not be saved in the dataset. The bundled results will be used in the report, presentation and discussions. After the project has been finished, datasets will be deleted. The report will be free to acess on the TU Delft repository.

V. Data sharing and long-term preservation

26. What data will be publicly shared?

• Not all data can be publicly shared - please explain below which data and why cannot be publicly shared

Only data results and conclusions can be shared. The dataset will not be shared.

28. How will you share your research data (and code)?

• All data will be uploaded to 4TU.ResearchData

VI. Data management responsibilities and resources

33. Is TU Delft the lead institution for this project?

• Yes, the only institution involved

34. If you leave TU Delft (or are unavailable), who is going to be responsible for the data resulting from this project?

The supervisors (Zac Taylor, Michaël peeters, Maria Villalba Muñoz)

35. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

The results of the questionnaire will be shared through the final results/presentation. Each respondent has the chance to opt for a follow-up email with the project results. During the expert meeting, notes are taken and shared with the participants.

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