

Exploring sustainable investment behavior of the private homeowner: the
influence of neighborhood satisfaction.

A case study in the City of Eindhoven, The Netherlands

Author: E.E.M. Bisseling, BSc.

Student number: 0609784

Date: 13-03-2013

Graduation committee:

prof.dr.ir. W.F. Schaefer

prof. dr. Q. Han

drs. P.H.A.M. Masselink

J. Bekkering (HetEnergieBureau B.V.)

— |

Contents

1. INTRODUCTION	7
1.1.1. <i>Actions of the Dutch Government</i>	7
1.1.2. <i>Actions of the province of Noord-Brabant, The Netherlands</i>	8
1.1.3. <i>Actions of the Municipality of Eindhoven</i>	8
1.1.4. <i>Existing housing stock</i>	8
1.1.5. <i>Blok voor Blok program</i>	9
1.1.6. <i>Neighborhood Satisfaction</i>	9
1.2. PROBLEM STATEMENT	9
1.3. HYPOTHESIS	10
1.4. RESEARCH GOAL	10
1.5. RESEARCH QUESTIONS	10
1.6. RESEARCH BOUNDARIES AND LIMITATIONS	10
1.7. RESEARCH RELEVANCE	11
1.8. EXPECTED RESULTS	11
1.9. RESEARCH DESIGN	11
1.9.1. <i>Theoretical orientation</i>	11
1.9.2. <i>Field Study</i>	12
1.10. READING GUIDE	12
2. NEIGHBORHOOD SATISFACTION	12
2.1. DEFINING THE NEIGHBORHOOD	13
2.1.1. <i>Conclusion</i>	15
2.2. DEFINING NEIGHBORHOOD SATISFACTION	15
2.2.1. <i>Objective versus subjective evaluation</i>	15
2.2.2. <i>Partial conclusion</i>	16
2.3. DETERMINANTS OF NEIGHBORHOOD SATISFACTION	17
2.3.1. <i>Physical characteristics</i>	18
2.3.2. <i>Social characteristics</i>	18
2.3.3. <i>Personal characteristics</i>	19
2.4. HOW NEIGHBORHOOD SATISFACTION, NEIGHBORHOOD ATTACHMENT AND MOVING INTENTIONS INTERRELATE.	19
2.4.1. <i>Neighborhood attachment</i>	19
2.4.2. <i>Moving intentions</i>	20
2.4.3. <i>Conclusion</i>	20
2.5. CONCLUSION	21
3. THE DECISION-MAKING PROCESS	23
3.1. GENERAL EXISTING MODELS AND THEORIES	23
3.1.1. <i>Theory of planned behavior (Ajzen, 1991)</i>	23
3.1.2. <i>Willingness To Pay</i>	23
3.2. EXISTING THEORIES ON 'GREEN' INVESTMENTS	24
3.2.1. <i>Motivation-Ability-Opportunity</i>	24
3.2.2. <i>Willingness to Pay for Green Electricity</i>	24
3.2.3. <i>Urging residents to save energy</i>	25
3.2.4. <i>Willingness to buy a new built sustainable home</i>	26
3.3. INFLUENTIAL FACTORS	26

3.3.1. <i>Motivation / Intention / Attitude</i>	26
3.3.2. <i>Knowledge</i>	27
3.3.3. <i>Socio-demographic factors</i>	27
3.3.4. <i>Ability and situational conditions</i>	27
3.4. THE INFLUENCE OF NEIGHBORHOOD SATISFACTION IN DECISION-MAKING	27
3.5. CONCEPTUAL MODEL	28
4. RESEARCH METHODOLOGY	29
4.1. BAYESIAN BELIEF NETWORK	29
4.2. CONCLUSION.....	30
5. CASE SELECTION.....	31
5.1. EINDHOVEN	31
5.2. SELECTION OF NEIGHBORHOODS.....	32
5.3. CONCLUSION.....	33
6. DATA COLLECTION	35
6.1. SAMPLE.....	35
6.2. SURVEY DESIGN	35
6.2.1. <i>Mail and online questionnaire design</i>	36
6.3. CONCLUSION.....	36
7. DATA ANALYSIS	37
7.1. SURVEY RESPONSE.....	37
7.2. DATA PREPARATION	38
7.2.1. <i>Multicollinearity</i>	38
7.2.2. <i>Missing data / other inconsistencies</i>	38
7.3. CONCLUSION.....	38
8. ANALYSIS AND RESULTS	39
8.1. NEIGHBORHOOD COMPONENTS	39
8.2. STRUCTURE OF THE BAYESIAN BELIEF MODEL	39
8.3. RESULTS SCENARIOS 1 AND 2 'INVESTMENT BEHAVIOR'.....	43
8.4. RESULTS SCENARIOS 3 THROUGH 8 'NEIGHBORHOOD SATISFACTION'	47
8.5. CONCLUSION.....	49
9. CONCLUSION AND DISCUSSION	51
10. LIMITATIONS AND RECOMMENDATIONS.....	57
10.1. LIMITATIONS	57
10.2. RECOMMENDATIONS	57
11. ACKNOWLEDGEMENTS.....	59
REFERENCES.....	61
APPENDICES	65

Preface

This report is the result of my Masters' thesis research for acquiring the degree of Master of Science in Construction Management and Engineering, under the chair of Construction Management and Urban Development. This research was conducted in collaboration with HetEnergieBureau B.V and the municipality of Eindhoven with the goal of finding new openings for policy making to aid the execution of the 'Buurt voor Buurt' program.

The research attempts to explore a new approach about the use of neighborhood upgrades to urge private-homeowners to invest in sustainable improvements to their dwellings. A desk study that focuses on neighborhood satisfaction of residents and decision-making processes of people form the base of the research to conduct a survey to test the relationship between neighborhood satisfaction and investment behavior and the way this relationship is portrayed next to other influential factors. The results were interpreted through the use of a Bayesian Belief Network model, which is a very insightful graphical way to depict results.

The research was a great challenge, because attitudinal factors, subjective factors and people's decision-making are a very difficult subject to grasp. Obtaining the right data for this research and obtaining significant results proved difficult.

I would like to thank by guidance committee for their input and help during the challenging parts of the research, and of course I want to thank all the family and friends in my environment that supported me during the whole process and kept me motivated during the hard times. Thank you!

Elie Bisseling

— |

1. Introduction

The worldwide energy use has increased the last few years and in the next twenty years, this will continue increase substantially. (Provincie Noord-Brabant, 2009) Not only the amount of households is increasing, but the average energy use per household is also increasing. This continuous increase in energy use poses a problem, because:

1. There are signs of climate change due to a rise in CO₂ emissions.

The earth is warming up due to the greenhouse effect: our CO₂ emissions are forming a 'blanket' around the earth. Human influence in this development cannot be denied.

In 1992, the discussion between the UN started to reduce CO₂ emissions to slow down the climate change due to the greenhouse effect. A series of conferences and negotiations were held to deal with this problem. The agreements made in the first agreement in Kyoto (1997), did not prove sufficient to reduce the CO₂ emissions enough. Therefore, in 2009 in Copenhagen, the UN reached new binding agreements against further warming of the earth. The goal is to limit the warming of the earth to an increase of two degrees Celsius. This means that the global emissions of greenhouse gasses cannot rise above it's current level and has to be decreased with 80% in 2050. (EuropaNU, 2010)

2. The fossil fuel reserves worldwide are decreasing

Our worldwide oil and gas reserves are decreasing. The proven global reserves of oil are estimated to be enough for another 40 years and gas for 60 years. For coals the reserves still seem enough for another 200 years. These estimates are made based on current worldwide energy usage. It is presumable that more reserves are available on earth. It depends on new finds, winning techniques and (high) costs of these techniques if these reserves can be used in the future. More troublesome can also become the geographical and political position of these new reserves (Senternovem, 2006). But global energy use will continue to rise, so it is unwise to depend on any of the predictions and on the winning of new reserves alone.

3. Because of both previous reasons, the energy prices rise every year

Forecast by the IMF (IMF, 2012) predict that the fossil fuel energy prices will double in the next ten years. This means that the expenses per household on energy will also double, if energy saving measures are not implemented. Most households will not be able to cope with this rise in monthly expenses. The energy prices in the Netherlands from 2000 to 20120 already rose significantly. The price for gas has doubled in this period and the price for electrics rose with 20%. (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2011)

The combination these factors pose problems that have to be dealt with. The Dutch government, the province of Noord-Brabant and the Municipality all developed goals to deal with parts of these problems.

1.1.1. Actions of the Dutch Government

The Dutch government aims through the program 'Schoon en zuinig' to reduce the emission of greenhouse gasses with 20% in 2020 (opposed to 1990). Together with this ambition, the government also aims to increase implementation of energy saving measures and to

increase the introduction of renewable energy sources. With these measures, the energy efficiency should increase with a yearly 2%. (VROM, 2007) Increased energy efficiency would decrease the dependence of the Netherlands on import fossil fuels, and will lead to less emission, will lower energy costs for households.

But also in the built environment, reductions of CO₂ emissions are possible. The ambition for the built environment is a CO₂ emission reduction of 6 to 11 Mton/year in 2020. The 'Plan van Aanpak Energiebesparing Gebouwde Omgeving' is developed purely for the targets that are set for the built environment. (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2011)

There are a lot of new technologies available on the market, but big scale implementation has yet to happen. Mechanisms and finances still have to be developed and found. Cooperation between the building sector, the government, corporations and private homeowners are important to realize these ambitions for the built environment.

1.1.2. Actions of the province of Noord-Brabant, The Netherlands

The province of Noord-Brabant proposes with its 'Masterplan Energie Brabant 2010-2020' (Londo et al, 2010) a frame of changes in the energy use and efficiency of the province. On the level of the built environment, the province wants to invest in technologies for:

- Energy use of appliances
- New buildings
- Existing buildings
- Effective conversion of gas in electricity

The Trias Energetica (Lysen, 1996) is a leading theory in these plans:

- Reducing unnecessary energy use (e.g. through sufficient insulation)
- Use of renewable energy sources (e.g. P.V. systems)
- Efficient and sparing use of fossil fuels.

1.1.3. Actions of the Municipality of Eindhoven

The Municipality of Eindhoven has the ambition to become energy neutral in 2040 (KENWIB, 2012). The energy saving potential of the municipality is calculated on 5.46 PJ, which exists for 2,02 PJ out of the improvement of isolation and installation in existing housing stock. The existing housing stock is therefore the most important to improve, to reach the projected goal of being energy neutral in 2040.

1.1.4. Existing housing stock

The existing buildings stock in the member states of the EU accounts for 40% of final energy consumption in the European Union, and 63% of this represents the existing residential housing stock. (Poel, 2007) In The Netherlands, the built environment accounts for 30% of the total energy use. This means a lot of the reductions can be gained from improving the existing residential housing stocks energy performance (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2011). In the plans of all discussed parties, (the UN, The Dutch Government, the province of Noord-Brabant and the municipality of Eindhoven) the existing building stock comes forward as a problem. For the existing housing stock the government implemented the energy label, which should be obligatory at the selling of a house. The biggest part of energy saving has to be gained from the existing housing stock with a low

energy label, generally built before 1992. Corporations are already working on measures to update their existing housing stock. But the government cannot easily influence private homeowners to invest in energy saving measures to their own houses. Subsidy and information programs have been designed (e.g. Meer met Minder), but they still did not urge homeowners enough to make this important transition. The subsidy programs in The Netherlands are now being cancelled, which means new (and more effective) ways have to be found to urge homeowners to invest. That is why further research focusing on this target group is needed.

1.1.5. Blok voor Blok program

The 'Blok voor Blok' program is a newly designed program by the Dutch Government to achieve sustainable improvements of the existing housing stock. In this program three players on the private market will form a consortium that exchanges knowledge and experience to design a plan to upgrade a minimum of 2000 dwellings in one Municipality. A new way to urge homeowners to invest could aid this new program. (AgentschapNL, 2011)

1.1.6. Neighborhood Satisfaction

Research shows that neighborhood satisfaction makes homeowners more connected to their neighborhood and house (Bonaiuto, Fornara, & Bonnes, 2003). The urge to move is less when the homeowner is satisfied with his house and neighborhood. (Fang 2006; Feijten & van Ham, 2009; Permentier, van Ham, & Bolt, 2009). Also, research shows that homeowners that are satisfied with their neighborhood, will invest more in maintenance of his or her house (Galster & Hesser, 1982). So when a homeowner is satisfied with his or her neighborhood and/or attached to the neighborhood, the homeowner might be more willing to invest in sustainable improvements to his or her house.

That is why it may be plausible that there is a connection between neighborhood satisfaction (the link between the mentioned researches) and the level of sustainable improvements made to privately owned houses in this neighborhood. This connection however, has not yet been researched. If this connection exists, neighborhood upgrade can possibly be an extra incentive for private homeowners to invest in sustainable improvements of their houses and can be used as a policy tool by the local governments and municipalities (for e.g. the 'Blok voor Blok' approach).

1.2. Problem statement

The Municipality of Eindhoven wants to reach an energy neutral status by the year 2040. The biggest problem in sustainable development are the existing housing stock (mostly built before 1992) that is not owned by corporations. These houses are often not sustainable in energy use and have a low energy label. To reach the energy neutral targets, these houses have to be upgraded. So for the Municipality urging homeowners to invest in energy saving sustainable improvements of their own home poses a problem. Subsidy programs that have existed did not urge homeowners enough. And now that they are gone, there have to be found other ways to increase the willingness of homeowners to invest in sustainable improvements of their house.

Problem

"Urging homeowners to invest in energy saving sustainable improvements of their own home."

1.3. Hypothesis

The influence of the neighborhood satisfaction has not been researched in current literature. Therefore the following hypothesis will be researched in this report:

Hypothesis

“A Private homeowner that is satisfied with his or her neighborhood has shown more investment behavior in sustainable improvements to his/her house, than a private homeowner that is not satisfied with his/her neighborhood.”

1.4. Research goal

The goal of this research is to investigate whether it is possible for the Municipality to use satisfaction with the neighborhood as an incentive to increase the willingness of private homeowners to invest in sustainable improvements to their houses.

1.5. Research questions

Combining the problem statement, the hypothesis and the research goal, the following research questions are formed:

Research question

“Is there a connection between the investment behavior of private homeowners and their neighborhood satisfaction? Can a neighborhood upgrade, a high level of neighborhood satisfaction, encourage private homeowner sustainable investment behavior?”

Research sub questions

1. What is Neighborhood satisfaction?
2. Which factors are important in the evaluation of neighborhood satisfaction?
3. What factors are important in the decision-making process of homeowners to invest in sustainable improvements of their house?
4. How do these factors relate to sustainable investment behavior?
5. Is there a connection between neighborhood satisfaction and the investment behavior in sustainable improvements of the house?

1.6. Research boundaries and limitations

Since this research will have a limited timeframe, certain limitations and boundaries are defined.

1. This research will focus on the energy neutral target of the municipality of the Province of Noord-Brabant, with as target area the city of Eindhoven. This means that homeowners for surveys and the choice of neighborhoods will be targeted to the city of Eindhoven only. Other cities are not taken into account. This, however, does not mean that the research cannot be applicable on other municipalities or provinces in the Netherlands.
2. In this research, only the existing housing stock, owned by private homeowners are taken into account. This target group is the key problem defined in this research.

3. This research will only focus on incentives that can urge residents to invest in sustainable upgrades to their houses, focusing on heating energy use. It does not focus on other energy saving behavior of the homeowner.

1.7. Research relevance

This research is being performed in collaboration with HetEnergieBureau B.V. and Eindhoven University of Technology. The research subject is chosen together with HetEnergieBureau, as a relevant addition to previous research of other graduate students. This research can add to the understanding of private homeowners in Eindhoven's investment behavior in sustainable improvements of their houses. This research could be a base for the university to do further research in private homeowners' willingness to invest. It can provide a new insight in how homeowners make their decisions to invest. A study to explore if there is a relation between neighborhood satisfaction and private homeowners' investment behavior has not been conducted and will therefore also add to the general research environment.

1.8. Expected Results

The expected result of this research is that there is a relation between neighborhood satisfaction and the investment behavior of private homeowners with regards to sustainable improvements of their houses. This research will also try to differentiate between more and less important factors in neighborhood satisfaction.

1.9. Research Design

A brief overview of the research design is shown in Figure 1.1.

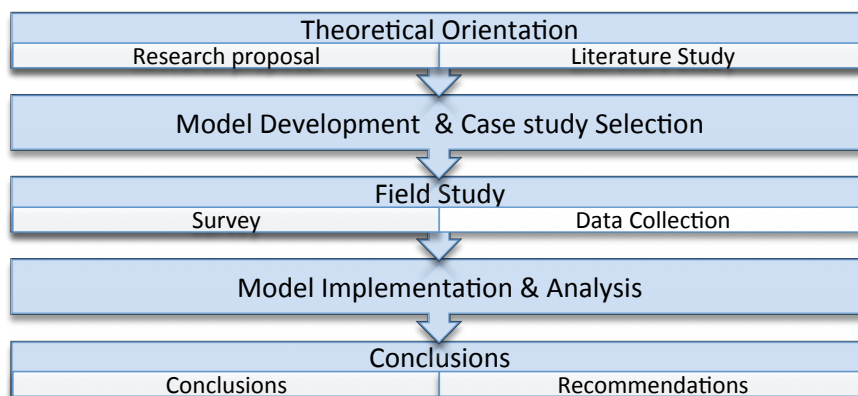


Figure 1.1: Research design

1.9.1. Theoretical orientation

The first part is a theoretical orientation on neighborhood satisfaction factors and decision-making models. This phase will include a literature study in the form of papers, books, journals and interviews. This desk study will result in enough background and a hypothetic decision-making model to perform a field study.

1.9.2. Field Study

In this field study, a case study of four representative neighborhoods is chosen and a survey is designed and distributed to private homeowners these neighborhoods. The returned questionnaires provide input for the decision-making model, derived in the desk study. The data will then be analyzed by producing a Bayesian Belief Model, which is more elaborately explained in Chapter 4.

1.10. Reading Guide

This report consists of three parts, each with a division in several chapters:

Part 1 consists of Chapter 2: Neighborhood Satisfaction which explores neighborhood satisfaction and influential factors, and Chapter 3: The Decision-making process which explores decision-making model theory. These chapters together form the theoretical base of the research.

Part 2 consists of Chapter 4: Research methodology, which explains about the used research method in this research, Chapter 5: Case selection, which explains the selection of case study neighborhoods on which will be focused this research, Chapter 6: Data collection elaborates the data collection method used, Chapter 7: Data preparation which elaborates about the received response and the handling of the resulting dataset. This part forms the base of the research framework.

Part 3: consists of Chapter 8: Analysis and Results which explains the final research decision model and its outcomes, Chapter 9: Conclusion then answers the research questions of the thesis. In Chapter 10: Limitations and recommendations the results of the research will be discussed in the forms of limitations and recommendations for further study. These form the results and conclusion of the report.

2. Neighborhood Satisfaction

The 'neighborhood' makes a big part of our everyday life. The satisfaction with your surrounding neighborhood therefore affects your everyday life. Neighborhoods are made up of different features, and therefore possess qualities that should benefit their residents (Lee, 2010). Therefore, to design quality neighborhoods, it is important to understand the specific qualities that lead to a satisfactory life for residents. (Herting & Guest, 1985). And the improvement of existing neighborhoods therefore should also be based on the way residents experience their neighborhood and what makes them satisfied. Before neighborhood satisfaction will be researched in relation to the willingness to invest of homeowners, a definition of neighborhood and neighborhood satisfaction is necessary. In this chapter, the neighborhood, neighborhood satisfaction and determinants of neighborhood satisfaction are discussed, together with focus points in neighborhood satisfaction research.

2.1. Defining the neighborhood

In our everyday life, the word neighborhood is used for multiple meanings and uses. It depends on the context which of the different aspects of the word becomes more or less important. Often, even multiple definitions of the word are used simultaneously. (Talen & Shah, 2007)

A study of the Flemish (Belgian) government (Verlet & Callens, 2010) states that the neighborhood hints to a certain area, location, where numerous social processes occur and where individuals derive a piece of their identity. A planning perspective views the concept of neighborhood as a subunit that builds the physical and social fabric of a city. Besides facilitating physical organization, neighborhoods serve as a means of social organization whereby, it is believed, interaction among residents is based on shared values and interests (Talen & Shah, 2007). These definitions do say something about the concept of neighborhood and its relation to its inhabitants. They do not, however, say anything about the size and components that a neighborhood consists of. Amerigo & Aragones (1997) even state that a neighborhood does not at all refer to the geographical area, which limits it, but rather to the subject's perception and to his/her sense of belonging. This viewpoint states that the neighborhood does not have a fixed surface, but varies from one subject to another. This means that every resident's perception of his/her neighborhood is different and depends on his/her own frame of reference.

There are definitions that do include geographical characteristics in the definition of neighborhood. When looking at these other definitions, the neighborhood is usually considered an intermediate zone somewhere between the macro-neighborhood and the micro-neighborhood (Marans & Rodgers, 1975). Galster (2001) even composed, next to his general definition of neighborhood: 'Neighborhood is the bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses', which is a spatial definition, a list of characteristics of a neighborhood:

- Structural characteristics of the residential and non-residential buildings (type, scale, materials, design, state of repair, density, landscaping, etc.)
- Infrastructural characteristics (roads, sidewalks, streetscaping, utility services, etc.)
- Demographic characteristics of the resident population (age distribution, family composition, racial, ethnic, religious types, etc.)
- Class status characteristics of the resident population (income, occupation and education composition.)
- Tax/public service package characteristics (the quality of safety forces, public schools, public administration, parks and recreation, etc. in relation to local taxes assessed)
- Environmental characteristics (degree of land, air, water and noise pollution, topographical features, views, etc.)
- Proximity characteristics (access to major destinations of employment, entertainment, shopping, etc. as influenced by both distance and transport infrastructure)
- Political characteristics (the degree to which local political networks are mobilized; residents exert influence in local affairs through spatially rooted channels or elected representatives.)
- Social interactive characteristics (local friend and kin networks, degree of inter-household familiarity, type and quality of interpersonal associations, resident's perceived commonality, participation in locally based voluntary associations, strength of socialization and social control forces, etc.)
- Sentimental characteristics (resident's sense of identification with place, historical significance of buildings or district, etc.)

Galster (2001) does emphasize, that while most of the attributes he describes usually are present to some extent in all neighborhoods, the quantity and composition typically vary dramatically across neighborhoods within a single metropolitan area. This implies that neighborhoods can be categorized by type and/or quality.

The list of characteristics is very elaborate, but shows that the attributes that form a neighborhood are abundant and form a complex network that form a neighborhood. This list is a mix of spatial and social characteristics, but shows that spatial characteristics do indeed make a big part of the neighborhood. Cater & Jones (1989) even suggest that a neighborhood should be more considered as a geographic location, therefore the neighborhood consists more of the physical aspects than the social. They introduce the word community for the social interactions within it. They do admit that the association is so strong, that the neighborhood and community can and have been regarded as synonyms.

Even though Galster (2001) has proposed a more spatial orientated list of characteristics, the precise boundary of a neighborhood, other than predetermined boundaries proposed by the local government, cannot be determined with just these characteristics. These characteristics are available in more or lesser form in a space designated as neighborhood and the presence and structure of these characteristics make a designated space a neighborhood, but the characteristics and presence or absence of these characteristics cannot be used to define a space that is one neighborhood. This is because attributes within a neighborhood have different spatial scales and areas of coverage and these areas can cross defined neighborhood boundaries to even serve people in other predefined neighborhoods.

2.1.1. Conclusion

So this means that it is difficult to decide on precise neighborhood borders when asking residents about their neighborhood (satisfaction), because of the perceptions of residents differ and because different aspects and facilities of a neighborhood have different areas of coverage. Municipalities do have predefined neighborhoods, and these are good to use as indications for placement and general neighborhood statistics, but it is not likely residents recognize these neighborhoods completely the same. So when asking residents about their neighborhood satisfaction, these factors should be kept in mind.

2.2. Defining neighborhood satisfaction

Firstly, the theory of neighborhood satisfaction is not one-dimensional. Tacken en Keijn, (1979, cited by Leidelmeijer & Van Kamp, 2004) have identified that neighborhood satisfaction results out of two dimensions: the general satisfaction with the neighborhood as a whole, and the specific satisfaction with characteristics of the neighborhood. There can be a difference between the general satisfaction and the total satisfaction outcome from adding the satisfaction rates from all different specific factors. Neighborhood satisfaction is the result of all different parts of a neighborhood, but more that the sum of the satisfaction of all different parts: it's an appreciation for the neighborhood as a whole. (RMB & RRO, 1996, cited by Leidelmeijer & Kamp, 2004)

Secondly, Connerly and Marans (1988) define neighborhood quality by the status of a neighborhood's physical environment, and sociocultural settings. With the definition of neighborhood as a combination of physical and social characteristics, this definition seems plausible. When this theory is elaborated more, we can say that the quality of the neighborhood is defined by the relationship between the objective characteristics of the neighborhood (facilities, access to public transport, crime level, noise nuisance, upkeep of the neighborhood, composition of inhabitants, etc.) and the housing characteristics (housing type, housing size, etc.) and also the subjective perceptions of these characteristics. These subjective perceptions define not only the sociocultural settings, but also the appreciation that residents have of the objective characteristics. This implicates that a third factor is involved: Personal characteristics (gender, age, income, length of residence, lifestyle, etc.) (Aiello, Ardone, & Scopelliti, 2010; SCP, 2007; Amerigo & Aragones, 1997).

2.2.1. Objective versus subjective evaluation

Lu, (1999) describes that residents' judge their residential conditions based on their needs and aspirations. Satisfaction with the neighborhood therefore means that there is a high degree of congruence between the actual situation, the perceived actual situation and the desired situation of the resident. This also means that incongruence between actual perceived neighborhood conditions and wanted conditions lead to dissatisfaction. This relates to the theory that perceived 'subjective' opinions about the neighborhood are the best indicators of neighborhood satisfaction. So if the neighborhood of a respondent does not meet the needs and aspirations he wants, the respondent is likely to feel dissatisfied. This is in line with various studies that have shown that subjective evaluations of characteristics are important factors in explaining neighborhood satisfaction and may even be more important than objective measures (Galster & Hesser, 1982; Bruin & Cook, 1997; Lu, 1999; Parkes, Kearns, & Atkinson, 2002; Lee, 2010). Parkes et al. (2002) even claim that

perceived neighborhood attributes by residents are a much better indicator than personal and housing characteristics to understanding residential satisfaction.

Objective and subjective measurements have pro's and cons according to Leidelmeijer & Kamp (2004). Reasons to use subjective indicators are:

- Get insight in the satisfaction residents derive from their neighborhood;
- Get insight in what residents find important in their neighborhood;
- It can help to increase involvement of residents and create public policy support;

Reasons to use objective measurements are:

- Get insight of unnoticeable neighborhood aspects;
- Policy measures are almost always based on objective conditions;
- Can be used as validation of subjective evaluations.

In addition to this list, it is found that neighborhood perceptions generally do correspond with its ecological features. So the negative evaluation of the neighborhood by the respondent is strongly associated with any disadvantaged physical features in a neighborhood (Cho, Park, & Echevarria-Cruz, 2005). This means that there is often a strong relation between subjective perceptions and objective characteristics.

Leidelmeijer & Marsman (2001, cited by Leidelmeijer & Kamp, 2004) composed a scheme that shows how the inhabitant evaluates his/her residential satisfaction, which for most parts corresponds with the found literature about how the inhabitant evaluates neighborhood satisfaction. See Figure 2.1

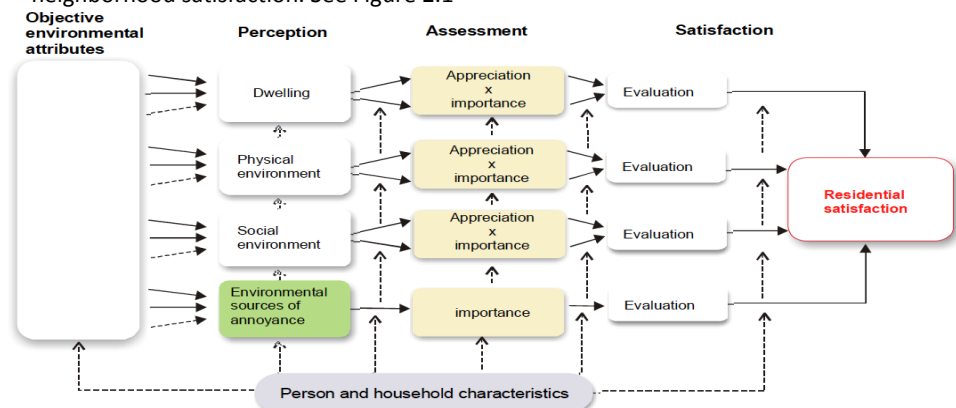


Figure 2.1: Scheme for residential satisfaction by residents (Marsman & Leidelmeijer, 2001)

In this scheme, it is shown that a neighborhood consists of objective environmental attributes that can be categorized and are assessed by an inhabitant on appreciation and importance. The personal and household characteristics of the inhabitant influence these perceptions and assessments. The combined evaluations together form the residential satisfaction.

2.2.2. Partial conclusion

In neighborhood satisfaction research the subjective opinion of residents about their neighborhood is the most important indicator for neighborhood satisfaction. Objective

neighborhood measurements however cannot be overlooked, because dissatisfaction measures in subjective opinions can very well also be visible in objective measurements. Using objective measurements can therefore be used as control variables. Personal and housing characteristics are useful to find patterns in different groups of inhabitants and as control variables.

In line with the literature about neighborhood satisfaction, another hypothetical scheme is proposed based on the Marsman & Leidelmeijer (2001, cited by Leidelmeijer & Kamp, 2004) scheme, see Figure 2.2.

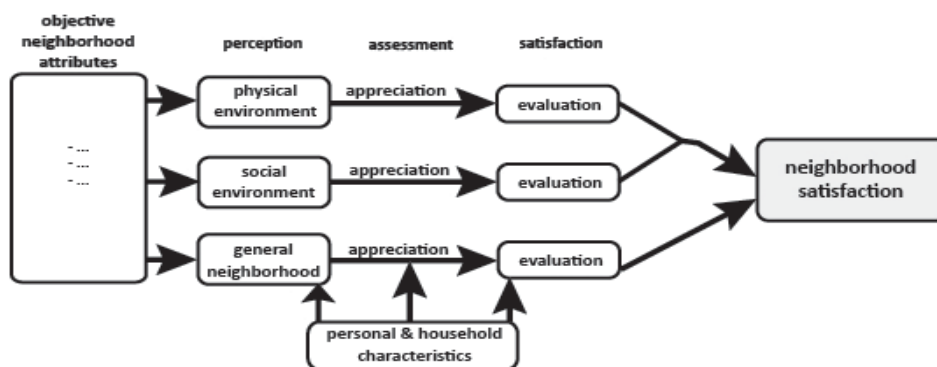


Figure 2.2: Neighborhood satisfaction evaluation by residents

This scheme is focused on neighborhood satisfaction, where dwelling perceptions can be seen together with physical environment. The ‘assessment x importance’ is changed into assessment. This is because of the addition of ‘general neighborhood’ in the row that depicts perceived categories. This addition represents the general neighborhood satisfaction, which is not the same as the sum of different categories, even if they are weighed by importance. The sum of the evaluation of the different categories, together with the general neighborhood evaluation, gives the neighborhood satisfaction. The influence of personal and household characteristics is visible in the perception, assessment and evaluation.

2.3. Determinants of neighborhood satisfaction

Which neighborhood characteristics are most important in predicting neighborhood satisfaction are difficult to answer, because neighborhood satisfaction studies all vary in variables used and also in sample population data used, from nation-wide surveys to surveys of groups or neighborhoods in one city. (Parkes et al., 2002)

In most neighborhood satisfaction researches, the respondents in a neighborhood are asked, through one question, how satisfied they are with their neighborhood (Lee, 2010; Lu, 1999; Parkes et al., 2002). This question gives a general idea of the overall satisfaction of an inhabitant. As discussed earlier, there can be a difference between the general satisfaction and the total outcome from all satisfaction rates of different specific factors, so it is important to include this question for a complete image of the respondents’ satisfaction with his/her neighborhood.

The different specific factors that are measured in neighborhood satisfaction studies, can be grouped into three determinant categories:

- Physical environment characteristics;
- Social environment characteristics;
- Demographic characteristics.

In the next part, these determinant groups and their different factors will be discussed.

2.3.1. Physical characteristics

In various studies, different characteristics and factors are used to measure the satisfaction with the physical neighborhood. In general, it is found that the physical environment has a strong correlation with the satisfaction of residents (Herting & Guest, 1985; Lee, 2010), as discussed above.

Studies have found that the following physical characteristics are important:

- Neighborhood aesthetics and general appearance (*Kearney, 2006; Leslie & Cerin, 2008; Herting & Guest, 1985; Parkes et al, 2002; SCP, 2007; Lee, 2010; Lee, 2010; Forrest and Kearns, 1999; Janse et al., 2009; Schepers & Buys, 2010*)
- Neighborhood maintenance and deterioration (*Kruger et al, 2007; Lee, 2010; SCP, 2007*). This maintenance applies to greenery, houses, yards, streets and paths. (*Galster & Hesser, 1982; Sirgy & Cornwell, 2002; Janse, Reneman, Herder, & Wouters, 2008 ;Verlet & Callens, 2010; Schepers & Buys, 2010*)
- Presence of social housing (*Leidelmeijer, Marlet, Schulenberg, & Van Woerkens, 2011a*)
- The presence and upkeep of greenery (*Kearney, 2006; Leslie & Cerin, 2008; Janse et al., 2008; Janse et al., 2009; Lee, 2010; Janse et al., 2008 ;Verlet & Callens, 2010; Schepers & Buys, 2010; Leidelmeijer, Marlet, Van Woerkens, & Schulenberg, 2011b*),
- Vandalism (*Leidelmeijer et al., 2011b*)
- Parking facilities (*Janse et al., 2008*)
- Street lighting (*Sirgy & Cornwell, 2002; Janse et al., 2008; Verlet & Callens, 2010*)
- Facilities needed, e.g. shops, playgrounds, sports, health, schools, youth, other (*Sirgy & Cornwell, 2002; Janse et al., 2008;)*
- Public transport stops and routes (*Janse et al., 2009 ; Leidelmeijer et al., 2011b*)

So, when doing neighborhood satisfaction research, these factors that take into account the physical environment of the neighborhood, are important.

2.3.2. Social characteristics

The social characteristics are also used to measure satisfaction with the neighborhood. Social characteristics say something about the coherence in the neighborhood.

Studies have found that the following social characteristics are important:

- Social control *and* Social conduct (*Lee, 2010*)
- Mix of social groups/people living in the neighborhood (*Galster & Hesser, 1982; Galster, 1981; SCP, 2007; Sirgy & Cornwell, 2002*)
- Feeling safe (*Bruin & Cook, 1997 ; Basolo & Strong, 2002; Talen & Shah, 2007; Lee, 2010; Sirgy & Cornwell, 2002*)

- Social interactions with neighbors (*Bruin and Cook, 1997; Galster, 1981; Galster and Hesser, 1982; Amerigo & Aragoes; 1997; Sirgy & Cornwell, 2002*)
- Socio-economic status of neighborhood (*Galster, 1981; B. A. Lee & Guest, 1983; Lu, 1999; Sirgy & Cornwell, 2002*)
- Neighborhood improvement (*Sirgy & Cornwell, 2002*)

Social coherence in a neighborhood is important. If people do not feel safe or have almost no ties with the inhabitants of the neighborhood, they may not be attached to their neighborhood and will move away more easily.

2.3.3. Personal characteristics

Next to the stand-alone characteristics of the neighborhood, Inhabitants of the same neighborhoods can differ in neighborhood satisfaction due to personal characteristics. (SCP, 2007)

Personal characteristics that can be of influence on the neighborhood satisfaction as identified by Lu (1999) and the SCP (2007) are: Age, Race, Education, Household type, Household income, Duration of residence and Recently moved in/period of residence

The personal circumstances of an inhabitant can influence his/her value appreciation of different social of physical factors. An elderly couple may not feel that a playground in a neighborhood is necessary. But if there are a lot of families with young children in a neighborhood, good playground facilities still are needed. People of different age groups, households and wealth have different appreciations. So for a proper neighborhood satisfaction research, it is necessary to include these variables.

2.4. How neighborhood satisfaction, neighborhood attachment and moving intentions interrelate.

There are more factors associated with neighborhood satisfaction in relation to the willingness to invest. Neighborhood satisfaction is not a stand-alone factor. Neighborhood attachment and moving intentions also play a role.

2.4.1. Neighborhood attachment

With the hypothesis of the influence of neighborhood satisfaction on the willingness to invest, the factor of neighborhood attachment, or place attachment is important. A definition of place attachment is given by Brown & Perkins (1992): 'Place attachment involves positively experienced bonds, sometimes occurring without awareness, that are developed over time from the behavioral, affective, and cognitive ties between individuals and/or groups and their socio-physical environment (Brown & Perkins, 1992, P. 284). Bonaiuto et al. (1999) proved a relationship between the satisfaction with the residential environment and neighborhood attachment. Bonaiuto et al. (1999) found significant predictors of neighborhood attachment in length of residence in the neighborhood, age of the resident, architectural and town planning indicators as aesthetic pleasantness, green areas, micro-upkeep, quiet and opportunities, and social indicators as social relationships. Negative significant predictors were lack of socio-economic status and violence. Aiello et al. (2010) found that neighborhood attachment is mainly related to affective and social aspects,

thus the presence of pleasant places like green areas as affective aspects and social relationships with neighbors as social aspects, while residential and neighborhood satisfaction is more predicted by contextual features, like aesthetic appearance of the neighborhood and facilities.

Before these researches, a relationship between the perceived neighborhood and residential quality and attachment was already generally accepted (Bonaiuto, Aiello, Perugini, Bonnes, & Ercolani, 1999).

2.4.2. Moving intentions

Feijten & van Ham (2009) and Lu, (1999) state that actual residential mobility can be seen as a mismatch between the residential needs and preferences a household has, compared to the characteristics of its current residential situation. So residents that are not satisfied with the quality of their neighborhood, are more likely to express an intention to move than residents that are satisfied (Parkes et al., 2002).

In addition, it is believed that residents that have a strong attachment to their neighborhood may be less likely to move (Permentier et al., 2009). This is because people that are attached to their neighborhood, mostly have made a social or psychological investment in their neighborhood by participation and social relationships (Permentier et al., 2009). In addition to that, Permentier et al. (2009) state that the reputation of the neighborhood influences this attachment and therefore mobility of its residents. They found that residents with a negative perception of their neighborhood's reputation are more likely to have the intention to leave the neighborhood. Further, research shows that expectations of neighborhood change in the future, in a way that the neighborhood does no longer correspond with the preferred characteristics of the resident, can cause a mobility wish for the resident (Feijten & van Ham, 2009).

2.4.3. Conclusion

Moving intentions are thus strongly related to the degree of attachment. Because of the finding that neighborhood satisfaction is an important predictor for neighborhood attachment (Aiello et al., 2010; Bonaiuto et al., 1999). One can presume that people that are satisfied with their neighborhood are most likely to also be attached to the neighborhood. Because of the findings that neighborhood satisfaction influence the mobility wishes (Parkes et al., 2002), the neighborhood satisfaction influences the attachment (Aiello et al., 2010; Bonaiuto et al., 1999) and the neighborhood attachment influences the mobility wishes (Permentier et al., 2009), I propose the following hypothetical part of the research model, see Figure 2.3

This hypothetical scheme assumes an influence from neighborhood satisfaction to neighborhood attachment and to residential mobility, while neighborhood attachment also influences residential mobility.

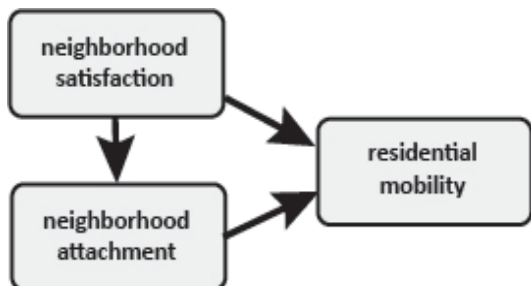


Figure 2.3: The relationships between neighborhood satisfaction, attachment and residential mobility

2.5. Conclusion

This chapter discussed the basic terms of neighborhood and neighborhood satisfaction and the factors that influence this. In addition, the relationship between neighborhood attachment and residential mobility was also discussed.

The neighborhood as perceived by the resident, although often predetermined by the Municipality, is often not exactly measurable. People are often aware of which administrative neighborhood they belong to, but do not experience their neighborhood exactly within these borders, because facilities could easily have another area of coverage. This should be kept in mind when performing neighborhood satisfaction research. But, is this really important? In neighborhood satisfaction research, it is proven more important to test the subjective opinion of residents about their neighborhood, than measuring objective factors in the neighborhood the resident lives in. The objective factors can be used as control variables, but will not always be sufficient to explain an opinion of a resident. Also, a partial satisfaction about one aspect or a few aspects in the neighborhood, do not relate directly to an overall satisfaction score for the neighborhood. Every resident weighs partial satisfactions in their own way. The importance of some partial satisfaction influences the overall satisfaction more than others. So, summing the satisfaction scores of partial neighborhood characteristics will not always produce the overall neighborhood satisfaction score. However, when an overall neighborhood satisfaction score is bad, partial scores can indicate the problems that residents experience, so are important to include in the research. Partial neighborhood satisfaction determinants are divided in physical and social determinants, influenced by personal characteristics. A hypothetic relational model is proposed in Figure 2.2.

In order to get a complete picture of how neighborhood satisfaction can influence the willingness to invest, it is necessary to include the additional influences of neighborhood attachment and residential mobility. All three states are interconnected and research has found causal links (Bonaiuto et al., 1999; Feijten & van Ham, 2009; Lu, 1999; Permentier et al., 2009).. A hypothetic relational model is proposed in Figure 2.3.

Integrated with the proposed hypothetical scheme of Chapter 3.2.2, the objective neighborhood features and the subjective partial neighborhood satisfaction evaluations, therefore also influence the neighborhood attachment. This integrated model is shown in Figure 2.4.

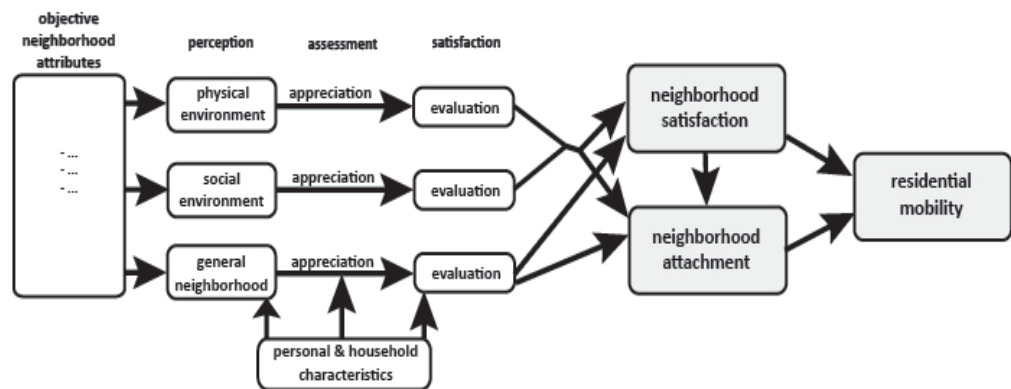


Figure 2.4: Integrated hypothetical model for the influences of neighborhood satisfaction, attachment and mobility.

3. The decision-making process

To test the influence of the neighborhood satisfaction of residents on willingness to invest in sustainable improvements to their houses, it is necessary to identify the decision-making process and which factors also influence this. In this chapter, you will find a review of different general decision-making theories, together with the review of some decision-making process models created to depict the decision-making process in green investments. Next an overview of all found influential factors is provided, with the found importance and relevance. At the end of this chapter, a hypothetic decision-making model is proposed for this research with integrated influence of neighborhood satisfaction, neighborhood attachment and residential mobility.

3.1. General existing models and theories

There are a lot of researches in the field of sociology and psychology that have tried to generate models for the decision-making process of humans on various different subjects.

3.1.1. Theory of planned behavior (Ajzen, 1991)

In 1991, Ajzen designed the theory of planned behavior, see Figure 3.1 “The theory of planned behavior is an extension of the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) made necessary by the original model’s limitations in dealing with behaviors over which people have incomplete volitional control”(Ajzen, 1991).

The central factor in this model is the intention to perform a behavior. The intention captures motivational factors that influence this intention. The motivational factors determine the willingness of the actor to perform the behavior. Ajzen (1991) points out that performance also depends at least to some degree on non-motivational factors as the availability of opportunities and resources (e.g. time, money, cooperation, skills)(Ajzen, 1991).

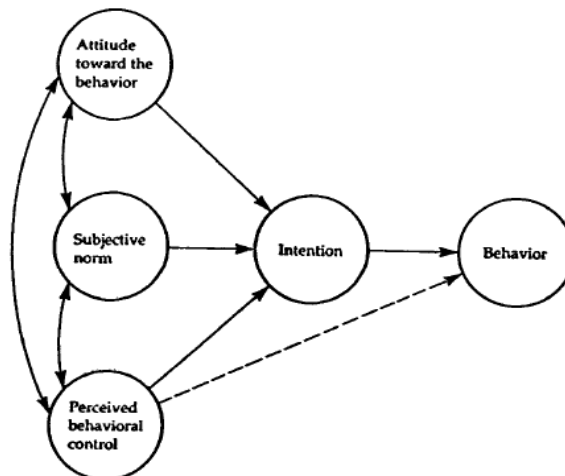


Figure 3.1: The theory of Planned Behavior (Ajzen, 1991)

This is described as behavioral control. So Ajzen’s model of

Theory of planned behavior suggests that behavioral achievement depends on the combination of motivation (intention) and ability (behavioral control) (Ajzen, 1991).

3.1.2. Willingness To Pay

The willingness to pay (WTP) researches focus mostly on the willingness of consumers to pay for new products in the market, compared to other comparative products and added value. These researches are often performed by a choice experiment, so the consumers make an

active choice in the experiment. Often through conjoint choice questions preferences are measured. This WTP method is focused purely on the question “Will the consumer buy, or not?”. It does not take into account decision-making background. An example of WTP research is (Borchers, Duke, & Parsons, 2007), which focus on WTP for green energy.

3.2. Existing theories on ‘green’ investments

There are also decision-making models developed for ‘green’ investments. These models range from willingness to pay for green energy, to complete decision-making models on energy use, investment behavior or buying behavior.

3.2.1. Motivation-Ability-Opportunity

Olander & Thøgersen (1995) suggest that “an appropriate frame of reference for the study of consumer behavior with an impact on the environment should include at least three main determinants (or classes of determinants): motivation, ability, and opportunity” (Olander & Thøgersen, 1995, p. 360). See Figure 3.2 for the visualization of this model. This model is inspired on the discussed model of Ajzen (1991).

Motivation

The motivation in this model is the actor’s intention to engage in the behavior. (Ajzen, 1991) The factors determining this intention are the attitude towards the behavior and the social norms regarding the behavior. (Olander & Thøgersen, 1995)

Ability

The ability is the actor’s ability to carry out the intention. Motivation leads to behavior when the actor had the required abilities to perform the behavior (Olander & Thøgersen, 1995).

Opportunity

Opportunities are objective preconditions for the behavior (Olander & Thøgersen, 1995).

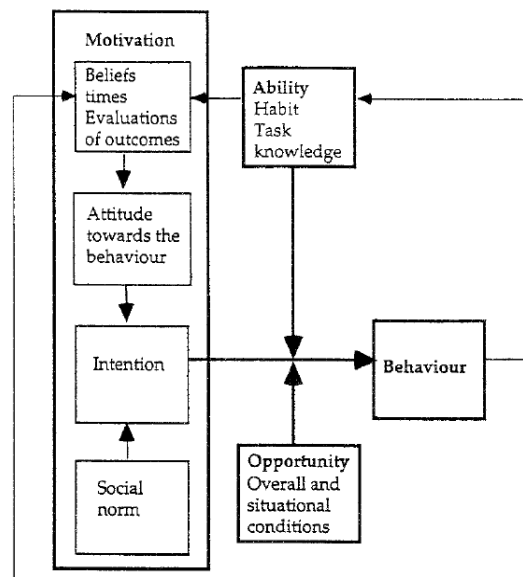


Figure 3.2: The motivation-ability-opportunity-behavior model (Olander & Thøgersen, 1995)

3.2.2. Willingness to Pay for Green Electricity

The next model is generated to estimate the willingness to pay for green electricity within Swedish Households. See Figure 3.3

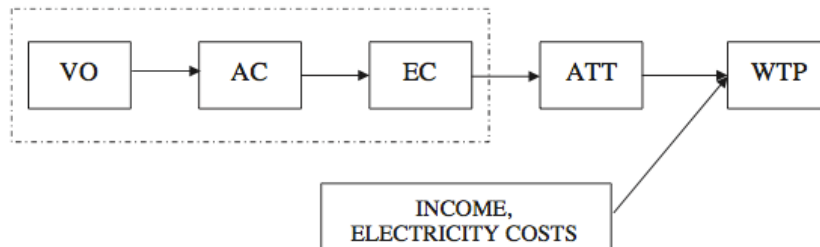


Figure 3.3: Hypothised Model of determinants of willingness to pay (WTP) for green electricity (Hansla et al., 2008)

This was tested by evaluating attitude (ATT), decreased with electricity costs and income. The attitude consisted of value orientation (VO), awareness of consequences beliefs (AC) and environmental concern (EC) (Hansla et al., 2008).

Value orientation (VO) in the context of this model can be divided in an altruistic of egoistic value orientation. Awareness of consequences is related to value orientation. These can be consequences for others or for the individual himself (Hansla et al., 2008).

Environmental concern (EC) is an evaluation of the consequences of environmental problems the individual has made (Hansla et al., 2008).

3.2.3. Urging residents to save energy

The model proposed by Han, Nieuwenhuijsen, de Vries, Blokhuis, & Schaefer (2013); Nieuwenhuijsen, (2010) is to test the influence of different forms of incentives on energy saving behavior of residents in Eindhoven and resulted in the identification of different target groups for incentives, see Figure 3.4

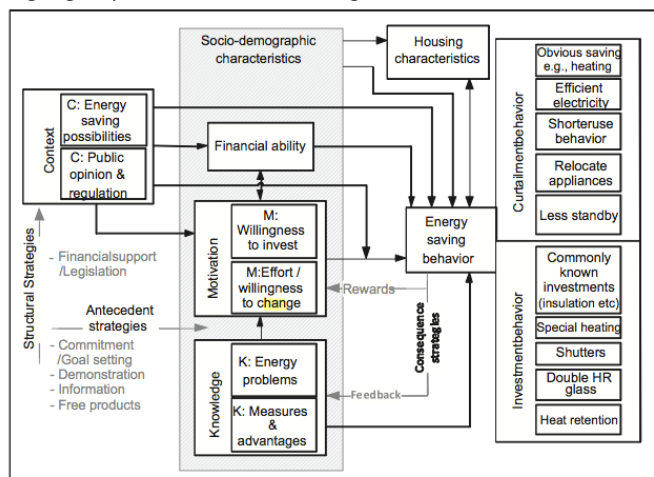


Figure 3.4: Energy saving behavior model (Han et al., 2013)

This research includes both investment behavior and curtailment behavior, with focus on the curtailment behavior. In this model socio-demographic characteristics influence the psychological factors (Nieuwenhuijsen, 2010). The intervention strategies also influence the psychological factors. This model is inspired by the MAO model of (Olander & Thøgersen, 1995) and expanded to fit as energy saving behavior model.

3.2.4. Willingness to buy a new built sustainable home

Also based on the theory of planned behavior of Ajzen (1991), the next model is proposed by (Luijten, 2010), See Figure 3.5.

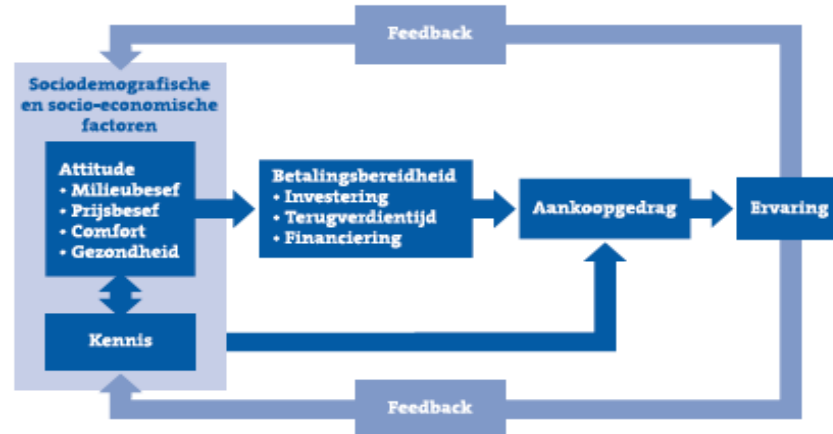


Figure 3.5: Conceptual model for market acceptance and willingness to pay for sustainable new built dwellings (Luijten, 2010)

This model places the attitude and knowledge as a direct influence factor on the buying behavior of consumers. Attitude in this model is formed by environmental awareness, price awareness, comfort and health.

A positive attitude will increase the willingness to buy a new built house. This attitude is influenced by socio demographic and socio economic factors (Luijten, 2010).

3.3. Influential factors

From all discussed models, a couple of influential factors in decision-making are frequently used and important. These influential factors are discussed below.

3.3.1. Motivation / Intention / Attitude

The factors motivation (Han et al., 2013; Nieuwenhuijsen, 2010; Olander & Thøgersen, 1995), intention (Ajzen, 1991; Olander & Thøgersen, 1995) and attitude (Hansla, Gamble, Juliusson, & Gärling, 2008; Luijten, 2010), are the most important factors that directly influence behavior in the discussed models. These factors, although named differently, describe the inner motivation of the consumer to act in behavior, not restrained by variables like an ability to act. These intrinsic factors are:

- Environmental concern (Han et al., 2013; Hansla et al., 2008; Luijten, 2010). If the resident has a big environmental concern, this attitude factor can help motivate the resident to invest.
- Importance of comfort (Han et al., 2013; Hansla et al., 2008; Luijten, 2010). The increase in comfort of a sustainable upgrade of the house can increase the motivation of the resident to invest, if the resident is aware of this increase in comfort and thinks it's important.

- Importance of health (Han et al., 2013; Luijten, 2010). Sustainable upgrades can increase the living circumstances inside a home. If the resident thinks this is important, it can improve the motivation.
- Price consciousness (Han et al., 2013; Luijten, 2010). The impact of the investment on the energy bills or increase in value of the house can, when the resident is aware of this and values this, increase the motivation to invest.

3.3.2. Knowledge

The factor knowledge (Ajzen, 1991; Han et al., 2013; Luijten, 2010; Olander & Thøgersen, 1995) is also considered an important variable to influence behavior, but also influence the motivation or 'willingness to invest'. The knowledge can be divided into two factors: the knowledge of current energy (gas) usage of the dwelling and the knowledge of the improvement options of the dwelling (Luijten, 2010). If the resident is aware his or her energy bill is high, the attitudinal factors of price consciousness and environmental concern can be influenced. When the resident is aware of the options available, price consciousness can be influenced, the positive effects on health and comfort can become more visible to the resident, and it's possible impact on the environment can become visible. Knowledge can also have a direct influence on 'willingness to invest', because even if there is a positive price consciousness, the resident may not know all energy saving options and can therefore decide not to invest, out of incomplete information.

3.3.3. Socio-demographic factors

Socio-demographic factors influence the total of all motivational factors (Ajzen, 1991; Han et al., 2013; Hansla et al., 2008; Luijten, 2010; Olander & Thøgersen, 1995). Factors like age, education, household, ethnicity, but also income have been found to have a great influence.

3.3.4. Ability and situational conditions

Ability and situational conditions, or perceived behavioral control (Ajzen, 1991; Han et al., 2013; Hansla et al., 2008; Luijten, 2010; Olander & Thøgersen, 1995) influence the actual behavior, but can also influence the motivation or 'willingness to invest'. Under ability and situational factors can be understood: Money, opportunity and time (Ajzen, 1991; Olander & Thøgersen, 1995). Specified for investment in sustainable upgrades to dwellings these factors are: height of investment, payback period and the availability of subsidies or loans (Luijten, 2010).

3.4. The influence of neighborhood satisfaction in decision-making

In the research of Galster & Hesser (1982) the relationship between the social neighborhood and also physical neighborhood factors on the maintenance behavior of residents, which means the investments of residents in housing upkeep. This research resulted in the finding that residents that live in a cohesive neighborhood spend significantly more on housing maintenance and do this more frequently. Also residents of higher quality neighborhoods (both physically and demographically), older dwellings and higher incomes have been found to correlate (Galster & Hesser, 1982).

Together with the previous study on the interrelationships between neighborhood satisfaction, neighborhood attachment and mobility, as described in Chapter 2, the hypothesis as described in Chapter 1 was formed.

3.5. Conceptual model

Based on the previous discussed literature, a hypothetic model is created, see Figure 3.6.

In this model, the hypothesis of this research is inserted and marked as hypothesis.

In this model, 'mobility' has a direct influence on the 'investment behavior'. This is 'Residential satisfaction' and 'residential attachment', influence 'mobility' as described in Chapter 2.4.3 and 0. The direct influence of mobility on 'willingness to invest' is based on the fact that when a resident is planning to move, the attitude to invest can be present, but the resident can still decide based on the plans to move to postpone the investments to their new dwelling or even be motivated by the fact that the resident is moving, due to price consciousness. This explains the proposed relation to attitude.

The intrinsic factors discussed in Chapter 3.3.1 are called 'attitude' in this model. The second part of the model and the influences of 'attitude', 'knowledge' and 'ability' are derived from the discussion of the reviewed models in chapter 3. The socio demographic factors influence, as discussed, every variable in the model that influences the 'Investment Behavior'. A more detailed relationship model is found in Appendix B.

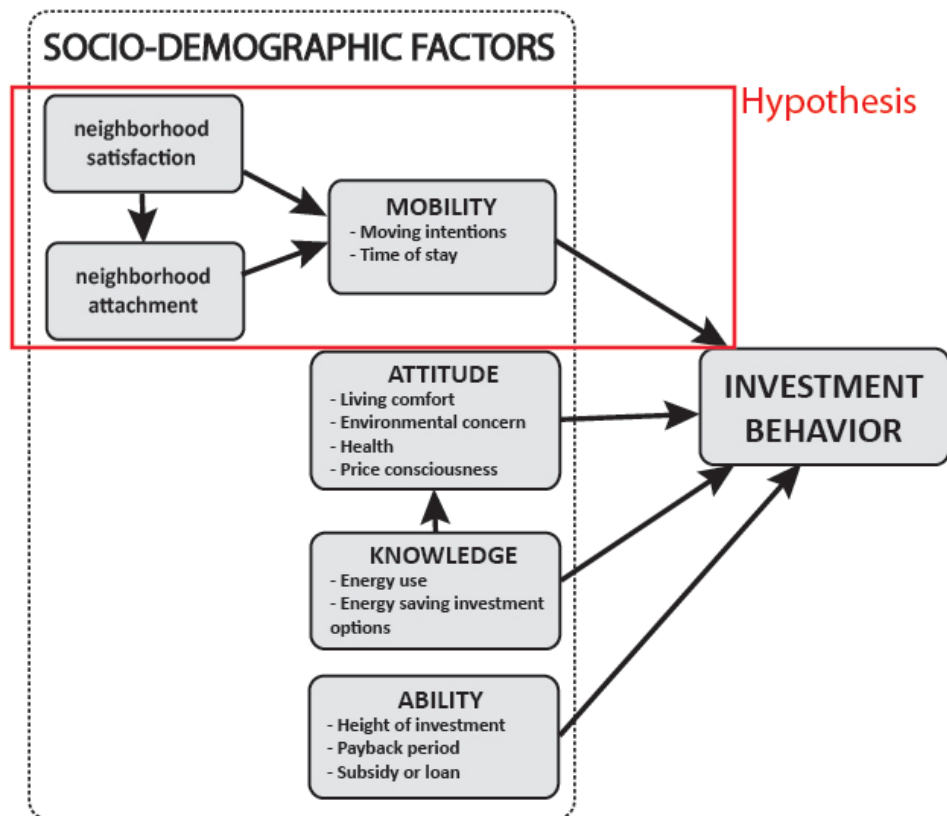


Figure 3.6: Hypothetic model of the influence of neighborhood satisfaction on willingness to invest

4. Research Methodology

Choice-behavior holds, as discussed in Chapter 3.3, often conditions beyond socio-demographics and just attributes of choice alternatives that influence the decision (Verhoeven, Arentze, Timmermans, & Waerden, 2006). This is why a model is needed that allows estimating direct and indirect effects and allows testing of causal relations. In this chapter, the used research methodology is explained.

4.1. Bayesian Belief Network

Bayesian Belief Network (BBN) is an approach to probabilistic reasoning. The consequences of a decision or opinion are in many real life situations uncertain and also complex. BBN is a powerful approach for combining different knowledge sources in a structured and above all, efficient way (Verhoeven et al., 2006) and is a technique for reasoning under uncertainty and comes from combined work in the fields of Artificial Intelligence, Statistics, Operations Research, and Decision Analysis (Arentze & Timmermans, 2009; Kemperman & Timmermans, 2012). The method has been successfully applied in the researches of Arentze & Timmermans, (2009); Kemperman & Timmermans, (2011); Parvaneh, Arentze, & Timmermans, (2012); Sharmeen & Timmermans, (2011) on travel behavior choices and in the researches of Arentze, Oppewal, & Timmermans, (2005) on shopping trip choices.

The BBN is composed of a (large) dataset of categorical variables. These variables are linked to show relations and interdependencies. A BBN network consists of several nodes that represent variables, and arcs, that connect the nodes and show the causal links between nodes (Verhoeven et al., 2006). Each node has an underlying conditional probability table (CP)

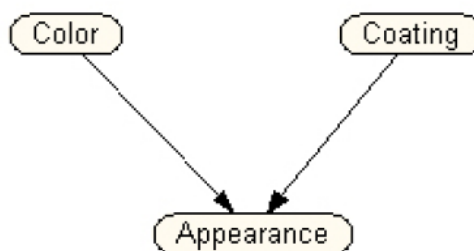


Figure 4.1: A BBN example (Verhoeven et al., 2006)

which holds the data of how much a variable depends on its parent nodes (Kemperman & Timmermans, 2012). A parent node is a node from which an arc originates, while the child node is a node to which the arc links. Each state within a node has a certain probability that represents beliefs about possible outcomes. These beliefs can be updated when evidence is available, so when datasets are implemented for the nodes.

A BBN is formally a directed acyclic graph (DAG). The proper notation is:

$BBN = (V, E)$

Where: V is a set of variables (X, Y)

and E is a set of links (X, Y)

When $X \rightarrow Y$, X is a parent of Y , and Y a child of X (Y can also be parent to another variable).

For each variable a CP table is formed. (Arentze & Timmermans, 2009; Kemperman & Timmermans, 2012). A representation of a simple BBN model is shown in Figure 4.1.

There are two ways to construct a BBN. These are: expert knowledge (based on literature and expertise) and network-learning algorithms.

1. When building a BBN with expert knowledge, the input consists of a set of variables and their direct and/or indirect causal relationships. Common knowledge, logic and/or statistical data can be used to complete the CP tables (Verhoeven et al., 2006).
2. When building a BBN with a network-learning algorithm, underlying data is needed. Structural learning determines the (inter) dependencies of variables and suggests a causal relation and direction. Parameter learning determines the CP tables of each node in the network, given the structure and data (Kemperman & Timmermans, 2012; Verhoeven et al., 2006). The network-learning algorithm is based on the three-phase dependency method (Cheng, Bell, & Liu, 1997), Drafting the network, Thickening the network and Thinning the network.

Kemperman et al. (2012) describe the process as: In the first phase, mutual information of each pair of variables as a measure of closeness is computed and based on this information a draft network is created. The mutual information between two variables (X and Y) is defined as:

$$I(X, Y) = \sum_{x,y} P(x, y) \log \frac{P(x, y)}{P(x)P(y)}$$

where $P(x)$ and $P(y)$ are unconditional probabilities of $X=x$ and $Y=y$ and $P(x,y)$ is the joint probability. The mutual information between variables X and Y measures the expected information gained about Y, after observing the value of variable X. This means that if two variables are dependent and the value of one variable is known, this will give information about the value of the other variable (Kemperman & Timmermans, 2012).

The second phase makes connections based on tests of conditional independence between pairs of variables (Kemperman & Timmermans, 2012).

The third phase re-examines each relation, removes them if the variables after implemented changes in the network seem conditionally independent. (Kemperman & Timmermans, 2012).

Last, the CP tables are estimated using the expectation-maximization (EM) learning algorithm (Lauritzen, 1995). This process proceeds until the log likelihood is no longer improving. (Kemperman & Timmermans, 2012).

4.2. Conclusion

Based on the different aspects of the decision-model, with direct and indirect dependencies that are very important in this research topic, the BBN model is an appropriate research method. The possibility to mix the expert knowledge structure design and network-learning algorithm is a secure way to test the validation of the model and ensure correct causal relations.

5. Case selection

For this research is chosen to perform a case study to gather data for the decision-model. In this chapter, the selection process for the case study is explained.

5.1. Eindhoven

The case study area is the city of Eindhoven, The Netherlands. Eindhoven is The Netherlands' fifth largest Municipality based on inhabitants and the biggest Municipality of the south of The Netherlands. The Municipality of Eindhoven has 217.120 inhabitants on a territory of 88,84 km² (CBS, 2012; GemeenteEindhoven, 2008). The Municipality of Eindhoven is part of the area SRE (Samenwerkingsverband Regio Eindhoven) and urban Network BrabantStad. The city has a target to become energy-neutral in 2040.

The city of Eindhoven consists of seven city districts: Centrum, Gestel, Stratum, Strijp, Tongelre, Woensel-Noord and Woensel-Zuid.

These city districts are again divided in 116 neighborhoods (Schampaert, 2010), see Figure 5.1.

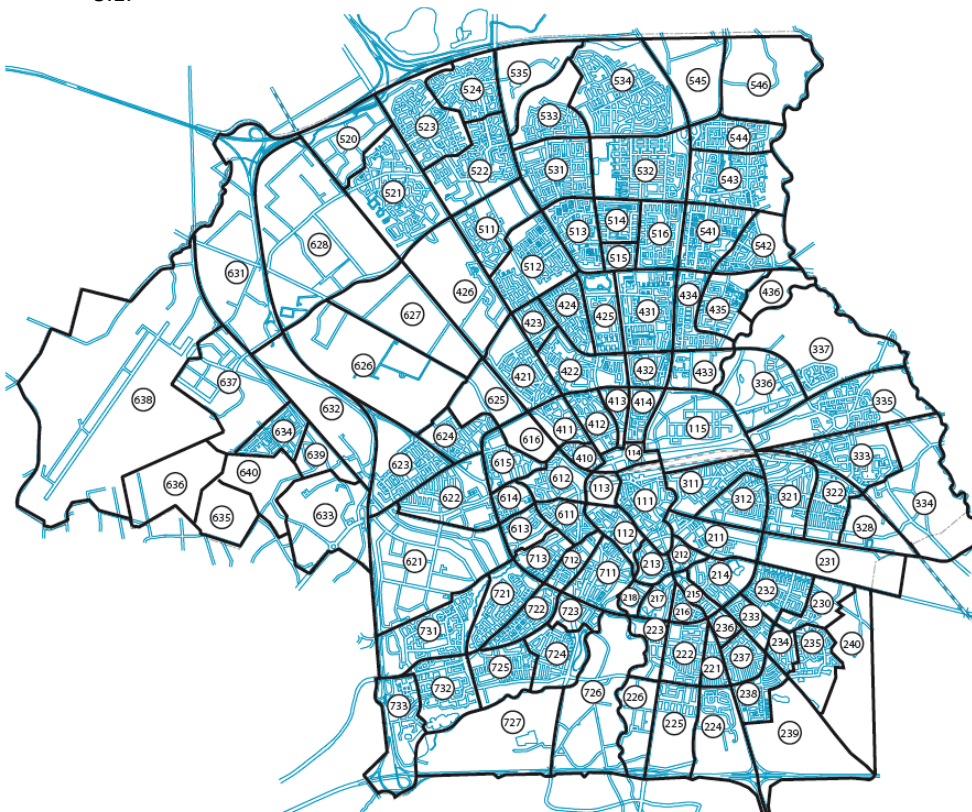


Figure 5.1: Statistical neighborhood division of the city of Eindhoven (Schampaert, 2010)

In Table 5.1 some characteristics of Eindhoven, its inhabitants and its houses are shown.

Characteristics of the city of Eindhoven	Score
Total number of inhabitants on the 1st of January 2012	217.223
Percent between 0-14 years of age (2011)	15,4%
Percent between 15-64 years of age (2011)	68,5%
Percent 65 years of age or older (2011)	16,1%
Percentage of natives (2011)	69,9%
% western immigrants (2011)	12,8%
% non-western immigrants (2011)	17,3%
Percentage of low household income (2011)	18%
Average spendable household income per year (2011)	€ 31.700
Urbanization (2010)	Strong Urban
Average property value (2011)	€ 243.000
Total number of dwellings (2011)	97404
Number of rented dwellings (2011)	48259
Number of privately owned dwellings (2011)	47570
Percentage of social housing (2011)	43%
Number of houses built before 1945 (2011)	14901
Number of houses built between 1945-1969 (2011)	30922
Number of houses built between 1970-1999 (2011)	40848
Number of houses built after 2000 (2011)	10719

Table 5.1: Characteristics of the city of Eindhoven. (Buurtmonitor Eindhoven, 2012)

Of course, for neighborhood satisfaction research it is necessary to know how inhabitants of Eindhoven value their living environment. In Table 5.2 the average scores of the quality of the social environment, physical environment and total scores are shown.

Average quality scores of neighborhoods in Eindhoven	Score
Quality of Social Environment (2011)	6,0
Quality of Physical Environment (2011)	6,2
Perceived Image of the Neighborhood (2011)	7,2

Table 5.2: Average neighborhood evaluation scores of the city of Eindhoven (Buurtmonitor Eindhoven, 2012)

5.2. Selection of neighborhoods

Because the study is focused on neighborhood satisfaction, a case study is designed between differently appreciated neighborhoods in Eindhoven. Two neighborhoods that have low neighborhood scores and two neighborhoods that have high scores opposed to the average scores of Eindhoven (according to statistics of the Municipality of Eindhoven, shown in Table 5.2) are selected. The case study neighborhoods are selected based on the following aspects:

1. The average property value of the houses in the neighborhood lies between €200.000, - and €275.000, -. The average property value of Eindhoven is €243.000, -, positioned in the center of this zone. This also makes the neighborhoods comparable on income levels and poverty rate.
2. Out of the private homeowners in this neighborhood, again is selected on a property value that lies between €200.000, - and €275.000, -, to ensure that all selected homeowners are comparable on income levels and poverty rate.

3. Out of the selected private homeowners under step 1 and 2, the houses built before 1992 are selected. Houses built after 1992 are often already very sustainable and are other than for sustainable energy systems not eligible for upgrading the house.
4. Out of this selection, four neighborhoods were chosen valuing the size of the neighborhoods, the percentage of social housing, average spendable income per year and inhabitant characteristics. The neighborhoods were chosen in such a manner that the mentioned aspects were as comparable as possible and the two neighborhoods with the lowest and two neighborhoods with the highest image evaluation scores within these boundaries were chosen. This does not guarantee a bad neighborhood score on all aspects, but these aspects will mostly be better or worse compared to the average scores of Eindhoven, based on the perceived image of the neighborhood scores, seen in Table 5.2. The shown quality of the environment scores are indicators, but are found from only homeowners in the neighborhood that filled in the survey of the Municipality, so from the sample only. This were sometimes less than sixteen respondents per neighborhood. That is why is chosen to rely more on perceived neighborhood image scores from the total neighborhood to select the neighborhoods.

An overview of the selected neighborhoods and characteristics is shown in table Table 5.3. The exact numbers for the sample and houses within the sample is shown in the next chapter, Table 6.1. The total of houses built before 1992 were not known exactly per neighborhood in total, so are shown until a year of construction of 1999, but the exact number is known for the sample, as seen in Table 6.1 in the next chapter.

5.3. Conclusion

The city of Eindhoven is chosen as case study area of this research. Eindhoven is the biggest city in the south of The Netherlands and consists of 116 statistical neighborhoods. Out of these neighborhoods, four representative neighborhoods (based on inhabitant and dwelling characteristics) were chosen, with two neighborhoods that have a neighborhood quality score lower than the average of Eindhoven (Vaartbroek and Het Ven), and two neighborhoods that have a neighborhood quality score above the average of Eindhoven (Prinsejagt and Tempel). These neighborhoods are selected as case study neighborhoods for this research.

Selected case study neighborhoods in Eindhoven	512: Prinsejagt	532: Tempel	543: Vaartbroek	622: Het Ven
Total number of dwellings (2011)	2.202	2.326	2.486	1.836
Average property value (2010)	€ 221.000	€ 220.000	€ 201.000	€ 205.000
Number of privately owned dwellings (2011)	1.103	840	937	778
Number of rented dwellings (2011)	1.090	1.486	1.549	888
Percentage of social housing (2011)	46%	64%	57%	47%
Number of houses built before 1945 (2011)	49	-	-	650
Number of houses built between 1945-1969 (2011)	1.381	983	1926	863
Number of houses built between 1970-1999 (2011)	709	1.307	429	251
Number of houses built after 2000 (2011)	63	36	131	72
Percentage of low household incomes (2011)	41,40%	45,30%	45,70%	40%
Average spendable income per year (2010)	€ 31.200	€ 29.900	€ 27.400	€ 28.600
Urbanization of the neighborhood (2011)	Strong Urban	Strong Urban	Strong Urban	Strong Urban
Percent between 0-14 years of age (2011)	15,3	15,7	16,7	16
Percent between 15-64 years of age (2011)	61,4	55,8	63,8	68,2
Percent 65 years of age or older (2011)	23,2	28,4	19,6	15,8
Percentage of natives (2011)	73,8	72,1	63,2	70,4
% western immigrants (2011)	11,7	11,5	12	13,9
% non-western immigrants (2011)	14,5	16,4	24,8	15,6
Quality of Social Environment of homeowners (2011)	6,1	6,2	5,2	5,5
Quality of Physical Environment of homeowners (2011)	6,8	5,7	5,3	6,1
Score on perceived image of the Neighborhood (2011)	7,8	7,8	6,7	7,2
Number of dwellings that are privately owned, and have a property value between 200.000-275.000 euros (2011)	404	337	280	321

Table 5.3: Characteristics selected case study neighborhoods (Buurtmonitor Eindhoven, 2012)

6. Data Collection

The data that is used for this research is collected through household surveys. In this chapter the process of data collection, as sample selection, survey design and survey process will be explained.

6.1. Sample

From the selected neighborhoods discussed in Chapter 5, the number of dwellings that are privately owned and have a property value between €200.000, - and €275.000, - are chosen as population. This is a total population of 1237 households. Based on the number of houses per neighborhood, respectively 404, 337, 280 and 321, to get a reasonable amount of responses per neighborhood, the choice was made to use the whole population as sample. This means that the survey was mailed to all households in the population of the case study area. Sample characteristics are shown in Table 6.1.

Characteristics per Neighborhood	512: Prinsejagt	532: Tempel	543: Vaartbroek	622: Het Ven
Total number of houses	355	288	273	321
Age groups				
Under 40	58	56	55	89
Between 40 and 60	167	129	125	144
Over 60	122	102	89	83
Unknown	8	1	4	5
Household size				
Single inhabitant	61	43	50	59
Two inhabitants	124	122	97	114
Three or more inhabitants	162	122	122	143
Unknown	8	1	4	5
Year of Construction				
Before 1945	0	0	0	218
1946 - 1964	254	0	0	83
1965 - 1974	95	218	233	1
1975 - 1991	6	70	40	19
Property Values				
Between €200.000 and €225.000	161	163	204	118
Between €225.000 and €250.000	56	97	43	124
Between €250.000 and €275.000	137	27	26	79

Table 6.1: Characteristics per neighborhood

6.2. Survey Design

The sample population was sent a questionnaire. The sample received an envelope, including an *invitation letter* (Appendix A1), which addressed the people to the importance of response from their neighborhood and mentioned the neighborhood they live in, a link to the online questionnaire and including a paper version of the questionnaire, for recipients that are not able to fill in the questionnaire online. A return envelope was also included. This package was sent on December 8th, 2012. After one week, on December 18th, 2012, a *reminder letter* (Appendix A2) was sent to the population, reminding about filling in the questionnaire, with the link to the online questionnaire again mentioned.

6.2.1. Mail and online questionnaire design

The questionnaire is focused on four parts:

1. Personal information
2. Energy saving investment behavior
3. Current housing situation / mobility
4. Neighborhood satisfaction

The questionnaire consists of multiple-choice answers, with on occasion a chance to enter an 'other' option or to make a comment about the question. The option 'don't know' or 'not appropriate' was also added to some questions to prevent non-response.

The evaluation questions were composed using a five-point likert-type scale. These were formulated in different ways:

1. Strongly agree – agree – neutral – disagree – strongly disagree
2. Very satisfied – satisfied – neutral – dissatisfied – very dissatisfied
3. Very high – high – average – low – very low

An example of these questions is seen in Figure 6.1. The full questionnaire is found in Appendix E.

23. Can you state your level of agreement with the following statements:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unknown
I am worried about climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A sustainable dwelling is more comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A sustainable dwelling is beter for your health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. Can you state your level of satisfaction with the following physical aspects of your neighborhood:

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Unknown
The aesthetical appearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The availability of parking places	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 6.1: Example of five-point likert scale questions in questionnaire

6.3. Conclusion

As a sample, a population of 1327 household within Eindhoven is chosen for distribution of a questionnaire, see Table 6.1. The questionnaire is mostly formulaed using a Likert-type scale, see Figure 6.1

7. Data Analysis

In this chapter, survey response, the resulting data and the process of preparation of the data for the analysis is explained.

7.1. Survey response

The survey received a total of 434 respondents. This accounts for a response rate of approximately 35%. For all figures see Table 7.1.

Survey Response	Total	Percentage
Surveys sent out	1238	100%
Surveys returned	434	35,1%
Online	185	42,3%
Mail	252	57,7%
Unusable surveys (Mail)	9	2,0%

Table 7.1: Response to survey

The response over mail was significantly larger than online response. The not completely filled in surveys all come from mail response, because in the online version you were not allowed to skip questions. The high numbers of mail responses correspond to the age of the respondent. Older respondents, in the age group 55 to 65, or over 65, mostly returned the mail response. This might be because of their unfamiliarity with computers. The high number of incomplete surveys may be due to skipping complete pages, which occurred 9 times and accidentally missing certain questions, or missing questions by not reading the sequential instructions carefully enough.

The characteristics of the respondents are shown in Table 7.2. The characteristics are compared to the entire sample population and the inhabitants of Eindhoven. The full list of characteristics is found in Appendix A3.

Characteristics of Response	512: Prinsejagt	532: Tempel	543: Vaartbroek	622: Het Ven	Total	%	% city of Eindhoven
No. of Responses	137	98	98	101	434	100%	100%
Percentage	31,6%	22,6%	22,6%	23,3%			
Age groups							
Under 18	0	0	0	0	0	0,0%	80,97%
18 to 25	1	1	0	0	2	0,5%	
25 to 35	14	10	9	16	49	11,3%	
35 to 45	19	13	16	18	76	17,5%	
45 to 55	20	20	19	21	80	18,4%	
55 to 65	26	17	20	12	75	17,3%	
Over 65	55	37	33	21	146	33,6%	19,03%
Unknown					6	1,4%	
Total	135	98	97	88	434	100,0%	100,0%

Table 7.2: Response characteristics

The number of respondents from the Prinsejagt neighborhood (31%) is slightly higher than the other neighborhoods (approximately 23%). This may be due to the fact that the number of surveys sent to that neighborhood were higher in the sample, or that there are more elderly people in the neighborhood. Elderly people also responded more than the other age groups. This can be because of the possibility to fill in a paper version of the survey, which makes it accessible for this age group. The big response of elderly people may affect how representative the outcomes of the research are for the population of Eindhoven.

7.2. Data preparation

The data is collected in IBM SPSS 20. The Likert-scores were recorded as numerical answers ranging from 1 (strongly agree, very satisfied, etc.) to 5 (strongly disagree, very dissatisfied). Statements with 'negative' character were recoded to represent the same 'mood' as the rest of the questions and statements.

7.2.1. Multicollinearity

The correlation matrix of the dataset was tested for multicollinearity (correlations >0.8). Of questions with high correlations, the most representative question was kept, the other discarded. These were questions regarding the same physical neighborhood qualities and availabilities. The availability questions were kept in the dataset.

7.2.2. Missing data / other inconsistencies

The data was also investigated on missing data patterns and other inconsistencies.

Neighborhood Related Variables

The variables "facilities for teens" were discarded. Most respondents answered this question with "Do not know"; therefore no added value can be gained from these variables.

Ability Related Variables

The variable "Income" unfortunately missed one answer category on the survey. When investigating open-ended answers, some answers from respondents with the highest category income were traceable, but chance is that other respondents that belong to this group answered "Won't Say", another option in the survey. Therefore the "Won't Say" option is regarded as 'Others', on the assumption that the respondents that belong to the answer categories that were present, answered truthfully.

The variables "maximum accepted investment height" and "maximum accepted investment payback time" had biased answers. Respondents, due to the difficult nature of the question, may have interpreted this question wrong. These variables have not been used in the analysis.

7.3. Conclusion

A total response of 434 respondents was gathered, which is 35% of the total sample. Only 9 surveys shown to be unusable. A slight over response of elderly people was also noted. The data is prepared in IBM SPSS 20 for use in the analysis.

8. Analysis and Results

This chapter will discuss the results of the analysis of the gathered data. First, a principal components analysis is performed to cluster the different neighborhood satisfaction aspects into representative components for analysis. Second, the Bayesian Belief Model is constructed and discussed. Third, scenarios are tested on the Bayesian Belief Model.

8.1. Neighborhood Components

The different tested physical and social aspects of the neighborhood are tested for similar components through a Principal Component Analysis performed in IBM SPSS 20 Statistics Package. The resulting matrix is found in Appendix C10. For this test the KMO test has a value of 0,813, which is above the required value of 0,5. Also, the Bartlett's Test of Sphericity is found significant ($p=0,000$). A promax rotation is used, because the resulting components are assumed to correlate. The principal components analysis resulted in four components, two that represent the physical neighborhood aspects, and two that represent the social neighborhood aspects, with a Cronbach's alpha score of >0.6 (De Heus et al, 2001):

1. Social Relations (Social) (Cronbach's $\alpha=0,841$)
2. Quality Outdoor Infrastructure and Upkeep (Physical) Cronbach's $\alpha=0,703$
3. Outdoor facilities (e.g. Green, Playgrounds) (Physical) (Cronbach's $\alpha=0,678$)
4. Secure feel (Social) (Cronbach's $\alpha=0,638$)

The resulting components were used in further research.

8.2. Structure of the Bayesian Belief Model

For the learning the structure of the Bayesian Belief Network model the BBN structure learning program Powerconstructor (Cheng et al., 1997) was used. This program uses the database (containing 425 usable records, as discussed in Chapter 7) as input for constructing links between the variables. The variables used are found in Appendix C1. Missing variables were taken into account in the model. It forms the network with the variables (as nodes) and learns the causal links between the variables based on the three step algorithm discussed in Chapter 5. The algorithm used for construction of the network has been found to be very efficient and reliable (Cheng et al., 1997).

The threshold of the first plausible network is set to 1.0, which is the default value (Keuleers et al, 2001). A higher threshold will result in less links and will leave the strongest links, which can be useful if the program produces too many links. A lower threshold results often in more links, of which must be kept in mind that some are less strong.

Prior knowledge can be inserted in the BN Powerconstructor, but too much prior information will only influence the relations the program finds and will bias the outcomes.

As prior knowledge, only two constraints were added:

1. The variable 'Age Category' was defined as a Parent Node, because no variable can influence the age of the respondent.
2. The variable 'Investment Behavior' was defined as a Child Node, because investment behavior is the resulting tested variable. It can therefore influence no other variable.

The first constructed model outlines are shown in Figure 8.1, and is found enlarged in Appendix C2. In this model, the direction of some arrows are reversed, because the causality the other way around seems more plausible. All indicated relationships were accepted.

The relationships that were reversed are:

- Education -> Social Contacts Neighborhood. It does not seem plausible that the social contacts one has in his or her neighborhood, influences their educational level. It does however seem plausible that the level of education influences the manner of social contacts in the neighborhood.
- Neighborhood Attachment -> Aware Energy Use. The fact that someone is more aware of their energy use and therefore is more or less attached to their neighborhood seems strange.
- Neighborhood Satisfaction -> Wish To Move. It seems incorrect that peoples wish to move influences their opinion about the neighborhood. Vice versa, the opinion about the neighborhood influencing the wish to move, seems more plausible.
- Secure Feel Neighborhood -> Neighborhood Attachment. Feeling secure, as found in literature, is a part of neighborhood attachment and satisfaction.
- Outdoor Facilities Neighborhood -> Neighborhood Attachment. Same as the statement above: this is, as found in literature, a part of neighborhood attachment and satisfaction.

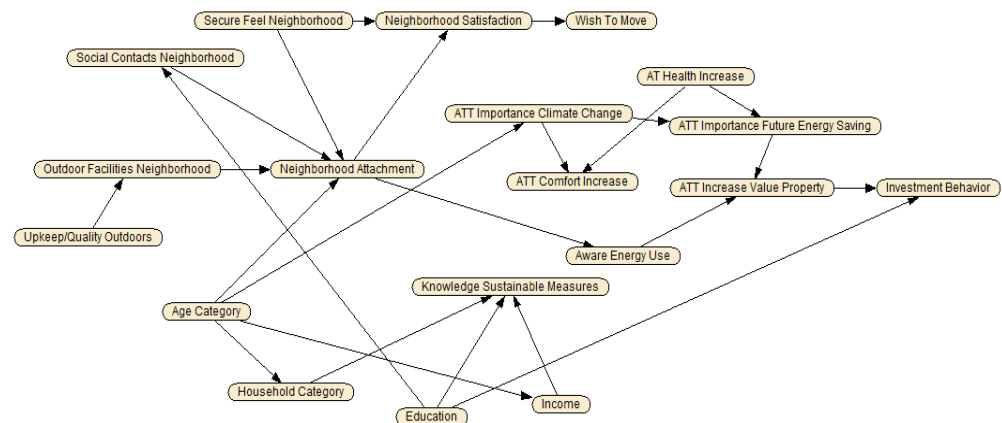


Figure 8.1: First constructed BBN model, threshold 1.0, changed link directions

The BN Powerconstructor, with the threshold set to 1, does not find a direct causal relationship between neighborhood satisfaction, neighborhood attachment or wish to move and investment behavior from the dataset. An indirect link between 'Neighborhood Attachment' and 'Investment behavior' is found through 'awareness of energy use' and the 'attitude increase value property' by investing.

To test if there is no relationship to be found from the data at all, models were constructed again in BN Powerconstructor, with the thresholds lowered one step at a time. A threshold of 0,7 was needed to find more plausible links: a new direct link between 'Wish To Move' and 'Investment Behavior'. This model was, with the same link directions as the first model, was adapted as the final model. With this model, the parameter learning was used to define

the conditional probabilities (CP tables) for each node. This model is shown in Figure 8.2, and a bigger version and the construction report is found in Appendix C3 and C4.

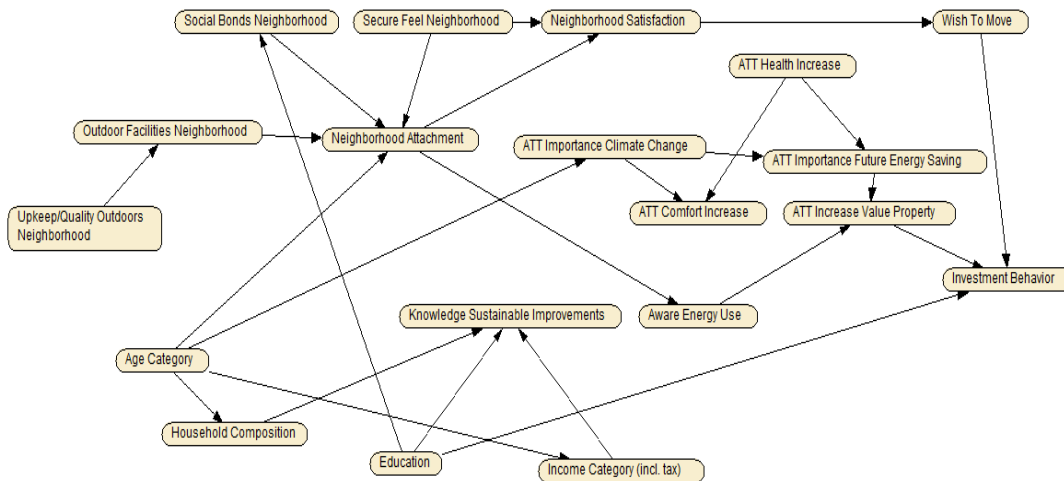


Figure 8.2: Final constructed and accepted model, threshold 0.7, changed link directions

Attitudes

When looking at the model, we see that ‘ATT Increase Value Property’ which is a price conscious attitude variable, is the only attitudinal variable that has a direct influence on investment behavior. This means that this attitude predicts investment behavior the best out of the attitudes used in the model. This attitude is related to the attitudes ‘Future Energy Saving’, which is a variable that is part price conscious and part environmental awareness in nature, which is again related to the attitude ‘Importance Climate Change’ that is an environmental awareness attitude and ‘Health Increase’, which indicates how people believe an investment will increase the healthy environment in their dwelling. ‘Importance Climate Change’ and ‘Health Increase’ together predict ‘Comfort Increase’, how people believe an investment will increase the comfort of the dwelling. Of the socio demographic variables, only ‘Age Category’ has a direct influence on ‘Importance of Climate Change’ and indirect on the other attitudes except ‘Health Increase’. No other indirect influences are predicted.

Knowledge

‘Aware of Energy Use’ is an indirect predictor of ‘Investment Behavior’, through attitude ‘Increase Value Property’. Neighborhood Attachment again is considered a predictor of the ‘Awareness of Energy Use’. This variable has through ‘Neighborhood Attachment’ indirect influences of the socio demographic variable ‘Age Category’ and the factors of neighborhood satisfaction.

‘Knowledge of sustainable improvements’ is not found to be a predictor of any variable in the network. This variable is however predicted through socio demographics ‘Household Composition’ and ‘Education’ and ‘Income’ (the ability value).

Ability

The ‘Income’ variable only predicts the ‘Knowledge of sustainable improvements’ and does not have a link found to predict ‘Investment Behavior’. ‘Age Category’ predicts ‘Income’. This

variable could perform not optimal, based on the assumptions made, so this must be kept in mind.

Neighborhood Satisfaction, Attachment and Wish to Move

In this model (threshold 0,7) a direct link as hypothesized is found between 'Wish to Move' and 'Investment Behavior'. 'Wish to Move' is again predicted by 'Neighborhood Satisfaction' and indirect by 'Neighborhood Attachment' and the neighborhood aspects. Socio demographics 'Age Category' and 'Education' show indirect effects. The direction of the link between neighborhood satisfaction and attachment is in the other direction than hypothesized.

Socio Demographics

'Education' shows a direct relationship with 'Investment Behavior'. 'Age Category' shows indirect relationships through various variables. The household composition seems not determinant.

This forms the structural model used for testing. The BBN modeling software used to test the further predictions of the model is Norsys Netica 4.16. (Norsys, 2011) Figure 8.3 shows the imported model (also found enlarged in Appendix C5). The bar diagrams displayed in each node represents the probability distribution of the categories of the variable.

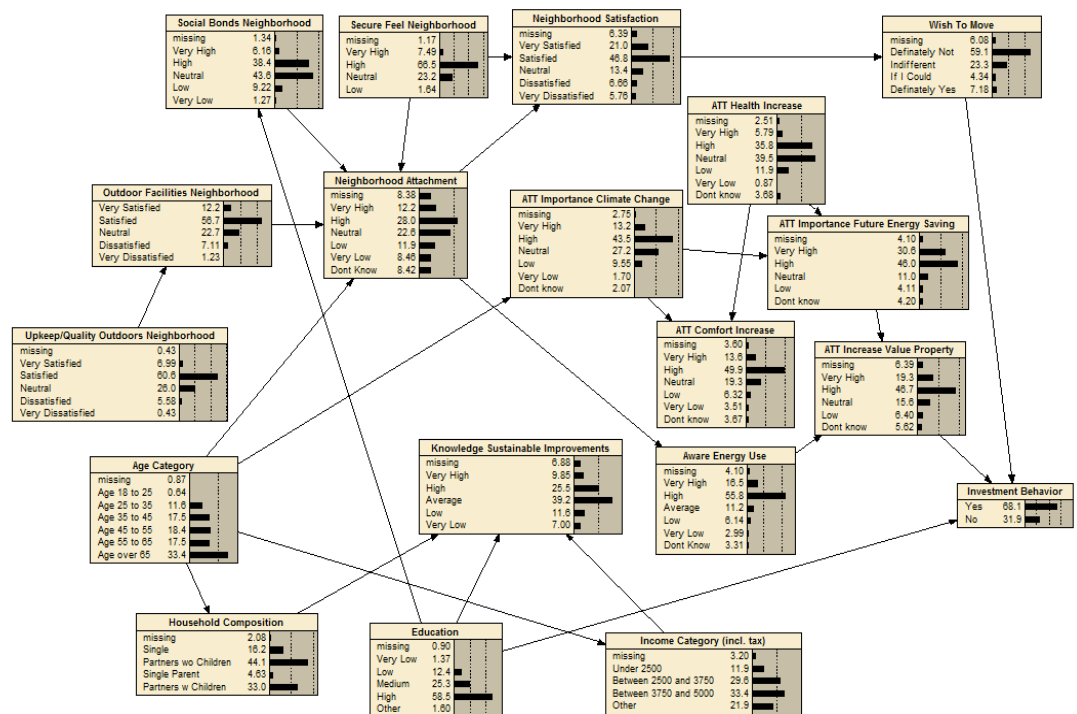


Figure 8.3: Final model imported in Norsys Netica

8.3. Results Scenarios 1 and 2 'Investment Behavior'

With the Bayesian Belief Network model, it is possible to test scenarios and see how the probabilities of the variables interact; thus how one (or more) variable(s) in the network predict other variables. The desired scenario state can be entered in the model as 'finding' and the model predicts percentages of possible outcomes based on this finding. These percentages can be used to compare different scenarios.

The first two scenarios test the outcomes of 'Investment Behavior' either set on 100% Yes, or 100% No. In the Tables 8.1 through 8.5 the results are presented. The full table and graphics are found in Appendix C6 to C8. Below, the results are discussed.

Attitude 'Increase of Property Value'						
Investment Behavior	Very High	High	Neutral	Low	Don't Know	
Yes	21,70%	50,60%	14,20%	4,29%	4,23%	
No	14,10%	38,40%	18,60%	10,50%	8,59%	
Attitude 'Future Energy Saving'						
Investment Behavior	Very High	High	Neutral	Low	Don't Know	
Yes	32,10%	46,40%	10,50%	3,71%	8,78%	
No	27,50%	45,10%	12,10%	4,95%	5,08%	
Attitude 'Importance Climate Change'						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	13,30%	44,00%	27,10%	9,41%	1,62%	1,97%
No	12,90%	42,60%	27,50%	9,82%	1,87%	2,28%
Attitude 'Increase Comfort'						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	13,70%	50,10%	19,30%	6,26%	3,45%	3,61%
No	13,60%	49,50%	19,30%	6,45%	3,64%	3,82%
Attitude 'Increase Health'						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	5,77%	35,90%	39,70%	11,80%	0,83%	3,55%
No	5,84%	35,40%	39,10%	12,00%	0,95%	3,97%

Table 8.1: Outcomes Attitudinal factors Scenarios Investment Behavior

Attitudes

When looking at the attitude results in Table 8.1, it shows that the level of attitude the property value increase from the investment, is the most significant predictor for investment behavior. Between the 'very high' attitudes a difference of 7,6% occurs in favor of the investors, as well as the 'high' attitudes that show a difference of 12,2% difference in favor of the investors. This means that in total 19,8% of the investors are more convinced their property value increases from investment than non-investors, of a total of positive attitudes of 72,3% for investors, respectively 52,50% for non-investors. Only 14,20% of investors are neutral, and as low as 4,29% of the investors do not believe that their property value will increase. Of the non-investors 4,40% more are neutral and 6,21% more believe that the value of the property does not increase at all. The value 'don't know' also indicates that of

the non-investors claim 4,36% more that they don't know it, which again can show a lack of information or interest in the topic.

The attitude about the importance of energy saving also shows to be a significant (but indirect) predictor. The investors show a very high attitude 4,60% more than non-investors, and a high attitude 1,30% more than non-investors. This is a total more positive attitude of 5,90% opposed to non-investors. The investors show in total a 78,5% positive attitude about the importance future energy saving, while the non-investors show only a 72,6% occurrence of a positive attitude. Again, the non-investors are more often neutral (1,6% more) or more often negative (1,24% more). When looking at the 'don't know' value, it is surprising that more investors indicate that they don't know, than non-investors, with a difference of 3,70%.

The attitude about the importance of climate change shows some indirect effects. Very environmentally aware investors are 0,40% more than very environmentally aware non-investors. A high attitude shows a difference of 1,4% more for investors than non-investors, making in total 1,8% of the investors more climate change aware (total 57,30%) than non-investors (total 55,5%). Again, more non-investors are neutral (0,4% more) or have a low or very low attitude about climate change (0,56%). Don't know was answered more often by 0,31% of the non-investors.

The attitude that predicts a believe in increase of comfort because of investments shows no value changes above 1% difference. This means that this attitude is not a good predictor.

The attitude that predicts the opinion about health increases in the dwelling is not a significant predictor. Marginal differences occur, but no differences above 1% are predicted.

Knowledge

When looking at the knowledge factors in Table 8.2, awareness of energy use seems significant for investors. Investors are 0,5% of the time more 'very highly aware' of their energy use, and 6,20% of the time more 'highly' aware. This means that 6,70% more investors claim to be highly aware of their energy use opposed tot non-investors, with total values of investors at 74,40% and non-investors at 67,70%. Again, more non-investors are neutral, so claim no extra awareness of energy use (0,6% more) and 3,02% more claim low of very low awareness of energy use. Also, a lot of non-investors claim more often that they do not know how aware they are of their energy use, which is 1,34% more.

The knowledge homeowners claim to have about sustainable improvements does not show a very good indicator, with no changes above 1% difference.

Aware Energy Use						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	16,70%	57,70%	11,00%	5,55%	2,61%	2,88%
No	16,20%	51,50%	11,60%	7,39%	3,79%	4,22%
Knowledge Sustainable Improvements						
Investment Behavior	Very High	High	Average	Low	Very Low	
Yes	9,80%	25,80%	39,50%	11,40%	6,78%	
No	9,96%	24,70%	38,60%	11,80%	7,48%	

Table 8.2: Outcomes knowledge factors Scenarios Investment Behavior

Neighborhood Satisfaction, attachment, wish to move

When looking at the indicated 'wish to move' in Table 8.3 of the respondent, significant changes can be seen. Of the investors 7,50% more indicate they definitely don't want to move. Investors also show somewhat more an indifferent attitude (1,4% more), while non-investors show more often that they would move if they could (2,73% more) or definitely want to move (3,61%), which is a total of 6,34% more moving wishes for non-investors.

	Wish to Move					
Investment Behavior	Definitely Not	Indifferent	If I could	Definitely yes		
Yes	61,50%	23,70%	3,47%	6,03%		
No	54,00%	22,30%	6,21%	9,64%		
Neighborhood Attachment						
Investment Behavior	Strongly Attached	Attached	Neutral	Disattached	Very Dissatached	Don't Know
Yes	12,20%	28,80%	23,20%	12,00%	7,96%	7,84%
No	12,20%	26,10%	21,30%	11,80%	9,54%	9,66%
Neighborhood Satisfaction						
Investment Behavior	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
Yes	21,40%	48,10%	13,20%	6,21%	5,12%	
No	20,30%	44,00%	13,60%	7,62%	7,12%	
Secure Feel Neighborhood						
Investment Behavior	Very High	High	Neutral	Low		
Yes	7,34%	67,00%	23,00%	1,58%		
No	7,82%	65,50%	23,60%	1,76%		
Social Bonds Neighborhood						
Investment Behavior	Very High	High	Neutral	Low	Very Low	
Yes	5,97%	38,50%	44,10%	9,07%	1,12%	
No	6,58%	38,10%	42,60%	9,53%	1,57%	
Outdoor Facilities Neighborhood						
Investment Behavior	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
Yes	12,10%	57,00%	22,60%	7,01%	1,21%	
No	12,50%	56,10%	22,80%	7,30%	1,28%	
Upkeep/Quality Outdoors Neighborhood						
Investment Behavior	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
Yes	6,95%	60,70%	26,00%	5,57%	0,43%	
No	7,08%	60,50%	26,00%	5,61%	0,44%	

Table 8.3: Outcomes Wish to Move, Neighborhood Satisfaction, attachment and factors Scenarios Investment Behavior

When looking at the indicated levels of neighborhood attachment, the percentage of homeowners that claim to be very attached, are the same within investors and non-investors. A slight change in favor of the investors occurs at the 'attached' answer, which occurs 2,70% more for investors than non-investors. So in total again 2,70% more of the investors claim high neighborhood attachment levels, than non-investors. Investors also

state 1,90% more often that they have a neutral opinion about their attachment. Disattached was also indicated 0,20% more often by investors, where very disattached is more answered by non-investors, with a difference of 1,59%. No really clear trend follows from these results, as for the notion that there are investors that are more attached to their neighborhood, as well as investors that are indifferent about attachment to the neighborhood and did not find this a condition for investing, and that non-investors could easily be attached to the neighborhood without wanting to invest.

Neighborhood satisfaction shows slightly more results than neighborhood attachment. Investors show 1,10% more often to be very satisfied, and 4,10% more often to be satisfied, so are in total 5,20% more often satisfied with their neighborhood than non-investors. In total, 69,5% of the investors claim to be satisfied with their neighborhood, opposed to 64,3% of the non-investors. Slightly more non-investors are neutral about their neighborhood satisfaction (0,40%) and 3,41% more of the non-investors is either dissatisfied or very dissatisfied about their neighborhood.

When looking at the factors of neighborhood satisfaction and neighborhood attachment, feeling secure does show a slight difference between investors and non-investors (total of 1,02% more for investors) and being neutral about social bonds was indicated 1,50% more by investors, but these are still slight differences, with no trend in the answer categories. The other factors show no difference over 1%.

Ability

When looking at income in Table 8.4, there seems no difference between investors and non-investors. Of course, a big difference was not expected because of the selection of same category neighborhoods, but there could be a small difference between homeowners that can largely afford their house and homeowners that can barely afford their house. No such thing was discovered in the model.

Income Category				
Investment Behavior	Under 2500	2500-3750	3750-5000	Other
Yes	11,90%	29,60%	33,40%	21,80%
No	11,90%	29,60%	33,50%	21,90%

Table 8.4: Outcome Ability Scenarios Investment Behavior

Socio Demographics

As for socio-demographic factors as seen in Table 8.5, education level shows to be a good predictor of investment behavior: 10,70% more of the investors have had a high level education, and 7,73% more of the non-investors have either a low or very low education level. Medium level education does not show a big difference between the two categories. Other socio-demographic variables show no significant changes.

Household Composition						
Investment Behavior	Single	Partners wo children	Single parent	Parents w children		
Yes	16,20%	44,10%	4,63%	33,00%		
No	16,10%	44,00%	4,64%	33,10%		
Age Category						
Investment Behavior	Under 25	25-35	35-45	45-55	55-65	over 65
Yes	0,61%	11,60%	17,50%	18,50%	17,50%	33,50%
No	0,68%	11,80%	17,50%	18,40%	17,50%	33,30%
Education Level						
Investment Behavior	Very Low	Low	Medium	High	Other	
Yes	1,07%	10,20%	25,00%	61,90%	1,20%	
No	2,00%	17,00%	25,80%	51,20%	2,46%	

Table 8.5: Outcome Socio-demographic Scenarios Investment Behavior

8.4. Results Scenarios 3 through 8 'Neighborhood Satisfaction'

To test the relationships with neighborhood satisfaction scenarios 3 through 8 are developed. The table containing these results is found in Table 8.6 and the full table in Appendix C9.

When looking at these results, it is clear that very high neighborhood satisfaction corresponds with high levels of neighborhood attachment. Of the homeowners that are very satisfied, 30,00% claims to be very attached and 34,50% claims to be attached. When looking the other way around, attached homeowners are not as much very satisfied, as very satisfied homeowners are attached. Attachment level seems therefore a good indicator of high neighborhood satisfaction, because very satisfied homeowners have indicated 64,50% of the time that they are (very) attached, while just satisfied homeowners indicate 45,46% of the time that they are (very) attached. The levels of attachment decrease when the level of satisfaction decreases.

Very satisfied homeowners have indicated 85,90% of the time that they feel (very) secure in the neighborhood. Just satisfied homeowners indicate 78,24% of the time that they feel (very) secure, where the numbers that say feel very secure is 11,96% less than of the homeowners that are very satisfied. Neutral or dissatisfied homeowners still often feel safe in the neighborhood (approximately 50%), but show to be neutral more than the (very) satisfied homeowners (approximate average per category of 35% opposed to 16% of the (very) satisfied homeowners).

Social bonds are valued mostly high and neutral throughout all categories of neighborhood satisfaction. It does not seem to influence neighborhood satisfaction much. The answer 'high' is the most given answer.

Neighborhood Satisfaction					
	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Neighborhood Attachment					
<i>Very High</i>	30,00%	7,16%	5,58%	8,13%	9,40%
<i>High</i>	34,50%	38,30%	11,80%	6,30%	6,58%
<i>Neutral</i>	11,40%	31,20%	33,80%	5,42%	6,27%
<i>Low</i>	6,17%	13,00%	17,40%	14,40%	12,40%
<i>Very Low</i>	4,95%	3,47%	11,10%	24,90%	18,10%
<i>Don't Know</i>	6,36%	3,72%	10,00%	20,10%	23,20%
Secure Feel Neighborhood					
<i>Very High</i>	14,30%	2,34%	6,36%	12,70%	14,70%
<i>High</i>	71,60%	75,90%	47,10%	52,60%	46,50%
<i>Neutral</i>	12,00%	20,70%	42,50%	27,20%	31,50%
<i>Low</i>	1,14%	0,51%	2,77%	4,71%	4,15%
Social Bonds Neighborhood					
<i>Very High</i>	6,60%	5,05%	6,19%	8,39%	8,25%
<i>High</i>	41,00%	38,90%	36,30%	35,10%	36,00%
<i>Neutral</i>	41,40%	45,60%	44,90%	40,80%	40,40%
<i>Low</i>	8,48%	8,35%	9,87%	11,80%	11,60%
<i>Very Low</i>	1,23%	1,02%	1,35%	1,88%	1,82%
Outdoor Facilities Neighborhood					
<i>Very Satisfied</i>	12,90%	10,80%	12,10%	15,10%	15,10%
<i>Satisfied</i>	55,90%	60,30%	56,90%	48,80%	49,10%
<i>Neutral</i>	23,00%	22,00%	22,10%	24,50%	24,50%
<i>Dissatisfied</i>	6,99%	5,95%	7,59%	9,85%	9,56%
<i>Very Dissatisfied</i>	1,20%	0,99%	1,31%	1,83%	1,78%
Upkeep/Quality Outdoors Neighborhood					
<i>Very Satisfied</i>	7,21%	6,42%	6,98%	8,13%	8,10%
<i>Satisfied</i>	60,40%	61,40%	60,60%	58,80%	58,90%
<i>Neutral</i>	25,90%	25,90%	25,90%	26,10%	26,00%
<i>Dissatisfied</i>	5,57%	5,41%	5,62%	5,99%	5,95%
<i>Very Dissatisfied</i>	0,43%	0,39%	0,44%	0,53%	0,52%
Wish to Move					
<i>Definitely Not</i>	77,60%	73,70%	36,70%	10,00%	16,70%
<i>Indifferent</i>	12,10%	18,30%	45,00%	50,00%	16,70%
<i>If I Could</i>	0,93%	1,53%	6,67%	10,00%	16,70%
<i>Definitely Yes</i>	3,74%	3,82%	3,33%	20,00%	33,30%
Investment Behavior					
<i>Yes</i>	69,30%	70,00%	67,60%	63,50%	60,60%
<i>No</i>	30,70%	30,00%	32,40%	36,50%	39,40%

Table 8.6: Outcomes scenarios neighborhood

Upkeep and quality outdoors again do not really predict levels of neighborhood satisfaction. The averages of all categories stay more or less the same throughout the different levels of neighborhood satisfaction.

The level of neighborhood satisfaction does not explicitly show much difference between the evaluations of outdoor facilities. Answers high and neutral are again the most given answers, where high is the average outcome.

The wish to move is better predicted by neighborhood satisfaction, as hypothesized and found in literature. Very satisfied and satisfied homeowners express mostly the answer 'definitely not', with 77,6% respectively 73,10% of the answers. When neutral about satisfaction or dissatisfied, the homeowners express to be indifferent about moving, respectively 45,00% and 50,00%. Also, being dissatisfied raises the definitely yes category to 20,00% and for very dissatisfied homeowners even to 33,30%.

And last, looking what the satisfaction level does for the investment probability, we see that very satisfied and satisfied homeowners respectively 69,30% and 70,00% of the times show investment behavior. Dissatisfied or very dissatisfied homeowners or very dissatisfied homeowners show less investment behavior (63,50% respectively 60,60%). This is a difference of approximately 8%. Neutral homeowners still show 67,60% investment behavior. This result also shows that the difference between very satisfied and satisfied is not very significant for investment behavior, even not being neutral about the neighborhood, but the actual difference between being satisfied and being (very) dissatisfied is somewhat related to investment behavior.

8.5. Conclusion

Out of the results, we see that the hypothesized link in the model does exist, when using a slightly lower threshold of 0,7 in the BBN model. Moving wishes provide approximately 6% difference between investors and non-investors, and neighborhood satisfaction approximately 5%. When controlling for neighborhood satisfaction it is clear, that the crucial point lies at being dissatisfied. Dissatisfied people show less investment behavior, while neutral and (very) satisfied do not differ a lot (2%).

Price Consciousness and education level prove, next to the hypothesis, to be significant predictors of investment behavior.



9. Conclusion and discussion

In this graduation thesis, a relationship between neighborhood satisfaction and private homeowners who are/were willing to invest in sustainable improvements to their dwelling was investigated. This was done using a Bayesian Belief Network (BBN) to research relationships within the decision-making process of private homeowners. The main research question is:

“Is there a connection between the investment behavior of private homeowners and their neighborhood satisfaction? Can a neighborhood upgrade, a high level of neighborhood satisfaction, encourage private homeowner sustainable investment behavior?”

The research question will be answered through the research sub questions.

1. What is neighborhood satisfaction?

Neighborhood satisfaction is a subjective opinion of a resident of this neighborhood. It describes the congruence between the actual neighborhood situation, both physical aspects and social relations within the neighborhood, the value of the resident and the desired situation of the resident. This means that incongruence between the actual situation and the desired situation of the resident, the resident is more likely to be dissatisfied.

2. Which factors are important in the evaluation of neighborhood satisfaction?

A Principal Component Analysis found four over-all components of different tested aspects derived from the literature study in Chapter 2. These components are: Social relationships (social), Security within the neighborhood (ethnicities, troubles, nuisance) (social), outdoor facilities (green space, parking places and playgrounds) (physical) and the general upkeep and quality of the main infrastructure in the neighborhood (physical). The BBN model found a direct link between neighborhood satisfaction and feeling secure in the neighborhood. Indirect through neighborhood attachment, social bonds and outdoors facilities are linked to neighborhood satisfaction. Upkeep is linked to outdoor facilities. These two possibly interrelate, because outdoor facilities in a neighborhood could be good, but still badly appreciated by homeowners because the upkeep of the overall area is bad, or vice versa. In the literature study in Chapter 2, also a suggested relation to neighborhood attachment and moving intentions were found. The BBN model confirmed a relationship between neighborhood satisfaction and neighborhood attachment. Being satisfied with the neighborhood proved to not automatically mean being attached to the neighborhood. Very satisfied homeowners indicate either a very high or high attachment to the neighborhood, whilst just satisfied homeowners indicate to be either attached or neutral. So neighborhood satisfaction levels are often higher than attachment levels, even though there seems to be a linear effect between the two.

Mobility also seems to be predicted by neighborhood satisfaction levels, and indirect predicted by neighborhood attachment levels.

3. What factors are important in the decision-making process of homeowners to invest in sustainable improvements of their house?

Evaluating literature on decision-making, the factors ‘Attitude’, divided in environmental concern, importance of comfort, importance of health and price consciousness, knowledge of own energy use and of the possibilities for sustainable upgrade, socio-demographic

factors as age, household, education and ability, in the form of money/funds and subsidies, and as addition neighborhood satisfaction, neighborhood attachment and mobility were formed into an 'Investment behavior decision model'. In this study the ability factors influence was studied less, because of the choice of samples within the same property value range, to evaluate the same categories of neighborhoods.

4. How do these factors relate to sustainable investment behavior?

The BBN model showed a direct causal link between the attitude that the value of the property increases when investing and investment behavior, so a price conscious attitude. The attitude about the importance of future energy saving, part price conscious and part environmental awareness, was found to be a first order indirect link, working through the attitude of 'increase value property'. The other attitudes are all second order indirect links, except for comfort increase, which seems to not influence investment behavior when looking at the descriptive links in the model. Of the knowledge factors, only awareness of energy use has a link to investment behavior, and also a direct link. The socio demographic value education has a direct link with investment behavior, the rest influence the other factors first and work as indirect influences.

Price consciousness

Private homeowners that show investment behavior are more likely to believe that their property value increases because of the investment (19.8% more). This implicates that private homeowners are very price conscious and that money or future benefit in the form of value gain is the most important factor for investment behavior found in this research.

The attitude on importance of energy saving in the future, which is part of price consciousness and part of environmental awareness, is the second highest attitude predictor for investors (with 5.90% more than non-investors), which again indicates the importance of 'value'. Because energy saving is reachable on more aspects than just investing in your house, it is more likely that non-investors still have a high attitude on the importance of future energy saving. Other forms of energy saving behavior were not tested in this model, so the impact of this is unknown. Also, smaller energy saving measures, for example using LED lighting and using less heating, does not require a big investment and could lead non-investors to still have a high attitude of future energy saving, because they already are involved by thinking about these smaller measures.

Focusing in information provision on actual facts on value increase of the property when investing in your house and other money or value related topics towards the investment, for example more insight in energy saving per measure and informing about the predicted rises in energy costs due to running out of fossil fuels, may be the most effective way to urge private homeowners to invest in their house. Of course, the small measures are a great start, and the homeowners that already think of saving energy this way, may very well be the best group to target.

Environmental awareness

The importance of climate change does not show to be a good predictor of investment behavior. The overall agreement with this attitude is about 20% less than the attitudes about the increase of the value of the property or the importance of future energy saving, and was approximately the same within the investors and non-investors group. Environmental problems are still a topic of discussion and there are a lot of skeptics.

Informing about the consequences will not likely influence skeptics more and therefore not especially urge homeowners to invest more.

The importance of energy saving in the future however does seem to have a relationship with the attitude of increasing value of property, which is a price conscious value, as described above. This means that people that may have less feeling with the climate change issue, could be more acceptable to the problem of running out of fossil fuels, which causes future rise of energy prices. Again, referring to the importance of price consciousness, focusing more on rising energy prices and running out of fossil fuels in the provision of information could influence investment behavior for price conscious homeowners.

Comfort and health increase

Comfort and health increases are not good single predictor factors of investment behavior. They are not found to differ much in percentages between investors and not investors. Comfort increases are over all more acknowledged by homeowners than health improvements, so information provision about health improvement benefits could lead to this attitude being more predictive in the future. Comfort increases are extra benefits that come with improving the dwelling, but are not found to be the predicting value or value that is the incentive for investing. This could be because of lack of information on forehand, or the price conscious attitude that is leading for investments over just comfort of health increases.

Knowledge

Approximately 6,70% more of the investors have more awareness of energy use than non-investors. Non-investors also claim more often to don't know how high their awareness is. This is not a surprising result, because when investing in energy saving measures, you either find that your energy use on forehand is too high and/or you want to monitor the improvements. When you are very conscious about your energy use, for example because of your monthly expenses that rise, it is more likely you decide to invest. The fact that still a lot of non-investors claim to have high awareness of their energy use, suggests that they may not be alarmed by their energy use and can afford their energy bills.

Again, providing information about the expected trend in rising energy prices because of the disappearing fossil fuels, especially targeted on very clear examples of how monthly expenses will rise in the next years, can probably urge homeowners to invest more.

Insight in sustainable measures does not seem to be a good predictor of investment behavior in this model. Most respondents think they have average to high knowledge.

This can indicate that non-investors either think they have more insight than they have and base their decision not to invest on incomplete information, or really did research possibilities and found these not convincing. This could be a concern. Investors still often do not claim to have high insight, which can indicate that maybe still information about sustainable improvements is not clear enough to most homeowners, or not easy enough to find and a lot of the investments were based on expert recommendations. Improving the knowledge about sustainable improvement options in clear information provision may help to give homeowners more insight in options and decide to invest.

Socio-demographics

Of the socio demographics, only education seems a valid predictor, with a direct link to investment behavior. Of the investors 10.70% more have had a higher level education and of the non-investors 7.73% has had a lower education level. Medium levels do not differ much between the groups. This means that having a higher education level makes a homeowner more probable to invest.

This could be because higher educated persons are more aware of implications of a higher energy use on costs, learn quicker about sustainable improvement options or have learned this in their education. In Eindhoven, relatively more engineers reside (Brainport, 2013), because of the engineering sector of businesses that is dominant in Eindhoven, and because the city's university is a university of technology.

5. Is there a connection between neighborhood satisfaction and the investment behavior in sustainable improvements of the house?

Together with above-mentioned decision-making aspects, neighborhood satisfaction, attachment and wish to move was also investigated. In the BBN model, wish to move shows a direct link with investment behavior at threshold 0.7. This link was hypothesized in the exploratory conceptual model and is confirmed in the BBN model. Neighborhood satisfaction shows a direct link to wish to move, which was also hypothesized in the conceptual model and is confirmed by the BBN model. Neighborhood attachment shows a direct link to neighborhood satisfaction, but no direct link to wish to move, which was hypothesized to be there in the conceptual model. This link is not confirmed. The link to neighborhood satisfaction was hypothesized and again confirmed by the model.

Wish to Move

Of the homeowners that show investment behavior, 7,5% more indicate to definitely do not want to move, whereas of the non-investors 6,34% more indicate that they definitely want to move.

When controlling for neighborhood satisfaction levels, more satisfied homeowners indicate more that they definitely don't want to move than dissatisfied homeowners (approximately 55% more). Answers 'if I could' and 'definitely yes' also decrease significantly when more satisfied (respectively approximately 15% and 30% averages).

Neighborhood attachment

Neighborhood attachment also shows some marginal differences between investors and non-investors, but does not show any trend in results.

When controlling for states of neighborhood satisfaction, neighborhood attachment also changes significantly. When (very) attached to the neighborhood, most homeowners are also (very) satisfied, but when satisfied, the homeowners are not always (very) attached. There is a linear trend in the results, where attachment levels always occur somewhat less than satisfaction.

Neighborhood Satisfaction

Of the investors, 5,20% more were (very) satisfied with the neighborhood opposed to non-investors. Non-investors were more often (very) dissatisfied (3,41% more) than investors.

When controlling for neighborhood satisfaction and looking at the percentages of possible investors, the model shows that with more neighborhood satisfaction, the percentage of

investors increase, opposed to low satisfaction. A difference of approximately 8% between satisfied and dissatisfied investment levels is found. Being neutral about neighborhood satisfaction shows only approximately 2% less investment behavior than for being satisfied.

Concluding answer main research question

In the model, an indirect relationship between neighborhood satisfaction and investment behavior is found, through the wish to move. The wish to move or wish to stay influences the shown investment behavior. Also, the wish to move is influenced by neighborhood satisfaction levels, so indirect there is a link. When looking at the differences that occur when controlling for investment behavior, only 5,20% more of the investors are (very) satisfied with the neighborhood and 3,41% of the non-investors are more dissatisfied. This shows that there is an effect. Next, when looking at the investment percentages that show in the model when controlling for neighborhood satisfaction levels, is that 8% more of the homeowners that indicate to be (very) satisfied did show more investment behavior. This again confirms that there is an effect. What also has to be taken into account, is that the difference between (very) satisfied with the neighborhood and investment levels opposed to being neutral about the neighborhood and investment levels, only differ at most 2%. So the biggest indicator seems to be dissatisfaction, rather than homeowners being satisfied with their living environment. Also, the neighborhood factors that should give more insight in which factors have the most influence on neighborhood satisfaction do not show much difference between neighborhood satisfaction levels; so more research is needed to define what causes homeowners to be dissatisfied with their neighborhood to make this finding usable for policy making; using a neighborhood upgrade to make homeowners more willing to invest.

Resulting from the attitudinal study, price consciousness proved to be the best indicator for investment behavior, with the increase of property value as leading attitude. When the neighborhood upgrade will improve property values as well and is promoted as such, there might be a possibility to implement this as a policy in neighborhoods with homeowners that are dissatisfied with their neighborhood and the factors that are mostly responsible for this satisfaction are discovered.

The biggest impact however, should occur when providing information about price conscious attitudes, such as increasing property values and increasing energy prices.



10. Limitations and Recommendations

This research was performed with certain limits and boundaries. These will be discussed in this chapter. After this, recommendations for future study are presented.

10.1. Limitations

Because of the limited timeframe of the research, pre-defined limitations were set that are discussed in Chapter 1.6.

This research focuses on the city of Eindhoven and the energy neutral ambitions of the city. This means that the case study population was also sampled in Eindhoven. It may be possible that inhabitants of other parts of The Netherlands or the rest of the world may respond differently due to their living environments and living standards.

The research also focuses on the private homeowner within a property value segment of 200.000 euros to 275.000 euros. Homeowners that own houses not in this segment may also respond differently, because of other living standards and attitudes and levels of neighborhood satisfactions.

With posterior knowledge it can be said that more questions about attitudes and knowledge (and money-related questions) were probably needed for a greater insight in these variables. Because the questionnaire was focused on neighborhood aspects, these aspects got to little attention in the survey to prevent it from becoming too long.

The big number of incomplete surveys reduced the usable response rate. The incomplete surveys were all mail returned and mostly filled in by elderly citizens.

An over response of elderly citizens could create a biased result, because a lot mentioned in open-ended questions that their age withholds them from certain actions.

10.2. Recommendations

Out of the conclusions of the study and the limitations, some recommendations for further study can be made.

First, the understanding of attitudes is very complex, but interesting in the field of decision-making for sustainable improvements of the existing housing stock. It is recommended to go into further detail exploring these attitudes. A qualitative study based on interviews could get more in depth of understanding these attitudes and refine them more.

Second, the influence of the ability factor, which consists of money, value and subsidy related influences is still a very important part in decision-making. Research focused on investment behavior without stimuli as subsidies can further be explored.

Third, the influence of the growing number of elderly citizens (the aging population) has on the investment behavior. As a side result of this research, mainly through investigating open-ended questions, several problems arose from elderly citizens to investing. Investigating how elderly could be more urged and facilitated is a valuable addition to investment research.

Last but not least, I would recommend researching further into the topic of neighborhood satisfaction in relation to investment behavior. This is because the link is very indirect and may not be defined well enough in this research for use in policymaking, because of the exploring nature of this research. Also, the best way of promoting this to homeowners and of course, after these researches find a good result, the way these neighborhood improvements could be implemented in terms of organization, finances, et cetera.

— |

11. Acknowledgements

The road from the beginning to the end of this research was not without corners, bumps and roadblocks. There are a few people and instances I would like to thank for helping me on my way and reaching my final destination.

First, I would like to thank Jan Bekkering for the opportunity of a graduation internship at HetEnergieBureau B.V. and brainstorming with me about a possible research subject. This brainstorm would lead the way to the research that has been done. Providing me with a comfortable desk and work environment, with nice and warm-hearted colleagues, made my process a pleasant one. I would like to thank all colleagues at HetEnergieBureau for the pleasant times, talks, hints, tips and one of the most important ingredients: coffee. Especially I would like to thank Maurice for his help, 'mentoring' words as experienced CME graduate and of course the countless pleasant 'fights' about whose turn it was to get coffee now.

Second, I would like to thank Kees van der Hoeven from the municipality of Eindhoven. He was not hesitant to provide me the data I needed for my survey and always replied to my mails and requests. Even during his free time, he was prepared to evaluate my letters and survey.

Third, I would like to thank my guidance committee. Especially, I would like to thank Paul Masselink, for his suggestions, enthusiasm about my topic and encouraging words near the end of the research. The reassurance that 'no result' was also a 'result' could pull me together at the end.

Fourth, I would like to thank Astrid Kemperman, for helping me with my research methodology and the acquiring of data from the Ministry of the Interior and Kingdom Relations.

And last, but certainly not least, I would like to thank my mother, sister and friends, who pulled me through and tried to motivate me during the research and especially just before the finish line, the hardest time in my research process. Your support was very important to me.

List of abbreviations

ATT	Attitude
BBN	Bayesian Belief Network
BiO	Department of Policy information and research of the Municipality of Eindhoven (The Netherlands)
CBS	Central Bureau for Statistics (The Netherlands)
CP table	Conditional Probability Table
DAG	Directed Acyclic Graph
IMF	International Monetary Fund
MAO	Motivation, Ability, Opportunity
TU/e	Technische Universiteit Eindhoven
WTP	Willingness To Pay

List of figures

Figure 1.1: Research design	11
Figure 2.1: Scheme for residential satisfaction by residents (Marsman & Leidelmeijer, 2001)	16
Figure 2.2: Neighborhood satisfaction evaluation by residents	17
Figure 2.4: Integrated hypothetic model for the influences of neighborhood satisfaction, attachment and mobility	22
Figure 3.3: Hypothised Model of determinants of willingness to pay (WTP) for green electricity (Hansla et al., 2008)	25
Figure 3.4: Energy saving behavior model (Han et al., 2013)	25
Figure 3.5: Conceptual model for market acceptance and willingness to pay for sustainable new built dwellings (Luijten, 2010)	26
Figure 3.6: Hypothetic model of the influence of neighborhood satisfaction on willingness to invest	28
Figure 5.1: Statistical neighborhood division of the city of Eindhoven (Schampaert, 2010)	31
Figure 6.1: Example of five-point likert scale questions in questionnaire	36
Figure 8.1: First constructed BBN model, threshold 1.0, changed link directions	40
Figure 8.2: Final constructed and accepted model, threshold 0.7, changed link directions	41
Figure 8.3: Final model imported in Norsys Netica	42

List of tables

Table 5.1: Characteristics of the city of Eindhoven. (Buurtmonitor Eindhoven, 2012)	32
Table 5.2: Average neighborhood evaluation scores of the city of Eindhoven (Buurtmonitor Eindhoven, 2012)	32
Table 5.3: Characteristics selected case study neighborhoods (Buurtmonitor Eindhoven, 2012)	34
Table 6.1: Characteristics per neighborhood	35
Table 7.1: Response to survey	37
Table 7.2: Response characteristics	37
Table 8.1: Outcomes Attitudinal factors Scenarios Investment Behavior	43
Table 8.2: Outcomes knowledge factors Scenarios Investment Behavior	44
Table 8.3: Outcomes Wish to Move, Neighborhood Satisfaction, attachment and factors Scenarios Investment Behavior	45
Table 8.4: Outcome Ability Scenarios Investment Behavior	46
Table 8.5: Outcome Socio-demographic Scenarios Investment Behavior	47
Table 8.6: Outcomes scenarios neighborhood	48

References

- AgentschapNL (2011). *Blok voor Blok*. last visited on the 12th of September, 2012, from www.agentschapnl.nl/print/book/export/html/107269,
- Aiello, A., Ardone, R. G., & Scopelliti, M. (2010). Neighbourhood planning improvement: Physical attributes, cognitive and affective evaluation and activities in two neighbourhoods in Rome. *Evaluation and Program Planning*, 33(3), 264–275.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Amerigo, M., & Aragones, J. I. (1997). A Theoretical and Methodological Approach to the Study of Residential Satisfaction. *Journal of Environmental Psychology*, 47–57.
- Arentze, T. A., Oppewal, H., & Timmermans, H. J. P. (2005). A multipurpose shopping trip model to assess retail agglomeration effects. *Journal of Marketing Research*, 109–115.
- Arentze, T., & Timmermans, H. (2009). Regimes in social-cultural events-driven activity sequences: Modelling approach and empirical application. *Transportation Research Part a: Policy and Practice*, 43(4), 311–322.
- Basolo, V., & Strong, D. (2002). Understanding the neighborhood: From residents' perceptions and needs to action. *Housing Policy Debate*, 13(1), 83–105.
- Bonaiuto, M., Aiello, A., Perugini, M., Bonnes, M., & Ercolani, A. P. (1999). Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. *Journal of Environmental Psychology*, 19(4), 331–352.
- Bonaiuto, M., Fornara, F., & Bonnes, M. (2003). Indexes of perceived residential environment quality and neighbourhood attachment in urban environments: a confirmation study on the city of Rome. *Landscape and Urban Planning*, 65(1-2), 41–52.
- Borchers, A. M., Duke, J. M., & Parsons, G. R. (2007). Does willingness to pay for green energy differ by source? *Energy Policy*, 35(6), 3327–3334.
- Brainport (2013) Brainport, last visited on the 1st of March, 2013 from <http://www.brainport.nl>
- Brown, G. Brown, B. Perkins, D. (2004). New Housing as Neighborhood Revitalization. Place Attachment and Confidence Among Residents. *Environment and Behavior* 36, 749-775.
- Brown, B. B., & Perkins, D. D. (1992). Disruptions in place attachment. Place attachment, 12, 279-304.
- Bruin, M.J., & Cook, C.C. (1997). Understanding constraints and residential satisfaction among low-income single-parent families. *Environment and Behavior*, 29, 532-533.
- Builddesk (2011). Transitie naar Energie Neutrale Steden. Slimme sturing door gemeenten nodig. *Energie Vol. 1*.
- Builddesk (2010a). *NL Energieneutraal in 2040. Alles uit de kast, en dan genieten!* Builddesk Benelux B.V., Arnhem. Projectnummer: 100086000
- Builddesk (2010b). Potentieelscan energiebesparing bestaande woningen. Builddesk Benelux b.v.
- Buurtmonitor Eindhoven. Last visited on the 28th of December, 2012, from <http://eindhoven.buurtmonitor.nl>.
- Centraal Bureau voor Statistiek. last visited on the 28th of December, 2012, from <http://www.cbs.nl/nl-NL/menu/home/default.htm>
- Cheng, J., Bell, D. A., & Liu, W. (1997). Learning belief networks from data: An information

- theory based approach, 325–331.
- Cho, Y., Park, G.-S., & Echevarria-Cruz, S. (2005). Perceived neighborhood characteristics and the health of adult Koreans. *Social Science & Medicine*, 60(6), 1285–1297.
- Connerly, C. Marans, R. (1988). Neighborhood Quality: A Description and Analysis of Indicators. In Huttman, E. and W. van Vliet (eds.), *The U.S. Handbook on Housing and the Built Environment*, Westwood, CO.: Greenwood Press.
- De Heus, P. Van der Leeden, R. Gazendam, B. (2001) Toegepaste Data-Analyse. technieken voor niet-experimenteel onderzoek in de sociale wetenschappen. Reed Business BV, Nederland, ISBN 9035222555.
- Downs, A. (1979). Key Relationships Between Urban Development and Neighborhood Change. *APA Journal*, 462 – 472
- EuropaNu (2010). last visited on the 28th of August, 2012, from http://www.europa-nu.nl/id/vi99ks4yzlac/klimaatconferentie_kopenhagen ,
- Fang, Y. (2006) Residential Satisfaction, Moving Intention and Moving Behaviors: A study of Redeveloped Neighborhoods in Inner-City Being. *Housing Studies* 21(5), 671 – 694
- Feijten, P., & van Ham, M. (2009). Neighbourhood Change... Reason to Leave? *Urban Studies*, 46(10), 2103–2122.
- Forrest, R. and Kearns, A. (1999) Joined-up Places? Social Cohesion and Neighbourhood Regeneration. York: York Publishing Services, for Joseph Rowntree Trust.
- Galster, G. (1981). A neighborhood interaction model of housing maintenance and quality changes by owner occupants. *Regional Science Perspectives*, 11, 29–48.
- Galster, G. (2001). On the Nature of Neighbourhood. *Urban Studies*, 38(12), 2111–2124.
- Galster, G. C., & Hesser, G. W. (1982). The Social Neighborhood An Unspecified Factor in Homeowner Maintenance? *Urban Affairs Review*, 18(2), 235–254.
- GemeenteEindhoven. (2008). Groei van Eindhoven. Last visited on December 31st, 2012, from <http://www.eindhoven.nl/stad/historie-1/Groei-van-Eindhoven-1.htm>
- Gemeente Eindhoven (2009) Programma Wonen 20120-2015, met een doorkijk naar 2020. Sector gebiedsontwikkeling Gemeente Eindhoven.
- Han, Q., Nieuwenhijzen, I., de Vries, B., Blokhuis, E., & Schaefer, W. (2013). Intervention strategy to stimulate energy-saving behavior of local residents. *Energy Policy*, 52(C), 706–715.
- Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). Psychological determinants of attitude towards and willingness to pay for green electricity. *Energy Policy*, 36(2), 768–774.
- Herting, J. Guest, A. (1985). Components of satisfaction with local areas of the metropolis. *Sociological Quarterly* 26, 99-115.
- IMF (2012). The Future of Oil: Geology versus Technology. *International Monetary Fund Research Department Working Paper*.
- Janse, A., Reneman, L., Herder, Den, N., & Wouters, R. (2008). Leefbaarheid in Schoonhoven, Nederlek en Bergambacht. *Rigo Research en Advies B.v.*
- Kearney, A. R. (2006). Residential Development Patterns and Neighborhood Satisfaction: Impacts of Density and Nearby Nature. *Environment and Behavior*, 38(1), 112–139.
- Kemperman, A. D. A. M., & Timmermans, H. J. P. (2011). Children's recreational physical activity. *Leisure Sciences*, 33(3), 183–204.
- Kemperman, A., & Timmermans, H. (2012). Environmental Correlates of Active Travel

- Behavior of Children. *Environment and Behavior*.
- KENWIB (2012). last visited on the 28th of August, 2012, from <http://www.kenwib.nl/>
- Keuleers, B., Wets, G., Arentze, T.A. & Timmermans, H.J.P. (2001). Association rules in identification of spatial-temporal patterns in multiday activity diary data. *Transportation Research Record*, 1752, 32-37.
- Krueger R.F, Markon K.E, Patrick C.J, Benning S.D, Kramer M. (2007) Linking antisocial behavior, substance use, and personality: an integrative quantitative model of the adult externalizing spectrum. *Abnormal Psychology* 2007;116, 645–666
- Lauritzen, S. L. (1995). The EM algorithm for graphical association models with missing data. *Computational Statistics & Data Analysis*, 19, 191-201
- Lee, S. (2010). The association between neighborhood environment and neighborhood satisfaction: moderating effects of demographics. *MSc. San Diego State University*.
- Leidelmeijer, K., & Van Kamp, L. (2004). Kwaliteit van de Leefomgeving en Leefbaarheid. *Rigo Research en Advies B.v. and RIVM*.
- Leidelmeijer, K., Marlet, G., Schulenberg, R., & Van Woerkens, C. (2011a). Leefbaarheid in balans. *Rigo Research en Advies B.v. Atlas Voor Gemeenten*.
- Leidelmeijer, K., Marlet, G., Van Woerkens, C., & Schulenberg, R. (2011b). Omslagpunten in de ontwikkeling van wijken. *Rigo Research en Advies B.v.*
- Leslie, E., & Cerin, E. (2008). Are perceptions of the local environment related to neighbourhood satisfaction and mental health in adults? *Preventive Medicine*, 47(3), 273–278.
- Londo, H. Bree, B. (2010). Masterplan Energie Noord-Brabant in perspectief. Kwantificering en analyse van de ambities in vergelijking met landelijke doelstellingen. *Energieonderzoek Centrum Nederland*
- Lu, M. (1999). Determinants of residential satisfaction: Ordered logit vs. regression models. *Growth and Change*, 30(2), 264–287.
- Luijten, A. (2010). Consument en duurzaamheid, NAW dossier extra, 11-30
- Lyssen, E. (1996) The Trias Energetica: Solar Energy Strategies for Developing Countries. *Eurosun Conference, Freiburg*.
- Marans, R. Rodgers, W. (1975) Toward an understanding of community satisfaction. Metropolitan America in Contemporary Perspective. In Hawley, A. and V. Rock (eds.) *Metropolitan America in Contemporary Perspective*. New York, Halsted Press, 1975.
- Meermetminder (2012). Last visited on the 28th of August, from <http://www.meermetminder.nl/43/over-ons.html>.
- Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2011). Plan van Aanpak Energiebesparing Gebouwde Omgeving.
- Ministerie van Infrastructuur en Milieu (2012). Investeren in gebiedsontwikkeling nieuwe stijl. Handreikingen voor samenwerking en verdienmodellen. *Fakton in opdracht van Ministerie van Infrastructuur en Milieu, Den Haag*.
- Nieuwenhuijsen, I. (2010). Urging residents in Eindhoven to save energy. Towards Energy Neutral Eindhoven in 2040 TU/e 2010. Graduation Thesis Construction Management and Engineering, Eindhoven University of Technology.
- Norsys (2011) last visited on the 2nd of March, 2013, from <http://www.norsys.com/download.html>,
- Olander, F., & Thøgersen, J. (1995). Understanding of Consumer Behaviour as a Prerequisite for Environmental Protection. *Journal of Consumer Policy*, 18, 345–385.

- Parkes, A., Kearns, A., & Atkinson, R. (2002). What Makes People Dissatisfied with their Neighbourhoods? *Urban Studies*, 39(13), 2413–2438.
- Parvaneh, Z., Arentze, T., & Timmermans, H. (2012). Understanding Travelers' Behavior in Provision of Travel Information: A Bayesian Belief Approach. EWGT 2012 Compendium of Papers
- Permentier, M., van Ham, M., & Bolt, G. (2009). Neighbourhood reputation and the intention to leave the neighbourhood. *Environment and Planning A*, 41(9), 2162–2180.
- Poel, B. van Cruchten, G. Balaras, C. (2007). Energy performance assessment of existing dwellings. *Energy and Buildings*, 39, (4), pp.393–403
- Provincie Noord-Brabant (2009). Startmotitie Masterplan Energie Brabant 2010-2020: Energietransitie als kans. 's Hertogenbosch, The Netherlands
- Schampaert, M. (2010). Clusterindeling per buurt, indeling 2010. *Stadsontwikkeling en Beleidsinformatie & Onderzoek (BiO, Gemeente Eindhoven)*.
- Schepers, W., & Buys, A. (2010). Bewonersonderzoek Bomenbuurt Winschoten. *SEV, RIGO Research en Advies, B.v.*
- SCP. (2007). Veel geluk in 2007, 1–167.
- Senternovem (2006). Basisdocument: Wat is Duurzaam Bouwen? *Den Haag, The Netherlands*.
- Sharmeen, F., & Timmermans, H. (2011). Effects of Residential Move on Interaction Frequency with Social Network. *Proceedings of the 16th International Conference of Hong Kong Society for Transportation Studies*.
- Sirgy, M. J., & Cornwell, T. (2002). How neighborhood features affect quality of life. *Social Indicators Research*, 59(1), 79–114.
- Talen, E., & Shah, S. (2007). Neighborhood Evaluation Using GIS: An Exploratory Study. *Environment and Behavior*, 39(5), 583–615.
- Telos (2008). Energiek Brabant. Een scenariostudie naar de energievoorziening van Noord-Brabant in 2040. *Telos, Brabants centrum voor duurzame ontwikkeling*.
- VROM (2007) Nieuwe Energie voor het Klimaat: Schoon en zuinig.
- Verhoeven, M., Arentze, T., Timmermans, H., & Waerden, P. (2006). Modelling Consumer Choice Behaviour with Bayesian Belief Networks. *Proceedings of the RARCS Conference, Budapest, Hungary*, 18
- Verlet, D., & Callens, M. (2010). SVR-studie: De kwaliteit van het leven, een mozaïek van het dagelijks leven. *Studiedienst Van De Vlaamse Regering*.

Appendices

Appendix A: Questionnaire information

A1 Invitation Letter

Geachte heer/mevrouw,

Voor mijn afstuderen voer ik een onderzoek uit naar de kwaliteit van buurten in Eindhoven en het energiebewustzijn van haar inwoners.

Hierbij is uw buurt, «Brtnm», uitgekozen als een goede, representatieve buurt van Eindhoven.

De gemeente Eindhoven heeft de doelstelling energieneutraal te worden in 2040. Dit houdt in dat het totale energieverbruik van de gemeente omlaag moet. Als huisbezitter speelt u hier een belangrijke rol in!

Hoe denkt u over het verbeteren van uw huis op energieverbruik?

Natuurlijk betekent een duurzame toekomst ook een lang houdbaar, dus duurzaam woonplezier. Uw tevredenheid met uw woonomgeving is daarbij van groot belang!

Graag wil ik het hoofd van dit huishouden uitnodigingen deel te nemen aan dit onderzoek. Deze enquête zal slechts 10 minuten van uw tijd in beslag nemen. U kunt de enquête invullen door naar de volgende site te gaan:

Enquête: https://nl.surveymonkey.com/s/onderzoek_tue«Kenm»

Wachtwoord: energie1

Als u naar deze site gaat en het gegeven wachtwoord intikt, krijgt u toegang tot de enquête.

Indien u niet in de gelegenheid bent deze enquête digitaal in te vullen, is er ook een papieren versie meegestuurd. Deze kunt u retourneren in bijgevoegde retourenvelop. Een postzegel is niet nodig.

Uiteraard worden uw antwoorden met zorg behandeld en wordt uw privacy gewaarborgd. Er worden geen gegevens verstrekt aan derden.

Wanneer u de enquête vóór 20 december 2012 invult, maakt u kans op een kleine prijs.

De resultaten van deze enquête zullen bijdragen aan een duurzame toekomst voor Eindhoven en een duurzame toekomst voor u!

Bij voorbaat hartelijk dank voor uw medewerking.

Met vriendelijke groet,
Elien Bisseling

A2 Reminder Letter

HERINNERING!

Geachte heer/mevrouw,

Ongeveer een week geleden heeft u een uitnodiging ontvangen om mee te doen aan mijn afstudeeronderzoek naar kwaliteit van buurten in Eindhoven en het energiebewustzijn van haar inwoners.

Respons uit uw buurt, «Brtnm», is hierbij van groot belang!

Heeft u de enquête al ingevuld?

Deze enquête vraagt slechts 10 minuten van uw tijd.
U kunt de enquête op de volgende site vinden:

Enquête: https://nl.surveymonkey.com/s/onderzoek_tue«Kenm»
Wachtwoord: energie1

Als u naar deze site gaat en het gegeven wachtwoord intikt, krijgt u toegang tot de enquête.

Uiteraard worden uw antwoorden met zorg behandeld en wordt uw privacy gewaarborgd. Er worden geen gegevens verstrekt aan derden.

Heeft u de enquête al ingevuld, dan dank ik u hartelijk voor uw deelname en kunt u deze brief als niet verzonden beschouwen.

Bij voorbaat hartelijk dank voor uw medewerking!

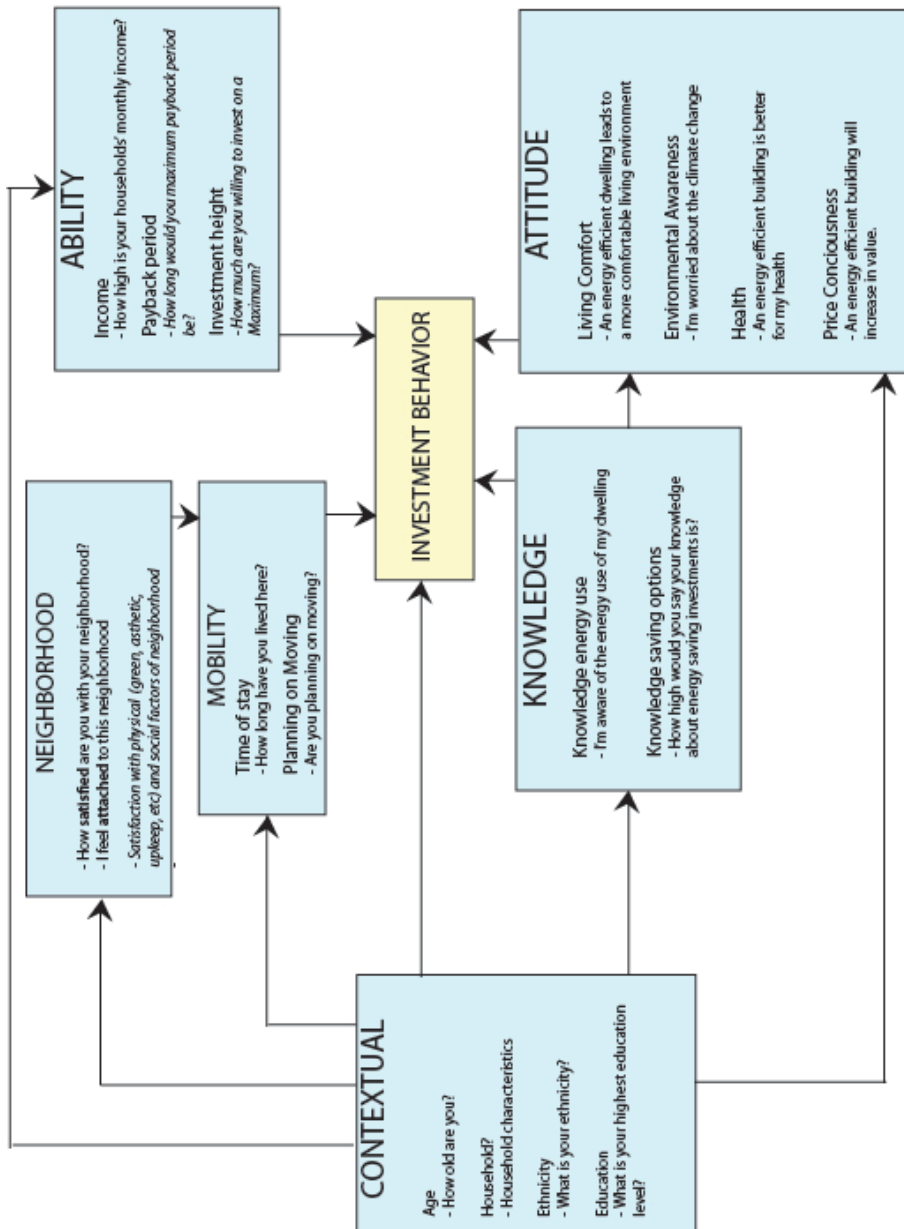
Met vriendelijke groet,
Elien Bisseling

A3 Respondent characteristics

Response survey per neighborhood	Column1	Prinsejagt	Tempel	Vaartbroek	Het Ven	Total	Percent age
Age	Under 18	0	0	0	0	0	0,00%
	18 to 25	1	1	0	0	2	0,50%
	25 to 35	14	10	9	16	49	11,70%
	35 to 45	18	13	16	27	74	17,70%
	45 to 55	20	20	18	20	78	18,60%
	55 to 65	26	17	19	12	74	17,70%
	Over 65	54	35	33	20	142	33,90%
	Missing					3	0,47%
Total		133	96	95	95	419	99,29%
	% of Total	31,52%	22,75%	22,51%	22,51%	100,00%	100,00%
Household	Single	23	9	18	16	66	15,80%
	Partners Without Children	60	53	41	38	192	46,00%
	Single Parent	2	5	2	6	15	7,11%
	Partners with Children	48	29	33	34	144	34,50%
	Missing					5	1,18%
	Total	133	96	94	94	417	98,82%
	% of Total	31,52%	22,75%	22,27%	22,27%	100,00%	100,00%
Income	Under 2.500 euros	12	12	10	13	47	11,40%
	Between 2.500 and 3.750 euros	50	24	28	25	127	30,80%
	Between 3.750 and 5000 euros	42	36	31	36	145	35,20%
	Won't say	27	22	26	18	93	22,60%
	Missing					10	2,37%
Total		131	94	95	92	412	97,63%
		31,04%	22,27%	22,51%	21,80%	100,00%	100,00%
Ethnicity	Dutch	130	93	92	93	408	97,80%
	Other	3	2	2	2	9	2,13%
	Missing					5	1,18%
Total		133	95	94	95	417	98,82%
		31,52%	22,51%	22,27%	22,51%	100,00%	100,00%
Investment Behavior	Yes	100	79	73	83	335	79,40%
	No	35	17	22	13	87	20,60%
Total		135	96	95	96	422	100,00%
		32,00%	22,70%	22,50%	22,70%	100,00%	100,00%
Dwelling Property Value	Under 200.000	15	5	10	5	35	9,00%
	Between 200.000 and 225.000	44	46	54	27	171	43,80%
	Between 225.000	27	24	20	34	105	26,90%

	and 250.000						
	Between 250.000 and 275.000	33	11	8	16	68	17,40%
	Over 275.000	5	3	1	2	11	2,80%
	Missing					32	7,58%
Total		124	89	93	84	390	92,42%
		29,38%	21,09%	22,04%	19,91%	100,00%	100,00%
Dwelling Year of Construction	Before 1945	0	0	0	65	65	15,70%
	1946 to 1964	86	2	9	20	117	28,30%
	1965 to 1974	42	63	60	5	170	41,10%
	1975 to 1991	4	28	23	3	58	14,00%
	1991 to 2005	1	1	1	1	4	1,00%
	2005 or later	0	0	0	0	0	0,00%
	Missing					8	1,90%
Total		133	94	93	94	414	98,10%
		31,52%	22,27%	22,04%	22,27%	100,00%	100,00%
Do you want to move withing 2 years?	Definitely not	106	65	69	56	296	72,20%
	Indifferent	18	23	18	31	90	22,10%
	If I Could	2	0	2	2	6	1,50%
	Definitely yes	3	3	4	5	15	3,70%
	Missing					15	3,55%
Total		129	91	93	94	407	96,45%
		30,57%	21,56%	22,04%	22,27%	100,00%	100,00%
Satisfied Neighborhood	Very Satisfied	47	25	9	21	102	24,30%
	Satisfied	75	59	72	51	257	61,20%
	Neutral	11	10	13	21	55	13,10%
	Dissatisfied	1	2	1	1	5	1,20%
	Very Dissatisfied	0	0	0	1	1	0,20%
	Missing					2	0,47%
Total		134	96	95	95	420	99,53%
		31,75%	22,75%	22,51%	22,51%	100,00%	100,00%
I am attached tot his neighborhood	Strongly Agree	24	13	3	13	53	12,70%
	Agree	67	30	37	36	170	40,80%
	Neutral	29	41	47	31	148	35,50%
	Disagree	13	7	7	13	40	9,60%
	Strongly Disagree	1	3	1	1	6	1,40%
	Missing					5	1,18%
Total		134	94	95	94	417	98,82%
		31,75%	22,27%	22,51%	22,27%	100,00%	100,00%

Appendix B: Conceptual Model



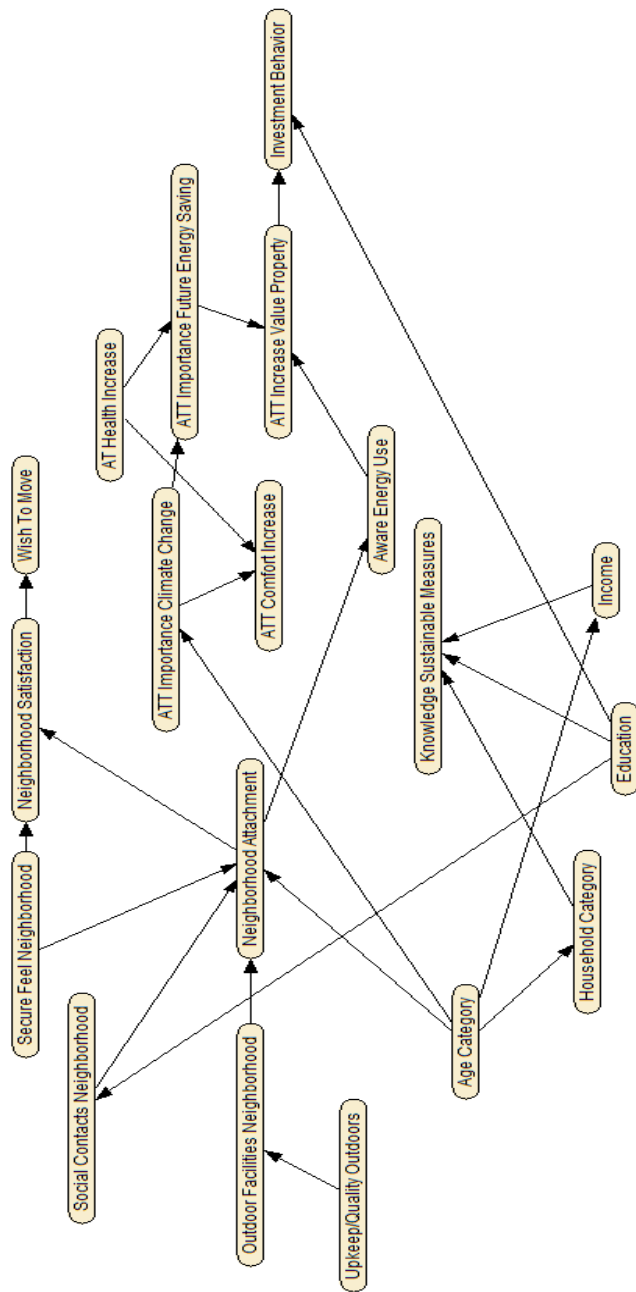
Appendix C: Data analysis output

C1 Variables

Variable	Question	Antw.code
Age	What age are you?	1=<18 / 2= 18 to 25 / 3=25 to 35 / 4=35 to 45 / 5=45 to 55 / 6=55 to 65 / 7=>65
HH	What is your household?	1=Single / 2=Partners w/o children / 3=Single Parent / 4=Partners w children
Educ	What is your highest completed education?	1=None / 2= Very Low Level/ 3=Low Level / 4=Medium Level / 5=High Level / 6=Other
INV_SUM	Did you invest or are you going to invest in sustainable measures for your house?	1= Yes / 2=No
KNWL_SUST	How do you value your knowledge of sustainable measures for your house?	1=Very High / 2=High / 3=Neutral / 4=Low / 5=Very Low / 6=Don't Know
ATT_CLIMATECHANGE	I am worried about climate change	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree / 6=Don't Know
ATT_COMFORT	A sustainable house leads to more comfort inside the house	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree / 6=Don't Know
ATT_HEALTH	A sustainable house is better for your health	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree / 6=Don't Know
KNWL_EU	I am informed about my energy use.	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree / 6=Don't Know
ATT_VP	A sustainable house will be of more value than a house that is not sustainable.	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree / 6=Don't Know
ATT_ESF	I think it is important that we save more energy in the future.	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree / 6=Don't Know
WTM	Do you want to move within 2 years?	1=Definitely not / 2=Potentially / 3=If I could / 4=Definitely yes
NBH_SAT	Are you satisfied with your neighborhood?	1=Very Satisfied / 2=Satisfied / 3=Neutral / 4=Dissatisfied / 5=Very dissatisfied
NBH_ATTACH	I feel attached to my neighborhood.	1=Very Agree / 2=Agree /

		3=Neutral / 4=Disagree / 5=Very Disagree
PC_SOCIAL	<ul style="list-style-type: none"> I have a lot of contacts with my neighbors I have a lot of contacts with my direct neighbors There is a lot of coherence in this neighborhood In this neighborhood, people are nice to each other The people in this neighborhood do not know each other (reversed) 	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree
PC_UPKEEP	<ul style="list-style-type: none"> The quality of streets and paths The maintenance of streets, paths, green The street lighting at night 	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree
PC_FAC	<ul style="list-style-type: none"> The availability of public green The availability of playgrounds for children The availability of parking spaces 	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree
PC_SECURE	<ul style="list-style-type: none"> I experience a lot of annoyance from neighbors (reversed) I often feel unsafe in this neighborhood (reversed) I am satisfied with the ethnicities in the neighborhood I feel at home in this neighborhood 	1=Very Agree / 2=Agree / 3=Neutral / 4=Disagree / 5=Very Disagree

C2 BBN PowerConstructor first model



C3 Construction Report accepted model

Belief Network PowerConstructor.

Database: \\psf\Home\Desktop\Last 2 weeks\SurveyData_preparedSPSS_22-02-2012.xls

Dataset: PrepDEF\$

Number of fields: 19

Age HH Incm Educ INV_SU KNW_SU ATT_CL ATT_CO ATT_HE KNW_EN
ATT_VP ATT_ES MOB_WT NBH_SA NBH_AT PC_SOC PC_QUA PC_ANN PC_FAC

Complete ordering: NO

Partial ordering: NO

Causes & Effects: NO

Forbidden Links: NO

Root fields: Age

Leaf fields: INV_SU

Threshold: 0.7 times of the default value.

Input logfile:

Output logfile:

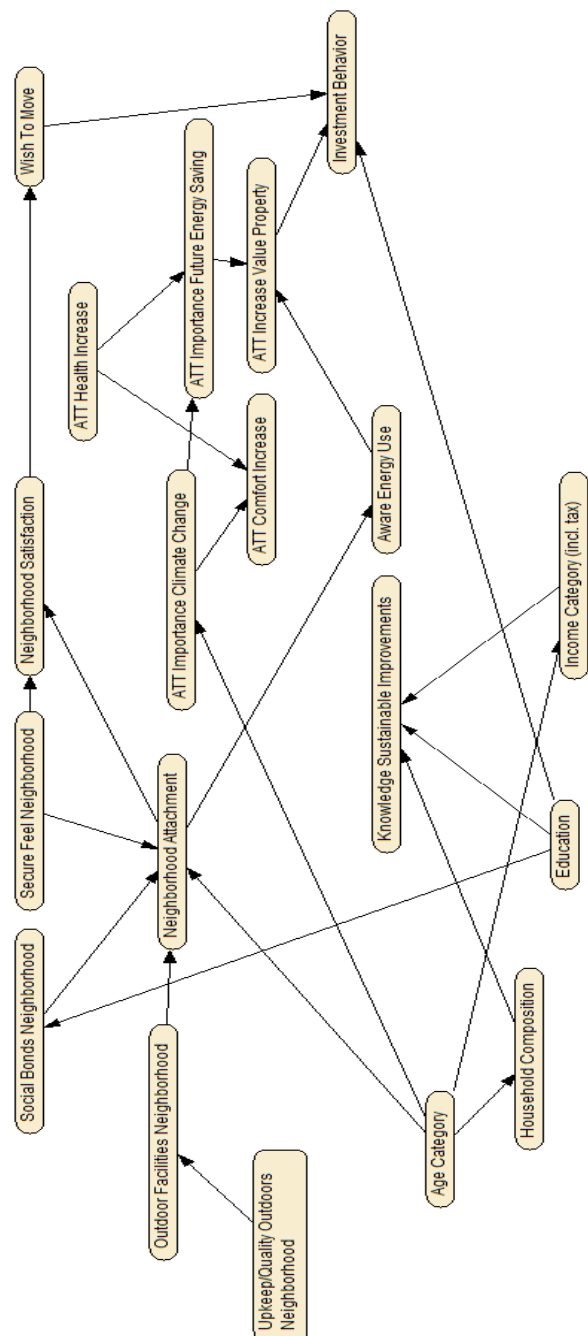
Results:

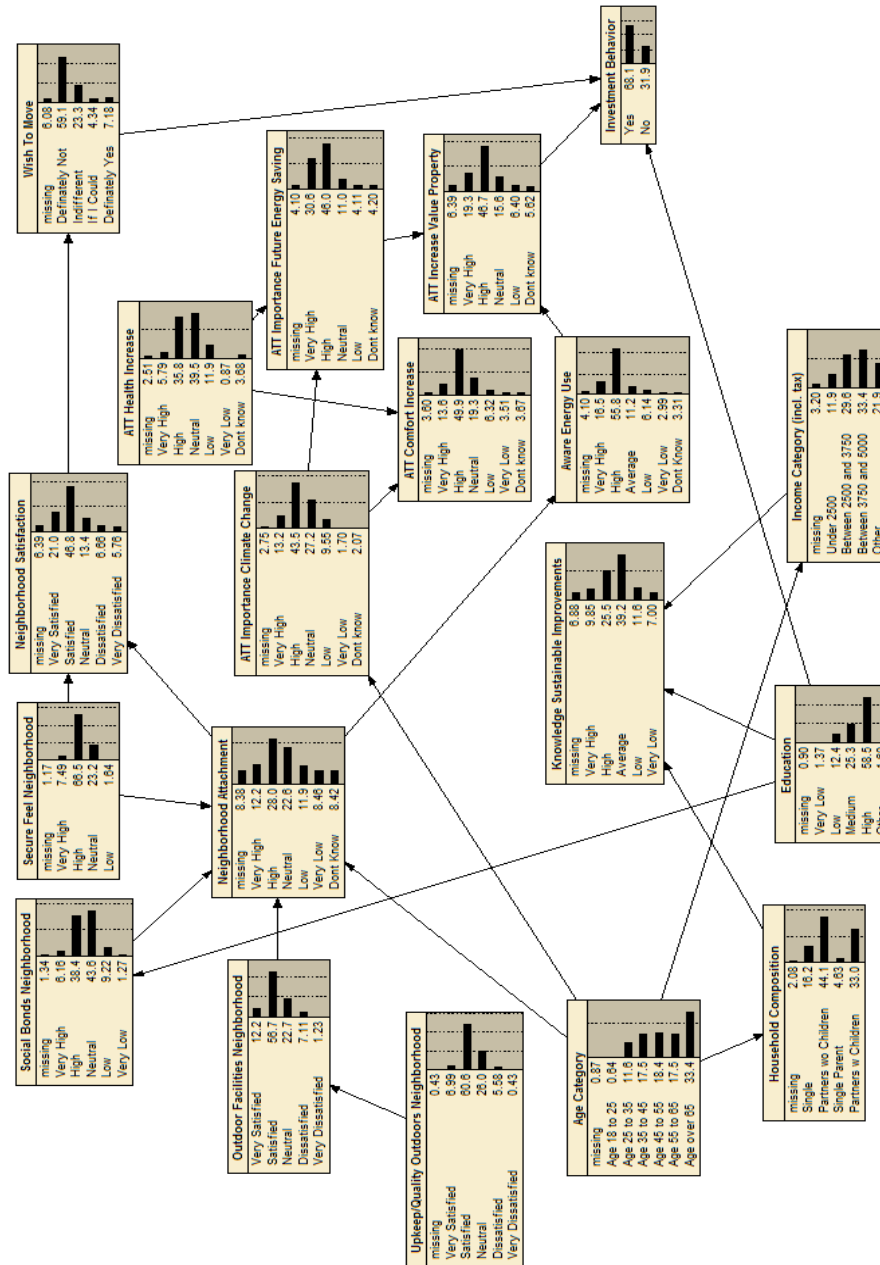
Age->HH Age->Incm Age->ATT_CL Age->NBH_AT HH->KNW_SU Incm->KNW_SU Educ->INV_SU Educ->KNW_SU Educ-<PC_SOC INV_SU-<ATT_VP
INV_SU-<MOB_WT ATT_CL->ATT_CO ATT_CL->ATT_ES ATT_CO-<ATT_HE
ATT_HE->ATT_ES KNW_EN->ATT_VP KNW_EN->NBH_AT ATT_VP-<ATT_ES
MOB_WT->NBH_SA NBH_SA-<NBH_AT NBH_SA-<PC_ANN NBH_AT-<PC_SOC
NBH_AT->PC_ANN NBH_AT->PC_FAC PC_QUA->PC_FAC

After Editing:

Age->HH Age->Incm Age->ATT_CL Age->NBH_AT HH->KNW_SU
Incm->KNW_SU Educ->INV_SU Educ->KNW_SU Educ->PC_SOC INV_SU-<
ATT_VP INV_SU-<MOB_WT ATT_CL->ATT_CO ATT_CL->ATT_ES ATT_CO-<
ATT_HE ATT_HE->ATT_ES KNW_EN->ATT_VP KNW_EN-<NBH_AT ATT_VP-<
ATT_ES MOB_WT-<NBH_SA NBH_SA-<NBH_AT NBH_SA-<PC_ANN NBH_AT-<
PC_SOC NBH_AT-<PC_ANN NBH_AT-<PC_FAC PC_QUA->PC_FAC

C4 Accepted model Outline





C6 Sensitivity Report Investment Behavior

Sensitivity of 'INV_SUM_YN' to findings at 'INV_SUM_YN':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0	0.6812	1	0.466
No	0	0.3188	1	0.466

Entropy reduction = 0.903 (100 %)

Belief Variance = 0.2171 (100 %)

Sensitivity of 'INV_SUM_YN' to findings at 'ATT_VP':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.4773	0.6812	0.7661	0.09811
No	0.2339	0.3188	0.5227	0.09811

Entropy reduction = 0.03095 (3.43 %)

Belief Variance = 0.009625 (4.43 %)

Sensitivity of 'INV_SUM_YN' to findings at 'Educ':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.4521	0.6812	0.7209	0.06263
No	0.2791	0.3188	0.5479	0.06263

Entropy reduction = 0.01252 (1.39 %)

Belief Variance = 0.003923 (1.81 %)

Sensitivity of 'INV_SUM_YN' to findings at 'MOB_WTM':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.5442	0.6812	0.7088	0.0518
No	0.2912	0.3188	0.4558	0.0518

Entropy reduction = 0.008574 (0.949 %)

Belief Variance = 0.002683 (1.24 %)

Sensitivity of 'INV_SUM_YN' to findings at 'KNW_ENERGY':

76 | GRADUATION REPORT CME - ELIEN BISSELING

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.5913	0.6812	0.7054	0.0377
No	0.2946	0.3188	0.4087	0.0377

Entropy reduction = 0.004599 (0.509 %)

Belief Variance = 0.001421 (0.654 %)

Sensitivity of 'INV_SUM_YN' to findings at 'ATT_ESF':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.5944	0.6812	0.7135	0.03363
No	0.2865	0.3188	0.4056	0.03363

Entropy reduction = 0.003691 (0.409 %)

Belief Variance = 0.001131 (0.521 %)

Sensitivity of 'INV_SUM_YN' to findings at 'NBH_SAT':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6056	0.6812	0.7002	0.02861
No	0.2998	0.3188	0.3944	0.02861

Entropy reduction = 0.002663 (0.295 %)

Belief Variance = 0.0008184 (0.377 %)

Sensitivity of 'INV_SUM_YN' to findings at 'NBH_ATTACH':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6342	0.6812	0.7023	0.02517
No	0.2977	0.3188	0.3658	0.02517

Entropy reduction = 0.002081 (0.23 %)

Belief Variance = 0.0006334 (0.292 %)

Sensitivity of 'INV_SUM_YN' to findings at 'PC_SOCIAL':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6034	0.6812	0.689	0.01484

No 0.311 0.3188 0.3966 | 0.01484

Entropy reduction = 0.0007122 (0.0789 %)

Belief Variance = 0.0002202 (0.101 %)

Sensitivity of 'INV_SUM_YN' to findings at 'KNW_SUST':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6576	0.6812	0.6905	0.01042
No	0.3095	0.3188	0.3424	0.01042

Entropy reduction = 0.0003582 (0.0397 %)

Belief Variance = 0.0001086 (0.05 %)

Sensitivity of 'INV_SUM_YN' to findings at 'ATT_CLIMATE':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6496	0.6812	0.6884	0.009892
No	0.3116	0.3188	0.3504	0.009892

Entropy reduction = 0.0003221 (0.0357 %)

Belief Variance = 9.786e-005 (0.0451 %)

Sensitivity of 'INV_SUM_YN' to findings at 'ATT_HEALTH':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6531	0.6812	0.6845	0.007541
No	0.3155	0.3188	0.3469	0.007541

Entropy reduction = 0.0001868 (0.0207 %)

Belief Variance = 5.686e-005 (0.0262 %)

Sensitivity of 'INV_SUM_YN' to findings at 'PC_ANNOY':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6572	0.6812	0.6859	0.007319
No	0.3141	0.3188	0.3428	0.007319

Entropy reduction = 0.000177 (0.0196 %)

78 | GRADUATION REPORT CME - ELIEN BISSELING

Belief Variance = 5.357e-005 (0.0247 %)

Sensitivity of 'INV_SUM_YN' to findings at 'ATT_COMF':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6685	0.6812	0.6839	0.004828
No	0.3161	0.3188	0.3315	0.004828

Entropy reduction = 7.704e-005 (0.00853 %)

Belief Variance = 2.331e-005 (0.0107 %)

Sensitivity of 'INV_SUM_YN' to findings at 'PC_FACILITIES':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6701	0.6812	0.6846	0.004305
No	0.3154	0.3188	0.3299	0.004305

Entropy reduction = 6.149e-005 (0.00681 %)

Belief Variance = 1.853e-005 (0.00853 %)

Sensitivity of 'INV_SUM_YN' to findings at 'Age':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6568	0.6812	0.6828	0.002953
No	0.3172	0.3188	0.3432	0.002953

Entropy reduction = 2.878e-005 (0.00319 %)

Belief Variance = 8.721e-006 (0.00402 %)

Sensitivity of 'INV_SUM_YN' to findings at 'PC_QUALITY':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6757	0.6812	0.682	0.00137
No	0.318	0.3188	0.3243	0.00137

Entropy reduction = 6.238e-006 (0.000691 %)

Belief Variance = 1.876e-006 (0.000864 %)

Sensitivity of 'INV_SUM_YN' to findings at 'HH':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6766	0.6812	0.6819	0.0008421
No	0.3181	0.3188	0.3234	0.0008421

Entropy reduction = 2.346e-006 (0.00026 %)

Belief Variance = 7.091e-007 (0.000327 %)

Sensitivity of 'INV_SUM_YN' to findings at 'Incm':

Probability ranges:	Min	Current	Max	RMS Change
Yes	0.6783	0.6812	0.6818	0.000618
No	0.3182	0.3188	0.3217	0.000618

Entropy reduction = 1.31e-006 (0.000145 %)

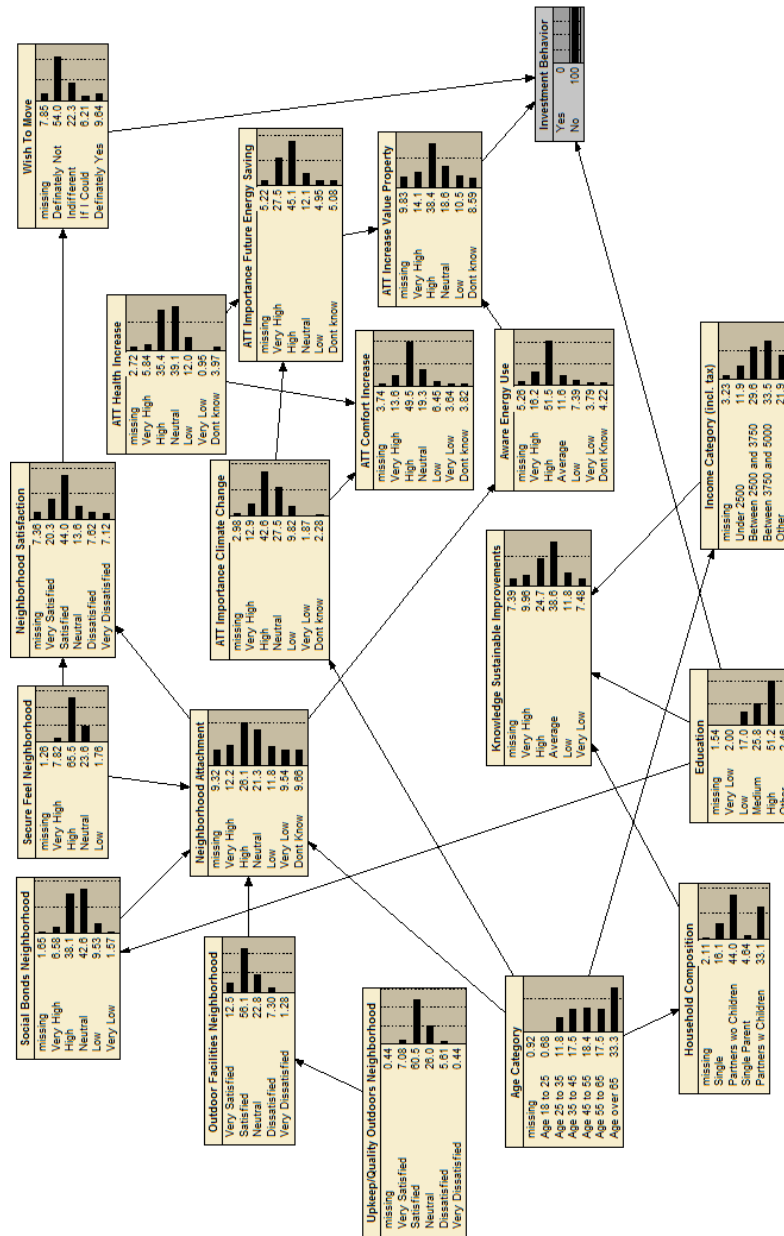
Belief Variance = 3.82e-007 (0.000176 %)

Sensitivity of 'INV_SUM_YN' to a finding at another node:

Node	Mutual Info	Percent	Variance of Beliefs

INV_SUM_YN	0.90302	100	0.2171487
ATT_VP	0.03095	3.43	0.0096249
Educ	0.01252	1.39	0.0039231
MOB_WTM	0.00857	0.949	0.0026830
KNW_ENERGY	0.00460	0.509	0.0014209
ATT_ESF	0.00369	0.409	0.0011311
NBH_SAT	0.00266	0.295	0.0008184
NBH_ATTACH	0.00208	0.23	0.0006334
PC_SOCIAL	0.00071	0.0789	0.0002202
KNW_SUST	0.00036	0.0397	0.0001086
ATT_CLIMATE	0.00032	0.0357	0.0000979
ATT_HEALTH	0.00019	0.0207	0.0000569
PC_ANNOY	0.00018	0.0196	0.0000536
ATT_COMF	0.00008	0.00853	0.0000233
PC_FACILITIES	0.00006	0.00681	0.0000185
Age	0.00003	0.00319	0.0000087
PC_QUALITY	0.00001	0.000691	0.0000019
HH	0.00000	0.00026	0.0000007
Incm	0.00000	0.000145	0.0000004

C7 Scenarios 1 and 2 model graphics



C8 Scenario 1 and 2 outcomes

Outcome table Scenarios 1 and 2						
Attitude 'Increase of Property Value'						
Investment Behavior	Very High	High	Neutral	Low	Don't Know	
Yes	21,70%	50,60%	14,20%	4,29%	4,23%	
No	14,10%	38,40%	18,60%	10,50%	8,59%	
Attitude 'Future Energy Saving'						
Investment Behavior	Very High	High	Neutral	Low	Don't Know	
Yes	32,10%	46,40%	10,50%	3,71%	8,78%	
No	27,50%	45,10%	12,10%	4,95%	5,08%	
Attitude 'Importance Climate Change'						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	13,30%	44,00%	27,10%	9,41%	1,62%	1,97%
No	12,90%	42,60%	27,50%	9,82%	1,87%	2,28%
Attitude 'Increase Comfort'						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	13,70%	50,10%	19,30%	6,26%	3,45%	3,61%
No	13,60%	49,50%	19,30%	6,45%	3,64%	3,82%
Attitude 'Increase Health'						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	5,77%	35,90%	39,70%	11,80%	0,83%	3,55%
No	5,84%	35,40%	39,10%	12,00%	0,95%	3,97%
Aware Energy Use						
Investment Behavior	Very High	High	Neutral	Low	Very Low	Don't Know
Yes	16,70%	57,70%	11,00%	5,55%	2,61%	2,88%
No	16,20%	51,50%	11,60%	7,39%	3,79%	4,22%
Knowledge Sustainable Improvements						
Investment Behavior	Very High	High	Average	Low	Very Low	
Yes	9,80%	25,80%	39,50%	11,40%	6,78%	
No	9,96%	24,70%	38,60%	11,80%	7,48%	
Wish to Move						
Investment Behavior	Definitely Not	Indifferent	If I could	Definitely yes		
Yes	61,50%	23,70%	3,47%	6,03%		
No	54,00%	22,30%	6,21%	9,64%		
Neighborhood Attachment						
Investment Behavior	Strongly Attached	Attached	Neutral	Disattached	Very Dissatisfied	Don't Know
Yes	12,20%	28,80%	23,20%	12,00%	7,96%	7,84%
No	12,20%	26,10%	21,30%	11,80%	9,54%	9,66%
Neighborhood Satisfaction						
Investment Behavior	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
Yes	21,40%	48,10%	13,20%	6,21%	5,12%	
No	20,30%	44,00%	13,60%	7,62%	7,12%	

	Secure Feel Neighborhood					
Investment Behavior	Very High	High	Neutral	Low		
Yes	7,34%	67,00%	23,00%	1,58%		
No	7,82%	65,50%	23,60%	1,76%		
	Social Bonds Neighborhood					
Investment Behavior	Very High	High	Neutral	Low	Very Low	
Yes	5,97%	38,50%	44,10%	9,07%	1,12%	
No	6,58%	38,10%	42,60%	9,53%	1,57%	
	Outdoor Facilities Neighborhood					
Investment Behavior	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
Yes	12,10%	57,00%	22,60%	7,01%	1,21%	
No	12,50%	56,10%	22,80%	7,30%	1,28%	
	Upkeep/Quality Outdoors Neighborhood					
Investment Behavior	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
Yes	6,95%	60,70%	26,00%	5,57%	0,43%	
No	7,08%	60,50%	26,00%	5,61%	0,44%	
	Income Category					
Investment Behavior	Under 2500	2500-3750	3750-5000	Other		
Yes	11,90%	29,60%	33,40%	21,80%		
No	11,90%	29,60%	33,50%	21,90%		
	Household Composition					
Investment Behavior	Single	Partners wo children	Single parent	Parents w children		
Yes	16,20%	44,10%	4,63%	33,00%		
No	16,10%	44,00%	4,64%	33,10%		
	Age Category					
Investment Behavior	Under 25	25-35	35-45	45-55	55-65	over 65
Yes	0,61%	11,60%	17,50%	18,50%	17,50%	33,50%
No	0,68%	11,80%	17,50%	18,40%	17,50%	33,30%
	Education Level					
Investment Behavior	Very Low	Low	Medium	High	Other	
Yes	1,07%	10,20%	25,00%	61,90%	1,20%	
No	2,00%	17,00%	25,80%	51,20%	2,46%	

C9 Scenarios 3 to 8 outcomes

Scenario Neighborhood Satisfaction					
	Neighborhood Satisfaction				
	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Neighborhood Attachment					
<i>Very High</i>	30,00%	7,16%	5,58%	8,13%	9,40%
<i>High</i>	34,50%	38,30%	11,80%	6,30%	6,58%
<i>Neutral</i>	11,40%	31,20%	33,80%	5,42%	6,27%
<i>Low</i>	6,17%	13,00%	17,40%	14,40%	12,40%
<i>Very Low</i>	4,95%	3,47%	11,10%	24,90%	18,10%
<i>Don't Know</i>	6,36%	3,72%	10,00%	20,10%	23,20%
Secure Feel Neighborhood					
<i>Very High</i>	14,30%	2,34%	6,36%	12,70%	14,70%
<i>High</i>	71,60%	75,90%	47,10%	52,60%	46,50%
<i>Neutral</i>	12,00%	20,70%	42,50%	27,20%	31,50%
<i>Low</i>	1,14%	0,51%	2,77%	4,71%	4,15%
Social Bonds Neighborhood					
<i>Very High</i>	6,60%	5,05%	6,19%	8,39%	8,25%
<i>High</i>	41,00%	38,90%	36,30%	35,10%	36,00%
<i>Neutral</i>	41,40%	45,60%	44,90%	40,80%	40,40%
<i>Low</i>	8,48%	8,35%	9,87%	11,80%	11,60%
<i>Very Low</i>	1,23%	1,02%	1,35%	1,88%	1,82%
Outdoor Facilities Neighborhood					
<i>Very Satisfied</i>	12,90%	10,80%	12,10%	15,10%	15,10%
<i>Satisfied</i>	55,90%	60,30%	56,90%	48,80%	49,10%
<i>Neutral</i>	23,00%	22,00%	22,10%	24,50%	24,50%
<i>Dissatisfied</i>	6,99%	5,95%	7,59%	9,85%	9,56%
<i>Very Dissatisfied</i>	1,20%	0,99%	1,31%	1,83%	1,78%
Upkeep/Quality Outdoors Neighborhood					
<i>Very Satisfied</i>	7,21%	6,42%	6,98%	8,13%	8,10%
<i>Satisfied</i>	60,40%	61,40%	60,60%	58,80%	58,90%
<i>Neutral</i>	25,90%	25,90%	25,90%	26,10%	26,00%
<i>Dissatisfied</i>	5,57%	5,41%	5,62%	5,99%	5,95%
<i>Very Dissatisfied</i>	0,43%	0,39%	0,44%	0,53%	0,52%
Wish to Move					
<i>Definitely Not</i>	77,60%	73,70%	36,70%	10,00%	16,70%
<i>Indifferent</i>	12,10%	18,30%	45,00%	50,00%	16,70%
<i>If I Could</i>	0,93%	1,53%	6,67%	10,00%	16,70%
<i>Definitely Yes</i>	3,74%	3,82%	3,33%	20,00%	33,30%
Investment Behavior					
<i>Yes</i>	69,30%	70,00%	67,60%	63,50%	60,60%

No	30,70%	30,00%	32,40%	36,50%	39,40%
Age Category					
18 - 25	0,61%	0,51%	0,67%	0,97%	0,92%
25 - 35	10,60%	11,40%	12,50%	13,00%	12,70%
35 - 45	16,40%	17,50%	18,50%	18,30%	18,10%
45 - 55	18,40%	18,20%	18,70%	18,90%	18,80%
55 - 65	18,20%	17,20%	16,50%	18,10%	18,30%
Over 65	35,10%	34,50%	32,10%	29,40%	30,00%
Education					
Very Low	1,36%	1,27%	1,40%	1,60%	1,58%
Low	12,50%	12,20%	12,30%	12,60%	12,70%
Medium	25,30%	25,40%	25,20%	24,80%	24,80%
High	58,40%	58,70%	58,50%	55,10%	58,10%
Other	1,57%	1,51%	1,65%	1,85%	1,82%
Household Category					
Single	16,50%	16,40%	15,80%	15,40%	15,10%
Partners w/o Children	45,00%	44,40%	43,20%	42,60%	42,90%
Single Parent	4,59%	4,56%	4,67%	4,85%	4,82%
Partners w Children	31,80%	32,70%	34,20%	34,80%	34,40%

C10 Principal Components Analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,813
Bartlett's Test of Sphericity	Approx. Chi-Square	1556,189
	df	153
	Sig.	0

Principal Component Analysis	1	2	3	4	5
I have a lot of contacts with my neighbors	0,868	-0,091	-0,188	0,015	0,015
I have a lot of contacts with my direct neighbors	0,821	-0,093	-0,061	-0,037	0,054
There is a lot of coherence in this neighborhood	0,767	0,096	-0,001	0,034	-0,068
In this neighborhood, people are nice to each other	0,765	0,06	0,099	-0,069	0,129
The people in this neighborhood do not know each other (reversed)	0,651	-0,089	0,075	0,052	-0,067
Aesthetic quality dwellings and neighborhood	0,392	0,315	0,069	0,008	-0,208
The quality of streets and paths	0,047	0,861	-0,102	0,008	0,056
The maintenance of streets, paths, green	-0,089	0,805	0,058	0,014	-0,165
The street lighting at night	-0,074	0,602	0,082	0,058	0,312
I experience a lot of annoyance from neighbors (reversed)	-0,045	-0,098	0,839	0,031	0,077
I often feel unsafe in this neighborhood (reversed)	-0,146	0,074	0,832	-0,041	-0,09
I am satisfied with the ethnicities in the neighborhood	0,25	0,061	0,497	-0,123	0,036
I feel at home in this neighborhood	0,385	-0,017	0,42	0,115	0,006
The availability of public green	0,038	0,03	-0,091	0,811	-0,06
The availability of playgrounds for children	0,023	0,012	-0,055	0,756	0,073
The availability of parking spaces	-0,051	0,02	0,101	0,746	0,001
The availability of stores for daily groceries	-0,012	-0,181	0,11	0,075	0,824
The availability of public transport	0,023	0,229	-0,124	-0,081	0,731

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a Rotation converged in 6 iterations.

C11 Sensitivity Report Neighborhood Satisfaction

Sensitivity of 'NBH_SAT' to findings at 'NBH_SAT':

Probability ranges:	Min	Current	Max	RMS Change
missing	0	0.06389	1	0.2446
Very_Satisfied	0	0.2102	1	0.4074
Satisfied	0	0.4682	1	0.499
Neutral	0	0.1335	1	0.3401
Dissatisfied	0	0.06662	1	0.2494
Very_Dissatisfied	0	0.05758	1	0.2329

Entropy reduction = 2.124 (100 %)

Belief Variance = 0.5289 (100 %)

Sensitivity of 'NBH_SAT' to findings at 'NBH_ATTACH':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.01355	0.06389	0.1919	0.0653
Very_Satisfied	0.1058	0.2102	0.5158	0.1298
Satisfied	0.1743	0.4682	0.647	0.1998
Neutral	0.05645	0.1335	0.1993	0.06334
Dissatisfied	0.01501	0.06662	0.1959	0.06596
Very_Dissatisfied	0.01355	0.05758	0.1651	0.0561

Entropy reduction = 0.2655 (12.5 %)

Belief Variance = 0.02367 (4.47 %)

Sensitivity of 'NBH_SAT' to findings at 'MOB_WTM':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.03087	0.06389	0.2103	0.04862
Very_Satisfied	0.04526	0.2102	0.2757	0.0825
Satisfied	0.1647	0.4682	0.5832	0.1475
Neutral	0.06196	0.1335	0.2583	0.07671
Dissatisfied	0.01126	0.06662	0.1855	0.06806
Very_Dissatisfied	0.01623	0.05758	0.2672	0.07747

Entropy reduction = 0.2211 (10.4 %)

Belief Variance = 0.01204 (2.28 %)

Sensitivity of 'NBH_SAT' to findings at 'PC_ANNOY':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.05207	0.06389	0.1557	0.02229
Very_Satisfied	0.1092	0.2102	0.4011	0.0733
Satisfied	0.1458	0.4682	0.5341	0.1169
Neutral	0.09445	0.1335	0.2445	0.0636
Dissatisfied	0.0527	0.06662	0.1912	0.02588
Very_Dissatisfied	0.04023	0.05758	0.1557	0.02776

Entropy reduction = 0.08279 (3.9 %)

Belief Variance = 0.00579 (1.09 %)

Sensitivity of 'NBH_SAT' to findings at 'KNW_ENERGY':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.04883	0.06389	0.1367	0.02667
Very_Satisfied	0.17	0.2102	0.2525	0.02139
Satisfied	0.2562	0.4682	0.5127	0.07586
Neutral	0.126	0.1335	0.1543	0.01046
Dissatisfied	0.05227	0.06662	0.1376	0.0263
Very_Dissatisfied	0.04521	0.05758	0.1228	0.02237

Entropy reduction = 0.03051 (1.44 %)

Belief Variance = 0.002251 (0.426 %)

Sensitivity of 'NBH_SAT' to findings at 'PC_FACILITIES':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.05445	0.06389	0.0956	0.01209
Very_Satisfied	0.2045	0.2102	0.222	0.005108
Satisfied	0.376	0.4682	0.4976	0.03789
Neutral	0.1301	0.1335	0.1427	0.003101
Dissatisfied	0.05726	0.06662	0.09893	0.01206
Very_Dissatisfied	0.04985	0.05758	0.08321	0.009815

Entropy reduction = 0.006652 (0.313 %)

Belief Variance = 0.0006594 (0.125 %)

Sensitivity of 'NBH_SAT' to findings at 'PC_SOCIAL':

88 | GRADUATION REPORT CME - ELIEN BISSELING

Probability ranges:	Min	Current	Max		RMS Change
missing	0.05861	0.06389	0.09594		0.01062
Very_Satisfied	0.1933	0.2102	0.2251		0.01307
Satisfied	0.375	0.4682	0.4892		0.03235
Neutral	0.1263	0.1335	0.1429		0.006037
Dissatisfied	0.061	0.06662	0.0991		0.01077
Very_Dissatisfied	0.05328	0.05758	0.08343		0.008621

Entropy reduction = 0.00565 (0.266 %)

Belief Variance = 0.0004947 (0.0935 %)

Sensitivity of 'NBH_SAT' to findings at 'ATT_VP':

Probability ranges:	Min	Current	Max		RMS Change
missing	0.05681	0.06389	0.08472		0.009677
Very_Satisfied	0.2056	0.2102	0.213		0.00228
Satisfied	0.4077	0.4682	0.4891		0.02826
Neutral	0.1319	0.1335	0.1387		0.002228
Dissatisfied	0.05981	0.06662	0.08679		0.009372
Very_Dissatisfied	0.05167	0.05758	0.07542		0.008119

Entropy reduction = 0.003995 (0.188 %)

Belief Variance = 0.0003652 (0.069 %)

Sensitivity of 'NBH_SAT' to findings at 'INV_SUM_YN':

Probability ranges:	Min	Current	Max		RMS Change
missing	0.05935	0.06389	0.07361		0.006648
Very_Satisfied	0.2027	0.2102	0.2137		0.005129
Satisfied	0.4404	0.4682	0.4812		0.01902
Neutral	0.1324	0.1335	0.1359		0.00161
Dissatisfied	0.06214	0.06662	0.07619		0.006545
Very_Dissatisfied	0.05119	0.05758	0.07124		0.009346

Entropy reduction = 0.002663 (0.125 %)

Belief Variance = 0.0001816 (0.0343 %)

Sensitivity of 'NBH_SAT' to findings at 'Age':

Probability ranges:	Min	Current	Max		RMS Change
---------------------	-----	---------	-----	--	------------

missing	0.05704	0.06389	0.09879	0.00626
Very_Satisfied	0.1907	0.2102	0.2204	0.01106
Satisfied	0.3734	0.4682	0.4838	0.01565
Neutral	0.1263	0.1335	0.1438	0.006443
Dissatisfied	0.05864	0.06662	0.1019	0.00698
Very_Dissatisfied	0.05168	0.05758	0.08367	0.005192

Entropy reduction = 0.002294 (0.108 %)

Belief Variance = 0.0001422 (0.0269 %)

Sensitivity of 'NBH_SAT' to findings at 'PC_QUALITY':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06185	0.06389	0.07951	0.003826
Very_Satisfied	0.2096	0.2102	0.217	0.00188
Satisfied	0.4207	0.4682	0.4746	0.01245
Neutral	0.1333	0.1335	0.1372	0.0003562
Dissatisfied	0.06459	0.06662	0.08247	0.003755
Very_Dissatisfied	0.05592	0.05758	0.07016	0.003105

Entropy reduction = 0.0006779 (0.0319 %)

Belief Variance = 7.143e-005 (0.0135 %)

Sensitivity of 'NBH_SAT' to findings at 'HH':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06129	0.06389	0.07239	0.002588
Very_Satisfied	0.2021	0.2102	0.2151	0.005908
Satisfied	0.4444	0.4682	0.474	0.005904
Neutral	0.1308	0.1335	0.1382	0.003411
Dissatisfied	0.06349	0.06662	0.07518	0.003163
Very_Dissatisfied	0.05532	0.05758	0.06421	0.002236

Entropy reduction = 0.0004813 (0.0227 %)

Belief Variance = 2.625e-005 (0.00496 %)

Sensitivity of 'NBH_SAT' to findings at 'Educ':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06276	0.06389	0.07537	0.002194
Very_Satisfied	0.2057	0.2102	0.212	0.0009412

90 | GRADUATION REPORT CME - ELIEN BISSELING

Satisfied	0.4338	0.4682	0.4715	0.006489
Neutral	0.133	0.1335	0.1374	0.0007112
Dissatisfied	0.06546	0.06662	0.07826	0.002224
Very_Dissatisfied	0.05664	0.05758	0.06668	0.001764

Entropy reduction = 0.0002127 (0.01 %)

Belief Variance = 1.986e-005 (0.00376 %)

Sensitivity of 'NBH_SAT' to findings at 'Incm':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06082	0.06389	0.06894	0.001721
Very_Satisfied	0.2071	0.2102	0.2169	0.003234
Satisfied	0.4544	0.4682	0.4749	0.003962
Neutral	0.1297	0.1335	0.136	0.00176
Dissatisfied	0.0628	0.06662	0.07197	0.002051
Very_Dissatisfied	0.05488	0.05758	0.06157	0.001484

Entropy reduction = 0.0001834 (0.00863 %)

Belief Variance = 1.053e-005 (0.00199 %)

Sensitivity of 'NBH_SAT' to findings at 'ATT_CLIMATE':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06221	0.06389	0.06743	0.0009071
Very_Satisfied	0.2033	0.2102	0.2156	0.002412
Satisfied	0.4579	0.4682	0.4712	0.002039
Neutral	0.1307	0.1335	0.1371	0.001267
Dissatisfied	0.06432	0.06662	0.07005	0.001126
Very_Dissatisfied	0.05598	0.05758	0.06013	0.0008005

Entropy reduction = 6.595e-005 (0.0031 %)

Belief Variance = 3.521e-006 (0.000666 %)

Sensitivity of 'NBH_SAT' to findings at 'KNW_SUST':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06343	0.06389	0.06486	0.0005784
Very_Satisfied	0.2088	0.2102	0.211	0.0005696
Satisfied	0.4654	0.4682	0.4695	0.001643
Neutral	0.1332	0.1335	0.1343	0.0003436

Dissatisfied	0.06611	0.06662	0.06773	0.0006055
Very_Dissatisfied	0.0572	0.05758	0.0584	0.0004665

Entropy reduction = 1.641e-005 (0.000772 %)

Belief Variance = 1.404e-006 (0.000265 %)

Sensitivity of 'NBH_SAT' to findings at 'ATT_ESF':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06383	0.06389	0.06408	9.006e-005
Very_Satisfied	0.2099	0.2102	0.2105	0.0001494
Satisfied	0.4676	0.4682	0.4684	0.0002685
Neutral	0.1334	0.1335	0.1337	6.086e-005
Dissatisfied	0.06656	0.06662	0.0668	8.911e-005
Very_Dissatisfied	0.05753	0.05758	0.05772	6.73e-005

Entropy reduction = 4.468e-007 (2.1e-005 %)

Belief Variance = 4.023e-008 (7.61e-006 %)

Sensitivity of 'NBH_SAT' to findings at 'ATT_COMF':

Probability ranges:	Min	Current	Max	RMS Change
missing	0.06383	0.06389	0.06413	6.911e-005
Very_Satisfied	0.21	0.2102	0.2105	0.0001586
Satisfied	0.4675	0.4682	0.4684	0.0002313
Neutral	0.1334	0.1335	0.1336	6.937e-005
Dissatisfied	0.06654	0.06662	0.06685	6.311e-005
Very_Dissatisfied	0.05752	0.05758	0.05775	4.716e-005

Entropy reduction = 3.075e-007 (1.45e-005 %)

Belief Variance = 3.166e-008 (5.99e-006 %)

Sensitivity of 'NBH_SAT' to a finding at another node:

Node	Mutual Info	Percent	Variance of Beliefs
NBH_SAT	2.12441	100	0.5289294
NBH_ATTACH	0.26546	12.5	0.0236688
MOB_WTM	0.22107	10.4	0.0120439
PC_ANNOY	0.08279	3.9	0.0057900
KNW_ENERGY	0.03051	1.44	0.0022513

92 | GRADUATION REPORT CME - ELIEN BISSELING

PC_FACILITIES	0.00665	0.313	0.0006594
PC_SOCIAL	0.00565	0.266	0.0004947
ATT_VP	0.00399	0.188	0.0003652
INV_SUM_YN	0.00266	0.125	0.0001816
Age	0.00229	0.108	0.0001422
PC_QUALITY	0.00068	0.0319	0.0000714
HH	0.00048	0.0227	0.0000262
Educ	0.00021	0.01	0.0000199
IncM	0.00018	0.00863	0.0000105
ATT_CLIMATE	0.00007	0.0031	0.0000035
KNW_SUST	0.00002	0.000772	0.0000014
ATT_ESF	0.00000	2.1e-005	0.0000000
ATT_COMF	0.00000	1.45e-005	0.0000000
ATT_HEALTH	0.00000	0	0.0000000

Appendix D: Management Summaries

DE INVLOED VAN BUURTTEVREDENHEID OP DUURZAAM INVESTERINGSGEDRAG VAN PRIVATE HUISEIGENAREN.

Een case studie in Eindhoven, Noord Brabant.

Auteur: E.E.M. Bisseling

Afstudeerprogramma:

Construction Management and Urban Development 2012-2013

Afstudeercomité:

prof.dr.ir. W.F. Schaefer

prof. dr. Q. Han

drs. P.H.A.M. Masselink

J. Bekkering (HetEnergieBureau B.V.)

Afstudeerdatum:

13-03-2013

SAMENVATTING

Bij het verduurzamen van de bestaande huizenvoorraad, blijkt het moeilijk te zijn private huiseigenaren over te halen tot deze investering. Kan buurtverbetering gebruikt worden om private huiseigenaren meer bereid te krijgen tot investeren? In dit onderzoek wordt een relatie tussen buurttevredenheid en investeringsgedrag onderzocht. Een Bayesiaans Netwerk model wordt gebruikt om relaties te vinden tussen buurttevredenheid, attituden, kennis, socio demografische informatie en de aangegeven investeringsgedrag, uit een enquête gedaan onder geselecteerde buurten in Eindhoven. Een indirecte relatie tussen buurttevredenheid en investeringsgedrag is gevonden in dit onderzoek, welke een basis kan vormen voor verder onderzoek over het gebruik van dit verband. Huiseigenaren blijken het meest prijsbewust te zijn, de grootste indicator voor investeringsgedrag die blijkt uit dit onderzoek.

Steekwoorden: duurzame investeringen; private huiseigenaren; bestaande huizenvoorraad; buurtverbetering; beslissingsmodel; Bayesiaans Netwerk; BBN; beleid

INTRODUCTIE

Het wereldwijde energieverbruik is in de afgelopen jaren gestegen en zal, volgens voorspellingen, blijven stijgen over de komende twintig jaar. (Provincie Noord Brabant, 2009). Dit is een probleem omdat: 1) Er zijn tekenen van klimaatverandering door stijgende CO₂ waarden in de atmosfeer; 2) De fossiele brandstofreserves wereldwijd nemen af; 3) Hierdoor nemen ook de energieprijzen jaarlijks toe. De combinatie van deze problemen vraagt om actie. De gemeente Eindhoven heeft de ambitie om in 2040 energie neutraal te worden (KENWIB, 2012). Veertig procent van het besparingspotentieel komt uit het verbeteren van de bestaande gebouwvoorraad gebouwd vóór 1992. Het is echter niet makkelijk om private huiseigenaren te laten investeren in duurzame verbeteringen aan hun woning. Subsidieprogramma's en groene leningen hebben nog niet het gewenste effect gehad en subsidies worden uit gefaseerd. Er moeten nieuwe manieren worden bedacht huiseigenaren bereid te krijgen te investeren. Galster & Hesser (1982) onderzochten dat er

een relatie tussen buurttevredenheid en investeringen in onderhoud aan het huis bestaat. In dit onderzoek wordt onderzocht of er een relatie bestaat tussen buurttevredenheid en duurzame investeringen aan het huis. Als deze relatie wordt gevonden, kan dit wellicht een opening zijn voor een nieuw beleid voor de gemeente en de overheid.

BUURTTEVREDENHEID

De buurt wordt in het dagelijks leven verschillend gebruikt. Naast een fysiek onderdeel dat de buurt het uiterlijk geeft, dient het ook als een middel voor sociale interactie (Talen & Shah, 2007). Er kan ook een verschil zijn tussen algemene buurttevredenheid en de tevredenheid met onderdelen van de buurt, dit is niet een simpele optelsom. Lu (1999) beschrijft dat inwoners hun buurt beoordelen op wat ze nodig hebben en ambities die ze hebben. Als de inwoner tevreden is, is er een hoge congruentie tussen de huidige situatie en deze behoeftes en ambities. Incongruentie kan dus voor ontevredenheid zorgen. Deze incongruentie kan volgens Lu (1999) en Feijten & van Ham (2009) zorgen voor verhuisgedrag. Ontevreden huiseigenaren kunnen hierdoor eerder een wens om te verhuizen koesteren (Parkes et al. 2002). Verder is ook onderzocht dat inwoners die sterk gehecht zijn aan hun buurt, minder snel geneigd zijn te verhuizen (Permentier et al. 2009).

BESLISSINGSMODELLEN

Om de invloed van buurttevredenheid te testen op investeringsgedrag, is het nodig eerst andere factoren die investeringsgedrag beïnvloeden, te identificeren. In het veld van psychologie en sociologie zijn veel onderzoeken over besluitvorming gedaan. In 1991, heeft Azjen de 'theorie van gepland gedrag' ontworpen. Deze gaat vooral over de intentie om een gedrag te vertonen. De combinatie tussen motivatie (motivation) en ability (capaciteit) is de kern van dit model. Olander & Thøgersen (1995) hebben het MAO model ontwikkeld, welke staat voor Motivation, Ability and Opportunity (gelegenheid). Luijten (2010) plaatst attituden en kennis als invloeden van investeringsgedrag (het kopen van een energiezuinige woning), welke worden beïnvloed door socio demografische gegevens. Deze attituden bestaan uit prijsbewustzijn, belang van comfort, belang van gezondheid en milieubewustzijn.

Uit de analyse van bovenstaande modellen, is een conceptueel model ontstaan. Attituden, kennis en capaciteit zijn erkend als belangrijke directe invloeden. Hierbij is de hypothese van dit onderzoek ingevoegd in de vorm van een directe invloed van verhuisgeneigdheid, welke weer wordt beïnvloed door buurttevredenheid en gehechtheid.

METHODE

Omdat keuzegedrag vaak meerdere directe en indirecte invloeden behelst, is voor een Bayesiaans Netwerk (BBN) model gekozen. BBN is een vorm van kans statistiek, die de kans uitrekent op een bepaald gedrag door invloed van bepaalde factoren. Het model vindt zijn oorsprong in de werkvelden van Artificial Intelligence, Statistiek, operationeel onderzoek en keuzegedrag (Kemperman & Timmermans, 2012). De BBN wordt samengesteld door het gebruik van de BN PowerConstructor (Cheng et al. 1997), welke door middel van een complex algoritme links tussen de variabelen in het netwerk 'leert' en de structuur van het netwerk bepaalt. Hierna kunnen in het programma Norsys Netica 4.16 (Norsys, 2011) scenario's worden getest.

DATA

Vier buurten uit Eindhoven uit hetzelfde segment (WOZ waarde tussen €200.000 en €275.000), waarvan twee met een goede buurt beoordeling en twee met een slechtere buurtbeoordeling, zijn geselecteerd voor distributie van een enquête, die de in het totaal 1237 huiseigenaren ondervraagt over investeringsgedrag en attituden, kennis, algemene gegevens en buurttevredenheid, met een likert beoordelingsschaal. Een respons van 35,1%, dus 434 geretourneerde enquêtes is gehaald. Hiervan waren 425 valide om in het BBN model te gebruiken.

ANALYSE EN RESULTATEN

Met de drempelwaarde op 0,7 is een plausibel BBN model gevonden. Hierbij wordt een directe link gevonden tussen de verhuisgeneigdheid en investeringsgedrag: 7,5% meer investeerders beweren zeker niet te willen verhuizen dan niet-investeerders, en 6,34% meer niet-investeerders geven aan graag te willen verhuizen. De verhuisgeneigdheid wordt weer bepaald door buurttevredenheid, welke op haar beurt weer wordt bepaald door de gehechtheid aan de buurt. Investeerders zijn 5,20% vaker tevreden met de buurt dan niet-investeerders. Van de tevreden huiseigenaren zal ongeveer 8% meer investeren dan de ontevreden huiseigenaren. Huiseigenaren die neutraal zijn over de buurt, zullen 2% minder vaak investeren. Investeerders zijn 1,20% vaker gehecht aan de buurt dan niet-investeerders.

Andere directe links met investeringsgedrag zijn gevonden in de attitude 'mijn huis wordt meer waard door het investeren', een prijsbewuste attitude die bij investeerders 12,2% vaker hoog is dan bij niet-investeerders, en het opleidingsniveau, welke aangeeft dat investeerders vaker een hogere opleiding hebben gedaan dan niet-investeerders. Van de attituden lijken de attituden 'comfort' en 'gezondheid' geen indicatoren van investeringsgedrag. Milieubewuste attituden zijn ook weinig bepalend voor investeringsgedrag. Bewust zijn van het eigen energieverbruik is een indirecte goede predictor: 6,70% meer investeerders hebben veel inzicht in energieverbruik dan niet-investeerders. Kennis over duurzame investeringsopties weer niet bepalend lijkt te zijn. Andere socio demografische gegevens zijn ook niet uitzonderlijk bepalend gevonden.

CONCLUSIE EN DISCUSSIE

Een indirecte relatie tussen investeringsgedrag en buurttevredenheid is gevonden, werkend door de verhuisgeneigdheid, als verondersteld na uitgebreid literatuuronderzoek. Het gevonden effect is niet uitzonderlijk groot, maar indiceert dat een verband bestaat. Dit verband is echter groter wanneer de buurt duidelijk negatief wordt beoordeeld, dan wanneer de buurt positief of neutraal wordt beoordeeld. Een verband tussen prijsbewuste attituden en investeringsgedrag is echter groter bevonden en lijkt de grootste drijfveer te zijn voor investering. Buurttevredenheid (en een buurt upgrade) gebruiken om huiseigenaren meer te laten investeren, zal leidend uit deze bevindingen alleen werken in buurten waar ontevredenheid heerst, en daarnaast duidelijk wordt gemaakt wat de invloed van investering en ook de buurtupgrade zal hebben op waarde verhoging van het huis. Daarnaast is voor algemene promotie van investeringsgedrag gebleken dat focus op waarde of geld gerelateerde informatie door het prijsbewuste karakter van huiseigenaren het beste zal aanslaan.

AANBEVELINGEN

Onderzoek dat dieper ingaat op de gevonden relatie en hoe deze gebruikt kan worden als beleidsmiddel is aan te raden. Voor vervolgonderzoek is het waardevol dieper in te gaan op de attituden die investeringsgedrag vormen. Ook een focus op prijsbewuste motivatie voor huiseigenaren en wat capaciteit hier voor invloed op heeft is een waardevol vervolgonderzoek. Daarnaast is aan te raden te kijken naar de vergrijzende bevolking en wat dit voor invloed heeft of motivatie van deze huiseigenaren te investeren.

REFERENTIES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*. 50 (2). pp. 179–211.
- Cheng, J., Bell, D.A. & Liu, W. (1997). *Learning belief networks from data: An information theory based approach*. pp. 325–331.
- Feijten, P. & van Ham, M. (2009). Neighbourhood Change... Reason to Leave? *Urban Studies*. 46 (10). pp. 2103–2122.
- Galster, G.C. & Hesser, G.W. (1982). The Social Neighborhood An Unspecified Factor in Homeowner Maintenance? *Urban Affairs Review*. 18 (2). pp. 235–254.
- Kemperman, A. & Timmermans, H. (2012). Environmental Correlates of Active Travel Behavior of Children. *Environment and Behavior*.
- KENWIB (2012). <http://www.kenwib.nl/>, last visited on the 28th of August, 2012
- Lu, M. (1999). Determinants of residential satisfaction: Ordered logit vs. regression models. *Growth and Change*. 30 (2). pp. 264–287.
- Luijten, A. (2010). *Consument en duurzaamheid*.
- Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2011). *Plan van Aanpak Energiebesparing Gebouwde Omgeving*.
- Norsys (2011) <http://www.norsys.com/download.html>, last visited on the 2nd of March, 2013
- Olander, F., & Thøgersen, J. (1995). Understanding of Consumer Behaviour as a Prerequisite for Environmental Protection. *Journal of Consumer Policy*, 18, 345–385.
- Parkes, A., Kearns, A. & Atkinson, R. (2002). What Makes People Dissatisfied with their Neighbourhoods? *Urban Studies*. 39 (13). pp. 2413–2438.
- Permentier, M., van Ham, M. & Bolt, G. (2009). Neighbourhood reputation and the intention to leave the neighbourhood. *Environment and Planning A*. 41 (9). pp. 2162–2180.
- Provincie Noord-Brabant (2009). Startmotitie Masterplan Energie Brabant 2010–2020: Energietransitie als kans. 's Hertogenbosch, The Netherlands
- Talen, E. & Shah, S. (2007). Neighborhood Evaluation Using GIS: An Exploratory Study. *Environment and Behavior*. 39 (5). pp. 583–615.

**EXPLORING SUSTAINABLE INVESTMENT BEHAVIOR OF THE PRIVATE
HOMEOWNER: THE INFLUENCE OF NEIGHBORHOOD SATISFACTION:
A Case Study In The City Of Eindhoven, The Netherlands**

Author: E.E.M. Bisseling

Graduation Program:

Construction Management and Engineering 2012-2013

Graduation Committee:

prof.dr.ir. W.F. Schaefer

prof. dr. Q. Han

drs. P.H.A.M. Masselink

J. Bekkering (HetEnergieBureau B.V.)

Date of Graduation:

13-03-2013

ABSTRACT

When upgrading the existing housing stock, urging private homeowners to invest in sustainable improvements of their dwellings proves difficult. Can a neighborhood upgrade be used to urge private homeowners to invest? In this research, a relationship between neighborhood satisfaction and investment behavior is explored. A Bayesian Belief Network Model is used to find relationships between stated satisfaction levels, attitudes, knowledge, socio-demographics and indicated investment behavior, retrieved from a questionnaire released in selected case study areas in the city of Eindhoven, The Netherlands. An indirect relationship between neighborhood satisfaction and investment behavior is found, which forms the base of further research. Price consciousness of homeowners is found the biggest indicator of investment behavior.

Keywords: sustainable investment behavior; homeowners; existing housing stock; neighborhood satisfaction; neighborhood upgrade; decision model; Bayesian Belief Network; BBN; policy making.

INTRODUCTION

The worldwide energy use has increased the last few years and in the next twenty years, this will continue increase substantially. (Provincie Noord-Brabant, 2009) Not only the amount of households is increasing, but the average energy use per household is also increasing. This continuous increase in energy use poses a problem, because: 1) There are signs of climate change due to a rise in CO₂ emissions; 2) The fossil fuel reserves worldwide are decreasing; 3) Because of both previous reasons, the energy prices rise every year.

The combination these factors pose problems that have to be dealt with. The Dutch government, the province of Noord-Brabant and the Municipality all developed goals to deal with parts of these problems.

The Municipality of Eindhoven has the ambition to become energy neutral in 2040 (KENWIB, 2012). Forty percent of saving potential comes out of the improvement of

isolation and installation in existing housing stock. The existing housing stock is therefore the most important to improve.

The existing buildings stock in the member states of the EU accounts for 40% of final energy consumption in the European Union, and 63% of this represents the existing residential housing stock. (Poel, 2007) In The Netherlands, the built environment accounts for 30% of the total energy use (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2011). In the plans of all discussed parties. The biggest part of energy saving has to be gained from the existing housing stock with a low energy label, generally built before 1992. Corporations are already working on measures to update their existing housing stock. But the government cannot easily influence private homeowners to invest in energy saving measures to their own houses. Subsidy and information programs have been designed, but they still did not urge homeowners enough to make this important transition. The subsidy programs in The Netherlands are now being cancelled, which means new (and more effective) ways have to be found to urge homeowners to invest. That is why further research focusing on this target group is needed.

Research shows that homeowners that are satisfied with their neighborhood, will invest more in maintenance of his or her house (Galster & Hesser 1982). So when a homeowner is satisfied with his or her neighborhood the homeowner might be more willing to invest in sustainable improvements to his or her house.

That is why it may be plausible that there is a connection between neighborhood satisfaction (the link between the mentioned researches) and the level of sustainable improvements made to privately owned houses in this neighborhood. This connection will be explored in this research. If this connection exists, neighborhood upgrade can possibly be an extra incentive for private homeowners to invest in sustainable improvements of their houses and can be used as a policy tool by the local governments and municipalities.

NEIGHBORHOOD SATISFACTION

In our everyday life, the word neighborhood is used for multiple meanings and uses. A planning perspective views the concept of neighborhood as a subunit that builds the physical and social fabric of a city. Besides facilitating physical organization, neighborhoods serve as a means of social organization whereby, it is believed, interaction among residents is based on shared values and interests (Talen & Shah 2007).

There can be a difference between the general satisfaction and the total satisfaction outcome from adding the satisfaction rates from all different specific factors. (Lu 1999) describes that residents' judge their residential conditions based on their needs and aspirations. Satisfaction with the neighborhood therefore means that there is a high degree of congruence between the actual situation, the perceived actual situation and the desired situation of the resident. This also means that incongruence between actual perceived neighborhood conditions and wanted conditions lead to dissatisfaction.

(Feijten & van Ham 2009) and (Lu 1999) state that actual residential mobility can be seen as a mismatch between the residential needs and preferences a household has, compared to the characteristics of its current residential situation, just as neighborhood satisfaction levels. So residents that are not satisfied with the quality of their neighborhood, are more likely to express an intention to move than residents that are satisfied (Parkes et al. 2002). In addition, it is believed that residents that have a strong attachment to their neighborhood may be less likely to move (Permentier et al. 2009). A relationship between

the perceived neighborhood and residential quality and attachment was already generally accepted (Bonaiuto et al. 1999).

Part conceptual model

The sum of the evaluation of the different sub categories, together with the ‘general’ neighborhood evaluation, gives the neighborhood satisfaction and also a part neighborhood attachment. How much however each factor influences is not known. The influence of personal and household characteristics is visible in the perception, assessment and evaluation. A connection between neighborhood satisfaction and attachment is hypothesized, with neighborhood satisfaction predicting neighborhood attachment more. Both neighborhood satisfaction and neighborhood attachment are hypothesized to predict the wish to move. This is seen in Figure 1.

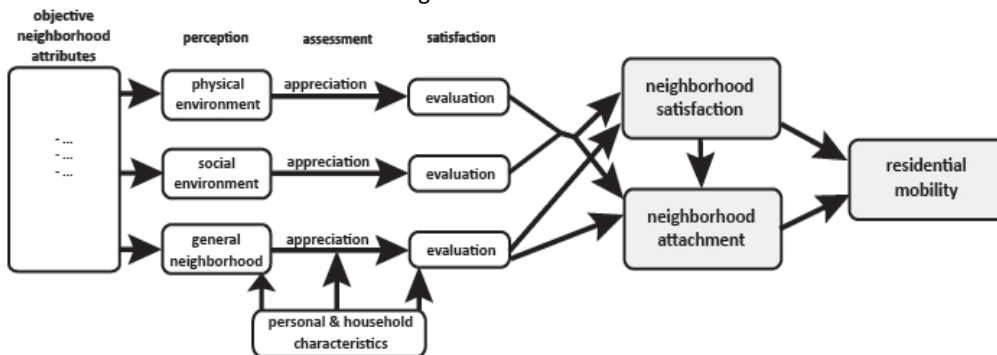


Figure 4: Part conceptual model

DECISION MODELS

To test the influence of the neighborhood satisfaction of residents on willingness to invest in sustainable improvements to their houses, it is necessary to identify the decision-making process and which factors also influence this. There are a lot of researches in the field of sociology and psychology that have tried to generate models for the decision-making process of humans on various different subjects.

In 1991, Azjen designed the theory of planned behavior. The central factor in this model is the intention to perform a behavior. The theory of planned behavior suggests that behavioral achievement depends on the combination of motivation (intention) and ability (behavioral control) (Ajzen 1991). Olander & Thøgersen (1995) suggest a MAO model that includes “motivation, ability, and opportunity” Hansla et al. (2008) developed a model to estimate the willingness to pay for green electricity within Swedish Households. This was tested by evaluating attitude (ATT), decreased with electricity costs and income. The attitude consisted of value orientation (VO), awareness of consequences beliefs (AC) and environmental concern (EC). The model proposed by (Han et al. 2013) is to test the influence of different forms of incentives on energy saving behavior of residents in Eindhoven and resulted in the identification of different target groups for incentives. This model is inspired by the MAO model and expanded to fit as energy saving behavior model. The model of Luijten (2010) places the attitude and knowledge as a direct influence factor on the buying behavior of consumers. Attitude in this model is formed by environmental awareness, price

awareness, comfort and health. A positive attitude will increase the willingness to buy a new built house. This attitude is influenced by socio demographic and socio economic factors (Luijten 2010). This model is inspired by the model of Azjen (1991).

According to these models, the most important factors in decision-making are:

1. Attitude (Environmental Concern, Comfort, Health, Price Consciousness)
2. Knowledge (Aware of own energy use, Knowledge of sustainable improvements)
3. Socio Demographic factors (Age, household, education)
4. Ability (Income, payback period, height of investment)

Conceptual Model

In this model (Figure 2), the hypothesis of this research is inserted and marked as hypothesis.

In this model, 'mobility' has a direct influence on the 'investment behavior'. 'Residential satisfaction' and 'residential attachment', influence 'mobility', as discussed. The direct influence of mobility on 'willingness to invest' is based on the fact that when a resident is planning to move, the attitude to invest can be present, but the resident can still decide based on the plans to move to postpone the investments to their new dwelling or even be motivated by the fact that the resident is moving, due to price consciousness. The

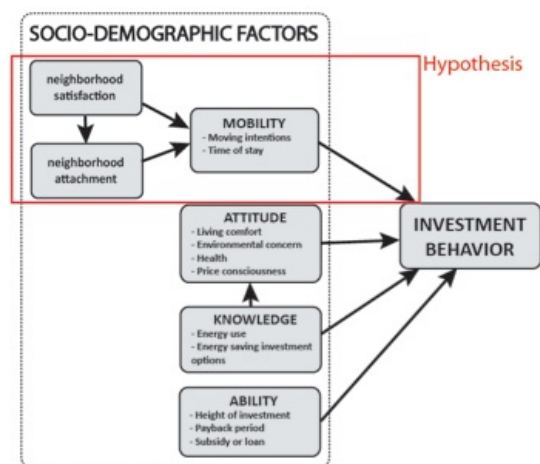


Figure 19: Conceptual model

second part of the model and the influences of 'attitude', 'knowledge' and 'ability' are derived from the discussion of the reviewed models. The socio demographic factors influence every variable in the model that influences the 'Investment Behavior'.

METHODOLOGY

Choice-behavior often holds conditions beyond socio-demographics and just attributes of choice alternatives that influence the decision (Verhoeven, Arentze, Timmermans, & Waerden, 2006). This is why a model is needed that allows estimating direct and indirect effects and allows testing of causal relations. For this research, a Bayesian Belief Network (BBN) model is used. BBN is an approach to probabilistic reasoning. The consequences of a decision or opinion are in many real life situations uncertain and also complex. It comes from combined work in the fields of Artificial Intelligence, Statistics, Operations Research, and Decision Analysis

(Kemperman & Timmermans 2012).

The BBN is composed of a dataset of categorical variables. These variables are linked to show relations and interdependencies. A BBN network consists of several nodes that represent variables, and arcs, that connect the nodes and show the causal links between nodes (Verhoeven et al., 2006). Each node has an underlying conditional probability table (CP) which holds the data of how much a variable depends on its parent nodes (Kemperman

& Timmermans, 2012). A parent node is a node from which an arc originates, while the child node is a node to which the arc links. Each state within a node has a certain probability that represents beliefs about possible outcomes. These beliefs can be updated when evidence is available, so when datasets are implemented for the nodes.

There are two ways to construct a BBN. These are: expert knowledge (based on literature and expertise) and network-learning algorithms. In this research, the BN PowerConstructor (Cheng, Bell, & Liu, 1997) is used to construct a network with a network-learning algorithm. Structural learning determines the (inter) dependencies of variables in a dataset and suggests a causal relation and direction. Parameter learning determines the CP tables of each node in the network, given the structure and data (Verhoeven et al. 2006; Kemperman & Timmermans 2012).

The network-learning algorithm is based on the three-phase dependency method (Cheng et al. 1997), Drafting the network, Thickening the network and Thinning the network.

Kemperman et al. (2012) describe the process as: In the first phase, mutual information of each pair of variables as a measure of closeness is computed and based on this information a draft network is created. The mutual information between two variables (X and Y) is defined as:

$$I(X,Y) = \sum_{x,y} P(x,y) \log \frac{P(x,y)}{P(x)P(y)}$$

where $P(x)$ and $P(y)$ are unconditional probabilities of $X=x$ and $Y=y$ and $P(x,y)$ is the joint probability. The mutual information between variables X and Y measures the expected information gained about Y, after observing the value of variable X. This means that if two variables are dependent and the value of one variable is known, this will give information about the value of the other variable (Kemperman & Timmermans 2012). The model will be analyzed in Norsys Netica 4.16 (Norsys, 2012)

DATA

The case study area is the city of Eindhoven, The Netherlands. Two neighborhoods that have low neighborhood scores and two neighborhoods that have high scores opposed to the average scores of Eindhoven are selected. The average property value of the houses in the neighborhoods lie between €200.000, - and €275.000, -. The average property value of Eindhoven is €243.000, -, positioned in the center of this zone. This also makes the neighborhoods comparable on income levels and poverty rate. For the sample, only houses built before 1992 are selected. Houses built after 1992 are often already very sustainable and are other than for sustainable energy systems not eligible for upgrading the house.

This results in a sample of 1237 households. The sample received an envelope, including an *invitation letter* which addressed the people to the importance of response from their neighborhood and mentioned the neighborhood they live in, a link to the online questionnaire and including a paper version of the questionnaire, for recipients that are not able to fill in the questionnaire online. The evaluation questions were composed using a five-point likert-type scale. A total response rate of 35,1% was achieved, resulting in a total of 434 surveys returned, of which 425 were valid to use in the BBN model.

ANALYSIS & RESULTS

Missing variables were taken into account in the model. The threshold of the accepted model is 0,7. A threshold of 1.0 is the default value. A higher threshold will result in less links and will leave the strongest links, which can be useful if the program produces too many

links. A lower threshold results often in more links, of which must be kept in mind that some are less strong. In this model, the direction of some arrows are reversed, because the causality the other way around seems more plausible. All indicated relationships were accepted, see Figure 3.

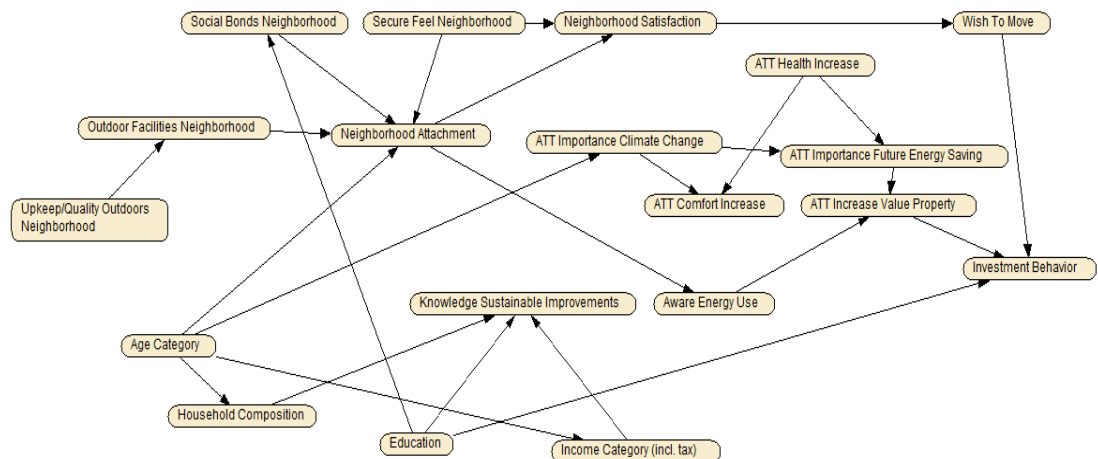


Figure 3: BBN Model

Results model structure

In this model a direct link as hypothesized is found between 'Wish to Move' and 'Investment Behavior'. 'Wish to Move' is again predicted by 'Neighborhood Satisfaction' and indirect by 'Neighborhood Attachment' and the neighborhood aspects. Socio demographics 'Age Category' and 'Education' show indirect effects. The attitude 'Increase Value Property' which is a price conscious attitude variable, is the only attitudinal variable that has a direct influence on investment behavior. The attitude for Comfort Increase does not seem to predict investment behavior. Of the socio demographic variables, only 'Age Category' has a direct influence on 'Importance of Climate Change' and indirect on the other attitudes except 'Health Increase'. 'Aware of Energy Use' is an indirect predictor of 'Investment Behavior', through attitude 'Increase Value Property'. Neighborhood Attachment again is considered a predictor of the 'Awareness of Energy Use'.

'Knowledge of sustainable improvements' is not found to be a predictor of any variable in the network. The ability value 'Income' only predicts the 'Knowledge of sustainable improvements' and does not have a link found to predict 'Investment Behavior'. 'Education' shows a direct relationship with 'Investment Behavior'. 'Age Category' shows indirect relationships through various variables. The household composition seems not determinant.

Results Scenario 1 and 2

Scenario 1 and 2 control for investment behavior, with either Yes set to 100% or No set to 100%. The significant predictors are discussed.

Wish to Move:

Of the investors 7,50% more indicate they definitely don't want to move, while non-investors show more often that they would move if they could (2,73% more) or definitely want to move (3,61%), which is a total of 6,34% more moving wishes for non-investors.

Neighborhood Attachment:

The percentage of homeowners that claim to be very attached, are the same within investors and non-investors. A slight change in favor of the investors occurs at the 'attached' answer, which occurs 2,70% more for investors than non-investors. Investors also state 1,90% more often that they have a neutral opinion about their attachment. Disattached was also indicated 0,20% more often by investors, where very disattached is more answered by non-investors, with a difference of 1,59%.

Neighborhood Satisfaction:

Investors show 1,10% more often to be very satisfied, and 4,10% more often to be satisfied, so are in total 5,20% more often satisfied with their neighborhood than non-investors. In total, 69,5% of the investors claim to be satisfied with their neighborhood, opposed to 64,3% of the non-investors. Slightly more non-investors are neutral about their neighborhood satisfaction (0,40%) and 3,41% more of the non-investors is either dissatisfied or very dissatisfied about their neighborhood.

Attitudes:

The level of attitude the property value increase from the investment is the most significant predictor for investment behavior. Between the 'very high' attitudes a difference of 7,6% occurs in favor of the investors, as well as the 'high' attitudes that show a difference of 12,2% difference in favor of the investors. This means that in total 19,8% of the investors are more convinced their property value increases from investment than non-investors, of a total of positive attitudes of 72,3% for investors, respectively 52,50% for non-investors.

The attitude about the importance of energy saving also shows to be a significant (but indirect) predictor. The investors show a very high attitude 4,60% more than non-investors, and a high attitude 1,30% more than non-investors. This is a total more positive attitude of 5,90% opposed to non-investors. The investors show in total a 78,5% positive attitude about the importance future energy saving, while the non-investors show only a 72,6% occurrence of a positive attitude.

The attitude about the importance of climate change shows some indirect effects. Very environmentally aware investors are 0,40% more than very environmentally aware non-investors. A high attitude shows a difference of 1,4% more for investors than non-investors, making in total 1,8% of the investors more climate change aware (total 57,30%) than non-investors (total 55,5%).

Knowledge:

Awareness of energy use seems significant for investors. Investors are 0,5% times more 'very highly aware' of their energy use, and 6,20% more highly aware. This means that 6,70% more investors claim to be highly aware of their energy use opposed tot non-investors, with total values of investors at 74,40% and non-investors at 67,70%.

Results scenario 3 through 8

Scenario 3 through 8 control for levels in neighborhood satisfaction.

Neighborhood Attachment:

Very high neighborhood satisfaction corresponds with high levels of neighborhood attachment. When looking the other way around, attached homeowners are not as much very satisfied, as very satisfied homeowners are attached. Attachment level seems therefore a good indicator of high neighborhood satisfaction. The levels of attachment decrease when the level of satisfaction decreases.

Wish To Move:

Very satisfied and satisfied homeowners express mostly the answer 'definitely not', with 77,6% respectively 73,10% of the answers. When neutral about satisfaction or dissatisfied, the homeowners express to be indifferent about moving, respectively 45,00% and 50,00%. Also, being dissatisfied raises the definitely yes category to 20,00% and for very dissatisfied homeowners even to 33,30%.

Investment Behavior:

Very satisfied and satisfied homeowners show respectively 69,30% and 70,00% of the times investment behavior. Dissatisfied or very dissatisfied homeowners or very dissatisfied homeowners show less investment behavior (63,50% respectively 60,60%). This is a difference of approximately 8%. Neutral homeowners still show 67,60% investment behavior. This result also shows that the difference between very satisfied and satisfied is not very significant for investment behavior, even not being neutral about the neighborhood, but the actual difference between being satisfied and being (very) dissatisfied is somewhat related to investment behavior.

CONCLUSION & DISCUSSION

In the model, an indirect relationship between neighborhood satisfaction and investment behavior is found, through the wish to move. The wish to move or wish to stay influences the shown investment behavior. Also, the wish to move is influenced by neighborhood satisfaction levels, so indirect there is a link. When looking at the differences that occur when controlling for investment behavior, only 5,20% more of the investors are (very) satisfied with the neighborhood and 3,41% of the non-investors are more dissatisfied. This shows that there is an effect. Next, when looking at the investment percentages that show in the model when controlling for neighborhood satisfaction levels, is that 8% more of the homeowners that indicate to be (very) satisfied did show more investment behavior. This again confirms that there is an effect. What also has to be taken into account, is that the difference between (very) satisfied with the neighborhood and investment levels opposed to being neutral about the neighborhood and investment levels, only differ at most 2%. So the biggest indicator seems to be dissatisfaction, rather than homeowners being satisfied with their living environment. Also, the neighborhood factors that should give more insight in which factors have the most influence on neighborhood satisfaction do not show much difference between neighborhood satisfaction levels; so more research is needed to define what causes homeowners to be dissatisfied with their neighborhood to make this finding usable for policy making; using a neighborhood upgrade to make homeowners more willing to invest.

Resulting from the attitudinal study, price consciousness proved to be the best indicator for investment behavior, with the increase of property value as leading attitude. When the

neighborhood upgrade will improve property values as well and is promoted as such, there might be a possibility to implement this as a policy in neighborhoods with homeowners that are dissatisfied with their neighborhood and the factors that are mostly responsible for this satisfaction are discovered.

The biggest impact however, should occur when providing information about price conscious attitudes, such as increasing property values and increasing energy prices.

RECOMMENDATIONS

It is recommended to go into further detail exploring the decision-making attitudes. A qualitative study based on interviews could get more in depth of understanding these attitudes and refine them more. Second, the influence of the ability factor, which consists of money, value and subsidy related influences is still a very important part in decision-making. Research focused on investment behavior without stimuli as subsidies can further be explored. Third, the influence of the growing number of elderly citizens (the aging population) has on the investment behavior. Investigating how elderly could be more urged and facilitated is a valuable addition to investment research. Last but not least, I would recommend researching further into the topic of neighborhood satisfaction in relation to investment behavior. Also, the best way of promoting this to homeowners and of course, after these researches find a good result, the way these neighborhood improvements could be implemented in terms of organization, finances, et cetera.

REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*. 50 (2). pp. 179–211.
- Bonaiuto, M., Aiello, A., Perugini, M., Bonnes, M. & Ercolani, A.P. (1999). Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. *Journal of Environmental Psychology*. 19 (4). pp. 331–352.
- Cheng, J., Bell, D.A. & Liu, W. (1997). *Learning belief networks from data: An information theory based approach*. pp. 325–331.
- Feijten, P. & van Ham, M. (2009). Neighbourhood Change... Reason to Leave? *Urban Studies*. 46 (10). pp. 2103–2122.
- Galster, G.C. & Hesser, G.W. (1982). The Social Neighborhood An Unspecified Factor in Homeowner Maintenance? *Urban Affairs Review*. 18 (2). pp. 235–254.
- Han, Q., Nieuwenhijzen, I., de Vries, B., Blokhuis, E. & Schaefer, W. (2013). Intervention strategy to stimulate energy-saving behavior of local residents. *Energy Policy*. 52 (C). pp. 706–715.
- Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). Psychological determinants of attitude towards and willingness to pay for green electricity. *Energy Policy*, 36(2), 768–774.
- Kemperman, A. & Timmermans, H. (2012). Environmental Correlates of Active Travel Behavior of Children. *Environment and Behavior*.
- KENWIB (2012). <http://www.kenwib.nl/>, last visited on the 28th of August, 2012
- Lu, M. (1999). Determinants of residential satisfaction: Ordered logit vs. regression models. *Growth and Change*. 30 (2). pp. 264–287.

- Luijten, A. (2010). *Consument en duurzaamheid*.
- Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2011). *Plan van Aanpak Energiebesparing Gebouwde Omgeving*.
- Norsys (2011) <http://www.norsys.com/download.html>, last visited on the 2nd of March, 2013
- Olander, F., & Thøgersen, J. (1995). Understanding of Consumer Behaviour as a Prerequisite for Environmental Protection. *Journal of Consumer Policy*, 18, 345–385.
- Parkes, A., Kearns, A. & Atkinson, R. (2002). What Makes People Dissatisfied with their Neighbourhoods? *Urban Studies*. 39 (13). pp. 2413–2438.
- Permentier, M., van Ham, M. & Bolt, G. (2009). Neighbourhood reputation and the intention to leave the neighbourhood. *Environment and Planning A*. 41 (9). pp. 2162–2180.
- Poel, B. van Cruchten, G. Balaras, C. (2007). Energy performance assessment of existing dwellings. *Energy and Buildings*, 39, (4), pp.393–403
- Provincie Noord-Brabant (2009). Startmotitie Masterplan Energie Brabant 2010-2020: Energietransitie als kans. 's Hertogenbosch, The Netherlands
- Talen, E. & Shah, S. (2007). Neighborhood Evaluation Using GIS: An Exploratory Study. *Environment and Behavior*. 39 (5). pp. 583–615.
- Verhoeven, M., Arentze, T., Timmermans, H. & Waerden, P. (2006). *Modelling Consumer Choice Behaviour with Bayesian Belief Networks*.



Elien Bisseling BSc.

During the last six-and-a-half years I have gained a lot of knowledge in the bachelor program of Architecture, Building and Planning and in the master program Construction Management and Engineering. My experience as board member of the study association and graduation Internship at HetEnergieBureau B.V. complete this résumé.

Sept. 2006 - Dec. 2011	BSc. in Architecture Building and Planning
Sept. 2008 – Sept. 2009	Board member of Study Association CHEOPS
Dec. 2011 – March 2013	MSc. in Construction Management and Engineering
Sept. 2013 – March 2013	Graduation Internship at HetEnergieBureau B.V.

Appendix E: Paper Version Survey

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

Introductie

Geachte heer / mevrouw,

Hartelijk dank dat u wilt meewerken aan dit onderzoek en dat ik uw ervaringen en meningen mag gebruiken.

De vragenlijst bestaat uit drie onderdelen: Een algemeen deel, een deel dat ingaat op duurzaamheid en energieverbruik en een deel over uw tevredenheid met uw woonomgeving.

Ik behandel uw gegevens zo discreet mogelijk en zal de gegevens die u invult niet voor andere doeleinden gebruiken. Het invullen van de vragenlijst zal niet meer dan 10 minuten van uw tijd vragen.

Mocht u nog vragen hebben naar aanleiding van de enquête dan hoor ik die graag van u. U kunt hiervoor contact zoeken via e.e.m.bisseling@student.tue.nl

U heeft gekozen voor het invullen van de papieren versie van deze vragenlijst. Let bij het invullen op volgtijdelijkheid van de vragen. Achter de vragen en/of antwoorden staat vermeld wanneer u een vraag over mag slaan. Let op: sla geen andere vragen dan aangegeven over. Gebruik na het invullen de bijgevoegde envelop om de vragenlijst weer naar mij terug op te sturen.

Nogmaals hartelijk dank voor uw medewerking!

Met vriendelijke groet,

Elien Bisseling

Masterstudent Construction Management and Engineering
Technische Universiteit Eindhoven

Voor we beginnen...

1. In welke buurt woont u?

- ☐ 512: Prinsejagt
- ☐ 532: Tempel
- ☐ 543: Vaartbroek
- ☐ 622: Het Ven

2. Bent u de eigenaar van de woning, of huurt u de woning?

- ☐ Eigenaar (koopwoning)
- ☐ Huurder (huurwoning) (Bent u huurder? Dan valt u helaas buiten de doelgroep voor dit onderzoek. U mag het invullen beëindigen. Hartelijk bedankt voor uw medewerking!)

Persoonlijk

Allereerst wil ik u een aantal vragen stellen over uzelf en uw huishouden

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

3. Tot welke leeftijdscategorie behoort u?

- | | |
|--------------------------------------|--|
| <input type="radio"/> Tot 18 jaar | <input type="radio"/> 45 t/m 54 jaar |
| <input type="radio"/> 18 t/m 24 jaar | <input type="radio"/> 55 t/m 64 jaar |
| <input type="radio"/> 25 t/m 34 jaar | <input type="radio"/> 65 jaar en ouder |
| <input type="radio"/> 35 t/m 44 jaar | |

4. Bestaat uw huishouden uit:

- ☐ Vaste partners zonder (thuiswonende) kinderen
- ☐ Vaste partners met thuiswonende kinderen
- ☐ Een ouder met thuiswonende kinderen
- ☐ Alleenstaande bewoner
- ☐ Anders, namelijk:

5. Hoe hoog is het gezamenlijk bruto inkomen van uw huishouden ongeveer?

- ☐ Minder dan € 2.500,-
- ☐ Tussen € 2.500,- en € 3.750,-
- ☐ Tussen € 3.750,- en € 5.000,-
- ☐ Wil ik niet zeggen

Persoonlijk (2)

6. Tot welke etniciteit rekent u zich?

- | | |
|---|--|
| <input type="radio"/> Nederlands | <input type="radio"/> Aziatisch (exclusief Indonesië en Japan) |
| <input type="radio"/> Turks | <input type="radio"/> Latijns-Amerikaans |
| <input type="radio"/> Marokkaans | <input type="radio"/> Indonesisch |
| <input type="radio"/> Pools | <input type="radio"/> West-Europees (excl. Nederland) |
| <input type="radio"/> Surinaams | <input type="radio"/> Oost Europees (excl. Polen) |
| <input type="radio"/> Nederlandse Antillen en Aruba | <input type="radio"/> Zuid Europees (exclusief Turkije) |
| <input type="radio"/> Afrikaans | <input type="radio"/> overige (niet-Europese) landen (bijv. Japan, Noord-Amerika en Oceanië) |

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

7. Wat is uw hoogst VOLTOOIDE opleiding?

- | | |
|--|--|
| <input type="radio"/> Geen | <input type="radio"/> HTS / HBO / WO / PostDoc / PhD |
| <input type="radio"/> Lagere school / basisschool | <input type="radio"/> Anders |
| <input type="radio"/> MULO / MAVO / LBO / VMBO | <input type="radio"/> Weet niet |
| <input type="radio"/> MBO / HAVO / VWO / HBS / MTS / MMS | |

Duurzaamheid

In dit gedeelte wil ik u een aantal vragen stellen met betrekking tot duurzaamheid in uw woning

8. Hoe zuinig zou u uw woning omschrijven wat betreft de verwarming (gasgebruik)?

- ☐ Zeer zuinig
- ☐ Zuinig
- ☐ Neutraal
- ☐ Onzuinig
- ☐ Zeer onzuinig
- ☐ Ik heb hier geen inzicht in

9. Heeft u in de afgelopen vijf jaar werkzaamheden aan uw woning verricht of laten verrichten die betrekking hebben op de energiezuinigheid van uw woning? (Bijvoorbeeld na-isoleren, dubbel glas laten plaatsen, nieuwe verwarmingsketel ...)

- ☐ Ja
- ☐ Nee (Sla vraag 8 t/m 14 over en ga door naar vraag 15)

Duurzaamheid (2)

10. Welke energiebesparende maatregelen heeft u getroffen in uw woning? (Meerdere antwoorden mogelijk)

- | | |
|--|---|
| <input type="checkbox"/> Spouwmuurisolatie | <input type="checkbox"/> CV-ketel met hoog rendement (HR) |
| <input type="checkbox"/> Dakisolatie | <input type="checkbox"/> Zonneboiler |
| <input type="checkbox"/> Dubbelglas HR ++ | <input type="checkbox"/> Zonnepanelen (PV) |
| <input type="checkbox"/> Dubbelglas | <input type="checkbox"/> Kierdichting |
| <input type="checkbox"/> Anders, namelijk: | |

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

11. Kunt u aangeven hoe belangrijk u onderstaande redenen heeft gevonden bij de beslissing uw huis te willen verbeteren?

	zeer belangrijk	belangrijk	neutraal	onbelangrijk	zeer onbelangrijk
Kostenbesparing op de energierekening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De woning beter verkoopbaar maken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Waarde van de woning verhogen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Milieubesparende overwegingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Comfort overwegingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gezondheidsoverwegingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als u nog andere belangrijke redenen heeft, kunt u deze hieronder invullen.

12. Kunt u aangeven in welke range het bedrag ligt dat u heeft uitgegeven aan deze verbeteringen?

- ☐ € 0 tot € 500,-
- ☐ € 500,- tot € 1.000,-
- ☐ € 1.000,- tot € 2.000,-
- ☐ € 2.000,- tot € 5.000,-
- ☐ € 5.000,- tot € 10.000,-
- ☐ Meer dan € 10.000,-
- ☐ Weet niet

13. Heeft u deze investering gedaan door gebruik te maken van een subsidieregeling en/of groene lening?

- ☐ Ja
- ☐ Nee

14. Kunt u aangeven hoe lang u denkt dat uw terugverdientijd voor deze investering is?

- ☐ Minder dan 5 jaar
- ☐ Tussen 5 en 10 jaar
- ☐ Tussen 10 en 15 jaar
- ☐ Langer dan 15 jaar
- ☐ Weet niet

Sla vraag 15 t/m 21 over en ga door naar vraag 22

Duurzaamheid (3)

15. Bent u in de nabije toekomst van plan uw woning te verbeteren op het gebied van energiezuinigheid?

- ☐ Ja
- ☐ Nee (Sla vraag 16 t/m 20 over en ga door naar vraag 21)

Duurzaamheid (4)

16. Welke energiebesparende maatregelen bent u van plan te treffen in uw woning? (Meerdere antwoorden mogelijk)

- | | |
|--|---|
| <input type="checkbox"/> Spouwmuurisolatie | <input type="checkbox"/> CV-ketel met hoog rendement (HR) |
| <input type="checkbox"/> Dakisolatie | <input type="checkbox"/> Zonneboiler |
| <input type="checkbox"/> Dubbelglas HR ++ | <input type="checkbox"/> Zonnepanelen (PV) |
| <input type="checkbox"/> Dubbelglas | <input type="checkbox"/> Kierdichting |
| <input type="checkbox"/> Anders, namelijk: | |

17. Kunt u aangeven hoe belangrijk onderstaande overwegingen zijn op uw beslissing uw huis te gaan verbeteren?

	zeer belangrijk	belangrijk	neutraal	onbelangrijk	zeer onbelangrijk
Kostenbesparing op de energierekening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De woning beter verkoopbaar maken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Waarde van de woning verhogen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Milieubesparende overwegingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Comfort overwegingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gezondheidsoverwegingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Zijn er nog andere belangrijke overwegingen geweest voor u?

18. Kunt u aangeven in welke range het bedrag ligt dat u wilt uitgegeven aan deze verbeteringen?

- | | |
|---|--|
| <input type="radio"/> € 0 tot € 500,- | <input type="radio"/> € 5.000,- tot € 10.000,- |
| <input type="radio"/> € 500,- tot € 1.000,- | <input type="radio"/> Meer dan € 10.000,- |
| <input type="radio"/> € 1.000,- tot € 2.000,- | <input type="radio"/> Weet niet |
| <input type="radio"/> € 2.000,- tot € 5.000,- | |

19. Gaat u bij deze investering gebruik maken van een subsidieregeling en/of groene lening?

- ☐ Ja
- ☐ Nee
- ☐ Weet ik nog niet

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

20. Kunt u aangeven hoe lang u denkt dat uw terugverdientijd voor deze investering wordt?

- ☐ Minder dan 5 jaar
- ☐ Tussen 5 en 10 jaar
- ☐ Tussen 10 en 15 jaar
- ☐ Langer dan 15 jaar
- ☐ Weet niet

Sla vraag 21 over en ga door naar vraag 22.

Duurzaamheid (5)

21. Kunt u aangeven wat de voornaamste reden is dat u niet heeft geïnvesteerd in energiezuinige verbeteringen aan uw woning? (Meerdere antwoorden mogelijk)

- | | |
|--|---|
| <input type="checkbox"/> De woning is al energiezuinig genoeg | <input type="checkbox"/> Verhuisplannen |
| <input type="checkbox"/> Onvoldoende geld beschikbaar | <input type="checkbox"/> Teveel ongemak |
| <input type="checkbox"/> De investering is te groot | <input type="checkbox"/> Ik ga in de nabije toekomst investeren in energiezuinige verbeteringen |
| <input type="checkbox"/> De terugverdientijd van de investering is te lang | |
| <input type="checkbox"/> Anders, namelijk: | |

Duurzaamheid (6)

22. Kunt u aangeven hoe hoog u uw kennis schat over de opties voor verbeteringen die aan het energieverbruik van het huis gedaan kunnen worden?

- ☐ Zeer hoog
- ☐ Hoog
- ☐ Gemiddeld
- ☐ Laag
- ☐ Zeer laag

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

23. Kunt u aangeven in hoeverre u het eens bent met de volgende stellingen:

	zeer eens	eens	neutraal	oneens	zeer oneens	weet niet
Ik ben bezorgd over klimaatverandering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Een energiezuinige woning leidt tot een comfortabeler binnenmilieu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Een energiezuinige woning is beter voor de gezondheid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik ben mij bewust van het energieverbruik van mijn woning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Een energiezuinige woning is op termijn meer waard dan een niet energiezuinige woning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik vind het belangrijk dat er in de toekomst meer energie wordt bespaard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. Kunt u aangeven welk bedrag u MAXIMAAL bereid zou zijn te betalen om uw huis energiezuinig te laten verbeteren?

- ☐ Geen enkel bedrag
- ☐ Tot maximaal € 1.000,-
- ☐ Tot maximaal € 2.500,-
- ☐ Tot maximaal € 4.000,-
- ☐ Tot maximaal € 5.000,-
- ☐ Tot maximaal € 8.000,-
- ☐ Tot maximaal € 10.000,-
- ☐ Het bedrag maakt mij niet uit.

Reden:

25. Kunt u aangeven welke terugverdientijd voor uw investering u bereid zou zijn MAXIMAAL te aanvaarden?

- ☐ Tot 5 jaar
- ☐ Tot 8 jaar
- ☐ Tot 10 jaar
- ☐ Tot 12 jaar
- ☐ Tot 15 jaar
- ☐ Het maakt me niet uit
- ☐ Weet niet

Reden:

Tevredenheid met de woonsituatie

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

In het volgende gedeelte ga ik u een aantal vragen stellen over uw woning en woonomgeving.

26. In wat voor type woning woont u?

- | | |
|---|---|
| <input type="radio"/> Vrijstaande eengezinswoning | <input type="radio"/> Bungalow |
| <input type="radio"/> 2 onder 1 kap woning | <input type="radio"/> Appartement / flat / maisonette / etagewoning, bovenwoning, benedenwoning |
| <input type="radio"/> Hoekwoning | <input type="radio"/> Anders |
| <input type="radio"/> Tussenwoning (rijwoning) | |

27. Kunt u aangeven in welke periode uw woning is gebouwd?

- | | |
|---|--|
| <input type="radio"/> Voor 1945 (vooorlogse woning) | <input type="radio"/> 1992 tot en met 2005 |
| <input type="radio"/> 1946 tot en met 1964 | <input type="radio"/> 2006 of later |
| <input type="radio"/> 1965 tot en met 1974 | <input type="radio"/> Weet ik niet |
| <input type="radio"/> 1975 tot en met 1991 | |

28. Voor onroerende zaakbelasting zijn koopwoningen getaxeerd. Wat is deze gemeentelijke taxatiewaarde, ookwel WOZ waarde, van uw huis?

- | | |
|---|---|
| <input type="radio"/> Onder € 200.000,- | <input type="radio"/> Tussen € 251.000,- en € 275.000,- |
| <input type="radio"/> Tussen € 200.000,- en € 225.000,- | <input type="radio"/> Boven € 275.000,- |
| <input type="radio"/> Tussen € 226.000,- en € 250.000,- | <input type="radio"/> Weet niet |

29. Bent u tevreden met uw huidige woning?

- ☐ Zeer tevreden
- ☐ Tevreden
- ☐ Niet tevreden, niet ontevreden
- ☐ Ontevreden
- ☐ Zeer ontevreden
- ☐ Weet niet

30. Hoelang bent u al woonachtig in uw huidige woning?

- ☐ 0 tot 2 jaar
- ☐ 2 tot 5 jaar
- ☐ 5 tot 10 jaar
- ☐ Langer dan 10 jaar

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

31. Hoe lang verwacht u in uw huidige woning te blijven wonen?

- ☐ Kortere dan 2 jaar
- ☐ Tussen de 2 en 5 jaar
- ☐ Tussen de 6 en 10 jaar
- ☐ Tussen de 10 en 15 jaar
- ☐ Langer dan 15 jaar
- ☐ Onbekend

32. Wilt u binnen 2 jaar verhuizen?

- ☐ Beslist niet (Sla vraag 33 over en ga door naar vraag 34)
- ☐ Eventueel wel, misschien
- ☐ Zou wel willen, maar kan niets vinden
- ☐ Beslist wel

Tevredenheid met de woonsituatie (2)

33. Wat is de reden dat u zou willen verhuizen? (Meerdere antwoorden mogelijk)

- ☐ Gezondheid
- ☐ Studie of werk
- ☐ Ontevreden met de woning
- ☐ Ontevreden met de buurt
- ☐ Overige (geef nadere toelichting)
- ☐ Overlast van overige bewoners
- ☐ Betere bereikbaarheid (wegen, openbaar vervoer)
- ☐ Betere parkeergelegenheden
- ☐ Architectonische kwaliteit van woning en buurt

Sla vraag 34 over en ga door naar vraag 35.

Tevredenheid met de woonsituatie (3)

34. Wat is de reden dat u beslist niet wilt verhuizen? (Meerdere antwoorden mogelijk)

- ☐ Ik ben tevreden met mijn woning
- ☐ Ik ben tevreden met de buurt waarin ik woon
- ☐ Ik wil niet weg uit deze buurt
- ☐ Overige (geef nadere toelichting)
- ☐ Ik verbouw liever
- ☐ Verhuizen kost teveel
- ☐ De huizenmarkt is momenteel ongunstig

Tevredenheid met de woonsituatie (4)

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

35. Hoe tevreden bent u met de buurt waar u in woont?

- ☐ Zeer tevreden
☐ Tevreden
☐ Niet tevreden, niet ontevreden
☐ Ontevreden
☐ Zeer ontevreden
☐ Weet niet

36. Hoe denkt u dat het imago van uw buurt is voor mensen van buitenaf?

- ☐ Zeer goed
☐ Goed
☐ Niet goed, niet slecht
☐ Slecht
☐ Zeer slecht

37. Kunt u aangeven hoe tevreden u bent over de volgende fysieke aspecten van uw buurt:

	zeer tevreden	tevreden	neutraal	ontevreden	zeer ontevreden	n.v.t.
De algehele uitstraling (woningen en omgeving)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De beschikbaarheid van parkeerplaatsen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De beschikbaarheid van winkels voor dagelijkse boodschappen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De kwaliteit van winkels voor dagelijkse boodschappen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De beschikbaarheid van openbaar vervoer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De hoeveelheid groen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De kwaliteit van het groen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De kwaliteit van straten, (fiets)paden	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De straatverlichting bij nacht	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De beschikbaarheid van speelvoorzieningen voor jonge kinderen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De kwaliteit van speelvoorzieningen voor jonge kinderen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De beschikbaarheid van voorzieningen voor jongeren (tussen 12 en 18 jaar)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De kwaliteit van voorzieningen voor jongeren (tussen 12 en 18 jaar)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het onderhoud van straten, paden, plantsoenen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als u belangrijke voorzieningen mist, of andere opmerkingen wilt maken over de fysieke kwaliteit van uw buurt, kunt u dat hier vermelden:

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

38. Kunt u aangeven in hoeverre u het eens bent met de volgende stellingen:

	zeer eens	eens	neutraal	oneens	zeer oneens	n.v.t.
<input type="radio"/> Ik voel mij thuis in deze buurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Ik ben gehecht aan deze buurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Ik heb veel contact met mijn directe buren	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Ik heb veel contact met andere buurtbewoners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> In deze buurt gaat men op een prettige manier met elkaar om	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Er is veel saamhorigheid in deze buurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> De mensen in deze buurt kennen elkaar nauwelijks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Ik ben tevreden met de volkssamenstelling in de buurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Ik voel mij vaak onveilig in deze buurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> Ik ervaar veel overlast van buren/omwonenden	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als u nog opmerkingen wilt plaatsen naar aanleiding van deze vraag, kunt u dit hier doen:

39. Vindt u dat de buurt in het afgelopen jaar vooruit of achteruit is gegaan?

- ☐ Vooruit
- ☐ Achteruit
- ☐ Is gelijk gebleven
- ☐ Weet niet

40. Kunt u aangeven in hoeverre uw tevredenheid met de kwaliteit van uw buurt invloed heeft op uw beslissing te investeren in energetische verbeteringen aan uw huis?

- ☐ Zeer veel invloed
- ☐ Veel invloed
- ☐ Neutraal
- ☐ Weinig invloed
- ☐ Zeer weinig tot geen invloed
- ☐ Weet niet

Opmerkingen m.b.t. deze vraag:

Papieren Versie Afstudeeronderzoek Tevredenheid en Energiebesparing

41. Kunt u aangeven in hoeverre uw tevredenheid met de kwaliteit van uw woning invloed heeft op uw beslissing te investeren in energetische verbeteringen aan uw huis?

- ☐ Zeer veel invloed
- ☐ Veel invloed
- ☐ Neutraal
- ☐ Weinig invloed
- ☐ Zeer weinig tot geen invloed
- ☐ Weet niet

Opmerking m.b.t. deze vraag:

Tot Slot

Hierbij wil ik u nogmaals hartelijk danken voor het invullen van deze vragenlijst.

Als u hieronder uw e-mailadres of adres en telefoonnummer invult, maakt u kans op een kleine prijs.

Tevens vindt u hieronder een mogelijkheid om nog opmerkingen te plaatsen naar aanleiding van de vragenlijst.

42. Vul hier uw e-mailadres of adres en telefoonnummer in als u wilt deelnemen aan de verloting van de prijs:

43. Laatste opmerkingen naar aanleiding van de vragenlijst:

— |