

MASTER

Tiny houses

state of affairs and requirements of potential future residents

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Tiny Houses: *State of affairs and requirements of potential future residents*

B. R. Boomgaard



Tiny Houses:
*State of affairs and requirements of potential
future residents*

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Preface

This report presents my master's thesis for the completion of the Urban Systems and Real Estate (USRE) program within the master's program Architecture Building and Planning (ABP) at Eindhoven University of Technology (TU/e). During the past year, I have studied the state of the art of Tiny Houses in The Netherlands and the preferred characteristics of possible Tiny House residents.

When I came across the Tiny House movement, I quickly realized there was a lack of information in many areas. A lot of examples are from the United States and are not one-to-one applicable in The Netherlands, for example due to regulations and also because we just have not so much space here. But even in the United States it is not common and easy yet. As I dived deeper into this movement I also came across the philosophy behind it; lower your ecological footprint, live more consciously and the fact that some people are happy with very little stuff.

I always explain to people that Real Estate is a very broad field and this Tiny House movement is such a good example; from the construction of a Tiny House with sustainable materials, to financial matters, to the regulations for the house itself as well as concerning a location to place it, to psychological theories on why people would want to live in such a small space with such little stuff. This covers (almost) every aspect of building engineering and more.

The Tiny House Nederland community was a great help with information, showing how people are trying to get this off the ground in The Netherlands, and not to mention being the main source for my respondents.

I also want to thank my supervisors Aloys Borgers, Astrid Kemperman and Ioulia Ossokina for guiding me through this project with feedback, ideas and advice and Mandy van de Sande - van Kasteren for helping with the survey. Furthermore I thank my parents for their support and patience.

B. R. (Babette) Boomgaard

Eindhoven, July 2018

Summary

The Tiny House movement originated in the United States, where in 2005 hurricane Katrina led to the design of the “Katrina Cottages”, houses of 30m² for people who became homeless because of this hurricane. These cottages became very popular and are, transported to different places, still inhabited. Also the economic crises boosted the popularity of Tiny Houses. Around 2015, the movement made its way to The Netherlands.

The Tiny House Movement, that is now gaining publicity in The Netherlands, has arrived at a critical point (van der Male, 2017). While some innovators (Rogers, 2003) took the initiative, the early adopters do not join them yet. At the same time, there is not much known about the demand for Tiny Houses.

The goal of this research is on the one hand to describe the current situation in the Netherlands concerning Tiny Houses, with country-specific information on regulations, and on the other hand find out what the wishes are of aspirant Tiny House residents and what potentially stops them from going to live in a Tiny House. Furthermore, the goal is to find out how Tiny Houses relate to climate change and tensions on (local) housing markets.

With this insight, public bodies can adjust regulations to create possibilities for Tiny Houses, and it can help potential future residents of Tiny Houses to realize their wishes.

Since the Tiny House movement just arrived in The Netherlands, this is a new type of housing and a new target audience, whereof the specific preferences are not measured yet, in contrast to other housing types.

The methods used in this research are on the one hand a research on the state of affairs of Tiny Houses in The Netherlands, and on the other hand a survey. The survey, that got 154 respondents, asked people who are interested in Tiny Houses about their preferences, motivations to (want to) live in a Tiny House, and their ecological view. Furthermore, a stated choice experiment was implemented, where respondents got 8 choice sets. With the gathered data, a Multinomial Logit model, a Random parameter model and a Latent Class model were estimated, to get more insight in the preferences of the respondents.

The Tiny Houses that currently exist in The Netherlands vary a lot. Similarities are that a lot of wood is used, especially for movable Tiny Houses. These movable Tiny Houses are often under 20m² because of the weight. Regarding technologies, solar panels are common, as well as non-drained toilets. For off-grid Tiny Houses every house has different solutions. The most difficult aspect of being off-grid is water; filtering rainwater and/or wastewater to make drinking water, and also filtering waste water to be able to discharge it. Different types of filters are used.

This is a difficult aspect, because in The Netherlands it is not allowed to make your own drinking water in principle. Furthermore, the building regulations in the Bouwbesluit can be hard to meet with a Tiny House, especially due to the small size. There are some possibilities, by demonstrating equivalence to the municipality. If the Tiny House is movable, the regulations for transport must be met. This concerns the size and the weight. The location for Tiny Houses mainly depends on the zoning plan of the municipality, where requirements on size and aesthetics are often not compatible with Tiny Houses. But a municipality has some tools to make exceptions. Not being able to find a suitable location is mentioned as reason for not living in a Tiny House yet by multiple respondents of the survey. Also regulations are mentioned very often as disadvantage of living in a Tiny House.

From the stated choice experiment came front that in general respondents do not want a flushing toilet, what suggests Tiny Houses will probably make the demand for alternative toilets rise. The respondents prefer a location outside the city and want to live together with 1-10 other Tiny Houses. But there is a small, critical group that wants to live in the city.

Sharing facilities was also asked in the survey. With direct neighbors, respondents want to possibly share interior space as well as equipment, while with the neighborhood they want to possibly share gardens. Also it came clear that most respondents want to buy a Tiny House (instead of renting) and also want to buy land for it.

The main motivations for people to want to live in a Tiny House are lower financial costs, more freedom, a smaller ecological footprint and owning less stuff, as well as living closer to nature.

Tiny Houses can possibly be a small part of the solution for tensions on the housing market in cities, because there are people that want to live in the city, even in the city center, in a Tiny House. The movability of Tiny Houses can also be an advantage in crowded, ever changing cities, for example on vacant lots. Furthermore, it came clear that (potential) Tiny House occupants have a pro-ecological view. Also, a lower ecological footprint is seen as a big advantage of living in a Tiny House. Together with the solar panels and non-flushing toilets that are common in Tiny Houses, they seem to contribute in reducing climate change.

Table of Contents

Preface	3
Summary	4
1. Introduction	8
1.1. Background	8
1.2. Problem analysis and research questions.....	8
1.3. Relevance	9
1.3.1. Scientific relevance	9
1.3.2. Practical relevance	10
1.4. Organization of the report	10
2. State of affairs	11
2.1. Development of the Dutch housing market	11
2.2. Literature on Tiny houses and the Tiny House philosophy.....	11
2.2.1. History	12
2.2.2. Practical aspects.....	12
2.2.3. Background Tiny House philosophy.....	13
2.3. Overview of Tiny House initiatives in The Netherlands.....	14
2.4. Sustainable techniques used in Tiny Houses	16
2.4.1. Non-drained toilets.....	16
2.4.2. Water purification with plants.....	17
2.4.3. Off-grid.....	18
2.5. Regulations.....	18
2.5.1. The Tiny House itself.....	18
2.5.2. Transport.....	19
2.5.3. Location.....	19
2.5.4. Finance	19
2.6. Conclusions	20
3. Research design	21
3.1. Respondents	21
3.2. The Survey.....	21
3.2.1. Stated choice experiment	21
3.2.2. Survey questions	23
3.3. Statistical analyses	24
3.4. Conclusions	26

4.	Survey results.....	27
4.1.	Descriptive statistics	27
4.1.1.	Socio-demographics and socio-economics	27
4.1.2.	Attitude towards Tiny Housing	32
4.1.3.	Attitude towards environment	36
4.1.4.	Housing requirements	37
4.2.	Model estimation.....	38
4.2.1.	Multinomial logit model.....	38
4.2.2.	Random parameter model.....	40
4.2.3.	Latent class model	40
4.3.	Conclusion from survey	46
5.	Conclusions and recommendations.....	47
5.1.	Research questions and answers.....	47
5.2.	Reflection	48
5.3.	Suggestions for further research	48
5.4.	Managerial implications.....	49
	References	50
	Appendix A.....	54
	Appendix B	59
	Appendix C	65
	Appendix D.....	67
	Appendix E	69
	Appendix F	71

1. Introduction

This chapter describes the background of this research before it goes on to the problem analysis and research questions. Afterwards the scientific as well as the practical relevance of this research is discussed. The last section explains the organization of this report.

1.1. Background

The world population is growing and the percentage of people living in cities grows even faster. At the same time, cities produce 80% of the anthropogenic CO₂ emissions and consume 60% of all energy used globally, what makes cities the largest contributor to climate change (Williams, 2013). But because of the efficient use of infrastructure and facilities, the ecological footprint per inhabitant is lower in cities than for inhabitants of villages and rural areas (Hemel, 2016). Also, the bigger the city, the lower the footprint per inhabitant.

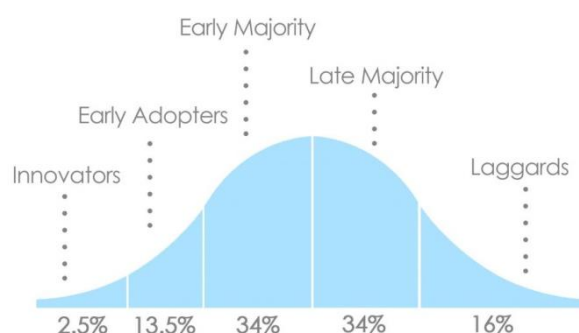


Figure 1: Rogers Adaptation curve (van der Male, 2017)

The Tiny House Movement has the philosophy to live in a more sustainable way and with a lower ecological footprint (Jonker, n.d.). Stimulated by the economic crisis, this movement became more and more popular in America and spread to other countries. There are a lot of websites and even TV-shows about Tiny Houses and recently it gets more attention in the Netherlands too. However, due to regulations and the lack of experience and knowledge on this more or less new way of living, problems and questions arise with potential future residents of Tiny Houses. This makes, according to the website of Tiny House Nederland (van der Male, 2017), that in the Netherlands the Tiny House movement has arrived at a critical point on the adaptation curve of Rogers (2003), see figure 1; The early adopters present themselves, but do not actually join the innovators yet.

Moreover, there is not much known about the demand for Tiny Houses and what these people exactly want.

1.2. Problem analysis and research questions

There is no strict definition for what a Tiny House is, because it is more like a philosophy. For this research the following description is used, suggested by Marjolein Jonker (n.d.), one of The Netherlands first Tiny House occupiers;

Tiny Houses are primary, fully fledged houses on a small scale. They are built and inhabited consciously to live a more basic life, less focused on consumption and with a lower ecological footprint. With the design and construction space, innovative techniques are used in a smart way. A Tiny House is max 50m², ideally (partly) self-sufficient, of good quality and built esthetically, functioning as a fulltime occupied dwelling. Being mobile is not a condition but often an aid; being fully off-grid is a possibility but not a requirement.

In this research, the following aspects will be addressed: Background information on migration to cities and the housing market in The Netherlands, literature about Tiny Houses worldwide, what techniques/aspects are used in Tiny Houses to be sustainable, regulations concerning Tiny Houses and an overview of Tiny House initiatives in The Netherlands. Furthermore, with the use of a survey there will be also insight in the motivations and wishes of potential Tiny House residents and the problems they come across.

Research objective and research questions

The goal of this research is on the one hand to describe the current situation in the Netherlands concerning Tiny Houses, and on the other hand find out what the wishes are of aspirant Tiny House residents and what stops them from going to live in a Tiny House. Furthermore, the goal is to find out how Tiny Houses relate to climate change and tensions on (local) housing markets.

With this insight, public bodies can adjust regulations to create possibilities for Tiny Houses, and it can help potential future residents of Tiny Houses to realize their wishes. When more people live in Tiny Houses, the climate can benefit from the lowered CO₂ emissions and cities can become healthier places.

To gain this insight, following research questions need to be answered:

- What are the main characteristics of Tiny Houses in general and in The Netherlands?
- Which technologies are used in Tiny Houses, regarding installations?
- What rules exist regarding Tiny Houses in The Netherlands and to what extent do potential occupants encounter these?
- What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) occupants of Tiny Houses?
- What are the main motivations for people to live in a Tiny House?
- Can Tiny Houses help reduce climate change?

1.3. Relevance

The relevance is divided into scientific and practical (or societal) relevance. Scientific relevance is focused on adding new knowledge, where practical relevance is about the relevance for potential residents, government bodies and commercial parties.

1.3.1. Scientific relevance

There is few research on Tiny Housing, especially concerning The Netherlands. Therefore this research will give an overview of the state of affairs of Tiny Houses in The Netherlands and country-specific information on regulations. So far, only the Dutch association for Tiny Houses did some research among people (interested in) living in Tiny Houses. This master project will investigate preferences of Dutch people interested in living in tiny houses more systematically by applying a stated choice approach.

Since the Tiny House movement just arrived in The Netherlands, this is a new type of housing and a new target audience, whereof the specific preferences are not measured yet. For existing housing types the housing preferences are measured already many times, for example student housing preferences (Nijënstein, Haans, Kemperman, & Borgers, 2015). According to Molin, Oppewal and Timmermans (1996), stated preference and choice models are useful methods to determine housing preferences, with the advantage of being able to test the validity of the assumptions made. Also the relative importance of housing attributes can be estimated with conjoint analysis, as well as the influence of each attribute on the decision on house choice (Nijënstein, 2012). With the obtained data, often a Multinomial Logit (MNL) model is estimated in research on housing preferences, while

individual differences are not taken into account with a MNL model (Molin, 2011). This can be done with, among other models, a Latent Class (LC) model. By incorporating both of these models, a good insight should be given in the preferences of potential Tiny House residents.

1.3.2. Practical relevance

The population of The Netherlands keeps growing, especially in the 4 biggest cities, but families tend to move from the city to surrounding municipalities (CBS, 2017a) what raises the share of 1-person households even more. There are currently tensions in the Dutch housing market due to a lack of housing supply (Bokeloh, 2018). At the same time cities try to lower the CO2 emissions; for example Amsterdam wants to be natural gas-free in 2050 (Gemeente Amsterdam, 2016) and Rotterdam has a Climate initiative for making the city, harbor and industry more sustainable, according to their website (www.rotterdamclimateinitiative.nl/).

With this research it will be made clear whether Tiny Houses can be a solution for (a part of) this. The survey that is part of this research will give insight in who are interested in Tiny Houses, how and where they want to live, and their attitude towards the environment. For The Netherlands there is very few research done on these subjects.

On the internet there are a lot of communities of people that live or want to live in a Tiny House, also in The Netherlands. Still there are only a few people living in a Tiny House or building one (Van der Male, 2017). This research can help these people by giving information, but it can also be used by public bodies to deal with regulations around Tiny Houses. In The Netherlands a new law is expected to enter into force in 2021 (Rijksoverheid, n.d.), the “Omgevingswet” (environment law), where all regulations concerning spatial development are simplified and bundled. This means those regulations are currently being examined. Dutch municipalities also have the power to provide exceptions on regulations and therefore they get such requests from the Tiny House community. Furthermore, parties like developers could be interested in the degree of the demand for Tiny Houses. Because this research also explores some sustainable technologies, companies that produce or work with these technologies can be interested in the attitude of the respondents towards them.

1.4. Organization of the report

Chapter two sketches a picture of the current state of affairs in the housing market and Tiny Houses in particular. First the housing market will be discussed. Then an overview of literature on Tiny Houses is covered as well as an overview of current initiatives in The Netherlands. Finally, sustainable techniques and regulations will be discussed.

Chapter three describes the research design for the survey with the stated choice experiment; the target audience, the chosen attributes, the chosen questions and which statistical analyses to use.

Chapter four deals with the analysis of the data collected from the survey. The estimated models will be discussed here.

In the last chapter, chapter five, all conclusions from this research can be found. An overview of the research questions with the accompanying answers will be given here, as well as reflection, implications and suggestions for further research.

2. State of affairs

Chapter two discusses the literature on the development of the housing market as a whole (2.1) and on Tiny Houses in specific (2.2). Then, in section 2.3, an overview of Tiny House initiatives in The Netherlands is given, accompanied by examples. This is followed by the description of some sustainable techniques used in Tiny Houses (2.4) and a discussion of the regulations (2.5) in The Netherlands where Tiny Houses have to deal with. The chapter closes with the conclusions that can be drawn from the state of affairs (2.6).

2.1. Development of the Dutch housing market

With globalization, urbanization is taking place at a high pace (Fiedler, 2014). In combination with the growing population, this influences housing markets. In The Netherlands the population is expected to keep growing until 2030 (Joosten, Wisman, & Klaver, 2016). Joosten, Wisman & Klaver (2016) also found a migration of the population to larger urban regions – especially cities with more than 100.000 inhabitants - to be a trend, as well as more and more one- and two-person households. They state that these are the biggest challenges for the housing market.

From the latest housing research “WoOn” (WoonOnderzoek), held in 2015, several changes come forward. For example there is less cheap (under the legal limit for Dutch social housing) rental housing, while the income of tenants and owner-occupants decreased (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016). In 2009 75% of the rental housing stock was under this legal limit, in 2015 only 58%. In the same period the income of owner-occupants decreased with 6% and for tenants even 9%. WoOn (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016) also points out that fewer households have moved, but the wish to move increased. Especially the flow from and to owner-occupied houses reduces greatly, because due to the economic crisis home owners had a hard time selling their house. In 2015 3,2 million households (potentially or certainly) want to move, while in 2009 2,1 million did. This increase is mainly seen in the group that wants to move potentially – what means not looking actively – while those who certainly want to move only increased a bit (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016).

But now the economy is recovering again, the housing demand rises and the supply cannot keep up with it; therefore the meter prices rise according to Dopper & Geuting (2017). They, too, see the increase in one- and two-person households and state that within about 10 years these will be 70% of the households in The Netherlands. This will lead to an increasing demand for small dwellings. They mention Tiny Houses as a niche market within the market for small dwellings. This increasing demand for small dwellings (thus, Tiny Houses and other small houses) leads to more pressure on the housing market in cities, while the pressure in surrounding areas can lower, because many one- and two-person households want to live in the city (Dopper & Geuting, 2017). They also found an increasing demand for sustainable, self-sufficient living, because people seem to become more aware of their footprint.

2.2. Literature on Tiny houses and the Tiny House philosophy

Based on literature, a short history of the Tiny House movement is given in this section. Further in this section the practical aspects of living in a Tiny House will be discussed. The last part of this section will provide insight in the philosophy behind the Tiny House movement.

2.2.1. History

The Tiny House movement originated in the United States, where early inspirers already became active in the 1970's (van Orden, 2017). When architect Sarah Susanka wrote the book *The Not So Big House* in 1997, it became very popular. Although it was not really about Tiny Houses, the idea was to build better instead of bigger, and also to live more sustainable with less stuff. Also in 1997 Jay Shafer built his Tiny House, becoming a famous pioneer. Another famous pioneer is Dee Williams, who built her Tiny House in 2004 and wrote a book about it, called *The Big Tiny* (van Orden, 2017).



Figure 2: Katrina cottages, from www.cnu.org

Then in 2005 hurricane Katrina made architect Marianne Cusato design the “Katrina Cottages”, houses of 30m² for people who became homeless because of this hurricane. These cottages became very popular and are, transported to different places, still inhabited. Those can be seen in figure 2. On top of this the housing crisis hit in 2007 and made more and more Americans want to live debt-free. Nowadays tens of thousands Americans live in a Tiny House (van Orden, 2017). The Tiny House movement then spread over the world, for example in Japan, Haruhiko Tagami built a Tiny House that fits on a parking spot and in Spain two interior architects designed a “house in a suitcase” with foldable design interior. In 2015 the Tiny House movement came to The Netherlands, where a few pioneers like Marjolein Jonker picked it up. She, with some others, founded the Tiny House Nederland platform that has now tens of thousands of visitors each month (van Orden, 2017) and in 2016 there also came the Tiny House Nederland foundation.

2.2.2. Practical aspects

A Tiny House means that there is less space for stuff. Although most Tiny Houses have very clever storage space, people still have to get rid of lots of stuff when they move to a Tiny House. Embracing the digital era can make living in a Tiny House more easy.

With the smart storage space, sustainable techniques, etcetera, designing a Tiny House can be tricky. For example ventilation is much more an issue in such a small house. There are already several architects and builders in The Netherlands that are specialized in Tiny Houses (van Orden, 2017). One can buy a ready-made Tiny House with prices starting at around €40.000 excluding land.

However, it is difficult to get a mortgage for a Tiny House on wheels or otherwise movable Tiny House. Some people set up a crowdfunding, others lend money from family and/or use their savings (van Orden, 2017).

For the land a Tiny House can be placed on, one is dependent on the municipality. Even if one owns a piece of land with residential destination, the municipality sets requirements for the building(s) on it (van Orden, 2017). The municipality has the right to deviate temporary from the zoning plan (Rijkswaterstaat, n.d.), which creates some possibilities to experiment with Tiny Houses. The municipality of Almere is leading the way in The Netherlands; they initiated a competition for people who want to live in a Tiny House where the 'winners' are allowed to live in their Tiny House on a spot at the "bouwEXPO", an experimental zone. There were 245 submissions, while there is only place for 15 permanent and 10 temporary Tiny Houses (Gemeente Almere, 2016). The first residents already live there. Also in Den Helder there is a permanent spot chosen for 33 Tiny Houses to come, where people can lease a lot. This was initiated by a housing corporation who owns a piece of land that was waiting for a permanent destination (Woningstichting Den Helder, n.d.). This place is currently still under development.

Anson (2014) points out the romanticization of living in a Tiny house, by stating that Tiny Houses are more accessible for the higher incomes and that it involves a lot of difficulties; the costs for living in a Tiny House, such as water and electricity, are lower but to get a Tiny House in the first place one will need \$20.000 - \$50.000 to buy a commercial Tiny House or one needs access to reclaimed materials and things like that. This money needs to come from one's own pocket, because banks do not want to provide a construction loan for a Tiny House due to the difficulties with regulations and insurance (Anson, 2014). These regulations also differ from state to state in the United States, but in most places it is hard to find a spot to place a Tiny House. Besides money, one also needs tools, a building site and time (Anson, 2014). Anson also experienced herself that living in a Tiny House makes you drive longer distances and go out for dinner more. If one wants to compost, filter waste water or have a (kitchen) garden, a place to stay for a longer period is necessary.

2.2.3. Background Tiny House philosophy

As said in the introduction, the Tiny House movement is one of the possible answers to live more sustainable. More on sustainable techniques can be found in section 2.4.

Another important part of the Tiny House philosophy is simplicity/ live simple. At the University of Leuven an international research is done where over 500 people who consciously live simply were questioned, to find out what to do with "mess fever" ("zooikoorts" in Dutch). Zegers (2017), who worked on this research, found out that the word 'stress' is used 8 times as much (relatively) in 2000 as it was in 1800 if you look at all English books. He defines mess fever as a disease where you have an abundance of stuff and pursuits. The people that were interviewed for the research chose to live more simple, and thus having less stuff and/or less activities in their agenda (Zegers, 2017). Those people now experience more meaning in their lives. The first step to accomplish this is to take a step back, what can be done in time – less activities – and in space – less stuff – (Zegers, 2017), where the last one is clearly something that is part of the Tiny House philosophy. Also the other steps Zegers (2017) describes have similarities with going to live in a Tiny House; step two is 'attention', for example more attention to nature. Step three is called 'select', where one thinks about what is important in his/her life. This is what most people do when they think about how their Tiny House should be like. Finally one should have a live that is 'making sense', where one has more time and energy to do things that are worthwhile. The things a person finds most important, are also most present in his life (Zegers, 2017).

Brown and Kasser (2005) even found a relationship between voluntary simplicity and psychological and ecological well-being; Subjective well-being and ecologically responsible behaviour have a positive correlation, and materialism is related to lower subjective well-being as well as less ecological responsible behaviour.

Besides that Tiny Houses become more popular in this time of climate change, recent economic crisis and shortages on the housing market, also, according to Genus (2016), a paradigm shift towards a sharing economy can be seen as well as more attention for sustainable consumption and the rise of slow-fashion. These are things that fit in the Tiny House philosophy.

2.3. Overview of Tiny House initiatives in The Netherlands

The Tiny House Nederland community keeps track of all Tiny House initiatives in The Netherlands. In figure 3 and 4 these initiatives are shown, where green stands for advanced initiatives, orange for initiatives under development and red for cancelled initiatives.



Figure 3: Tiny House (soon to be) residents

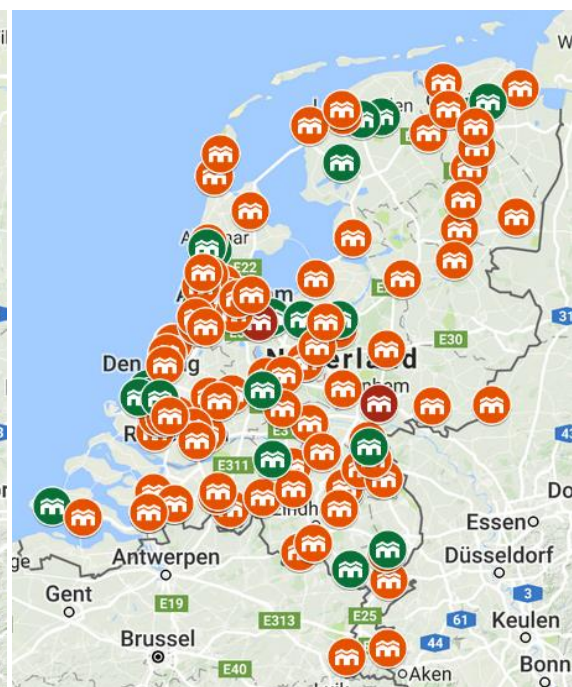


Figure 4: Possible residential locations and initiative groups

On the left map (Figure 3) almost all points represent 1 single Tiny House (the symbol with one house), while the points on the right map (Figure 4) represent much more initiatives for groups of Tiny Houses (the symbol with two connected houses), but those are mainly initiatives under development. This also shows that the innovators (left) are living in or building a Tiny House and the early adopters (right) present themselves, but are still ‘under development’.

To give a good picture of the wide variety in Tiny Houses in The Netherlands, three very different Tiny Houses will be presented. Besides these, almost every conceivable shape exists, even a multi-storey Tiny House (ANA ROCHA architecture, 2016).

Marjolein in het klein

Marjolein Jonker is, as already mentioned, one of the pioneers of the Tiny House movement in The Netherlands. 'Marjolein in het klein' is translated as 'Marjolein in miniature'. Her Tiny House is featured in many newspapers and other articles about Tiny Housing. The Tiny House is uniquely, custom build to the personal housing requirements of Marjolein Jonker. It is a 20m² off-grid house built on a trailer, with sleeping loft, composting toilet, solar panels and wood stove. It is placed on a temporary location at an old gas factory that is no longer in use. The house can be seen in figure 5.



Figure 5: Marjolein in het klein Tiny House (Jonker, n.d.)

Wikkelhouse

Wikkelhouse, what means wraphouse, is a Tiny House made of cardboard that is wrapped many times around a mold. This house does not have wheels but it still does not need a foundation and it can be moved. Hennie Tibben is the first to live permanently in a Wikkelhouse, in Almere on a spot with several Tiny Houses, meant as experiment. In figure 6 a Wikkelhouse is shown that is part of a hostel in Dordrecht.



Figure 6: Wikkelhouse (<https://www.wikkelhouse.com>)

Mill Home Tiny Loft

The Mill Home company has a different approach: They have built a 'Tiny House street' with five of their Tiny Lofts in a row, as shown in figure 7, each on a lot of 160m². The Tiny Lofts are built on a foundation and therefore could be sold as 'normal' houses with a mortgage. These 22m² Tiny Houses are energy neutral, but connected to the energy grid, water and sewer. They are equipped with solar panels.



Figure 7: Row of Tiny lofts (www.millhome.nl)

2.4. Sustainable techniques used in Tiny Houses

Not all sustainable techniques used in Tiny Houses are discussed, for not making the research too time consuming. For example solar panels, that (almost) every Tiny House has, are widely used already. Three techniques, that are thought to be distinctive for Tiny Houses, are highlighted; non-drained toilets, water purification with plants, and fully off-grid (as combination of techniques). These techniques will also be questioned in the survey.

2.4.1. Non-drained toilets

For flushing the toilet, each time approximately 5.7 liter water is used and (in The Netherlands) on average 33.32 liter per day per person (Vitens, n.d.). Also this wastewater needs to be purified. If one wants to reduce his ecological footprint and/or not wants to depend on rainwater, a 'dry' toilet offers a solution.

A composting toilet is the best know non-drained toilet, where the human waste is turned into compost. After one uses this toilet, sawdust or paper is sprinkled on top. There are also composting toilets with separate urine collection, so that one has to empty the bucket of the toilet less often, about every 3-6 weeks (Separett, n.d.). Such toilets have a small fan to prevent odours and to dry out faeces.



Figure 8: composting toilet (www.separett.com)



Figure 9: Incineration toilet (<https://cinderellaeco.us>)

Another option is an incinerating toilet, which burns the human waste at 550° C (Separett, n.d.). It uses around 0,4-1,7 kWh per use for an electrical powered incinerations toilet, but there are also other brands that have incineration toilets running on gas, for example from the Cinderella brand (<https://cinderellaeco.us/>).

2.4.2. Water purification with plants

One can purify rainwater and/or wastewater to use in the house and/or discharge it on the land. This can be done with several kinds of filters. One that is already applied in a Tiny House and purifies rainwater as well as waste water (from shower, sink and urine), is the purifying facade wall of Tiny TIM (Tiny TIM, n.d.), see figure 10. This is a 6m² wall with rows of special plants above each other. The downside of this is that it is not allowed to make your own drinking water in The Netherlands, except if it is tested regularly by the water Authority, what is very expensive (Tiny TIM, n.d.). Of course one can drink what he wants, but you are not allowed to 'serve' it to somebody else. This can for example be a problem if a Tiny House with such a system is meant to be rented out.



Figure 8: Tiny TIM purifying facade (<https://www.waterinnovatieprijs.nl/project/de-groene-wand-van-tiny-tim/>)

2.4.3. Off-grid

Off-grid means not connected to any kind of infrastructure; Water pipe, sewerage, gas pipe, electricity cable, internet cable, telephone cable. In line with the Tiny House philosophy, the solutions are preferably sustainable, so more common options like a diesel generator, gas bottles and chemical toilet fall off (Tiny TIM, n.d.). Besides that most off-grid techniques are considered to be more sustainable, it gives opportunities considering the location: An off-grid Tiny House can be placed on spots where there is no infrastructure (yet), for example wasteland or in nature, and if the Tiny House needs to move more often it saves costs on connecting to the grids each time (Tiny TIM, n.d.).

If not connected to water, it is necessary to purify rainwater and probably also wastewater, depending on the water usage. For sewerage, non-drained toilets were discussed in section 2.4.1. The wastewater from shower and sink needs to be purified before it can be discharged and one should only use biodegradable products for washing. Gas is not considered as necessary anymore, since the goal is to get the whole country gas-free, to achieve the goals of the climate agreement of Paris (NOS, 2016). For electricity solar panels can be used, as well as (small) windmills (Tiny TIM, n.d.). Solar panels that harvest electricity from sunlight and also warmth from sunlight and air already exist, such as the Triple Solar-system, which is used for heating, warm water and electricity (Triple solar, n.d.). Internet and telephone are already used by almost everyone on their mobile devices, so this is not really an issue anymore.

2.5. Regulations

Tiny Houses encounter quite a lot of regulations. Because there are not many Tiny Houses yet in The Netherlands, potential residents as well as municipalities struggle how to deal with these regulations. In this section the following will be discussed: building regulations for the Tiny House itself, regulations concerning transport of a Tiny House, the location to place a Tiny House and financial difficulties.

2.5.1. The Tiny House itself

When building a house, one needs to keep in mind the Building Regulations (in The Netherlands summed up in the 'Bouwbesluit'). Some of these regulations are hard to realize in a Tiny House. For example a sleeping room needs to be at least 5m² and 2,6m high. A sleeping loft that you see often in Tiny Houses does not meet this requirement, so the owner/builder better can say it is a high sleeper (van der Lee, 2016). Another important requirement in the Bouwbesluit is thermal resistance of external separation constructions. This leads to fairly thick walls and no account is taken for small spaces (van der Lee, 2016), although these heat up much quicker and therefore maybe do not need such insulated walls but can still have a low energy consumption for heating.

The requirements are lower for private construction, what makes it easier for those who want to build a Tiny House themselves. Furthermore it is possible to deviate from the Bouwbesluit with the so called "equivalence determination" (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, n.d.). One must demonstrate that his solution is as good as the prescribed, for: safety, protection of health, usability, energy efficiency and protection of the environment.

As already said in the introduction, a new law will enter into force in 2021 (Rijksoverheid, n.d.), the "Omgevingswet" (environment law). The Bouwbesluit than shall lapse and be replaced with the "Besluit Bouwwerken Leefomgeving" (decree constructions living environment). Municipalities will probably get the opportunity to deviate from this Besluit Bouwwerken Leefomgeving, what gives opportunities for permanent living in Tiny Houses (Jonker, 2017).

Furthermore, the legal obligation to connecting a house to the gas network, expired on January 1, 2018 (Penders, 2017). This means one obstacle less for Tiny Houses.

2.5.2. Transport

When a Tiny House is on wheels, one needs to take into account the regulations for transport. When a Tiny House is on a trailer, it may weigh up to 3500kg in total and then it can be transported by someone with a BE-driving license (Veerman & van der Male, 2018). The maximum size is than 12m long, 2,55m wide and 4m high, or, if it is defined as 'indivisible load', it can be 3m wide. With this weight the Tiny House probably cannot be longer than 7m (Veerman & van der Male, 2018). This option is useful if one wants to move the Tiny House by himself and/or wants to move often. The trailer is most common in America, but the regulations differ from The Netherlands. A special kind of trailer that is regarded as an agricultural vehicle, can have a weight up to 10.000kg. It still has the maximum dimensions of 12m long, 3m wide and 4m high and has to be pulled by a tractor (so not allowed on the highway).

A Tiny House without a trailer can be transported with a low loader truck with mounted crane, like is usual for mobile homes from recreation parks. The total height still may not exceed 4m. The maximum width is 3.5m and the length 15m, with a maximum weight of 27.000kg (Veerman & van der Male, 2018). In this case one does not need to buy an expensive trailer, but pays for each move.

2.5.3. Location

Finding a location for a Tiny House is hard. Small plots, smaller than 150m² are (almost) not available (van der Lee, 2016). Also in the zoning plan the location should be marked as residential usage. Municipalities often set requirements in the zoning plan for the appearance of the houses, which can be hard for a Tiny House to meet, for example a fixed height for the roof gutter.

In the new law Omgevingswet the zoning plan will be replaced by an environmental plan, where it is easier for municipalities to designate areas to Tiny Houses (Jonker, 2017).

It may be clear that somebody who wants to live in a Tiny House, needs to get and maintain good contact with the municipality.

It appears that there are possibilities for placing temporary Tiny Houses on vacant lots; Heijmans places their Tiny House called Heijmans ONE on their vacant land positions (Van Beurden, 2013). Currently, it takes on average 4 to 8 years before a project comes to completion (de Blauw, 2017), creating opportunities for placing Tiny Houses at the temporary empty plots.

2.5.4. Finance

In section 2.2.2 was already mentioned that a bank does not want to give a mortgage for a Tiny House on wheels. For a Tiny House that is moved by a low loader truck, a foundation is easily made because of the low weight of such a small house. With stelcon plates (concrete) one has an easy and inexpensive foundation that can be transported together with the Tiny House on the low loader truck (Veerman & van der Male, 2018). Another example is screw foundation, what is also easy to place. These kind of solutions can make a Tiny House real estate, while it is still more or less movable. But still, banks do not have much experience with these kinds of dwellings and therefore can be hesitant.

Other possibilities for financing are, as mentioned before, using savings, lend from friends or family, set up a crowdfunding.

Another difficult part is the insurance for the Tiny House. Again, insurance companies have little to no experience with this so one can encounter restraint. Dutch insurance company OOM is one of the few (if not only) insurance companies that is willing to insure a Tiny House and its household effects (OOM, n.d.).

2.6. Conclusions

After the economic recession, tensions have arisen on the Dutch housing market. There are more and more one- and two-person households and also more and more people move to the cities. This leads to a demand for small dwellings. Also there is more demand for sustainable dwellings. Together with these developments, the Tiny House movement came from the United States to The Netherlands, where it was already known for several years. The Tiny House movement comes with its own philosophy of living more simple, sustainable and with little stuff, which is supported by the fact that living more simple (voluntary) seems to make people happier. At the same time critics point out that Tiny House living is romanticized sometimes.

Currently in The Netherlands a few people are already living in a Tiny House, but there are a lot of initiatives that try to make it possible to have more people living in a Tiny House, especially in groups. Some companies have seen this upcoming market and offer Tiny Houses. It is hard to define the main characteristics of Tiny Houses in general or the Tiny Houses in The Netherlands, what was one of the research questions. Tiny Houses on wheels have similarities in materials (lot of wood) and their shape and size (because of transport), but there are also Tiny Houses without wheels and in a wide variety of shapes, sizes and materials. Another research question is "Which technologies are used in Tiny Houses, regarding installations?". The installations used in these Tiny Houses vary a lot. Solar panels are often used and also non-drained toilets quite a lot. For being off-grid there are several options, there is no standard solution. The hardest part of off-grid is water; filtering rainwater and/or wastewater to make drinking water, and also filtering waste water to be able to discharge it. The regulations concerning drinking water are tough, because in The Netherlands it is not allowed to make your own drinking water in principle. Furthermore there are building regulations that a Tiny House must meet, what is quite difficult, but there are some options. If the Tiny House is movable, one must also keep in mind the regulations for transport. The location for Tiny Houses seems to be the most difficult part, but municipalities play a role here, as well as with building regulations. Besides the regulations there are also obstacles with financing Tiny Houses, because most of them are not considered to be real-estate, and so one will not be provided a mortgage. This is the answer to the first part of the research question "What rules exist regarding Tiny Houses in The Netherlands and to what extent do potential occupants encounter these?", the second part, to what extent potential occupants encounter these rules, will be answered in chapter 4, with the use of the results of the questionnaire. But first the research design will be explained in chapter 3.

3. Research design

Some of the research questions could not be answered with researching the current state of affairs. More information is needed about the motivations and preferences of people who (consider to) live in a Tiny House. This information is obtained by means of a survey among people who (consider to) live in a Tiny House. This chapter first discusses how to reach respondents (3.1) and then goes on to explain the stated choice experiment and the survey in section 3.2. In section 3.3 the statistical analyses that will be conducted on the data collected with the survey, are discussed. Finally, section 3.4 summarizes it all in a conclusion.

3.1. Respondents

The target audience for the survey are people who are interested in living in a Tiny House. There are no restrictions, like age, as long as they are interested in Tiny Houses. This will be checked by including a question in the questionnaire, with one of the options being “I am not interested in Tiny Houses”. To reach the potential respondents, the survey was posted in the Facebook group of Tiny House Nederland. Furthermore it was spread via email to several personal contacts of the author and on the author’s personal Facebook profile, with the question to share the survey. The goal was to get around 300 respondents, in order to have suitable data for a discrete choice model.

3.2. The Survey

The survey itself was made using the Berg Enquête System 2.2, an online questionnaire system developed by Jessurun (2007). One of the benefits of this system is the possibility to include a stated choice experiment as part of the questionnaire. Besides a stated choice experiment, the survey consists of questions on preferences and motivations, as well as questions on socio-demographics. Also the NEPscale (Dunlap, Van Lier, Mertig, & Jones, 2000) is implemented to measure the attitude towards the environment.

3.2.1. Stated choice experiment

One of the research questions is “What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) occupants of Tiny Houses?”. To find out these preferences, a stated choice experiment is used, where respondents choose between hypothetical Tiny Houses. Stated choice experiments are used for measuring individuals’ preferences and choice behaviour for alternatives that are not currently available (Fry, 2001). Because there are so few Tiny Houses in The Netherlands at the moment, they are considered ‘not currently available’. Stated choice experiments are often used to measure consumer preferences (Molin et al., 1996). Also Molin (2011) states that a stated choice experiment is more equal to real-life decision-making than when respondents need to make a ranking or rate alternatives.

To set up a stated choice experiment, one needs to identify the relevant attributes and associated attribute levels describing the hypothetical alternatives. Following, the experimental task can be designed. These steps will be discussed below.

Identifying attributes and attribute levels

When researching the state of affairs, several characteristics of Tiny Houses came forward as important aspects. Concerning techniques, the toilet and drinking water supply are the stumbling blocks for an off-grid Tiny House and also encounter regulations. When looking at regulations, the location also pops out because it is so hard to find one. The preferences for toilet and drinking water can be used to answer (part of) the research question “What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) future occupants of Tiny Houses?”, while the preferences on location are useful for the research question “Are Tiny Houses a suitable

option to reduce the tension on the housing markets of cities?”. Furthermore, to find out if Tiny Houses can contribute to reducing the tension on the housing market in cities, the preferences regarding the acreage of private land need to be studied. In line with this also the preferences regarding sharing land and the presence of other Tiny Houses will be included in the experiment, to give a more complete idea of the preferred location. These attributes also appear to be popular topics for conversation on Tiny House-related websites.

For each attribute, 4 levels are identified. For toilet and drinking water, 4 levels cover the most important possibilities without making the experiment too extensive, and the other attributes also ‘fit’ well in 4 levels. Table 1 shows the attributes and their levels. The levels for toilet and drinking water are based on the previous research (chapter 2). Location levels are considered to cover all kinds of locations, with a focus on the city because of the research question mentioned before. The levels of the other 3 attributes are chosen in a way to be reasonable/realistic.

Table 1: Attribute levels

Attributes	Levels			
Toilet	Toilet with water flush, connected to sewer	Toilet with water flush, not connected to sewer	Composting toilet	Incinerating toilet
Drinking water	Connected to waternet	Rain water filtering with plants	Rain water and own waste water filtering with plants	Rain water and/or waste water filtering with filters (not plants)
Location	In/ close to city center	City, outside center	Village	Rural area
Minimum acreage private land (apart from possible joint land)	Approx 40m ²	Approx 70m ²	Approx 100m ²	Approx 130m ²
land to be used with local residents (not public)	None	approx 50m ²	Approx 100m ²	Approx 150m ²
presence of other Tiny Houses	None	1-5	6 -10	More than 10

To be able to choose a design, expected interactions between the attributes should be taken into account. Based on websites, forums, and common sense, these interactions were selected (table 2).

Table 2: Expected interaction between attributes

	Toilet	Drinking water	Location	Minimal acreage	Shared land	Other TH
Toilet		No	No	No	No	No
Drinking water			No	No	No	No
Location				Yes	Yes	No
Minimal acreage					Yes	No
Shared land						Yes
Other TH						

Experimental task design

Alternative Tiny Houses can be created by combining the levels of the attributes. A so called full factorial design (all combinations) will lead to $4^6 = 4096$ possibilities. As this is an infeasible number, a fractional factorial design is used. However, the fractional design should support the estimation of the interaction effects. Therefore, masterplan 12 from Hahn and Shapiro (1966) was chosen, to be more precisely columns 1, 2, 3, 7, 9 and 10. This masterplan is most suitable, although it is only possible to estimate interactions between the first three columns. Therefore, *location*, *minimum acreage private land* and *land to be used with local residents* were allocated to the first three columns. These are expected to interact with each other, while presence of other Tiny Houses has only one expected interaction.

From the masterplan, 64 alternatives (hypothetical Tiny Houses) were created. These were randomly combined in choice sets of 2 Tiny Houses. To each choice set, a 'none of both'-alternative was added. Respondent 1 was given choice set 1 to 8, Respondent 2 choice set 9 to 16, etcetera. Each respondent got 8 of the 32 choice sets. This means that after 40 respondents, every Tiny House alternative is shown 10 times. The choice sets were placed in a random order, but in a way that every 32 consecutive choice sets contained every choice set once. Choice sets were randomized as well. Respondents are asked to choose the alternative they prefer most from each choice set.

The choices of the respondents will be analyzed by estimating Multinomial Logit Models, random parameter models and latent class models, to find out which attributes are most important to the respondents and which levels they prefer most. This will be discussed in section 3.3.

3.2.2. Survey questions

The first set of questions in the survey is related to preferences and motivations, as two research questions are: "What are the main motivations for people to live in a Tiny House?" and "What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) occupants of Tiny Houses?". The respondents will first be asked about their current situation in relation to Tiny Houses, also to check if they belong to the target audience of the survey. When they indeed are interested in Tiny Houses, questions follow on what their main reasons are to (want to) live in a Tiny House, as well as what they see as disadvantages. These are open questions, in case respondents have reasons that did not come to front in the research yet. Also 6 statements on advantages and disadvantages will be presented to the respondents, using a 5-point Likert scale.

These statements are easier to analyze and compare on demographic characteristics. Furthermore, the respondents will be asked about their preference on renting or buying a Tiny House and land to place it on.

After this set of questions, the stated choice tasks will be presented to the respondents, where they will be presented eight choice sets.

Furthermore, the revised NEP scale (Dunlap et al., 2000) is implemented in the survey. This is a set of statements about the relationship between humans and the environment. One of the research questions is “Can Tiny Houses help reduce climate change?” and therefore it is thought to be interesting to see the respondents’ view on the environment.

Several socio-demographics will be asked at the end of the survey, to be able to describe the sample, and to find out if there are differences between for example men and women. This includes year of birth, gender, household composition, gross annual income and education. The division in education groups was copied from the WoOn survey (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016), mentioned in section 2.1. For income the division that CBS (2018b) uses is also used here.

The full questionnaire can be found in appendix B. Appendix A shows the questionnaire as presented to the respondents, in Dutch.

3.3. Statistical analyses

To answer the research questions on motivations and preferences, the data from the survey will be analysed. With the use of IBM SPSS Statistics 23, first the socio-demographics and socio-economics will be analysed, followed by the attitude towards Tiny Housing, attitude towards the environment and housing requirements. Gender, income and education will be compared with nationwide data, to see if the sample differs from the Dutch population. The chi-square test will be used to look for significant relations and to find out if differences are significant, for example between male/female. This test is based on the difference between the expected count and the observed count.

Stated choice experiment

The random utility theory assumes that if one has to choose between alternatives, the alternative with the highest level of utility will be chosen, where utility can be described as follows (Louviere, Hensher and Swait, 2000):

$$U_{ni} = V_{ni} + \varepsilon_{ni} = \sum_{k=1}^K \beta_k x_{nik} + \varepsilon_{ni}$$

Where

U_{ni} = overall utility that consumer n obtains from alternative i ;

V_{ni} = structural utility of alternative i for individual n ;

ε_{ni} = error term (random utility component);

β_k = utility weight for attribute level k ;

x_{nik} = attribute variable k , $k=1, \dots, K$

With the utilities of the alternatives, the alternatives can be compared with each other to find out which aspects of a Tiny House are most important for the respondents and which levels of alternatives are preferred.

For the stated choice experiment, dummy coding will be used for the attributes, a common data transformation that allows for a non-linear relationship between the levels of the attributes and utility (Hensher, Rose & Greene, 2015). Table 3 shows the dummy coding scheme. This type of coding causes that the utility of attribute level 4 = 0.

Table 3: Dummy coding scheme

Attribute level	D1	D2	D3
1	1	0	0
2	0	1	0
3	0	0	1
4	0	0	0

Also a constant is implemented, which will be 1 for each of the Tiny House alternatives and 0 for the “none” alternative. This means that a positive parameter for the constant shows that respondents prefer the alternatives above “none”.

The outcomes of the stated choice experiment will be used to estimate several types of random utility models with the use of NLogit (Econometric Software Inc, 1986-2016): a multinomial logit model, random parameter model and latent class model will be estimated to find the model that best fits, by looking at the Rho². As Train (2009) states, the goodness-of-fit can be measured with the Log-likelihood function, the most basic way. For discrete choice models, the likelihood ratio index or McFadden’s Rho² (ρ^2) is most commonly used, where Rho² is formulated as follows:

$$\rho^2 = 1 - \frac{LL_{\beta}}{LL_0}$$

Where ρ^2 lays between 0 and 1 and 0.2 – 0.4 represents excellent fit (McFadden, 1979).

The goal is to find out the preferences people have for a Tiny House and the selected attributes, by taking “choice” (TH1, TH2 or none) as the dependent variable. The models will give the utility of the attributes, so the levels of the attributes can be compared to see which are preferred most. With the latent class model it becomes clear if there are clusters of respondents that have different preferences.

Multinomial Logit (MNL) model

The MNL model is a good starting point for estimating preferences, according to Hensher et al. (2015). The MNL model can be described as follows (Louviere, Hensher and Swait, 2000):

$$P_{ni} = \frac{e^{V_{ni}}}{\sum_{j=1}^J e^{V_{nj}}}$$

Here, P is the probability alternative i is chosen from the set of J alternatives.

Mixed (random parameters) logit (MMNL) model

While the MNL model assumes no taste variations among respondents, the random parameter version of the mixed logit model assumes that respondents attach varying weights to the attribute levels, but have the same kind of preferences (Borgers & Vosters, 2011). For each β -parameter of the utility function, a distribution is estimated to capture these taste variations; a normally distributed random component v_k is added to each β_k -parameter, with mean 0.0 and standard deviation σ_k (Borgers & Vosters, 2011). σ_k will be estimated additional to the mean effect β_k . The equation for the structural utility is as follows (Borgers & Vosters, 2011):

$$V_{ni} = \sum_k (\beta_k + v_k) x_{nik}$$

Latent Class (LC) model

A latent class model in fact consists of multiple MNL models that are estimated for multiple clusters of respondents (classes), where the chance that a respondent who belongs to class c chooses alternative i is as follows (Hensher et al., 2015):

$$P_{ni|c} = \frac{e^{V_{ni|c}}}{\sum_{j=1}^J e^{V_{nj|c}}}$$

These classes are determined by similarities in respondents' observed variable distributions (Hensher et al., 2015).

3.4. Conclusions

Data will be collected using a survey, where a stated choice experiment is implemented in. This survey will be held among people that are interested in Tiny Houses and will be spread online. The respondents will be asked about their motivations and preferences and also personal characteristics. The stated choice experiment goes deeper into the preferences of the respondents for a Tiny House. Interaction between attributes of this stated choice experiment will also be taken into account. With estimating models it will become clear which attribute levels are most preferred and also if there are different clusters with different preferences.

4. Survey results

In this chapter the results from the survey can be found. This is divided in descriptive statistics (4.1) and model estimations (4.2). In section 4.1, first socio-demographics are discussed, such as gender, age and situation in relation to Tiny Houses. Furthermore, the attitudes towards Tiny Houses and attitude towards the environment will be discussed. Section 4.2 then discusses first a multinomial logit model, then a random parameter model, latent class models and decision trees. The chapter closes with conclusions from the survey (4.3) and the answers to the research questions “What are the main motivations for people to live in a Tiny House?” and “What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) occupants of Tiny Houses?”.

The survey was put on the Internet on July 25 2017 and closed on September 14 2017. Eventually 285 respondents started the survey. Only the fully completed surveys were used for further analysis: 154 respondents. The answers were checked on outliers; only 4 non-existent postal codes were found. These respondents were not removed as they may currently live outside The Netherlands and they can still be interested in living in a Tiny House in the Netherlands.

4.1. Descriptive statistics

First, descriptive statistics are discussed, starting with socio-demographics followed by the attitude of the respondents towards Tiny Houses and environment. These are the results of the survey – excluding the stated choice experiment.

In 2017, a questionnaire was set out among Dutch people who are interested in Tiny Houses by the Dutch Tiny House Foundation (Tiny House Nederland, 2017). If applicable, the results from this survey (referred to as the THNL-survey) will be compared with those of the current survey. This is also the case for a survey done by other students (Heslinga & de Jong, personal communication, 2017).

4.1.1. Socio-demographics and socio-economics

Gender

The sample of 154 consists of 49 males (32%) and 105 (68%) females, see figure 11. This differs a lot from the Dutch population, where gender has, rounded to whole percentages, an equal ratio (CBS, 2017b). The survey of Heslinga & de Jong had 30% male out of 128 respondents. This suggests that maybe more Dutch women are interested in Tiny Houses than men. The fact that the survey was spread mainly on social media is not supposed to influence the male-female ratio of the respondents, since from the Dutch population aged 12 and over, 85.1% of men and 84.1% of women use social media (CBS, 2018a).

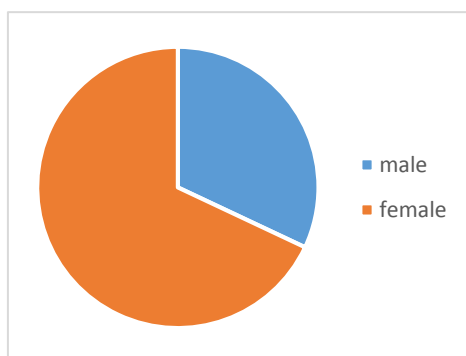


Figure 9: Gender of respondents

Year of birth

The oldest and youngest respondent are born in 1941 and 1999 respectively (76 and 18 years old by the end of 2017). The mean age is 42 or 43 years old.

The report regarding the THNL-survey only shows age categories. Table 4 compares the results.

Table 4: year of birth in two surveys

Year of birth	THNL		This study	
1956-1965	19.5%	180	17.5%	27
1966-1975	24%	160	16.9%	26
1976-1985	21.5%	179	24.0%	37
1986-1995	24.1%	145	27.3%	42
Before 1956/ after 1995	10.9%	81	14.3%	22
TOTAL	100%	754	100%	154

Tiny House Nederland used partly the same channels as we did to distribute the survey, but the age distribution is significantly different at the 10% level according to the outcome of the chi square test ($p=0.057$). This needs to be kept in mind when comparing their conclusions with ours.

To look for similarities between people of (more or less) the same age, a categorization is used, different than the categories of the survey by THNL. Generations are defined for age-groups that share certain attitudes and consumer behaviour (Solomon, Bamossy, Søren & Hogg (2006); Geck (2006); Meredith & Schewe (1994)). This is considered as a more useful categorization than the more random 10 year-groups. The generations with corresponding years of birth can be seen in table 4.

Because there was only one respondent that was older than the generation Baby boomers, and this was only a few years, it was decided to create the group “(pre-) Baby boomers”

Table 5: Generations

Generation	Year of birth	Respondents	Percentage
(pre-) Baby boomers	Up to 1965	45	29.2%
Generation X	1966 - 1976	33	21.4%
Generation Y	1977 - 1994	71	46.1%
Generation Z	After 1994	5	3.2%

Table 5 shows generation Y is the biggest group amongst the respondents and Generation Z the smallest. Generation Z contains respondents of 23 years old or younger, what could explain why this group is smallest; a lot of them are still in school or studying. Because this group is so small, it will be left out in analyses where the generations are used. Generation Z is not merged with generation Y because their housing situations differ too much. Therefore, generation Z is left out when comparing generations. The fact that generation Y is the biggest suggests that this generation is most interested in Tiny Houses, but it can also be a result of spreading the survey online.

Income and education

Income and education level of the respondents are compared with nationwide data from CBS.

Table 6: Income

Gross annual household income	Respondents (N=135)	Nationwide (2016)
Less than €10.000	10.4%	5.3%
€10.000 - €20.000	23%	27.1%
€20.000 - €30.000	21.5%	32.7%
€30.000 - €40.000	20%	20.6%
€40.000 - €50.000	14.8%	8.3%
More than €50.000	10.4%	6%

19 respondents chose “I prefer not to say”. Those are not included in the calculation of the percentages, for a better comparison with the nationwide data from CBS (2018b). We can see that in comparison, more respondents have a very low income, but also there are more respondents with a very high income. So we cannot say that only people with a low income are interested in living in a Tiny House, as one might expect. Although maybe not related to income, lower financial costs are seen as an advantage of living in a Tiny House, by almost all respondents, as can be seen in figure 12;

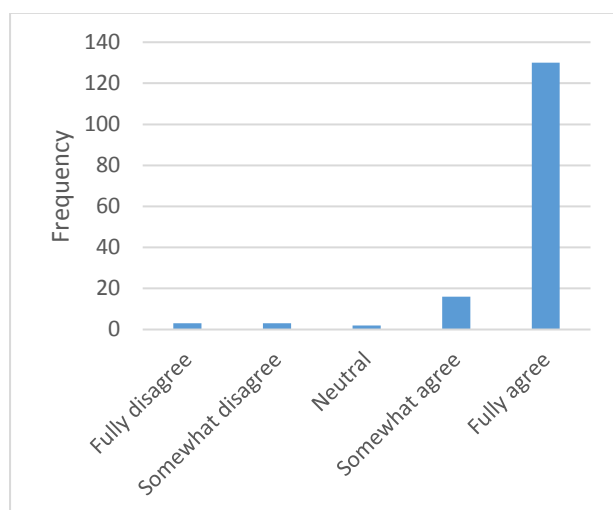


Figure 10: "I see lower financial costs as an advantage"

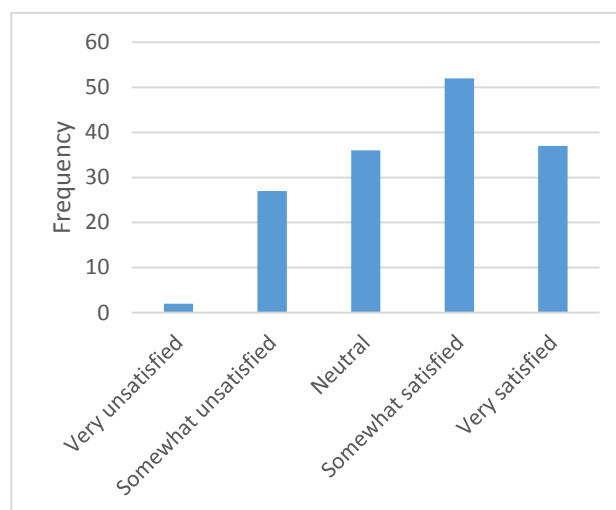


Figure 11: Income satisfaction

The respondents were also asked how much they are satisfied with their income. The given answers for this question show that only 29 respondents are unsatisfied with their income (figure 13). This is 18.8%. When connecting income to income satisfaction, no significant relationship was found.

Also the education level of the respondents is compared to the nationwide data of CBS (2018c), as can be seen in table 7.

Table 7: Highest education completed

Education level	Respondents	Nationwide
Low education	2.6%	32.1%
Secondary education	25.3%	38.5%
High education	72.0%	28.6%
Unknown	0	1.5%

The respondents seem to differ a lot from the education levels in The Netherlands. It can be seen that the respondents mainly have a high educational level, that is, hbo or wo. Secondary education means secondary school (havo/vwo) or mbo; Low education means elementary school, craft school (or alike), vmbo.

There was no significant relationship found between education and income of the respondents. Even if it was, it could still rely on coincidence: the survey asked for the education level of the person filling in the questionnaire, while the question about income asked for concerned total household income.

Situation in relation to Tiny Houses

The following situations were presented to the respondents:

- (1) I live in a Tiny House
- (2) I am building/ let build a Tiny House
- (3) I would like to live in a Tiny House, but it is not possible due to circumstances
- (4) I am exploring my possibilities to live in a Tiny House
- (5) I want to know more about Tiny Houses, but do not want to live in a Tiny House (as yet)

Most respondents (66.2%) are in an oriental phase (answer 4 and 5), while 16.2% are already living in or building a Tiny House. The other 17.5% would like to live in a Tiny House but cannot (due to circumstances), see figure 12.

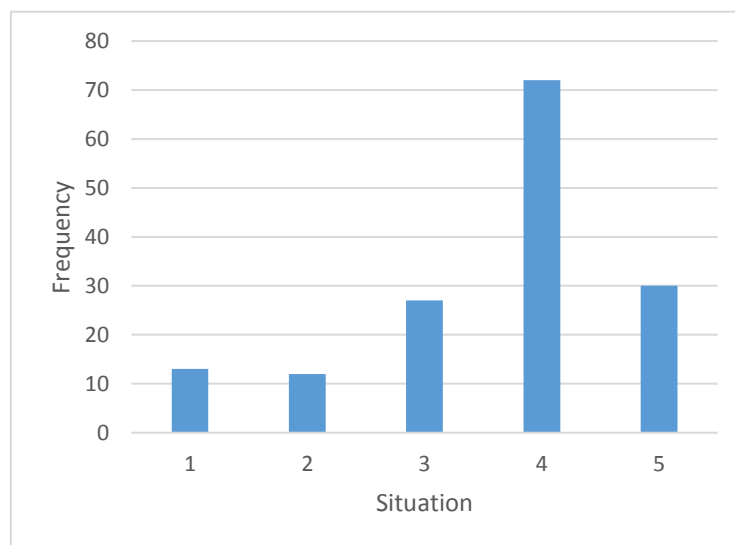


Figure 12: Current situation

The respondents that chose options 3 or 5 were also asked the main reason for not wanting/ being able to live in a Tiny House yet. The results are summarized in Table 8.

Table 8: main reason for not wanting/ being able to live in a TH yet

Main reason	Times chosen
I don't have the money	11
I don't have a location yet	11
I'm not ready yet	9
My partner/ family does not want	3
I wait until it is more common in The Netherlands	4
Another reason	7

As can be seen in table 8, the most chosen reasons are lack of money and location. Also some of the answers for “another reason” are related to this; No possibility for a mortgage, few possibilities in The Netherlands and therefore expensive, laws and regulations.

If we look at the situation per generation, the ratios differ clearly. It is notable that the (pre-) Baby boomers and generation Y are quite alike, while generation X (which lies in between in terms of age) has a much higher percentage of respondents who are exploring possibilities and a lower percentage of respondents living in or building a Tiny House. Generation Z is not taken into account, because of the small number of respondents (only 5) belonging to it.

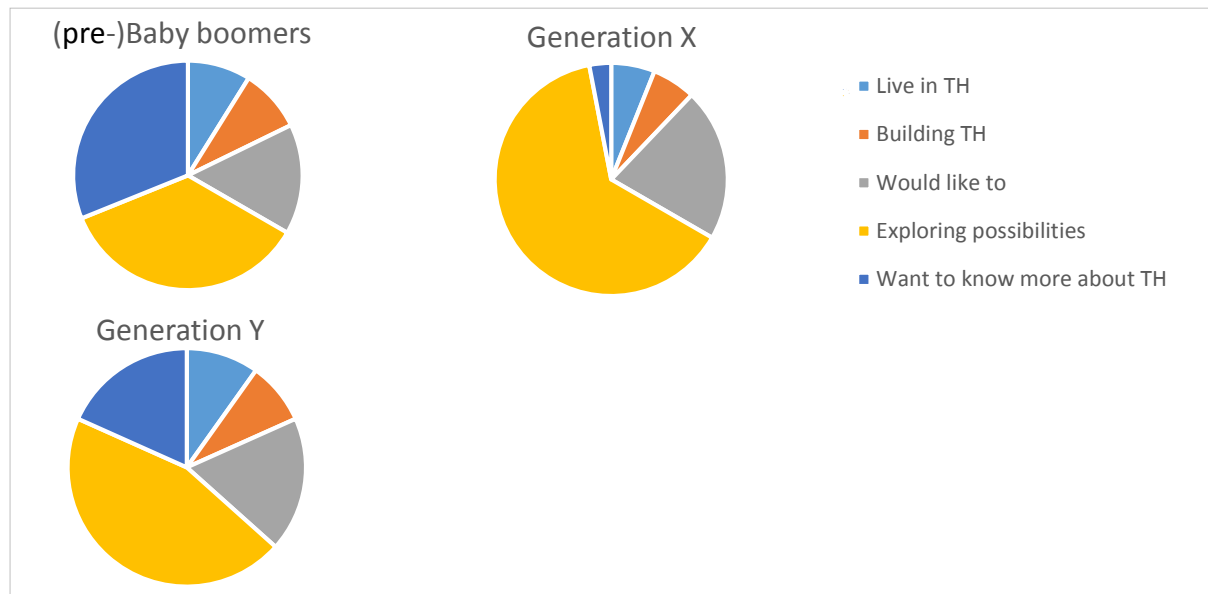


Figure 13: Generations vs situation

A chi square test could not be conducted for generation and current situation, because of the low values in several cells (due to the low number of respondents in combination with a 3x5 table). Therefore the categories were reduced to three; 1+2 (living in or building Tiny House), 3+4 (would like to/exploring) and 5 (want to know more). Now the relationship is significant at the 5% level).

The current situation also differs for men and women. A higher percentage of men choose option 1 and 2, and are thus living in or building a Tiny House, than women did. Among women, option 4 (exploring possibilities) was chosen much more often in comparison to men. This difference is significant at the 10% level. These differences can be seen clearly in figure 16.

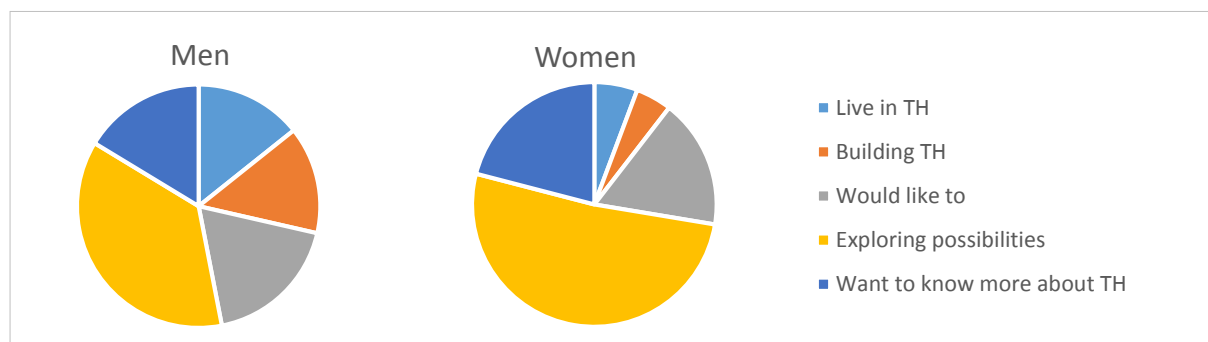


Figure 14: Gender vs situation

4.1.2. Attitude towards Tiny Housing

The statements in the survey on (dis)advantages of living in a Tiny House give some insight in the attitude respondents have towards Tiny Housing. The charts in figure 16 show the given answers;

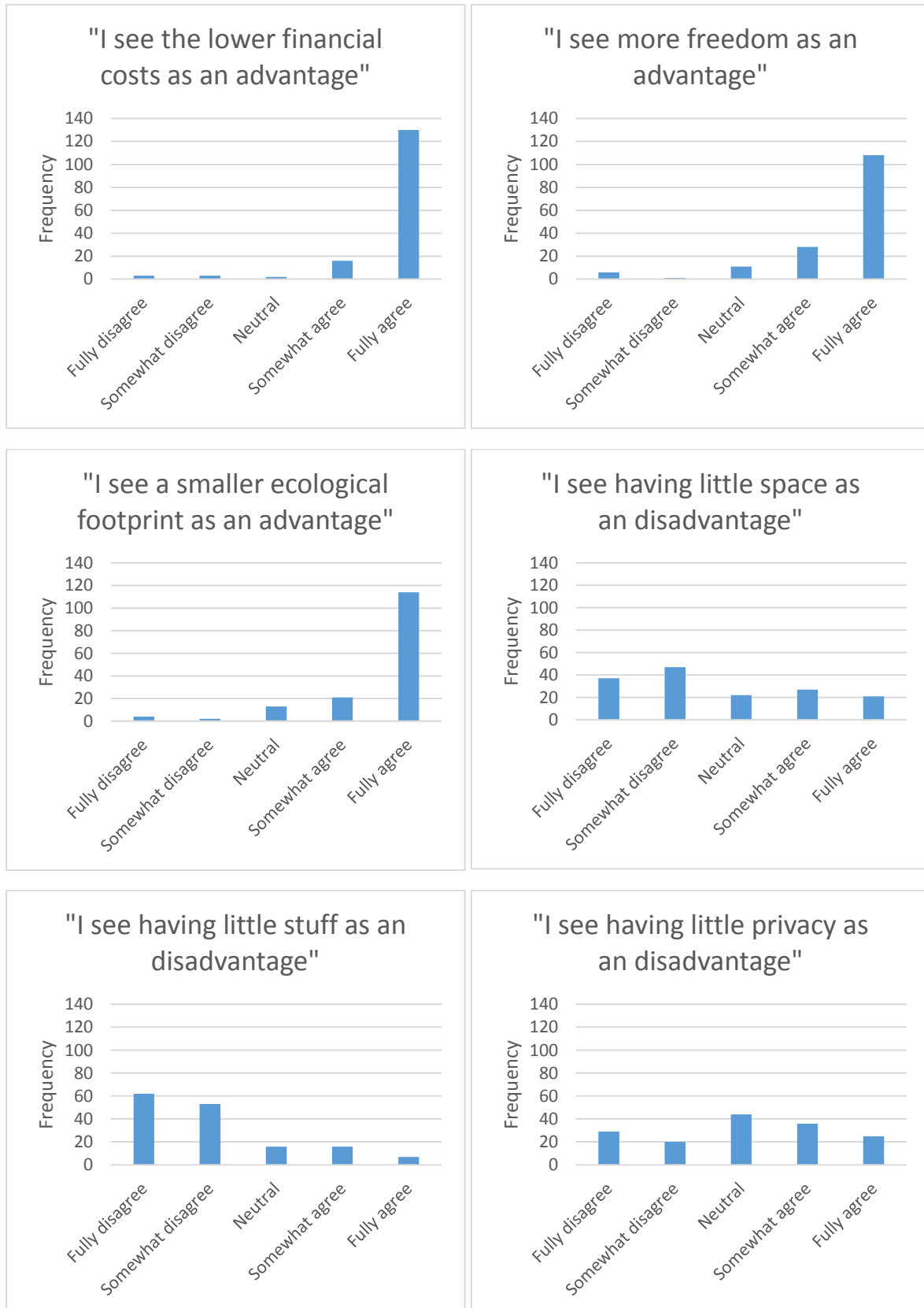


Figure 15: statements (dis)advantages - all respondents

The suggested advantages all show a very high percentage of “agree” answers. This means that most respondents see lower financial costs, more freedom and a smaller ecological footprint as an advantage of living in a Tiny House. Little space and little privacy are not clearly an advantage or disadvantage. Three quarters of the respondents state that having little stuff is not a disadvantage for them, what also is consistent with the research of Zegers (2017) discussed in section 2.2.3, which states owning less stuff can make people happier.

Smaller ecological footprint, more freedom, lower costs and owning less stuff are also mentioned often in the open question on advantages of living in a Tiny House, as well as living closer to nature. For disadvantages (building) regulations and finding a location are mentioned very often.

These statements are also analyzed per gender, to see if there is a significant difference between men and women (figure 16).

Only for the three disadvantage-statements a chi square test was possible, but the results were not significant. For little space $p=0.584$, for little stuff $p=0.822$ and for little privacy $p=0.732$. Although for this sample, men and women least agree on the statement of having little space.

The same is done for these statements and the generations ((pre-)baby boomers, X and Y), see the charts in figure 17. Generation Z is left out again (5 respondents).

The statements on costs, freedom, footprint and little stuff could not be tested with a chi square test. For little space the differences between these three generations were significant at 5% level. The generation differences on privacy did not turn out to be significant.

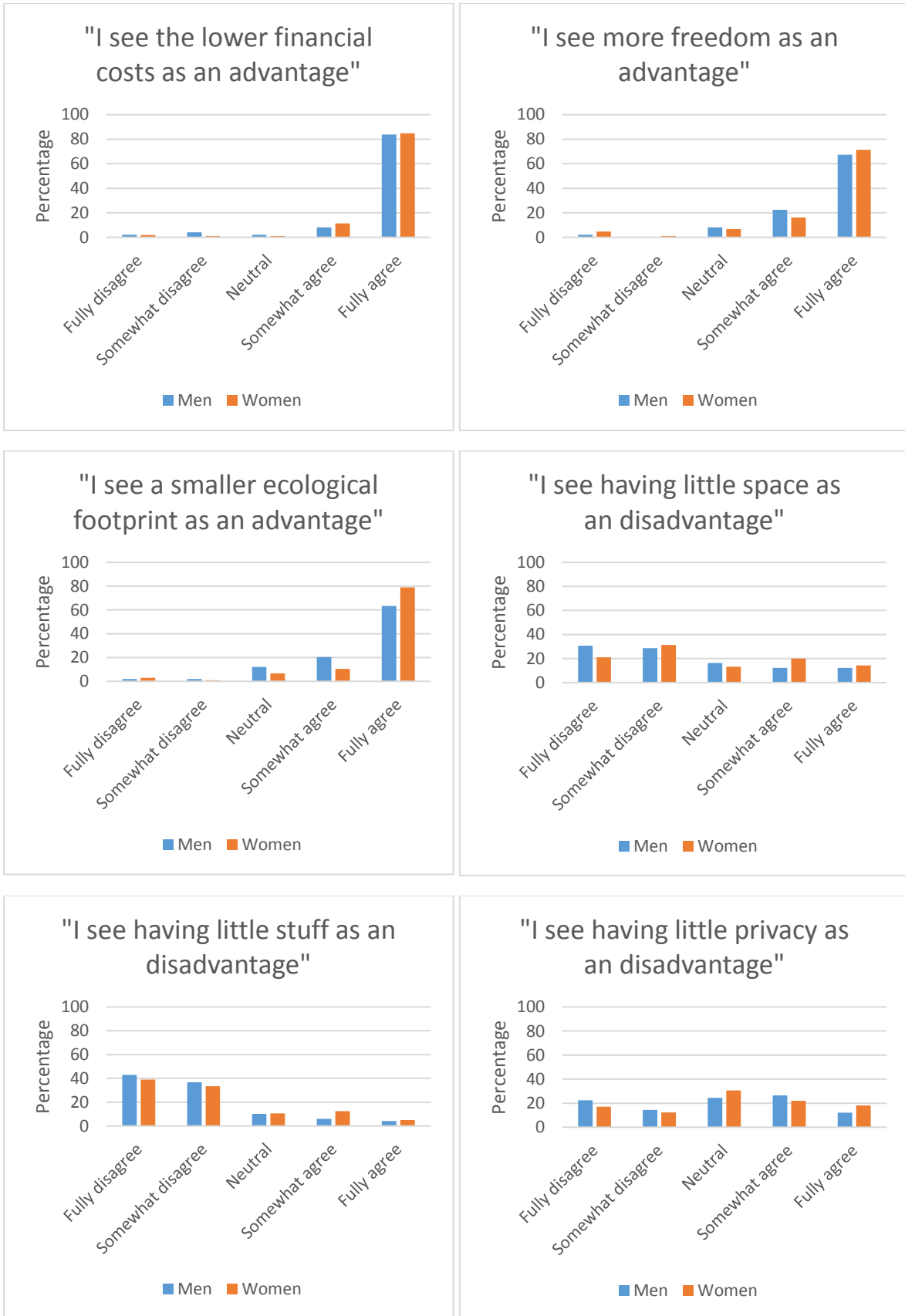


Figure 16: Statements (dis)advantages - men/women



Figure 17: Statements (dis)advantages - generations

4.1.3. Attitude towards environment

Although almost all respondents see a lower ecological footprint as an advantage of living in a Tiny House (see above), that does not say everything about their attitude towards the environment. It can be seen as a nice extra.

A frequency table with all statements of the NEP-scale is included in appendix C. The NEP-scale is made in such a way that agreement with odd-numbered statements and disagreement on even-numbered statements indicates a pro-ecological view (Dunlap et al., 2000). For most statements the respondents have on average a pro-ecological view, except for three of them; “Human ingenuity will insure that we do NOT make the earth unliveable”, “The earth has plenty of natural resources if we just learn how to develop them” and “The earth is like a spaceship with very little room and resources”.

With the use of Cronbach’s Alpha, it is found that the 15 items can be grouped together to use as one single scale, the same Dunlap et al. (2000) do. Alpha namely has a value of 0.747, thus > 0.7 . This new variable shows the mean value of the 15 statements of each respondent. In the chart below (figure 18), the mean scores of the respondents are shown, where 1 is the least and 5 is the most pro-ecological view.

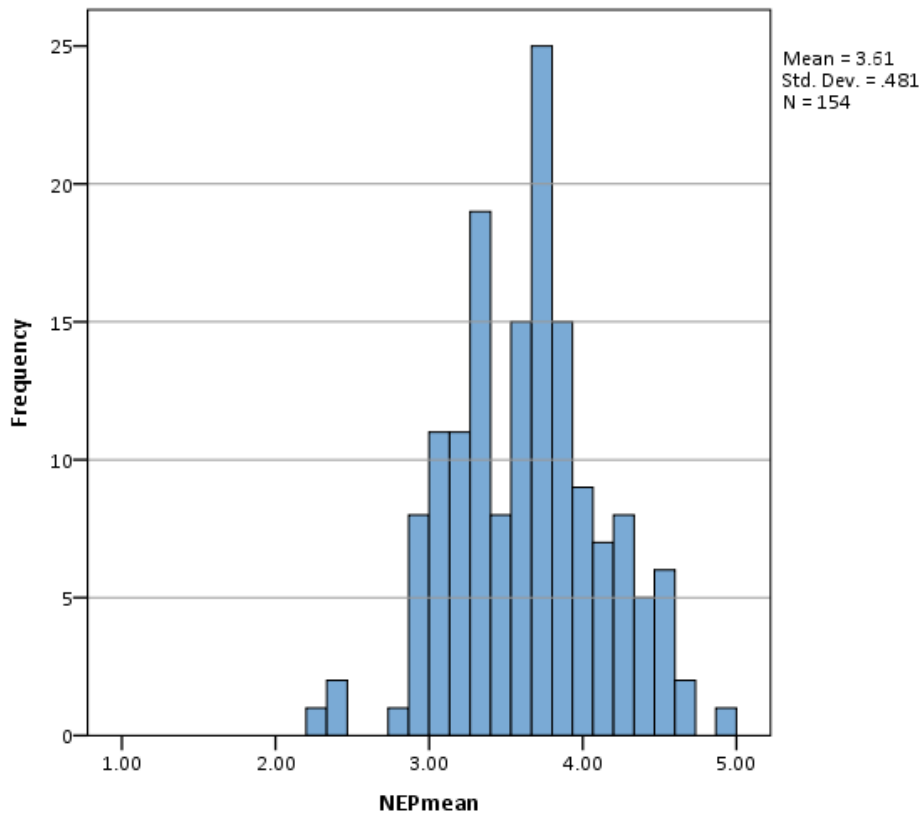


Figure 18: Mean score on the 15 statements of the NEP scale

4.1.4. Housing requirements

The preference of the respondents concerning hiring or buying a Tiny House is shown in figure 21. Buying can also mean self-construction and is chosen by 87% of the respondents. Those who choose for buying also were asked if they would buy or lease land for their Tiny House; 71.2% prefers to buy the land, see figure 22. This is quite different from what Tiny House Nederland (2017) found; around a quarter of respondents wants to buy land.

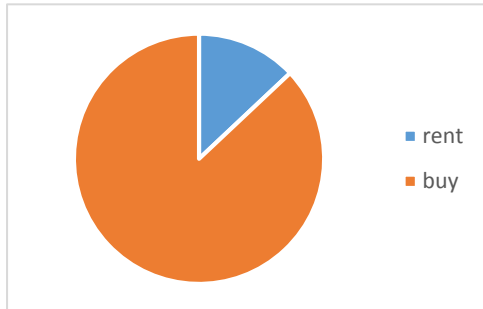


Figure 21: Rent or buy TH

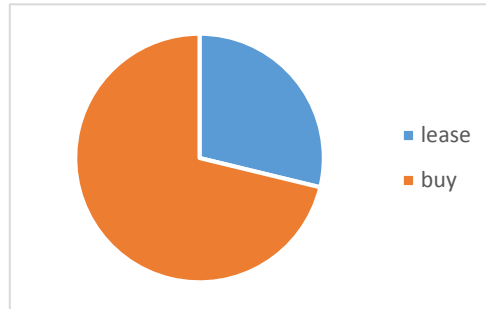


Figure 22: Lease or buy land for TH

For those who prefer to buy (build) a Tiny House, figure 23 shows what they want to pay for it. Respondents who choose the lowest amount, probably want to build everything by themselves while those who choose the highest amount probably want to buy a fully-fledged Tiny House.



Figure 23: Price for Tiny House

Sharing facilities, as also occurs in apartment buildings, can be a solution for the lack of space in a Tiny House. Respondents could choose if they wanted to share only with direct neighbors, with the neighborhood, or not sharing the facility at all. It was possible to select more than one answer. There were also empty fields to fill in other facilities. Figure 24 shows the presented possibilities;

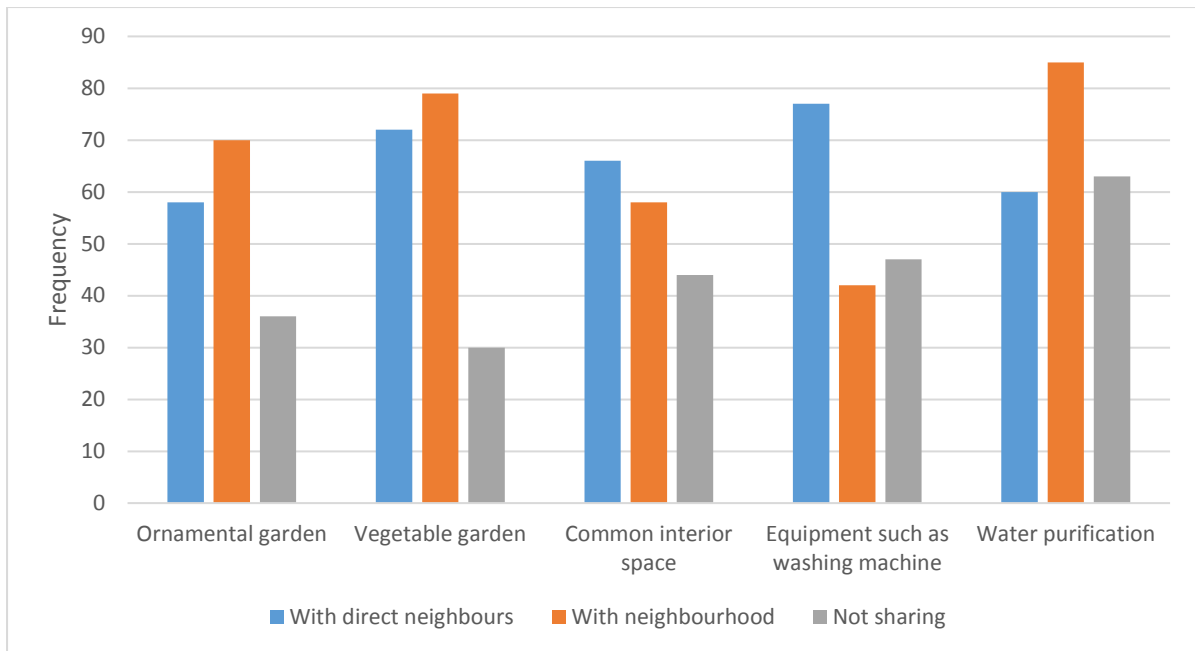


Figure 24: Sharing facilities

Gardens and water purification are preferred to share with the neighborhood more often than sharing with direct neighbors, while sharing interior space and equipment is chosen more often to share with direct neighbors. Also a lot of respondents do not want to share (some of) these facilities, especially water purification. Respondents who do not want to live with other Tiny Houses probably do not want to share these kind of facilities either.

Other things that are mentioned to share (more than once) are a car, tools, a kitchen and energy generation/storage.

For more insight in the requirements of potential Tiny House residents, see the next sections on the stated choice experiment.

4.2. Model estimation

In the following section, model estimations using data collected by means of the choice experiment are discussed. This stated choice experiment was part of the survey. With the use of NLogit (Econometric Software Inc, 1986-2016), a multinomial logit model, random parameter model and a latent class model are estimated, to find out which characteristics of Tiny Houses (presented in the experiment) influence the choice for a Tiny House. With this information the research question “What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) occupants of Tiny Houses?” will be answered.

4.2.1. Multinomial logit model

For this model, the rho-squared is very low: $\rho^2 = 0.041$. This means this model does not fit the data well, but still the outcomes are discussed briefly. The parameters are as expected. The results of the model estimation can be found in appendix D.

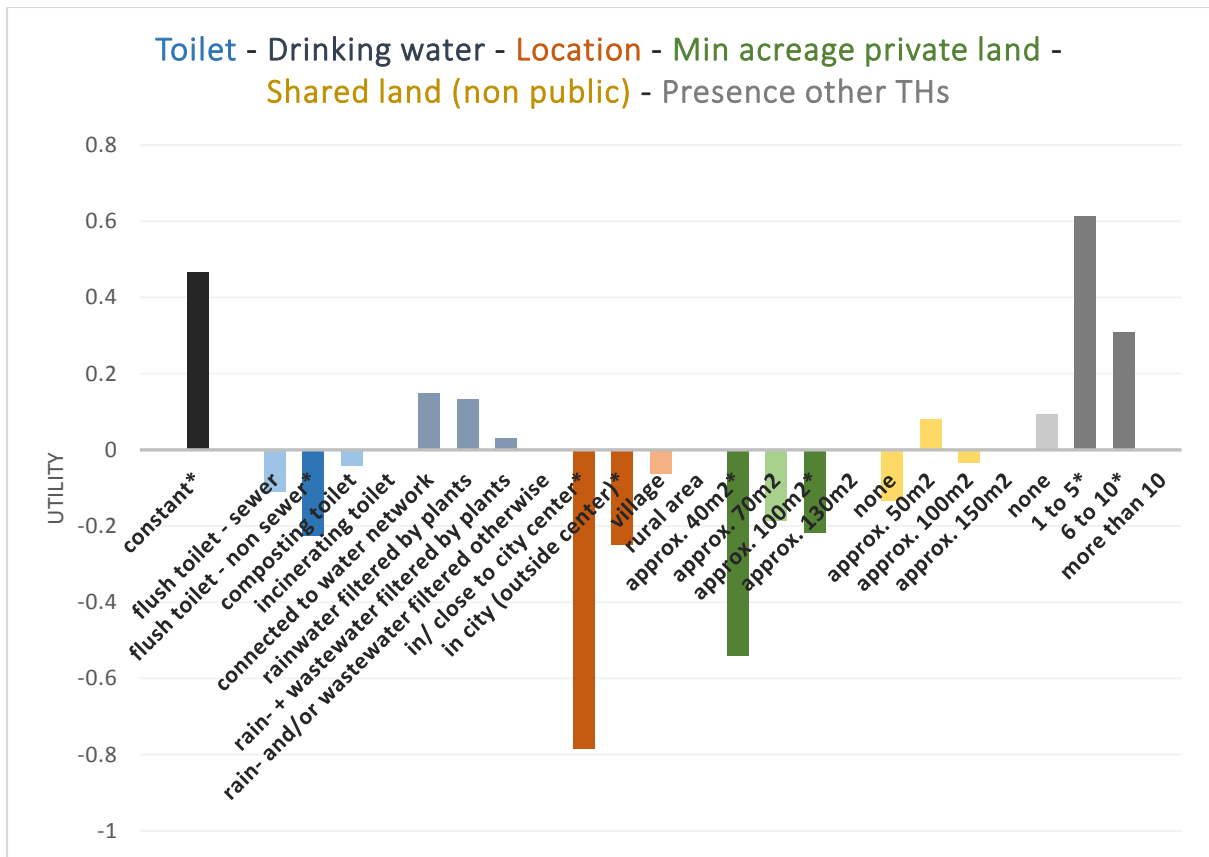


Figure 25: utility values

For each aspect listed in figure 25, the utility is shown as we set option 4 of each attribute to zero. The darker coloured bars (also with an asterisk) show the characteristics that are significant at a 10% level. This shows that a flush toilet (not connected to sewer) is less preferred than an incinerating toilet. Also a location in a city is clearly not the choice of most people interested in Tiny Housing. We can say that a smaller acreage of private land is less preferred than the 130m² option and that people who want to live in a Tiny House, prefer a group of up to 10 Tiny Houses.

Also can be seen that the constant is positive, what in this case means that the respondents prefer the Tiny Houses above the option “none”.

Interaction

Interaction effects between location, minimal acreage and shared land were estimated, where only the interaction between minimum acreage of 40m² and no shared land turned out to be significant (at 10% level). A Multinomial Logit Model was estimated with this interaction variable and the results are presented in figure 26.

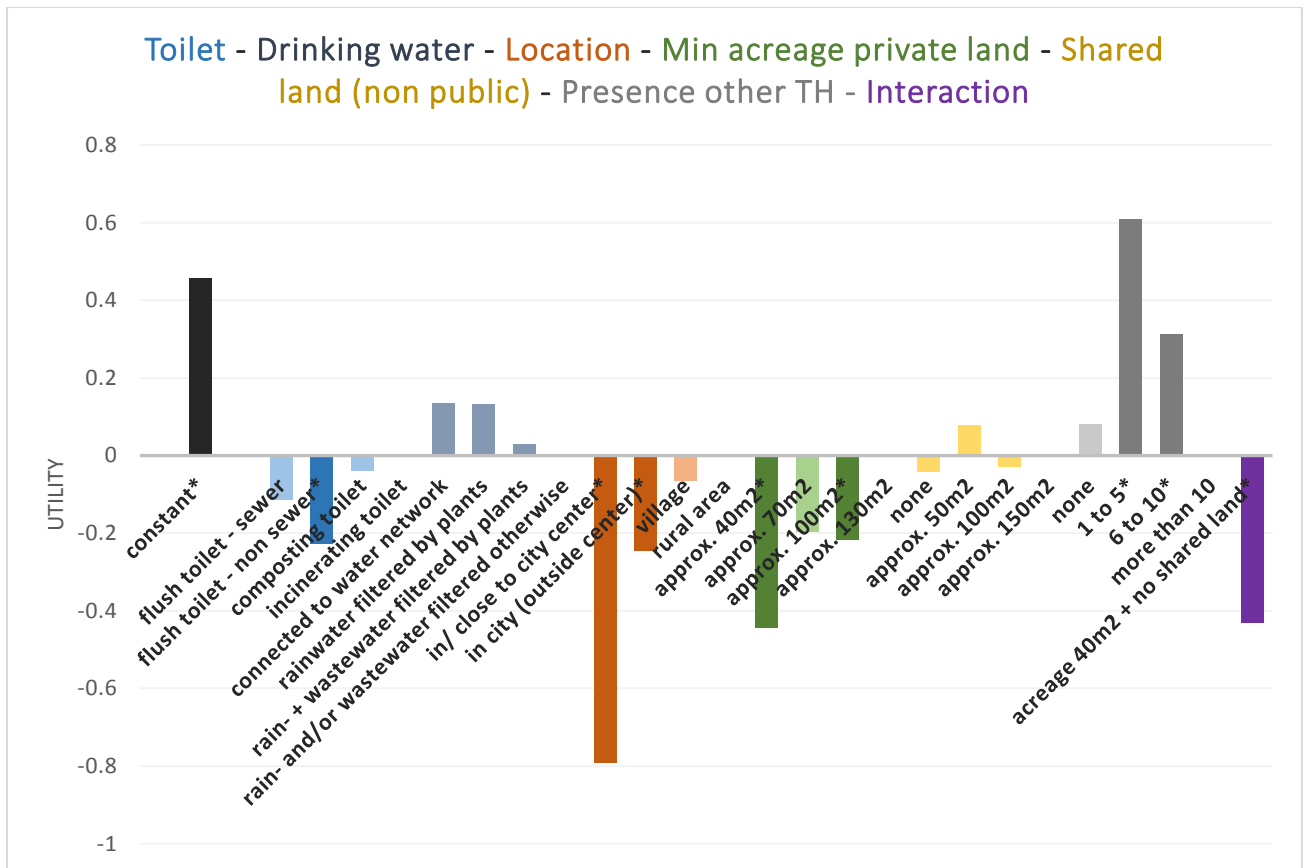


Figure 26: utility values with interaction

This model has a ρ^2 of 0.042, what shows a very small improvement relative to the model without interaction. When comparing figure 25 and 26, it can be seen that the utility values of approximately 40m² private land as well as for no shared land are less negative if interaction between these two is taken into account. If a Tiny House is presented with approximately 40m² private land as well as no shared land, the utility decreases with 0.4312, as also can be seen in figure 26. This means that the respondents do not find this combination attractive.

4.2.2. Random parameter model

The random parameter model was estimated by assuming a Normal distribution for each variable and 1000 draws for the calculation of probabilities. The results of the model estimation can be found in appendix E. This model has a better fit than the multinomial logit model: ρ^2 is 0.1866. In this random parameter model only few parameter means were significant and the standard deviations went up to quite large numbers. This can be due to large mutual differences between respondents or to the relatively small sample size. Just as in the case of the MNL model, the interaction variable (approximately 40m² private land combined with no shared land) was significant. Because of the high standard deviations, it was decided to not discuss this model.

4.2.3. Latent class model

A 2-class as well as a 3-class model was estimated. The results of the model estimations can be found in appendix F. For the 2-class model, ρ^2 is 0.1551. This is less than the random parameter model. The 3-class model has a higher fit; therefore the 3-class model will be discussed.

3-class model

For the 3-class model ρ^2 is 0.183. This is almost as good as the Random Parameter model, and because this model is easier to interpret and more useful for recommendations, this model is chosen for a more in-depth analysis. The classes are not the same size, where half (51%) of the respondents (79) are in class 1, 32% are in class 2 and only 26 respondents (17%) are in class 3. The results are shown in figures 27-29.

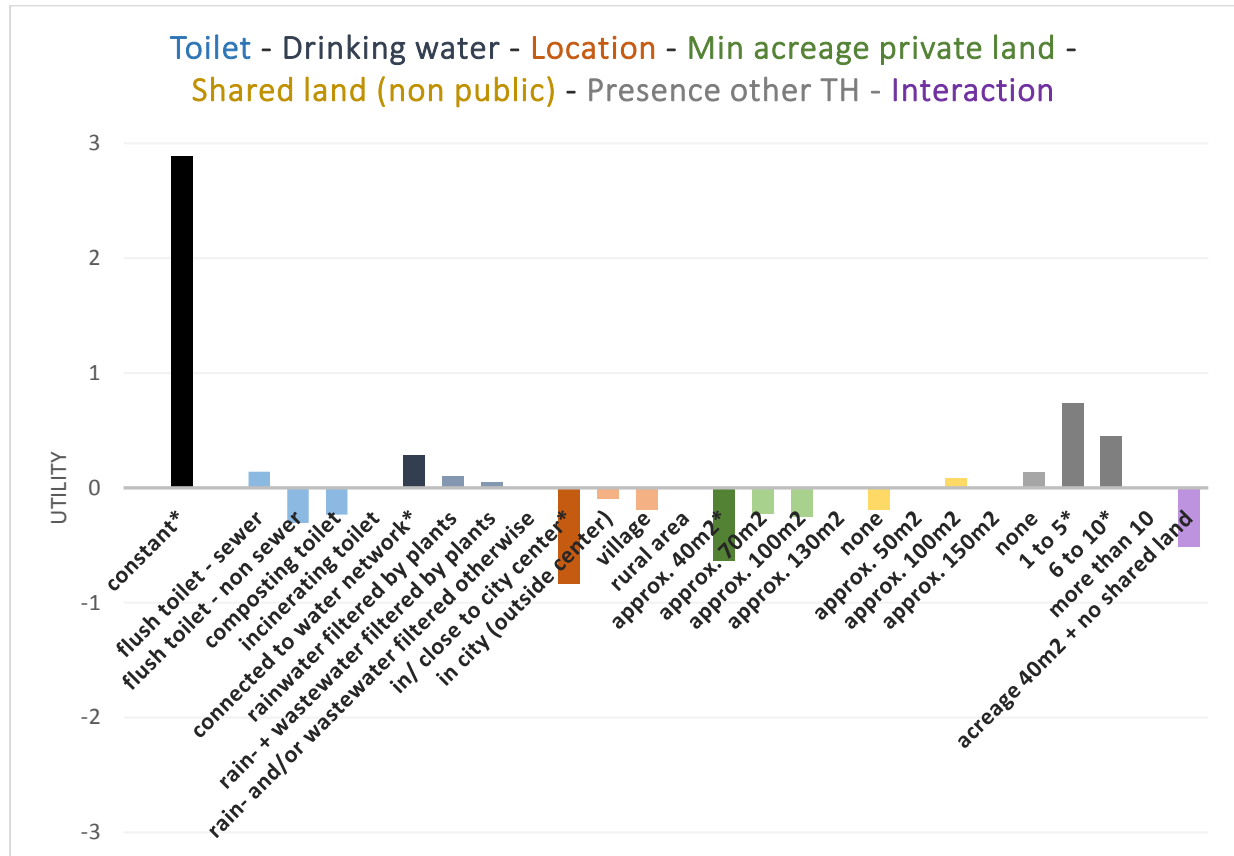


Figure 27: 3-class model - class 1

Respondents in class 1 (see figure 27) often prefer one of the two Tiny Houses above none, but they are quite moderate in the assessment of the attributes. For as far as the results are significant (at the 10% level), those people slightly prefer to be connected to the water network than using filtered water, prefer to live not in or close to a city centre, rather have more than 40m² private land and would like to live with others as long it does not exceed 10 other Tiny Houses. The interaction between 40m² private land and no shared land is not significant for this class.

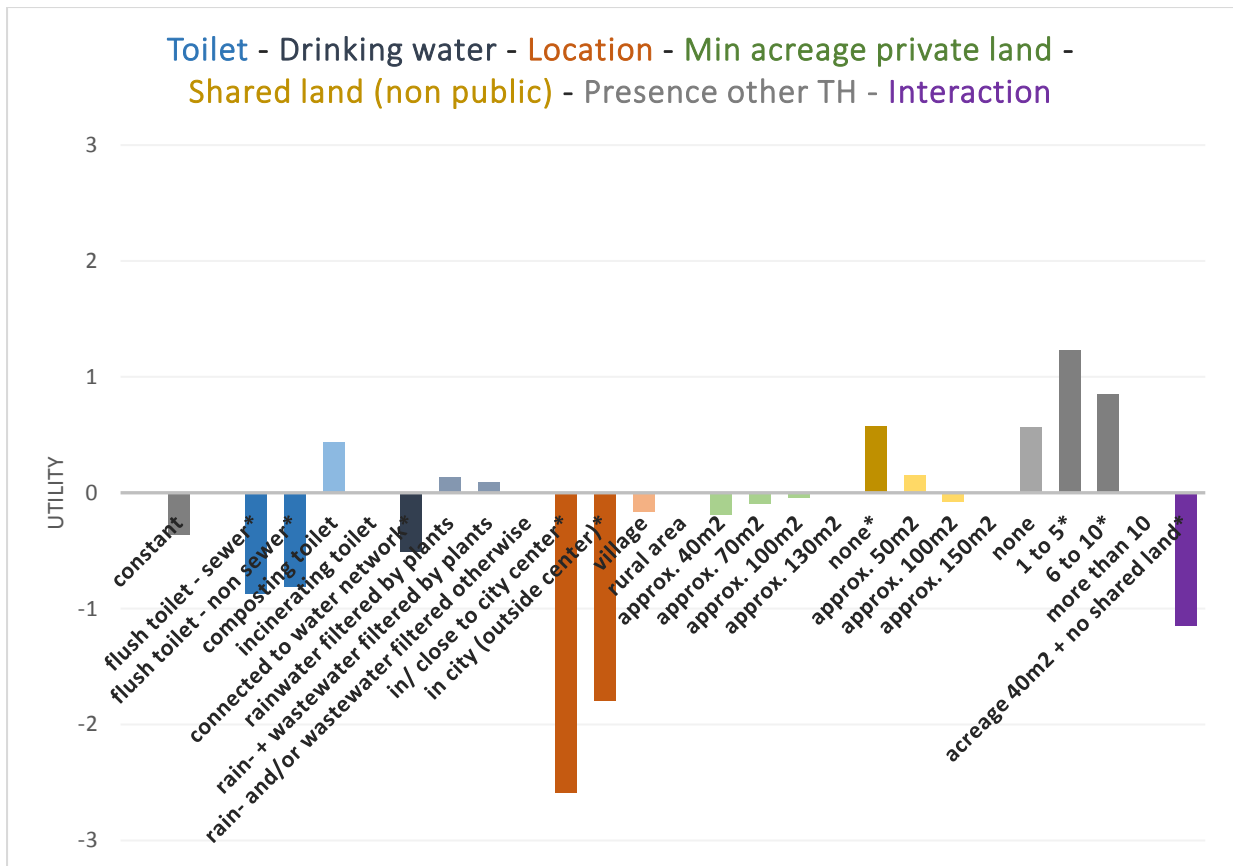


Figure 28: 3-class model - class 2

For class 2 (figure 28) the constant is somewhat negative, but not significant. People in this class do not prefer a flush toilet and more strongly dislike living in a city relative to a rural area. Furthermore they prefer living with 1 to 10 other Tiny Houses above living with more than 10 other Tiny Houses. The combination of 40m² private land with no shared land has a clear negative effect on the utility (-1.44).

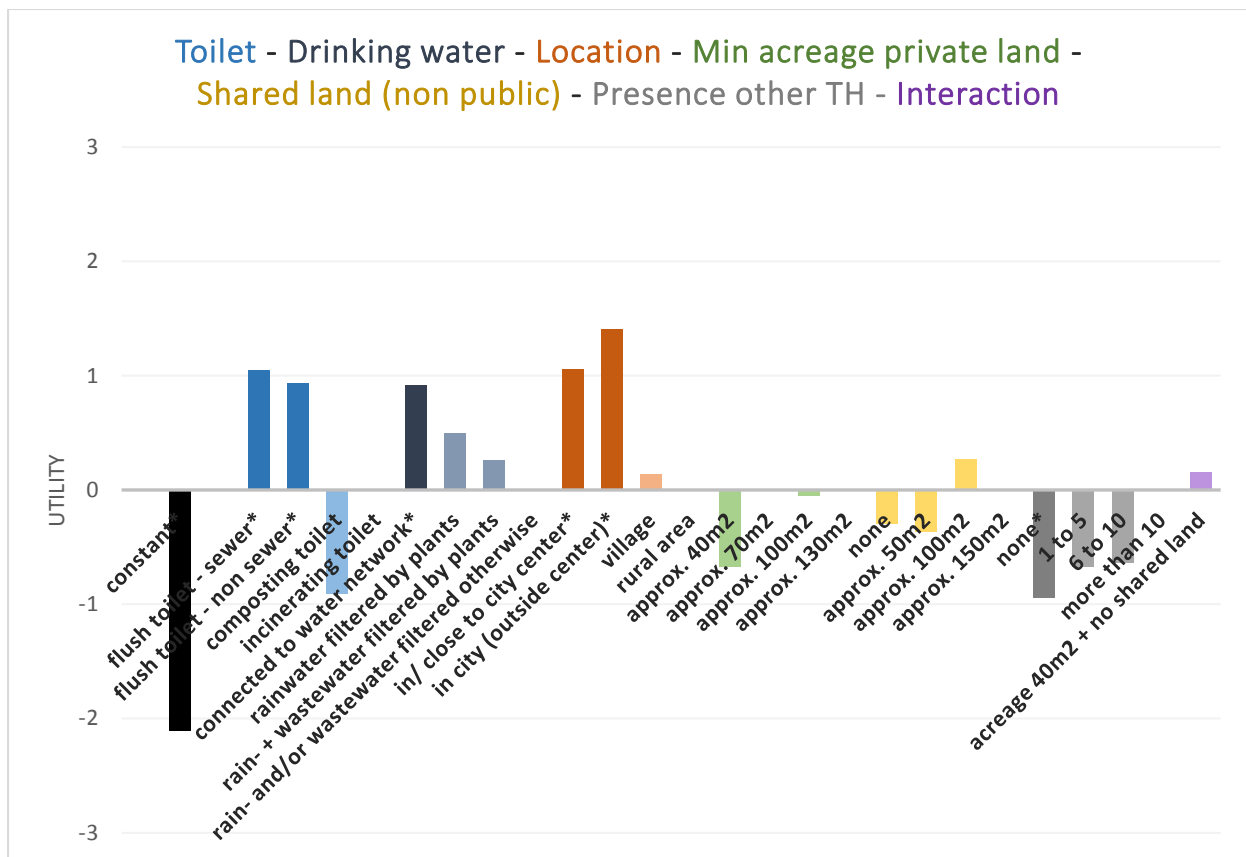


Figure 29: 3-class model - class 3

Class 3 is with 26 respondents rather small to draw conclusions, but the very negative constant is obvious; those respondents choose “none” more often. See figure 29. Class 3 furthermore differs from class 1 and 2 on the fact that those respondents do prefer to live in a city and that they do not want to live on a location without other Tiny Houses. Furthermore class 3 is the only one where respondents prefer a flushing toilet. In contrast to the other two classes, for this class the interaction variable (although not significant) does not show a negative effect.

Comparison of the 3 classes

The 3-class model shows three quite different clusters of respondents. The first and largest cluster seems to give preference to tiny houses anyway without being very critical about the attributes. Therefore they are named “TH-lovers”. In contrast, the third class consists of rather critical respondents, the “TH-critics”. They only accept a tiny house if it offers conventional utilities in an urban environment. The second class seems to be more indifferent regarding the concept of tiny houses and rather negative concerning most attributes. They are named the “TH-moderates”. They do not want to live in a city.

Tree analysis

With the use of a tree analysis, it is found that the best predictor for the class a respondent belongs to is income, see figure 30. All except one respondents with an annual income of less than €10.000 are in class 1. For those with a yearly income of €10.000 or more, the next best predictor is education (high/secondary/low), where a secondary education level gives more chance of belonging to class 2. Furthermore, generation, situation in relation to Tiny Houses and household composition are predictors. For this tree, the risk that a respondent is incorrectly classified is 38%.

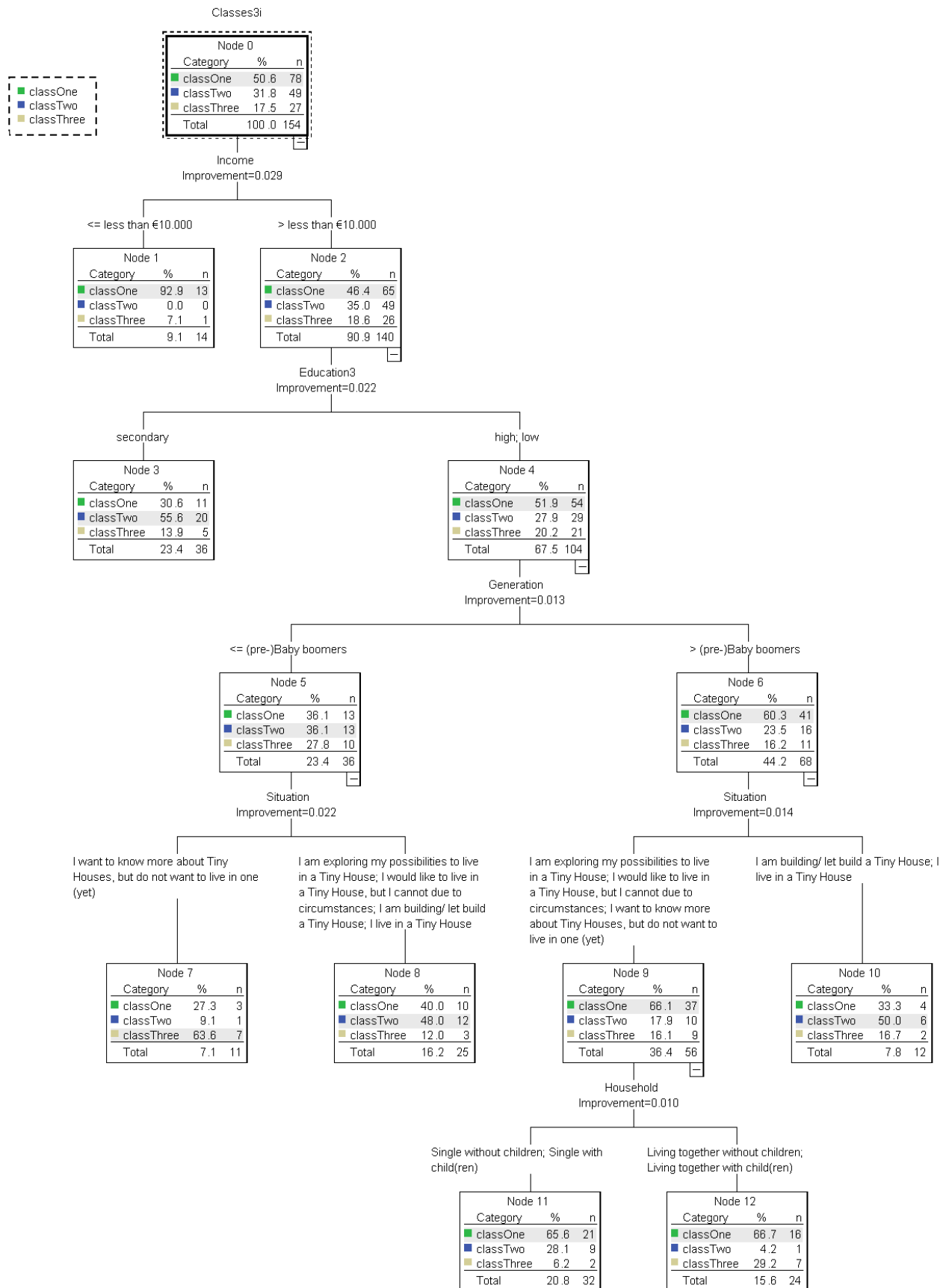


Figure 30: Tree with all possible predictors taken into account

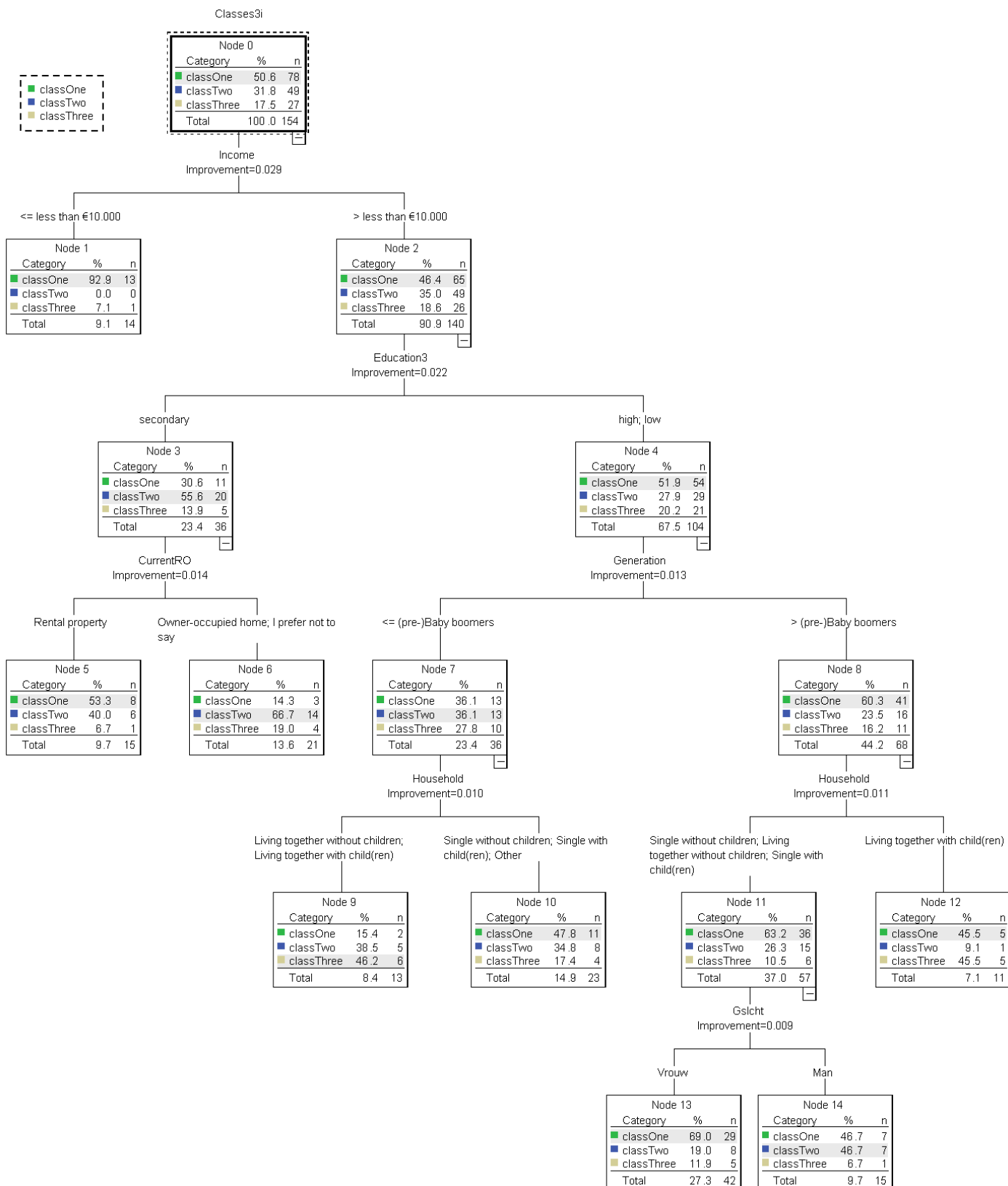


Figure 31: Tree with only personal and household characteristics taken into account

Also a tree is estimated for only personal and household characteristics, with a similar risk of 39%. This tree can be seen in figure 31. Again, income and education are the best predictors in the same way as mentioned before. Furthermore, current home ownership, generation, household composition and gender are predictors.

4.3. Conclusion from survey

The sample (N=154) of this survey consist for two thirds of females, this is similar to the survey of Heslinga & de Jong (2017), what suggests that woman are more interested in Tiny Houses than men. The average age is 42, but the spread is large. The respondents are a bit younger than those of the Tiny House Nederland (2017) survey. In this survey generation Y (1977-1994) is by far the largest group. Income also has a large spread, much larger than on national level (CBS, 2017b). Although the respondents are quite satisfied with their income, lower financial costs are seen as one of the biggest advantage of living in a Tiny House. In contrast to income, education level shows a concentration (72%) on highly educated respondents. By far the most respondents are exploring their possibilities of living in a Tiny House. This is especially true for generation X, while the (pre) baby boomers and generation Y are more likely to be in the phase of 'wanting to know more about Tiny Houses, but not wanting to live in it yet'. More men than women are already living in or building a Tiny House. The most frequently mentioned obstacles for not living in (or building) a Tiny House yet are not having the money and not having a location. Besides the advantages of lower financial costs, most respondents also agree on a lower ecological footprint and having more freedom as being advantages. The proposed disadvantage of not being able to have much stuff was not seen as disadvantage. Furthermore, almost all respondents have a pro-ecological view.

Most respondents want to buy a Tiny House (instead of renting) and almost three quarters of them also wants to buy the land, while Tiny House Nederland (2017) found that around a quarter of their respondents wants to buy land. There seems to be enthusiasm for sharing facilities. With direct neighbors, sharing equipment such as a washing machine is chosen most, while water purification is chosen most for sharing with the neighborhood. Although this is also the option that was most chosen not to share. Regarding the location, the city is not popular relative to a rural place. It has to be kept in mind that the requirements vary widely. Most of the respondents prefer private land of 130m² (biggest option in this survey) and also do want to live with other Tiny Houses, but not more than 10. Tiny House Nederland (2017) also found that a group of Tiny Houses is preferred as long it is not bigger than 10 Tiny Houses.

For the models, it came clear that the MNL models do not fit well. The random parameter model performs better, but has very large standard deviations. The latent class model with 3 classes performs almost as good as the random parameter model.

Yearly income, education level, generation, situation in relation to Tiny Houses and household composition are predictors for 3 identified classes of respondents, although the variation within these classes is large. There are the TH-lovers, who are not critical on the aspects of a Tiny House and prefer to live in a Tiny House anyway, although they do have a slight preference for living outside the city center. The TH-moderates are quite indifferent, but slightly negative on the Tiny House aspects, but have a clear preference for not living in a city. The TH-critics on the other hand, want to live in the city. This is the smallest group, but they stand out by their criticism.

5. Conclusions and recommendations

In this chapter, after researching the state of affairs and conducting a survey, everything is packed together for drawing conclusions. Section 5.1 repeats the research questions with their answers, and how this was accomplished. In section 5.2 a reflection on the research can be found. Furthermore recommendations for further research (5.3) and managerial implications (5.4) are given.

5.1. Research questions and answers

- What are the main characteristics of Tiny Houses in general and in The Netherlands?

Although there are not many Tiny Houses yet in The Netherlands, there is a wide variety of shapes, sizes and materials. By searching the internet, most of these houses were found. Tiny Houses on wheels have similarities in materials, where a lot of wood is used. Also in shape and size similarities can be seen, mainly because of transport. Tiny Houses on wheels are often not bigger than 20m², to stay under a weight of 3500kg for transport, and with a rectangular shape. There are also Tiny Houses without wheels in The Netherlands, which are more different from each other.

- Which technologies are used in Tiny Houses, regarding installations?

Solar panels are often used, and also non-drained toilets are used quite a lot, as can be seen on the many Dutch web pages about Tiny Houses. But for being fully off-grid there are several options, there is no standard solution. The most difficult aspect of being off-grid is water; filtering rainwater and/or wastewater to make drinking water, and also filtering waste water to be able to discharge it. Different types of filters are used.

- What rules exist regarding Tiny Houses in The Netherlands and to what extent do potential occupants encounter these?

This question is partly answered with online research and partly with results from the survey (N=154). Subsequent to the previous question; in The Netherlands it is not allowed to make your own drinking water in principle. Furthermore the building regulations in the Bouwbesluit can be hard to meet with a Tiny House, especially due to the small size. There are some possibilities, by demonstrating equivalence to the municipality. If the Tiny House is movable, the regulations for transport must be met. This concerns the size and the weight. The location for Tiny Houses mainly depends on the zoning plan of the municipality, where requirements on size and aesthetics are often not compatible with Tiny Houses. But a municipality has some tools to make exceptions. Not being able to find a suitable location is mentioned as reason for not living in a Tiny House yet by multiple respondents of the survey. Also regulations are mentioned very often as disadvantage of living in a Tiny House.

- What are the preferences regarding new technologies and other aspects of Tiny Houses among (potential) occupants of Tiny Houses?

A stated choice experiment was used to determine the preferences of (potential) occupants of Tiny Houses. In general respondents do not want a flushing toilet, what suggests Tiny Houses will probably make the demand for alternative toilets rise. The respondents prefer a location outside the city and want to live together with 1-10 other Tiny Houses. But there is a small, critical group that wants to live in the city. Furthermore the respondents were asked about sharing facilities.

With direct neighbors, respondents want to possibly share interior space and equipment, while with the neighborhood they want to possibly share gardens. Also it came clear that most want to buy a Tiny House (instead of renting) and also want to buy land for it.

- What are the main motivations for people to live in a Tiny House?

From the survey, lower financial costs, more freedom, a smaller ecological footprint and owning less stuff came out as advantages, as well as living closer to nature.

- Are Tiny Houses a suitable option to reduce the tension on the housing market in cities?

Tiny Houses can possibly be a small part of the solution, because there are people who want to live in the city, even in the city center, in a Tiny House. The movability of Tiny Houses can also be an advantage in crowded, ever changing cities, for example on vacant lots.

- Can Tiny Houses help reduce climate change?

From the NEPscale that was incorporated in the survey, it came clear that (potential) Tiny House occupants have a pro-ecological view. Also, a lower ecological footprint is seen as a big advantage of living in a Tiny House. Together with the solar panels and non-flushing toilets that are common in Tiny Houses, they seem to contribute in reducing climate change.

5.2. Reflection

Since there is few research on Tiny Houses and the requirements of potential future residents, especially for The Netherlands, this research offers some new insights, especially on the preferences and motivations of people to want to live in a Tiny House.

For the survey, the aim was to get around 300 respondents, but only half was accomplished. It was a bit too optimistic that this was an achievable number. But the number of times the questionnaire was started did almost reach 300. This means a lot of people did not finish it, probably because there were too many questions.

In the stated choice experiment, there was no monetary attribute, while people can make different choices when they know what different attributes cost. Now the willingness-to-pay could not be calculated.

For policy makers, this research shows that there is demand for Tiny Houses and that location is a difficult part, where policy makers play a role. But the other preferences of the respondents are quite varied and not many of the results are significant. Therefore it is hard to determine what the demand exactly is.

5.3. Suggestions for further research

Because this was the first research of this kind for Tiny Houses in The Netherlands, there are many opportunities for further research.

In the questionnaire, there is a question about the price people are willing to pay for a Tiny House, but this was for self-built as well as for buying a fully-fledged Tiny House. It could be interesting to know how much people are willing to pay for a fully-fledged Tiny House and probably also other forms like a casco Tiny House. Also the desired type of location as well as the duration (for example temporary or not) can be useful information.

Furthermore the NEP scale was used to find out if the respondents have a pro-ecological view, but there is no comparative material available about the NEP scores of the average Dutch person.

The stated choice experiment was limited in number of attributes to keep it understandable, but there are many more attributes to think of that can be worth testing.

When Tiny Houses become more common in The Netherlands, opinions about it are likely to change, what can also be investigated by then.

Furthermore, as regulations came from as an obstacle for Tiny Houses, it can be investigated how regulations can be adjusted, especially the new Environment law that is still in the making.

5.4. Managerial implications

Interest aroused for Tiny Houses in The Netherlands, but regulations are holding people back. It came clear that the municipalities play a fairly large role here, but it is all still very new. Knowledge exchange between municipalities is desirable, as a few municipalities already found ways to accommodate Tiny Houses. Because the preferences and requirements of potential Tiny House occupants vary widely, it seems good as a municipality to work together with initiative groups. Also in urban development this new type of housing can be considered to implement, because there are people that want to live in Tiny House in a city and Tiny Houses can create new opportunities that maybe cannot be fulfilled with the common housing types. For example on temporary locations and/ or locations that are not suitable for regular houses (like a rooftop), movable (off-grid) Tiny Houses can be a solution. Also the sustainable character of Tiny Houses contributes to sustainable urban development.

References

- ANA ROCHA architecture. (2016). Slim fit. Retrieved from <https://www.anarocha.nl/work/slim-fit-presentatie/#>
- Anson, A. (2014). "The World is my Backyard": Romanticization, Thoreauvian Rhetoric, and Constructive Confrontation in the Tiny House Movement. In W. G. Holt (Ed.), *From Sustainable to Resilient Cities: Global Concerns and Urban Efforts* (pp. 289-313). doi:10.1108/S1047-004220140000014013
- van Beurden, R. J. M. (2013). *Transportable CO2-neutral houses for one-person households: how to house one-person households in CO2-neutral dwellings on vacant land positions in the Netherlands?*. Retrieved from <https://research.tue.nl/en/studentTheses/transportable-co2-neutral-houses-for-one-person-households>
- de Blauw, R. (2017). Keurmerk moet norm worden. *PropertyNL*, 17(12), 56-58.
- Bokeloh, P. (2018). *Woningmarktmonitor - Toenemende spanning op woningmarkt*. Retrieved from <https://insights.abnamro.nl/2018/04/woningmarktmonitor-toenemende-spanning-op-woningmarkt/>
- Borgers, A., & Vosters, C. (2011). Assessing preferences for mega shopping centres: A conjoint measurement approach. *Journal of retailing and consumer services*, 18(4), 322-332.
- Brown, K. W., & Kasser, T. (2005). Are Psychological and Ecological Well-being Compatible? The Role of Values, Mindfulness, and Lifestyle. *Social Indicators Research*, 74(2), 349-368. doi:10.1007/s11205-004-8207-8
- CBS. (2017a, January 3). 2016: grote steden groeien door geboorten en immigratie. Retrieved from <https://www.cbs.nl/nl-nl/nieuws/2017/01/2016-grote-steden-groeien-door-geboorten-en-immigratie>
- CBS. (2017b, November 1). Bevolking; kerncijfers. Retrieved from <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=37296ned&D1=0-2&D2=65&HDR=G1&STB=T&VW=T>
- CBS. (2018a, March 8). Internet; toegang, gebruik en faciliteiten. Retrieved from <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83429NED/table?dl=91F4>
- CBS. (2018b, March 28). Inkomen van huishoudens; inkomensklassen, huishoudenskenmerken. Retrieved from <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83932NED/table?ts=1525009776980>
- CBS. (2018c, April 1). Bevolking; hoogstbehaald onderwijsniveau en onderwijsrichting. Retrieved from <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82816ned/table?dl=8083>
- Composttoilet spaart veel water. (n.d.). Retrieved from <http://composttoilet.info/>
- Dopper, B., & Geuting, E. (2017). Klein wonen: trend of hype?. Retrieved from <http://stec.nl/wp-content/uploads/2018/02/Stec-Groep-rapport-Klein-wonen-trend-of-hype.pdf>

- Dunlap, R. E., Van Lier, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of Social Issues*, 56(3), 425-442.
- Fiedler, J. (2014). *Urbanisation, unlimited*. doi:10.1007/978-3-319-03587-1
- Fry, T. R. L. (2001). Stated Choice Methods Analysis and Application. *Economic Record*, 77(238), 312-314. Retrieved from <https://search-proquest-com.dianus.libr.tue.nl/docview/219664675/fulltext/776184C3669F44AAPQ/1?accountid=27128>
- Geck, C. (2006). The Generation Z Connection: Teaching Information Literacy to the Newest Net Generation. *Teacher Librarian*, 34(3), 235-241.
- Gemeente Almere. (2016). Woningmarkten in perspectief 2016. Retrieved from http://www.bouwexpo-tinyhousing.nl/fileadmin/files/almere/subsites/BouwEXPO_Tiny_Housing/tiny-winnaarsboekje.pdf
- Gemeente Amsterdam. (2016). *Naar een stad zonder aardgas*. Retrieved from https://www.amsterdam.nl/publish/pages/810369/bijlage_3_2016-11-15_def_strategie_naar_een_stad_zonder_aardgas.pdf
- Genus, A. (2016). *Sustainable consumption: Design, Innovation and Practice*. doi:10.1007/978-3-319-29665-4
- Hahn, G. J., & Shapiro, S. S. (1966). *A Catalog and Computer Program for the Design and Analysis of Orthogonal Symmetric and Asymmetric Fractional Factorial Experiments*. Schenectady, NY: Corporate Research and Development.
- Hemel, Z. (2016). *De toekomst van de stad*. Amsterdam, The Netherlands: Amsterdam University Press.
- Hensher, D. A., Rose, J. M., & Greene, W. H. (2015). *Applied Choice Analysis* (2nd ed.). Cambridge, United Kingdom: Cambridge University Press.
- Jonker, M. (n.d.). Wat is een Tiny House. Retrieved from <https://www.marjoleininhethetklein.com/mijn-tiny-house/wat-is-een-tiny-house/>
- Jonker, M. (n.d.). Foto's van mijn Tiny House. Retrieved from <https://www.marjoleininhethetklein.com/mijn-tiny-house/fotos-van-mijn-tiny-house/>
- Jonker, M. (2017, March 23). Omgevingswet 2018 – wat betekent het voor Tiny Houses? Retrieved from <https://www.tinyhousenederland.nl/regelgeving/omgevingswet-2018-wat-betekent-het-voor-tiny-houses/>
- Joosten, H., Wisman, H., & Klaver, S. (2016). *Woningmarkten in perspectief 2016*. Retrieved from https://www.bpd.nl/media/105965/q564_bpd_dunefra-2016_nederlands_lr-web.pdf
- van der Lee, A. (2016). *Notitie Tiny Housing*. Retrieved from http://www.bouwexpo-tinyhousing.nl/fileadmin/files/almere/subsites/BouwEXPO_Tiny_Housing/Notitie_Tiny_Housing_23-7__light_-_web_.pdf

- Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: Analysis and application*. Cambridge, United Kingdom: Cambridge University Press.
- van der Male, J. (2017, January 19). We hebben meer pioniers nodig. Retrieved from <https://www.tinyhousenederland.nl/inspiratie/we-hebben-meer-pioniers-nodig/>
- McFadden, D. (1979). Quantitative Methods for Analyzing Travel Behaviour of Individuals: Some Recent Developments. In D. Hensher, & P. Stopher (Eds.), *Behavioural Travel Modelling* (pp. 272-318). London, United Kingdom: Croom Helm.
- Meredith, G., & Schewe, C. (1994). The Power of the Cohorts. *American Demographics*, 16(12), 22-31.
- van Mierlo, M. (2017, November 5). Tiny House Hausse in Almere [photograph]. Retrieved from <http://www.levenintuinen.nl/2017/10/tiny-house-hausse-in-almere-dat-tiny.html>
- Ministerie van Binnenlandse Zaken en Koninkrijksrelaties. (n.d.). 1.3 Gelijkwaardigheidsbepaling. Retrieved from https://rijksoverheid.bouwbesluit.com/Inhoud/docs/wet/bb2003_nvt/artikelsgewijs/hfd1/p ar1-3
- Ministerie van Binnenlandse Zaken en Koninkrijksrelaties. (2016). *Wonen in beweging*. Retrieved from <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2016/04/01/rapport-wonen-in-beweging/rapport-wonen-in-beweging.pdf>
- Molin, E. J. E. (2011). Conjoint analysis. In S. J. T. Jansen, H. C. C. H. Coolen, R. W. Goetgeluk (Eds.), *The measurement and analysis of housing preference and choice* (pp. 127-156). Dordrecht, Heidelberg, London, New York: Springer.
- Molin, E. J. E., Oppewal, H., & Timmermans, H. (1996). Predicting consumer response to new housing: A stated choice experiment. *Netherlands Journal of Housing and the Built Environment*, 11(3), 297-311.
- Nijënstein, S. (2012). *Determining the role of values in students' housing choice behaviour with latent class and mixed logit conjoint analysis methods*. Retrieved from <https://pure.tue.nl/ws/portalfiles/portal/47035539>
- Nijënstein, S., Haans, A., Kemperman, A. D. A. M., & Borgers, A. W. J. (2015). Beyond demographics: human value orientation as a predictor of heterogeneity in student housing preferences. *Journal of Housing and the Built Environment*, 30(2), 199-217. doi:10.1007/s10901-014-9402-9
- NOS. (2016, October 25). Na vijftig jaar gaat Nederland afscheid nemen van aardgas. Retrieved from <https://nos.nl/artikel/2139598-na-vijftig-jaar-gaat-nederland-afschied-nemen-van-aardgas.html>
- OOM. (n.d.). Tiny house. Retrieved from <https://www.oomverzekeringen.nl/brandverzekeringen/particuliere-risicos/tiny-house/>
- van Orden, M. (2017). *Tiny Houses*. Utrecht, The Netherlands: Kosmos.
- Penders, E. (2017, June 30). Gasaansluitplicht bij nieuwe woningen vervalt. Retrieved from <https://www.aedes.nl/artikelen/bouwen-en-energie/warmtewet/wet--en-regelgeving/vervallen-gasaansluitplicht-nieuwbouw.html>

- Rijksoverheid. (n.d.). Omgevingswet. Retrieved from <https://www.rijksoverheid.nl/onderwerpen/omgevingswet/>
- Rijkswaterstaat. (n.d.). Regels in de Wabo voor tijdelijk afwijken van het bestemmingsplan. Retrieved from <https://www.infomil.nl/onderwerpen/ruimte/ruimtelijke/wet-algemene/tijdelijk-afwijken/>
- Rogers, E. M. (2003). *The Diffusion of Innovations* (5th ed.). New York, NY: The Free Press.
- Separrett. (n.d.). Frequently asked questions. Retrieved from <http://www.separrett.com/frequently-asked-questions/>
- Solomon, M., Bamossy, G., Søren, A., & Hogg, M. K. (2006). *Consumer behaviour: A European perspective*. Harlow, United Kingdom: Pearson Education.
- Tiny House Nederland. (2017, March 18). Tiny House Nederland enquête uitslag. Retrieved from <https://www.tinyhousenederland.nl/onderzoek/tiny-house-nederland-enquete-uitslag/>
- Tiny TIM. (n.d.). Independent. Retrieved from <http://www.tinytimhouse.nl/independent/>
- Train, K. (2009). *Discrete choice methods with simulation* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Triple solar. (n.d.). Het Triple Solar®-systeem: zo werkt het. Retrieved from <http://www.triplesolar.eu/home/het-triple-solar-systeem/hoe-werkt-het/>
- Veerman, N., & Van der Male, J. (2018, January 10). Verplaatsbaarheid van een tiny house. Retrieved from <https://www.tinyhousenederland.nl/regelgeving/verplaatsbaarheid-van-een-tiny-house/>
- Vitens. (n.d.). Hoeveel water gebruiken we per dag? Retrieved from <https://www.vitens.nl/service/hoeveel-water-gebruiken-we-per-dag>
- Williams, J. (2013). The role of planning in delivering low-carbon urban infrastructure. *Environment and Planning B: Planning and Design*, 40(4), 683-706. doi:10.1068/b38180
- Woningstichting Den Helder. (n.d.). Tiny House. Retrieved from <https://www.woningstichtingdenhelder.nl/aanbod/projecten/tiny-house/>
- Zegers, H. (2017). *Zooikoorts*. Tielt, Belgium: Lannoo.

Appendix A

Enquête Tiny House geïnteresseerden

Deze enquête is bedoeld voor iedereen die in meer of mindere mate interesse heeft in het wonen in een Tiny House.

Onder een Tiny House wordt verstaan: Een vrijstaande volwaardige woning op kleine schaal, bedoeld voor permanente bewoning. Een Tiny House is gericht op een meer eenvoudig leven met een kleinere ecologische voetafdruk en minder gericht op consumeren. Bij het ontwerp wordt uitgegaan van slim gebruik van ruimte en innovatieve technologieën.

Het doel van deze enquête is het in kaart brengen van de wensen van mensen die in een Tiny House (zouden willen) wonen. Dit maakt onderdeel uit van mijn afstudeerproject, ter afsluiting van mijn master Urban Systems & Real Estate aan de Technische Universiteit Eindhoven.

U zou mij erg helpen door deze enquête in te vullen! Uw gegevens worden anoniem verwerkt en niet verstrekt aan derden.

Babette Boomgaard

Voorkeuren

Wat is uw situatie met betrekking tot Tiny Houses?

- Ik woon in een Tiny House
- Ik ben een Tiny House aan het (laten) bouwen
- Ik zou graag in een Tiny House willen wonen, maar het kan niet door omstandigheden
- Ik ben mijn mogelijkheden aan het verkennen om in een Tiny House te kunnen wonen
- Ik wil meer te weten komen over Tiny Houses, maar wil er (voorlopig) niet zelf in wonen
- Ik ben niet geïnteresseerd in Tiny Houses [respondent bedanken en stoppen]

Indien optie 3 wordt gekozen:

Door welke omstandigheden is het niet mogelijk om in een Tiny House te wonen?

[invullen]

Indien optie 3 of 5 wordt gekozen:

Waar ligt het (hoofdzakelijk) aan dat u nog niet in een Tiny House woont? (meerdere antwoorden mogelijk)

- Ik heb er geen geld voor
- Ik heb nog geen locatie
- ik ben er nu nog niet aan toe
- Mijn partner/ gezin wil niet
- Ik wacht tot het meer gebruikelijk is in Nederland
- Anders, namelijk: [invullen]

Wat zijn voor u de 3 belangrijkste redenen om in een Tiny House te (willen) wonen?

- [invullen]
- [invullen]

- [invullen]

Wat zijn voor u de 3 belangrijkste nadelen van het wonen in een Tiny House?

- [invullen]
- [invullen]
- [invullen]

Kunt u toelichten waarom u dit als nadelen ziet?

[invullen]

Geef aan in hoeverre u het eens bent met de volgende stellingen met betrekking tot het wonen in een Tiny House;

	VOLLEDIG ONEENS	ENIGSZINS ONEENS	NEUTRAAL	ENIGSZINS EENS	VOLLEDIG EENS
DE LAGERE FINANCIËLE LASTEN ZIE IK ALS VOORDEEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MEER VRIJHEID ZIE IK ALS VOORDEEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EEN KLEINERE ECOLOGISCHE VOETAFDruk ZIE IK ALS VOORDEEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WEINIG RUIMTE HEBBEN ZIE IK ALS NADEEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WEINIG SPULLEN BEZITTEN ZIE IK ALS NADEEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WEINIG PRIVACY ZIE IK ALS NADEEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Stel u woont in een Tiny House, welke voorzieningen zou u willen delen en met wie? (u kunt meerdere antwoorden geven per optie)

	MET DIRECTE BUREN	MET BUURT	NIET DELEN
SIERTUIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MOESTUIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GEMEENSCHAPPELIJKE BINNENRUIMTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPARATUUR ZOALS WASMACHINE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
WATERZUIVERING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ANDERS, NAMELIJK:	<input type="checkbox"/> [invullen]	<input type="checkbox"/> [invullen]	<input type="checkbox"/> [invullen]

Gaat uw voorkeur uit naar het huren of kopen van een Tiny House?

- Huren
- Kopen (incl. zelfbouw)

Indien gekozen voor kopen:

Hoeverveel zou u willen betalen voor een Tiny House (exclusief de grondkosten)?

- Tot €15.000

- €15.000 - €30.000
- € 30.000 - €45.000
- Meer dan €45.000

Waar gaat uw voorkeur naar uit met betrekking tot de grond waarop het Tiny House staat?

- Eigendom
- Pachten

Stated choice experiment

Hierna krijgt u een aantal keren een keuzesituatie voorgelegd. Per keuzesituatie vragen we u een keuze te maken uit 2 verschillende Tiny Houses. U kiest steeds het Tiny House waar u het liefst in zou willen wonen, of u kiest voor “Ik zou in geen van deze Tiny Houses willen wonen”.

Hierbij wordt uitgegaan van een Tiny House van ongeveer 20m², voorzien van keuken, douche en toilet. Verder liggen er zonnepanelen op het dak ten behoeve van de stroomvoorziening.

Aangenomen wordt dat je altijd ergens kunt parkeren, bijvoorbeeld op straat of een gezamenlijk parkeerterrein in het geval van meerdere Tiny Houses bij elkaar.

Er zijn zes kenmerken waarop de voorgelegde Tiny Houses kunnen verschillen. U kunt er van uit gaan dat de Tiny Houses op alle andere vlakken hetzelfde zijn. Om een beter beeld te geven, krijgt u eerst een voorbeeld te zien.

Deze tabel krijgt men niet te zien;

KENMERKEN	MOGELIJKE WAARDEN			
TOILET	Toilet met waterspoeling, aangesloten op riool	Toilet met waterspoeling, niet aangesloten op riool	Composttoilet	Verbrandingstoilet
DRINKWATER	Aangesloten op waternet	Regenwater filteren met planten	Regenwater en eigen afvalwater filteren met planten	Regenwater en/of afvalwater filteren met filters (geen planten)
LOCATIE	In / nabij stadscentrum	Stad, buiten centrum	Dorp	Landelijk gebied
MINIMAAL OPP PRIVÉ GROND (AFGEZIEN VAN EVT. GEZAMENLIJKE GROND)	Ca. 40m ²	Ca. 70m ²	Ca. 100m ²	Ca. 130m ²
GROND TE GEBRUIKEN MET BUURTBEWONERS (NIET OPENBAAR)	Geen	Ca. 50m ²	Ca. 100m ²	Ca. 150m ²
AANWEZIGHEID VAN ANDERE TINY HOUSES	Geen	1-5	6 -10	Meer dan 10

Houding t.o.v. milieu

Nu volgen een aantal stellingen met betrekking tot het milieu. Geef aan in hoeverre u het eens bent met de volgende stellingen.

	Volledig oneens	Enigzins oneens	Niet zeker	Enigzins eens	Volledig eens
We benaderen het maximale aantal mensen dat de aarde aankan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mensen hebben het recht de natuurlijke omgeving aan te passen aan hun behoeftes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Als mensen ingrijpen in de natuur, heeft dat vaak desastreuze gevolgen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Menselijke vindingrijkheid zal zorgen dat we de aarde NIET onleefbaar maken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mensen maken ernstig misbruik van de omgeving	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De aarde heeft ruim voldoende natuurlijke hulpbronnen, als we maar leren hoe ze te ontginnen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planten en dieren hebben even veel recht van bestaan als mensen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het evenwicht van de natuur is sterk genoeg om te kunnen omgaan met de impact van moderne industriële landen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ondanks onze vaardigheden, zijn mensen onderworpen aan de wetten van de natuur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De zogenaamde 'ecologische crisis' waar de mensheid mee geconfronteerd wordt is sterk overdreven	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De aarde is als een ruimteschip met weinig ruimte en hulpbronnen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mensen waren voorbestemd om over de rest van de natuur te heersen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het evenwicht van de natuur is erg delicaat en gemakkelijk van slag	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mensen zullen uiteindelijk genoeg leren over hoe de natuur werkt, om in staat te zijn haar te beheersen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Als de dingen voortgaan op hun huidige beloop, zullen we binnenkort een grote ecologische catastrofe meemaken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Persoonlijke vragen

Wat is uw geboortjaar?

[getal]

Wat is uw geslacht?

- Man
- Vrouw

Wat is de samenstelling van uw huishouden?

- Alleenstaand zonder kinderen
- Alleenstaand met kind(eren)
- Samenwonend zonder kinderen
- Samenwonend met kind(eren)
- Anders

Indien gekozen voor met kinderen (2/4):

Aantal personen in huishouden: [getal]

Wat is het bruto jaarinkomen van uw huishouden?

- Minder dan €10.000
- €10.000 - €20.000
- €20.000 - €30.000
- €30.000 – €40.000
- €40.000 - €50.000
- Meer dan €50.000
- Zeg ik liever niet

Hoe tevreden bent u met uw financiële situatie?

- Zeer tevreden
- Tevreden
- Neutraal
- Ontevreden
- Zeer ontevreden

Wat is het niveau van uw hoogst voltooide opleiding?

- Geen
- Lagere school (inclusief speciaal onderwijs, bijv. LOM, BLO, etc)
- Lbo of vso (lts, leao, vbo, huishoudschool, ambachtsschool)
- Vmbo (mavo, mulo)
- Havo, vwo (hbs)
- Mbo (mts, meao, middenstandsdiploma, pdb, mba)
- Hbo (hts, heao, kweekschool, associate degree)
- Universitaire opleiding, inclusief postdoctorale opleidingen en PhD
- Andere opleiding

Appendix B

Survey Tiny House interested

This survey is meant for everyone who is more or less interested in living in a Tiny House.

A Tiny House is understood: A detached full-fledged house on small scale, meant for permanent occupancy. A Tiny House is focused on a more simple live with a smaller ecological footprint and less focused on consuming. The design is based on smart use of space and innovative technologies.

The goal of this survey is mapping the wishes of people who (would) want to live in a Tiny House. This is part of my graduation project, at the conclusion of my master's degree in Urban Systems & Real Estate at the Eindhoven University of Technology.

You would help me a lot by filling in this survey! Your data will be processed anonymously and not provided to third parties.

Babette Boomgaard

Preferences

What is your situation in relation to Tiny Houses?

- I live in a Tiny House
- I am building/ let build a Tiny House
- I would like to live in a Tiny House, but I cannot due to circumstances
- I am exploring my possibilities to live in a Tiny House
- I want to know more about Tiny Houses, but do not want to live in one (yet)
- I am not interested in Tiny Houses [thank respondent and stop]

If option 3 is chosen:

Due to which circumstances it is not possible to live in a Tiny House?

[fill in]

If option 3 or 5 is chosen:

What is the main reason you do not live in a Tiny House yet? (multiple answers possible)

- I have no money for it
- I do not have a location yet
- I am not ready yet
- My partner/ family does not want to
- I wait until it is more common in the Netherlands
- Otherwise, namely: [fill in]

What are the three main reasons for you to (want to) live in a Tiny House?

- [fill in]
- [fill in]
- [fill in]

What are the 3 most important disadvantages for you when living in a Tiny House?

- [fill in]
- [fill in]
- [fill in]

Can you explain why you see these as disadvantages?

[fill in]

Indicate to what extent you agree with the following statements regarding living in a Tiny House;

	FULLY DISAGREE	SOMEWHAT DISAGREE	NEUTRAL	SOMEWHAT AGREE	FULLY AGREE
I SEE THE LOWER FINANCIAL COSTS AS AN ADVANTAGE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I SEE MORE FREEDOM AS AN ADVANTAGE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I SEE A SMALLER ECOLOGICAL FOOTPRINT AS AN ADVANTAGE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I SEE HAVING LITTLE SPACE AS A DISADVANTAGE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I SEE HAVING LITTLE STUFF AS A DISADVANTAGE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I SEE HAVING LITTLE PRIVACY AS A DISADVANTAGE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Assume you live in a Tiny House, which facilities would you like to share and with who? (you can give multiple answers per option)

	WITH DIRECT NEIGHBORS	WITH NEIGHBORHOOD	NOT SHARING
ORNAMENTAL GARDEN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VEGETABLE GARDEN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
COMMON INTERIOR SPACE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EQUIPMENT SUCH AS WASHING MACHINE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
WATER PURIFICATION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHERWISE, NAMELY:	<input type="checkbox"/> [fill in]	<input type="checkbox"/> [fill in]	<input type="checkbox"/> [fill in]

Do you prefer to rent or buy a Tiny House?

- Renting
- Buying (incl. self-construction)

If "Buying" is chosen:

How much would you pay for a Tiny House (excluding land)?

- Up to €15.000
- €15.000 - €30.000
- € 30.000 - €45.000
- More than €45.000

What do you prefer concerning the land the Tiny House is situated on?

- Ownership
- Lease

Stated choice experiment

After this, you will be presented with a choice situation a number of times. For each choice situation we ask you to make a choice from two different Tiny Houses. You can choose the Tiny House you prefer to live in, or you choose “I do not want to live in any of these Tiny Houses”.

This is based on a Tiny House of approximately 20m², provided with kitchen, shower and toilet.

Furthermore solar panels lay on the roof for the purpose of power supply.

It is assumed that you can park your car somewhere, for example on the street or on a joint parking lot in case of several Tiny Houses together.

There are six characteristics on which the submitted Tiny Houses can differ. You can assume the Tiny Houses are the same in all other areas. To give a better picture, you will first see an example.

This table is not shown in the survey;

CHARACTERISTICS	POSSIBLE VALUES			
TOILET	Toilet with water flush, connected to sewer	Toilet with water flush, not connected to sewer	Composting toilet	Incinerating toilet
DRINKING WATER	Connected to waternet	Rain water filtering with plants	Rain water and own waste water filtering with plants	Rain water and/or waste water filtering with filters (not plants)
LOCATION	In/ close to city center	City, outside center	Village	Rural area
MINIMUM ACREAGE PRIVATE LAND (APART FROM POSSIBLE JOINT LAND)	Approx 40m ²	Approx 70m ²	Approx 100m ²	Approx 130m ²
LAND TO BE USED WITH LOCAL RESIDENTS (NOT PUBLIC)	None	approx 50m ²	Approx 100m ²	Approx 150m ²
PRESENCE OF OTHER TINY HOUSES	None	1-5	6 -10	More than 10

Attitude towards environment

Now a number of statements relating to the environment follow. Indicate to what extent you agree with the following statements.

	Fully disagree	Somewhat disagree	Unsure	Somewhat agree	Fully agree
We are approaching the limit of the number of people the earth can support.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans have the right to modify the natural environment to suit their needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When humans interfere with nature, it often produces disastrous consequences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human ingenuity will insure that we do NOT make the earth unliveable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans are severely abusing the environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The earth has plenty of natural resources if we just learn how to develop them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plants and animals have as much right as humans to exist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is strong enough to cope with the impacts of modern industrial nations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Despite our abilities, humans are subject to the laws of nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The so-called 'ecological crisis' facing humankind has been greatly exaggerated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The earth is like a spaceship with very little room and resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans were meant to rule over the rest of nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is very delicate and easily upset.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Humans will eventually learn enough about how nature works to be able to control it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If things continue on their present course, we will soon experience a major ecological catastrophe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Personal questions

What is your year of birth?

[year]

What is your gender?

- Male
- Female

What is your household composition?

- Single without children
- Single with child(ren)
- Living together without children
- Living together with child(ren)
- Otherwise

If chosen for with child(ren) (2/4):

Number of persons in household: [number]

What is the gross annual income of your household?

- Less than €10.000
- €10.000 - €20.000
- €20.000 - €30.000
- €30.000 – €40.000
- €40.000 - €50.000
- More than €50.000
- I prefer not to say

How satisfied are you with your financial situation?

- Very satisfied
- Satisfied
- Neutral
- Unsatisfied
- Very unsatisfied

What is the level of your highest education completed?

- None
- Primary school (including special education, e.g. LOM, BLO, etc)
- Lbo or vso (lts, leao, vbo, house work school, craft school)
- Vmbo (mavo, mulo)
- Havo, vwo (hbs)
- Mbo (mts, meao, middenstandsdiploma, pdb, mba)
- Hbo (hts, heao, kweekschool, associate degree)
- University education, including postgraduate and PhD
- Other education

Appendix C

Frequencies NEP-scale

FD = Fully Disagree, SD = Somewhat Disagree, N = Neutral, SA = Somewhat Agree, FA = fully Agree.

Statement	Frequencies												
1. We are approaching the limit of the number of people the earth can support.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>10</td></tr> <tr><td>SD</td><td>10</td></tr> <tr><td>N</td><td>35</td></tr> <tr><td>SA</td><td>50</td></tr> <tr><td>FA</td><td>40</td></tr> </table>	Response	Frequency	FD	10	SD	10	N	35	SA	50	FA	40
Response	Frequency												
FD	10												
SD	10												
N	35												
SA	50												
FA	40												
2. Humans have the right to modify the natural environment to suit their needs.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>20</td></tr> <tr><td>SD</td><td>45</td></tr> <tr><td>N</td><td>40</td></tr> <tr><td>SA</td><td>35</td></tr> <tr><td>FA</td><td>10</td></tr> </table>	Response	Frequency	FD	20	SD	45	N	40	SA	35	FA	10
Response	Frequency												
FD	20												
SD	45												
N	40												
SA	35												
FA	10												
3. When humans interfere with nature, it often produces disastrous consequences.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>5</td></tr> <tr><td>SD</td><td>10</td></tr> <tr><td>N</td><td>30</td></tr> <tr><td>SA</td><td>80</td></tr> <tr><td>FA</td><td>30</td></tr> </table>	Response	Frequency	FD	5	SD	10	N	30	SA	80	FA	30
Response	Frequency												
FD	5												
SD	10												
N	30												
SA	80												
FA	30												
4. Human ingenuity will insure that we do NOT make the earth unliveable.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>10</td></tr> <tr><td>SD</td><td>20</td></tr> <tr><td>N</td><td>45</td></tr> <tr><td>SA</td><td>65</td></tr> <tr><td>FA</td><td>15</td></tr> </table>	Response	Frequency	FD	10	SD	20	N	45	SA	65	FA	15
Response	Frequency												
FD	10												
SD	20												
N	45												
SA	65												
FA	15												
5. Humans are severely abusing the environment.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>5</td></tr> <tr><td>SD</td><td>10</td></tr> <tr><td>N</td><td>25</td></tr> <tr><td>SA</td><td>65</td></tr> <tr><td>FA</td><td>55</td></tr> </table>	Response	Frequency	FD	5	SD	10	N	25	SA	65	FA	55
Response	Frequency												
FD	5												
SD	10												
N	25												
SA	65												
FA	55												
6. The earth has plenty of natural resources if we just learn how to develop them.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>15</td></tr> <tr><td>SD</td><td>25</td></tr> <tr><td>N</td><td>25</td></tr> <tr><td>SA</td><td>45</td></tr> <tr><td>FA</td><td>40</td></tr> </table>	Response	Frequency	FD	15	SD	25	N	25	SA	45	FA	40
Response	Frequency												
FD	15												
SD	25												
N	25												
SA	45												
FA	40												
7. Plants and animals have as much right as humans to exist.	<table border="1"> <tr><th>Response</th><th>Frequency</th></tr> <tr><td>FD</td><td>5</td></tr> <tr><td>SD</td><td>10</td></tr> <tr><td>N</td><td>20</td></tr> <tr><td>SA</td><td>30</td></tr> <tr><td>FA</td><td>90</td></tr> </table>	Response	Frequency	FD	5	SD	10	N	20	SA	30	FA	90
Response	Frequency												
FD	5												
SD	10												
N	20												
SA	30												
FA	90												

<p>8. The balance of nature is strong enough to cope with the impacts of modern industrial nations</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>60</td> </tr> <tr> <td>SD</td> <td>60</td> </tr> <tr> <td>N</td> <td>25</td> </tr> <tr> <td>SA</td> <td>10</td> </tr> <tr> <td>FA</td> <td>0</td> </tr> </tbody> </table>	Category	Percentage	FD	60	SD	60	N	25	SA	10	FA	0
Category	Percentage												
FD	60												
SD	60												
N	25												
SA	10												
FA	0												
<p>9. Despite our abilities, humans are subject to the laws of nature.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>0</td> </tr> <tr> <td>SD</td> <td>5</td> </tr> <tr> <td>N</td> <td>20</td> </tr> <tr> <td>SA</td> <td>65</td> </tr> <tr> <td>FA</td> <td>65</td> </tr> </tbody> </table>	Category	Percentage	FD	0	SD	5	N	20	SA	65	FA	65
Category	Percentage												
FD	0												
SD	5												
N	20												
SA	65												
FA	65												
<p>10. The so-called 'ecological crisis' facing humankind has been greatly exaggerated.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>75</td> </tr> <tr> <td>SD</td> <td>50</td> </tr> <tr> <td>N</td> <td>25</td> </tr> <tr> <td>SA</td> <td>5</td> </tr> <tr> <td>FA</td> <td>0</td> </tr> </tbody> </table>	Category	Percentage	FD	75	SD	50	N	25	SA	5	FA	0
Category	Percentage												
FD	75												
SD	50												
N	25												
SA	5												
FA	0												
<p>11. The earth is like a spaceship with very little room and resources.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>25</td> </tr> <tr> <td>SD</td> <td>35</td> </tr> <tr> <td>N</td> <td>60</td> </tr> <tr> <td>SA</td> <td>30</td> </tr> <tr> <td>FA</td> <td>10</td> </tr> </tbody> </table>	Category	Percentage	FD	25	SD	35	N	60	SA	30	FA	10
Category	Percentage												
FD	25												
SD	35												
N	60												
SA	30												
FA	10												
<p>12. Humans were meant to rule over the rest of nature.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>70</td> </tr> <tr> <td>SD</td> <td>50</td> </tr> <tr> <td>N</td> <td>25</td> </tr> <tr> <td>SA</td> <td>10</td> </tr> <tr> <td>FA</td> <td>5</td> </tr> </tbody> </table>	Category	Percentage	FD	70	SD	50	N	25	SA	10	FA	5
Category	Percentage												
FD	70												
SD	50												
N	25												
SA	10												
FA	5												
<p>13. The balance of nature is very delicate and easily upset.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>10</td> </tr> <tr> <td>SD</td> <td>30</td> </tr> <tr> <td>N</td> <td>35</td> </tr> <tr> <td>SA</td> <td>55</td> </tr> <tr> <td>FA</td> <td>35</td> </tr> </tbody> </table>	Category	Percentage	FD	10	SD	30	N	35	SA	55	FA	35
Category	Percentage												
FD	10												
SD	30												
N	35												
SA	55												
FA	35												
<p>14. Humans will eventually learn enough about how nature works to be able to control it.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>20</td> </tr> <tr> <td>SD</td> <td>35</td> </tr> <tr> <td>N</td> <td>60</td> </tr> <tr> <td>SA</td> <td>30</td> </tr> <tr> <td>FA</td> <td>10</td> </tr> </tbody> </table>	Category	Percentage	FD	20	SD	35	N	60	SA	30	FA	10
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FD	20												
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<p>15. If things continue on their present course, we will soon experience a major ecological catastrophe.</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>FD</td> <td>5</td> </tr> <tr> <td>SD</td> <td>15</td> </tr> <tr> <td>N</td> <td>25</td> </tr> <tr> <td>SA</td> <td>60</td> </tr> <tr> <td>FA</td> <td>50</td> </tr> </tbody> </table>	Category	Percentage	FD	5	SD	15	N	25	SA	60	FA	50
Category	Percentage												
FD	5												
SD	15												
N	25												
SA	60												
FA	50												

Appendix D

Output NLogit Multinomial Logit Model

Without interaction

```
-----
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -1297.45686
Estimation based on N = 1232, K = 19
Inf.Cr.AIC = 2632.9 AIC/N = 2.137
Model estimated: Oct 23, 2017, 21:38:11
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 1232, skipped 0 obs
-----
```

KEUZE	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	
CONST	.46715**	.19605	2.38	.0172	.08290	.85140
WC1	-.10979	.12781	-.86	.3903	-.36029	.14070
WC2	-.22555*	.12757	-1.77	.0770	-.47558	.02448
WC3	-.04143	.12267	-.34	.7356	-.28186	.19901
DRINK1	.14922	.12275	1.22	.2241	-.09137	.38982
DRINK2	.13220	.12039	1.10	.2722	-.10376	.36816
DRINK3	.02979	.12754	.23	.8153	-.22019	.27976
LOC1	-.78320***	.12576	-6.23	.0000	-1.02969	-.53671
LOC2	-.24754**	.12335	-2.01	.0448	-.48930	-.00577
LOC3	-.06136	.11678	-.53	.5993	-.29024	.16752
MINOPP1	-.53900***	.12619	-4.27	.0000	-.78633	-.29166
MINOPP2	-.18617	.12484	-1.49	.1359	-.43086	.05852
MINOPP3	-.21726*	.12192	-1.78	.0747	-.45623	.02170
DEELGR1	-.13339	.12688	-1.05	.2931	-.38206	.11528
DEELGR2	.08085	.12118	.67	.5047	-.15666	.31836
DEELGR3	-.03405	.12199	-.28	.7801	-.27316	.20505
ANDTH1	.09229	.12375	.75	.4558	-.15026	.33485
ANDTH2	.61292***	.12124	5.06	.0000	.37529	.85055
ANDTH3	.30785**	.12336	2.50	.0126	.06608	.54962

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

With interaction

```
-----
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -1296.03289
Estimation based on N = 1232, K = 20
Inf.Cr.AIC = 2632.1 AIC/N = 2.136
-----
```

```
Log likelihood R-sqrd R2Adj
ASCs only model must be fit separately
Use NLOGIT ;...;RHS=ONE$
Note: R-sqrd = 1 - logL/Logl(constants)
Warning: Model does not contain a full
set of ASCs. R-sqrd is problematic. Use
model setup with ;RHS=one to get LogL0.
-----
```

```
Response data are given as ind. choices
Number of obs.= 1232, skipped 0 obs
-----
```

	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	
CONST	.45644**	.19703	2.32	.0205	.07027	.84261
WC1	-.11360	.12805	-.89	.3750	-.36458	.13737
WC2	-.22702*	.12761	-1.78	.0752	-.47713	.02309
WC3	-.04033	.12266	-.33	.7423	-.28075	.20009
DRINK1	.13512	.12324	1.10	.2729	-.10643	.37667
DRINK2	.13393	.12030	1.11	.2656	-.10185	.36972
DRINK3	.03001	.12748	.24	.8139	-.21985	.27987
LOC1	-.79223***	.12627	-6.27	.0000	-1.03971	-.54474
LOC2	-.24556**	.12334	-1.99	.0465	-.48731	-.00380
LOC3	-.06438	.11690	-.55	.5818	-.29350	.16474
MINOPP1	-.44419***	.13762	-3.23	.0012	-.71392	-.17446
MINOPP2	-.19650	.12502	-1.57	.1160	-.44153	.04853
MINOPP3	-.21827*	.12190	-1.79	.0734	-.45720	.02066
DEELGR1	-.04189	.13769	-.30	.7609	-.31176	.22798
DEELGR2	.07821	.12113	.65	.5185	-.15920	.31562
DEELGR3	-.02858	.12189	-.23	.8146	-.26747	.21032
ANDTH1	.08164	.12394	.66	.5101	-.16128	.32456
ANDTH2	.60993***	.12115	5.03	.0000	.37247	.84738
ANDTH3	.31204**	.12336	2.53	.0114	.07026	.55382
MO1DG1	-.43120*	.25842	-1.67	.0952	-.93768	.07529

```
-----
***, **, * ==> Significance at 1%, 5%, 10% level.
-----
```

Appendix E

Output NLogit Random Parameter Models

```
-----
Random Parameters Multinom. Logit Model
Dependent variable          KEUZE
Log likelihood function     -1100.95147
Restricted log likelihood   -1353.49034
Chi squared [ 40](P= .000)  505.07774
Significance level          .00000
McFadden Pseudo R-squared  .1865834
Estimation based on N =    1232, K =  40
Inf.Cr.AIC = 2281.9 AIC/N =  1.852
-----
```

```
Log likelihood R-sqrd R2Adj
No coefficients -1353.4903 .1866 .1732
Constants only can be computed directly
Use NLOGIT ;...;RHS=ONE$
At start values -1296.0329 .1505 .1365
Note: R-sqrd = 1 - logL/Logl(constants)
Warning: Model does not contain a full
set of ASCs. R-sqrd is problematic. Use
model setup with ;RHS=one to get LogL0.
-----
```

```
Response data are given as ind. choices
Replications for simulated probs. =1000
Used Halton sequences in simulations.
RPL model with panel has 154 groups
Variable number of obs./group =VOLT00ID
Number of obs.= 1232, skipped 0 obs
-----
```

KEUZE	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	

Random parameters in utility functions.....						
CONST	1.70062***	.46951	3.62	.0003	.78040	2.62085
WC1	-.22324	.26602	-.84	.4014	-.74464	.29816
WC2	-.50963*	.27492	-1.85	.0638	-1.04846	.02920
WC3	-.19065	.24576	-.78	.4379	-.67233	.29102
DRINK1	.00424	.29155	.01	.9884	-.56719	.57567
DRINK2	.18275	.22791	.80	.4226	-.26395	.62946
DRINK3	.27685	.23570	1.17	.2402	-.18512	.73881
LOC1	-2.25133***	.50523	-4.46	.0000	-3.24157	-1.26109
LOC2	-.80170***	.30125	-2.66	.0078	-1.39214	-.21126
LOC3	-.07461	.22696	-.33	.7424	-.51945	.37023
MINOPP1	-.72544***	.27743	-2.61	.0089	-1.26920	-.18169
MINOPP2	-.31287	.23884	-1.31	.1902	-.78099	.15526
MINOPP3	-.14175	.22745	-.62	.5332	-.58754	.30405
DEELGR1	-.24054	.26533	-.91	.3647	-.76058	.27951
DEELGR2	.16141	.26466	.61	.5419	-.35731	.68013
DEELGR3	-.11687	.23636	-.49	.6210	-.58013	.34639
ANDTH1	-.07105	.29625	-.24	.8105	-.65170	.50959
ANDTH2	1.20616***	.29521	4.09	.0000	.62756	1.78477
ANDTH3	.56319**	.25101	2.24	.0249	.07121	1.05517
MO1DG1	-1.10963**	.54562	-2.03	.0420	-2.17903	-.04024
Distns. of RPs. Std.Devs or limits of triangular.....						
NsCONST	3.29276***	.49321	6.68	.0000	2.32609	4.25942
NsWC1	1.27044***	.44867	2.83	.0046	.39107	2.14981
NsWC2	1.30885***	.45229	2.89	.0038	.42237	2.19533
NsWC3	1.19870***	.41531	2.89	.0039	.38471	2.01269

NsDRINK1	1.71268***	.57056	3.00	.0027	.59441	2.83095
NsDRINK2	.70153*	.41506	1.69	.0910	-.11198	1.51504
NsDRINK3	.08137	.34789	.23	.8151	-.60048	.76322
NsLOC1	3.02485***	.71023	4.26	.0000	1.63284	4.41687
NsLOC2	2.37385***	.50692	4.68	.0000	1.38030	3.36740
NsLOC3	1.07207**	.42691	2.51	.0120	.23534	1.90880
NsMINOPP	1.01269**	.41612	2.43	.0149	.19711	1.82826
NsMINOP1	.58896	.48411	1.22	.2238	-.35988	1.53779
NsMINOP2	.25522	.62752	.41	.6842	-.97471	1.48514
NsDEELGR	.42942	.54854	.78	.4337	-.64569	1.50453
NsDEELG1	1.08507**	.49791	2.18	.0293	.10918	2.06096
NsDEELG2	.84550*	.45014	1.88	.0603	-.03675	1.72775
NsANDTH1	1.89341***	.38847	4.87	.0000	1.13202	2.65480
NsANDTH2	.65056	.49110	1.32	.1853	-.31199	1.61310
NsANDTH3	.97386**	.40739	2.39	.0168	.17539	1.77232
NsMO1DG1	1.09097	.83822	1.30	.1931	-.55191	2.73386

-----+-----
 ***, **, * ==> Significance at 1%, 5%, 10% level.

Appendix F

Output NLogit Latent Class Models

2 classes

```
-----
Latent Class Logit Model
Dependent variable          KEUZE
Log likelihood function     -1143.55262
Restricted log likelihood   -1353.49034
Chi squared [ 41](P= .000)  419.87544
Significance level         .00000
McFadden Pseudo R-squared  .1551084
Estimation based on N =   1232, K = 41
Inf.Cr.AIC =   2369.1 AIC/N =   1.923
-----
```

```
Log likelihood R-sqrd R2Adj
No coefficients -1353.4903 .1551 .1408
Constants only can be computed directly
Use NLOGIT ;...;RHS=ONE$
At start values -1296.0338 .1177 .1027
Note: R-sqrd = 1 - logL/Logl(constants)
Warning: Model does not contain a full
set of ASCs. R-sqrd is problematic. Use
model setup with ;RHS=one to get LogL0.
-----
```

```
Response data are given as ind. choices
Number of latent classes =          2
Average Class Probabilities
      .565  .435
```

```
LCM model with panel has      154 groups
Variable number of obs./group =VOLT00ID
Number of obs.= 1232, skipped   0 obs
-----
```

	KEUZE	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	

Random utility parameters in latent class -->> 1.....							
CONST 1		2.31283***	.36839	6.28	.0000	1.59081	3.03486
WC1 1		.19069	.18979	1.00	.3150	-.18128	.56267
WC2 1		-.24863	.18677	-1.33	.1831	-.61469	.11743
WC3 1		-.19158	.16662	-1.15	.2502	-.51815	.13500
DRINK1 1		.29935*	.16460	1.82	.0690	-.02326	.62196
DRINK2 1		.13388	.15777	.85	.3961	-.17533	.44310
DRINK3 1		.05790	.16886	.34	.7317	-.27306	.38886
LOC1 1		-.71380***	.17706	-4.03	.0001	-1.06084	-.36676
LOC2 1		-.11789	.17543	-.67	.5016	-.46172	.22594
LOC3 1		-.07527	.16642	-.45	.6511	-.40145	.25091
MINOPP 1		-.64200***	.18541	-3.46	.0005	-1.00539	-.27860
MINOP1 1		-.22583	.17524	-1.29	.1975	-.56929	.11762
MINOP2 1		-.20751	.17267	-1.20	.2295	-.54593	.13092
DEELGR 1		-.19897	.18491	-1.08	.2819	-.56138	.16344
DEELG1 1		-.02589	.16302	-.16	.8738	-.34541	.29362
DEELG2 1		.11062	.17243	.64	.5212	-.22734	.44858
ANDTH1 1		-.01345	.16919	-.08	.9366	-.34505	.31815
ANDTH2 1		.65535***	.17104	3.83	.0001	.32011	.99059
ANDTH3 1		.36846**	.16915	2.18	.0294	.03693	.69999
MO1DG1 1		-.29497	.35318	-.84	.4036	-.98719	.39724
Random utility parameters in latent class -->> 2.....							
CONST 2		-.73756**	.37595	-1.96	.0498	-1.47441	-.00071
WC1 2		-.46849*	.26356	-1.78	.0755	-.98506	.04808

WC2 2	-.20797	.24463	-.85	.3952	-.68744	.27149
WC3 2	.16996	.23778	.71	.4747	-.29608	.63600
DRINK1 2	-.12224	.24422	-.50	.6167	-.60091	.35643
DRINK2 2	.08594	.23644	.36	.7163	-.37748	.54935
DRINK3 2	.00087	.24247	.00	.9971	-.47436	.47609
LOC1 2	-1.37496***	.28653	-4.80	.0000	-1.93656	-.81337
LOC2 2	-.75373***	.26329	-2.86	.0042	-1.26978	-.23769
LOC3 2	-.10430	.20692	-.50	.6142	-.50985	.30125
MINOPP 2	-.17823	.26273	-.68	.4975	-.69318	.33671
MINOP1 2	-.18202	.23865	-.76	.4456	-.64977	.28572
MINOP2 2	-.14004	.22890	-.61	.5407	-.58868	.30860
DEELGR 2	.13391	.27024	.50	.6202	-.39574	.66356
DEELG1 2	.08578	.22694	.38	.7054	-.35901	.53057
DEELG2 2	-.10760	.22722	-.47	.6358	-.55293	.33774
ANDTH1 2	.34629	.26621	1.30	.1933	-.17546	.86805
ANDTH2 2	.76799***	.24787	3.10	.0019	.28218	1.25380
ANDTH3 2	.46064*	.25184	1.83	.0674	-.03295	.95423
MO1DG1 2	-.77490	.51448	-1.51	.1320	-1.78327	.23346
Estimated latent class						
probabilities.....						
PrbCls1	.56465***	.04484	12.59	.0000	.47678	.65253
PrbCls2	.43535***	.04484	9.71	.0000	.34747	.52322

-----+-----
***, **, * ==> Significance at 1%, 5%, 10% level.

3 classes

```

-----
Latent Class Logit Model
Dependent variable           KEUZE
Log likelihood function      -1105.66395
Restricted log likelihood    -1353.49034
Chi squared [ 62](P= .000)   495.65278
Significance level           .00000
McFadden Pseudo R-squared   .1831017
Estimation based on N =    1232, K = 62
Inf.Cr.AIC =    2335.3 AIC/N =    1.896
-----

```

```

                Log likelihood R-sqrd R2Adj
No coefficients -1353.4903 .1831 .1620
Constants only can be computed directly
                Use NLOGIT ;...;RHS=ONE$
At start values -1296.0385 .1469 .1249
Note: R-sqrd = 1 - logL/Logl(constants)
Warning: Model does not contain a full
set of ASCs. R-sqrd is problematic. Use
model setup with ;RHS=one to get LogL0.
-----

```

```

Response data are given as ind. choices
Number of latent classes =          3
Average Class Probabilities
                .505 .321 .174
LCM model with panel has          154 groups
Variable number of obs./group =VOLT00ID
Number of obs.= 1232, skipped      0 obs
-----

```

KEUZE	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	
-----+-----						
Random utility parameters in latent class -->> 1.....						
CONST 1	2.88279***	.39016	7.39	.0000	2.11809	3.64749
WC1 1	.13929	.20038	.70	.4870	-.25344	.53203
WC2 1	-.30657	.20099	-1.53	.1272	-.70050	.08736
WC3 1	-.23180	.17745	-1.31	.1915	-.57960	.11600
DRINK1 1	.28633*	.17349	1.65	.0988	-.05369	.62635
DRINK2 1	.10171	.16706	.61	.5426	-.22571	.42913
DRINK3 1	.04995	.17672	.28	.7774	-.29642	.39632
LOC1 1	-.83603***	.19668	-4.25	.0000	-1.22150	-.45055
LOC2 1	-.09791	.19610	-.50	.6176	-.48225	.28644
LOC3 1	-.18835	.18165	-1.04	.2998	-.54437	.16767
MINOPP 1	-.63579***	.19812	-3.21	.0013	-1.02409	-.24749
MINOP1 1	-.22477	.18618	-1.21	.2273	-.58968	.14014
MINOP2 1	-.25327	.18081	-1.40	.1613	-.60766	.10112
DEELGR 1	-.18593	.20003	-.93	.3526	-.57798	.20612
DEELG1 1	-.00563	.17215	-.03	.9739	-.34304	.33179
DEELG2 1	.08431	.18271	.46	.6445	-.27379	.44242
ANDTH1 1	.13120	.18015	.73	.4664	-.22188	.48428
ANDTH2 1	.73786***	.18556	3.98	.0001	.37417	1.10156
ANDTH3 1	.44953**	.17870	2.52	.0119	.09928	.79977
MO1DG1 1	-.51133	.39626	-1.29	.1969	-1.28798	.26532
Random utility parameters in latent class -->> 2.....						
CONST 2	-.36459	.47017	-.78	.4381	-1.28611	.55694
WC1 2	-.86935***	.31256	-2.78	.0054	-1.48196	-.25674
WC2 2	-.81303**	.33560	-2.42	.0154	-1.47079	-.15526
WC3 2	.43587	.29290	1.49	.1367	-.13821	1.00995
DRINK1 2	-.50985*	.30340	-1.68	.0929	-1.10450	.08481

DRINK2 2	.13299	.28168	.47	.6368	-.41910	.68508
DRINK3 2	.09041	.29450	.31	.7589	-.48681	.66762
LOC1 2	-2.58920***	.40488	-6.39	.0000	-3.38275	-1.79565
LOC2 2	-1.79717***	.33392	-5.38	.0000	-2.45165	-1.14270
LOC3 2	-.16164	.23898	-.68	.4988	-.63004	.30675
MINOPP 2	.19227	.32423	.59	.5532	-.44321	.82775
MINOP1 2	.09576	.29276	.33	.7436	-.47803	.66955
MINOP2 2	.04165	.29108	.14	.8862	-.52886	.61216
DEELGR 2	.57307*	.33198	1.73	.0843	-.07761	1.22375
DEELG1 2	.15285	.30794	.50	.6196	-.45070	.75639
DEELG2 2	-.07303	.28777	-.25	.7997	-.63705	.49099
ANDTH1 2	.56355	.34327	1.64	.1007	-.10926	1.23635
ANDTH2 2	1.22835***	.31448	3.91	.0001	.61199	1.84471
ANDTH3 2	.85363***	.31759	2.69	.0072	.23117	1.47608
MO1DG1 2	-1.14402*	.61913	-1.85	.0646	-2.35749	.06945
Random utility parameters in latent class -->> 3.....						
CONST 3	-2.10834***	.75888	-2.78	.0055	-3.59572	-.62095
WC1 3	1.04902**	.51485	2.04	.0416	.03994	2.05809
WC2 3	.92840*	.53837	1.72	.0846	-.12679	1.98359
WC3 3	-.90692	.64983	-1.40	.1628	-2.18056	.36672
DRINK1 3	.91590**	.45952	1.99	.0462	.01525	1.81655
DRINK2 3	.49573	.56997	.87	.3844	-.62139	1.61285
DRINK3 3	.25433	.50537	.50	.6148	-.73617	1.24484
LOC1 3	1.05815*	.58125	1.82	.0687	-.08108	2.19738
LOC2 3	1.40697**	.57428	2.45	.0143	.28140	2.53255
LOC3 3	.13445	.56038	.24	.8104	-.96387	1.23278
MINOPP 3	-.66862	.54995	-1.22	.2241	-1.74650	.40927
MINOP1 3	.00693	.41674	.02	.9867	-.80987	.82373
MINOP2 3	-.04902	.39574	-.12	.9014	-.82465	.72661
DEELGR 3	-.29604	.51368	-.58	.5644	-1.30283	.71075
DEELG1 3	-.36769	.51154	-.72	.4723	-1.37028	.63491
DEELG2 3	.26304	.42753	.62	.5384	-.57491	1.10099
ANDTH1 3	-.94464*	.51435	-1.84	.0663	-1.95276	.06347
ANDTH2 3	-.66785	.50833	-1.31	.1889	-1.66416	.32847
ANDTH3 3	-.63206	.45180	-1.40	.1618	-1.51757	.25345
MO1DG1 3	.15196	.80117	.19	.8496	-1.41832	1.72223
Estimated latent class						
probabilities.....						
PrbCls1	.50496***	.04381	11.53	.0000	.41910	.59082
PrbCls2	.32139***	.04461	7.21	.0000	.23396	.40881
PrbCls3	.17365***	.03853	4.51	.0000	.09814	.24916

***, **, * ==> Significance at 1%, 5%, 10% level.