Behavioural Change within the Energy Transition: Case study of insulating housing in Oranjewijk Leeuwarden

Fenna de Jong, S4883276

Global Responsibility and Leadership, University of Groningen

Capstone Thesis

Dr. Elena Cagnavaro

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Abstract

Understanding the complexity of insulation behaviour is of increasing importance for our low-carbon transition. This research provides insights into the perceived barriers and enablers of insulation behaviour among residents of Oranjewijk Leeuwarden. A behaviour change framework called the COM-B model has been utilised in this study, that cites Capability (C), Opportunity (O) and Motivation (M) as three main factors capable of changing behaviour (B). Through the COM-B lens, a thorough literature review has been conducted structured along these three key components to provide a comprehensive understanding of the existing knowledge in the field. The literature laid the foundation for further data collection. Qualitative data were collected in collaboration with Energieloket Oranjewijk Leeuwarden, the Netherlands, through 11 interviews with homeowners in the neighbourhood. The results show a wide array of barriers and enablers within each component of the COM-B. This includes the critical role of know-how skills in enhancing capability, the positive influence of social opportunities and the multifaceted nature of motivation beyond economic factors, including comfort, both thermal and aesthetic, and environmental concerns. These findings both validate and expand on previous research. Interventions tackling these factors have been proposed. This study underlines the importance of a dimensional and multi-faceted understanding of insulation behaviour. Future research could explore if other social contexts and demographic settings can validate these results.

Keywords: insulation behaviour, low-carbon transition, COM-B model, behavioural change.

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Introduction

In recent decades, greenhouse gas emissions (GHG) have been increasing at an accelerating speed (Ritchie et al., 2023). Ambitious reduction efforts within the energy sector are called for given the significant impact of greenhouse gas emissions on global warming. To reach the main objective of the Paris Agreement and the 2030 Agenda for Sustainable Development - a cutdown of GHG emissions of 45 % in 2030 and reaching net zero by 2050 - low-carbon energy transitions are essential (Kamali Saraji & Streimikiene, 2023). The transition to a low carbon energy system requires rapid and strong socio-technical change within our systems and society (Geels et al., 2017). Technological change alone is insufficient, it also requires widespread changes in consumers' behaviour and energy usage (Axsen & Kurani, 2012). Understanding behavioural change in the energy transition is thus of critical importance in our strategies towards this transition.

Despite its importance, behavioural change has received little attention in the majority of energy transition research (Kamali Saraji & Streimikiene, 2023). There is a need to explore individual behaviour changes within 'energy transition-friendly behaviour' and their impact (Steg et al., 2015). Few studies have focused on specific low-carbon behaviours in local contexts and their contributions to broader energy transition strategies (Hafner et al., 2019; Steg et al., 2015). Current models fail to fully explain individual behaviour beyond economic factors (Organ et al., 2013; Fridge & Chappin, 2014).

Therefore, this qualitative research aims to shed some light into the barriers and enablers of a specific behaviour required for the energy transition: insulating. This research concentrates on the Netherlands, namely Leeuwarden. The Dutch government’s ‘Klimaat akkoord’ targets carbon neutrality for 1.5 million households by 2030 and total fossil fuel independence by 2050 (Ministerie van Algemene Zaken, 2023). With the ‘Programma Aardgasvrije Wijken’ (PAW), the government wants to learn how homes can get rid of natural

gas and develop local knowledge and experience with insulation and installation of fuel-efficient heating (Ministerie van Algemene Zaken, 2023). Oranjewijk Leeuwarden, the neighbourhood that will be the subject of this study, is included in the PAW as an "experimental garden" to investigate what is required to reach the goals of the ‘Klimaat akkoord’. This research will be conducted in collaboration with the local energy cooperation ‘Energieloket Oranjewijk Leeuwarden’. The energy cooperation works together with the residents of Oranjewijk to transition into a low-carbon neighbourhood.

This research employs the COM-B (Capability, Opportunity and Motivation) model to study the behavioural processes in housing insulation in Oranjewijk Leeuwarden (West & Michie, 2020). Identifying behavioural barriers, which can reduce energy savings by 63-80%, is crucial for effective solutions (Niamir et al., 2018). The COM-B model helps us study these barriers and enablers to enhance capability, opportunity, and motivation.

After listing the research questions, this paper will start with an explanation of the theoretical framework that will be used. This framework will be at the heart of the research and will be used to structure the existing literature and the results. The literature provided in the literature review will give us an understanding of what is already known and help to structure our interview questions. How the interviews will be conducted is explained in the research methods. Then, the results and discussion of the interviews will follow. In this section, the connection will be made between the findings and the existing literature. This way the research objectives can be answered. The paper will end with a conclusion in which we return to the central research question.

Research question

Central research statement: to examine the presence and relevance of the perceived barriers and enablers of insulation behaviour of Oranjewijk Leeuwarden residents.

Research objectives:

1. Describe the behaviour of Oranjewijk residents in insulating their housing.
2. With reference to the COM-B model, identify and examine which capability variables are perceived as barriers by Oranjewijk residents.
3. With reference to the COM-B model, identify and examine which capability variables are perceived as enablers by Oranjewijk residents.
4. With reference to the COM-B model, identify and examine which opportunity variables are perceived as barriers by Oranjewijk residents.
5. With reference to the COM-B model, identify and examine which opportunity variables are perceived as enablers by Oranjewijk residents.
6. With reference to the COM-B model, identify and examine which motivation variables are perceived as barriers by Oranjewijk residents.
7. With reference to the COM-B model, identify and examine which motivation variables are perceived as enablers by Oranjewijk residents.
8. Examine the possible relation between the findings from the COM-B model and the selected criteria of the sample.
9. Design a matrix as an intersection of the COM-B model and selected sample criteria that can be used to inform communication strategies.

Literature review

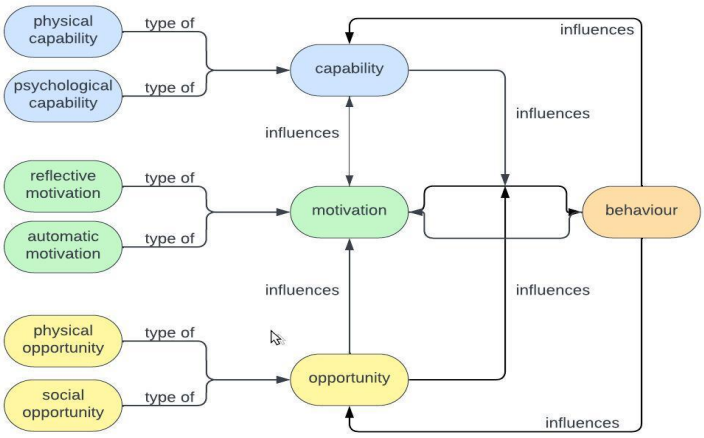
The objective of this section is to explore different bodies of literature that identify specific barriers and enablers of insulation behaviour. This informs our interview questions, that can either be aimed at confirming or rejecting certain findings of the literature or explore topics that are under highlighted in the current field. Two theoretical frameworks will be given, the COM-B model and the behavioural wheel model (Michie et al., 2011), that will provide a structure through which we will try to understand our further literature and results. The literature will be divided into the following three sections of the COM-B model: Capability, Opportunity and Motivation. The body of literature used is mostly concerned with behavioural changes in the energy transition, but with different emphases e.g. the reduction of thermal energy demand (Hafner et al., 2019), the adoption of innovative heating systems (Mahapatra & Gustavsson, 2008), energy efficient refurbishments (Organ et al., 2013) or energy-saving measures (Zundel & Stieß, 2011). Recurring themes and motivations have been identified and compared within the literature and classified along the COM-B sections.

COM-B model

The framework used in this study to be able to analyse the target behaviour is the COM-B model (see Figure 1). According to the COM-B model, three factors must be met for any behaviour to occur: capability (C), opportunity (O), and motivation (M) (West & Michie, 2020; The decision lab, 2021). A particular behaviour, such as insulating your house, will only occur when the person concerned has the capability and opportunity to engage in the behaviour and is more motivated to enact that behaviour than any other behaviours (West & Michie, 2020).

Figure 1

The COM-B model of behaviour



Note. Reproduced from "A brief introduction to the COM-B Model of behaviour and the PRIME Theory of motivation", by R. West & S. Michie, 2020, https://doi.org/10.32388/WW04E6.2.

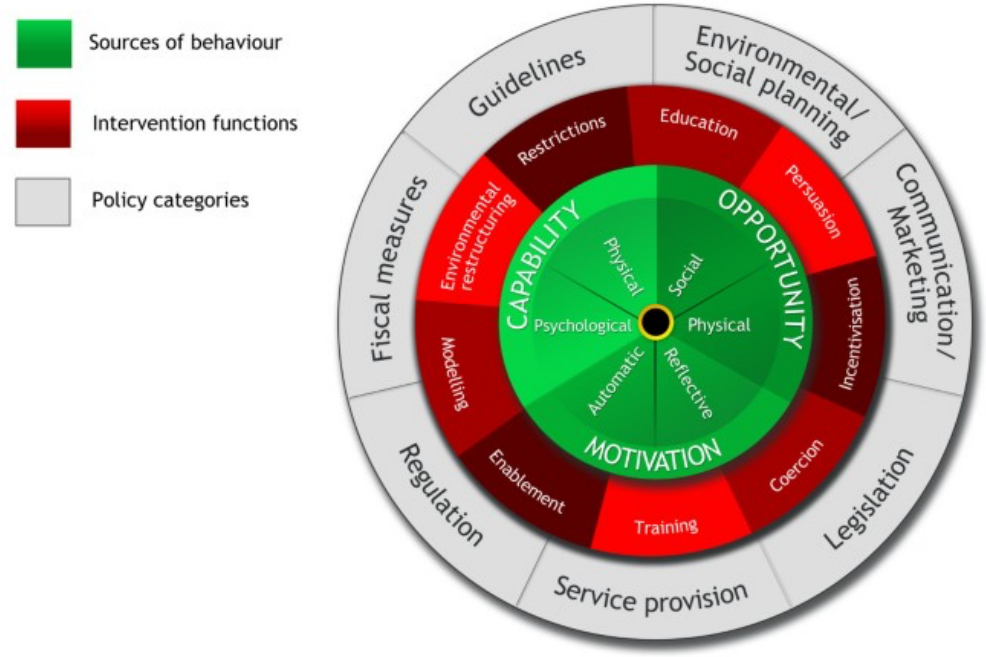
First, Capability is defined as the individual's psychological and physical capacity to engage in the behaviour concerned (Michie et al., 2011). A distinction is made between physical capability, for instance a person's physique, skills and strength, and psychological capability, which relates more to understanding and memory (West & Michie, 2020). Second, Opportunity is defined as all the factors that lie outside the individual that make the behaviour possible or prompt it (Michie et al., 2011). This includes social opportunity, which is defined by culture and social norms, as well as physical opportunity, which is the financial and material means to participate in the behaviour (West & Michie, 2020). Central to the model is motivation, all those mental processes that energise and direct behaviour, not just goals and conscious decision-making. It includes habitual processes, emotional responding, as well as analytical decision-making (Michie et al., 2011). Motivation can be both automatic or reflective.

It should be noted that Opportunity and Capability are shown as influencing motivation or the relationship between motivation and behaviour, rather than directly the behaviour itself (West & Michie, 2020). Both need to be in place before motivation is able to generate behaviour. In general, the more capable we are, or believe we are, in enacting a behaviour and the more conducive the environment is to enacting it, the more we tend to want to do it (West & Michie, 2020). In turn, behaviour also influences the three factors again, possibly creating both positive and negative feedback cycles.

With the aid of the COM-B model, we can better understand what particular factors can support, or obstruct, behaviour change. This model of behaviour is also the first foundation of The Behaviour Change Wheel (BCW) (see Figure 2). BCW is a framework to articulate effective interventions that are informed by the original sources of behaviour (Michie et al., 2011). The COM-B model forms the hub of the BCW around which are positioned the nine intervention functions aimed at addressing deficits in one or more of these conditions. Around this are placed seven categories of policy that could enable those interventions to occur (Michie et al., 2011).

Figure 2

The Behavioural Change Wheel model



Note. This model was produced by West et al. in 2011. From "The behaviour change wheel: A new method for characterising and designing behaviour change interventions", by West et al., 2011, p. 8, https://doi.org/10.1186/1748-5908-6-42

The next section will give an overview of the body of literature on behavioural change in the energy transition. The aim is to give a summary of the recurring reasons and motives for behavioural change given in literature and indicate them along the lines of the COM-B model. However, classifications along these lines required decisions to be made because the literature was not always as clear-cut. Thus, readers are encouraged to evaluate and interpret the classifications in their own way.

Capability

Capability can be divided into knowledge capability and skills & expertise capability. First, we will focus on knowledge capability. Knowledge can affect the evaluation of pros and cons of energy alternatives (Steg et al., 2015). Knowledge and information are used synonymously. A study by Pelenur & Cruickshank (2012) identified lack of information as a key barrier to behavioural change in the adoption of home energy efficiency measures. Ucl (2021) also considers lack of knowledge of what to do to improve the energy efficiency of their homes as a known influence on homeowner's perception of capability. For instance, lack of knowledge on the return value influences homeowners decision making. It is shown that the significance of cost increases as a barrier if the benefits of the energy efficiency measures are unknown or if they are perceived to be very low (Pelenur & Cruickshank, 2012). However, given only ten percent of all respondents mentioned this as a barrier, it can be disputed how big of a barrier this really is. In the same vein, the study of University College London (2021) notes that there is a very poor public understanding of 'energy' and 'carbon'. Homeowners thus often cannot make informed decisions. Providing Information and support can enhance the capability of homeowners. A study conducted by Jager (2006) shows that information and support meetings organised in Groningen had a strong positive effect on the diffusion of PV systems, due to the reduction of perceived technical and bureaucratic barriers. Furthermore, people have limited understanding of the extent to which their behaviour contributes to climate change (Steg et al., 2015). For instance, only a limited number of people know that their heating and cooling systems contribute to global warming (Bord et al., 200; as cited in Steg et al., 2015). Generally, people tend to associate global warming more with distant activities such as the industry than with their own actions.

Second, we will look at skills & expertise capability. This is closely related to the level of perceived behavioural control of homeowners: do homeowners feel able to carry out an action successfully and that their action will bring about the expected outcome? (Hafner et al., 2019). It is thus not only about the actual skills & expertise of homeowners, but mostly their perception of them. A perceived lack of expertise can have an impact on homeowners' perception on their capability in the adoption of home energy efficiency measures (Pelenur & Cruickshank, 2012). This perceived lack of expertise is not only limited to knowledge about energy efficient refurbishments itself, but also the lack of knowledge to appoint a trustworthy contractor (Pelenur & Cruickshank, 2012). The skill to know where to get trustworthy advice is also indicated as a known influence on homeowners' perception of capability by Ucl (2021). Another dimension of the skills capability is the practical Do It Yourself (DIY) skills. Mogensen & Gram-Hanssen (2023) distinguish in their study between two different types of knowledge; the project-management know-how skills, as mostly discussed here above, and the practical craft skills that are developed by DIY renovations. While only a small minority of their participants indicated to have engaged in renovations project themselves, they reported that it positively impacted their feeling of capability through the accumulation of practical skills and knowledge on the know-how (Morgensen & Gram-Hanssen, 2023)

In this research, Oranjewijk residents understanding on energy renovations will be explored. Among others, we will take a look at whether homeowners know what to do to improve the energy efficiency of their homes, whether they perceive themselves to hold sufficient knowledge and their understanding of terms such as energy, gas usage and energy labels. The topic of skills and expertise capability will also be studied, with an emphasis on determining if homeowners know where to access advice and find a contractor, as well as their capability to conduct renovations themselves.

Opportunity

Once more, we must distinguish between social and physical opportunity when discussing opportunity. Literature in the field on social opportunity mostly focuses on cultural norms, e.g. how are homeowners' decisions influenced by what the social environment, for instance friends or neighbours, do? (Hafner et al., 2019; Ucl, 2021; Organ et al., 2013). People want to do what others do, and specifically what others wish them to do (Hafner et al., 2019). Schultz et al. (2007) conducted a field experiment examining the effects of normative information on household energy consumption. All households received feedback about how much energy they had consumed in previous weeks and descriptive normative information about the average consumption of other households in their neighbourhood. Results show that households with a significantly higher energy consumption than their neighbours, reduced their usage drastically (Schultz et al., 2007). Similar research was done by energy company O'Power, which gave households feedback in comparison with their neighbour. Again, energy usage reduced drastically (Allcott, 2011). However, it has also been questioned how influential social norms are, since social norms relating to actions must be visible and homeowners must be aware of the pressure to conform (Organ et al., 2013). Without such interventions as mentioned above, energy efficiency refurbishment is potentially less visible and therefore social norms may have a diminished effect. Another study also notes the 'Lack of strong cultural narrative to promote desirability of retrofit measures' and 'Improving home energy efficiency is not socially normal in the way that other improvements are (e.g. new kitchens and bathrooms)' as barriers to opportunity (Ucl, 2021).

Secondly, Financial means is the primary boundary to physical opportunity. The household income and availability of capital is of particular influence on homeowners' perceived opportunity (Organ et al., 2013). Homeowners with higher incomes are expected to be more inclined to install a new heating system than those with low incomes (Mahapatra & Gustavsson,

2008). However, the physical financial opportunity is not only dependent on household income, but also impacted by the economic environment. Fridge & Chappin (2014) indicate the ‘uncertainty if the investment will pay off’ as one of the main economic barriers to homeowners for Energy Efficient Renovations (EER). The uncertain economic environment is also mentioned as a barrier to consumers' opportunity for investments in low-carbon technologies by Ucl (2021). These factors in turn influence the financial motivation of homeowners and are thus highly linked to each other.

This research will study if, and how, Oranjewijk residents are possibly influenced in their decision making by their social environment such as friends, relatives and/or neighbours. It will also explore the physical financial opportunities of Oranjewijk residents by inquiring whether they feel like they have sufficient resources or that alternative resources, such as loans, are available to them. This will also be related back to financial motivations.

Motivation

A great deal of previous research into behavioural change in the energy transition has focussed on motivation (Hafner et al., 2019; Mahapatra & Gustavsson, 2008; Friege & Chappin, 2014; Organ et al., 2013; Zundel & Stieß, 2011; Steg et al., 2015). Motivation can be roughly divided into three recurring motivations including financial motivation, comfort motivation and environmental motivation. This section will discuss them in the given order.

One of the most recurring motivations referred to within literature is financial motivation (Axen & Kurani, 2012; Mahapatra & Gustavsson, 2008; Friege & Chappin, 2014; Organ et al., 2013). Financial motivation seen from the perspective of a house owner is on one side the investment to be done and on the other hand the expected lower energy costs. This is supported by Mahapatra & Gustavsson (2008) in their research on the adoption of innovative heating systems in Sweden. Their research indicated the most frequently given system-related factors affecting respondents’ choice of heating system, with two of the most important ones being 'annual cost

of heating' and 'investment cost' (Mahapatra & Gustavsson, 2008). Further barriers related to the investment to be done include the 'unwillingness to raise a (further) loan' (Friege & Chappin, 2014). Economic factors, however, can also serve as an enabling factor. Economic motivations of homeowners for energy efficient renovations can be, as mentioned before, the reduction of energy bills, but also the increase in the home's value and the pay back of energy efficient renovations (Friege & Chappin, 2014). This is complemented by Organ et al. (2013) in his study on motivations for energy efficient refurbishments, indicating the following economic factors: cost of energy bills, potential savings and the value added to the property.

However, the importance of going beyond the motivation of profitability is also prevalent in literature. A broader perspective has been adopted by Zundel & Stieß (2011) that argues that "refurbishments are the outcome of a broader decision which is shaped by an alliance of economic and non-economic motives and goals". It is stressed that the home is a place of shelter and security contributing to our public image, providing a space for activities and social interaction (Organ et al., 2013). Homeowners' decisions are likely to be influenced by these aspects as well. One of the motivations highlighted in current literature is the comfort of the home (Organ et al., 2013; Aune 2007; Steg et al., 2015). A significant relationship was found between respondents' level of satisfaction and their plans to install a new heating system (Mahapatra & Gustavsson, 2008). Aune (2007) also argues for the importance of 'the home as heaven', which is a more symbolic, mental picture of the homeowner about what home means. To materialise this picture, homeowners need to construct the environment and enact certain behaviour. This feeling of home can be for instance realised by a comfortable indoor temperature, an open fireplace, the right lighting, etc. (Aune, 2007). Another motive can be 'the home as a project', in which there is an interest in spending time and money to continuously design and build an indoor environment. This is mainly done to provide a space for activities and leisure time that is increasing in comfort (Aune, 2007). Regarding the house, there is another barrier that prevents homeowners from changing behaviour. This is what Zundel &

strieß (2011) call ‘refurbishment stress and overstrain’, a low engagement in energy-efficient refurbishment due to negative perceptions about the process of refurbishment and uncertainty about the outcome. Negative perceptions include the idea that renovations cause much stress and dirt (Firege & chappin, 2014) and the perception that implementation of new energy systems is an unnecessary hassle, which simply takes ‘too long’ or is ‘too complicated’ (Hafner et al., 2019). The disruptive nature of the work required to install low-carbon technologies was also identified as one of the barriers in the Ucl study (2021). This is also further reinforced by what is called an action inertia, which refers to the reluctance to consider investing in new heating systems due to the preference of inaction (Hafner et al., 2019). People are more likely to defer choice and or stick with defaults when choosing is perceived to be complicated. A study done by the Department of Energy and Climate Change (DECC) (2013) found that in a non-emergency scenario, e.g. the current heat system is still functioning, the majority of survey respondents would opt to do nothing, rather than a pre-emptive replacement.

Lastly, behaviour can also be driven by environmental motivations (Hafner et al., 2019). Environmental factors of motivation can include the environmental impact of an individual's behaviour, resilience against climate change or the reduction of the carbon footprint (Mahapatra & Gustavsson, 2008; Organ et al., 2013). However, literature shows opposing results on the strength of environmental motivations. Respondents gave low priority to environmental aspects when deciding on a heating system (Mahapatra & Gustavsson, 2008). Along the same lines, Organ et al. (2013) finds that economic benefits have been most successful in encouraging pro-environmental behaviour. The principal motivation for performing energy efficiency works is to save money on energy bills, which as often priority over environmental benefits (Organ et al., 2013). Unlike Organ et al., Hafner et al. (2019) argue that people are more likely to adopt pro-environmental behaviour, such as insulating your house, if provided with feedback emphasising the environment, as opposed to the financial benefits. This is because decision makers often

seek to act in ways that make them feel better about themselves, and acting upon altruistic motivations is one way of achieving this.

This research will call into question all three dimensions of motivation. We will investigate which financial motivation factors are most frequent, as well as Oranjewijk homeowners' perceptions of added value to the property and return on investment. Comfort will be assessed by questioning homeowners about their own thermal comfort and their thoughts on the renovation process itself. Finally, the concept of environmental motivation will be discussed by looking into what specific factors influence environmental motivation.

Oranjewijk Leeuwarden

This study builds forth on earlier research done by Energieloket Oranjewijk Leeuwarden. A quantitative survey has been conducted in 2019 to get a general overview of the demographics and attitudes towards energy insulation in the neighbourhood (NEO-peiling, 2019). To highlight a few of the findings, 92 out of 190 respondents absolutely agreed that living sustainable is a reason to insulate their house. While this suggests that environmental motivation is present in the decision making and confirms the literature by Mahapatra & Gustavsson (2008), it does not tell us anything about the strength of this motivation and the priority of environmental reasons over economic benefits (Organ et al., 2013). Additionally, 100 out of 192 also absolutely agree that comfort is a reason to insulate their house. This shows the prevalence of comfort motivation within the neighbourhood and confirms earlier findings (Organ et al., 2013; Aune 2007; Steg et al., 2015). However, it does not give us a good insight as to how comfort is perceived or interpreted. Furthermore, knowledge capability was not really considered a barrier. 132 out of 188 says not to miss information on what the best ways are to save energy. Another research report done by a student from the NHL Stenden indicated that living comfort, financial resources, affinity with the topic, time and ambiguity were the most important factors in the decision making of insulation (Moltmaker, 2023). This is in line with the

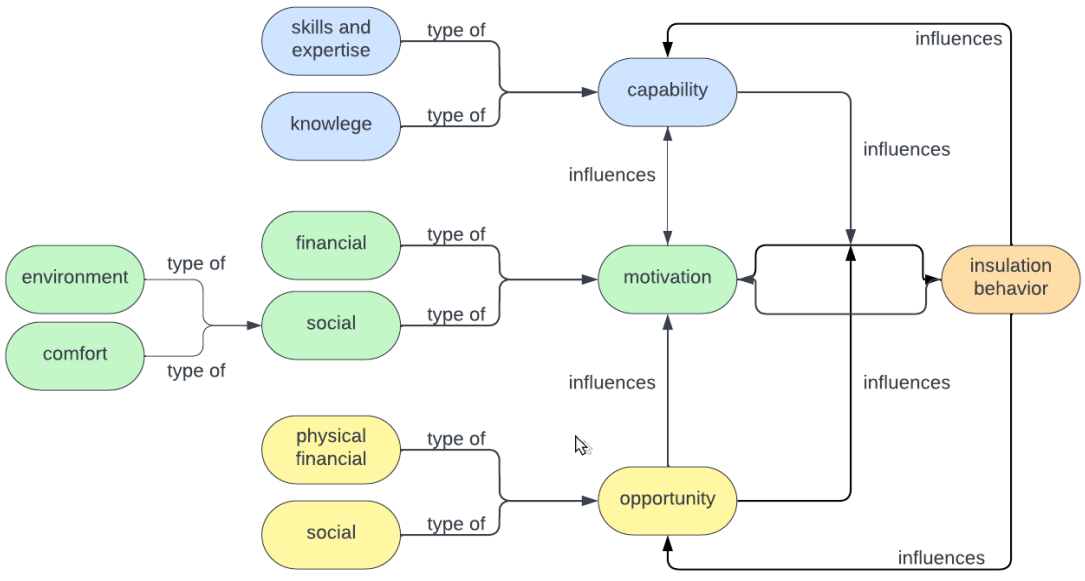
current literature known on the topic. A particularly insightful finding was the prevalence of 'living comfort' as an important factor, confirming the importance to look beyond economic factors (Moltmaker, 2023; Zundel & Stieß, 2011). This study aims to provide a more qualitative understanding of the above.

Incorporating theory into the COM-B model

To visualise the information extracted from the studies discussed above, the main factors of Capability, Opportunity and Motivation for insulation behaviour have been connected to the COM-B model (see Figure 3). This visualisation does not cover the full extent of the literature, but it does give a clear overview of the most important themes.

Figure 3

The updated COM-B model for insulation behaviour



Note. An interpretation of the COM-B model applied to the decision making process of insulation behaviour. Own work.

Insulation renovations

This paragraph will provide some fundamental foundational knowledge regarding what insulation is, what options are available, and what their relevance is. When we speak about (insulation) renovations in this paper, we refer to thermal insulation renovations. Thermal renovations are defined as 'the use of materials or a combination of materials that retard the rate of heat flow by conduction, convection, and radiation' (Al-Hamoud, 2005). Simply put, it ensures that heat does not escape the house (Solvari, 2022). This is mainly done to make households more energy efficient, e.g. eliminating energy waste and being able to use less energy for heating and other functions. It can also ensure a more stable temperature within a house (Solvari, 2022). There are four main insulation types, but there is a lot of variety in materials and approaches possible. These four types include roof insulation, window insulation, floor insulation wall insulation.

Research gap

Literature suggests that further research is needed to study energy efficiency in an integrated way concerning the local context and different subpopulations (Hafner et al., 2019; Steg et al., 2015). Specifically, there is a lack of deep understanding of the uncertainties around economic factors and non-economic factors driving energy efficient renovation decisions of homeowners (Friege & Chappin, 2014). Although research on financial opportunity and motivation is common, the knowledge on social opportunities and social motivations (e.g. comfort, environmental) is less rich. In addition, there is very little research on which types of knowledge, skills and expertise are particularly important for homeowners to feel capable to enact energy efficient behaviour (Steg et al., 2015). Lastly, Friege & Chappin (2014) conclude that most models and simulations typically ignore non-economic factors and recommend new approaches to study the decision making processes of homeowners. In sum, studies often focus

on one aspect of the decision making process, making it difficult to assess the relevance of that aspect in comparison to other COM factors.

Overall, this research contributes to a more thorough and qualitative knowledge of particular energy-efficient behaviours like insulation. Emphasis is placed on the necessity to understand different contexts and populations and to look at factors influencing behaviour beyond economic ones. To cope with the limitations of current models, the COM-B model is hereby used because it offers a holistic approach to factors influencing behaviour.

Research methods

The main objective of this study is to investigate the main barriers and enabling factors of insulation behaviour along the lines of the COM-B model for the inhabitants of Oranjewijk Leeuwarden. In this section, the methods used in the research to investigate this will be discussed. In the current study a qualitative method will be employed. Qualitative methods offer an effective way of getting a profound and nuanced understanding of the research issues that embrace the perspectives of the study population and the context in which they live (Hennink et al., 2020). They can give us more detailed and diverse information than quantitative research on why people act or think the way they do.

To put this choice in the context of the literature, a review of research methods of similar studies is covered. Then, the sample selection and criteria are discussed and a rationale is given for the data collection and analysis that allows for the replication and repetition of the study. The section concludes with the ethical considerations involved.

Research methods in previous studies

Earlier studies have made use of a variety of different quantitative and qualitative approaches. A great number of studies have conducted literature reviews to get a comprehensive understanding of the existing research in the field (Hafner et al., 2019; Friege & chappin, 2014; Organ et al., 2013; Steg et al., 2015; Aune, 2007). While certain studies focussed specifically on the psychological discipline (Steg et al., 2015; Hafner et al., 2019), others employed a range of different disciplines as well (Organ et al., 2013; Friege & Chappin, 2014). Surveys have also been conducted with specific emphasis on the local context and case studies, such as in Sweden (Mahapatra & Gustavsson, 2008) and in Germany (Zundel & Strieß, 2011). Qualitative interviews have been used in a case study on the adoption of low-carbon

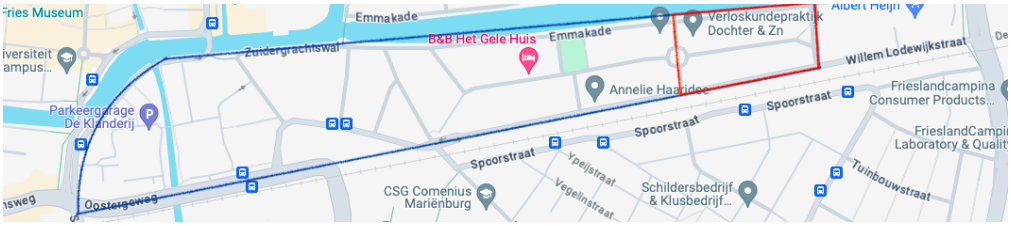
heating technologies in Whales (Ucl, 2021) and street interviews conducted in the context of Greater Manchester and Cardiff (Pelenur & Cruickshank, 2012).

Sampling method

This study focuses on the specific neighbourhood called Oranjewijk in Leeuwarden (see Figure 4). These homes, which span a variety of price ranges, are thought to provide a good representation of the entire neighbourhood. This study made use of a purposive sampling method, selecting specific criteria that are considered relevant to the research (Hennink et al., 2020). Three classifications have been set in cooperation with Energieloket Oranjewijk Leeuwarden to select the participants. These classifications have been used as guiding principles rather than fixed inclusion criteria. First, the aim was to interview four households from three different streets, namely ‘Emmakade’, ‘Gysbert Japicx straat’ and ‘Spoorstraat’. These three streets are a relative indication of the type of house, e.g. the houses at Emmakade relatively bigger and from a different price classification than the houses in the Gysbert Japicx straat and Spoorstraat. Within this, the interviewer aimed at selecting homes with different maintenance levels, as an indication of the household’s income. Last, three demographic groups were indicated: a single couple, a family with kids, and a senior couple. These criteria were set with the aim to have a representative sample of the neighbourhood Oranjewijk Leeuwarden. The classifications and amount of interviews are further specified and evaluated in Figure 5.

Figure 4

A map of the Neighbourhood Oranjewijk Leeuwarden.



Note. The blue lines indicate the whole neighbourhood Oranjewijk. Red shows the selected houses for the research.

Own work.

Figure 5

Table with classification criteria and the distribution of interviews

Table 1: classification by Streets

street	average house size	price range	No. of interviews
Emmakade	bigger	higher	4
Gysbert Japicx straat	smaller	lower	3
Spoorstraat	average	average	3

Table 2: classification by maintenance condition

Condition	Criteria	No. of houses
well maintained	regurlarly maintained garden, no paint damage, no visible decay to the house or damage on windows, roofs, doors, etc.	8
bad maintained	unmaintained garden, visible paint damage, damaged windows,roof and gutter	2

Table 3: classification by residence type

resident type	criteria	No. of interviews
young couple	not studying, working, no kids	4
working family	at least one parent working, has kids	5
older couple	retired	1

Note. Own work.

A "ring the doorbell" strategy was used to collect participants. This means that the researcher went from door to door in the Oranjewijk and selected participants based on the criteria and willingness to participate. Partner Energieloket Oranjewijk Isoleert helped with informing the residents of Oranjewijk Leeuwarden through a letter sent to all residents in the selected streets.

In total, 54 houses in the selected neighbourhoods were approached. 23 out of 54 homeowners were not home at the time that the interviews were being conducted. Of the 31 people who did open the door, 20 refused to take part in the questioning. Reasons given were ‘no time’, ‘I am not interested or want to be involved with renovations insulation’ or ‘I have no knowledge/no renovations done so I cannot tell you anything.’ Participants declined to participate because they felt inapt, even after it was clarified that the latter would not be of any issue and would be beneficial for this study. A pattern can be seen that the participants that refused to participate for this reason, often were the ones with houses that were badly-maintained. On the other hand, the homeowners that did agree to participate, often had more renovations done and prior knowledge on the topic. This led to a self-selection bias in the participant sample, where those that choose to participate voluntarily may systematically differ from those that do not. The reader should be aware of such bias.

Data collection

Semi-structured interviews were chosen because of the flexible nature that allows for the exploration of topics that arise during the conversation. This way, the researcher can adapt to the interviewee’s response and has the opportunity to probe and ask follow-up questions that seem relevant. The semi-structure provides a framework for all interviews and ensures that all main questions are addressed (see Appendix A). The interview questions are theoretically informed by a wide range of literature. The questions were separated into three different parts

based on the COM-B model of Michie et al. (2011). All interviews were conducted in person. The main language spoken during the interviews was Dutch. The length of the interviews was approximately around 30 minutes. All interviews were recorded with the mobile device application dictaphone. After the interviews, the recordings were transcribed using the internet tool ‘turboscribe.ai’(see for example Appendix B). Both tools could only be accessed through a separate password. After copying the transcribed interviews into a closed data file, the transcriptions were deleted from turboscribe.ai.

Data analysis

A thematic deductive analysis was applied to the collected data. The data was first put in an operationalization matrix based on the three themes as given by the theoretical framework of the COM-B model. Then, themes have been analysed and identified within the three components. Themes were first coded based on themes earlier identified within literature. Then, new sub-themes within the data were identified through repetition and active reading (Hennink et al., 2020). As such, the main themes were theory-driven and based on the COM-B framework, and the subthemes were more flexible and data-driven. This system of coding gives us a structural organisation of the data while conserving its rich detail.

Ethics

All participants were beforehand asked to give signed informed consent (see Appendix C for the consent form). Before signing, they were clearly informed about the type of questions, the aim of the research and their right to withdraw from the study at any time before, during or after the interview. Important details such as that the interview would be recorded and used for research purposes were explicitly stated in the consent form. All interviews were held confidentially and anonymized after transcribing the interview. Personal information from which the identity of participants can be derived were removed from the transcriptions, such as names,

addresses, etc. However, possible risks include the limitations of ensuring anonymity. Even when identifiers are removed, participants may still be identifiable based on the context of information or demographic data, specifically considering the small size of the community in which the interviews take place. The participants are informed about this. Other riks, such as physical or mental harm, are considered to be of very little bearing for this study. Additionally, it has been pointed out to participants that there are no direct benefits for them to participate in the research. While this study hopes to contribute to a better service tailored to the residents by Energieloket Oranjewijk Leeuwarden, this cannot be guaranteed. This is done to be clear and transparent about the risk and benefits in participating and to manage the possible expectations.

All data has been stored on a drive that is both secured with a password as well as an authentication code and can only be accessed by the researcher. The anonymized data will not be deleted after the research, but will be confidentially shared with two employees of the external organisation Energieloket Oranjewijk Isoleert. This is because the data can be of relevance for further research and policy implementation. The collaboration with Energieloket Oranjewijk Isoleert is set out in the Non-Disclosure Agreement, ensuring the rightful use of confidential information and ownership of the research. Both parties acknowledge that there is not any curricular or voluntary internship and the independence of the researcher in conducting the research. Energieloket Oranjewijk Isoleert has no influence or say on the results of the research. Ethical approval has also been granted by an independent third party; The ethics committee of the University of Groningen, Campus Fryslân.

Results & discussion

This section will discuss the results of the qualitative interviews conducted. The aim is to report on the findings of the interviews, connect these findings to the existing literature that has been explored, evaluate their relation and indicate potential new themes. The main themes that occurred during the interview will be discussed according to the COM-B model. This means that this section will first give an overview of the insulation behaviour of the homeowners and the demographics involved. Then, three sections will follow on Capability, Opportunity and Motivation. Discussion takes place after the presentation of findings related to each dimension.

Behaviour

This section will focus on the insulating behaviour of the respondents. Behaviour here specifically refers to the action of undertaking insulation renovations. When asked about if and what the participants had already done on insulation renovations, 9 out of 10 indicated they had done at least one or more insulation renovation (see Figure 6).

Figure 6

Table overview of insulation behaviour

	insulation renovations done:	satisfaction with insulation:	insulations renovations planned:
participant 1	• insulating glass • floor insulation • roof insulation	• satisfied but space for more renovations	• no
participant 2	• floor insulation • solar panels	• unsatisfied, still space for more (small) renovations	• yes, scheduled: insulating glass and solar panels
participant 3	• insulating glass • synthetic window frames	• satisfied, out of gas	• yes, scheduled: insulating glass and window frames
participant 4	• floor heating • energy saving boiler	• satisfied but space for more renovations	• no
participant 5	• roof insulation • synthetic window frames • insulating glass	• satisfied but space for more renovations	• no, because of moving plans
participant 6	• roof insulation • solar panels	• satisfied but space for more renovations	• no, because of moving plans
participant 7	• wall insulation • solar panels	• satisfied but space for more renovations	• no
participant 8	• synthetic window frames • insulating glass	• unsatisfied, still space for more (small) renovations	• no, because of moving plans
participant 9	• synthetic window frames • insulating glass	• unsatisfied, little to none renovations done	• yes, unscheduled: insulating glass and floor insulation
participant 10	• none	• unsatisfied, little to none renovations done	• yes, unscheduled: roof insulation

Note. Own work.

However, insulation behaviour should rather be approached like a spectrum in which there are different actions and steps that can be taken. The ultimate desired insulation behaviour in this research would be to go out of gas. This thus means that the majority of participants could still enact different insulation renovations. While studying the perceived enablers and barriers of insulation behaviour in these participants, we can both see insulation behaviour from the perspective of what has been done and what can still be done.

Out of gas

Only one household could confirm that they were completely independent of gas. Four households indicated that they would be willing to go out of gas. Three other households

reported that this is a step too far for them; they do not have the financial means or do not consider it profitable yet. Others were more reluctant in their opinion, having concerns about the logistic feasibility and possible noise issues that could come up with such adaptations. Such concerns will be discussed later in the following sections on COM. The comment below illustrates some of these sentiments:

"No, that's impossible. Impossible. A house from 1905, Single-stone [...] But how do you want to get rid of the gas? Do you want one of those nice compressors on your roof that makes noise and keeps you awake day and night?"[1] (respondent 4, r. 626 - 628, translated by author)

The next set of questions was concerned with the (estimated) length of living somewhere. A clear overview of these results can be found in Figure 7. The implications of these results on Opportunity and Motivation will be discussed later.

[1] "Nee, dat is onmogelijk. Onmogelijk. Een woning uit 1905, Enkelsteens [...] Maar hoe wil je dan van het gas af? Wil je dan zo'n leuk compressor op je dak die herrie maakt en je dag en nacht wakker houdt?"

Figure 7

Table overview of living length and moving plans

participant number	years in home	Future residential plans
respondent 1	<15 years	undetermined, as long as possible
respondent 2	<5 years	undetermined, as long as possible
respondent 3	>5 years	undetermined, as long as possible
respondent 4	<15 years	undetermined, as long as possible
respondent 5	<5 years	uncertain, considering moving
respondent 6	<5 years	uncertain, considering moving
respondent 7	>5 years	undetermined, as long as possible
respondent 8	>5 years	uncertain, considering moving
respondent 9	<5 years	uncertain, considering moving
respondent 10	>5 years	undetermined, as long as possible

Note. Own work.

While this section gives a short overview of the actual behaviour of the participants, it can mostly be studied and interpreted in relation to the perceived Capabilities, Opportunities and Motivation. That is why this section will be revisited through the following sections and be elaborated more on in relation to these themes.

Capability

This section will focus on the two factors of capability, knowledge and skills & expertise, that have been determined in the literature review. An overview of named influences is given in

Figure 8. Due to length constraints, not all findings will be discussed. A more articulated overview of the findings can be found in the operationalization matrix.[2]

Figure 8

Perceived influences on Capability

knowledge barriers	knowledge enablers
• Don't know where to start the process • No clear list of the options that are relevant for my house • Too much information • No knowledge on my gas usage • Fast information development of the field • Lack of trustworthy online sources to inform myself	• 'Smart meters' - digital tools to track gas usage • Estimated quote • Affinity via work or experience • Informal networks • Contractors
skills & expertise barriers	**skills & expertise enablers**
• How to choose a trustworthy contractor • Where to get trustworthy advice	• Experience with earlier renovations

Note. Own work.

Perceived knowledge capability

A majority of the participants indicated that they perceive their knowledge to be sufficient enough. They reported that they have a clear picture of what is possible in terms of insulation renovations and are well acquainted with the different options available. What stood out was

[2] The operationalization matrix can be accessed via the following link: https://docs.google.com/spreadsheets/d/1CWIRxerw-k4rEA79wBjny1JTI4V8LQheVOvjG7ELIw0/edit?usp=sharing

that simultaneously it was also mentioned that they lacked specific knowledge. One participant mentioned:

"*Well actually, yes. If you're really talking about roof insulation, things like that, I don't know very much about that. But yes, I'm thinking about the water pump.*"[3] (respondent 8, line 1690 - 1692, translated by author)

Other respondents did state that they felt inadequate in their knowledge of insulation. They acknowledged that they did not have the expertise to know what is possible and available and that this affected their decision making. Both respondents had little to no previous experience with renovations. Unique was that one other respondent indicated that they felt like they lacked knowledge, while their house was already out of gas. They said:

"*It's always evolving. [...] It's such a dynamic subject. To be honest, you have so much new knowledge every year that you have to constantly renew that to really advise well. ...*"[4] (respondent 3, line 495 - 504, translated by author)

While these participants represent a smaller proportion of the total participant group, their perspectives are very significant to this research in understanding the barriers that are being experienced.

[3] "nou toevallig, ja. Als je het echt hebt over dakisolatie, dat soort dingen, daar weet ik niet heel veel van af. Maar ja, ik zit te denken aan de waterpomp."
[4] "Het ontwikkelt steeds door. [...] het is zo'n dynamisch onderwerp. Eigenlijk heb je elk jaar zoveel nieuwe kennis, dat je dat continu moet vernieuwen om echt goed te kunnen adviseren. ..."

Understanding of energy labels and gas usage. Energy labels of the homes were often unknown by homeowners. Energy labels were only known when they were needed for mortgages and loan requests or they were not officially determined. Notable was that people did have a perception on the meaning and value of energy labels, as opposed to gas usage. When the energy label was known, opinions were expressed such as the incorrectness of the label or higher expected energy label:

"I think it's E. Okay. [...] When I had to do that, three years ago, four years ago. Oh yeah. But I think it's kind of crazy, because we've done quite a lot. And still the energy label is E."
[5](respondent 5, r. 927 - 929, translated by author)

When asked about gas usage, similar uncertainty could be noticed. Some respondents grabbed their phones to access this data via digital tools, but could either not find the right information or interpret it right.

This finding is consistent with that of Ucl (2021) who identified the poor understanding of energy and carbon as a barrier. However, its relevance for homeowner's perceived capability can be questioned. When not actively prompted about it, no respondent mentioned the lack of understanding of such terms as an issue.

[5] "Volgens mij is het E. Oké. [...] Toen ik dat moest doen, drie jaar geleden, vier jaar geleden. Oh ja. Maar ik vind het een beetje gek, want we hebben best wel veel gedaan. En nog steeds is het energielabel E."

Understanding of estimated costs. When asked about the estimated costs of such renovations, the majority of interviewees reported that they had a good understanding of this. These estimations were either based on requested quotes via contractors or knowledge acquired via work or acquaintances that had done such renovations previously. The former is considered critical for understanding prices and making this information available. As one respondent expressed:

"Yes, we had quotes for the solar panels. [...] I knew exactly what it was going to cost beforehand. And there was also a payback period. And that was also correct. [...] But you know in advance what it's going to cost. Because that's straightforward. That will be measured. And then you know in advance what it's going to cost." (respondent 1, line 65 - 70)

Contractors and quotes can thus be considered the main source of knowledge for prices. These results suggest that knowledge on costs is not necessarily a barrier because the majority of respondents feel like this information is accessible to them via contractors. Some concerns surrounding contractors will be discussed further in the section on skills & expertise capability.

Lack of overview. A few respondents felt that they lacked a clear overview of the available information. For them, it was difficult to assess where to start the insulation renovation process and what information was relevant to them or not. They acknowledged that they did not have the expertise to know what to do or how to choose from the amount of options available to them. They lacked the skills to filter through them. For instance, one respondent when asked about what they struggle with:

“... What makes sense to do. Yes. Because of course there are a lot of opinions about what to do [...] And at some point it becomes such a chaos of information, good, bad, opinions, I know

of what, that at some point I think, yeah, never mind. Yeah. I don't know anymore already."[6] (respondent 9, line 1967 - 1972, translated by author)

This quote demonstrates how the lack of overview overwhelms the respondents to the point that they decide not to even consider it anymore. These respondents mentioned that they would like a clear list of options available for their house that they could pick from.

The barrier to knowledge capability is thus not insufficient knowledge available, but rather the lack of overview of the knowledge and the capability to assess the relevance of the available information for the own situation. The lack of knowledge has been identified within literature (Ucl, 2021; Pelenur & Cruickshank, 2012), but nothing was known yet about the cause of this lack of knowledge. This valuable finding thus adds to the field in the way that it helps us understand what is needed for residents to feel capable in their knowledge, e.g. providing them with comprehensible and clear overview sheets with all the relevant possibilities.

Knowledge networks and structures. The majority of respondents felt that their knowledge was sufficient enough. Understanding how this knowledge is constructed will help us understand how others can overcome barriers in this area. The results show that knowledge is mostly acquired via informal networks. Informal networks can include friends, families or neighbours. Informal networks were not only mentioned when directly asked about information accessibility, but also came up indirectly when asked about prices or renovation options. As one interviewee put it:

[6] Nou ja, wat logisch is om te doen. Ja. Want ook daar zijn natuurlijk heel veel meningen over [...] En het wordt op een gegeven moment zo'n chaos van informatie, wel, niet, meningen, weet ik van wat, dat ik op een gegeven moment denk, ja, laat maar. Ja. Ik weet het al niet meer."

"Well, like I said, I just ask people who have actually purchased the thing. Or the solar panels, or the heat pump. Then I just ask, how did you do that? What does that look like? So I personally always find that the nicest information."[7] (respondent 7, line 1447 - 1450, translated by author)

Informal networks can also help with more practical capabilities, such as getting a contractor via a neighbour that did similar renovations. Other types of knowledge sources mentioned were Energieloket Oranjewijk Leeuwarden, the contractor, google or via their work. The latter applied to those employed in related sectors such as construction, sustainable consultation or the development of energy start-ups.

The importance of informal networks is a significant finding that has not before been highlighted in the research on insulation behaviour. In conclusion, it demonstrates that in order for respondents to feel capable in their knowledge, we must consider not just the information we provide them with, but also how we present it and through which networks.

Skills & expertise capability

In terms of skills & expertise capability, two main themes can be identified that can explain the perceived capability in this subject. Both will be discussed below.

[7] "Nou, zoals gezegd, ik vraag dus gewoon aan mensen die het ding daadwerkelijk hebben aangeschaft. Of de zonnepanelen, of de warmtepomp. Dan vraag ik gewoon, hoe heb je dat gedaan? Hoe ziet dat eruit? Dus dat vind ik zelf altijd de meest fijne informatie."

Do it yourself skills. When the participants were asked if there were any insulation renovations they think they could themselves, the majority commented that they prefer to leave this to the contractors. Insulation renovations were considered of technical complexity, or respondents commented on the overall lack of their own renovation skills. One participant explained it the following:

"Yes, I find that difficult. Because when I think of insulation I quickly think of things that you don't see afterwards. So insulating the walls, glass, double or triple glazing. How? I don't know how. I'd rather leave that to experts."[8](respondent 7, line 1487 - 1489, translate by author)

Other respondents did mention that they did do some small renovations themselves. These include the application of radiator foil or weatherstrips, replacement of radiator valves and insulating mailboxes.

Overall, the lack of Do It Yourself skills did not seem to result in a lack of perceived capability. Most respondents that mentioned to lack those skills, directly mentioned that that is why they hire a contractor. As mentioned in the literature review, Morgensen & Gram-Hansen (2023) reported that do it yourself skills positively impacted feelings of capability through the accumulation of practical skills and knowledge on the know-how. While the results do not provide a conclusive confirmation of this, it is worth considering if such tiny DIY projects would have this effect.

[8] "Ja, dat vind ik lastig. Want ik denk bij isolatie toch snel aan dingen die je daarna niet meer ziet. Dus de muren isoleren, glas, dubbel glas of driedubbel glas. Hoe dan? Ik weet niet hoe dat moet. Ik laat dat liever aan experts over."

Know-how skills. Know-how skills refer to the skills that are required that help residents to know how to structure and manage such renovation projects. Know-how skills are related to some of the themes mentioned in the knowledge capability section and include for instance knowing how to choose a good contractor or knowing how to filter through information. The respondents that had done one or more renovation projects before, were overall positive in their capability to choose a contactor. A few respondents were however also particularly critical of contractors. For instance, one respondent mentioned that he requested six different quotes for his new windows. Their prices varied greatly, sometimes by 8000 euros or more, while he could not distinguish a difference between the windows provided.

We can see a division between those that have done renovations before, and feel capable in their know-how skills, and those with little experience. Know-how skills are thus perceived as a barrier when homeowners have little previous experience in insulation renovations, but can be perceived as an enabler when these skills are present. This finding confirms earlier studies done by Pelenur & Cruickshank (2012) and Ucl (2021) who indicated that the lack of knowledge to appoint a good trustworthy contractor or get trustworthy advice are important factors.

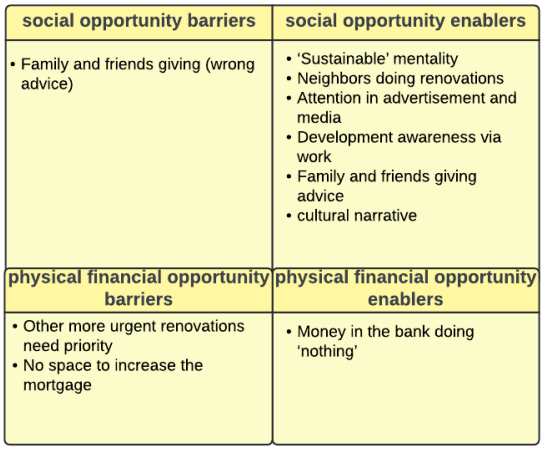
To come back to our research objective, we can identify the lack of overview and know-how skills as the most important barriers. Identified enabling factors in homeowners' capability are providing clear relevant information, guiding them in acquiring know-how skills and increasing knowledge networks.

Opportunity

Earlier we have distinguished between social and physical financial opportunity. These will be discussed below according to the findings of the interview.

Figure 9

Perceived influences on Opportunities



Note. Own work.

Social opportunity

Social norms via friends, family and neighbours. Findings suggest that social relations (e.g. family, friends and/or neighbours) influence the decision making process, both positively and negatively. Some participants were hesitant to make a decision about a specific renovation, but changed their minds after talking to friends that did similar renovations and motivated them. For example, one participant was concerned about the noise of a heat pump, but after talking to friends with heat pumps, she had a more hopeful outlook.

This finding confirms Hafner et al. (2019) that found that people want to do what others do. The strength of such social norms is however difficult to assess. Not one respondent mentioned that they felt pressure to conform to certain social standards, even though they did acknowledge they were influenced by social relations. This suggests that the influence of these norms is relatively low and aligns with the findings of Organ et al. (2013) who questioned the

strength of social norms, since social norms relating to actions must be visible and homeowners must be aware of the pressure to conform.

Social norms via media. When analysing the findings on social influence, a new theme arose. A few of the interviewees reported it was not necessarily friends or family that influenced their perception, but rather the overall (media) landscape as a whole. The participants mentioned that they saw insulation renovations happening everywhere around them. As one respondent put it:

"*Oh. Yes, for sure. Yeah, you see your neighbours. They're doing solar panels everywhere. Surely someone is on the roof somewhere all year long. So yeah, you're faced with it all the time and you see it in the news everywhere, too. And the commercials, they're really bombarded with it. So yes, I did look into it on purpose, yes. Partly because of that … because of the attention*."[9] (respondent 5, line 998 - 1001, translated by author)

This quote illustrates that attention in advertising and media led to an increased awareness in the participant. Social norms are thus not only transferred via personal social relations, but are also part of the social landscape within the country as a whole. This finding is valuable because it means that when social norms are perhaps not visible within personal social relations (Organ et al., 2013), they could be visible within a broader cultural narrative. This is in contrast with earlier findings by Ucl (2021) that stated the lack of a cultural narrative around insulation measures. This discrepancy could perhaps be explained by the different countries in which the studies were conducted, the time lapse and the cultural narratives that belong to them.

[9] "Oh, zo. Ja, dat zeker weten. Ja, je ziet je buren. Overal zijn ze met zonnepanelen bezig. Er zit het hele jaar toch wel iemand op het dak ergens. Dus ja, je wordt er steeds mee geconfronteerd en je ziet het ook in het nieuws overal. En de reclames, die worden er echt mee doodgegooid. Dus ja, ik heb me er wel expres meer in verdiept, ja. Mede daardoor, ja, door de aandacht."

Physical financial opportunity

A majority of the respondents said that they had the financial means for insulation renovations. It was frequently viewed as an investment with the expectation that they would receive something in return. A few respondents did experience a lack of financial means. Both commented that some more urgent renovations in the house had taken priority. One participant explained that they had a huge leak in the roof while moving in that needed to be repaired first. This took up their whole renovation budget. For some respondents with limited financial resources, insulation is thus not always the first priority.

Previous studies have also demonstrated that the household income and availability of capital is of particular influence on homeowner's perceived opportunity (Organ et al., 2013). The findings here however show no evident proof for the reported barrier of the economic environment on physical financial opportunity (Friege & Chappin, 2014). No respondent mentioned that they were uncertain about if their investment would pay off. A further discussion will follow now in the section on motivation.

In sum, social norms can be identified as the most prominent enabler of opportunity, but the strength of this enabler is more indirect. Social norms are twofold and can be conveyed via social relations and media. Physical financial opportunity can be identified as a strong barrier, but is not always experienced by people due to other enabling financial motivations.

Motivation

Motivation refers to all those mental processes that energise and direct behaviour. In the literature review, we have distinguished between three types of motivation: financial motivation, comfort motivation and environmental motivation. These types and their occurring themes are going to be discussed in this section.

Figure 10

Perceived influences on motivation

Financial motivation barries	Financial motivation enablers
• Unwillingness to lend money • No space to increase mortgage • Increased monthly expenses	• Lower annual heating costs • Value of the house • Return of investment
comfort motivation barriers	**comfort motivation enablers**
• Sacrification of comfort to save energy • Waiting times of contractors • Disruption of daily routine	• By effects such as noise protection • 'Aesthetic' comfort of the house: feeling at home • Less drafts
environmental motivation barriers	**environmental motivation enablers**
• Not sustainable to replace when something is not 'broken' yet	• Being able to be more self-sufficient • Contribution & responsibility to the future • Energy 'waste' • Sustaining the house for future generations

Note. Own work.

Financial motivation

Loans and increase of mortgage. Most of the respondents have an open mindset towards the use of loans or increasing their mortgage. Financial considerations are frequently treated from a more rational standpoint: what do I put in, and what do I get out of it? Participants reported that they do not have an issue with a loan if that's the most beneficial, even when own capital is also available. As one respondent reflected this view:

"*Yeah, putting your own money in means you can't invest it into other things. So I always look at what's convenient, equity or borrowing. So that's what I'm doing here as well.*"[10] (respondent 2, line 269 - 270, translated by author)

However, mortgage increases are considered more usual than separate loans. Co-financing with the mortgage is the most named and preferred method of financing. However, one participant was also hesitant to make use of this method. They stated that increasing the mortgage would result in an increase in their monthly expenses and they were unsure whether this would be a worthwhile trade-off for lower monthly heating costs. Another respondent was unique in their opinion and opposed to lending money in general. They quoted that they had been raised with the idea that if you want to buy something, you do that with your own money. This notion reflects a more unique, but important barrier to financial motivation.

This outcome is contrary to that of Friege & Chappin (2014) that indicated the unwillingness to raise a (further) loan as a barrier to insulation renovations. The majority of respondents in this research do not share this sentiment. A few respondents were more reluctant to lend money. This could be rather due to the fact that there was an inability to loan further money, then an unwillingness to do so in the first place.

Annual heating costs. We can see a clear distinction in motivation between respondents that consider their annual heating costs as high and those that consider them low or average. The participants that indicated their heating costs as high reflected a strong motivation to partake in insulation renovations. The main driver was to decrease monthly expenses. One individual stated that:

[10] "ja, eigen geld erin stoppen betekent dat je het niet meer in andere dingen kan doen. Dus ik kijk altijd naar wat handig is, eigen vermogen of lenen. Dus dat doe ik ook hier"

“ I would love for my monthly expenses to go down. And that I can more easily just go turn on a heater. Without having to think, today it was 54 euros again and I don't know what. See, that whole concept about payback.... 7 years, I think that's way too long too [...] For the thousands of euros it costs. But if that means my monthly expenses go down, I think that's fair." [11]
(respondent 9, line 2032 - 2037, translated by author)

Another respondent commented that while they thought that the heating costs were way too high, they were more concerned about the high energy usage. They wanted to lower their energy costs because they thought it wasteful to generate so much energy while so much is getting ‘lost’. However, annual heating costs do not automatically lead to insulation renovations. Most of the respondents also mentioned that they adapted their energy consumption behaviour in general. Examples of this include putting on extra layers, using a fireplace or being more selective about when and where to put the heating on.

This broadly supports the work of other studies that commented on the influence of annual heating costs (Organe et al., 2013; Fridge & Chappin, 2014). However, while annual heating expenses are a significant motivator for those at the start of the process to move off gas, other factors can better explain the motivations of those in the later phases that have already decreased their annual heating costs significantly.

[11] “ Ik zou het fijn vinden als mijn maandlasten naar beneden gaan. En dat ik gemakkelijker gewoon een verwarming kan gaan aanzetten. Zonder dat ik hoef te bedenken, vandaag was het weer 54 euro en weet ik veel wat. Kijk, dat hele concept over terugverdienen…. 7 jaar, ik vind dat ergens ook veel te lang [...]. Voor die duizenden euro's wat het kost. Maar als dat betekent dat mijn maandlasten naar beneden gaan, dan vind ik dat fair."

Value of the house. The increase of house value does not seem to be a primary motivation for respondents. In the beginning, when asked about the primary reasons for undertaking insulation renovations, not one respondent mentioned the increase of property's value. Only when participants got actively asked about it, some responded that this was a motivation factor for them. However, this was only in combination with other motivations. The increase of home value alone was insufficient to motivate anyone in insulation renovations.

Other respondents reported that they did not find the property value increase important at all. They questioned as to which extent the price of insulation renovations is reflected in the home's value. Another participant commented that the investment costs were too high in comparison to the increase of the home's value. They said:

"... putting a heat pump here will cost you 15000s euros. And you'll never get that back when we sell the house. Because actually, if you look, technically we are already at the maximum we could get out of it..."[12] (respondents 8, line 1764 - 1771, translated by author)

Another respondent also commented that the increase of the home's value can also decrease again when replacement of certain renovations are needed. For instance, in 15 years the solar panels may be written off already.

Overall, the increase of home value was not a big primary motivation for most of the respondents. Some respondents were even critical and questioned whether the value would actually increase. While this finding does support the increase of value as a motivational factor and thus does not contrast earlier studies (Organ et al., 2013; Fridge & Chappin, 2014), it does cast some doubts on its overall relevance.

[12] " Want kijk, een warmtepompje hier neerzetten, dan ben je 15.000 euro verder. En dat krijg je nooit meer terug als we het huis verkopen gaan. Want eigenlijk, als je kijkt, zitten we markt technisch al op het maximale wat we eruit zouden kunnen halen [...] Maar toen ze het over die bedragen hadden… Dat ga je nooit meer terugkrijgen als je het huis verkoopt."

Return of investment. Return of the financial investment was explained in two ways by the respondents. First, some respondents commented on the payback period as motivation. Specifically solar panels were named in this context. One respondent stated it simply: you put in X amount of money and expect to earn the same amount of money and more back after a specified time period. For these respondents, such renovations are more of a cost and benefits analysis that they approach quite rationally. Others referred to the return of investment in lower monthly expenses on heating. They were more critical of the long term return.

Interestingly, participants did not only refer to monetary factors when asked about the return of investment. Rather, return was also understood in terms of comfort and sustainability. These factors will be dealt with later on. One participant had a particularly unique response. They stated that they just liked the idea of being able to provide for yourself and being more self-sufficient. For them, the main return was to be energy autonomous. They said:

“Look, now the sun is shining again, that’s what I like [..] My computer is on upstairs. So I'm working on solar energy. That's what I care about. And I don't even know if we get some back. No idea, we just consume it ourselves. Because that's why we have it, just to be able to use it ourselves."[13] (respondent 7, line 1544 - 1550, translated by author)

Overall, these findings supports the motivation of the return of investment but also stresses the importance of looking beyond economic factors (Zundel & Strieß, 2011). Return of investment can also be interpreted in non monetary terms.

[13] ‘nee, dat speelt bij ons helemaal geen rol. Kijk, nu gaat de zon weer schijnen, dus ik vind het toch wel leuk. Ik heb nou verder niks aan, mijn computer staat bovenaan. Dus ik zit op zonne energie te werken. Het gaat ons daarom. En ik weet niet eens of we wat terugkrijgen. Geen idee, wij verbruiken het gewoon zelf. Want daarom hebben we het, om het gewoon zelf te kunnen gebruiken.’

Comfort motivation

Thermal comfort of the house. Surprisingly, all respondents said to be satisfied with the thermal comfort of their house. Even when they were actively prompted about if they ever had cold feet or experienced drafts in their house, most respondents still responded to be satisfied. This can perhaps be attributed to the fact that the majority of the respondents had a certain level of insulation renovations already done. These respondents did indicate that thermal comfort was an initial motivation to start the process. Additionally, some respondents mentioned that thermal comfort was sometimes sacrificed to lower energy costs. For example, the heating was put lower or people decided to put extra layers on. In some cases, participants indicated that they also experienced positive side effects that increased their comfort when insulating. Such side effects were for example that the insulating glass was also more soundproof. Worries about the disruption of comfort in the process of renovation itself were on the other hand very minor.

These results are in agreement with Mahapatra & Gustavsson (2008). It shows that thermal comfort is an important motivation, specifically for those that now experience a low level of thermal comfort and did little renovations yet.

Aesthetic 'comfort' of the house. We use this term to describe the comfort that comes with the joy and pleasure of living in the home. This can work two ways. Firstly, sometimes aesthetic comfort can be a barrier when people do not understand how isolation renovations can contribute to the living comfort. As a participant commented for instance, insulation material is invisible within your walls but a new kitchen you can enjoy every day. For them, insulation renovations do not contribute to their perception of home. Second, it can also be an enabler when isolation renovations allow homeowners to also simultaneously invest in renovations that enhance their feeling of home. A few participants saw this as an 'and and' approach where you tackle the isolation renovation but also immediately invest in something that brings you aesthetic comfort or joy. This is illustrated by what one respondent commented:

"I don't like anything more than that that money is just brought back into my house [...] On the one hand, maybe you get the value of your house up. But it's also just, you live in a house. You have the aesthetic value every day. So I think it's a very fine investment."[14] (respondent 3, line 551 - 556, translated by author)

This finding highly stresses the importance of Aune (2007) work on 'the concepts of the home as a heaven' and 'the home as a project.' This is a different understanding that can help us put isolation renovations in a broader context within overall renovations.

Environmental motivation

All participants indicated that environmental motivations played a role in their decision making. The environment was the most cited reason for isolating renovations when the question was first raised during the interview. Respondents felt that they had a responsibility to contribute

[14] "Ik vind niks leuker als dat geld gewoon in mijn huis zit [...] Aan de ene kant is het, misschien krijg je de meerwaarde van je huis misschien omhoog. Maar het is ook gewoon, je woont in een huis. Je hebt elke dag de esthetische waarde. Dus ik vind het een hele fijne investering.

to a better planet or solution for climate change. The most named environmental motivation was thus to contribute to the solution, or as expressed in Dutch ‘een steentje bijdragen’. One respondent reflected on this the following:

“Yeah, we are destroying the earth a little bit. yes, that is really bad. I hope we can still be in time to reverse it. I am afraid that’s not going to happen anymore. But yes, slowing it down as much as possible…I do want to do my own part in that.”[15] (respondent 4, r. 1041 - 1043, translated by author)

Other environmental motivations included the preservation of the earth for future generations and their children, energy independence and sustaining the houses itself. Some also experienced environmental motivations as barriers, since they did not think it was sustainable to replace or renovate certain parts of the house if they were not broken or at the end of their lifetime yet.

Environmental motivation is thus more present than the literature perhaps indicates. It is difficult however to assess how environmental motivation relates itself to financial motivation as is questioned in earlier research (Hafner et al., 2019; Organ et al., 2013). A few respondents stated that the environment motivates them, but it must still be financially feasible and appealing. Therefore, environmental motivation can be used for incentivization but should still be accompanied by financial motivation as well.

To answer our research objectives we can identify three prominent enabling factors of motivation, namely financial, comfort and environmental. Financial motivation is mostly

[15] "Ja, we maken de aarde een beetje stuk, hè. Ja. Ja, dat is wel heel erg.Ik hoop dat we nog op tijd kunnen zijn om het terug te draaien. Ik ben bang dat dat niet meer gaat gebeuren. Maar ja, zoveel mogelijk afremmen... daar wil ik wel mijn eigen steentje aan bijdragen."

determined by annual heating costs and return of investment, where comfort also consists of both thermal and aesthetic motivations. Barriers of motivation are on the other hand very minor.

Intervention recommendations

Based on the findings, specific interventions can be designed to diminish barriers and increase enablers. The interventions are informed by the Behavioural Change Wheel. One of the research objectives is to make recommendations based on the relations between the selection criteria and the findings. However, respondents from the same selection criteria offered a vast array of views on enablers and barriers, which made it difficult to make any conclusions based on this. Thus, more general recommendations are made based on different barriers and enablers of the COM-B model. These recommendations can be used by Energy Cooperation Oranjewijk Leeuwarden to structure their communication strategy and approach. The most relevant influences and interventions are highlighted in Figure 11.

Figure 11

Recommended interventions per component based on the Behavioural Change Wheel [16]

	Most perceived influences, barriers (-) and enablers (+):	Intervention:	example:
Capability	lack of overview (-)	modelling	providing an overview or model with all the relevant options for people's individual homes.
	lack of know-how skills (-)	training	imparting skills by guiding them through the process by for instance creating a step to step guide.
Opportunity	social influence (+)	environmental restructuring	confronting people with positive social cues and norms present in the neighbourhood through for example communal meetings or information on the development of the neighbourhood.
	lack of financial opportunity (-)	enablement and incentivisation	increasing means to opportunity by enabling and showing homeowners how to access financial benefits (e.g. subsidies, investment discounts, etc.)
motivation	annual heating costs and return of investment (+)	coercion	create an expectation of 'cost', that reflects on the increase of return of investment and the decrease of annual heating costs.
	thermal and aesthetic comfort (+)	persuasion	using communication to induce positive feelings about the contribution of insulation to the feeling of home, both in terms of warmth and aesthetic joy.
	environment (+)	persuasion	to stimulate action, make use of prompts to confront people with their environmental conciousness and their actual behaviour.

Note. Own work.

[16] The specific definitions of the interventions can be checked on the website of the Behavioural Change Wheel (https://www.behaviourchangewheel.com).

Conclusion

Understanding behavioural change is crucial in the low-carbon transition. More understanding about individual energy behaviour and varied contexts, as well as the use of a comprehensive model, are required to develop more tailored approaches and strategies for this transition. This research has aimed to contribute to this by examining the presence and relevance of the perceived barriers and enablers of insulation behaviour of Oranjewijk Leeuwarden residents through the COM-B model. Foremost, this research has confirmed that insulation renovations are complex and consist of many components that shape and influence each other. Insulation behaviour, barriers and enablers will always be highly contextual, but all the more stress the importance of a dynamic model and approach.

First, capability should not only be understood in terms of perceived knowledge, but also perceived know-how skills, including but not limited to mental processes, such as filtering information or choosing a contractor, that make homeowners feel confident in the insulation process. Know-how skills emerge as the biggest enabler in homeowners' capability. This study has been one of the first studies to enhance our understanding of know-how skills and knowledge to such an extent, making a great contribution as to how we can tailor knowledge and support the best to homeowners.

Second, findings show that social opportunity is a relative positive influence in the neighbourhood. Social networks and media both led to increasing awareness and positive attitudes towards insulation behaviour. The physical financial opportunity of homeowners is a low, but strong barrier in the neighbourhood. Strong financial motivations can help overcome this barrier. Taken together, these findings suggest a role for energy corporations to strengthen such networks to create a positive narrative within communities and neighbourhoods. This new finding contradicts some earlier studies (Ucl, 2012; Organ et al., 2013) done in different settings and thus highlights the importance of context-specific research.

Third, this research has shown that motivations go beyond purely economic factors. While heating costs and the return of investment are considered important motivators, return of investment is not only understood in monetary terms, but also with reference to comfort or other non-monetary outcomes. Comfort, on the other hand, showed to be more layered than in existing studies and also includes aesthetic comfort of the house. Finally, environmental motivation is very present in the neighbourhood. No previous research reported on such significant environmental motivation. The understanding of environmental and comfort reasoning is a valuable addition to the growing body of literature that looks beyond economic factors (Zundel & Stieß, 2011).

Taken together, these findings give insight on how homeowners come to the decision to enact insulation behaviour. However, the self-selection bias in the sample is an important limitation. Most participants had already done or were quite advanced in their insulation process. This study could be possibly biased towards more positive attitudes and opinions of homeowners. Further studies are needed to validate these results over different homeowners groups, including those that have not yet started any insulation renovations. Furthermore, it would be beneficial to determine the effectiveness of the proposed interventions, if these are implemented. All with all, the small sample size and the context specific location of the study emphasises the relevance of further studies on bigger scales and in different settings to strengthen the evidence base for targeted approaches.

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Appendix A

Interview questions (english)

Thank you for participating in this research. This research focuses on homeowners in the Oranjewijk Leeuwarden and their reasons and barriers to insulating their housing. I want to make clear once again that this interview will be recorded, but that you reserve the right to withdraw your participation in this research at any time during or after the interview. All information discussed will be kept confidential.

Criteria questions:

- Do you own this house?
- Who are you living with in this house?

Introductory questions:

- How long have you been living in this house? How long do you plan on living here?
- How much gas do you use?
- Can you indicate the energy label of your house?
- Do you know about Energieloket Oranjewijk isoleert?
    - How would you describe them/their services?
- How would you describe the insulation of your house?
- How satisfied are you with the insulation of your house?
- Have you done any insulation renovations on the house?
    - If yes, could you explain what you specifically renovated?
    - Do you feel like the insulation of your house is sufficient now or do you plan on more insulation renovations?
- Would you want to go out of gas? Is your house ready to go out of gas?

(Why/why do you not want to insulate your house? → follow up questions)

Questions Capability:

Capability knowledge:

- What options for insulating your house do you know?
- Do you know how to improve the insulation of your home? Can you elaborate?
- What do you know about the costs of such renovations? How do you estimate them?
- Where would you go for trustworthy advice?

- Do you feel like you have sufficient knowledge on insulation?
    - If not, what information do you lack mostly?
    - If not, do you feel able to access or gain this information easily?

Capability skills:

- If you wanted to appoint a contractor, what would you look for?
- Do you know how to appoint a good contractor?
- Do you think you could do the insulation renovations yourself?

- Do you feel like you have sufficient skills to insulate?
    - If not, do you feel like you need those skills? is this a barrier to insulate your house?

Questions Opportunity:

Social opportunity:

- Do you know any neighbours, relatives or friends that insulated their housing?
- How has this changed your perception and opinion on insulating your own house?
- Do you think your energy usage is average, higher or lower than others in your neighbourhood?
    - Does this influence your decisions on insulation?

- Imagine a heating grid ('warmtenet') will be introduced in the neighbourhood, where you don't have to pay any more for your gas than now, would you be willing to participate?
    - Meaning that you will be stuck to one company
    - The bigger the collective, the lower the costs

Physical financial opportunity:

- How do you consider/feel about the resources you have to invest in the insulation renovations?
- Do you feel like the resources are available for you?
    - If not, is this something you would/have prioritised when saving up?
    - If not, are you willing to loan money to renovate? Why yes or why not?
- *Any considerations about the return of investment?*
- *Any considerations on the value of the house?*

Questions Motivation:

Financial motivation:

a. Enabler annual costs of heating:

- how would you perceive your annual cost of heating: high, low, or average?
- How does this motivate you to lower your consumption?
- How do you think you can lower these costs?

b. Barrier investment cost:

- *Do you know what the investment costs would be?*
- *How do you perceive/consider the investment costs; high, low, or average?*

c. Enabler increase value property:
- *Any considerations on the value of your house in your decision making?*
    - How much do you think that the value of your property increases through renovations?

With both factors, the investment cost and the increase of value property, do you think about how long you are planning on living somewhere? Does this change your opinion?

Comfort motivation:
- How do you perceive the thermal comfort of your house at the moment?
    - *Are you satisfied with the (thermal) comfort of your house?*
        - Do you ever have cold feet in your house?
        - Do you ever feel/have drafts in the house?
    - How do you think this would/did increase through insulation?

- How do you feel about the renovation process itself?
    - Does the idea of renovating cause your stress? What are you concerned about?
        - What do you consider disruptive about the work?
        - What could help you with this?

Did any other factors that have not been mentioned yet play a role for you to insulate your house? (if the environment is mentioned, ask questions).

Environmental motivation:
- What specifically motivates you to insulate for environmental reasons?
    - E.g. Do you consider the future for your children?
    - E.g. Do you consider climate impact?

Concluding questions:

- Is there anything else you would like to mention?

Thank you for your time. I will use this information for my further research. If you have any questions now or after, feel free to contact me. The research will be published by the university of Groningen in their online database. If you are interested, I can contact you and forward the final result.

Interviewvragen (nederlands)

Bedankt voor je deelname aan dit onderzoek. Dit onderzoek richt zich op huiseigenaren in de Oranjewijk Leeuwarden en hun redenen en belemmeringen voor het isoleren van hun huis. Ik wil duidelijk maken dat dit interview zal worden opgenomen, maar dat u het recht heeft om uw

deelname aan dit onderzoek in te trekken, ten alle tijde tijdens of na het interview. Alle informatie wordt vertrouwelijk behandeld.

Kriteria vragen:

- Bent u eigenaar van dit huis?

Inleidende vragen:

- Met wie woont u in dit huis?
- Hoe lang woont u in dit huis? Hoe lang bent u van plan hier te wonen?
- Hoeveel gas verbruikt u?
- Kunt u het energielabel van uw huis aangeven?
- Kent u het Energieloket Oranjewijk Isoleert? Hoe zou u hun diensten omschrijven?
- Hoe zou u de isolatie van uw huis omschrijven?
- Hoe tevreden bent u met de isolatie van uw huis?
- Heeft u ooit de isolatie van uw huis vernieuwd/isolatie maatregelen genomen?
    - Zo ja, kunt u uitleggen wat u specifiek gerenoveerd hebt?
    - *Vindt u dat de isolatie van uw huis nu voldoende is of bent u van plan om meer isolatie maatregelen te nemen?*
- Zou u van het gas af willen? Is uw huis klaar om van het gas af te gaan? (only 5-10 houses in the whole neighbourhood are out of gas so prob not)

(*Waarom zou u uw huis willen/niet willen isoleren? → follow up questions*).

Vragen Capability:

Capability knowledge:

- Welke opties voor het isoleren van uw huis kent u?
    - *Welke opties denkt u dat relevant zijn voor u?*
- Wat weet u over de kosten van dergelijke renovaties? Hoe schat u ze?
- Waar zou u naartoe gaan voor betrouwbaar advies?

- Heeft u zelf voldoende kennis over isolatie, denkt u?
    - Zo niet, welke informatie ontbreekt u?
    - Zo niet, kan u die informatie makkelijk verkrijgen?

Capability skills:

- *Weet u hoe u een goede aannemer moet benoemen?*
- Denkt u dat u de isolatie renovaties eventueel zelf kan doen?

- *Heeft u het gevoel dat u genoeg vaardigheden hebt om te isoleren?*
- Zo niet, heeft het gevoel dat u die vaardigheden nodig hebt? Is dit een barrière om uw huis te isoleren?

Questions opportunity:

Social opportunity:

- Kent u buren, familieleden of vrienden die hun huis hebben geïsoleerd?
- Hoe heeft dit uw perceptie en mening over het isoleren van uw eigen huis veranderd?
- Denkt u dat uw energieverbruik gemiddeld, hoger of lager is dan in uw buurt?
    - Beïnvloedt dit uw beslissingen over isolatie?

- Stel u voor dat er een verwarmingsnet ('warmtenet') in de buurt wordt geïntroduceerd, waar u niet meer hoeft te betalen voor uw gas dan nu, zou u bereid zijn om mee te doen?
    - Dat betekent dat je vast zit te zitten aan één bedrijf.
    - Hoe groter het collectief, hoe lager de kosten

Physical financial opportunity:

- Hoe denkt u/voelt u zich over de financiële investering van de isolatie-renovaties?
- Heeft u het gevoel dat de middelen voor u beschikbaar zijn?
    - Zo niet, is dit iets wat uw prioriteit geeft/zou hebben gegeven bij het besparen?
    - Zo niet, bent u bereid om geld te lenen om te renoveren? Waarom ja of waarom niet?
- Andere financiële overwegingen over het rendement van de investering?
- Andere financiële overwegingen over de waarde van het huis?

Questions Motivation:

Financial motivation:

a. Jaarlijkse kosten van verwarming:
- hoe zou u uw jaarlijkse verwarmingskosten zien: hoog, laag of gemiddeld?
- Hoe motiveert dit u om uw consumptie te verminderen?
- Hoe denkt u dat u deze kosten kunt verlagen?

b. Barrier investeringskosten:
- *Weet u wat de investeringskosten zouden zijn?*
- *Hoe ziet u de investeringskosten; hoog, laag of gemiddeld?*

c. Enabler verhogen waarde eigendom:
- *enige overwegingen over de waarde van uw huis in uw besluitvorming?*
- Hoeveel denkt u dat de waarde van uw huis stijgt door renovaties?

Bij beide factoren, dus de investeringskosten en het verhogen van de waarde, denkt u dan na over hoe lang u van plan bent om ergens te wonen? Verandert dit uw mening?

Comfort motivation:

- Hoe ziet u het thermische comfort van uw huis op dit moment?
- Bent u tevreden met het (thermische) comfort van uw huis?
    - Heeft u ooit koude voeten in uw huis?
    - Voelt u ooit tocht in huis?
- *Hoe denkt u dat dit door isolatie zou toenemen?*

- Hoe voelt u zich over het renovatieproces zelf?
- Wat voor zorgen of stress heeft u eventueel over het renovatieproces?
    - Wat vind u disruptief over het werk?
    - Wat kan u hierbij helpen?

Hebben er nog andere factoren die nog niet zijn genoemd een rol gespeeld voor u om uw huis te isoleren? (als het milieu wordt genoemd, stel de volgende vragen).

Milieu-motivatie:

Wat motiveert u specifiek om om milieugebonden redenen te isoleren?

- Denkt u bijvoorbeeld aan de toekomst voor uw kinderen?
- Denkt u bijvoorbeeld aan de klimaatimpact?

Afsluitende vragen:

- Is er nog iets dat u zou willen noemen dat niet aan bod gekomen is?

Bedankt voor uw tijd. Ik zal deze informatie gebruiken voor mijn verdere onderzoek. Als u nu of later vragen hebt, neem dan gerust contact met me op. Het onderzoek zal door de Universiteit van Groningen in hun online database worden gepubliceerd. Als u geïnteresseerd bent, kan ik contact met u opnemen en het eindresultaat doorsturen.

Appendix B

1 Transcript interview 1

Interviewer: Ja, dus dit onderzoek is vooral gericht op beweegredenen en waarom mensen hun huis al dan wel, al dan niet isoleren. En wat de motivaties zijn en eigenlijk de barrières wat mensen daarin tegenhoudt. Om eerst een beetje een achtergrond beeld te krijgen.

Interviewer: Bent u de eigenaar van dit huis en met wie woont u in dit huis?

participant: Ja, ik ben eigenaar, samen met mijn vrouw wonen we hier, kinderen zijn de deur uit.

Interviewer: Oké, duidelijk. En hoe lang woont u al in dit huis?

participant: 30 jaar.

Interviewer: Zo, lang genoeg. En woont u ook met het plan om hier voor langere termijn te wonen?

Participant: Ja, zolang mogelijk.

Interviewer: En weet u hoeveel gas u verbruikt?

Participant: Jazeker, de laatste twee jaar 1150 kuub gemiddeld.

Interviewer: Oké, duidelijk. En weet u ook het energielabel van uw huis?

Participant: Nee. Nee, dat weten we niet.

Interviewer: Dat is ook nooit vastgesteld voor uw huis?

Participant: Nee, dus dat is officieel wat de overheid erover zegt, maar dat klopt niet, want ik heb wel van allerlei maatregelen genomen. Ik geloof dat het F is volgens de minister.

Interviewer: Oh ja, nee, dat loopt dan misschien achter. Ja, u zegt dus dat u al maatregelen genomen heeft. Wat voor maatregelen heeft u precies genomen?

Participant: Wij hebben isolerend glas, voor en achter. Nou, dat is ook een paar jaar oud, dus dat is ook al een keer vervangen. In ieder geval voor vervangen door hoog rendement. Plus, plus, plus. Oké, onder de vloer liggen chips. Die vloer is er uit geweest en die is toen opgevuld met chips. Dat is een vorm van isolatie. Verder zijn de platte daken van dit, de keuken, de bijkeuken. Er zit een isolatielaag op. Het grote dak helemaal boven, dat had geen buitenisolatie, maar er was wel een binnenisolatie laag. Dat heb ik zo gelaten.

Interviewer: Oké, zou u zeggen dat u nu tevreden bent over de isolatie van uw huis? Of ziet u nog mogelijkheden voor verbeteringen?

Participant: Ik ben wel tevreden, maar als ik echt zou willen, dan kan ik nog wel een paar dingen bedenken. Ik heb trouwens ook een radiatorfolie.

Appendix C

Consent form voor het kwalitatief onderzoek:

Gedragsverandering binnen de energietransitie: woningisolatie in Oranjewijk Leeuwarden

Beste deelnemer,

Hartelijk dank voor uw deelname aan dit onderzoek. Deze brief legt uit wat het onderzoek inhoudt en hoe het onderzoek zal worden uitgevoerd. Neem alstublieft de tijd om de volgende informatie zorgvuldig te lezen. Als iets niet duidelijk is, aarzel dan niet om de onderzoeker te vragen.

WAAR GAAT DEZE STUDIE OVER?

- Dit onderzoek wordt uitgevoerd door een student van Campus Fryslân, Global Responsibility and Leadership, voor hun afstudeerproject. In dit onderzoek werken zij samen met Energieloket Oranjewijk Leeuwarden. Informatie zal worden gedeeld met beide instellingen.
- Deze studie richt zich op het specifieke gedrag van bewoners van Oranjewijk Leeuwarden in hun beslissing om hun huizen al dan niet te isoleren. De studie maakt gebruik van psychologische modellen om hun beslissingen op een zinvolle manier te interpreteren. Deze gegevens zullen worden gebruikt om effectieve strategieën en beleid te ontwerpen die Energieloket Oranjewijk Leeuwarden kunnen helpen.

WAT HOUDT DEELNAME IN?

- Deelname omvat een kort interview van ongeveer 30 minuten.

MOET U DEELNEMEN?

- Deelname is vrijwillig en kan op elk moment vóór, tijdens of na het interview worden ingetrokken.
- Deelnemers kunnen op elk moment kiezen om geen vragen te beantwoorden zonder gevolgen of het geven van redenen.

ZIJN ER VOORDELEN AAN DEELNAME?

- Er zijn geen directe voordelen, maar het onderzoek kan bijdragen aan verdere kennis over het onderwerp isolatie die relevant kan zijn voor de deelnemer.

HOE WORDT DE DOOR UW VERSTREKTE INFORMATIE BESCHERMD EN OPGESLAGEN?

- Interviews worden opgenomen met een mobiel apparaat. Na het interview wordt de opname naar de online database verplaatst en van het mobiele apparaat verwijderd.

- De verzamelde gegevens worden opgeslagen in een online database die alleen toegankelijk is voor de betrokken onderzoeker en twee medewerkers van Energieloket Oranjewijk Leeuwarden.

WAT GEBEURT ER MET DE RESULTATEN VAN DE STUDIE?

- De resultaten van de studie worden gebruikt voor het afstudeerproject en zullen beschikbaar zijn voor zowel Campus Fryslân als Energieloket Oranjewijk Leeuwarden. Het eindproject zal ook in juni aan een klein publiek worden gepresenteerd.
- De resultaten van de studie zullen door Energieloket Oranjewijk Leeuwarden worden gebruikt om het isolatie proces in de buurt te bevorderen.

ETHISCHE GOEDKEURING

- Deze onderzoeksstudie heeft ethische goedkeuring verkregen van de Ethische Commissie van Campus Fryslân.
- De onderzoeker zal zich houden aan ethisch relevante normen.

INFORMED CONSENT FORMULIER

Hieronder vindt u het toestemmingsformulier. Door het toestemmingsformulier te ondertekenen toont u uw intentie om deel te nemen, maar behoudt u nog steeds het recht om op elk moment vóór, tijdens of na het interview terug te trekken.

Contactgegevens: Fenna de Jong, f.de.jong.19@student.rug.nl

TOESTEMMINGSFORMULIER

Titel studie: gedragsverandering binnen de energietransitie: woningisolatie in Oranjewijk Leeuwarden

Naam deelnemer:

Beoordeling:

- Ik heb het informatieblad gelezen en kon eventuele aanvullende vragen aan de onderzoeker stellen.
- Ik begrijp dat ik op elk moment vragen over de studie mag stellen.
- Ik begrijp dat ik me op elk moment zonder opgave van reden uit de studie mag terugtrekken.
- Ik begrijp dat ik op elk moment kan weigeren om vragen te beantwoorden zonder enige gevolgen.
- Ik begrijp dat ik niet direct voordeel zal hebben van deelname aan dit onderzoek.

Vertrouwelijkheid en gegevensgebruik

- Ik begrijp dat geen van mijn individuele informatie aan iemand buiten het onderzoeksteam zal worden onthuld.
- Ik begrijp dat de verstrekte informatie alleen voor dit onderzoek en publicaties die rechtstreeks verband houden met dit onderzoeksproject zullen worden gebruikt.

Nadat ik alles hierboven heb gelezen en begrepen, stem ik ermee in om deel te nemen aan het onderzoek: ja / nee

Datum:

Handtekening:

In te vullen door de onderzoeker:

Ik verklaar dat ik de onderzoeksdeelnemer grondig heb geïnformeerd over de onderzoeksstudie en eventuele resterende vragen naar beste weten heb beantwoord.

Ik ga ermee akkoord dat deze persoon deelneemt aan het onderzoek.

Datum:

Handtekeningen: