IEBB Theme 2: Insights into Renovation Processes and Use (not Decisions)

IEBB symposium 19 NOV 2024

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IEBB Theme 2: Insights into Renovation Processes and Use (not Decisions)

Goal:

- new data insights and tools
- to guarantee performance of energy- and indoor climate systems

Activities:

- Modelling
- Monitoring
- Propose user-centred design

IEBB Theme 2: Insights into Renovation Processes and Use (not Decisions)

Goal:

- new data insights and tools
- to guarantee performance of energy- and indoor climate systems

Activities:

- Modelling
- **Monitoring**
- **Propose user-centred design**

Are current renovations not user-centred?

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Previous research:

- wrong use
- bad installation
- more monitoring needed

In-depth monitoring of 16 renovated dwellings

In-depth monitoring of 16 renovated dwellings:
Results: residents' 'wrong' use is reasoned and normal.

Residents open windows because

- residents are too warm – **discomfort**
- residents do not **trust** their ventilation systems
- residents are **bothered** by noise from their ventilation systems

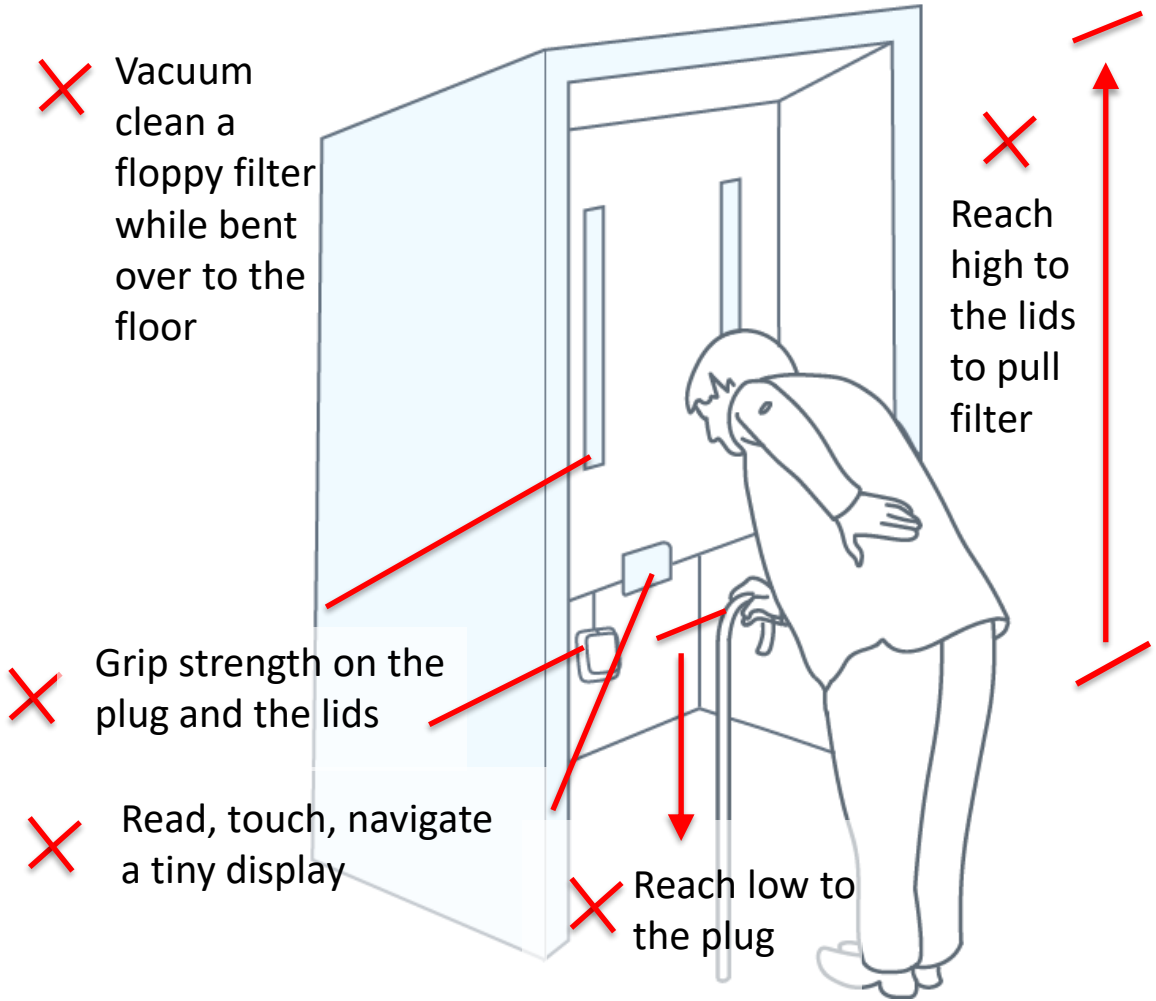
Effect:
Energy performance and indoor air quality is not always good enough.

In-depth monitoring of 16 renovated dwellings:
Results: residents' 'wrong' use is reasoned and normal.

Residents do not use and maintain their home systems well because

- Systems are often very **difficult to use**
- Systems are often **not made for residents**

Effect:
Energy performance and Indoor air quality is not always good enough.



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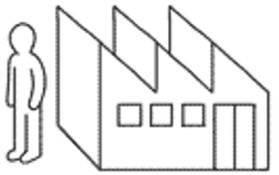
Why these problems?

Why these problems?

- Lack of user-centred design
- Lack of feedback loop in renovation processes



User-centred design of residential energy renovated buildings

- User-centred methods adapted to renovation process. Please also see report shortly on IEBB website. New developments: more-than-human design methods

- It requires system change in the building chain

  - **Designs** should be approached from user perspective
  - **Communication** on a level with residents – also facilitate bottom-up
  - **Process** more iterative

- Also needs addressing: accessibility of buildings (-> new norm NEN 9120)

www.tudelft.nl/en/tu-delft-urban-energy/research/projects/iebb

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Co-creative spaces for energy transition in communities:

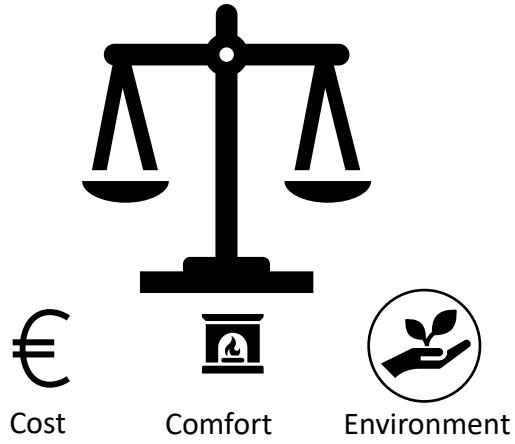
co-creation games + digital behavioural twins

Ioulia Ossokina – Urban Energy Symposium 2024 – 19/11/2024 Delft

Millions of dwellings need to become more sustainable

Often, people have to decide together (VVE, neighbourhood, complex).

How to find best solutions when individuals differ in their preferences for environment, costs, comfort?



Co-creative spaces for energy transition in communities:

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Based on projects with: Theo Arentze, Julia Kaltenegger, Taanis Karigar, Stephan Kerperien, Pieter Pauwels and others

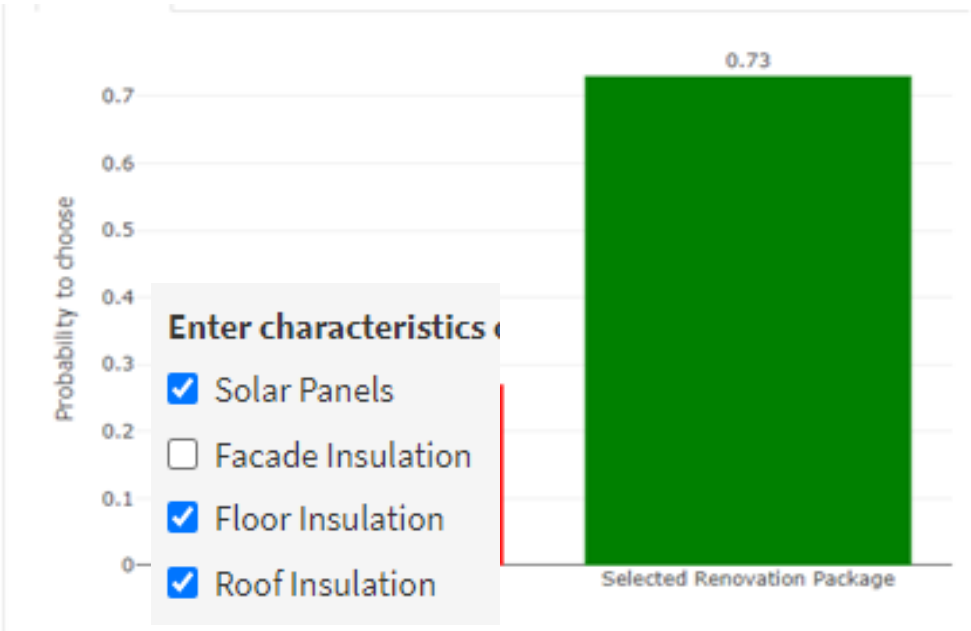
A co-creation game

- Which elements of home upgrades are most important for people?
- How does this differ per group?

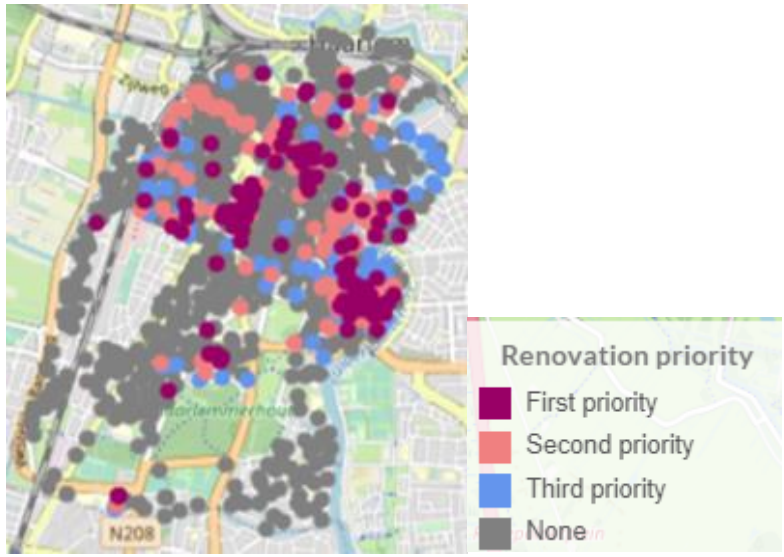
Digital behaviour twin

- Mimics choice behaviour of individuals
- Predicts % support, helps prioritize

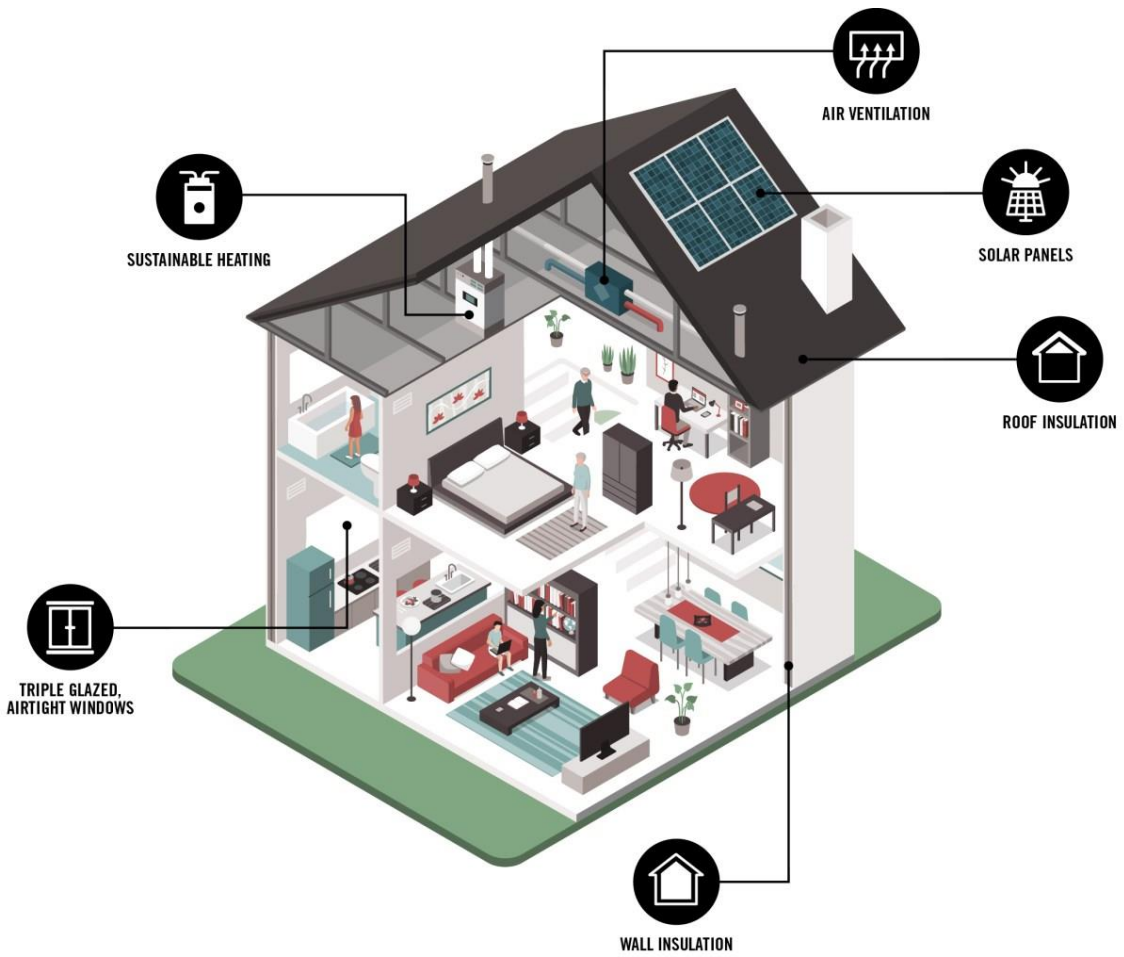
Predicts support for different home upgrades



Helps prioritize renovations



Economics: people choose for home upgrade if this increases utility



Comfort
Environment

Utility

Nuisance
Costs

$Utility_{hi} = c*comfort_h + m*environment_h - k*cost_h - o*nuisance_h + \varepsilon_{ih}$

$Utility_{upgrade} > Utility_{no.upgrade}$ → *DO IT!*

But what are the weights of different attributes (comfort, environment, cost)?

→ *Discover with a GAME-OF-CHOICE*

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Example: trade-offs and compromises in energy collectives

	Package 1		Package 2		
Wall + Roof	**M1-EPS (cavity)**	**M2-Glass Wool (cavity)**	**M1-Glass Wool (roles)**	**M2-Rock Wool (plates)**	**M3-Wood Fibre-(plates)**
						
Installation method	Injection	Injection	Second layer inside	Second layer inside	Second layer inside
Rc-Value (Wall, Roof)	1.7, 2.5	1.7, 2.5	4.0, 6.5	4.0, 6.5	4.0, 6.5
Thickness (Wall, Roof)	6 cm, 8 cm	6 cm, 9 cm	14 cm, 22 cm	14 cm, 23 cm	15 cm, 25 cm
Energy bill saving (€/a)	235.44	235.44	358.28	358.28	358.28
Investment Cost (IC)	€ 2,693.32	€ 2,626.65	€ 2,901.16	€ 3,435.29	€ 3,730.06
Financial Payback time (FPT)	14 years	14 years	10 years	12 years	13 years
CO2 footprint in manufacturing	1,348.94 kgCO2eq	249 kgCO2eq	1,349.77 kgCO2eq	1,774.32 kgCO2eq	1,028.61 kgCO2eq
CO2 payback time (CPT)	2.9 years	0.5 years	1.9 years	2.5 years	1.4 years
Street noise reduction	25%	50%	50%	50%	>50%
Humidity regul.	NO	NO	NO	NO	YES
Life expectancy	75yr	50yr	50yr	50yr	40yr
Fire resistance	Flashover before 2 min (E)	No flashover (A)	No flashover (A)	No flashover (A)	Flashover after 10min (C/D)

Game-of-choice (stated choice experiment)

Attributes	Package 1	Package 2	None of these
In which way will insulation be installed?	Insulation injected inside the cavity wall.	False wall inside (6cm thick) with insulation plates behind it.	
What will it cost me to insulate my house?	3500 euro	2500 euro	
What are the energy savings?	500 euro yearly	500 euro yearly	
What are the yearly CO2 savings?	800 kg (equal to planting 40 trees)	800 kg (equal to planting 40 trees)	
Does insulation reduce street noise?	Yes 25% less noise than now	Yes 50% less noise than now	
Is there a comfort improvement in house?	No only energy saving	No only energy saving	
Your choice	Choose	Choose	Choose

Digital behavioural twin predicts support and shows trade-offs

Make a choice: insulation

Predict the support for a package

Attributes	Package	Valuation (thousand euro)
In which way will insulation be installed?	Insulation injected inside the cavity wall	0
What will it cost me to insulate my house?	2500 euro	0
What are the energy savings?	300 euro yearly	0
What are the yearly CO2 savings?	400 kg (equal to planting 20 trees)	0
Does insulation reduce street noise?	Yes 25% less noise than now	0
Is there a comfort improvement in house?	No only energy saving	0
Market share	69.85%	

Digital behavioural twin predicts support and shows trade-offs

Make a choice: insulation

Predict the support for a package

Attributes	Package	Valuation (thousand euro)
In which way will insulation be installed?	False wall inside (6cm thick) with insulation plates behind it	-5
What will it cost me to insulate my house?	2500 euro	0
What are the energy savings?	300 euro yearly	0
What are the yearly CO2 savings?	400 kg (equal to planting 20 trees)	0
Does insulation reduce street noise?	Yes 25% less noise than now	0
Is there a comfort improvement in house?	No only energy saving	0
Market share	43.05%	

UTILITY

Digital behavioural twin predicts support and shows trade-offs

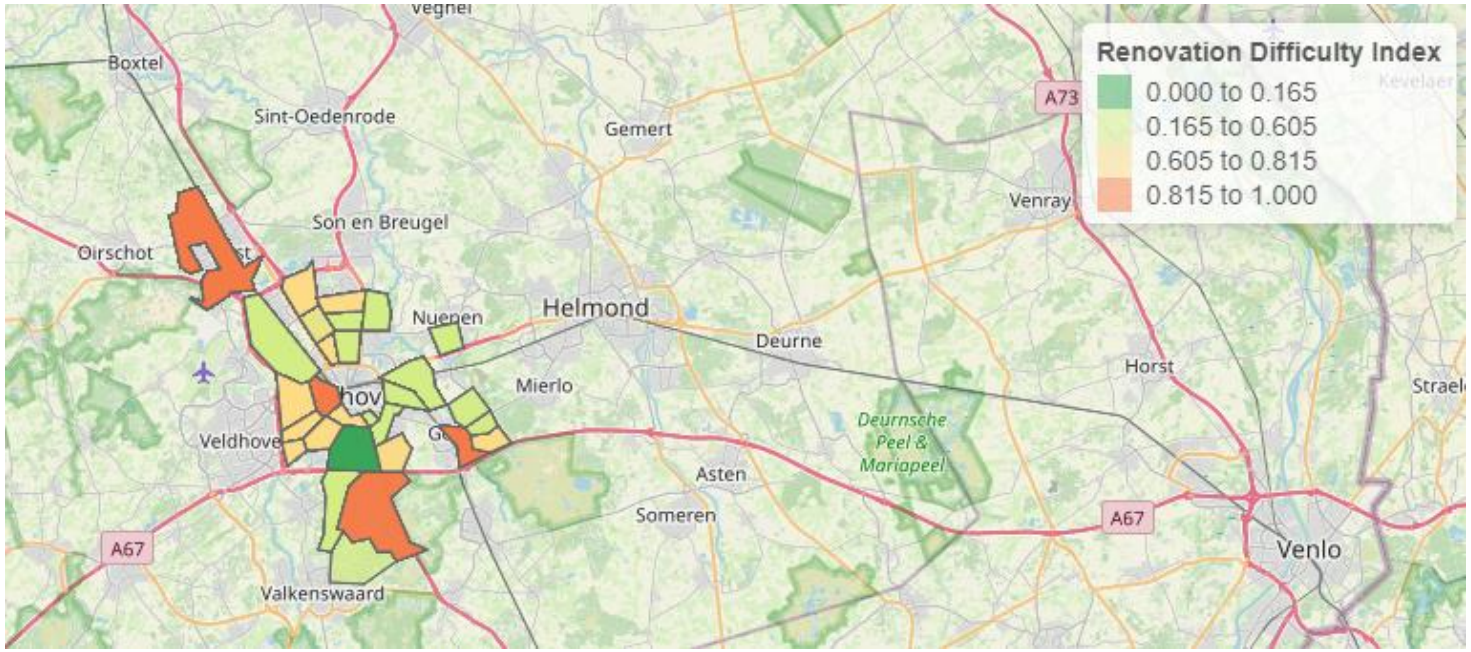
Make a choice: insulation

Predict the support for a package

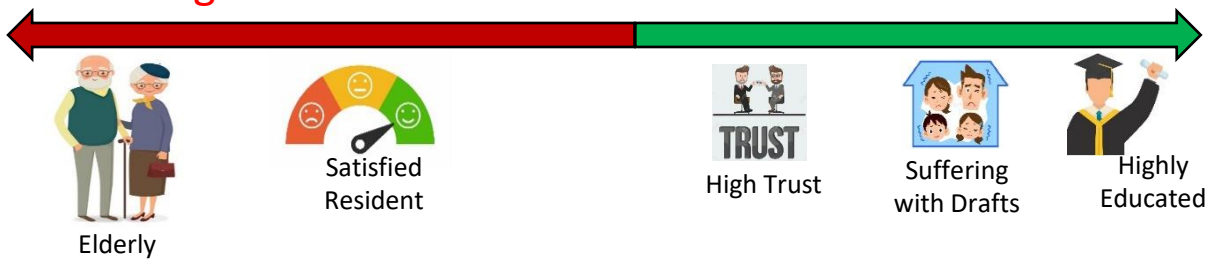
Attributes	Package	Valuation (thousand euro)
In which way will insulation be installed?	False wall inside (6cm thick) with insulation plates behind it	-5
What will it cost me to insulate my house?	2500 euro	0
What are the energy savings?	500 euro yearly	2
What are the yearly CO2 savings?	800 kg (equal to planting 40 trees)	2
Does insulation reduce street noise?	Yes 50% less noise than now	1
Is there a comfort improvement in house?	Yes draught disappears	2
Market share	78.07%	

UTILITY

Digital behavioural twin helps prioritize renovations, early in process



Kritisch tegenover renovatie <-



WOONBEDRIJF

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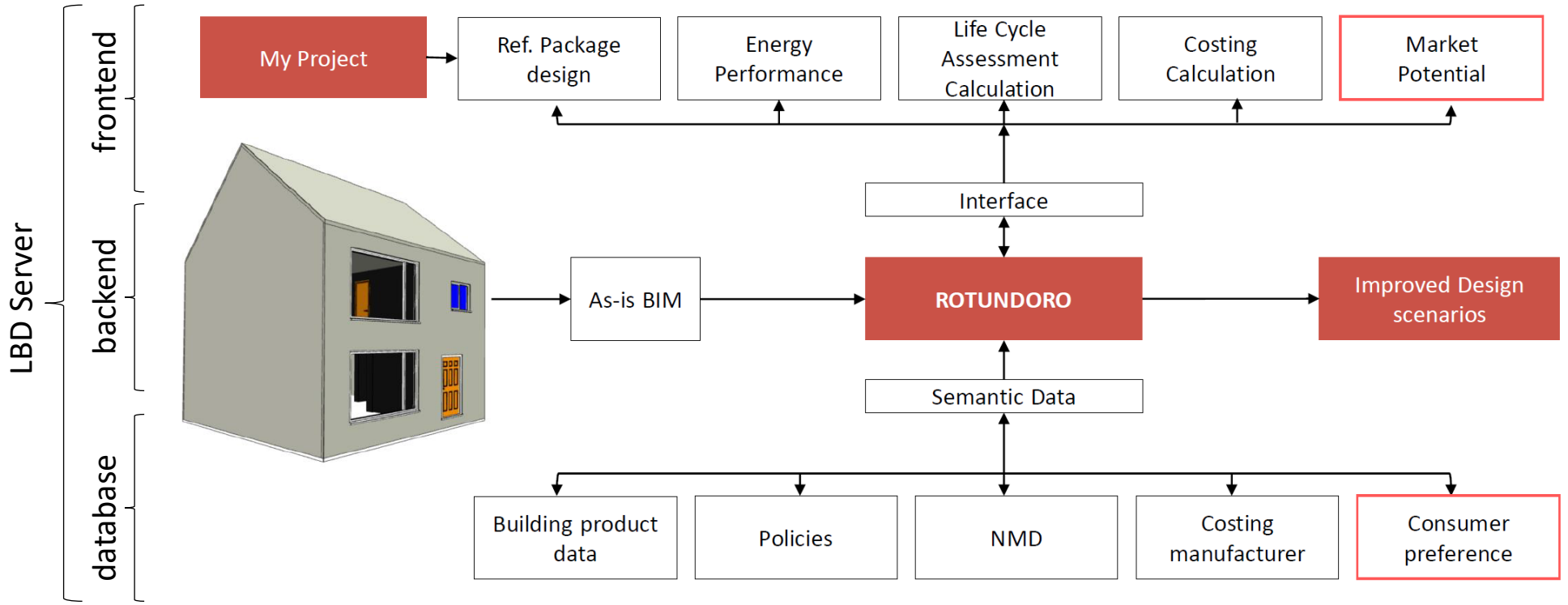
Digital behavioural twin and BIM: Rotundoro



Utility

Important: do not forget to express effects as user experiences

Technical		User experience
Roof insulation	⟷	No draught in attic
Façade insulation	⟷	
Floor insulation	⟷	Warm feet
Solar panels	⟷	Green energy

Summary and next steps; check www.bel-tue.nl

5+ co-creative spaces for partners; 2000+ deelnemers

1) Co-creative space helps:

- Track trade-offs and compromises in an early stage
- Make best home upgrades for communities
- Distinguish segments and prioritize policy
- Test ideas.

2) Important: Talk to residents in terms of **user experience. Use visuals.**

Next step: PONG Phasing Out Natural Gas

- Including eXtended Reality

Trigger my motivation and remove my barrier

Latent class analyses of homeowners' perception of home energy retrofit

Dr. Queena K. Qian
Associate Professor
Behaviour and Governance in Sustainable Transition
Management in the Built Environment Department
TU Delft / Faculty of Architecture and The Built Environment

Urban Energy Institute Symposium, 19 Nov, 2024, Delft

Shutong He[1], Queena K. Qian[1], Jarry T. Porsius[2]

1 Delft University of Technology, the Netherlands
2 PBL Netherlands Environmental Assessment Agency, the Netherlands

Submitted to Energy Research & Social Science

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BESTAANDE BOUW

Informational

Technical

Financial

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Informational

Technical

Financial

Check je isolatie

Leestijd: 2 minuten

Advies op maat

Isolatie-zelfscan

Zijn je dak en vloer geïsoleerd, en welk glas zit er in de ramen? Met de praktische uitleg van de zelf-scan, een aansteker en meetlint ontdek je het zelf. Aan de slag!

Naar de zelfscan →

Milieu Centraal

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- ✓ We helpen bij het vinden van aannemers
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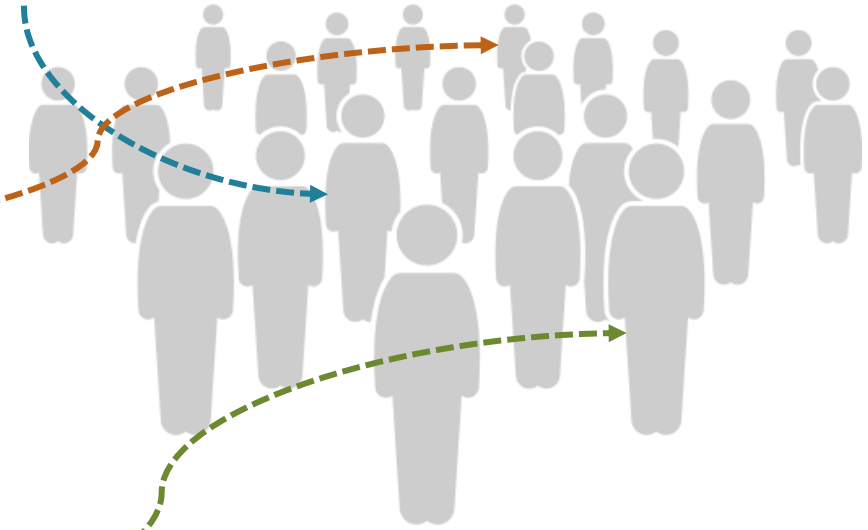

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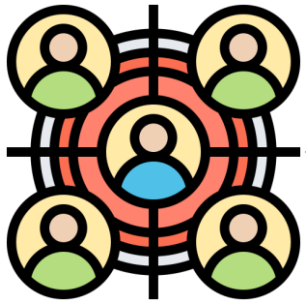
Our approach

Identify consumer segments



Tailored policy/market interventions

- Segmentation according to perceived motivations and barriers.
- A sample of experienced Dutch homeowners (N=1011).
- Latent Class Analysis (LCA) – a person-oriented analysis discovering probabilities of class membership.

- Identify typical characteristics of consumer segments.
- Propose policy and marketing interventions for potential consumers, based on
  - socio-demographic characteristics
  - behavioural reasoning
  - behavioural patterns

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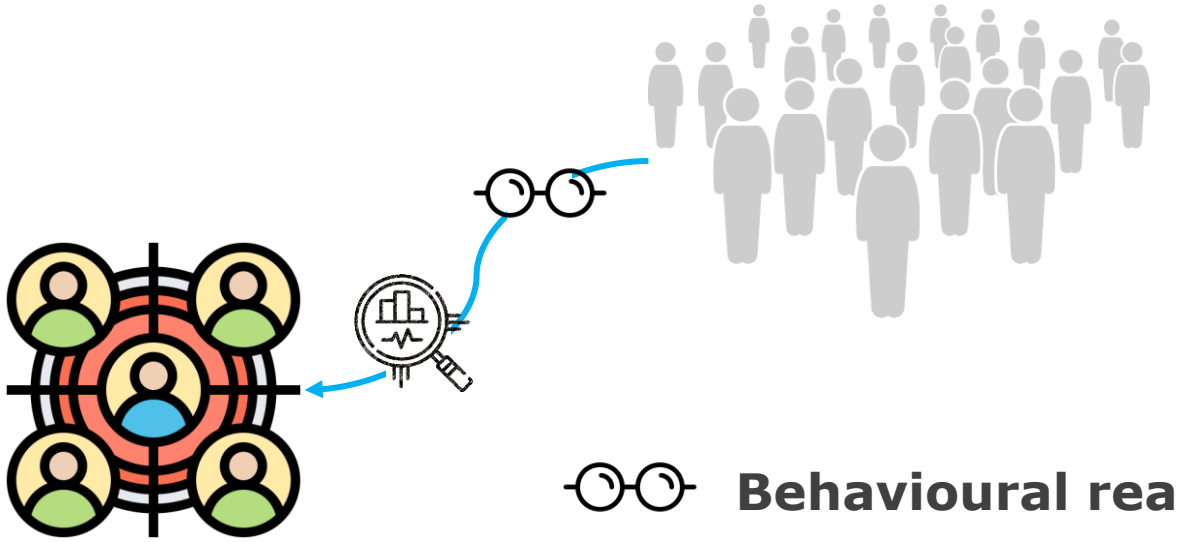

Behavioural reasoning theory

Reasons for and reasons against adopting innovations differ qualitatively, and they influence consumers' decisions in dissimilar ways (Westaby, 2005).

Latent Class Analysis

A statistical method used to identify unobserved subgroups in a population with a chosen set of indicators.
(Nylund-Gibson & Choi, 2018).

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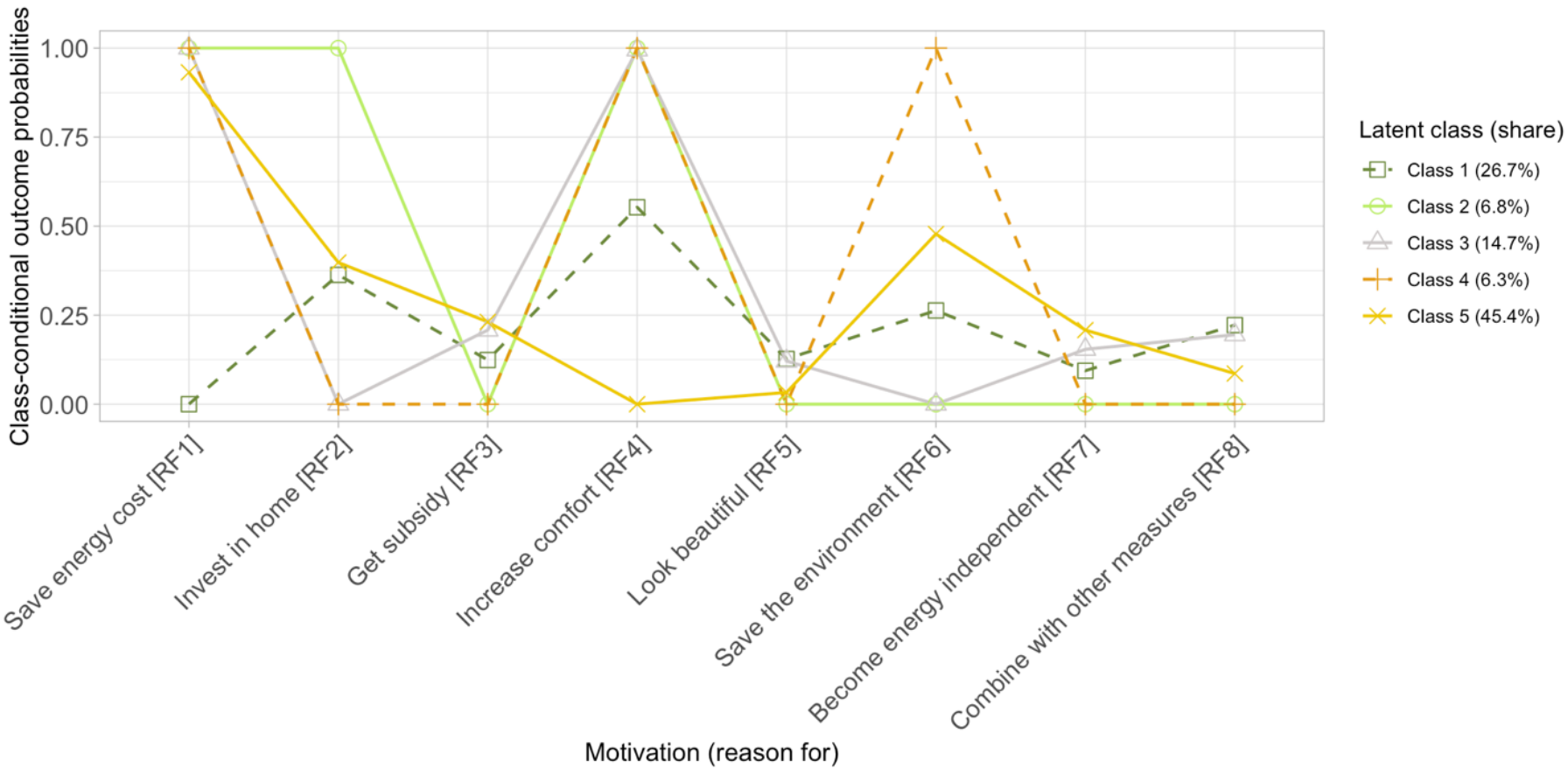
5 segments were identified for motivations



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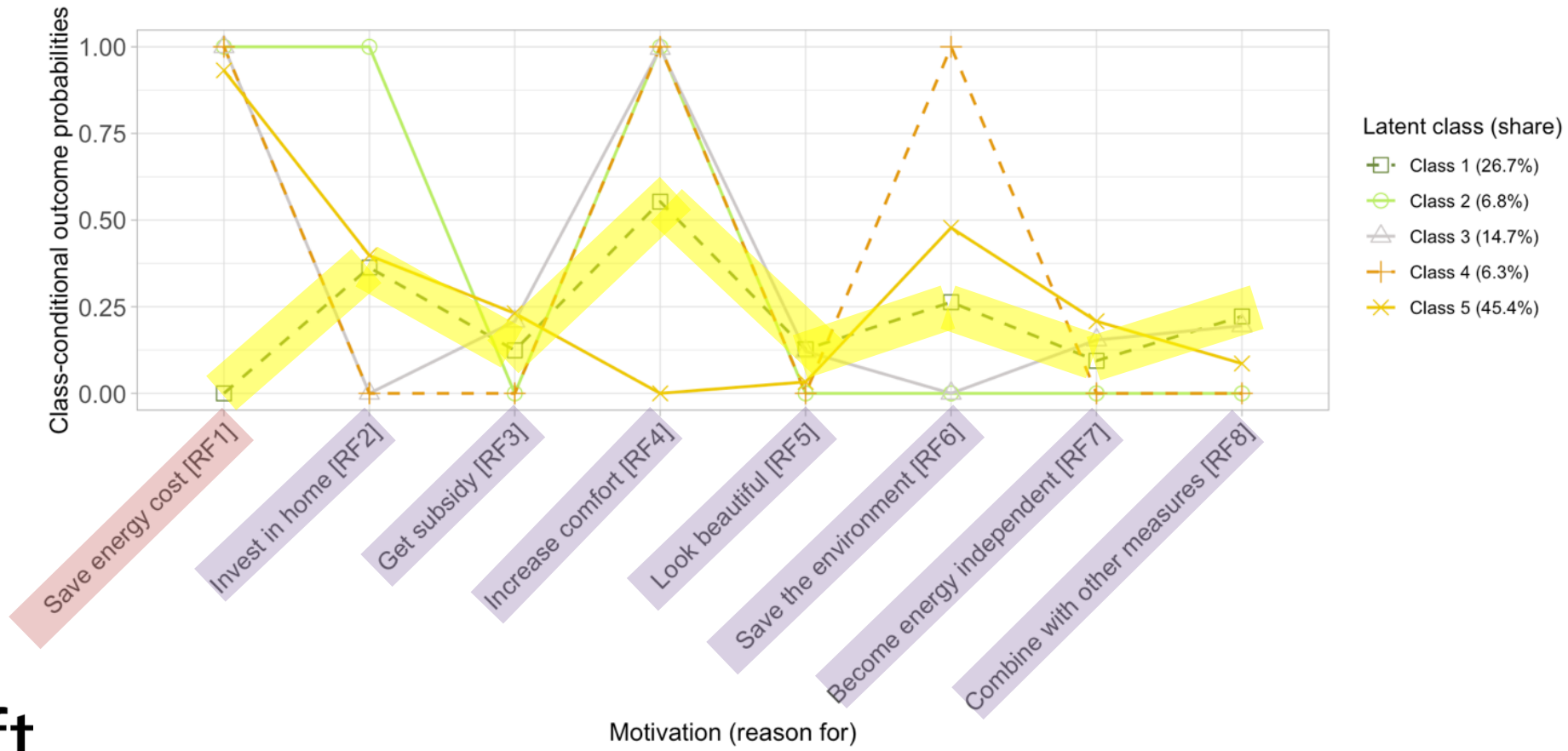
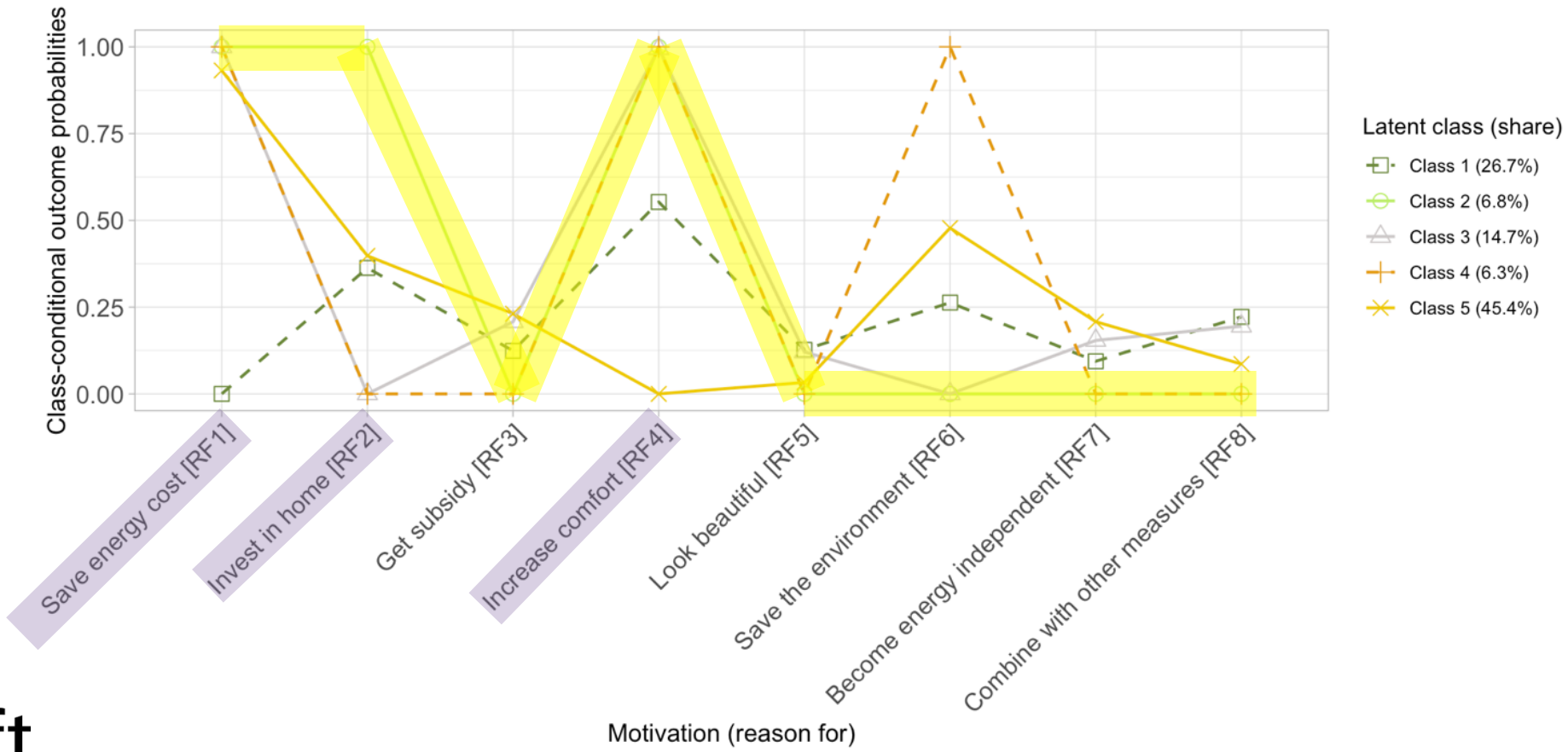
Class 1: Balanced motivation homeowner (26.7%)

- Driven by financial, hedonic, environmental, and practical motivations in a balanced manner.
- Saving energy cost is not a concern.



Class 2: Individual utility maximiser (6.8%)

- Homeowners in this segment all identified saving energy cost, investing in their homes, and increasing home comfort as their top three motivations for energy retrofitting.



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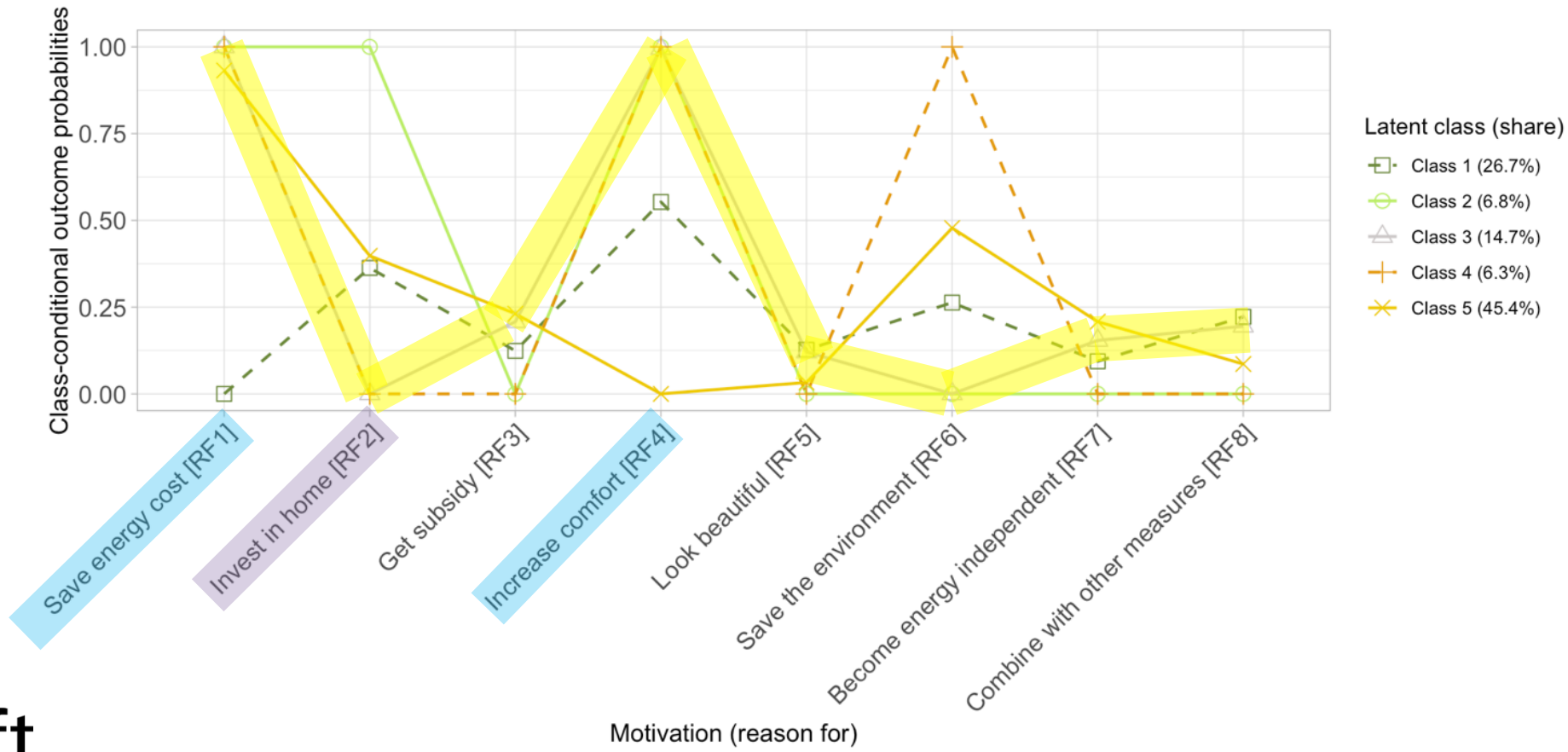
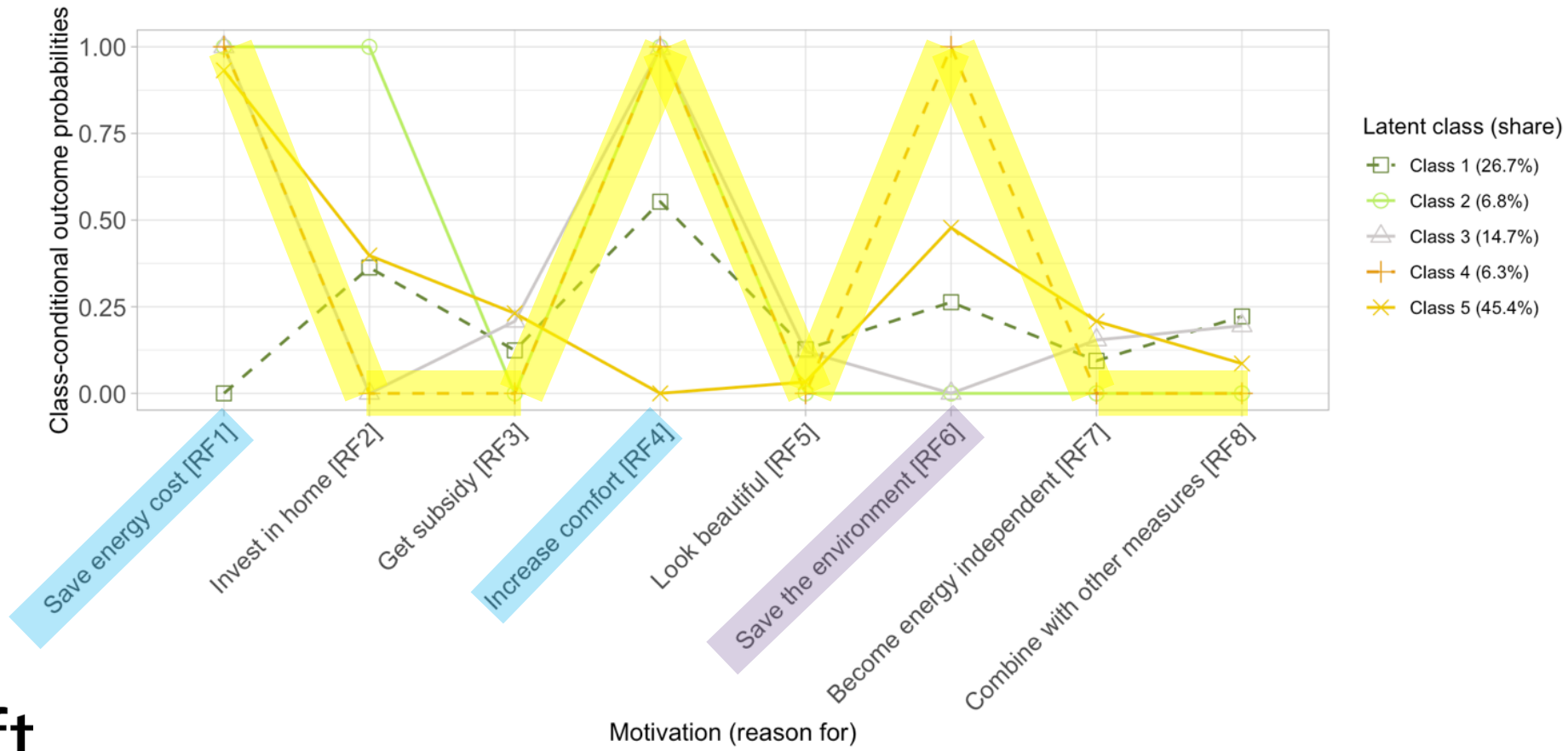
Class 3: Immediate utility seekers (14.7%)

- Similar to the "individual utility maximiser" [Class 2], except that
  - they were driven mostly by immediate gains – saving energy cost and increasing comfort;
  - cared less about the long-term investment in their homes.



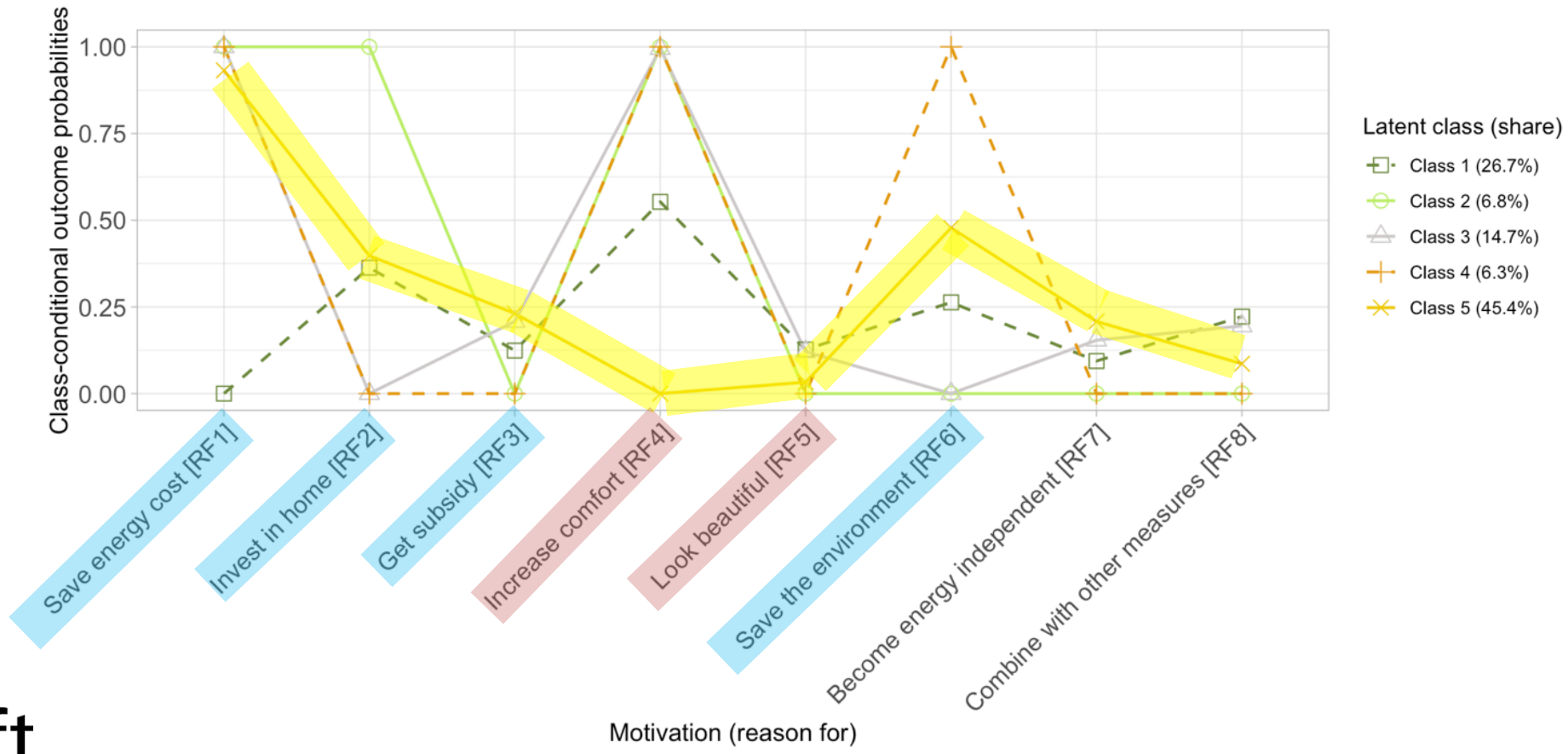
Class 4: Environmental and immediate utility maximiser (6.3%)

- Similar to the "immediate utility maximiser" [Class 3], except that
  - homeowners in this class were homogeneous in the pro-environmental motivation.



Class 5: Environmental-financial sensitive majority (45.4%)

- Characterised by relatively high probabilities of indicating the three financial motivations and the environmental motivation.
- Increasing home comfort and aesthetics are less a consideration.



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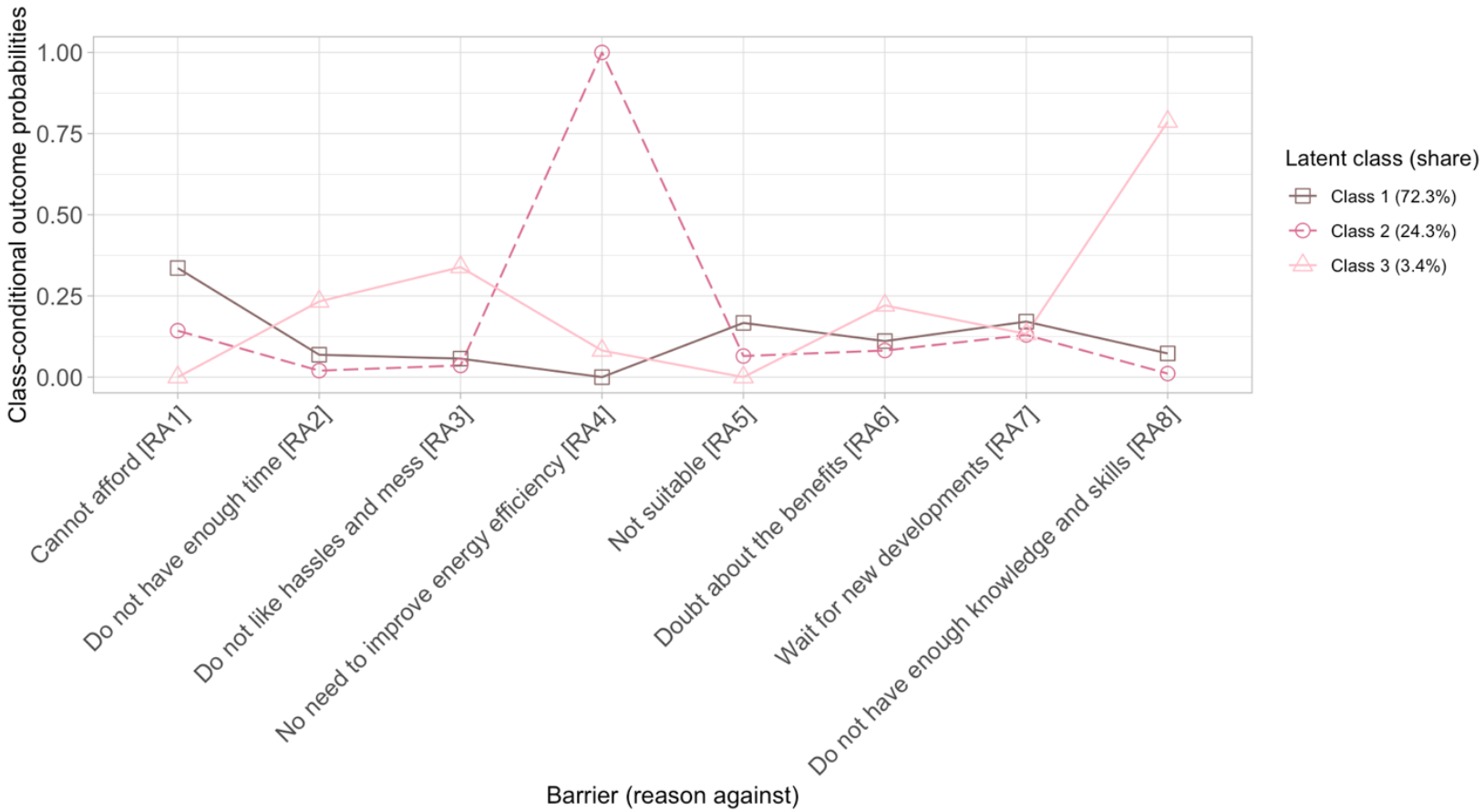
3 segments were identified for barriers



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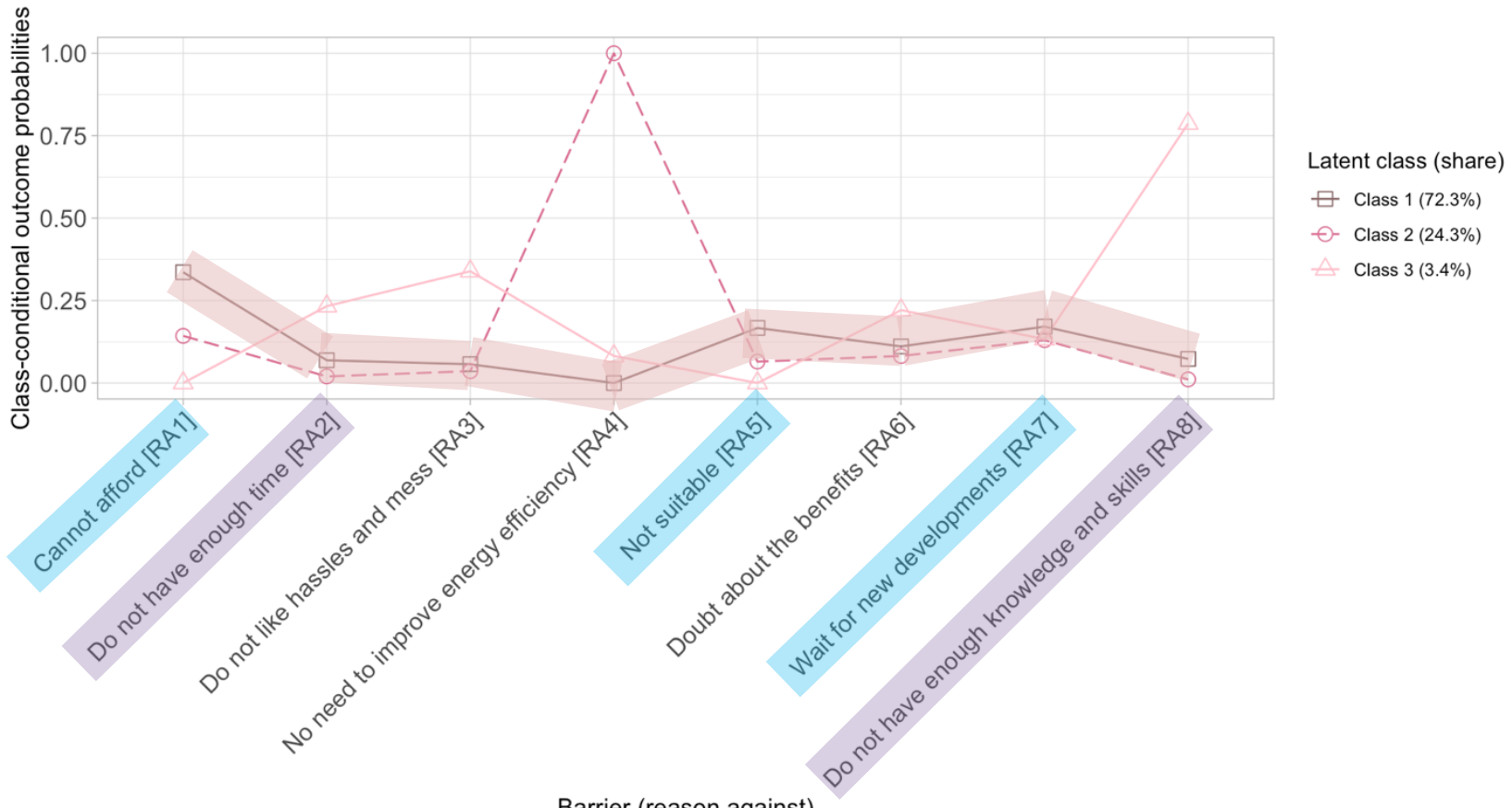
Class 1: Balanced financial and feasibility barriers (72.3%)

- Affordability and feasibility are major concerns.
- Also bothered by the lack of time, knowledge, and skills.



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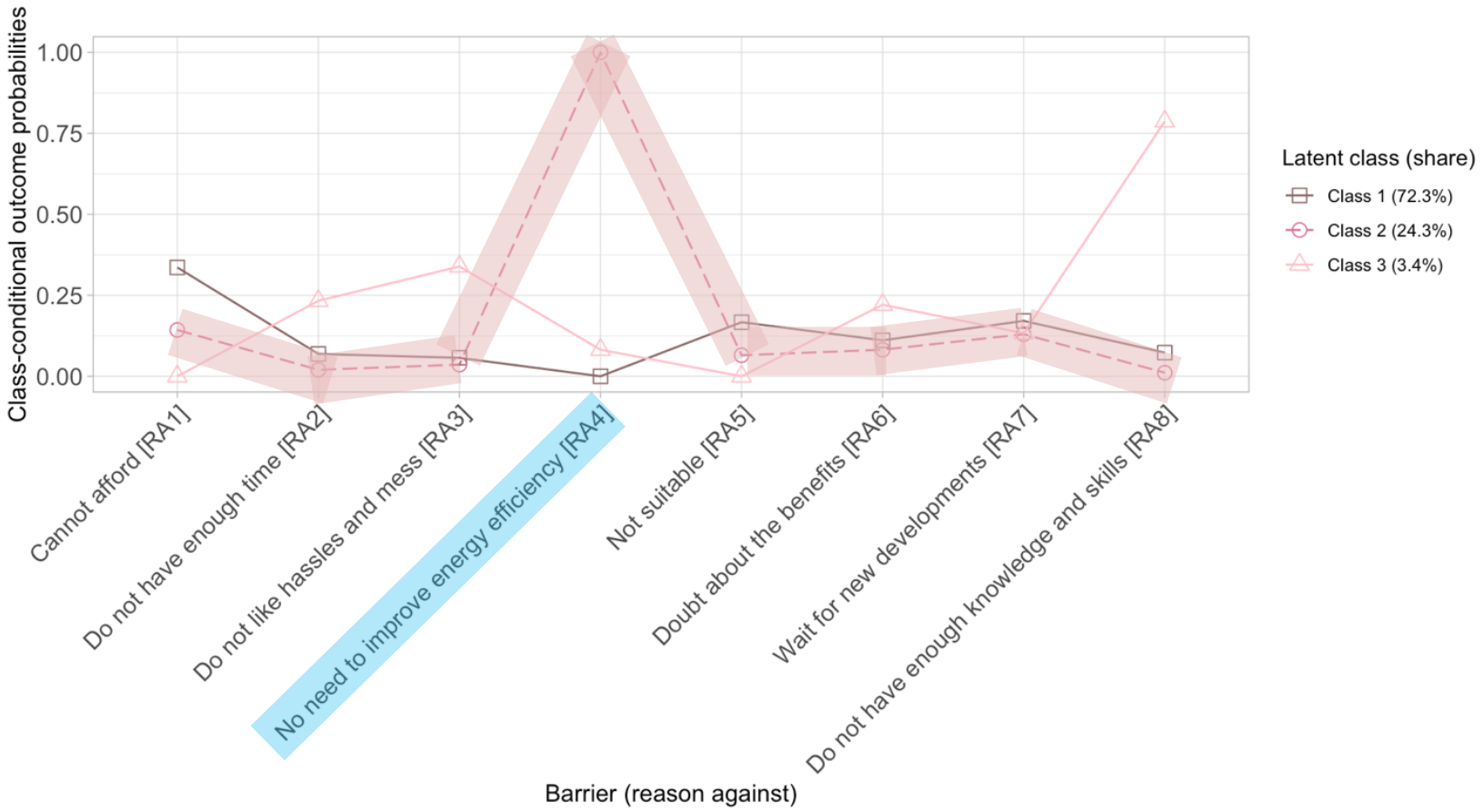
Class 2: Lack of demand (24.3%)

- All homeowners in this class indicated that there is no need to further improve home energy efficiency.



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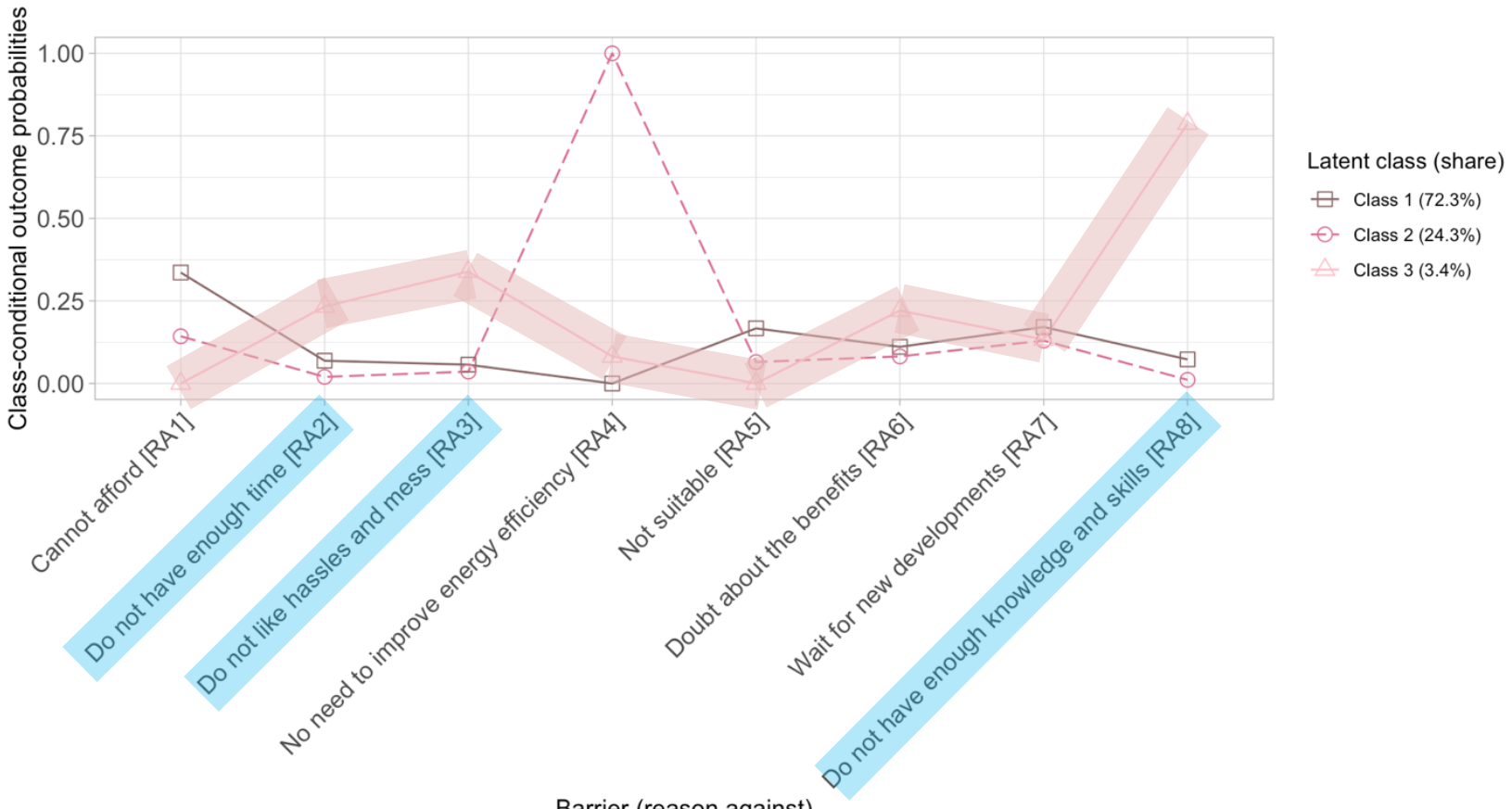
Class 3: Prominent non-financial barriers (3.4%)

- Hindered by mostly transactions costs – time and hassles – and the lack of knowledge and skills.



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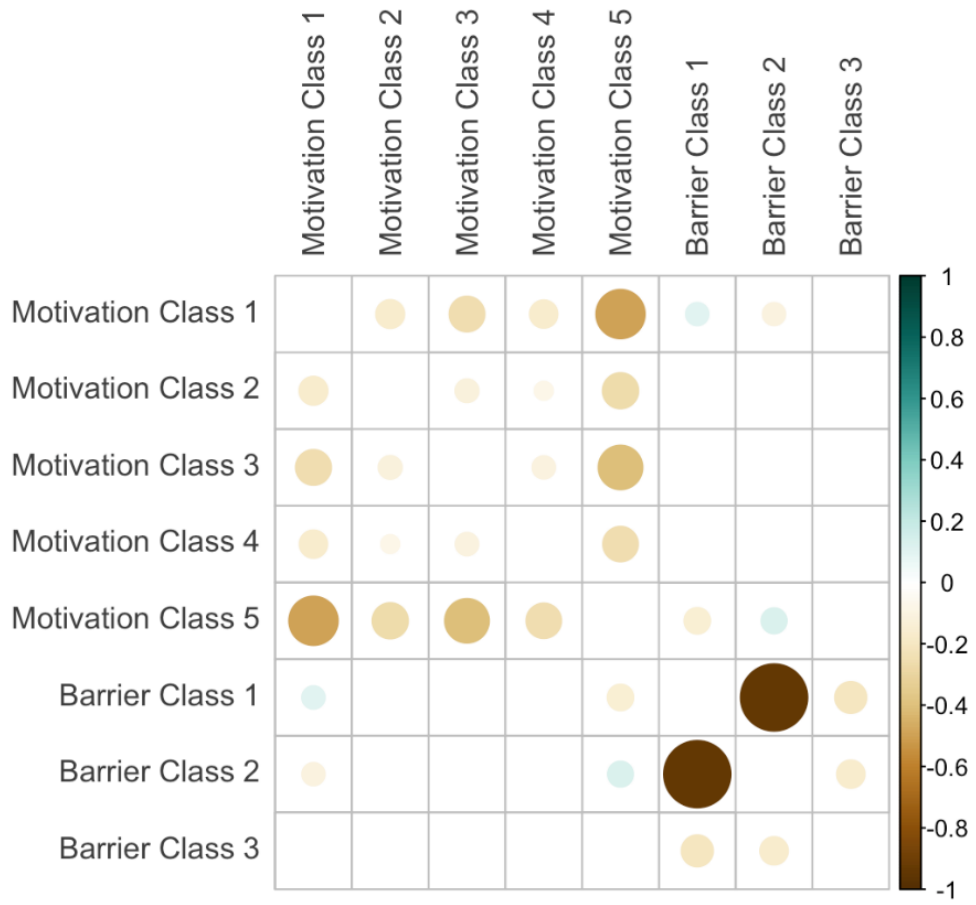

The probabilities of reasons for classes membership and reasons against classes membership are not strongly correlated.

Leveraging motivations and addressing barriers should be considered separately in interventions.

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Table. Share of observations per cross-tabulated latent class.

	Class 1 *Balanced fin. and feasibility barriers*	Class 2 *Lack of demand*	Class 3 *Prominent non-fin. barriers*
Class 1 *Balanced motivation homeowner*	21.5%	4.5%	0.7%
Class 2 *Individual utility maximiser*	4.9%	1.6%	0.3%
Class 3 *Immediate utility seeker*	11.2%	3.2%	0.4%
Class 4 *Env. and immediate utility maximiser*	4.9%	1.2%	0.2%
Class 5 *Env. - financial sensitive majority*	29.8%	13.8%	1.8%

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Policy implications: Example persona

Environmental-financial sensitive majority x Lack of demand (13.8%)

- This person is 60, towards her retirement.
- She is highly educated and has a medium-high income.

Policy implications: Example persona

Environmental-financial sensitive majority x Lack of demand (13.8%)

- This person is 60, towards her retirement.
- She is highly educated and has a medium-high income.

- She cares about saving energy cost and saving the environment.
- Getting subsidy and becoming energy independence also motivate her to take energy retrofit measures.
- Increasing home comfort and aesthetics are less a concern for her.
- She is happy to take actions as long as there is a need.

Policy implications: Example persona

Environmental-financial sensitive majority x Lack of demand (13.8%)

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- She has a strong preference for installing solar panels.

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Policy implications: Example persona

Environmental-financial sensitive majority x Lack of demand (13.8%)

- This person is 60, towards her retirement.
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- She cares about saving energy cost and saving the environment.
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- Increasing home comfort and aesthetics are less a concern for her.
- She is happy to take actions as long as there is a need.

- She has a strong preference for installing solar panels.

Emphasising environmental values of energy retrofit, and providing subsidies, smoothing the subsidy application process can be effective interventions for this person.

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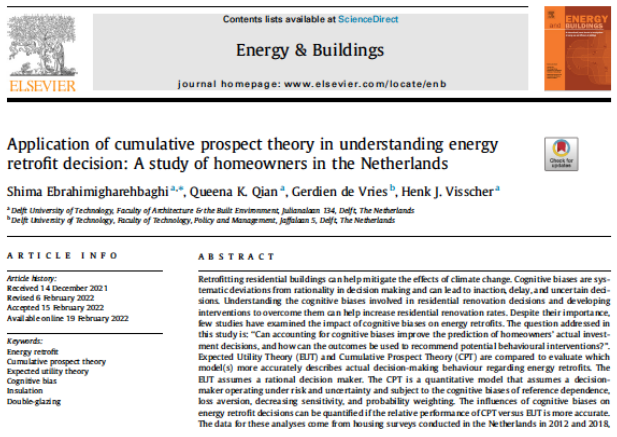
IEBB5.2 scientific output summary (1 PhD & 1 Post Doc: dr. Shima Ebrahimi; dr. Shutong He)



Contents lists available at ScienceDirect

Energy & Buildings

journal homepage: www.elsevier.com/locate/enb

Application of cumulative prospect theory in understanding energy retrofit decision: A study of homeowners in the Netherlands

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ABSTRACT

Retrofitting residential buildings can help mitigate the effects of climate change. Cognitive biases are systematic deviations from rationality in decision making and can lead to inaction, delay, and uncertain decisions. Understanding the cognitive biases involved in residential renovation decisions and developing interventions to overcome them can help increase residential renovation rates. Despite their importance, few studies have examined the impact of cognitive biases on energy retrofits. The question addressed in this study is: "Can accounting for cognitive biases improve the prediction of homeowners' actual investment decisions, and how can the outcomes be used to recommend potential behavioural interventions?". Expected Utility Theory (EUT) and Cumulative Prospect Theory (CPT) are compared to evaluate which model(s) more accurately describes actual decision-making behaviour regarding energy retrofits. The EUT assumes a rational decision maker. The CPT is a quantitative model that assumes a decision-maker operating under risk and uncertainty and subject to the cognitive biases of reference dependence, loss aversion, decreasing sensitivity, and probability weighting. The influences of cognitive biases on energy retrofit decisions can be quantified if the relative performance of CPT versus EUT is more accurate. The data for these analyses come from housing surveys conducted in the Netherlands in 2012 and 2018,

BRI BUILDING RESEARCH & INFORMATION
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Identification of the behavioural factors in the decision-making processes of the energy efficiency renovations: Dutch homeowners

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Faculty of Architecture & the Built Environment, Delft University of Technology, Delft, Netherlands

ABSTRACT

Over half of all residential buildings in the Netherlands are owner-occupied. In this study, the influence of behavioural factors on individual decisions toward energy efficiency renovations (EERs) was investigated. This study focused on contextual (e.g. building characteristics), personal (e.g. awareness of energy consumption), and motivational factors (e.g. improving comfort). Logistic regression analyses were selected as the preferred method of analysis. The Netherlands's housing survey energy modules, which was conducted in 2018, was the basis of these analyses. 2878 homeowners were surveyed. Behavioural factors that influence the homeowners' decisions were investigated for four types of EERs: (1) double glazing, (2) insulation, (3) photovoltaic (PV) panel, and (4) sustainable heating. It was found that homeowners' preferences for double glazing were mainly influenced by the characteristics of the building and household and motivation to adopt EERs. Similarly, insulation and PV panels were to be mainly influenced by building characteristics. For sustainable heating, a combination of building and household characteristics and personal factors (e.g. deliberate gas reduction) influenced the decisions regarding this EER. None of the personal factors had a significant impact on the decisions regarding installation of double glazing; in contrast, the installation of PV panels was found to be highly influenced by these factors.

ARTICLE HISTORY
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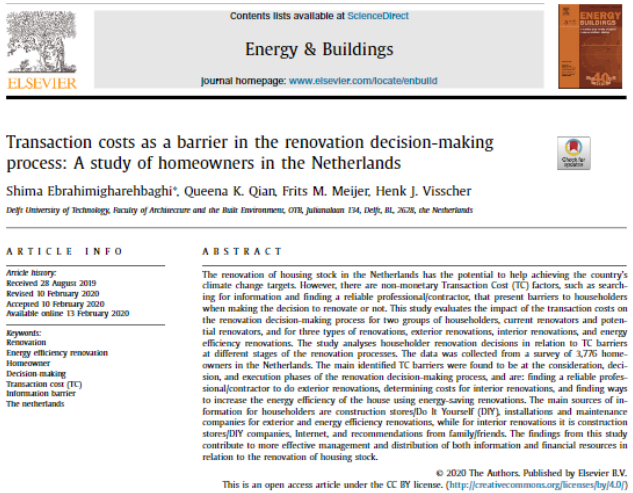
KEYWORDS
Energy efficiency; renovation; behaviour-influencing factor; residential sector; owner-occupied sector; the Netherlands



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Energy & Buildings

journal homepage: www.elsevier.com/locate/enbuild

Transaction costs as a barrier in the renovation decision-making process: A study of homeowners in the Netherlands

Shima Ebrahimigharehbaghi*, Queena K. Qian, Frits M. Meijer, Henk J. Visscher

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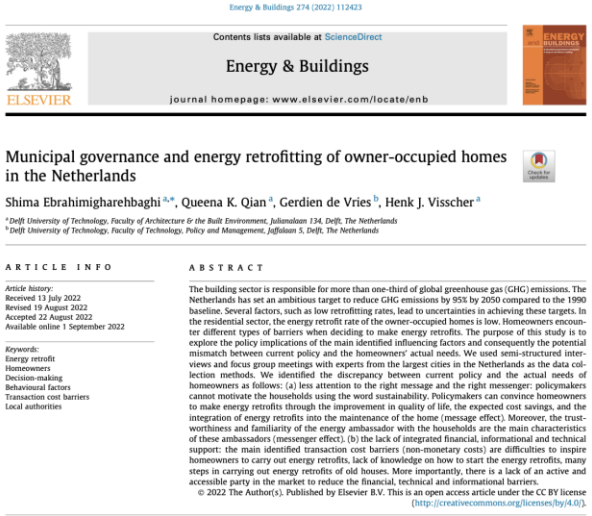
Energy efficiency renovation
Homeowner
Decision making
Transaction cost (TC)
Information barrier
The netherlands

ABSTRACT

The renovation of housing stock in the Netherlands has the potential to help achieving the country's climate change targets. However, there are non-monetary Transaction Cost (TC) factors, such as searching for information and finding a reliable professional/contractor, that present barriers to householders when making the decision to renovate or not. This study evaluates the impact of the transaction costs on the renovation decision-making process for two groups of householders, current renovators and potential renovators, and for three types of renovations, exterior renovations, interior renovations, and energy efficiency renovations. The study analyses householder renovation decisions in relation to TC barriers at different stages of the renovation processes. The data was collected from a survey of 3,776 homeowners in the Netherlands. The main identified TC barriers were found to be at the consideration, decision, and execution phases of the renovation decision-making process, and are: finding a reliable professional/contractor to do exterior renovations, determining costs for interior renovations, and finding ways to increase the energy efficiency of the house using energy-saving renovations. The main sources of information for householders are construction stores/Do It Yourself (DIY), installations and maintenance companies for exterior and energy efficiency renovations, while for interior renovations it is construction stores/DIY companies, Internet, and recommendations from family/friends. The findings from this study contribute to more effective management and distribution of both information and financial resources in relation to the renovation of housing stock.



Energy & Buildings 274 (2022) 112423

Contents lists available at ScienceDirect

Energy & Buildings

journal homepage: www.elsevier.com/locate/enb

Municipal governance and energy retrofitting of owner-occupied homes in the Netherlands

Shima Ebrahimigharehbaghi [a,*], Queena K. Qian [a], Gerdien de Vries [b], Henk J. Visscher [a]

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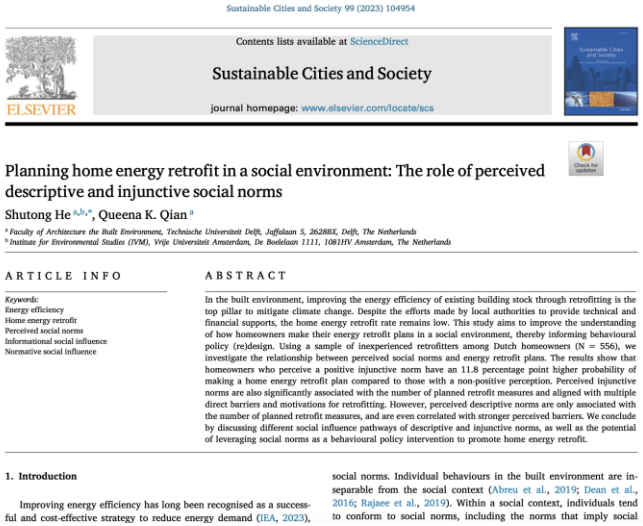
Energy retrofit
Homeowners
Decision-making
Behavioural factors
Transaction cost barriers
Local authorities

ABSTRACT

The building sector is responsible for more than one-third of global greenhouse gas (GHG) emissions. The Netherlands has set an ambitious target to reduce GHG emissions by 95% by 2050 compared to the 1990 baseline. Several factors, such as low retrofitting rates, lead to uncertainties in achieving these targets. In the residential sector, the energy retrofit rate of the owner-occupied homes is low. Homeowners encounter different types of barriers when deciding to make energy retrofits. The purpose of this study is to explore the policy implications of the main identified influencing factors and consequently the potential mismatch between current policy and the homeowners' actual needs. We used semi-structured interviews and focus group meetings with experts from the largest cities in the Netherlands as the data collection methods. We identified the discrepancy between current policy and the actual needs of homeowners as follows: (a) less attention to the right message and the right messenger: policymakers cannot motivate the households using the word sustainability. Policymakers can convince homeowners to make energy retrofits through the improvement in quality of life, the expected cost savings, and the integration of energy retrofits into the maintenance of the home (message effect). Moreover, the trustworthiness and familiarity of the energy ambassador with the households are the main characteristics of these ambassadors (messenger effect). (b) the lack of integrated financial, informational and technical support: the main identified transaction cost barriers (non-monetary costs) are difficulties to inspire homeowners to carry out energy retrofits, lack of knowledge on how to start the energy retrofits, many steps in carrying out energy retrofits of old houses. More importantly, there is a lack of an active and accessible party in the market to reduce the financial, technical and informational barriers.



Sustainable Cities and Society 99 (2023) 104954

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Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs

Planning home energy retrofit in a social environment: The role of perceived descriptive and injunctive social norms

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[b] Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, De Boelelaan 1111, 1081HV Amsterdam, The Netherlands

ARTICLE INFO

Keywords:
Energy efficiency
Home energy retrofit
Perceived social norms
Informational social influence
Normative social influence

ABSTRACT

In the built environment, improving the energy efficiency of existing building stock through retrofitting is the top pillar to mitigate climate change. Despite the efforts made by local authorities to provide technical and financial supports, the home energy retrofit rate remains low. This study aims to improve the understanding of how homeowners make their energy retrofit plans in a social environment, thereby informing behavioural policy (re)design. Using a sample of inexperienced retrofitters among Dutch homeowners (N = 556), we investigate the relationship between perceived social norms and energy retrofit plans. The results show that homeowners who perceive a positive injunctive norm have an 11.8 percentage point higher probability of making a home energy retrofit plan compared to those with a non-positive perception. Perceived injunctive norms are also significantly associated with the number of planned retrofit measures and aligned with multiple direct barriers and motivations for retrofitting. However, perceived descriptive norms are only associated with the number of planned retrofit measures, and are even correlated with stronger perceived barriers. We conclude by discussing different social influence pathways of descriptive and injunctive norms, as well as the potential of leveraging social norms as a behavioural policy intervention to promote home energy retrofit.

1. Introduction

Improving energy efficiency has long been recognised as a successful and cost-effective strategy to reduce energy demand (IEA, 2023), social norms. Individual behaviours in the built environment are inseparable from the social context (Abreu et al., 2019; Dean et al., 2016; Rajaee et al., 2019). Within a social context, individuals tend to conform to social norms, including the norms that imply social

Energy Policy 129 (2019) 546–561

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Energy Policy

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Unravelling Dutch homeowners' behaviour towards energy efficiency renovations: What drives and hinders their decision-making?

Shima Ebrahimigharehbaghi*, Queena K. Qian, Frits M. Meijer, Henk J. Visscher

Delft University of Technology, Faculty of Architecture and the Built Environment, OTB, Julianalaan 134, 2628, BL, Delft, the Netherlands

ARTICLE INFO

Keywords:
Energy efficiency renovation
Homeowner
Housing
Barriers
Drivers
Behavioural factors
Transaction costs (TCs)
Policy instruments
Decision-making

ABSTRACT

The housing stock has a considerable share of 40% in energy consumption and 36% of CO_2 emissions in the EU. In accordance to energy efficiency and emissions targets set by EU, The Netherlands has aimed to renovate 300,000 homes each year, leading to 50% reduction in CO_2 emissions, by 2050. Many factors including low renovation rates create uncertainties in achieving these targets. The current study aims for understanding the barriers and drivers towards energy efficiency renovations (EERs) amongst Dutch homeowners, and to aid in gaining a better insight into the role of public authorities in promoting EERs. First, the extrinsic drivers, including policies and other initiatives in the EER process are explained. Second, the intrinsic drivers and intrinsic/extrinsic barriers are explored. Regression analyses are performed on the national Dutch survey data for renovators and potential renovators. Our main findings include: (a) desire to enhance the quality of their life, rather than the financial benefits, etc. is identified as the main driver; (b) the main barriers are the costs of EERs, complexities in the process, information barriers, and finding reliable experts and information; (c) For improvement in meeting renovation targets, the current Dutch policies need to consider all the decision criteria by

Thank you!

Queena Qian

k.qian@tudelft.nl

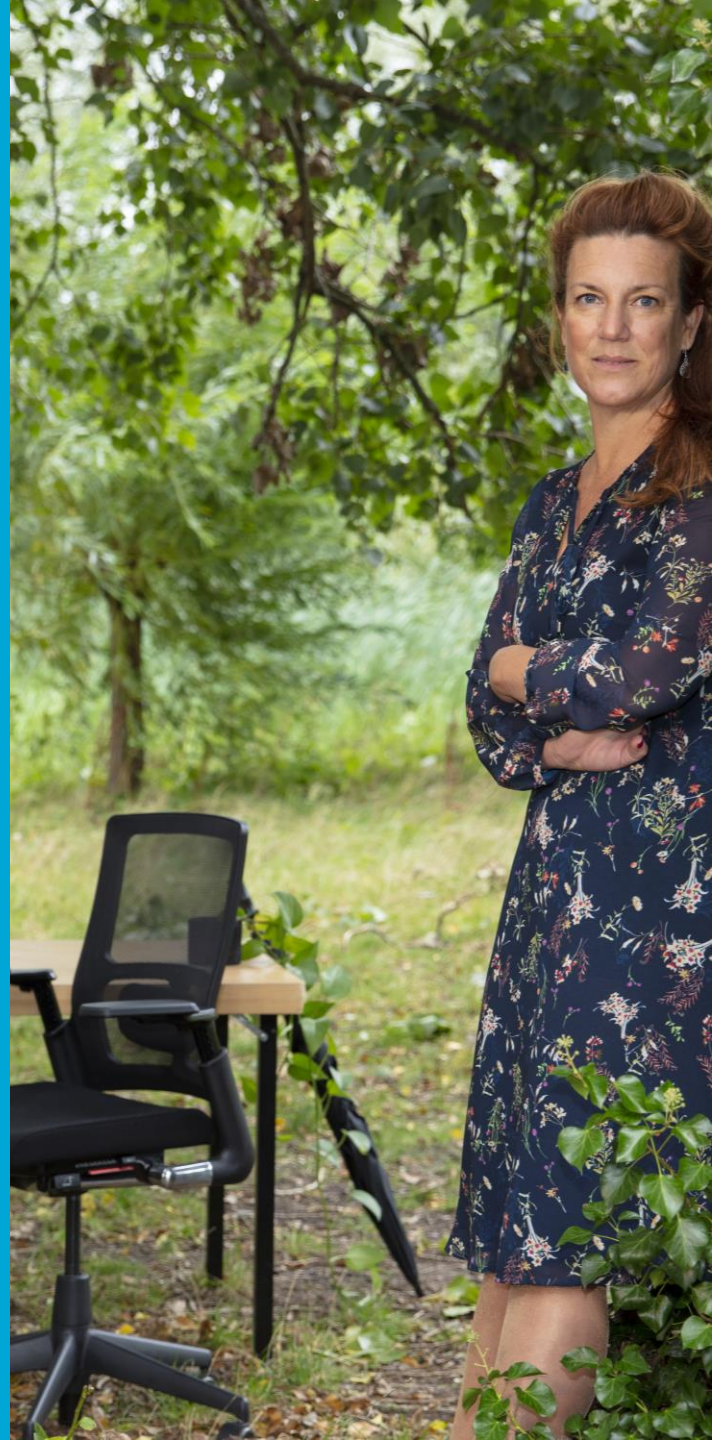
Psychological Barriers to Green Homes

Gerdien de Vries

UEI Symposium Speeding Up the Energy Transition in Existing Buildings

19 November 2024

TU Delft



Gerdien de Vries

- **Associate Professor**
  Faculty: Technology, Policy, and Management
- **Scientific Director**
  TPM Energy Transition Lab
- **Co-founder**
  Platform for Social Innovation in the Energy Transition
  Delft Energy Institute
- **Dutch Expert “Behavioural Insights in Energy Policy”**
  International Energy Agency
- **Climate Psychologist**

Behaviour is important

Equity and Inclusion

C.5 Prioritising equity, climate justice, social justice, inclusion and just transition processes can enable adaptation and ambitious mitigation actions and climate resilient development. Adaptation outcomes are enhanced by increased support to regions and people with the highest vulnerability to climatic hazards. Integrating climate adaptation into social protection programs improves resilience. Many options are available for reducing emission-intensive consumption, including through behavioural and lifestyle changes, with co-benefits for societal well-being. (*high confidence*) {4.4, 4.5}

IPCC AR6 Synthesis Report. Summary for Policymakers, 2023

TU Delft

Heat pump, district heating? A complex multi-actor problem

Hybride warmtepomp vanaf 2026 verplicht bij vervanging cv-ketel

17 mei 2022 09:36
Laatste update: 1 dag, 18 uur geleden

6.1K NUjij-reacties

Vanaf 2026 wordt een hybride warmtepomp de standaard voor het verwarmen van woningen, kondigt het kabinet dinsdag aan. Dat betekent dat mensen verplicht worden om zo'n pomp te installeren als hun cv-ketel aan vervanging toe is. Voor woningen die niet geschikt zijn, is een elektrische warmtepomp of een aansluiting op het warmtenet ook een optie.

NU+

Minder warmtepompen door vol stroomnet? 'Boel hoeft niet overal op slot'

Door Jeroen Kraan

5 mei 2024 om 12:00
Update: 4 maanden geleden

1.4K reacties Delen

Huishoudens in een deel van het land krijgen het advies om geen elektrische warmtepomp te nemen, maar een hybride. Door de drukte op het stroomnet is er volgens het demissionaire kabinet geen ruimte voor volledig elektrische modellen. Een gemiste kans voor de verduurzaming van woningen?

HUIS, TUIN & HOBBY

Warmtepomp niet langer verplicht: alles op een rijtje

Publicatiedatum: 8 juli 2024

Met het aantreden van het kabinet-Schoof is het vanaf 2026 niet meer verplicht om een (hybride) warmtepomp te installeren bij het vervangen van uw oude verwarmingsinstallatie. Is het met het vervallen van deze maatregel nog wel de moeite waard om uw oude cv-ketel te vervangen door een hybride warmtepomp?

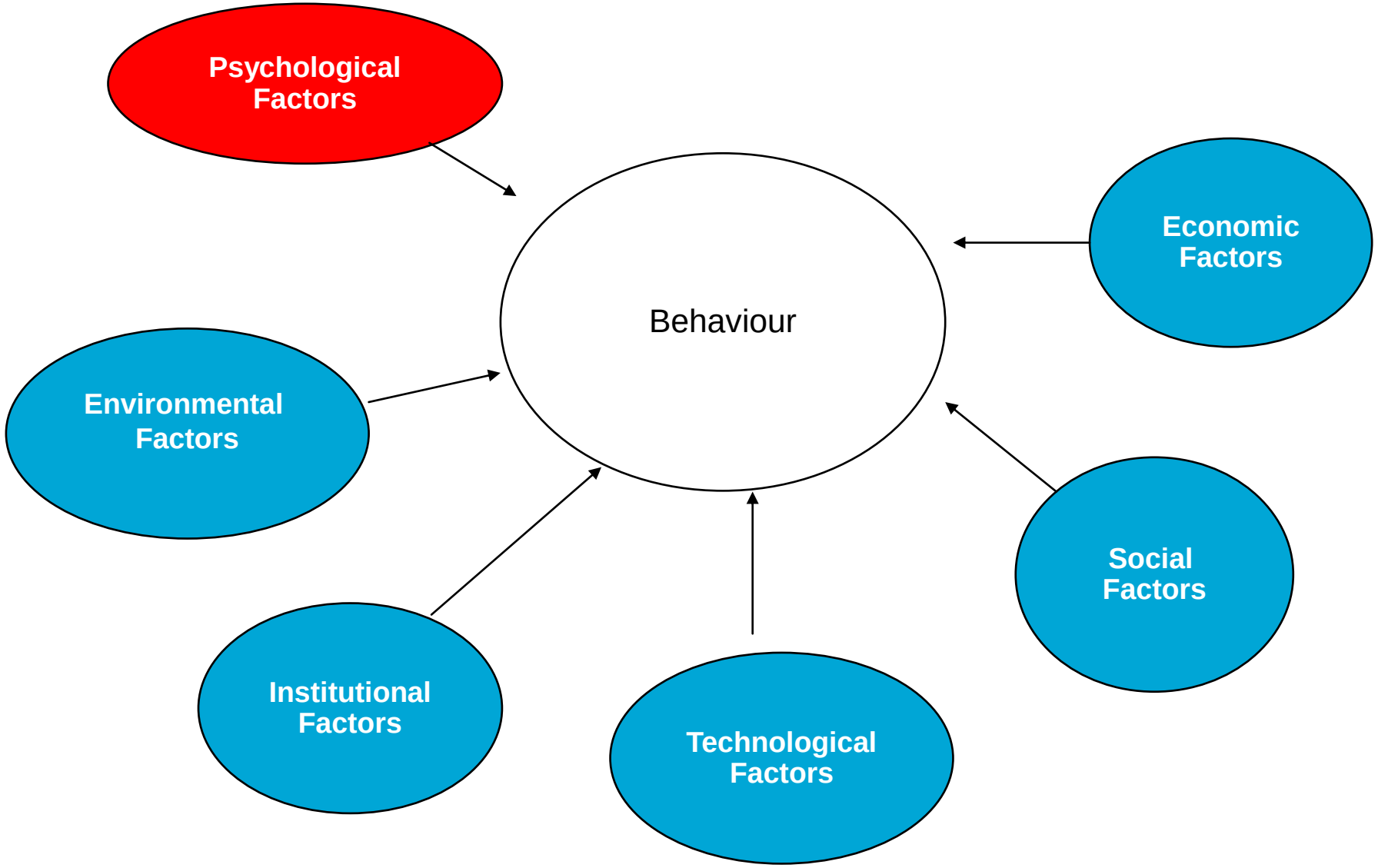
CLIMACS model

***Behaviour in Transitions* course (MSc Engineering and Policy Analysis)**

Behaviour	Description	Example
Continue	Continue old behaviour as it is	Continue buying vegetarian food
Learn	Learn new behaviour	Installers must learn how to install heat pumps
Increase	Increase	Increase the number of times you cycle to work
Mitigate	Reduce the current behaviour	Reduce meat in your meals
Adapt	Minor changes to old behaviour	Do the laundry at a different time of the day
Change	Major changes to old behaviour	Policymakers integrate behaviour insights in their policy design
Stop (quit)	Stop completely	Never smoke again

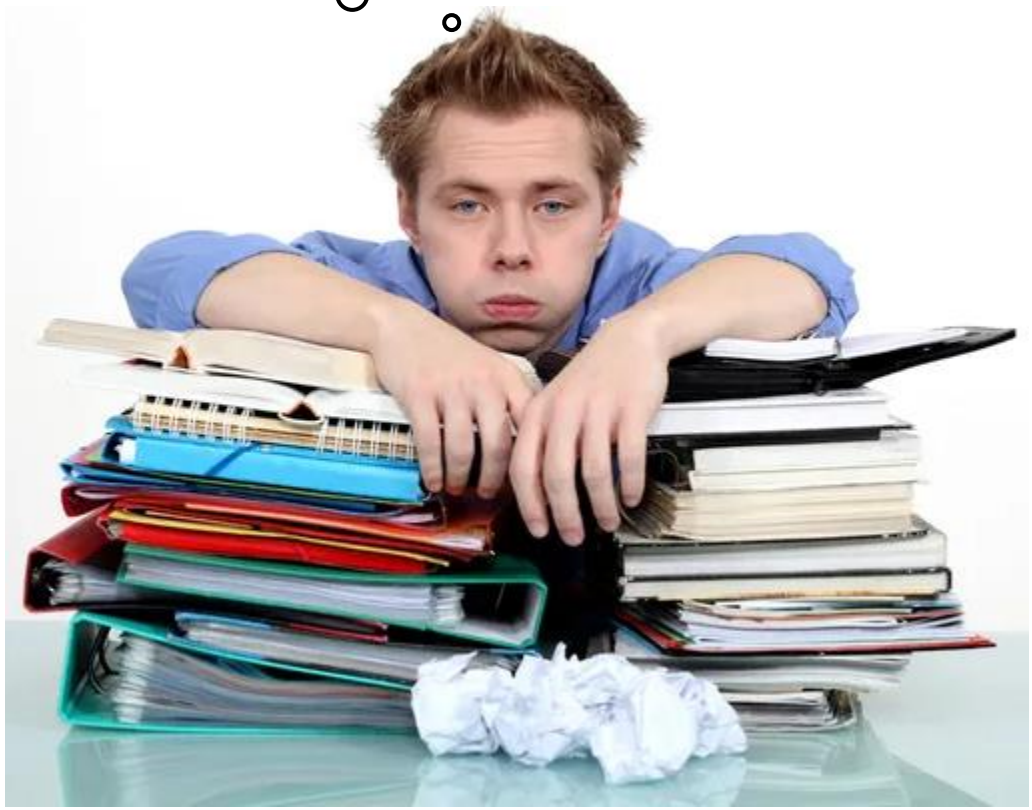
TU Delft

Contextual and psychological factors influencing behaviour in energy transitions

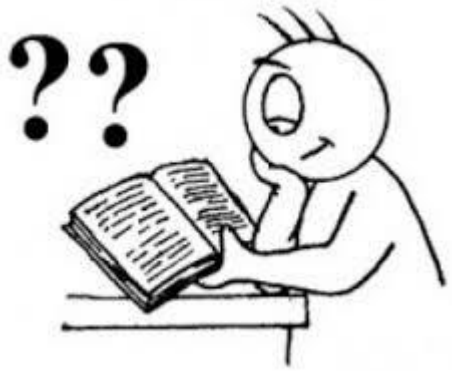


Policymaker

What a hassle!

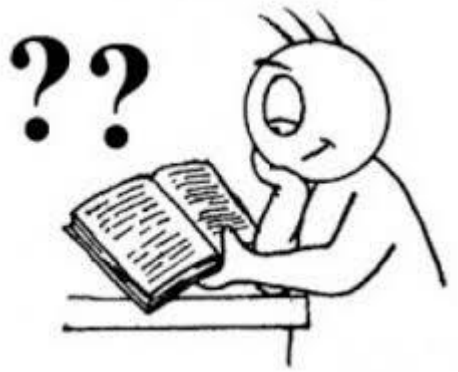


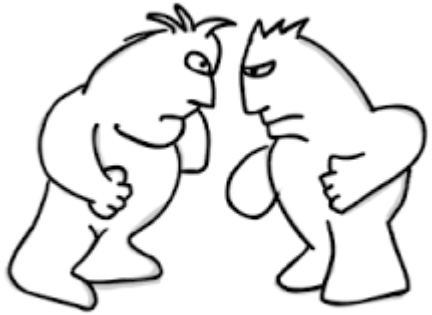
Installer

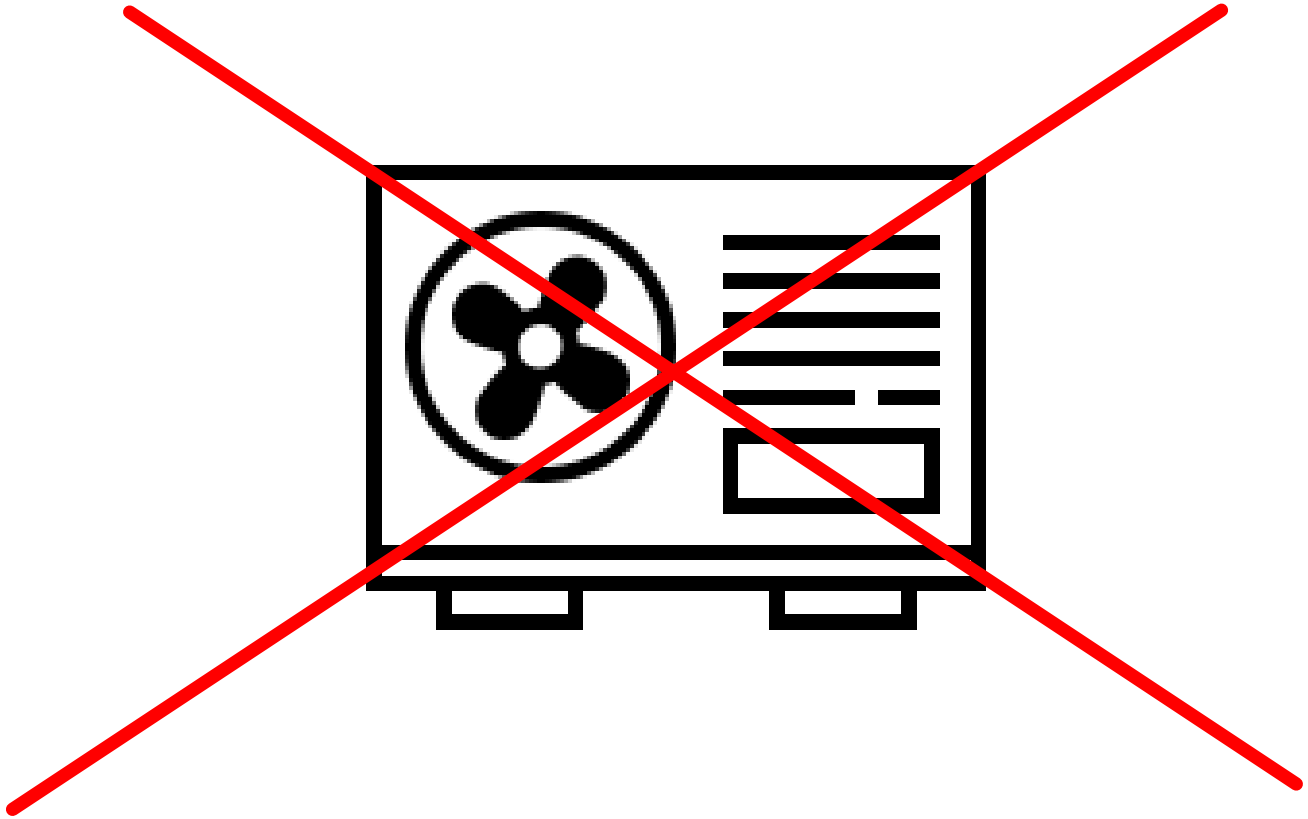


Consumer

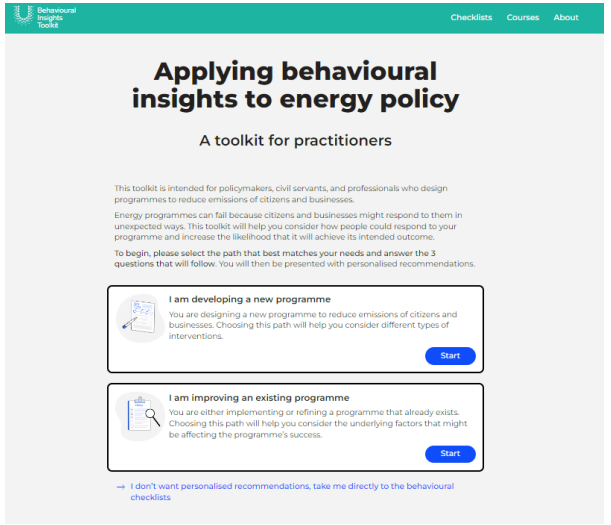
What a hassle!



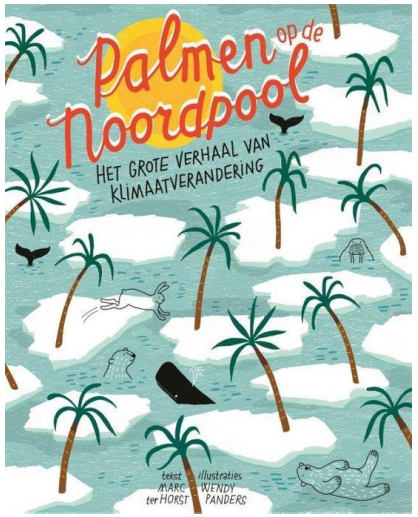


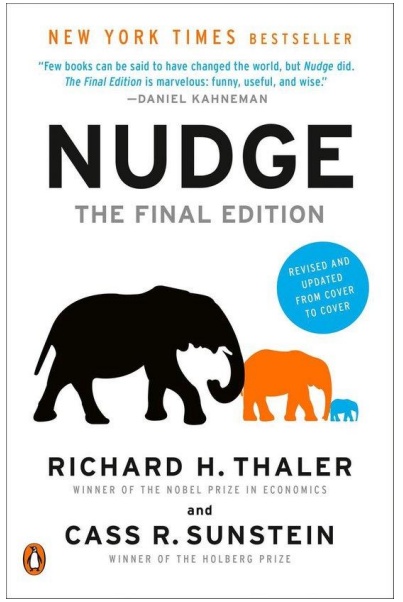


Research Projects



Book Tips


Palmen op de Noordpool
HET GROTE VERHAAL VAN KLIMAATVERANDERING
tekst MARC ter HORST
illustraties WENDY PANDERS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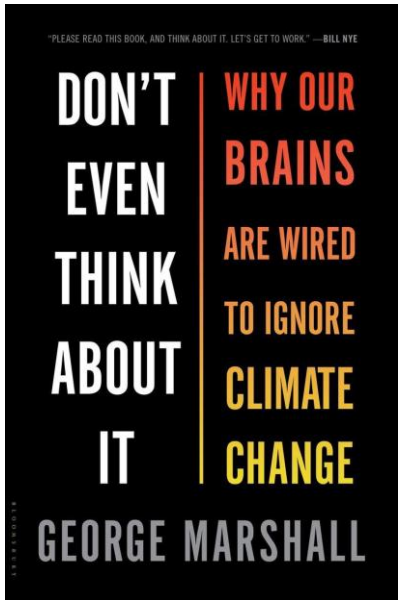
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DON'T EVEN THINK ABOUT IT
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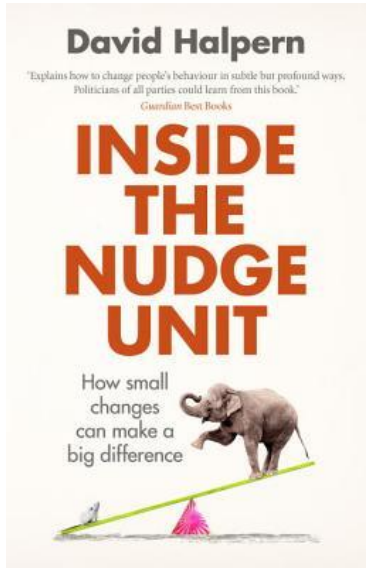
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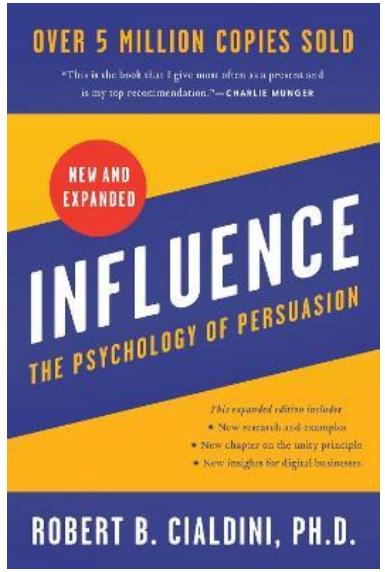
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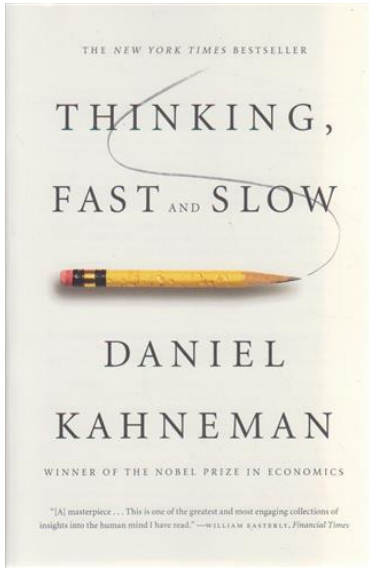
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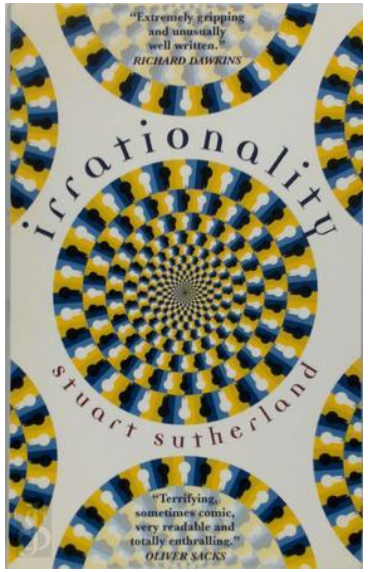
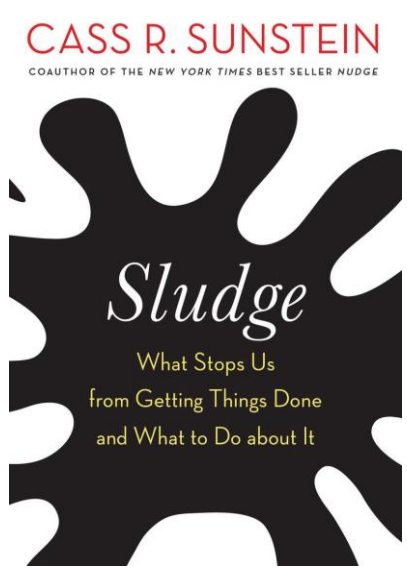
"[A] masterpiece . . . This is one of the greatest and most engaging collections of insights into the human mind I have read." —WILLIAM EASTERLY, Financial Times


"Extremely gripping and unusually well written."
RICHARD DAWKINS
irrationality
stuart sutherland
"Terrifying, sometimes comic, very readable and totally enthralling."
OLIVER SACKS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Sludge
What Stops Us from Getting Things Done and What to Do about It

g.devries-2@tudelft.nl

Gerdien de Vries, PhD

Do You Listen To Your Neighbour?

THE ROLE OF BLOCK LEADERS IN COMMUNITY-LED ENERGY RETROFITS

Tije van Casteren, Ioulia Ossokina, Theo Arentze – 19-11-2024

TU/e - Urban Systems and Real Estate

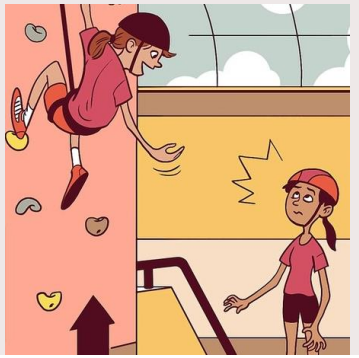
buurkracht.

EINDHOVEN TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Millions of dwellings need to become more sustainable,
but residents doubt whether to **energy retrofit.**

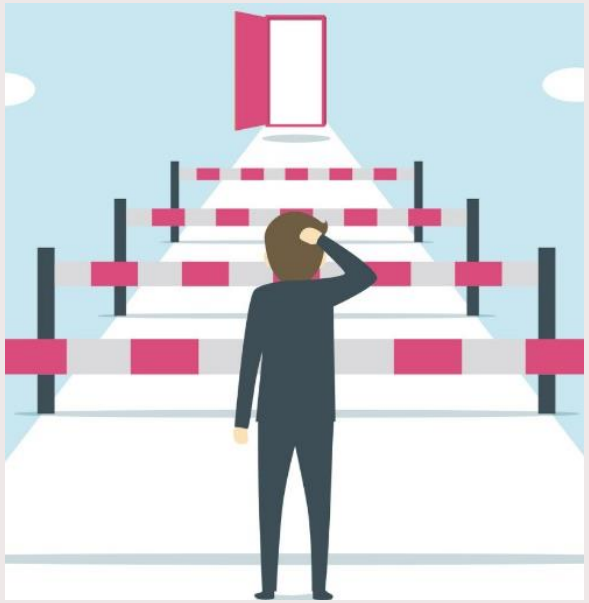
This study: mechanisms at work in community-led retrofits
Can block leaders stimulate people to retrofit?

Goal: How large and far-reaching is the effect of block leaders on neighbours? How to choose optimally?

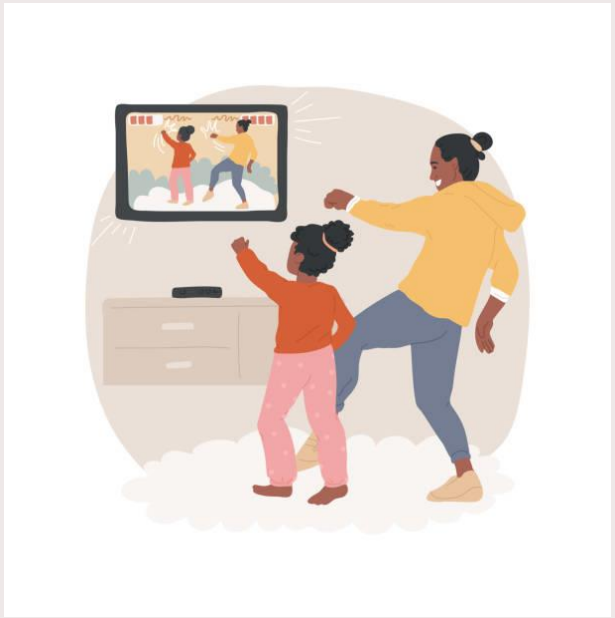


Why do we use the power of the collective?

Consumers face barriers towards adoption

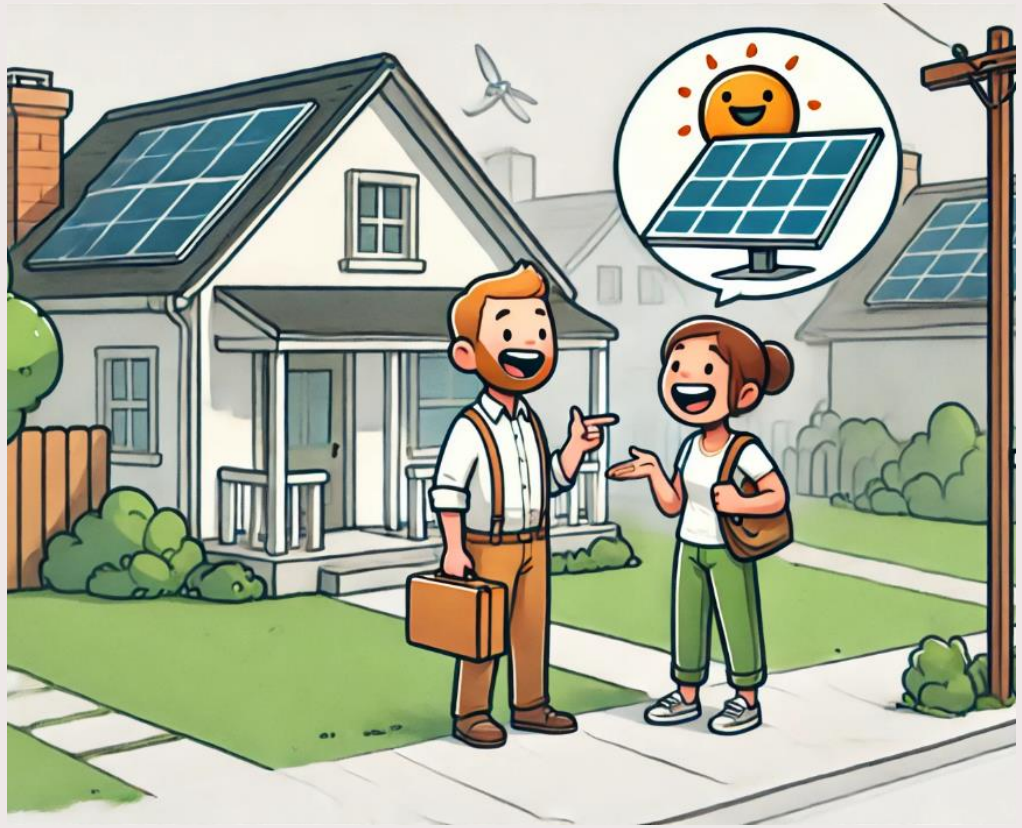


Communities reduce barriers through peer influence



Block leaders in communities speed up information diffusion and increase compliance

Case Study: Buurkracht



Collectively purchasing a retrofitting measure:

- ‘Block Leaders’ define neighbourhoods
- Actively managing campaigns
- Externalities:
  → cheap talk

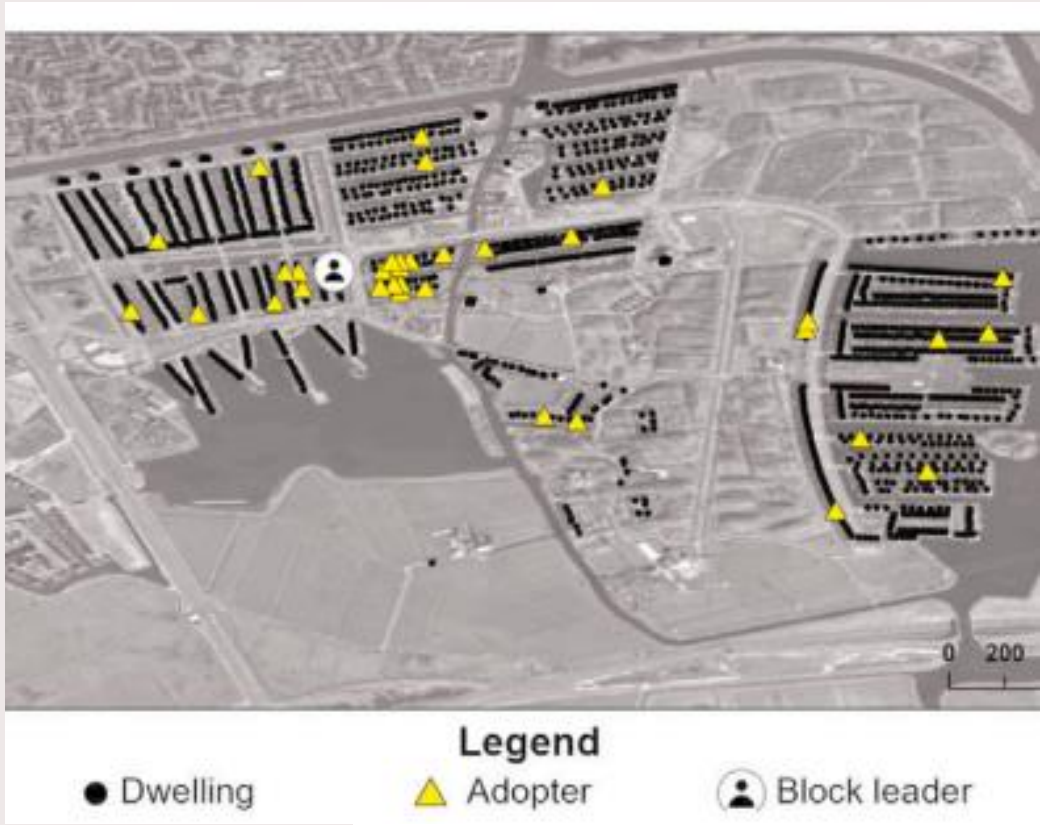
→ reduce barriers

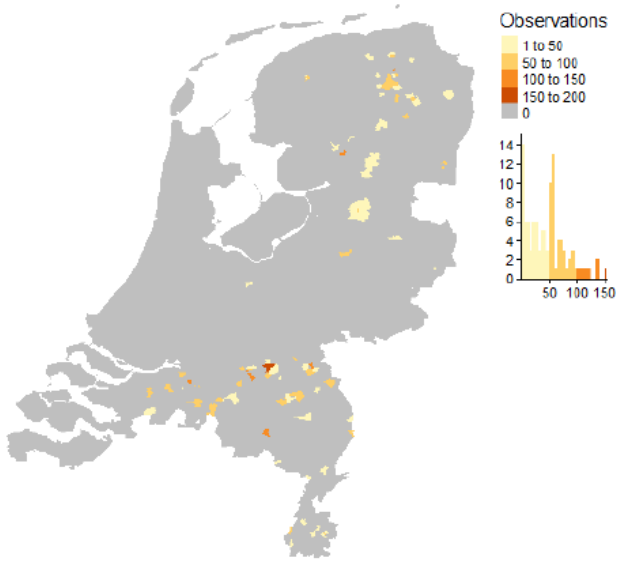
Data on communities

78 communities followed from start

66.000 dwellings

2000 retrofit uptakes (PV, Insulation)

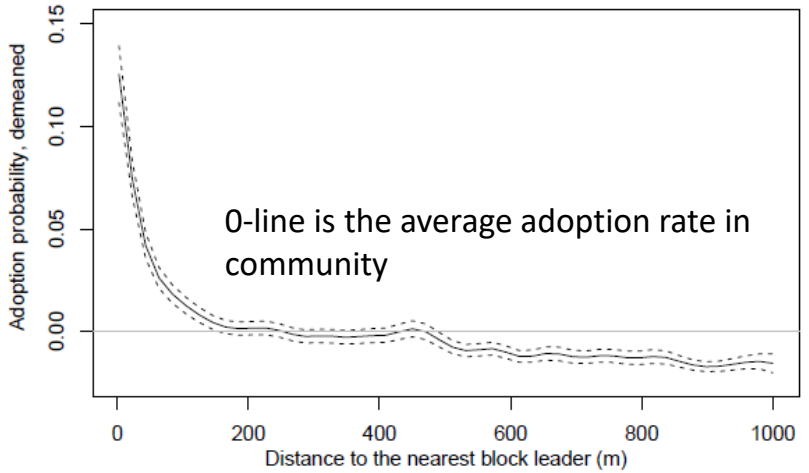




Results

- Econometric analysis on large dataset
- Control for dwelling characteristics, similarity

Figure 5: Non-parametric estimate of the block leader proximity effect



Notes: The line is a Nadaraya-Watson kernel regression of the community-demeaned probability to adopt a retrofit measure, as a function of the distance to the nearest block leader. A 95% confidence interval is used.

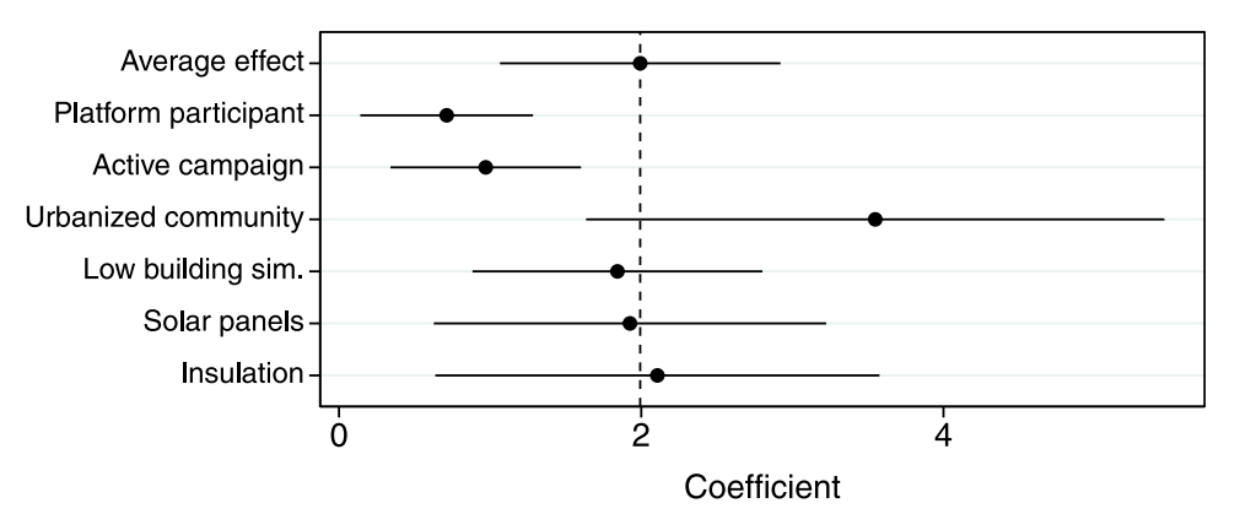
✓ Proximity to block leader **increases** retrofit probability

✓ Similarity to block leader **increases** retrofit probability

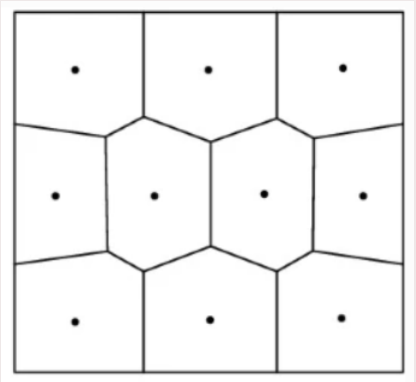
Results

- Largest effect within 200 meters (from 2.5% average to 7.5% uptake)

- Proximity effect smaller when other factors which reduce barriers gain importance



Implications



How to choose block leaders to maximize their effect?

- Dispersed within compact communities
- Representative dwellings
- High density neighbourhoods

Faster than imitation-based diffusion
No pre-existing measure needed