

MASTER

55+ housing in 2040

insights in the future supply and demand of attractive and appropriate 55+ housing

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55+ HOUSING IN 2040

INSIGHTS IN THE FUTURE SUPPLY AND DEMAND OF ATTRACTIVE AND
APPROPRIATE 55+ HOUSING

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3 December 2019

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55+ housing in 2040. Insights in the future supply and demand of attractive and appropriate 55+ housing.

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PREFACE

In the media, a lot of news is about the ‘too hot’ housing market: shortages, outbids of the housing price, and starters that have problems to find their first house. I, as a potential starter, am wondering what is going on the Dutch housing market. Newspapers headlines open with: ‘Seniors are responsible for stagnation on the housing market’ (nu.nl, November 2017) and ‘Stay-at-home elderly leads to stagnation in the housing market’ (plusonline.nl, December 2016). These statements about the role of the older population are interesting, especially when you take into account that the senior population is growing due to the aging process in the Netherlands and because of the policy to close retirement homes and extramuralisation.

It is because of this ongoing discussion that I have decided to dive into this area of tension between the problems in the housing market and the role of the older generation. Researching these subjects gives me the chance to get more insights into these ongoing problems. This report is the result of the obtained insights into these problems.

The report represents my thesis of the master track Urban Systems & Real Estate (USRE). A track of the master Architecture, Building and Planning at the Eindhoven University of Technology.

I would like to thank my academic supervisors Astrid Kemperman and Stephan Maussen, for their guidance throughout the project. They offered me the possibility to develop my academic way of thinking, triggered me to explore more of this subject, and advice to set up an appropriate approach for this research. Second, I would like to thank my corporate supervisor Erwin Daalhuisen for his accurate and inspiring vision and help during this project: the considerations lead to new and more in-depth insights.

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SUMMARY

55+ housing in 2040. Insights in the future supply and demand for attractive and appropriate 55+ housing.

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Keywords: Elderly housing, Bayesian Belief Network, level of match, housing market, aging

Abstract

The number of housing movements among the 55+ population in the Netherlands is decreasing, which contributes to the stagnation in the housing market. Moreover, the role of the 55+ population on that stagnation is increasing up to 2040 due to the double aging process and extramuralisation policy. One reason for this decreasing trend in movements is linked to the lack of attractive and appropriate housing for the 55+ population. This research presents a model that gives insights into the level of match between the expected supply and expected demand for housing of the 55+ population in residential neighborhoods with high- and low rise in 2040. This model can be used for the development of a neighborhood that has attractive and appropriate housing for the 55+ population, and to increase the number of movements of this age-group.

INTRODUCTION

Elderly housing changed over time. From 1945, various variants of housing for the older population are built, influenced by changing supply and demand over time, and driven by policies of the government. Nowadays, the extramuralisation policy leads to an increase of older people with a continued participation in the housing market.

However, there is a stagnation in the housing market in the Netherlands. The number of movements is decreasing, and the speed of new developments is too low. The older population is playing an important role in this stagnated housing market due to a decrease in outflow (because of an increase in life-expectancy and extramuralisation) and because of a decreasing trend in housing movements of the older population. This impact will increase up to 2040 due to the double aging process in the Netherlands. Tackling the decreasing trend of movements of the older population will have a positive effect on the stagnation in the housing market. The reason for this decrease in housing movements is because of the shortage in attractive and appropriate housing for the older population. Therefore, there is a need to get insights into the supply and demand of the older population in 2040, to make it possible to create a match (between demand and supply) for 55+ housing, which could lead to a decrease of the stagnation in the housing market up to 2040. This need for insights in the level of match of 55+ housing, leads to the main question of this research: to what extent is there a match between the future expected supply of and the future expected demand of 55+ population in 2040?

In this research, the older population is framed from the age of 55 years, because from the age of 55 years, in general, the composition of household changes since children are leaving home. From the age of 75 years, generally an increase in health problems, making daily life activities become more difficult. Therefore, this research is not about elderly housing but about 55+ housing, with a division in groups 55 to 74 years and 75 years and older.

A conceptual research model is developed to determine the level of match between future supply and demand of the 55+ population to 2040. This model shows first how the expected supply

according to 55+ housing up to 2040 is analyzed and how the expected demand of 55+ population in 2040 is determined. Next, the model shows that comparing the expected supply and demand leads to the expected level of match of 55+ housing in 2040 and recommendations to increase the level of match if needed.

Insights in the expected supply, expected demand of the next generation elderly, and the level of match are relevant for several reasons. The understanding of the possible changes in demand is relevant to anticipate appropriately to the wishes of the target group and to create better match on various fields. This will decrease the stagnation of the housing market. This all makes that this research has an important practical perspective.

LITERATURE REVIEW

Worldwide a lot of developed countries have to deal with the aging process. Japan and Germany have the strongest aging population. The government of Japan deals with the aging process to stimulate a wide scope of elderly housing concepts. In Germany, there is a system to let the elderly live in well-known neighborhood nearby facilities in lifecycle resistant housing. Multigenerational co-housing seems to be a success to react to the aging process as well. For this research, these insights make clear that it is important to take into account various housing concepts to deal with the increasing demand of the elderly population and extramuralisation.

The Netherlands is also aging. The 55+ population is increasing strongly due to the expected double aging process up to 2040. Moreover, more people of this age-group are participating in the housing market because of the extramuralisation policy of the government: people with some need for care are stimulated to live longer independently. This increasing group is changing over time to 2040: the difference in life expectancy between gender is leveling out, and the ratio of one-person households is increasing.

This 55+ population in the Netherlands has some specific preferences and needs when it comes to housing and living environment. Specifically, the suitability to easily access a house, and the proximity of facilities in the living environment, in order to increase the self-reliance when the needed level of care increases. The theory of aging in place is implemented in this research, which allows to translate the demand of the current population to the future population in 2040.

Focusing on the supply of the 55+ population, it is shown that there are shortages, which are increasing up to 2040 if no action takes place. Therefore, various developments and policies are planned and in progress by the public- and private sector. The developments are becoming more diverse, and various housing concepts become more popular, of which one of these popular concepts is Collective Private Commissioning. The supply of the housing stock is divided into six housing typologies. In this research, senior housing and ground floor apartments are added as separate types to this list of typologies. Next to that, in this research the supply of care housing will be investigated. In this research only extramural housing will be implemented, and intramural and cure are excluded.

In the Netherlands, the municipalities could be divided into four kinds of neighborhoods: rural municipalities, suburban municipalities, welfare suburban municipalities, and the bigger cities. This research focuses on the bigger cities in the Netherlands. Multiple arguments are given: the dependency of the elderly population in the housing stagnation problem in the bigger cities, the lack of housing, ratio older people with lower social-economic status and higher ratio one-person households. Moreover, the growth of these big cities and the increase of the absolute number of the older population in these cities are also important.

These bigger cities could be split up into neighborhoods. In general, in the Netherlands, there are nine different kinds of neighborhoods. One of these is *a residential neighborhood with high- and*

low-rise. A sort of neighborhood that developed mainly between 1945 and 1965, with monotone architecture of mainly apartments without an elevator. Nowadays many of these kinds of neighborhoods have to deal with economic-social problems. Therefore this research focuses on that kind of neighborhoods in the bigger cities. In The Hague, Bouwlust / Vrederust is one of those neighborhoods and in Rotterdam, IJsselmonde is a residential neighborhood with low- and high rise. Both have restructuring plans to increase the socioeconomic status in the neighborhood.

METHODOLOGY

A model is developed to answer the research question. A mixed-method approach is used which includes both quantitative and qualitative research. The quantitative research is a data analysis, which shows the demand for the 55+ population of selected neighborhoods. A Bayesian Belief Network is used to translate the findings over time to 2040 to predict the expected demand in 2040. Specifically, this technique is used to identify the dependencies between a set of variables in a data set, and in this research, it helps to found out how the demand variables are likely to differ when the personal variables change over time. The qualitative research is in the form of a case study, to determine the expected supply in 2040 and the size of the target group. Two neighborhoods with low- and high rise are implemented in the model. Information about these neighborhoods is collected by interviewing experts and by using existing data sources. The collected data from the quantitative research and the qualitative research, are added into the mixed-method model and results in the expected level of match in 2040. Recommendations could then be given to influence the level of match.

DATA

This mixed-method model uses various data sources (qualitative and quantitative) to determine the supply and demand of people from the age of 55 concerning housing, living environment facilities, and housing concepts, all in 2040. The qualitative data sources are divided into existing data and data from interviews. The existing data give insights into the current supply and the prognosis of the target group. The interviews provide insights into the future supply. Quantitative data source (*De Grote Omgevingstest*) is implemented to get insights into the demand of the target group.

RESULTS

In this research a model is developed to calculate the expected level of match between expected supply and housing demand. The model is implemented to look at the level of match in residential neighborhoods with low- and high rise building. Therefore, two case-studies are conducted: Bouwlust / Vrederust, and IJsselmonde. Various data sources are implemented into the model to calculate the expected level of match in 2040. This model exists out of multiple steps, which leads to sub-results: the expected supply and expected demand in 2040. Subtracting these sub-results leads to the final result which is the expected level of match. In this research, the results are addressing three topics: housing, facilities in the living environment and housing concepts.

For Bouwlust / Vrederust various mismatches are found between the expected supply and demand. There is a negative mismatch to be expected for owner-occupied housing and a positive mismatch for social rent housing. There is a shortage expected for apartments with elevator and an overplus for apartments without elevator. Concerning the ratio new-build housing, there is a negative mismatch expected up to 2040. For care housing a positive mismatch is expected for housing without care(services) and a negative mismatch for extramural housing with services. Concerning the facilities in the living environment, only one negative mismatch is expected up to 2040: general practitioners. Looking at the housing concept a negative mismatch is expected for housing on or next to water, and a positive mismatch for CPO housing.

For the second case-study about IJsselmonde, multiple mismatches between the expected supply and demand are found in the model as well: a negative mismatch for owner-occupied housing, and positive mismatch for social rental housing and private rental housing. Concerning housing typologies, new developments, and care housing, the mismatches are similar to the case-study of Bouwlust / Vrederust. Also for facilities in the living environment the same mismatch is found: negative mismatch for general practitioner facility in 2040. Looking at housing concepts, a negative mismatch is expected for housing on or next to water, and a positive mismatch is CPO.

Scenario thinking is used to research the impact of trends up to 2040. It shows that a stronger life expectancy for men will not influence the demand of the target group. The trends of individualism has a minimal impact on the demand: the biggest difference is found for housing property: owner-occupied housing decreases and social rent housing increases. Next to that the attractiveness for shared housing, transformation, and high-rise increase a little.

CONCLUSION

This research has developed a model which shows to what extent there is a match expected between the future expected supply and future expected housing demand. The focus is on the 55+ population in residential neighborhoods with high- and low rise housing, in 2040. The following mismatches in 2040 are found (according to three topics):

Concerning housing, a negative mismatch is expected for owner-occupied housing in 2040 and a positive mismatch for social housing. Therefore, it is recommended to transform social housing into owner-occupied housing. There is a negative mismatch expected for apartments with an elevator and a positive mismatch for apartments without elevator. It is crucial that the transformation to apartments with elevators is big enough because circa 50% of the apartments need to be transformed. There is a shortage expected for new-build housing: the scale of restructuring plans determines the level of mismatch, which need to be ambitious to achieve the demand of 50% new-build housing. There is a strong mismatch expected for housing without care(services): the government strives to letting people living in their home when disabilities or limitations occur, and receive care at home, while the demand for this option is limited. A negative mismatch is expected for extramural housing with (care)services. It is recommended to decrease the ambition for housing without (care)services and invest in extramural housing with these services.

Looking at facilities in living environment, in general, it is expected that there is a match between expected supply and demand. Except for the general practitioner facility; for this facility, a negative mismatch is expected in 2040. The target group (55+ population) found it relatively important to have a general practitioner facility nearby in the living environment; however, on average, this facility is not available in the living environment. It is not easy to increase the number of general practitioners in the neighborhood. However, flexibility in locations, like working on different locations during the week, leads to increase in level of match for general practitioners.

For housing concepts, there is a negative mismatch expected for housing on or next to water. This housing concept is very attractive, but not named by policymakers, as possible concept to implement. Where possible, it is recommended to, create possibilities to implement this housing concept. Furthermore, there is a positive mismatch expected for CPO housing. This concept is the least attractive housing concept for the target group. However, policymakers strive to implement this housing concept up to 2040 in these kinds of neighborhoods. It is not recommended to continue the ambition to create room for CPO up to 2040, focusing on the target group of this research.

If all these expected mismatches are solved in 2040, than there are sufficiently attractive and appropriate housing options available for the 55+ population, which could have as results that 18% of the single-family dwelling occupied by 55+ population becomes free for young starting households, due to the expected increase in movements of the 55+ population out of the single-family dwellings.

This research is completed, despite some uncertainties and limitations. First the prediction uncertainty; because this research focuses on 2040, forecasting assumption is done. Second the assumption that the neighborhoods will not get another kind of population with other demands, following the theory of aging in place. Third, the limitation that in the model only data are used which was available on the moment of research. Not all the variables that are a part of the demand of a population could be included.

In conclusion, this report described a model that gives insights into the level of match between the expected supply and housing demand of the target group. This model makes it possible to calculate the expected level of match of a specific neighborhood, any period in time, and for any target group. In this research the model is used for the problem definition, and therefore, it focuses on the level of match in 2040 for the 55+ population living in residential neighborhoods with low- and high rise buildings.

1. INTRODUCTION

In this chapter, an introduction to the topic will be given. First, to get familiar with the subject of 55+ housing, a historical timeline will be presented. This shows that the demand and supply for housing (influenced by policies) for this age-group, differ over time. Nowadays, the extramuralisation policy leads to a change in supply and demand for the older population.

This research will be elaborated on the following problem definition: there is a stagnation in the housing market, and the older population plays a role in that stagnation. This role will become more important up to 2040, due to the double aging process in the Netherlands. After the problem definition, the target group will be explained: 55+ population. Literature is about the *elderly* and *older population*, but this research will be focused on the 55+ population, because from that age on average, a new phase in life starts.

Next, the research goals, the research questions, and the conceptual model will be set up. It describes a model that is used to get insights into the future expected supply and the demand of the 55+ population. The expected supply and demand are merged to calculate the expected level of match in 204. These insights about the level of match according to 55+ population, could help to solve the problem of a stagnated housing market.

At last the relevance of this research will be described from both a scientific and a practical perspective: the model is valuable to create a better level of match on neighborhood scale for the 55+ population, which will have a positive impact on the stagnated housing market.



OVERTURE 55+ ACTIVE ADULT APARTMENT HOMES: American concept of 55+ community housing. Luxury resort with various amenities. Retrieved from: Overture.com, 2019

1.1. BACKGROUND: HISTORICAL TIMELINE OF HOUSING FOR THE OLDER POPULATION

As a start, this section will give a historical timeline of elderly housing in the Netherlands, which helps to get familiar with the subject of elderly housing. This is needed because this research is about the supply and demand of housing of this aging population. The historical timeline shows that demand and policies for elderly housing changes over time: from intramural to extramural, from small scale to big scale elderly housing, and from one total financial budget for care-housing to a separation between care and housing.

When the second world war was over, the Netherlands started with the reconstruction of the country and the development of the welfare state. The elderly group became seen a separate age group, and public responsibility was increasing: the working population became responsible for the non-working population (Dekker, 2016). However there was a big shortage of housing, and people had to deal with poverty (Spiering, 2014). Therefore, cheap retirement housing and pensions were developed, which had small rooms, were relatively sober and without facilities (Breuer, et al. 1992; Dekker, 2016). In 1957, the AOW (Algemene Wet Ouderdomsvoorziening) was introduced in the Netherlands: the elderly got a new social position, and with that a new real estate typology became possible: elderly housing. Retirement homes, nursing homes and rest homes were developed very frequently and were becoming more popular (Dekker, 2016; Beira, 2010).

During the 60s elderly housing changed: the elderly were not just seen as one homeogenous group so, more diversity and flexible housing were needed (Dekker, 2016). Next to that, there were a demographic change: an increase in immigrants, economic growth, and individualism, which all led to new preferences and needs (Spiering, 2014). The elderly had the preference to keep living independently in a well-known neighborhood with better facilities. This change in demand resulted in other elderly housing: service flats with relative spacious houses and shared facilities, but these were aimed of the richer elderly (Spierings, 2014; Dekker, 2016). In 1968, the AWBZ (Algemene Wet Bijzondere Ziektekosten) was implemented in the Netherlands, which led to a strong increase in demand for nursing homes and care homes leading to big scale developments (Kwakernaak, 2015; Spiering, 2014). But around 1975, the government became more strict with financial cuts to decrease the rising costs for care-housing and therefore care housing became soberer and thus less popular (Beira, 2010; Dekker, 2016). This decrease in attractiveness led to other kinds of housing: a shift to extramural housing with daily care and facilities in the neighborhood (Dekker, 2016; Beira, 2010).

In the 80s, more elderly started living independently, and the demand for adjustable and flexible housing increased (Beira, 2010). Developments of big-scale diverse multifunctional complexes for the elderly took place, with more green and services, where elderly could live more individually (Spierings, 2014). The popularity of retirement homes was still decreasing among vital older population, reinforced to the fact that retirement homes had implemented more care facilities to release pressure for the nursing home (Dekker, 2016). Therefore, the demand for independent housing grew, and new housing concepts were introduced like sheltered housing (*aanleunwoning*) and *inleunwoning* (Dekker, 2016). Independent housing was in line with the national policies to keep the elderly with a low level for needed care out of the care- and nursing houses and created a shift from professional care to informal care and self-reliance (Breuer, et al. 1992).

During the 90s, a new trend of housing was introduced in the Netherlands; a variant in-between care-housing and independent housing (Spierings, 2014; Beira, 2010). Big scale complexes with shared facilities, with a shift from rooms to real apartments (with living room, bathroom and kitchen). However, the separation between care and housing was difficult: elderly with a flexible

need for care fell in-between (Dekker, 2016). Therefore in the 00s, the development of these complexes continued with more customized care in 'normal' housing (Spierings, 2014).

The last decade, the AWBZ system of 1968 became too expensive, due to the increasing life expectancy, the number of elderly, the increasing demand for quality of life, new technological and medical innovations, and therefore, reforms were inevitable (GWHP, 2013; Castelijn, et al (2013). A stricter division between care and housing was needed (Beira, 2010).

For that reason, on January 1st 2012, the government introduced the NHC: *Normative Huisvestingscomponent*. With the start of this policy, the capital remuneration became dependent on the occupancy rate of a healthcare institution-building and the level of care, instead of a standard remuneration with recalculations, regardless of the occupancy rate of a building (Montfort et al. 2016; Van Dam, 2013). Next to that, in 2013 the policy of separation of living and care was introduced, and living and care weren't reimbursed with the AWBZ (*Algemene Wet Bijzondere Ziektekosten*) anymore (Stoffelen, 2016; Van Dam, 2013). Elderly that are classified in a relative low care-group (ZZP 1-3) aren't covered anymore, and this group is not eligible for intramural care (Bijvanck, 2013). Therefore, the people of lower care categories were disappearing out of the care institutions. The decrease of people in care institutions is reinforced by the implemented policy called extramuralisation, which aims to let people live in their homes as long as possible (Ministerie VWS, 2018).

Overall, these implementations lead to a shift from intramural to extramural housing of the older population in the Netherlands (Montfort et al. 2016). The policies led to 30% fewer clients for intramural care-housing and to an increase in the demand for extramural care-housing (Meijdam & Nijhof, 2014). The trend of extramuralisation makes that more elderly participate in the general housing market and become a more important factor.

This historical description of the housing situation of the older population shows that the demand and supply (influenced by policies) for housing for this age-group, differs over time. Nowadays, the extramuralisation policy leads to an increase of older people stay living in normal housing: more elderly continue to participate in the housing market.

1.2. PROBLEM DEFINITION

The described historical timeline of elderly housing concluded with the fact that elderly became a bigger factor in the housing market due to the current policy of extramuralisation. This section explains the problem of the current stagnated situation of the housing market and how the elderly are a part of this stagnation, but also that this older population could be a possible solution for the current stagnation in the housing market, by means of developing attractive and appropriate housing for the elderly.

STAGNATION IN HOUSING MARKET

There is a stagnation in the Dutch housing market: the number of transactions is decreasing, and the number of sold new-build housing has reduced with 8% in 2019 compared to 2018 (NVM, 2019). There is a housing shortage due to the lack of new-build houses, which leads to an increase in housing prices (PBL, 2018). Households cannot make a new movement, and therefore, households cannot live in a house that fits with their preferences and needs (MBZK, 2015). This stagnation is a big problem for starting households who want to enter the housing market. Renes & Jokovi (2008) describe that the number of starting households that can enter the housing market is dependent on the number of new developments, number of movement flows and the number of houses that become available because of outflow (combination of people who start living together, mortality and movement intramural) (see figure 1). Starting households are more dependent on the outflow in the housing market, due to the stagnation in the movement flow and because of the limited number of new developments.

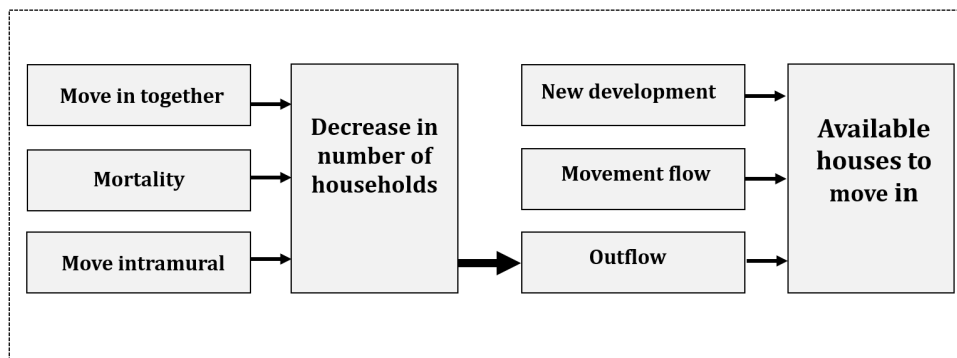


Figure 1.1: concept of the flow of the housing market; based on model of PBL 2018.

ROLE OF OLDER POPULATION IN STAGNATED HOUSING MARKET

The older population is playing an important role in this stagnated housing market. This role is two-piece. First, because the older population affects the outflow. Rli (2014) states that the elderly population becomes older than in the past due to the increase in health. Next to that, the older population influences the outflow because of the extramuralisation policy in the Netherlands: elderly are stimulated or forced to live longer independently at home instead of living intramural, which decreases the number of movements to intramural housing (Nieuwenhuis, 2010; Knipp 2018; De Groot, et al. 2013; MZBK, 2015). Furthermore, in addition to the decrease of intramural housing: because the elderly will be more active and vital in the future, the need for intramural care decrease even more (Van Dam, et al. 2013). To recap, the older population affects the outflow of the housing market.

The other factor in the role of the older population concerns the movement flow (see figure 1.1). There is a decrease in the number of movements in the group of elderly: in 1995, 6,5% of the elderly moved, 2013 5% of the elderly, and in 2018 it is even lower to 4,5% (CBRE 2018; Van Dam, et al. 2013). Ministerie van Buitenlandse Zaken en Koninkrijkrelaties (2015) confirms this trend by noting that in the years 2013 to 2015, the number of households that moved was 870.000, which was 300.000 lower than in 2009 and 77.000 lower than in the year 2012. Besides that, the group elderly is growing to 2040 with more than 10% (compared to 2014) in the Netherlands: from 2,6 million elderly to 4,7 million in 2040 (Rli, 2014). This increase of the older population group influences the impact on the movement flow even more.

This two-sided role of the elderly population on the stagnated housing market has consequences for other age-groups as well. Knipp (2018) describes that most of the elderly stay living in single-family dwellings. These houses are relatively spacious and popular for young starting households (SCP, 2004). The decrease in movements of the elderly makes it more difficult for young starting households to rent or buy a single-family dwelling (De Groot, et al. 2013). Research of CBRE (2018) confirms this problem by stating that around 80% of the houses that are sold by the elderly are single-family houses, which are suitable and attractive for young starting households. So, from the perspective of these young households, elderly is a jamming factor to realize their housing preferences (De Groot, et al. 2013; SCP; 2004). On top of that, nowadays, 50% of the elderly whom are moving, are buying again a single-family house (Prins & De Vries, 2018). It is striking that these single-family houses are inhabited by the elderly because those houses have stairs (that could become difficult when people become older, and disabilities occur) and have, for example, multiple bedrooms (which are not needed when children leave home) (Prins & De Vries, 2018).

SIMPLISTIC APPROACH: BUILD MORE HOUSES FOR THE STARTING HOUSEHOLDS

A first solution could be to develop more houses for the starting households, which fulfills the current demand of these young households looking for a suitable house. But in the long term, this expansion of the housing stock could lead to vacancy problems, especially in contracting regions (De Groot, et al. 2013).

Until the year that the big group of elderly, called baby boom generation, is participating in the housing market, the shortages will be a problem (De Groot, et al. 2013). However, after this period, a big part of the housing stock (especially own-occupied houses) will become available due to the pass away of these elderly of the baby boom generation and because of movements to intramural institutions of this generation (De Groot, et al. 2013). The baby boom generation is born between 1945 and 1955: so, based on a life expectancy of 80 to 85 years, from the year 2025, houses become available on the housing market. This trend will continue until the end of the baby boom generation in 2040. In a research of the *Planbureau voor de Leefomgeving* (2013), it is written that it is expected that around the year 2030 53.000 of the occupied houses become available. Moreover, a further forecast of Van Dam et al. (2013) shows that in 2038, around 90.000 houses will become available on the housing market. So, the approach to plus up the housing stock for the current shortages leads to vacancies after 2040.

THOUGHTFUL APPROACH: STIMULATE THE MOVEMENTS OF ELDERLY ON THE HOUSING MARKET

Another approach is to zoom-in into the elderly population and make clear why the movements are decreasing and use this information to stimulate the elderly to move.

REASONS WHY THE ELDERLY DO NOT MOVE

There are three reasons why the movements of the elderly are decreasing: (1) elderly are concerned and found it difficult to move, (2) elderly have a willingness to stay in their own house, and (3) the lack of attractive and appropriate housing for the older population.

Let's first take a look at the explanation about the argument regarding the concerns of the elderly. This argument for postponing a movement mainly refers to the elderly owning a house. It is expected that the ratio of house ownership will increase to 2040 (Van Dam, et al. 2013; De Groot, et al. 2013). Comparing 2009 with 2015, especially the number of movements in the owner-occupied housing market decreased more than half from 320.000 to 140.000 removals (MBZK, 2015). This group of elderly are concerned about selling a house; they see selling as a big obstacle (Meijdam & Nijhof, 2014). Clark & Dieleman (1996) state that elderly more often have an owner-occupied house with low or without mortgage. A movement could lead to an increase in costs. Elderly experience a movement as far-reaching because of uncertainty about the costs and difficulty to clarify the suitability and availability in the housing stock and the possible adjustment that could be done (MVWS, 2018). The elderly that are renting a house has concerns as well. Knipp (2018) describes that a lot of elderly are living for a long period in a single-family dwelling already and have relatively low rents. A movement could nowadays often lead to a significant increase in rent, which makes that the elderly do not move out to specific elderly or 55+ housing. For the group of elderly that are concerned, it is important to make the housing market more transparent and easy to understand. Therefore, policymakers have to take into account the concerns of the elderly population.

The second argument why the elderly are not moving is because they do not have the willingness to do so. Parts of the elderly want to stay at home as long as possible in their well-known house and neighborhood to prevent disturbance in daily life and change in the social network (Rli, 2014; De Kam, et al. 2012; MVWS, 2018; Meijdam & Nijhof, 2018). This group of elderly is satisfied with their house, but when disabilities occur (mostly from the age of 75), the level of satisfaction of their house decreases (SCP, 2004). The willingness to move increases because then the house

becomes unsuitable for the needed level of care and less accessible, leading to a forced movement (CBRE, 2018; MVWS, 2018; Prins & De Vries, 2018). SCP (2004) confirms that the tendency of the movement of the elderly depends on the healthy level and anxiety for expected health issues. When the situation of disabilities, for example, occurs, the time to look for a suitable place that matches the need and preferences is difficult, so movements are made more in a rush, and the chance for unsuitable and unsatisfied moving is increasing. Therefore, a big part of those elderly starting a need for care are living in not-adjustable housing, which not match the needs to receive care (MVWS, 2016). Next to the risk for rushed movements to unsuitable housing, there is another argument to move before disabilities occur. Knipp (2010) describes an important profit of a movement to specific elderly or 55+ housing: it decreases the costs for care because the houses are more suitable and adjustable to receive care if it becomes needed. If people stay in a regular house (e.g. single-family dwelling), it is relatively expensive (to 30.000 euros) for the inhabitants to make these houses suitable and elderly-proof (Kiers, 2016). So, for this group, it is crucial to make them aware that it is important to move in time (before limitations and disabilities occur) to prevent rushed unsuitable movements and high costs for elderly-proof constructions.

The last argument for the decrease in movements is about the lack of attractive and appropriate housing for the elderly population in the Netherlands. There is a part of the elderly that have the willingness to move: 21% of the elderly from the age of 65 have a wish to move within two years, but the actual movements of the elderly are significantly lower (4,5% in 2018) (CBRE, 2018). Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2015) describes an increasing demand: in 2015, 3,2 million households want to move within two years, which is significantly higher than in 2009 (with 2,1 million households with a wish to move). But nowadays, the number of movements of the group of elderly is decreasing because of an increasing lack of attractive and appropriate elderly housing (CBRE, 2018; Van Dam, et al. 2013; Prins & De Vries, 2018). If no developments and actions take place, the lack of not suitable houses for the elderly will increase to more than 400.000 independent houses in 2040, with shortages for all different kinds of elderly housing (De Groot, et al. 2013; Rli, 2014; SCP, 2004; Meijdam & Nijhof, 2014). The potential and available houses do not fulfill the preferences and needs without a significant rise in costs (Meijdam & Nijhof, 2014). For example, Treur (2016) shows that more than 50% of the people from the age of 60, want to move to independent care-apartment, but shortages and not attractive and appropriate housing, stagnate this movement. So, to create more movements in the housing market, more attractive and appropriate housing is needed for the older population.

ATTRACTIVE AND APPROPRIATE HOUSING TO STIMULATE THE HOUSING MARKET

The last paragraph made it clear that the number of movements of the older population is decreasing because of three reasons. The first reason is about concerns for movements and can be solved with reassurance and assistance when the elderly want to take a movement in the housing market. These improvements could lead to more movements.

The second reason is 'no willingness to move'. For this group, it is essential to create awareness that a new movement is better before limitations or disabilities occur, to prevent a rushed movement or strong increase in costs to transform an ordinary house ready for the needed care. Next to this awareness, it could help to develop more attractive and appropriate housing that tempts this group to move to another house, which is suitable if disabilities and limitations occur.

The last argument is about the lack of attractive and appropriate housing. A part of the older population does not move due to shortages of attractive and appropriate housing, that matches the preferences and needs of the older population (De Kam, et al. 2012; Bijvank, 2016). So, if more attractive and appropriate housing becomes available in the housing stock, it is expected that the number of movements of the older population will increase.

To sum up, it is a thoughtful approach to create more attractive and appropriate housing, to stimulate the older population to move (to increase the number of movements of the older population). On top of that, more attractive and appropriate housing could tempt the elderly to move earlier (before limitations or disabilities occur). In this case, demand is created which prevents rushed movements to unsuitable housing or strong increase in reconstruction costs when disabilities or limitations arise.

HOUSING MARKET CHALLENGE EVEN BIGGER IN 2040

The paragraph above described a possible approach to solve the problem of a stagnated housing market. This problem is depending on the size of the elderly population people; if this group elderly increases, the impact on the housing market rises. And it is stated that the elderly population (65+) will increase strongly to 2040. After 2040, it is expected that this age-group will stagnate (Castelijns, et al, 2013). To prevent problems not only nowadays but also in 2040, when the demand for elderly housing is maximum, and the pressure on the housing market is big for that reason, it is important to do a forecast about the older population in 2040 and the expected housing stock in 2040. Also in 2040, the housing stock needs to be attractive and appropriate for the elderly to decrease possible stagnation in the housing market.

CONCLUSION

To summarize, the housing market in the Netherlands is stagnated. The older population plays an important role in the flow of the housing market. There is a trend that the elderly participate longer in the housing market due to an increase in life expectancy and because of the extramuralisation policy. Next to that, there is a decreasing trend in housing movements of elderly in the Netherlands. One of the reasons why elderly move less to another house than in the past is because of a lack of attractive and appropriate housing for this group. So, this problem of a lack of attractive and appropriate housing for the older population needs to be solved to decrease the stagnation in the housing market. Therefore, there is need for insight into the supply and demand for housing, focusing on the older population. These insights contribute to a housing stock which matches the preferences and need of these elderly. This importance of a good match for housing and living environment (between demand and supply), becomes bigger to 2040. The strong increase of the older population in the Netherlands (and its trends, which could have a negative effect on the housing market) increase the role and the impact of this group on the housing market. Therefore, there is an even stronger need to get insights into the supply and demand of the older population in 2040. This all to create a match that has a positive effect on the housing market.

1.3. EXPLANATION OF THE TARGET GROUP

So far, the introduction is about the *older population* or the *elderly*. It is essential that for this research, the group is framed. To start, the focus group is people living in houses that are maybe more suitable for other (starting) households because those older people are at a stage in life (for example due to children that left home) to perhaps make a step in the housing market. In this section, the frames of this target group will be explained. This analysis leads to the conclusion that in this research the focus will be on people from the age of 55 and older.

It is expected that the current elderly generation is not the same as the previous elderly generations, and in the future, the elderly generation could differ from the elderly nowadays. So, the definition of the group called the elderly differs. Van Der Gaag & De Beer (2017) states that the name elderly should get another interpretation: the current elderly live a longer vital life than in the past, and people with the age of 70 are still mostly active instead of resting. Rosenberg & Everitt (2001) divide the group elderly into three groups: the young-old (65 to 69 years), middle-

old (70-74), and old-old (over the age of 75). This division is made because from the age of 75, people are more vulnerable to physical and social challenges and experience more difficulties in completing the activities of daily life, which is all associated with the old age (Rosenberg & Everitt, 2001; DSO Den Haag, 2014). Also, Pan & Fukuda (2016) divide the elderly into groups according to the increase of health problems from the age of 75 and older. Taking a look at the group of early-stage (65 to 74 years old) and the later group (over the age of 75). The early-stage group of the elderly are relatively healthy and just retired from working life and are having a relaxed and comfortable life with a pension (Meno Fumitake, 2012). Following the line, in this research, the first part of the target group is established: people from the age of 75.

The other part of the target group is established following the life-cycle of people: the moment that households will change in composition. One of the changes in a household (which leads to a change in demand) is the moment when children are leaving home. This phase in the life cycle is called the empty nest: the period in life when children have grown up and leave home (Harkins, 1978). In the Netherlands, children are leaving home at the age of 24,6 on average and are going to live independently (CBS, 2016). Next to that, another research of CBS (2019) shows that from the age of 25 years an increase at the start of parenthood is visible (See figure 1.2). The average age of the mother when the first child is born is 29,9 years (CBS, 2019). The sum-up of these two marks, when children leaving their home (24,6) and when parenthood averagely starts (29,9), gives the age of 55 years and older. That is the moment that the demand for housing probably changes, and people could be tempted to move out to another better fitting house. This group, from the age of 55 are not elderly, but it fits with the research goal to decrease the stagnation of the housing market by tempting to make a new movement in the housing marketing flow.

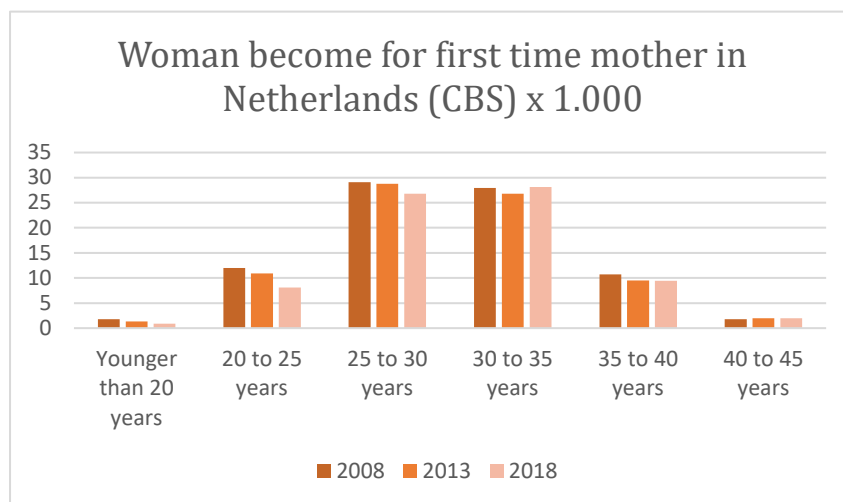


Figure 1.2: Year woman become mother for the first time in the Netherlands. In the years 2008, 2013 and 2018. CBS data with own operations. Retrieved from: CBS, (2019). Leeftijd moeder bij eerste kind stijgt naar 29,9 jaar. Geboorte kerncijfers, levend geboren kind. Retrieved from: <https://www.cbs.nl/nl-nl/nieuws/2019/19/leeftijd-moeder-bij-eerste-kind-stijgt-naar-29-9-jaar>

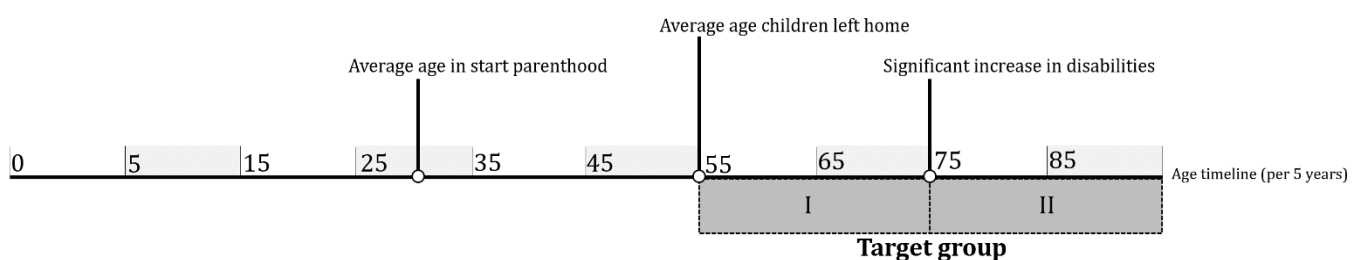


Figure 1.3: Overview of the total population divided 5 year age groups. The target group is grey.

So, the target group of this research is two-fold, according to changing moments in life (see figure 1.3). First, the moment of the empty nest (from the age of 55) and second the moment when health problems increase and daily life activities become more difficult on average (from the age of 75). Therefore, from this point, the research is not about elderly housing but about 55+ housing and the division is made from 55 to 74 years and 75 years and older.

1.4. RESEARCH GOALS AND RESEARCH QUESTIONS

The previous section explained that this research is about 55+ housing. The problem definition states that the 55+ population has an important role in the flow of the housing market, which increases to 2040 because of the double aging process in the Netherlands. Therefore, more insight into attractive and appropriate 55+ housing is needed, focused on 2040. Research goals and questions are established to receive these insights. This section describes the main-goal, sub-goals, and the research questions to establish these goals.

Before the description of the goals and research questions, the scale that is going to be used in this research is needed. Exact insight into the supply and demand for housing are better distractible if research takes place on a scale where houses and households can be analyzed separately. Therefore, this research zooms-in into a level in which exact numbers (for houses, facilities, and personal characteristics, e.g. households) could be researched: a neighborhood-scale. Therefore, the following goals and research questions refer to neighborhoods.

MAIN GOAL

It is important to get insights into the supply and demand for attractive and appropriate 55+ housing in 2040 in order to increase the number of movements of the elderly population and therefore decrease the stagnation in the housing market at the peak of the aging process in the Netherlands. Next to that, insights into the supply and demand for attractive and appropriate 55+ housing helps to tempt the elderly to move to a more suitable house before limitations and disabilities occur.

A model could help to indicate the insights into the supply and demand for attractive and appropriate 55+ housing, which results in a level of match. If a mismatch is expected, the level of match helps policymakers to strive to a better match between supply and demand for 55+ housing to stimulate the flow of the housing market.

Therefore the goal of this research is to develop a model that helps to forecast to what extent there is a match expected between the demand and the supply of 55+housing, focusing on the peak of the aging process in 2040. If the level of match is determined and improvements are needed, a better match could be achieved through changes in the housing stock, which leads to more appropriate and attractive housing for the 55+ population in 2040.

Main goal: Get insight into the level of match between the future expected housing stock and future expected demand of the 55+population in 2040, and establish recommendations to optimize the expected level of match.

To reach this main goal, the following main research question is set up:

- To what extent is there a match between the future expected supply and future expected demand for housing for the 55+ population in 2040? If needed, how can a better match be reached?

SUB GOALS

In order to realize the main goal, two sub-goals are established for this research:

First, the supply side: insight in the future housing stock and the surrounding living environment is needed in the model to establish the level of the match of 55+ housing in 2040. Therefore, the first sub-goal of this research is to clarify the future expected housing stock, focusing on 2040.

This sub-goal about the supply of 55+ housing in 2040, will be found out by the two following sub-research questions:

- What is the current supply for 55+ housing?
- To what extent do plans and policies influence the supply to 2040?

The second sub-goal is about the demand of the 55+ population in 2040. The preferences and needs of this future target group are needed in the model to get insights into the future expected level of the match of 55+ housing in 2040. So, the second sub-goal of this research is to clarify the demand for 55+ housing (preferences and needs) of the 55+ population of 2040.

The sub-goal about the demand of the 55+ population in 2040, will be established by the following sub-research questions:

- What is the expected prognosis of the size of the 55+ population in 2040?
- What is the demand of the 55+ population?
- What are the factors and trends that influence the 55+ population, which affects the demand for housing of this target group, and to what extent?

1.5. CONCEPTUAL RESEARCH MODEL

The main goal of this research is to get insights into the expected level of match between the future expected supply and the future expected housing demand of the 55+ population in 2040. This main goal will be reached by performing the model. Therefore in the model the following sub-goals need to be realized: the supply of 55+ housing in 2040 and the demand of the 55+ population of 2040. These sub-goals will be achieved by answering multiple sub-research questions. In other words, multiple steps will be followed in the model to achieve the main goal of this research. Figure 1.4 shows the research concept. This conceptual model clarifies how the main goal of this research will be achieved by following all steps (which refers to sub-research question).

Starting with step A in the concept model: the current supply of housing. This step A refers to the first sub-question: 'What is the current supply of 55+ housing?'. Step B zooms-in into the policies and plans that could influence the current housing stock to 2040. This step links to sub-question: 'To what extent influence the plans and policies the supply to 2040?'. Step B will have an impact on the current housing stock (A) and leads together to the expected housing stock in 2040, which is step C in the conceptual research model.

The conceptual research model shows, parallel to the supply side, the demand side of this research. It starts with step D: The current preferences and needs of the 55+ population. It is expected that this current demand for the 55+ population will change over time due to prognosis trends. Therefore, in step E, the prognosis trends of the 55+ population to 2040 are implemented in this research and will be layered over the current demand of the 55+ population. This merging step of D and E leads to the expected demand of the 55+ population in 2040 (F).

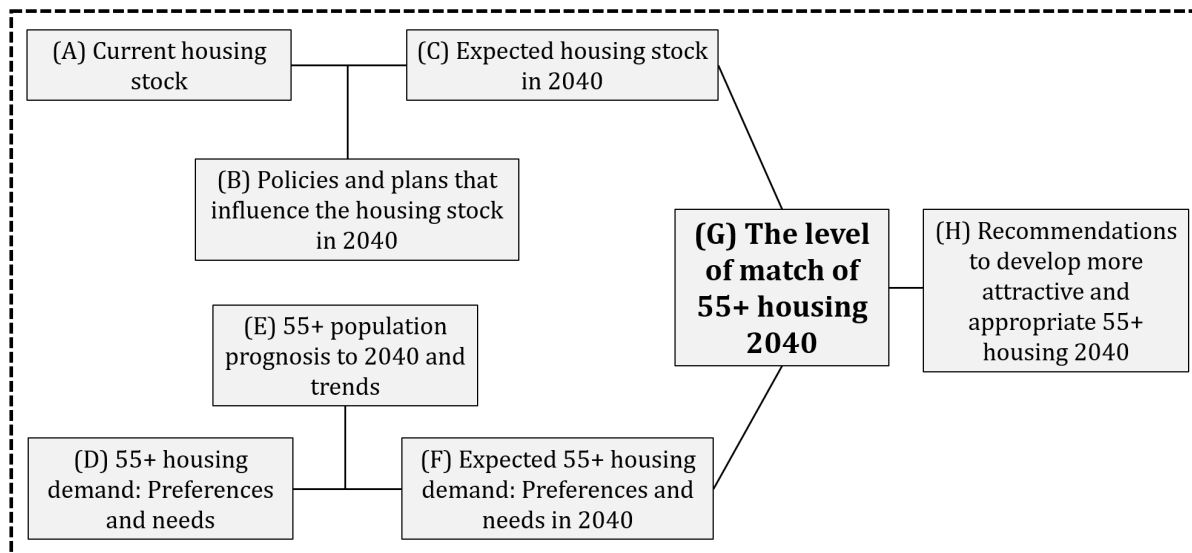


Figure 1.4: The conceptual research model

When step C en step F are clarified, the expected future level of the match in 2040 can be established in step G. The expected future demand of 55+ population and the expected future supply of 55+ housing will be compared to calculate to what extent there is a match between both sides. This step G is the first part to answer the main question: ‘To what extent is there a match between the future expected supply and future expected demand for 55+ housing for the 55+ population in 2040?’. The last step in the conceptual research model is step H. Recommendations will be described to develop a better level of match (which includes more attractive and appropriate 55+ housing to 2040). This step answers the second half of the main question of this research: ‘and (if needed), how can a better match be reached?’.

1.6. RELEVANCE

This section describes the practical and scientific relevance of this research. These explanations show the added value of this research and the utility of the investigation. The research is using a model to indicate the expected level of the match of 55+ housing in 2040, according to the demand and supply in 2040. This forecasting insight is relevant for different perspectives: it has scientific and practical relevance.

1.6.1. SCIENTIFIC RELEVANCE

First, the scientific relevance. International research is conducted about the effects of the aging process. Lauf & Kleinschmit (2016) states that an aging population has implications for the urban space, due to the specific preferences of the elderly, e.g., regarding housing. Rosenberg & Everitt (2001) state that the elderly in the future will have different demands in contrast to younger age cohorts, and that will be reflected in their housing needs, as well as in their recreational landscapes, with seasonal or permanent homes. The next generation elderly will be more dominant in the housing market than in the past.

How to react to the growth of the older population is not unilateral: Rosenberg & Everitt (2001) explain that planners could be divided into two camps: one part believes in the full integration of the elderly population within the community: integrated-based planning. The idea of this full integration is to maximize the life satisfaction of the elderly population over the longest as long as possible. By building specific elderly housing in single-family dwelling area zones, the development of community-based care, and public transport, which is fully accessible for seniors

regardless of level physical disabilities (Rosenberg & Everitt, 2001). The other part of the planners plead for a specially developed environment for the elderly following the particular elderly needs which is called segregated-based planning. The special developed environment means a senior-only community with separate health and social services and transport systems (Rosenberg & Everitt, 2001).

Haldeman and Wister (1994) suggest three approaches to housing the older population. First, there are the institutionalization and purpose-built housing: It concentrates on nursing homes, homes for the aged, residential care homes and personal care homes. This approach is focusing on the elderly population with serious health problems. The second approach is termed housing alternatives and maximization of choice. For this approach, it is assumed that elderly are a heterogeneous population with a variety of challenges which demand a multiplicity of solutions. There isn't one solution to the housing question for elderly. The elderly choose among various types of available housing and move in anticipation of future health needs. The third approach is aging-in-place: Remaining in one's own house, as well as remaining in a different house, but in the same community — a way to alleviating the escalating costs of alternative housing types.

Also, Kramer & Phaffenbach (2015) describes an academic debate about the housing preferences of senior citizens, with two opposing processes: 1) Some assume that the lifestyle and choice of residence of those approaching retirement age will have same behavioral patterns as current senior citizens, in which people leaving the city for the suburbs upon retirement. 2) Assume that senior citizens will move back to the cities, following a transgenerational trend of re-urbanization and urban renaissance.

In conclusion, there is acknowledgment that the aging process and differences between generations lead to other demand. However, there are debates how to implicate and react and which kind of elderly housing approach should be implemented. In this research, more insights will be given by the model, which generates results about the supply and demand on neighborhood scale. The outcomes of that model will not lead to one specific primary solution or approach. It will create scope and ratio of the diverse housing options, that can be used for various approaches. Next to that, the target group is framed from another perspective, which gives new perspective for scientific research. Most research about elderly is focused on the 65+ population, while this research shows the importance of the 55+ population.

1.6.2. PRACTICAL RELEVANCE

This research also has a practical relevance. First, from a political perspective. The government has stated that it is important to get insight into the changing living needs and preferences of the elderly and fitting the housing demand (MWVS, 2018). A precise forecast helps policymakers to implement the possible changing housing demand and the resulting housing challenge for the elderly on time (Rli, 2014). Next to that, municipalities are free to choose a kind of concept for (care-)housing, and therefore, insights in demand are valuable. The realization of new (care-)housing concepts are planned and developed for multiple years, and also should fulfill the preferences and needs of the next generations elderly (MVWS, 2018).

In the second place, this research is also relevant from a market perspective. Public and private sector planners have to deal with demographic changes for housing, health, social services, shopping, and green structures (Rosenberg & Everitt 2001; Lauf & Kleinschmitt, 2016). Foot & Stoffmann (1996) states that understanding how the generations will affect the public and private sector can create economic opportunities for those willing to invest in 55+ housing or recreational services for the elderly.

Insights in the future preferences and needs of the 55+ population benefits the development and design of specific 55+ housing. Before the year 2009, the healthcare buildings were developed according to the Bouwcollege with established requirements. From 2009 the requirements of the Bouwcollege were stopped, and developers received more flexibility in their designs, which results in better-designed buildings following the wishes and requirements for the target group (Stoffelen, 2016). Due to this change, the demand for the 55+ age group became more important. When the similarities and differences between the current generation and the future generation are known, the level of flexibility could be determined. Smelt (2016) confirms that the level of technical flexibility is important to anticipate future changes. The flexibility can be enabled through technical solutions, design flexibility, flexibility during the construction process, or in the use of the building (Van Reedt, et al. 2016).

Specifically for the health care sector in the Netherlands, insights in the level of match is an added value as well. There are privatization and market forces on the health care organizations, which leads to an increase of competition between the healthcare organization with more responsibility for financials, profits, and risks of their real estate investments. It is important for health care organizations to define a strategy about their building typologies and locations for their real estate to minimize loss of the carrying amount (Van Der Zwart, et al. 2009; Stoffelen, 2016). Insights into the preferences and needs of elderly housing and information about the level of match are valuable. Research of Van Der Voort (2016) confirms the importance of these insights by stating that end-user satisfaction is the most important value to create added value on the real estate of healthcare organizations.

Next to the health care organizations, these insights are also valuable for the investors in the elderly housing market. Because of the marketization, more investors start investing in specific (elderly) housing in the Netherlands. In 2016, 750 million euros of investor transactions is done on healthcare real estate (75% on care-housing) in the Netherlands (Hermus & De Baaij, 2016). The amount of investments in healthcare real estate is increasing by more than 50% (comparing 2018 and 2017) to 964 million euros, and the total amount of transactions increased with 45% to 121 transactions (CBRE, 2018). In the Netherlands, investors' funds are established to invest, like the Achmea Dutch Healthcare Property Fund (De Baaij, 2014). The attractiveness to invest in healthcare real estate is also confirmed by international investors: Confinimmo invested in 2017 21 million in healthcare real estate in the Netherlands (Holle, 2017). A significant part (37%) of the investors are international, 50% are Belgium investors.

1.6.3. CONCLUSION

To conclude, insights in the expected level of match, in which the housing demand of the next-generation 55+ population is included, is important from various perspectives. It is relevant from the political perspective, market perspective for public, private sector, and specifically the healthcare sector, and from an investor perspective. Understanding the possible changes in demand is relevant to anticipate the wishes of the target group appropriately and creates better match in various fields. It could also decrease the stagnation of the housing market, which makes this research crucial from a practical perspective.

2. LITERATURE REVIEW

This chapter describes the published literature about 55+ housing. A funnel model is used to give an extensive overview of the topic. It zooms-in from a international perspective, to a national perspective, followed by the perspective from a city-scale and ends with a neighborhood perspective.

From international perspective is explained that, next to the Netherlands, other developed countries are dealing with aging as well. Japan and Germany are the most graying developed countries and it is explained how both countries deal with the process, with different models and systems. From a national perspective is shown that target group in the Netherlands becomes bigger up to 2040. The next generation elderly differs with the current elderly population: the difference in life expectancy between gender is leveling out and ratio of one-person households is increasing. Next to that, it describes the specific demand of the target group and supply of 55+ housing. On a city scale is explained that in this research the focus is on the bigger cities in the Netherlands. The section about the neighborhood scale explains that this research focuses on residential neighborhood with low- and high rise building, because this kind of neighborhood is dealing with socio-economic challenges and therefore, restructuring plans are planned and ongoing. Insights about the level of match could be implemented in these restructuring plans.

The outcomes of the literature reviews form the basis for the model development. The model is about the level of match between the supply and demand for 55+ housing in 2040.



WOONGROEP HET KWARTEEL CULEMBORG: A housing project developed by a group of friends. Based on a preference list of how the group of friends want to live when they are getting older. Retrieved from: kwarteel.com, 2019.

2.1. ELDERLY HOUSING: ON AN INTERNATIONAL SCALE

This section describes 55+ housing from an international perspective. Starting from this perspective contributes to getting more insight into the topic of aging and its housing problems, and how other countries deal with these challenges.

First, an explanation of the target group. The literature is mainly based on people from the age of 65: 'elderly'. There is limited information about the age group between 55 and 65 and their housing preferences and policies. Nevertheless, the international literature about the elderly group (65+) could also give insight into the younger group from the age of 55.

2.1.1. AGING WORLDWIDE

Worldwide a lot of the developed countries have to deal with an aging process, all with different speeds (Ortman, et al. 2014; Van Dam, et al 2013). The change in the proportion of the elderly can be clarified due to the combination of low fertility and longer life expectancy, migration and the baby-boom generation (Rechel et al, 2013; Van der Gaag & Van Nimwegen 2017). Figure 2.1 shows the developed countries which have the strongest aging process: Japan, Germany and Italy have the expected biggest growth of the elderly population. Focusing on Europe, the Netherlands is nowadays out of the top 10 of the most grayed countries and placed on number 13. This could be clarified because the Netherlands has a relatively high birth rate comparing to other European countries. However, in 2040, it is expected that the Netherlands will be in the top 10 (Van Dam, et al 2013). The following paragraphs zooms-in into the most graying developed countries worldwide and describes how they are dealing with the process.

2.1.2. JAPAN

Japan is the country with the largest ratio of people from the age of 65: in 2014, about 26% of the Japanese population was 65 years and older (Van Der List, 2016; Pan & Fukuda, 2016). The population is aging in a high tempo, and it is expected that the amount of elderly will increase to 40% in 2050. This strong aging process leads to a strong increase in demand for housing which is suitable for elderly. This specific housing demand differs in needs on safety, comfort and convenience (Ortman, et al 2014; Pan & Fukuda, 2015). Next to that, urban migration (from rural to urban areas) increases the demand for housing in the bigger cities (Kobayashi, 2016).

Therefore, various policies and initiatives are made and in progress. In 2000, the government introduced policies that made care institutions more affordable, and many of the elderly population moved out of their normal houses. The effect of this policy was long waiting lists: in 2025 a shortage of 300.000 rooms is expected in care institutions, together with a lack of staff to keep all the care institutions working (Van Der List, 2016). Before this policy, elderly lived together with the family and received informal care. This change in elderly housing and its challenges are also confirmed in the research of Pan & Fukuda (2015): Pan & Fukuda state that in Japan, normally older people are living with their families, but last years the number of households with just elderly couples and single older people is increasing.

The Act on Securement of Stable Supply of Elderly persons' Housing 2001 (updated in 2011) reacts on the shift in need when people get older, by stating that: elderly have less physical competence than the working-age population, and housing units have to have several different structures in terms of accessibility and others (Kobayashi, 2016). Therefore, the government changed its housing policies. At the end of World War II, the government of Japan was focusing on the quantitative supply of housing, but nowadays, the quality of housing is an important part of the housing policy, with attention for new construction and renovation of the existing housing stock (Kobayashi, 2016). The government stimulates the process by developing sites for rental apartments and private-sector apartments, specific for the elderly. And the policymakers

stimulate to invest in the renovation of public rental houses, due subsidies for construction costs, accelerated depreciation for income tax and reduction of property tax (Pan & Fukuda, 2015; Kobayashi, 2016). Pan & Fukuda (2015) describe a project as a result of the stimulation of the government: A project with various housing concepts like group homes, short stay, special nursing homes and care houses and with multiple facilities to increase the self-care ability, like bus stops nearby (maximum scope of 200 meter) and a service center. Next to that, the citizens introduced local initiatives to facilitate care for each other: an exchange in physical and mental care to make it possible for the elderly to stay longer home with help for the small disabilities (Van der List, 2016).

To conclude, this analysis of Japan shows that the demand for elderly housing is changing over time. And it shows that it is important to react to these changes to prevent shortages. Also, the wide scope of elderly housing is explained: from care institutions to housing projects with various housing and facilities to local initiatives to let elderly stay home.

2.1.3. GERMANY

After Japan, Germany has the oldest population of the developed countries. In Germany, 21% of the population is older than 65 years in 2012, which are, in total, 17 million people. The expectation is that this will increase to 24 million people in 2035 (Hospers, 2014). In comparison with the Netherlands, Germany has a higher percentage of elderly who are live independent. Bremmers (2015) explains that in Germany, 58% of the elderly population have the chance to live in an intramural institution. A different policy explains this lower percentage: in Germany the financial position of the children of the elderly is taken into account to determine if an older person has to pay for themselves to live in intramural institutions. Therefore, more often families choose for extramural housing with informal care due these differences in costs. Germany has various concepts and models to accommodate the elderly.

A successful and popular model is the *Bielefelder-Model*. The goal of this model is to let elderly stay in their known neighborhood and purchase care. In this model, there are housing-complexes with adapted houses that are lifecycle resistant and with an activity center for 24/7 care possibility. The *Bielefelder-Model* meets the *Stadt der kurzen Wege-principle*: this principle strives to create a mixed-use environment with housing, working and facilities nearby to let people live in their known neighborhood.

In Germany some cities (e.g. Görlitz and Meppen) see the graying population as an opportunity and invest in facilities for elderly: good cultural city center, good infrastructure which is also accessible with disabilities, affordable rental prices, low costs in livelihood, senior proof bungalows in green areas, facilities and services on walking distances. Nevertheless, most of the cities are not elderly proof. Hospers (2014) states that only 5% of the housing stock is lifecycle resistant.

Labit & Dubost (2016) describe the concept of the multigenerational housing concept co-housing. The multigenerational house is based on the principle that all generations live together and help each other with various services and activities. It was started as bottom-up movement but is in 2006 supported by the government with a federal program of 88 million, which created 500 houses between 2006 en 2011. In 2015, there were 1.000 self-organized co-housing projects in Germany. Municipal authorities state that multigenerational co-housing is a way to manage the needs of the aging population and it is an opportunity to improve the available housing stock (less turnover, maintenance of communal areas).

To recap, earlier than in the Netherlands, the Germans have to deal with a big extramural housing challenge. There is a success if the elderly could stay in their known neighborhood and receive

care and therefore housing needs to be lifecycle resistant. Another success is multigenerational co-housing, which should be considered to deal with the extramuralisation in the Netherlands.

2.1.4. CONCLUSION

Worldwide more countries next to the Netherlands have to deal with the growth of the elderly population. Japan shows that it is important to have diversity in the elderly housing stock to prevent shortages and that it is important to react to the demand of this population. Germany shows how a country could deal with extramuralisation. Germany shows that it is successful to let elderly live in their known neighborhood in lifecycle resistant housing, and success is found for multigenerational housing concept of co-housing. For this research, these insights make clear that it is important to take into account various housing concepts for the elderly to deal with the increasing demand of the elderly population and extramuralisation.

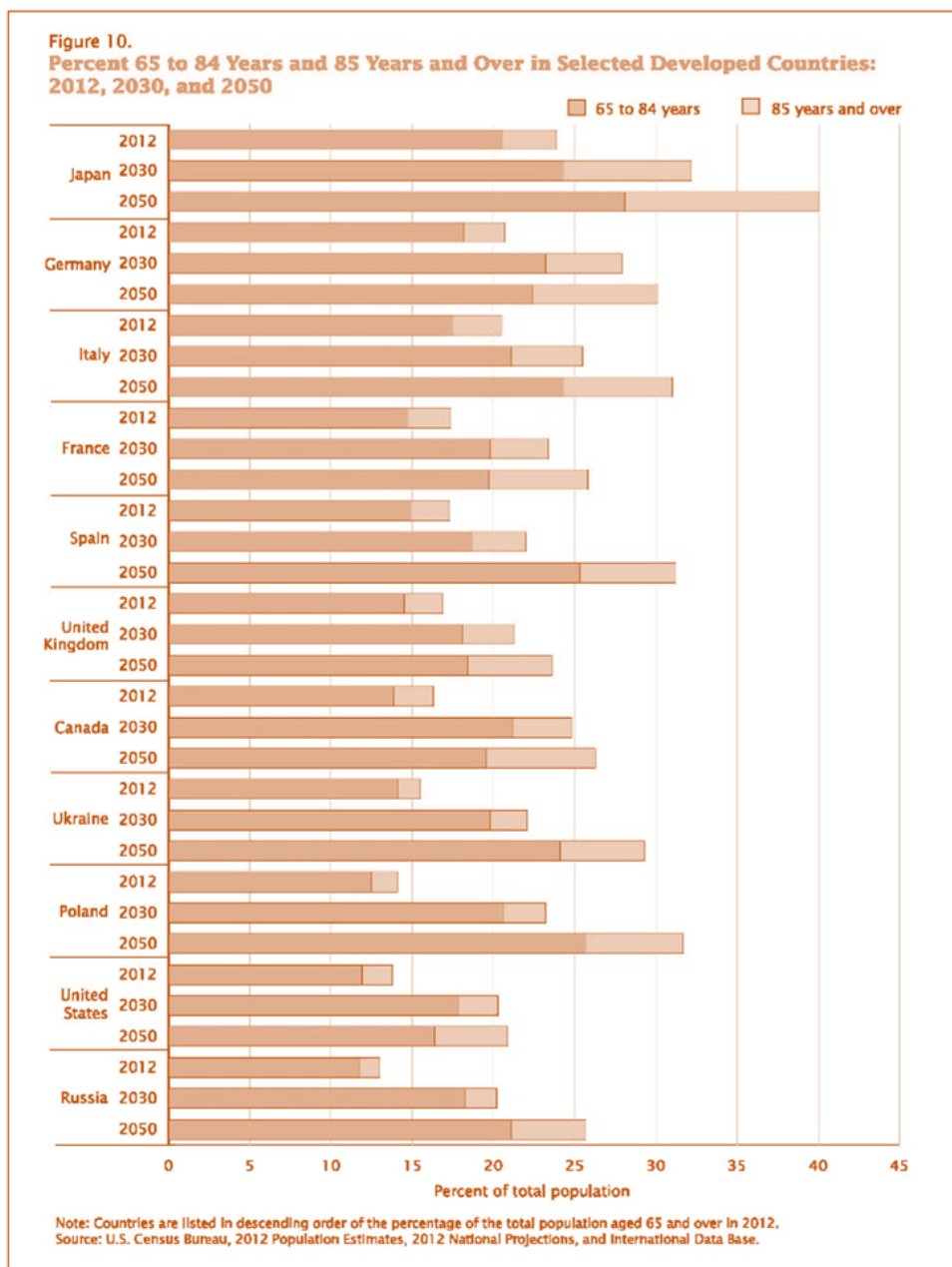


Figure 2.1: Prognosis of elderly population (from age of 65) comparing the developed countries. (Ortman, et al., 2014).

2.2. ELDERLY HOUSING: ON A NATIONAL SCALE

The previous section gave insights into the supply and demand of housing for the elderly from an international perspective. This section zooms-in on a national scale and focuses on the Netherlands. There is chosen for a focus on the Netherlands because of the problem definition and goal to react to the stagnation in the Dutch housing market, and because more data is available and possible to collect in the Netherlands for this research.

This section is about the Dutch situation concerning 55+ housing. It starts with a description of the target group: people from the age of 55 and older. Second, an overview is given of the demand for this target group. Third, the supply according to 55+ housing in the Netherlands is explained.

2.2.1. THE TARGET GROUP

In chapter 1 (Problem definition) is described the impact of the target group on the stagnation in the current housing market in the Netherlands. This impact depends on the size of this target group and the ratio of this group that participates in the housing market (instead of living intramural). Besides that, the development of the target group up to 2040 according to characteristics like household composition and gender, has an impact on the housing market. Therefore, first the size of the target group will be analyzed, and second will be described the trends that could influence the characteristics of this target group to 2040.

THE SIZE OF THE TARGET GROUP

In this research, the target group is about people from the 55+ population. Literature mainly divided the population at the age of 65 and called them the elderly. Therefore, a division is made between 55 to 65 and from the age of 65 (elderly). First, about the people from the age of 65.

In the Netherlands, there is a double aging process: there is an increase of the elderly population due to the baby boom generation, but next to that, the population is also aging because people become older than in the past (Kornegoor et al. 2016). It is expected that the peak of the growing elderly population group is in 2040: with 4.7 million people of 65 and older, which is 26% of the population in the Netherlands (Van Der Heijden & Van Hove. 2016; Rli, 2014). In comparison, in 2014 the group of elderly (from the age of 65) was around 2.6 million elderly (16,5%): which results in a rise of approximately 10% in the Dutch population to 2040 (Rli, 2014). After this peak in 2040, the percentage of elderly stabilize with circa 4.4 million elderly to 2055 (Castelijns, et al. 2013). The amount of elderly with the age of 80 and higher will increase significantly: in 2040 10% of the population will be older than 80, with an expected peak at 2050 (Van Der Heijden & Van Hove, 2016; Castelijns, et al. 2013). The ratio of elderly from the age of 85 will change relatively with the age of 45-64: 1:13 in 2018 to 1:5 in 2040 (MVWS, 2018).

In contrast with the elderly from the age of 65, will decrease the population from 55 to 65 years old up to 2040. CBS (2019) shows that this group will decrease by circa 350.000 people, but it is still an important group with 2 million people (CBS, 2019).

In total, the target group (55+ population in the Netherlands) will increase strongly: with a rise of more than 1 million people up to 2040, compared to 2019 (See figure 2.2) (CBS, 2019). In 2040, the prediction is that the Dutch population consists of 18.5 million people in 2040, of which 37% will be 55 years and older. So, in conclusion, it is expected that the target group of this research could have a high and increasing impact on the flow of the housing market due to the size of the target group compared to the total population.

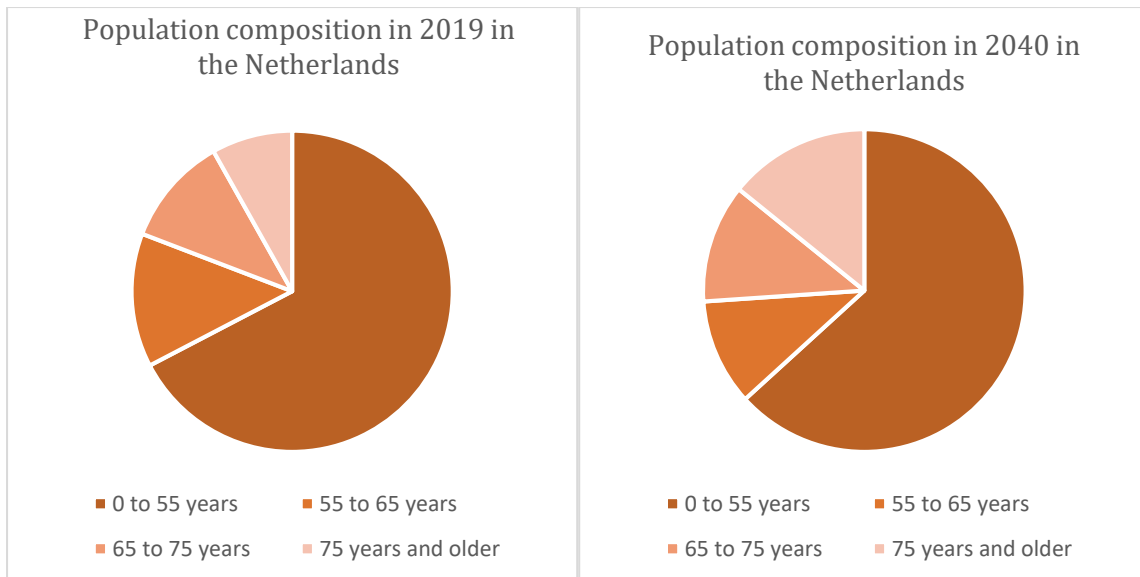


Figure 2.2: The change in the population in the Netherlands: Double aging (CBS Statline, 2019)

EXTRAMURALISATION

The previous paragraph stated that the target group is increasing to 2040, which enlarges the possible impact on the housing market. Besides that, it is important to know which percentage of this group participate in the housing market. In the Netherlands it was common that if people needed daily care, they moved to a care institution to live intramural with all daycare. When these people move to intramural care institutes, they do not participate anymore in the housing market because the freedom the move or stay is limited to the care institution housing stock. Therefore, the living intramural population is excluded from this research. This paragraph explains the intramural policies and so the percentage of people that participate in the housing market.

In the Netherlands, there is an ongoing process which is called extramuralisation. Extramuralisation is the process that people with a dependency of care or with an intellectual or physical disability no longer live in traditional institutions (intramural) but more often independent at home with the possibility to receive care at home (Nieuwenhuis, 2010). Due to this extramuralisation policy, people live longer independent in normal housing and therefore more people will participate in the housing market. Since 2002, the number of people who are living intramural is decreasing with 4% and this process is continuing (MBZK, 2015). And the policy will lead to 30% less clients for intramural care-housing and to an increase in the demand for extramural care-housing (Meijdam & Nijhof, 2014). The percentage of elderly from the age of 80 who live intramural, is decreased from 20% in 2000 to 14% in 2010 (Gerssen, 2011).

So, to conclude, it is expected that the target group of this research will increase due to the increasing percentage of people that participate in the housing market, which could lead to more impact of the target group of this research on the housing market. Also, when disabilities or need for care occur, people are stimulated to live independent: extramural (care-)housing.

In section 2.2.3, all the possible option for housing with care (intramural and extramural) are explained.

TRENDS ACCORDING TO THE TARGET GROUP

In previous section is described how the size of the target group increase up to 2040. In this section is pointed out how the target group is going to change per characteristic, over time up to 2040. These differences between the generations of the nowadays target group and the future

target group need to be taken into account to get a comprehensive insight in the future expected demand for 55+ housing.

Various research clarified that next-generation elderly will differ on several characteristics with the elderly generation nowadays (Rosenberg & Everitt, 2011; Van Dam, et al. 2013; MBZK, 2015; SCP, 2004; Rli, 2014; Kramer & Phaffenbach, 2015). This paragraph explains the following characteristics: Socio-economic status, health and lifestyle, personal characteristics like gender and household composition, and diversification.

SOCIOECONOMIC STATUS

One important trend is the expected changes in the socioeconomic status of the target group to 2040. Socioeconomic status is the social standing of an individual or group, measured as a combination of education, income and occupation (APA, nb). In this paragraph is described the expected changes according to education, income and occupation (house-ownership).

First, the level of education. It is expected that on average, next-generation elderly, included the baby-boom generation, are higher educated than previous generations (MBZK, 2015; SCP, 2004; Van Dam, et al. 2013; Labit & Dubost 2016). Van Dam, et al (2013) describes that of the elderly generation before the baby-boom, 1/3 of the men above the age of 75 had only primary school diplomas and 1/2 of the women. For both genders will increase the level of education on average, but especially women will be higher educated on average. To clarify, 50% of the women of the previous generation elderly was only primary school educated but nowadays only 13% of the women between 55 and 65 is only primary school educated and more than 25% is high educated (HBO or WO) (Van Dam, et al 2013). It is expected that in 2025, the difference between men and woman will be minimal, and the shift in percentage will continue. This change in the level of education influences spatial planning behavior. It is known that higher educated people are longer vital and healthy and (therefore) are living longer independent (Van Dam, et al. 2013).

Second, about the on average income and capital of the target group. When people retire, the income decrease, but is expected that on average the capital of the elderly population increase to 2040 (Soed, 2012). On average, the next generations elderly population will have higher income and capital. Van Dam et al. (2013) described multiple arguments for this trend. First, more people have expended on their retirements savings during their working period. Second, more women have participated in the labor market, which also strengthens the retirement savings. Third, next-generation elderly will have participated longer on the labor market due to the shift of the retirement age threshold in the Netherlands, and more people have worked as self-employed (ZZP) during their working years and will keep working after the retirement age. And last, it is expected that the percentage of elderly who are owning a house will rise. In 1981 30% of the people with the age of 65 and older had an own occupied house, in 2009 it increased 45%. And from 2009 to 2015, the percentage of people (from the age of 55) that are owning a house increased with 4%, and it is expected this percentage will continue (MBZK, 2015; SCP, 2004; TK, 2010). TK (2010) confirms that the ratio house ownership of elderly will rise because more starters and middle-aged people are owning a house than in the past: a trend of less popularity for rental houses is visible, compared to the popularity of the previous century (TK, 2010). This trend is invigorated due to the policy of the government to stimulate house ownership (TK, 2010). Owner-occupied housing increases the income, because more people are free from mortgage or rent, which results in lower generally (net) monthly costs (MBZK, 2015). In 2012 1/3 of the elderly (age between 65-74) was free from mortgage, which is doubled from 1986, and it is expected this trend will continue (De Groot, et al. 2013).

The forecasted change in capital has an impact on the housing market and changes the demand of the next generation elderly. TK (2010) and Van Dam et. Al (2013) state that house owners are

more static; they have a lower willingness to move, which leads to more stagnation in the housing market. Next to that the demand changes if the next generation elderly has more capital: more elderly wants to stay in owner-occupied housing if they move (MBZK, 2015). This effect is nowadays already visible (and will increase): 60% of the elderly moves from an own-occupier single-family house, want to own a house again after moving (Prins & De Vries, 2018). And because of the increase in capital, next-generation elders have more the requirement to live in on average bigger and more luxury houses (Vegter & Leber, 2006). Next to that, the demand according to care-housing differs. It is known that elderly with higher income use less informal care because of the more financial possibility to buy help and care in-house (De Kam, et al. 2012).

HEALTH AND LIFESTYLE

Previous paragraph described that the next generation elderly, on average, has higher socioeconomic status. More people will have a middle or high socioeconomic status and number of people with low socioeconomic status will stabilize to 2030 (Chorus, et al. 2014). And Chorus, et al. 2014 state there is a strong connection between socioeconomic status and health. This paragraph is about health and lifestyle of the next generation elderly.

There is shown that the new generation elderly, on average, will be more healthy and vital pensioners with a healthier lifestyle, during working life and retirement life than the previous generations elderly people, due to for example less heavy working conditions (Van Der Gaag & De Beer, 2017; Labit & Dubost, 2016; Van Dam et al, 2013; SCP, 2004). Van Dam et al. (2013) state that life expectancy is increasing and that the number of elderly (with the age of 65) which is free from disabilities/limitation will increase. Women live in 2009, 12 years from the age of 65 without limitations on average. To compare: in 1983 it was eight years. The limit-free years (from 65) for men increased from 10 to 13 years on average (Van Dam, et al. 2013).

But because of the double aging process, the total amount of elderly that have health problems will increase: Chorus et al. (2014) state that the number of men with a health problem that influence the daily activities will increase with factor 1,9 and the number of women with those problems will increase with the factor 1,5. The total amount of elderly with those problems will increase with 60% to 2030, compared with 2012 (Chorus, et al. 2014). The biggest part is mobility problems, followed by self-reliance problems: the biggest group is expected are elderly with low to moderate dementia problems and whether with physical limitations (Chorus, et al, 2014).

The increase in vitality and activity of the next generation elderly people affects the informal care and volunteer work activities (Van Dam, et al. 2013). Because the elderly people are more vital and active, more experience could take place with informal care, local initiatives and volunteer work. Van Dam et al. (2013) states that this experience could lead to better organization of informal care in the future. But in contrast, individualism (also in family structures) makes informal care possible more complex (Van Dam et al. 2013). The divergence also affects the demand for intramural care (Van Dam, et al. 2013). It is expected that next-generation elderly people are more independent due to the increase in vitality and health.

Van Dam et al. (2013) state that these expected differences also change the behavior of people in travel behavior, leisure activities and consumption. This trend is called active aging. This effect is strengthening by the bigger income and capital on average of elderly, which leads to more budget to go out. The next-generation elderly is grown up with a more independent lifestyle: a lifecycle with economic and technologic prosperity, which makes more normal to commute, travel and participate in (outdoor) activities (Van Dam, et al. 2013). Dool & Hoekman (2017) links this active aging with the on average increase in the level of education: in the research is stated that highly educated people have been more in touch with sport during life and therefore it is expected that in the future more elderly will participate in sports activities. Rosenberg & Everitt (2001) confirm

the correlation between education level and income and the different demand for leisure and recreational activities. The ratio of elderly participating in traffic is increasing, the elderly are more mobile and drive longer distances compared to previous elderly-generations (Van Dam, et al. 2013; SCP, 2004). This divergence between the previous elderly people and next-generation elderly people is correlated to the ongoing change in car ownership and the increase of car license of the elderly. Van Dam et al. (2013) state that the percentage of car ownership is increasing. In 1985, 24% had a car, in 2013 it is 48%. In the group of 45-65, more than 90% have a car. In line with this rising percentage, the assumption is made of more car ownership of the elderly in the future. Also, more elders will have a driving license, compared to previous generations (Van Dam, et al. 2013). In 1985 30% of the elderly had a driving license. In 2010 66% of the elderly is having a driving license. Especially the ratio of women with a driving license is changing from 1985 to 2010 it increased from 13% to 48%. Van Dam, et al (2013) state that innovation and rise in fuel prices will not change this increase of car use, due to the willingness of independence and self-reliance of the elderly. The change in mobility patterns also influences the more direct living environment around the housing of elderly people (Van Dam, et al. 2013). Elderly spend more (leisure) time on relatively short distances from their homes than other age-groups. Therefore, facilities nearby home become more important and availability of (care) facilities contribute to the independency level of elderly (Van Dam, et al. 2013).

PERSONAL CHARACTERISTICS: GENDER AND HOUSEHOLD COMPOSITION

Two other trends of which is expected it will influence the target group to 2040 are change in gender composition and change in household composition. In this paragraph both composition trends are explained. Starting with gender composition.

Nowadays, men have a shorter life expectancy than women. CBS (2017) shows that a man of 65 years old in 2017 has the life expectancy of 84 years and a woman of 65 years old in 2017 has the life expectancy of 86 years. But the difference between gender will decrease in the next-generation elderly (Janssen, 2017; Van Dam, et al. 2013). The life expectancy of men will increase stronger than woman, which leads to a smaller difference between gender (Janssen, 2017; Van Dam, et al. 2013). Janssen (2017) clarify this trend by stating that in 1982, the difference between gender was 6,7 years and in 2015 the difference was already decreased to 3,4 years in the Netherlands. Figure 2.3. shows the increase in life expectancy per gender.

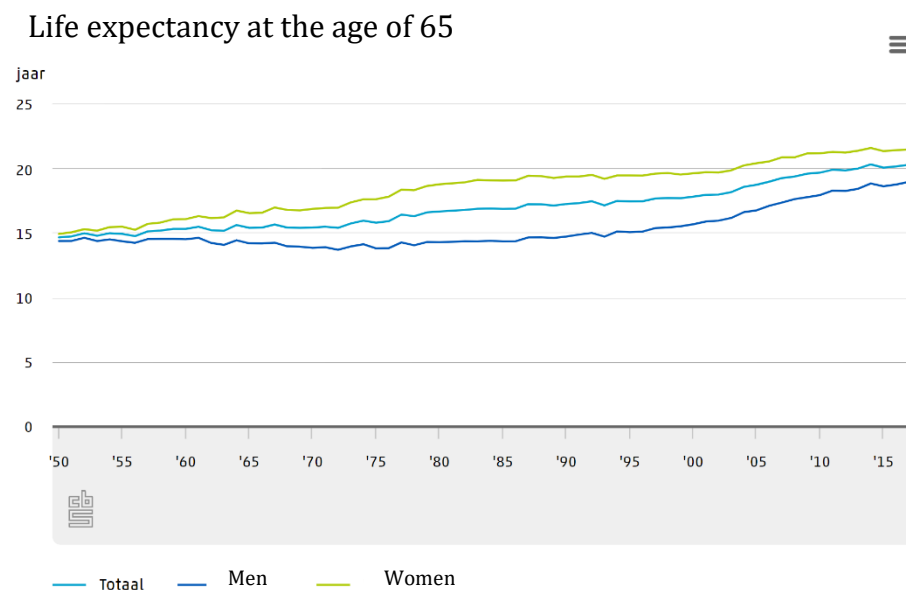


Figure 2.3: timeline of life expectancy of men (dark blue) and woman (green) in the Netherlands. From 1950 to 2017. (CBS, 2017).

Second, the personal characteristic about household composition. In the Netherlands, the old standard life-cycle (move out from parents home and got married, getting children and keep married till death) is changing: since 1960 there is a decrease in weddings and re-weddings, more divorces and increase in difference life-compositions (Van Dam et al. 2013). There is an ongoing trend of individualism: more elderly people are and will be a one-person household in the future (Rli, 2014; De Jong & Van Duin 2010; Van Dam, et al. 2013; Lauf & Kleinschmit, 2016). In 2014 900.000 elderly people were living alone and in 2030, 1,400.000 elderly people will live alone in the Netherlands (Rli, 2014). Van Dam, et al (2013) confirms the trend: in 2013, 31% of the people from the age of 65 were alone, in 2040, 36% will be alone. The increase in life expectancy of men lead to a change of elderly-men that are living alone: in 1990, 104.000 men were a one-person household; in 2006, this was increased to 196.000. But still more women will be alone, due to the culture that woman has a relationship with older men: on average women are 2 to 3 years younger than the men partner (Van Dam, et al. 2013). To put the trend of individualism into perspective, most of the people that are retiring are together with a partner (Lauf & Kleinschmit, 2016; Van Dam, et al. 2013). And there will also be more two-person household in the future, due to the increase in life expectancy of men (MVRM, 2009). Next to that, in the future, more elderly will be childless: in 2013 11% of the elderly was childless, in 2040 18% will be childless (Van Dam et al. 2013). Van Duin (2009) confirms this increasing trend and states that in 2050, 20% of the elderly women are childless.

DIVERSIFICATION

In the above paragraphs are described the expected trends that could influence the target group to 2040. These trends explain the trends of the older population on average. It is important to note that there are differences in this age group. Therefore, this paragraph describes the increasing diversification of the elderly population.

The described trends do not apply the same for all the older people of next generation. To start, Van der Gaag & De Beer (2017) states that the gap become bigger when people are getting older because differences are pulling up during life: the difference between rich and poor, low and high educated, between (healthy) lifestyles and working participation.

Next to that, there is a expected difference between the current elderly generation and the future elderly population: there will be a bigger bandwidth in health, life expectancy, mobility and a bigger divergence in welfare. For clarification: there is a big differences between a couple with additional retirements savings and a repaid mortgage of a house (which is increasing in value) compared to a low educated elder which is started working on later age (e.g. immigrants) with a limited retirement saving and a rental house (Van Dam, et al. 2013). Van Dam, et al. 2013 clarify that in the future this dichotomy will become three-part: elderly with an own occupied house but with residual mortgage debt. To clarify in 1986, 70% of the elderly with an own occupied house was free from residual mortgage debt, in 2012 only 34% was free, due to the interest-only mortgage.

The diversification will also be strengthened by the increase of immigrants in the Netherlands. De Jong en Van Duin (2010) explain that since 1970, the growth of the overall population is rising for a big part because of immigration. Therefore, in the aging process, the immigrant group will be a bigger part (Leyerzapf et al. 2017). The bigger amount of immigrant elderly will lead to a more diverse group in the future (Van Iersel, 2016). The elderly with a Turkish and Moroccan background will increase the most from 10% in 2017 to around 20% in 2027 (Leyerzapf, et al. 2017).

CONCLUSION ACCORDING TO TRENDS

Literature overviews show that the elderly generation nowadays will differ with the elderly generation of the future. On average, the target group will have a higher socioeconomic status (according to level of education, income and capital), be more healthy, vital and mobile, the difference in life expectancy between men and woman will be level out, and the ratio of one-person households will increase to 2040. However, it is important to note that the target group becomes more diverse: the summed up trends do not apply for every 65+ person to the same amount.

CONCLUSION: THE TARGET GROUP

This research focuses on the 55+ population in the Netherlands. The size of this age-group is increasing strongly due to double aging process to 2040. Double aging is about the fact that the group is bigger due to baby boom, and because people become older than in the past. Next to that, more people of the target group participate in the housing market and longer because of the extramuralisation policy of the government. The government strives to stimulate people with disabilities/need for care to live longer independent. The target group will differ over time: in general, in 2040 more people will have a higher socioeconomic status, people of the target group are more healthy, vital and mobile, the difference in life expectancy between men and woman will be level out and the ratio of one-person households will be increased, compared to 2019. However, it is important to note that the summed up trends do not apply for every 65+ person to the same amount.

Not all the outcomes of this paragraph can be used for this research. There are limitations due to available data (see chapter 4: data). Therefore, the following conclusions will be taken into account: the prognoses about the size of the population of the target group, focus on extramural care housing by the government, and the trends about personal characteristics: gender and household composition.

2.2.2. THE 55+ TARGET GROUP DEMAND

This research has the goal of getting insights into the level of match in housing for the 55+ population in 2040. Therefore the supply and the demand will be compared. This section describes an introduction about the demand side of the target group, to get more knowledge to substantiate the demand. The following topics appear in the literature: housing preferences, housing concepts, need for care and self-reliance and the living environment. Starting with housing.

HOUSING

The first variable according to housing, which is named in literature as an essential factor of the demand, is the suitability to have easy (walkable) access into a house. From the age of 65, 32% of the elderly have trouble with walking stairs, 25% with normal walking and 11% with walking inside and outside their house (Aedes, nb; MVWS, 2016). Due to the double aging process, the group of people that experience mobility limitations for the first time will increase: 35.000 in 2015 to 65.000 in 2040 (MVWS, 2016). Therefore, many elderly have the preference for (ground-floor) apartments without stairs (Prins & De Vries, 2018; MBZK, 2015). Striking is the fact that the biggest part of the Dutch housing stock is terraced houses with stairs (65%), and 95% of these stock could be adjusted with a stairlift (MVWS, 2016).

In the Netherlands, the diversity of demand for elderly housing increases due to the enlargement in transparency in care- and housing costs. There are more insights and more freedom of choices (Ratio price and quality) for care and housing. And because of the more heterogeneity in the elderly population on social and cultural factors, preferences will more diverse (Rli, 2014; Van Iersel, 2016). Therefore more diversity in housing concepts is needed and expected following

various variables: higher and lower segments, clustered- or individual housing, big or small rooms, level of influence of residents for help and care and living in a rural or urban environment (Rli, 2014; SCP 2004).

To recap, suitability to easy access a house is described in the literature as important variables for demand, according to housing. In addition, it is important to note that the demand for the elderly becomes more diverse in the future. In this research the suitability to easily access a house when mobility limitation occurs will be implemented. The number of houses that are suitable to continue living will be added to the supply side. The importance of diversity in housing concepts is taken into account for this research: various housing concepts will be added to determine the demand of the 55+ population.

NEED FOR CARE

Another important factor on the demand side for the elderly, is the level of care. Bakker et al. (2018) state that from the age of 65, there is a significant increase in the use of and demand for care. In the Netherlands, 80% of the elderly (from the age of 65) are using care symmetrical.

Level of need for care and services is depending on the self-reliance of the elderly (MVWS, 2016). This self-reliance is reliant on the housing and on the living environment. Facilities in the neighborhood could have a positive effect on self-reliance (MVWS, 2016). The demand for self-reliance housing isn't similar in all neighborhoods in the Netherlands: the attractiveness, facilities, housing typology, urban typology and economy are all effects of the self-reliance (MVWS, 2016).

So for this research, it is important to keep in mind the needed level of care. This will be implemented following the argument that the needed level of care is dependent on the self-reliance and the available facilities in the living environment. Therefore, the facilities are implemented as factor in this research.

LIVING ENVIRONMENT

Next to the housing variables, also the living environment is important to determine the demand of the 55+ population. In general is known that the important factors in the living environment for elderly people are the proximity and accessibility of facilities, proximity of a diverse social network, traffic safety, social safety, social well-being, in an open neighborhood and level of pleasure (De Kam, et al. 2012; Bijvank, 2016; Rli, 2014; SCP, 2004). With facilities is meant shops, public transport, activities, care and cure services (Rli, 2014; SCP, 2004).

For this research, only the factors will be implemented of which data is published on the scale of the research areas. Therefore, the factor of proximity to facilities will be taken into account.

LOCATION: AGING IN PLACE

To forecast the future demand of elderly housing, the location where people will live when they get elder, is important. In the paragraph, the theory of aging in place is introduced, which explain that people stay in the same neighborhood when they get older.

Vanleerbreghe et al. (2017) explains that aging in place refer to individuals growing old in their own homes, remaining in the current community and living in the residence of one's choice. Abramsson & Andersson (2012) states that in general, the elderly want to stay as long as possible in their current home and environment. It is the importance of the social network that makes most of the elderly people who moves, move inside their municipality or even in their well-known neighborhood (De Groot, et al. 2013; Rli, 2014; De Groot, et al. 2012; Van Dam et al. 2013). The aging in place leads to benefit for the quality of life due to the preservation of the autonomy and

the social connections (Vanleerbreghe, et al. 2017). De Groot, et al. 2012 clarify that how longer someone lives in a living environment or houses, how stronger is the principle of aging in place.

This preference of older people to live in their own familiar environment as long as possible is advanced in western countries (Vanleerbreghe, et al. 2017). Kramer & Pfaffenbach (2015) have done research in Germany about housing preferences of retiree citizens and found out that aging in place is a strong trend, because the citizens could identify with the current place of residence and the surrounding neighborhood. The willingness to stay is also linked to home ownership, financial aspects and existing social network (Kramer & Pfaffenbach, 2015). Vanleerberghe et al. (2017) state that older people preferences aging in place because it is often considered less expensive than residential care and is often seen as a cost-effective solution.

There are also negative effects of aging in place, there is a delayed access to necessary services and accommodations which create more need of informal caregivers. Next to that, for elderly people with a decreased functional capacity, managing home and the home environment could be too much. And as last, the change on social loneliness because of the dependency on social network and other external factors.

To conclude; Because of the theory of aging in place in this research the assumption is made that people who are living in a specific neighborhood nowadays, also have the preference to live there in the future (2040). And therefore, this assumption will be used in this research.

CONCLUSION

This section described factors that influence the demand of the target group. For housing is stated that the suitability to easily access a house is important, and is, therefore, implemented in this research in the form of establishing the number of easily accessible houses the housing stock. Next, it is explained that the self-reliance of the target group depends on the facilities in the living environment. Therefore, the proximity of facilities in the living environment are included in this research. As last, the assumption is made that people continue living in the same neighborhood. This assumption is based on the theory of aging in place and makes it possible to analyze the demand of the current population in a neighborhood and translate these results for a forecast about the population in 2040.

2.2.3. SUPPLY FOCUSED ON THE TARGET GROUP

Previous section pointed out factors for the demand side of this research. This section describes factors that has effects on the supply. It is about the current situation of the housing market, the ongoing developments, and an overview with the different options for housing for the 55+ population.

CURRENT HOUSING MARKET

Van Dam et al. (2013) state that the elderly will move if more appropriate housing will available. But there is an increasing qualitative shortage of appropriate and attractive elderly housing (Van Dam et al. 2013; CBRE, 2018; Rli, 2014; Meijdam & Nijhof, 2014). Prins & De Vries (2018) confirms that the low percentage of movements in the group of elderly is linked to the lack of attractive and suitable housing for elderly (Prins & De Vries, 2018). The potential and available houses do not fulfill the most important demand, needs and preferences: the accessibility to social network and the suitability and adjustability of a house to receive care, without a significant rise in costs (Meijdam & Nijhof, 2014).

De Groot et al. (2013) state that the amount of elderly that will live in not suitable houses will increase to more than 400.000 independent houses (for elderly from the age of 75) in 2040 if no developments and actions take place. There are shortages on different levels in the housing

market, both for rental housing and own occupied housing (Rli, 2014). For example, nowadays, there is already a shortage of 32.000 private-sector care-apartments in the Netherlands, which increase to a shortage of 52.000 in 2040 without significant changes (CBRE, 2018). And a shortage of 80.000-lifetime houses in the Netherlands, to fulfill the demand in private-, social, and owner-sector (CBRE, 2018). And there is a strong increasing demand for apartments (private rent an own-occupied housing) and land-bases elderly housing (Van Iersel, 2016).

More zoomed in; the shortages are visible in all different kind of care housing (Rli, 2014; SCP, 2004; Meijdam & Nijhof, 2014). *Raad voor de leefomgeving en infrastructuur* (2014) states a shortage of 46.000 for extramural elderly housing living with services in the Netherlands, in 2014. The Ministerie (MWVS, 2018) confirms by founding out there is a significant demand for housing concepts where elderly live together nearby facilities. This kind of extramural elderly housing is relatively expensive, depending on the number of services and facilities and therefore, the demand is especially strong for low and middle-class income households (SCP, 2004). Second, for extramural elderly care-housing, there is an increasing demand, that is a lot bigger than the available housing stock. The demand for more (divers) care-housing concepts is rising strongly (Rli, 2014; MVWS, 2018). As third, there is also a growing shortage of housing special developed for elderly and adjustable housing (SCP, 2004). The last one is frequent for the elderly with a high level of education (SCP, 2004).

CURRENT DEVELOPMENTS IN THE HOUSING MARKET

The wide shortages, the increasing demand for diversity, the pursuit of creating a better flow on the housing market and the overall increase of the elderly population (and diversification of is a group) asks for development and plans for the elderly (care-) housing market (CBRE, 2018; Rli, 2014). Nowadays, various new housing concepts for elderly are planned and realized (Rli, 2014). The expansion in diversity in housing concepts is an ongoing process: housing corporations and commercial investors are developing, for example, kangaroo-housing and informal-care housing. The elderly are also participating independent by starting foundations for the development of small-scale housing for living-alone elderly (Rli, 2014). The stronger social position of elderly and the fewer financials and organization of the state makes that the CPO increase: the collective private ownership developments will be used to develop, e.g. independent homes complexes (with specific care facilities) or group accommodations (Dekker, 2016). More on an urban planning level, concepts op residential-service areas is taking place: different due to the diversity in arrangements, urban level, housing stock and moment of realization (De Kam, et al. 2012). Next to these, there is increasing development and offer for the concept of clustered care-housing (MWVS 2018). And in line with the clustered care-housing, the development of small scale healthcare buildings is more than doubled in the last five years (CBRE, 2018).

The government is informed with the ongoing stagnation in the housing market and have various visions and plans to improve the current situation. The government wants to strive for improvements together with the market actors, housing corporations, healthcare organizations, and citizens to realize a sufficient housing stock for the elderly. The government has planned to invest around 340 million in extramural elderly housing (CBRE, 2018). Investments to achieve multiple goals like: reducing the level of loneliness of elderly, creating good care and service at home (to make extramural housing more attractive and appropriate), stimulating new initiative of (clustered) elderly (care-)housing concepts or housing concepts where the level of care and cure could be customized (for the specific needed care), stimulating redesign of neighborhoods and buildings, stimulating the user (elderly) to move to smaller houses and making elderly more aware for the needed time to find an appropriate new house (MVWS, 2018; De Groot et al. 2013). And besides that, The *Raad voor de leefomgeving and infrastructure* (2014) advices and confirms

the government to renovate care-real estate, making more suitable housing, innovate in better possibilities of extramuralisation and development of new (care)housing concepts.

OVERVIEW OF HOUSING TYPOLOGIES

In this research, insight will be given in the level of match according to housing and its living environment for the 55+ population. In this paragraph the different housing typologies are summed up that will be used for this research. In addition there is an overview of housing of people when disabilities and limitations occur and care is needed.

De Grote Omgevingstest (2018) summed up seven typologies for housing as follows:

- Apartment or flat with elevator: A independent house with a routing via a lift, in a building with more floor levels.
- Apartment or flat without elevator: A independent house with a routing via stairs, in a building with more floor levels. Including a porch house, maisonette, basement and upstairs-apartment.
- Single Family dwelling (terraced housing): A house occupied by not more than one family or household or that is designed for one family or household. And it is constructed in a block as terraced houses.
- Single family dwelling (corner house): The ending houses of the terraced housing blocks.
- Semi-detached housing: A house that is joined to another similar house on only one side.
- Detached housing: A house that is not connected to any other building
- Others

In this case, others stands for various housing typologies that are less common, like houseboat, trailer, student housing, ground-floor, and senior- and care housing. Because this research focuses on 55+ population, ground-floor, senior housing and care housing will be named separate and are added to the list of housing typologies for this research.

First a description about senior housing. Senior housing is housing that is specially designed for older people, or is normal housing that is adjustable according to the needs of seniors but without directly care services (SCP, 2004). Rijksoverheid (2010) and MVWS (2016) describes that adjusted housing is customized for the discomfort and (mobility) limitations, to make it possible to live (longer) independent. It could be on a profound level like an entrance without height differences, placing stairlifts, wheelchair friendly kitchen, and where primary rooms (bedroom, kitchen, bathroom and living room) are accessible without stairs. But also less profound adjustments possible like remove of doorsills, replace of door handles and installation of an alarm system (Rijksoverheid, 2010; MVWS, 2016).

- Senior housing: Housing that is designed or adjusted for possible physical discomfort. In this research a combination of life cycle housing, suitable for disabled persons, special 55+ housing, sheltered housing.

It is described that senior housing is adjustable housing for when disabilities or (mobility) limitations occur. Ground-floor apartments are standard more suitable for disable persons due to the fact that there are no different levels. In this research this option is a separate housing typology:

- Ground floor apartment: A apartment on the ground floor in a building with more floor levels.

Because care housing has various options, in this research, this option will be researched as a separate variable. Following paragraph describes the different options of care housing in the Netherlands.

OVERVIEW OF CARE HOUSING OPTIONS

Different kinds of care housing options are possible when disabilities or limitations occur and people need care. In the Netherlands, the healthcare real estate is divided into cure and care sectors (Van der Gijp, 2014).

Care has the goal to minimize the disadvantages of diseases, disorders and limitations (Jukito, 2012). And this help could take place intramural and extramural. This division is determined on the needed level of care: the dependency of care indicates if someone could be selected for intramural care, which is also known as a nursing home. People with a lower need for care are eligible for extramural care.

The first option of extramural care housing is senior housing/adjustable housing, which is explained in the previous paragraph. This could be normal housing that is adjusted to make it possible to continue living when disabilities occur. Or special designed housing for older people.

Next option could be living with services: housing with accessibility to (extra) facilities and (care) services, like meal-services, cleaning and collective rooms (Rli, 2014). Living with service could also be in complexes together with other elderly and extra facilities like reception, recreation, facilities and rooms for cure and care (SCP, 2004; MVWS, 2018). Instead, the focus on the accommodation complex scale, living with services could also be more focused on the living environment and called: residential-service area. De Kam et al. (2012) describes the residential-service area as an area where elderly could live longer independent because of the higher than average availability of (care-) services. In this concept service points have a maximum distance of 200 meters from the elderly housing, the multifunctional centers and shopping facilities have a maximum distance of 500 meters (Snoep, 2012). De Kam et al. (2012) found out that the proximity of services, traffic safety, social safety and fun are important factors for independent living. The satisfaction and success is depending on the tailor-made adjustability and appropriability of the houses; all services-areas are different due to the divers in arrangements, urban level, housing stock and moment of realization (De Kam, et al. 2012)

Another option of care housing is extramural care housing: independent housing with the possibility to receive care, cure and service at home from a nearby support center or (care) service center (SCP, 2004).

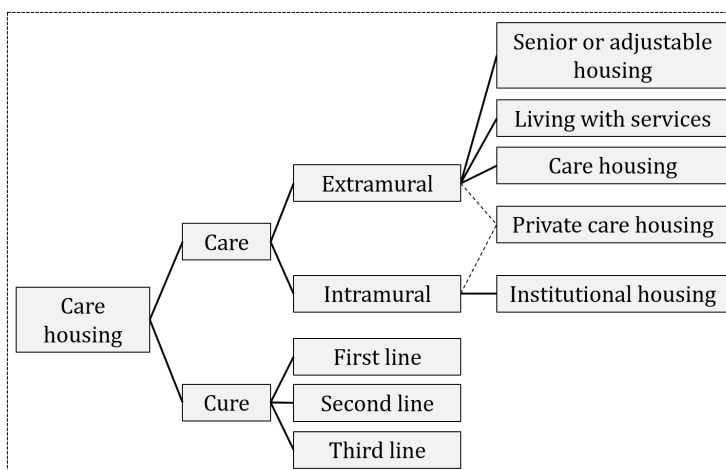


Figure 2.4. Overview: Options for care housing

In-between the intramural and extramural is the private care-housing: an accommodation where persons are welcome with the low need for care but also for the higher need for care. In this kind of care-housing is no need for moving if persons become less vital and need more care; the level of care can rise.

Intramural care is excluded for this research because it is not an option to choose for the target group. It is necessary to live intramural and the movement is required. It is not possible to tempt the 55+ population to start living intramural.

The other side of care housing is the cure side. The cure section has the goal to heal/advance the recovery, with associated nursing and care (Jukito, 2012). And this cure section is divided in 3 lines depending on the difficulty and the needed specialism of the cure: the first line for the first help (e.g. family doctors, physiotherapists, pharmacies), the second line for the more difficult help (the general hospitals) and the third line for the most difficult and specialism help (academic and specialism hospitals). But cure is a temporarily and for short stay and not for housing. Because this housing is temporary staying it is not implemented in this research.

CONCLUSION

In the Netherlands there are shortages for elderly housing and this will increase to 2040 if no action takes place. Therefore, different developments and plans are ongoing and planned by public and private sector. These developments become more diverse, due to the diversification of the older population, and more different housing concepts are being developed. One of these popular concepts is CPO.

In this research the housing stock is divided into six housing typologies. For this research, senior housing and ground floor apartments are added to these typologies. Next to the overview in housing typologies an overview in different kind of care housing is implemented in this research. In this research only extramural housing will be implemented. Intramural and cure are excluded.

2.2.4. CONCLUSION

The Netherlands is also aging. The 55+ population is increasing strongly due to the double aging process to 2040. Next to that, more people of this age-group are participating in the housing market because of extramuralisation policy of the government: people with some need for care are stimulated to live longer independent. This increasing group is changing over time to 2040: there are various trends and factors that will have impact on the 55+ population. First the socioeconomic status: it is expected that on average elderly have more income, capital and are higher educated. Second about the lifestyle and health: it is expected that next generation older people become older and is more longer vital. Last is about expected changes in the characteristics of the 55+ population: the difference in life expectancy between gender is leveling out and ratio of one-person households is increasing. These last to trends are implemented in this research.

This 55+ population in Netherlands, has some specific preferences and needs according to housing and its living environment, that are implemented in this research. These are the suitability to easily access a house and the proximity of facilities in the living environment to increase the self-reliance when the needed level of care increase. The theory of aging in place is implemented in this research, which allows to translate the demand of the current population for the future population in 2040.

Focusing on the supply of 55+ population, it is shown that there are shortages, which are increasing to 2040 if no action takes place. Therefore various developments and policies are planned and in progress by public- and private sector. The developments are becoming more

diverse and various housing concepts become more popular; one of these popular concepts is CPO. The supply of the housing stock is divided into six housing typologies. And for this research, senior housing and ground floor apartments are added to these list of typologies. Next to that, in this research the supply of care housing will be researched. In this research only extramural housing will be implemented. Intramural and cure are excluded.

2.3. ELDERLY HOUSING: ON A CITY SCALE

Per city or region in the Netherlands, differences are visible according to the population. Some places are aging stronger than others (Van Dam et al. 2013). Therefore in this section a zoom-in is described, from a national scale into a city scale. In this section will be explained that for this research, the focus will be on the biggest cities in the Netherlands. These cities, compared to other municipalities in the Netherlands, are dealing with stronger stagnation on the housing market, bigger lack of appropriate and adjustable housing for elderly population, and a bigger general growth of population included elderly.

2.3.1. DESCRIPTION OF FOUR DIFFERENT KIND OF MUNICIPALITIES

The research of Wensveen (2014) divides the municipalities in the Netherlands into 4 types, according to the migration flows and the population composition: the rural municipalities (1), the suburban municipalities (2), the welfare suburban municipalities (3) and the bigger cities (4).



Figure 2.5. Different types of municipalities in the Netherlands. (1) rural municipalities, (2) suburban municipalities, (3) welfare suburban municipalities, (4) The bigger cities

Starting with the rural municipalities in the Netherlands (1). This group is very diverse: some rural municipalities are growing (mostly in the South) while others are shrinking (mostly in the North) and all have a different population composition and prognosis (Wensveen, 2014). In general it can be stated that the rural municipalities are aging: De Jong & Van Duin (2010) explains that it is expected that by 2040 the non-urban municipalities have an increase from 16% to 27% of people from aging 65 and older. On average is noted that in these rural municipalities, the older populations is less dependent on care and more helped by informal care (Rietman, 2011; Wensveen, 2014). Compared to other cities, these areas have less care services and general facilities. (Post, Poulus, Van Galen en Van Staalduinen, 2012). Schellekens (2010) adds that in these rural areas, the lack of facilities is the biggest problem. Residents in these municipalities are focused on making their house futureproof, due to a range of possibilities: the houses are on average bigger and more people are home owners (Rietman, 2011). In these rural municipalities, the housing itself is not the main challenge.

The second group of municipalities are the suburban municipalities of the bigger cities (2). These cities have a relative strong aging process as well (Wensveen, 2014). They are mostly developed between 1970 and 1990, with the ambition attracting younger households to these cities (De Jong & Van Duin, 2010). Reiindorp et al. (2012) state that the starting point was to develop mainly own

occupied housing, but due to less economic periods, a substantive part of the housing is social rent and suitable for the less welfare households. This led to homogenous composition of the population, which results in a relative similar demand for housing.

The third group is called the welfare suburban municipalities (3). A separate group because the residents of these municipalities, have a 15% higher income on average, compared to the rest of the Netherlands (Wensveen, 2014). In these municipalities, there is a relative strong aging process, but the housing demand is different compared to other suburban municipalities, this is due to the fact that the elderly are managing their housing themselves and have financial possibilities to fulfil their housing preferences. The elderly population of these welfare suburban municipalities, have an in general above average income a significant high part of these group owns a house (Wensveen, 2014).

The last group are the bigger cities (4) in the Netherlands. These cities have good employment opportunities and most have their own university. These municipalities have a relative low ratio of elderly population, due to the city's strong attractiveness of students and highly educated migrants (De Jong & Van Duin, 2010). Van Dam, et al. (2013) confirm this process by stating that there is a migration trend of urbanization, which leads to less aging. The low ratio of older people and the high ratio of young people could be clarified by the escalator concept. Fielding (1992) states that bigger cities attract young starting people, whom are developing themselves and leave the cities with more knowledge, capital and experience. This social mobility process is called the escalator effect. Beets et al (2016) and Kooiman et al. (2016) confirm that the growth of the bigger cities could be linked to the magnet process: the availability of education, technological innovation, economic activities, career opportunities and cultural facilities all attract young adults and immigrant to the bigger cities.

2.3.2. FOCUS ON THE BIGGER CITIES

In the previous section, four different kind of municipalities are described. This research zooms in into the bigger cities in the Netherlands. This section explains the decision to focus on these kind of municipalities: bigger cities.

The first reason to focus on the bigger cities, is because of the stagnation in the housing market here. As described before, in the normal situation young people are moving to these cities for work and study, and later they leave the city again (according to the concept of Fielding) (De Jong & Van Duin, 2010; Fielding, 1992). However, in the last decades, people who first moved out after their student period, stay living in the city (Kooiman, et al. 2016). Since 2014, this stagnation problem is slowly decreasing but still a lot of households keep staying in the big cities (Kooiman, et al. 2016). The lack of housing for this group leads to stagnation in the housing market. Young starting households have problems finding a house and from the perspective of these young households, the elderly, who are living in single-family houses, are a jamming factor for realizing their housing preferences (De Groot, et al. 2013; SCP; 2004). The older population is living in spacious houses, which are popular under young households. The high percentage of elderly occupying a single-family dwelling, lead to problems for young starting households willing to move or buy a single-family dwelling (De Groot, et al. 2013). Therefore, the first argument to focus on the bigger cities, is the stagnation in these cities, which is partly caused by the not-moving-further elderly. It is important to focus on the demand of these older population to create more attractive and appropriate housing for this age group in order to positively influence the flow in the housing market.

The second reason for choosing the bigger cities is because of the lack of appropriate and adjustable houses for the elderly population. In contrast with the rural municipalities, the challenge for the elderly is not the lack of facilities but rather the lack of adjustable housing

(Schellekens, 2010). There is less room and houses are smaller. This makes it more difficult to fulfil the demand of housing for the older population. In addition, the chances of fulfilling the preferences and needs of the elderly is more limited because in the bigger cities the ratio of people renting a house is higher, the ratio of older people with lower social economic status is higher than the rural municipalities, and more elderly people are living alone (which makes them more dependent for care) (Van Leeuwen, 2011; Wensveen, 2014). Thus, the second argument to choose for the bigger cities in this research is because of the lack of housing, the higher percentage of rental houses, the ratio of older people with a lower socioeconomic status and the higher ratio of one-person households.

The third argument to focus on the bigger cities, is the general growth these bigger cities. In the Netherlands the 4 biggest cities are growing the fastest (De Jong & Van Duin, 2010; De Beer, et al 2018). Amsterdam and Utrecht will increase with 40.000 more households (growth of 25% for Utrecht and 10% for Amsterdam), Rotterdam will increase with 20.000 more households and the Hague with 25.000 more households in 2025 (see figure 2.5). The cities are growing because of international immigration and national migration from smaller to the bigger cities (De Beer, et al, 2018). Within this rising population, it is a challenge to keep all different target groups feel heard.

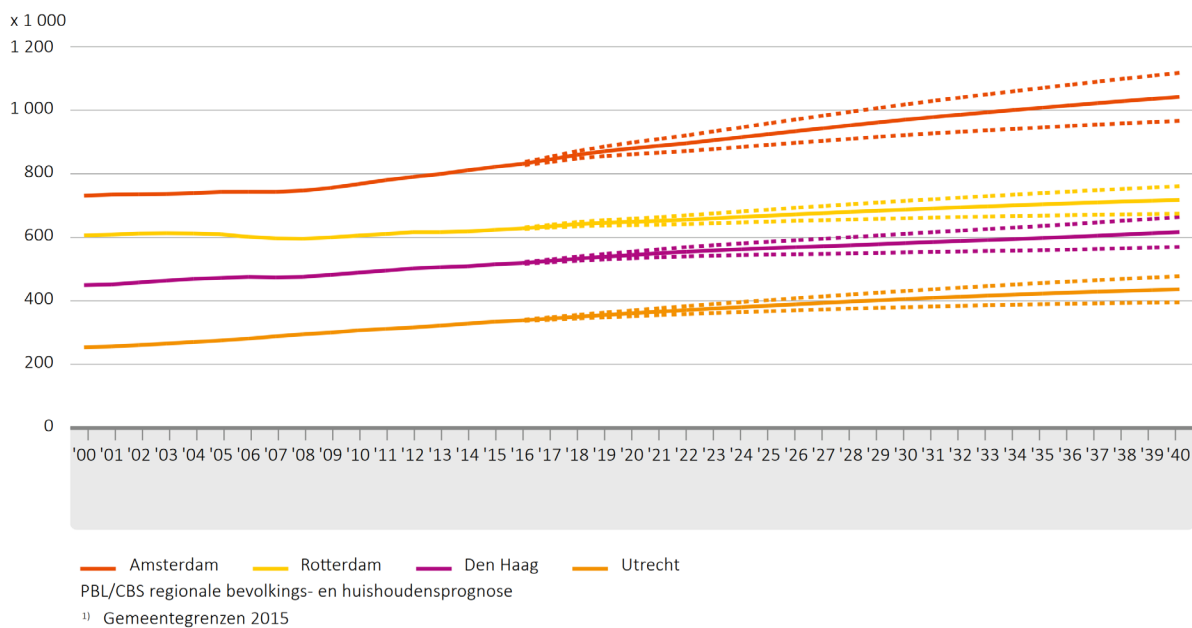


Figure 2.6. Population growth of the four biggest municipalities (based on the municipality area in 2015) in the Netherlands, according the uncertainty-prognosis interval (67%) with bottom and upper limit. (Kooiman, et al. 2016).

Lastly, the size of the elderly group is a factor. In the previous section is described that the bigger cities are less aging than other kind of municipalities. The most urbanized municipalities will be increased “only” from 13% in 2010 to more than 22% in 2040 (De Jong & Van Duin, 2010). Despite a relative low ageing process, also the biggest cities have to deal with a rise of people within the group 65 and older (Kooiman, et al 2016). De Beer et al. (2018) state that since 2005, aging is well visible in the four biggest cities of the Netherlands (see figure 2.6). And looking to absolute values, the municipalities of the bigger cities have to deal with bigger number of older

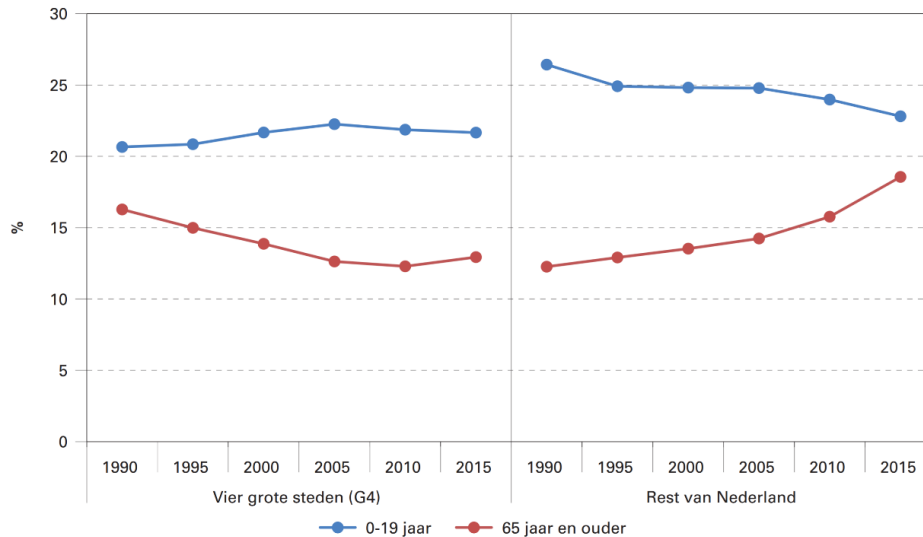


Figure 2.7. Percentage young and elderly in the four biggest cities and rest of the Netherlands. Figure from CBS and NIDI. (De Beer, et al. 2018).

population than a lot of the other municipalities (Wensveen, 2014). So, the absolute increase of the older population in the bigger cities, is the last argument to focus on the bigger cities.

2.3.3. CONCLUSION

In the Netherlands, the municipalities could be divided into four kind of neighborhoods: rural municipalities, suburban municipalities, welfare suburban municipalities and the bigger cities. In this research the focus is on the bigger cities in the Netherlands. Multiple arguments for this decision are given: the impact of the elderly population in the housing stagnation problem in the bigger cities, the lack of housing, the ratio of older people with lower social economic status and the higher ratio one-person households, the growth of these big cities and the increasing absolute number of the older population in these cities.

2.4. ELDERLY HOUSING: ON A NEIGHBORHOOD SCALE

In previous section is explained that this research focuses on the four biggest cities in the Netherlands. In addition, because the data (as described in chapter 4) is about the province of South-Holland, the biggest cities The Hague and Rotterdam are chosen to focus on. This section zooms in further into neighborhood scale of these cities. This analysis leads to the conclusion to do case studies about neighborhoods called: residential neighborhood with low and high rise.

2.4.1. DESCRIPTION OF DIFFERENT KIND OF LIVING ENVIRONMENTS

In the Netherlands cities are developed following a historical pattern. In this section the different kind of neighborhoods are described.

In the research of *De Grote Omgevingstest of Springco* (2018) (which is the data source to establish the demand of the target group in this research; see chapter 4) 9 different kind of living environments are set up: the inner city (brown), lively urban neighborhood (red), quiet urban neighborhood (orange), luxurious urban neighborhood (purple), residential neighborhood with low- and high-rise (yellow), residential neighborhood with mostly low-rise (dark green), luxurious residential neighborhood (dark blue), rustic neighborhood (light blue) and a rural environment (light green).

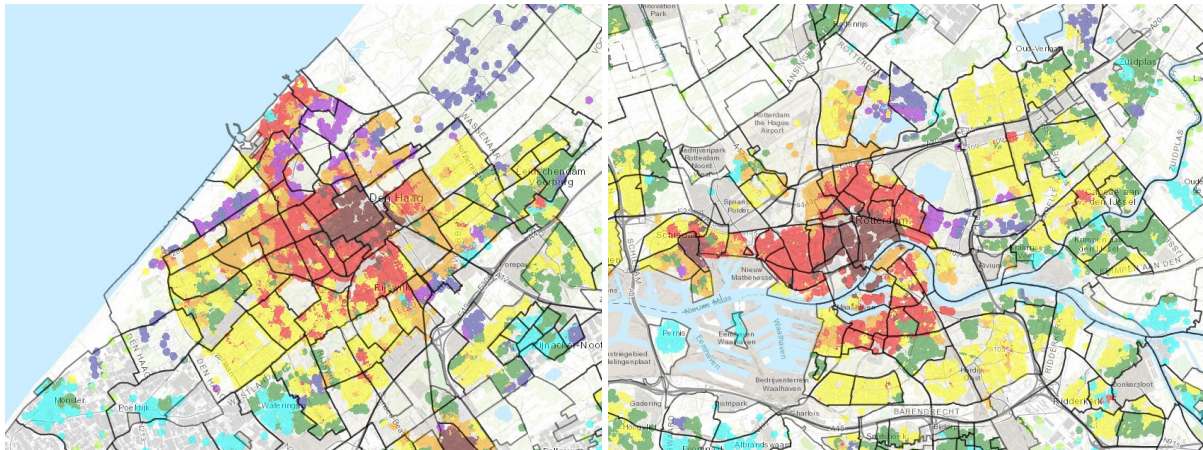


Figure 2.8. Maps of the cities The Hague (left) and Rotterdam (right). Divided in neighborhood categories. (*De grote omgevingstest* of Springco, 2018).

Figure 2.7 shows the urban development of the cities of The Hague and Rotterdam. It shows that these cities have developed over centuries in construction circles with the inner city in the middle. In general, the older buildings can be found in the inner cities. Rotterdam is an exception, due to bombing during the second world war. Around the inner cities are the urban neighborhoods, also with mostly older buildings. These neighborhoods are developed during the end of the 19 century and have mostly monotone terraced housing blocks with narrow streets without a front yard (BAG, 2015; InfoNu, nb).

During the second world war, the construction for housing was minimal which led to big housing shortages in the cities (CBS, 2017; InfoNu, nb). Therefore, after the war, cities expanded in fast tempo and new neighborhoods were developed quickly. This new type of neighborhood mainly exist of multiple apartments in a row called portico apartments. They lack an elevator and consist of four to five levels. Because of the big shortages the constructions needed to be fast and cheap which resulted in limited quality of the housing stock (CBS, 2017; InfoNu, nb). To make progress on the quality of housing in the 1960s, higher flats (more often with elevator) were developed with more public green around. However, these new flats were not very attractive and nowadays most of these houses are inhabited by people with lower incomes (high percentage of social housing). These developments of apartments from 1945 are categorized as: residential neighborhood with low- and high rise.

Due to the unpopularity of these apartments, in the 1970s and 1980s mostly single family dwellings are developed. Typical for this period are the homezones and *Bloemkoolwijken*: a spatial structure with focus on children safety and low speed traffic (InfoNu, nb). This is categorized as: Residential neighborhood with (mostly) low-rise.

The other neighborhood categories are located at the outer circle of the cities (rustic neighborhoods and rural environments).

2.4.2. FOCUS ON RESIDENTIAL NEIGHBORHOOD WITH HIGH- AND LOW-RISE

Previous section mentioned all the different kind of neighborhoods. This section describes why this research focuses on the residential neighborhoods with high- and low-rise.

CBS (2017) found out that the neighborhoods that are built in the period 1945 to 1965 are associated with social-economic deprivation. For example due to the relative high percentage of people that are in welfare system. These neighborhoods have relative many social housing and the houses have, compared with national average, lower WOZ-values (CBS, 2017). Therefore,

these kind of neighborhoods receive special attention from the government and plans are made to change the imago of these kind of neighborhoods to decrease the problems in these areas. These restructuring plans gives the opportunity to research an neighborhood that could increase or decrease the level of match over time.

2.4.3. SELECTION OF RESIDENTIAL NEIGHBORHOOD WITH HIGH- AND LOW-RISE

Due to the planned restructuring plans, the category residential neighborhood with high- and low-rise is selected. This section described the two selected neighborhoods for this research: one in The Hague and one in Rotterdam.

First the selection of a neighborhood in The Hague. Figure 2.7 shows that The Hague has two zones that mainly consists of residential neighborhoods with high- and low-rise: Bouwlust / Vrederust and Mariahoeve / Marlot. Taking a close look, it is shown that the percentage of category residential neighborhood with high- and low-rise, is a little higher for Bouwlust / Vrederust. Due to the available areas for the categories quiet urban neighborhood and luxurious residential neighborhood and because of this research focuses specially on on residential neighborhoods with high- and low-rise, Bouwlust / Vrederust is selected for a further case study.

The municipality of Rotterdam published data about the following neighborhoods: Rotterdam centrum, Delfshaven, Overschie, Noord, Hillegersberg-Schiebroek, Kralingen-Crooswijk, Prins Alexander, Feijenoord, IJsselmonde, Charlois, Pernis, Hoogvliet, Hoek van Holland and Rozenburg. De Grote omgevingstest Springco (2018) shows that of these neighborhoods, Prins Alexander, IJsselmonde and Hoogvliet have a relative high percentage of the category residential neighborhood with high- and low-rise. However, Prins Alexander has also a part which is categorized as residential neighborhood with mostly low-rise and luxurious residential neighborhood. Hoogvliet, originally a separate village, is located relatively far from the city of Rotterdam, compared to other neighborhoods. It is located next to Spijkenisse nearby the harbor industry. Due to this location, this neighborhood is useful as specific residential neighborhood with high- and low-rise. In conclusion, the neighborhood of IJsselmonde is selected for a case study in Rotterdam.

BOUWLUST / VREDERUST

Bouwlust / Vrederust is a neighborhood of The Hague and part of the post-war urban expansion called The Hague South-West, which started in 1953 (Van Marissing, et al. 2004). The neighborhood is designed by W.M. Dudok and followed up by Van de Broek (Ouwehand and Davis, 2004). The plan is a rectangular road system, with function separation, wide public green and with an open building structure (Van Marissing, et al. 2004). Housing is developed following a repeating stamp and portic flats of 4 levels can mostly be found here (van Marissing, et al. 2004). In 1960, these houses were seen as spacious, but are nowadays considered too small. In the 1980s, the relative low rents for housing attracted people with a limited budget.

Nowadays Bouwlust / Vrederust has to deal with economic-social problems. Around 11% of the population are in the welfare system, compared to 6,5% for The Hague in total (CBS, 2017) and housing-value is much lower than average of The Hague (119.000 euro in Bouwlust / Vrederust, compared to 188.000 euro in The Hague) (CBS, 2017). Therefore, the plan named *Plangebied Zuid-West* is established by the municipality to strengthen the social cohesion, create more work and increase the diversification of the housing stock (Gemeente Den Haag, 2019).

IJSSELMONDE

IJsselmonde can be divided into the following neighborhood: Lombardijen, Groot-IJsselmonde, Oud-IJsselmonde and Beverwaard. Until 1941, IJsselmonde was a separate municipality (Janssen & Ruitenbeek, 2004). Furthermore, during the second world war, no spatial urban developments

had taken place. But in 1949, Van Traa drew up an expansion plan for IJsselmonde due to the big housing shortages in Rotterdam (Hage, 2005). In 1956 the expansion plan was established and Peter Drimmelen started with the development of the neighborhood. His vision was to create a green-structure, where people, most of them working hard in the harbor industry, could rest in a peaceful living environment. In the plan, a facility center was developed per neighborhood, where all the shops, business and public functions were located (Hage, 2005). The architecture is dominated by apartments in combination with less single-family dwellings. The neighborhood is financed by private investors and Dienst Volkshuisvesting (Hage, 2005). Due to financial limitations of Dienst Volkshuisvesting, the program of requirements was minimal which led to relative monotone architecture (Hage, 2005). Private investors had more financial possibilities and ambitions and took care for some diversification in the housing stock (Haag, 2005).

Nowadays, the municipality names IJsselmonde a pivot point neighborhood, with multiple problems according to economic social status of the population. Therefore, IJsselmonde participates in the National Program Rotterdam South (NPRZ), to increase the quality of living, educational level, working life participation and economic perspective (Gemeente Rotterdam, 2019).

2.4.4. CONCLUSION

Neighborhoods in the Netherlands can be divided into 9 different kinds. One of these is the category: residential neighborhood with high- and low-rise, which is a kind of neighborhood that developed mainly between 1945 and 1965, with monotone architecture of mainly apartments without an elevator. Nowadays many of these kind of neighborhoods are dealing with economic-social problems. In The Hague, Bouwlust / Vrederust is one of those neighborhoods and in Rotterdam, IJsselmonde is a residential neighborhood with low- and high rise. Both have restructuring plans to increase the social-economic status.

3. METHODOLOGY

Chapter one described the problem definition about the stagnation in the housing market and the role of the elderly population. It stated that there are shortages of attractive and appropriate housing for this target group (which increases to 2040), and therefore it is needed to clarify the demand and supply for this age group. In chapter one is also described that the corresponding research goal is about the level of match between the expected supply and demand in 2040 with the research question: to what extent there is a match expected between the supply and expected demand in 2040 for the 55+ population?

This chapter examines how this research question can be answered. To solve this problem a model is developed based on a mixed-method approach existing of both quantitative and qualitative research.

The quantitative research is a data analysis, which shows the demand of the 55+ population of selected neighborhood. Because this research is about the level of match in 2040, scenario thinking is used to determine how the demand of the target group could differ in 2040 compared to the demand in 2019. The demand and the scenario thinking is analyzed with the Bayesian Belief Network. This technique is used to identify the dependencies between a set of the variables in a data set. In this research this helps to found out how the demand variables differ when the personal variables change over time.

The qualitative research is in the form of a case study. Two neighborhoods, that are categorized as residential neighborhoods with low- and high rise, are implemented in the model. The case study is used to collect information about the two neighborhoods. Interviewing is used to found out the future supply and existing data is used to collect data about the current supply the size of the target group are collected.

The collected data from the quantitative research and the qualitative research, are added into the mixed-method model and results in the expected level of match in 2040. After which recommendations are written to influence the level of match.



TYPICAL HOUSING IJSSELMONDE: This housing block is located in the neighborhood Lombardijen, which is a part of IJsselmonde. At the Augustinusstraat. A block of 4 levels, Built between 1963. The apartments have on average a surface of 70 m² with a small balcony (Funda.nl, 2019).

3.1. APPROACH AND DESIGN

In this research a model is used to determine the level of match between supply and demand for 55+ housing in 2040. The model is achieved by doing a mixed-method research. Creswell (2014) explains that a mix-method research is a combination of using the quantitative and qualitative data, to get a complete understanding of a research problem. The following section describes the approach of the mixed method.

RESEARCH APPROACH: MIXED METHOD

The goal of this research is to gain more insight into the extent to which there is a match between supply and demand, focusing on the 55+ population in 2040. The research tests if housing and the surrounding living environment are attractive and appropriate for people from the age of 55 and older. This kind of research needs a detailed and location-dependent approach because there are a lot different variables involved which all could have some impact on the demand and supply. Therefore, a quantitative method is needed to get detailed results of the demand of the 55+ population. It tests which relations can be found between the specific target group and the variables concerning housing and the surrounding living environment. According to the supply of housing and the living environment, it is necessary to zoom-in, to get all the detailed information. This zoom-in is needed to get a total view of the housing and its living environment. Therefore a qualitative approach is useful in the form of case studies. Combining the quantitative and qualitative approaches results in a mixed-method approach (see figure 3.1). In this model, the quantitative research is suitable for the demand side and a qualitative research, in the form a case study, is suitable for the supply side. Both will be combined in the mixed-method approach, to get insight to what extent there is a match. Next sections zoom-in into the separate designs of these three parts and starts with the quantitative design.

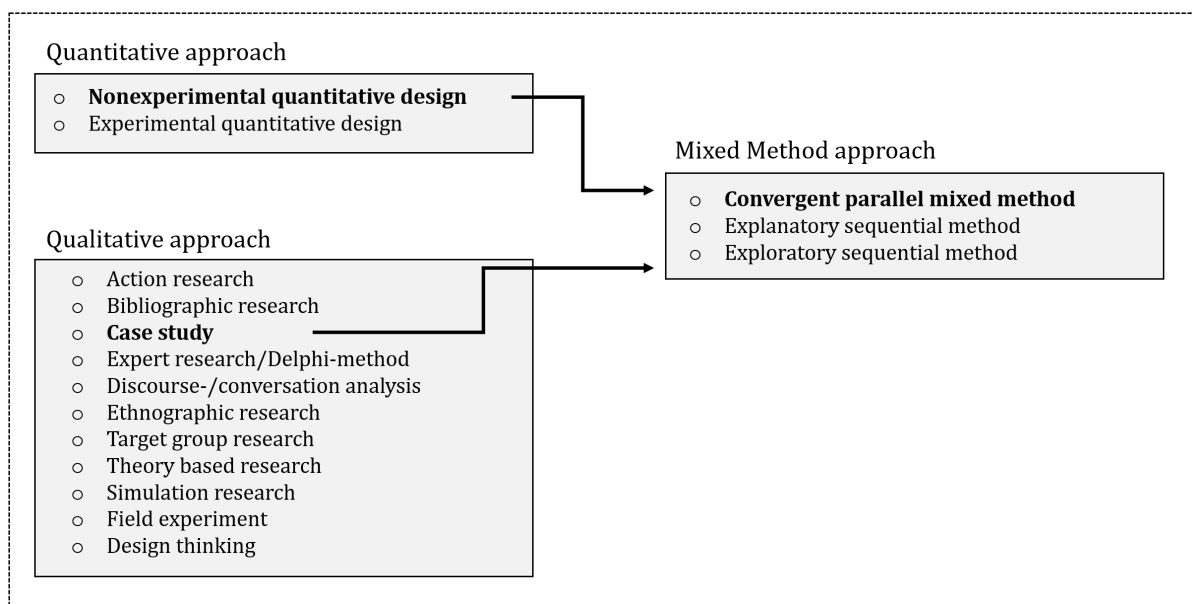


Figure 3.1. Overview of the research approach and design

QUANTITATIVE DESIGN: NON-EXPERIMENTAL

Mertler (2016) explains that quantitative research has two categories: nonexperimental research designs and experimental research designs. The difference between these two categories is as follows: in the nonexperimental research the variables are not manipulated in the study, and in experimental research design the variables are manipulated to establish effects. This research analyze the preferences and needs of the target group to get insight in the demand of the 55+

population. It is not needed to manipulate the variables to come to these preferences and needs. Therefore, the quantitative approach of this research is categorized as a nonexperimental design.

Mertler (2016) describes that this nonexperimental design could be a descriptive research (which includes observational research and survey research), correlation research or causal-comparative research. For this research the correlation research is suitable, because a sub-goal of this research. The sub-goal is to get insight into the demand of the target group, and therefore the relation between the personal characteristics of the target group and the preferences and needs of the target group, need to be measured, which is possible with the correlation research design.

QUALITATIVE DESIGN: CASE STUDY

In this research, the qualitative research is used to get detailed insight into the supply of housing and the surrounding living environment, focused on 2040. Figure 3.1. numerates all the different designs for a qualitative approach. Case study design is chosen because it is a design, wherein it is possible to zoom-in into a neighborhood and collect the data concerning housing and the surrounding living environment. A case study design is a way to analyze a case in-depth and get a grip on the complexity of a particular single case by collecting detailed information (Stake, 1995; Creswell, 2014).

MIXED METHOD DESIGN: CONVERGENT PARALLEL

Creswell (2014) explains three possible primary design models for a mixed-method approach. The first is the convergent parallel mixed method: quantitative and qualitative data are converged or merged to get a comprehensive analysis. The second model is the explanatory sequential mixed method: first the quantitative research will be worked out, and these results will be further explained with qualitative research. The opposite of the explanatory sequential mixed method is the the exploratory sequential mixed method. In this mixed method, first, a qualitative phase is worked out to use as instruments to research the quantitative phase. This research about the level of match of 55+ housing in 2040 uses the first design: the convergent parallel mixed method design, because there is no question to do the quantitative and qualitative in line instead of parallel. The quantitative research shows the demand and the qualitative research shows the supply of housing. In this mixed-method design, the data from both parts are included.

3.2. RESEARCH METHOD

This section explains the implemented research methods. Research methods are used to gather the data, that is needed for this research. In line with the previous section, this section is also split up into three parts: the quantitative method, the qualitative method and the mixed method.

3.2.1. QUANTITATIVE METHOD: DATA ANALYSIS

First, the quantitative method. A data set is analyzed to examine relationships between personal characteristics and housing/living environment variables, to establish the demand of people from the age of 55 and older. The demand is established by analyzing data about the demand of people that represent the target group in age and neighborhood type (living in a residential neighborhood with high- and low rise). Section 1.5. showed the conceptual model of this research, of which an abstracted version is shown in figure 3.2. figure 3.2. shows this first step (D): Data

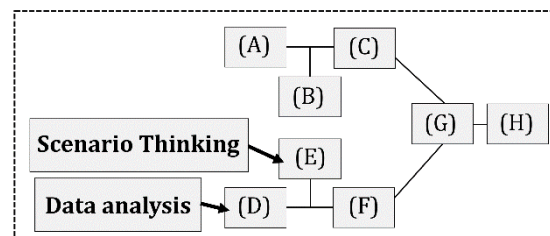


Figure 3.2. Quantitative method: Data analysis and Scenario Thinking to establish the demand.

analysis to establish the demand. Next section explains scenario thinking which implements the trends and factors that influence the demand in 2019 to the demand in 2040 (step E). Implementing step E (scenario thinking) into step D, gives the expected demand of the target group in 2040: F in figure 3.2.

SCENARIO THINKING: BAYESIAN BELIEF NETWORK

The above described data analysis is about the demand of people from the age of 55 years and older in 2019. However, this research is not focused on the demand of 55+ population in 2019 but of the 55+ population in 2040. Therefore, scenario thinking with Bayesian Belief Network is implemented in this research to get insights into the future demand in 2040. This section explains the principle and of the Bayesian Belief Network and the implementation for this research.

The quantitative data analysis researched the demand of the 55+ population in 2019 and trends and factors are analyzed, to determine the effect on demand up to 2040. For example, it is expected that the percentage of one-person households will increase to 2040. Therefore, the dependencies of the variable one-person household on variables about the demand need to be established. In other words, a scenario is made: "To what extent does the demand change if only people of an one-person household are included?" This process is called scenario thinking or 'what-if' thinking and is a method to zooms-in into specific sub-groups and establish their specific preferences. These outcomes are used to determine the demand in 2040. Bayesian Belief Network is used to implement this scenario thinking and to get knowledge about probable effects.

A Bayesian Belief Network (BBN) is a graphical technique representing random variables and their conditional dependencies (Zong & Wang, 2015). Therefore, BBN is developed following a network-learning algorithm to identify the connections between a set of the variables in a data set (Kemperman, & Timmermans, 2014). Zong & Wang (2015) explain that when a data set is uploaded into the Bayesian Belief Network, a graphical structure can be drafted, learnt from the data input. It helps decision making by considering the probabilities of the possible consequences in decision making. In a Bayesian Belief Network, the variables are represented as nodes and the relationships between the variables are representatives as links (Parvaneh, Arentze & Timmermans, 2012). Figure 3.3. shows that the BBN exists of two kinds of variables: X and Y, represented by nodes. Zong & Wang (2015) explain that Y are called parents of X, and X is called the child of Y, and the edges from Y to X shows the dependency of X on the parents' nodes (Y).

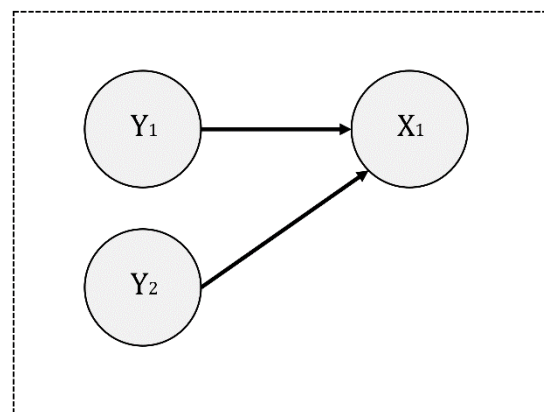


Figure 3.3. Bayesian Belief Network principle of random variables and their dependencies.

In this research, the BBN network is used to formulate and estimate the relations between the variables that (in)directly influence the preferences of a 55+ population in a specific kind of neighborhood and to found out information about the strengths of the connections of the variables. The preferences, concerning housing and surrounding living environment, of the target group (55+ population) are the child variables (Y) of the parents nodes, which are in this case the personal characteristics (e.g. age, household, gender and location of living on neighborhood scale).

Figure 3.4. and figure 3.5 show an example of the implementation of the Bayesian Belief Network for this research, about the level of match for 55+ population in 2040. Figure 3.4 indicates the

standard network learnt from the data set with adjusted edges between the variables, which are relevant for this research. The variable *Living Environment* is the parent node and connects to the variables *Gender* and *Age*. These two variables are the parents' nodes of the child's nodes, which are the variables about the preferences: *Housing property*, *Housing typology*, *New develop.* and *Care Housing*.

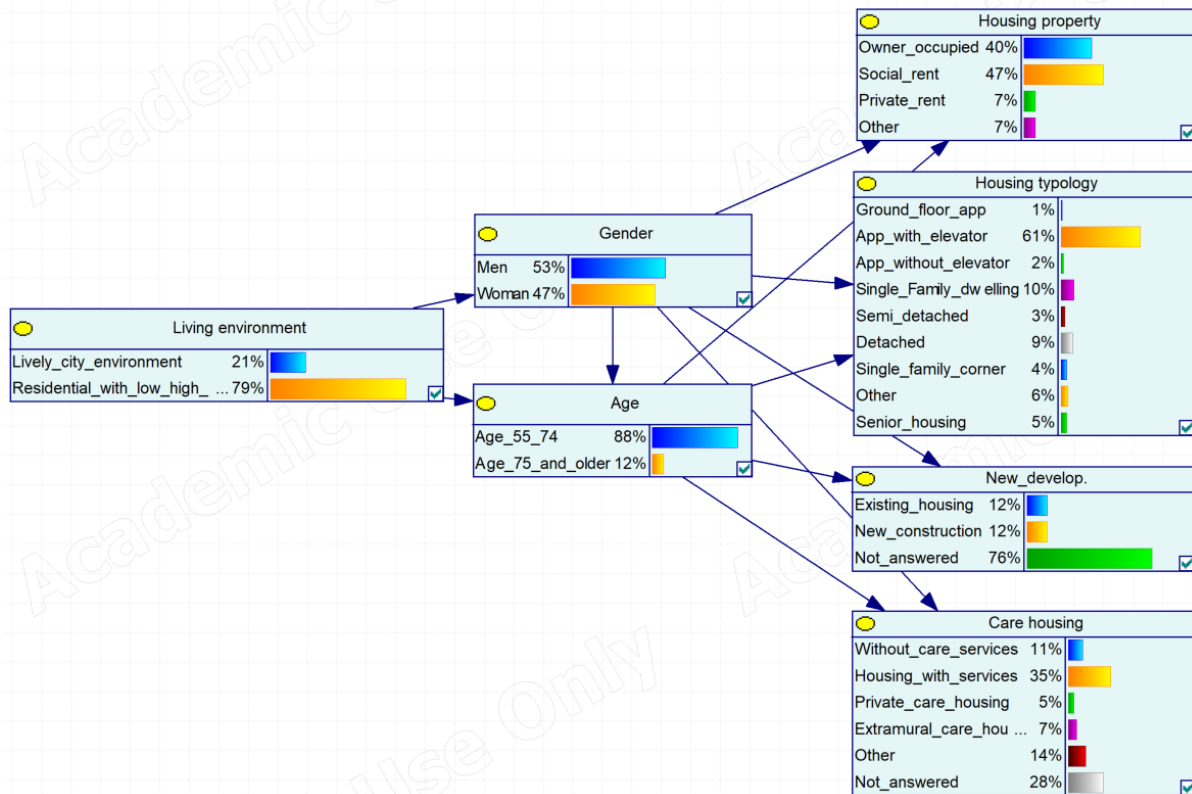


Figure 3.4. Screenshot of a network. Software: Bayesian Belief Network. It shows the *standard* network for this research.

As example, the impact of men between the age of 55 and 74, living in a residential environment with low- and high rise, will be analyzed. Figure 3.5 shows this limitations in the *standard* network. The 'what-if' implementation works here as follows: what if 100% lives in a residential environment with low- and high rise, 100% is men, and 100% is between the age of 55 and 74. As result the ratio preferences for the various child's nodes are shown. It indicates that, comparing to the standard network, the preference for *owner-occupied housing* increase with 7% and the preference for *social rent housing* decrease with 7%. Furthermore, the preferences for housing typology shift (minimal) with a higher demand for apartment with elevator and single family dwellings.

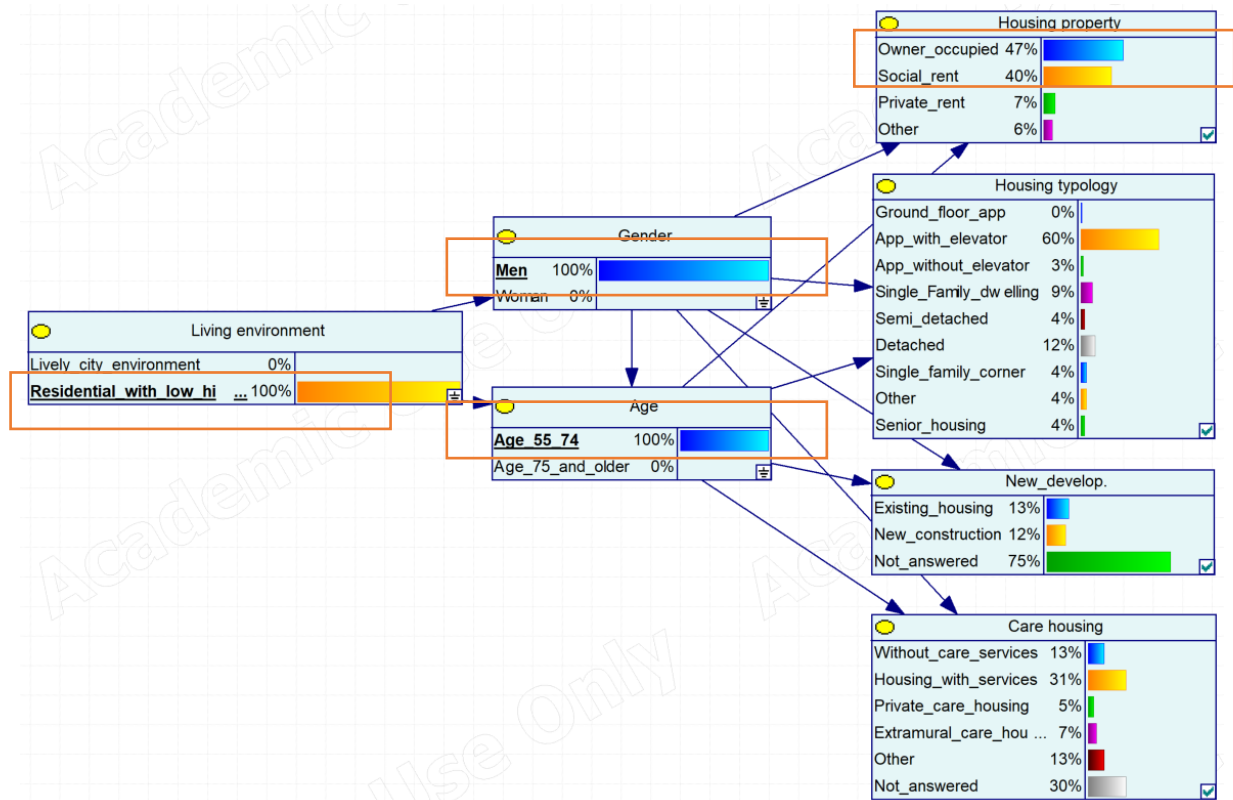


Figure 3.5. Screenshot of a network. Software: GeNIe 2.1. It shows the what-if implementation into the *standard* network, to establish the preferences of a specific group (men between age of 55 and 74, living in a residential living environment with low- and high rise).

As conclusion, the Bayesian Belief network is a datamining technique to identify the connections and dependencies between a set of the variables in a data set. For this research this method is used to implement the ‘what-if’ question, which helps to found out the impact of trends and factors of the 55+ population in 2040.

3.2.2. QUALITATIVE METHOD: EXISTING INFORMATION AND INTERVIEWS

The second part of the research method is the qualitative method. Baarda, et al. (2018) explains three ways to obtain the required qualitative data: 1) the use of existing information, 2) conducting interviews, 3) making observations. In this research a combination of the following two methods are used: 1) existing information and 2) interviews. The observation method is not used because this method focuses on the patterns and behavior of participants, which is not needed for this research.

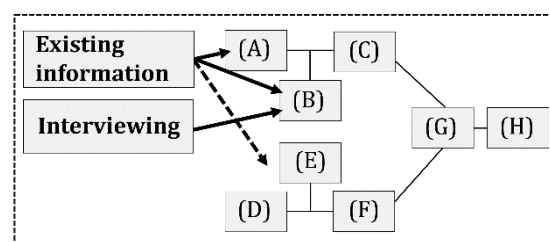


Figure 3.6. Qualitative method: Existing information and interviewing to establish the supply.

Figure 3.6. shows that existing information is used to get insight into the existing housing stock (A), planned developments on the case study locations (B), the existing population including its ratio characteristics (households, gender and age) (D), and the prognosis of the population composition (E). The method of using existing information can be executed with non-numerical data and with numerical data. Non-numerical data is used for the planned developments of the case study locations. The numerical data is analyzed to obtain the data on existing housing stock, the existing population and its ratio characteristics, and the prognosis of the population.

The interview method is used to get more detailed data about the planned developments on the case study locations and its variables (B). Baarda, et al (2018) make a distinction between conducting individual interviews and group interviews. Group interviews are used to create a setting where people can trigger each other which gives more information. However, this research uses individual interviews, in the form of an in-depth expert interview to obtain the planned information. There is no need to elicit with group interviews because the developments are planned and established.

Baarda, et al (2018) and Gall, et al. (2003) describe four kinds of interviews, depending on the strictness of structure. On one hand, there is the option of structured interviews with stated questions in a fixed order. The other side of the spectrum is the open interview with only a starting question. In between there is the semi-structured interview, and the topic interview. In a semi-structured interview, the main questions are established but there is room to ask further. The option of topic interviewing is based on topics to discuss, but the questions are open to formulate. For this research, it is chosen to do the semi-structured interview. To obtain the information about the future of a neighborhood, questions must be established in advance, but room is needed to ask further about planned developments and ambitions about a neighborhood.

INTERVIEWING

This section explains the method of interviewing. Holding the interviews with experts of the municipalities gives more detailed data about planned policies that influence the supply to 2040. First the operationalization of the interviews is described followed by an explanation of the participants of the interviews.

OPERATIONALIZATION. For this research semi-structured interviews are used: information is gathered with using open questions in an interview. The first step is to clarify which specific data are required. These data are classified into topics, that lead to open interview questions. Second, municipalities are contacted to request interviews with experts of the spatial development section of the municipality(specialized in the areas of the case studies). The experts are informed about the goal of the research and the exact delimitations of the locations of the case studies.

The next step is the interview itself. two interviews with two experts have take place. The expert from the municipality of The Hague participates in one interview, and the expert from the municipality of Rotterdam participates in the other interview. At the start of the interviews, the case study location is shown in a hardcopy map. This map makes that the participant sharply focused on the specific location of the case study, which prevent possible uncertainties about the corners of the area, and it is possible to point out specific location and housing blocks to clarify extra their answers. The interviews are conducted in Dutch, so participants can speak freely in their native language. During the interviews the answers are written down directly, and are later set out in more fluent sentences. It is important that the tone and the strength of the statements of the participants are maintained. All the interviews are shown in appendix 2.

PARTICIPANTS. Participants are the people that are interviewed for the research. In this research, expert interview take place to gather knowledge about policies (planned developments and ambitions). These policies influence the housing stock and the living environment of the selected case study areas, and therefore, the expert interview take place with policy makers of municipalities. These policy makers deal with spatial and social issues, and are responsible for the spatial development of the municipality. Policy makers are performing the ambitions and plans of the municipal administration by developing, estimating and steering the plans of the municipality. Their goal is to maintain or improve the livability and the quality of life for the residents in the municipality.

Because it is an expert interview the participants are not selected randomly but there are specifically chosen concerning their association to the location of the case study. This method of choosing participants is called the non-random sampling approach (Baarda et al, 2018). The saturation of the required content can be fulfilled with one interview per case study due to the fact that the policy makers are specialists in the city and its neighborhoods, and are informed in all the ambitions and plans of the municipality at the desired level of detail.

Table 3.1. List of participants for semi-structured interviews.

Participant	Municipality	Description
1.	Rotterdam	Policy maker of municipality Rotterdam. Expert Housing and spatial development.
2.	The Hague	Policy maker of municipality of The Hague. Expert Housing and (elderly) care.

In this research, two case studies are worked out. One case study in the municipality of Rotterdam and one case study in the municipality of The Hague. Therefore, two interviews take place, one with the expert policy maker of Rotterdam and one interview with the expert policy maker of The Hague: see table 3.1.

To summarize: in this research interviews are conducted to get insight into the plans and policies that will have an effect on the current supply of the housing stock and the surrounding living environment, of the case study locations (B). This information will be included in the collected supply (A) of the current situation, which leads to the expected supply in 2040: C in figure 3.6.

3.2.3. MIXED METHOD: MERGE DATA AND ANALYSIS

The previous sections explain the quantitative and the qualitative method for this research. These two methods are combined and used for the mixed method. This section describes the implementation of this mixed method and shows how the collected data is used to come to the results.

Section 3.2.2. explains how the expected supply in 2040 (C) concerning housing and the living environment is established. Section 3.2.1. shows how the expected demand in 2040 (F) according to housing and the living environment is researched. In the mixed method the expected supply (C) is subtracted from the expected demand in 2040 (F), and results in the expected level of match in 2040 concerning housing and the living environment (G) of a selected neighborhood (see figure 3.7).

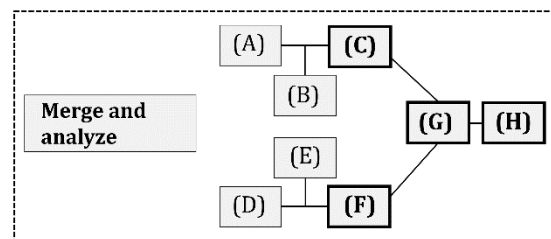


Figure 3.7. Mixed-Method method: Existing information and interviewing to establish the level of match.

The result could be zero, positive or negative. When the result is around zero, it is expected that in 2040 there is a match between the supply and demand in the selected neighborhood. The result could also be positive: in that situation there is a positive mismatch expected in 2040. In other words, it is expected that the supply is higher than the demand in 2040. Third option is that the result is negative. In that case, a negative mismatch is expected in 2040 concerning housing and/or the living environment. The supply is less than the demand. These three options are placed in G in figure 3.7.

With the outcome about the level of match (G), recommendations are set up, to keep this level of match when the result was zero, to change the supply to decrease a possible mismatch, or to change the supply to decrease the negative mismatch. These recommendations are shown in (H) in figure 3.7.

Next section explains the mixed-model method, following the conceptual model, step-by-step, to get insight in all the options, factors, statements and assumptions that are made in in this model.

EXPLANATION OF THE MIXED METHOD RESEARCH MODEL

The above described sections, explain the approaches and the methods, which are all merged into one research model. This model is the basis which generates the results for this research. The final result of this model is the level of match per demand-variable. In this section the model is explained step-by-step, including assumptions (if these are needed to fulfil the model), factors and statements per variable. All the steps are shown in figure 3.8.

As start it is important to note that in this research model, four options are possible. In the model results can be determined dependent on gender or dependent on household. And for gender and households are both two scenarios which leads to four options. The following steps are for all options similar because only the input differs. This input is size of target group and its subgroups. The subgroups for gender are prepared with the variables men and woman, and the subgroups for households are prepared with the different household types variables.

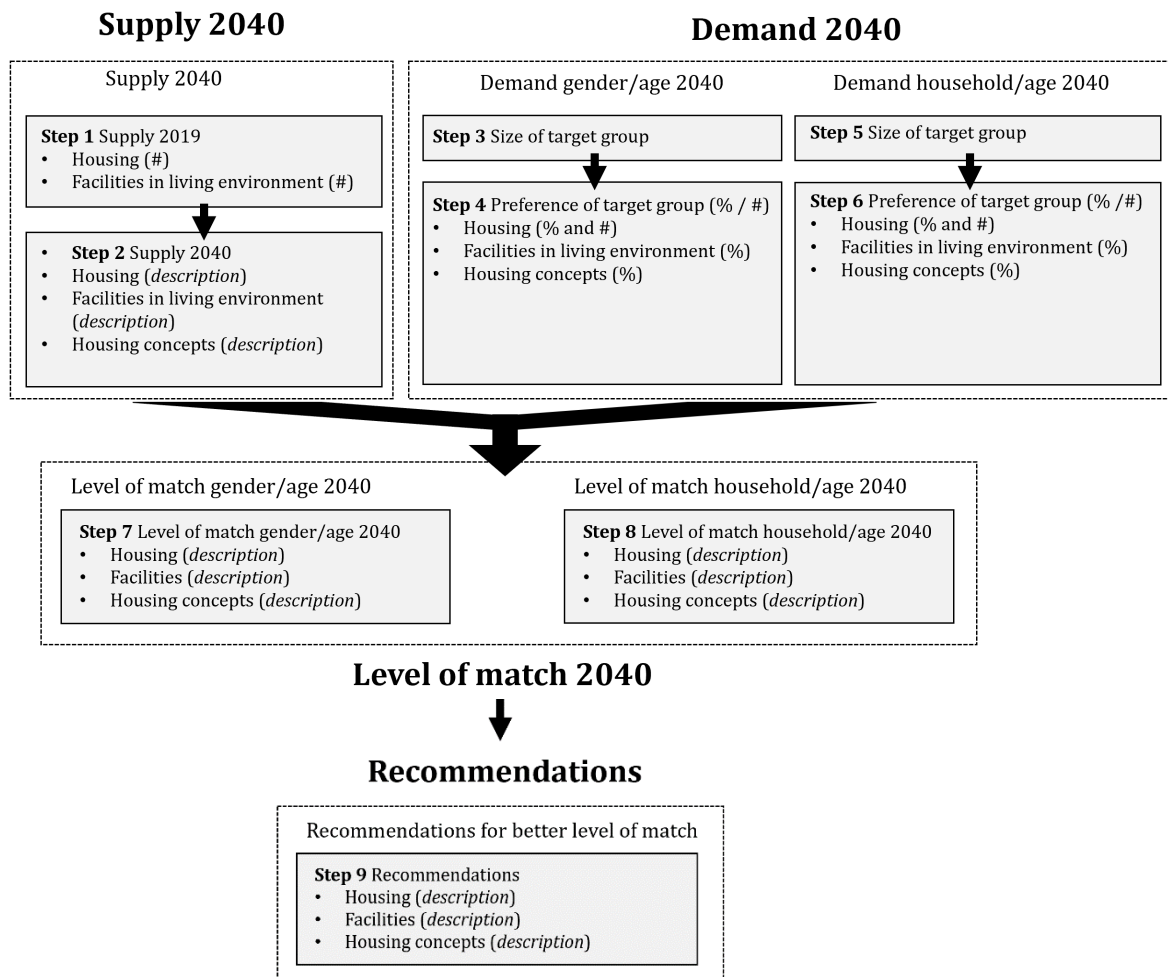


Figure 3.8. Overview of all the step in the mixed method research model.

STEP 1. The first step is about the current supply in 2019 concerning housing and the facilities in the living environment. With existing information, the input for the supply-variables are collected in exact numbers. The definitions of these variables are written in appendix 3. The variables for housing are:

- Housing property: number of owner-occupied houses, social rent housing, private rent housing and other. (In this case other are the unknown property statuses).
- Housing type: Number of ground floor apartments, apartments/flats with elevator, apartments/flats without elevator, single family dwellings (terraced housing), semi-detached houses, detached houses, single family dwellings corners, other and senior housing. Other are for example, a boathouse or a bungalow.
- New developments: number of housing constructed before 2010 (existing housing stock) and number of houses constructed after 2010 (new constructions)
- Care housing: number of houses without care-(services), extramural houses with services, private care houses, extramural care housing and other. In this case other are less familiar concepts as live in house with family to get informal care.

In the model these variables are filled in as follows:

Variable	Option	Supply in 2019 (#)	Supply in 2019 (%)
Housing property	Social rent housing	#	%

And for the facilities in the living environment the variables are:

- Sports
- Groceries
- Fashion
- Community center
- General practitioner
- Catering industry
- Culture
- Public transport stops
- Parks and green

The variables for the facilities in the living environment are established in density per km²: the total surface of the neighborhood is established, divided by the number of facilities. In the model these variables are filled in as follows:

Variable	Number of facilities (#)	Density per km ²
Sports	#	#

STEP 2. Second, the plans and policies, that change the current supply from 2019 to 2040, are filled in the model. For the three topics (housing, facilities in the living environment and housing concepts), statements are done that gives insight in the expected supply. These statements are filled in the model as follows:

Variable	Option	Supply in 2019 (#)	Supply in 2019 (%)	Plans to 2040
Housing property	Social housing	#	%	Increase, because of... / decrease, because of... / no changes expected

STEP 3. Step 3 establish the size of the population per subgroup in 2040. The expected size of the population in 2040 per subgroup need to be determined, to forecast the demand of the population in 2040

Per subgroup, the size is implemented for the year 2019 and for 2040. For example, the subgroups concerning gender are as follows:

- Men (55 – 74 years)
- Men (75+ year)
- Woman (55 – 74 years)
- Woman (75+ year)
- Residual group (all people younger than 55 years old)

In the model the size of the subgroups are placed on places A and B (e.g. for the gender option):

55 to 74 years						75 years and older					
men			woman			men			woman		
Size of group	A	B	Size of group	A	B	Size of group	A	B	Size of group	A	B
	# 2019	# 2040		# 2019	# 2040	Preference	# 2019	# 2040		# 2019	# 2040

In the model is filled in on place A, the number of people of the subgroup in the year 2019. In the model is filled in on place B, the number of people of the subgroup in the year 2040.

STEP 4. Next step is about the demand of the population per subgroup per variables and these filled in into the model. After the sizes per subgroup are filled in in step 3, in step 4 the preferences for the variables (per topic) will be filled in per subgroup. The preferences are established in the Bayesian Belief Network and are expressed in percentage, and filled in the model at place C. For example, 40% of the men (age between 55 to 74 years) have the preference to live in a owner-occupied house (Variable X). Then the size of the subgroup (A or B) will be multiplied with C% and gives as result AC of BC: the expected number of people that prefer variable X. For example, if A=100, C% is 40%, than AC has the result of 40 people with the preference for variable X.

55 to 74 years						
men				woman		
	Size of group	A	B	Size of group	A	B
Option	Preference	# 2019	# 2040	Preference	# 2019	# 2040
Variable X	C%	AC	BC	C%	AC	BC

The sum of all the AC values gives the total demand for variable X in 2019. The sum of all BC values gives the total demand for variable X in 2040.

In this step an assumption is made for the variables of care housing. So far, it was assumed that the total size per subgroup is eligible for all the variables. For care-housing it is not expected that 100% of the people will live in a housing option of care-housing. Some people have a high level of health and may not have to live in housing with care (services). Therefore, the an assumption is made as filter in the model about the demand for care housing. CBS (2019) state that in the age group 55 to 74 years old 15,40% of the people have limitation in Instrumental General Daily Life operations (IADL: *Instrumentale Algemene Dagelijkse Levensverrichtingen*), and 35,60% of the people older than 75 years. In the model the demand (AC or BC) is multiplied with these IADL

percentages, which lead to lower demand for care housing. IADL gives an indication if people are able to do independent activities like doing groceries, financial administration and other household activities (CBS, 2019).

For the topic housing concepts the demand is about the attractiveness of housing concept. The demand for housing concepts indicates how attractive a specific housing concept is for the target group. This level of attractiveness is expressed as a percentage. These percentages are categorized as follows:

Demand (Attractiveness for a concept %)	Categories depending on percentage
>=20%	Not to very limited attractive / interesting
21% - 40%	Limited attractive and interesting
41% - 60%	Quite attractive and interesting
61% - 80%	Attractive and interesting
81% - 100%	Very attractive and interesting

In section 3.2.1. is described that Bayesian Belief Network is used to determine per subgroup the preference and to do the 'what-if' method. This 'what-if' scenario thinking, is used to found out what happened when a trend (of personal characteristic, like one-person households) changes stronger or less than expected. Different variants are made of the table of step 4, to implement scenario thinking in the model. In each variant, different numbers are place in the model, at position B. If for example, a stronger increase in life expectancy of men is expected in scenario two, the input B will be bigger, which have effect on the BC.

STEP 5. This step is similar to step 3, but the sub-groups are not divided dependent on gender and age but dependent on household and age. The subgroups are as follows:

And the subgroup for household are:

- One person households (55 - 74 year)
- One person households (75+ year)
- Couple (55 - 74 year)
- Couple (75+year)
- Household with children (55 - 74 year)
- Household with children (75+year)
- Residual group (all households younger than 55 years old)

STEP 6. This step in the model is equal with step 4, only the subgroups differ. Instead of men and woman, in the model is written: One-person household, couple and household with children.

STEP 7. The expected supply in 2040 the expected demand in 2040 are calculated. The next step is to compare those outcomes. This comparison results into the level of match per variable, by subtracting the supply (combination of *Supply in 2019* and *Plans to 2040*) from expected demand in the model (*Demand (#) Gender*). This level of match is shown per topic in the model. First for the topic housing:

Variable	Option	Supply in 2019 (#)	Plans to 2040	Demand (#) Gender	Level of match
Housing property	Social housing	#	Increase, because of... /	\sum BC	#, but will decrease because of the plans to 2040

Second result of the level of match is about the topic facilities in the living environment. The supply is stated with density per km². The demand is in percentage and indicates how important people think it is to have a facility nearby in the living environment. The level of match for facilities in the living environment is expressed in a score range from 1 to 5.

	Demand (importance)			
	75% and +	50% - 74%	25% - 49%	<25%
Density > 1 per km ²	5	4	4	5
Density < 1 per km ²	1	2	2	3

A score of 1 indicates a strong mismatch and score of 5 shows a match. 5 indicates that a facility is important for the target group and sufficient available in the nearby living environment, or a facility is not important for the target group and less available nearby in the living environment. In the model this is filled in as follows:

Variable	Density per km ²	Importance	Plans to 2040	Level of match score
Sports	#	%	Increase, because of... /	# (1-5), but will decrease because of...

The last level of match in the model is about the topic housing concepts. For this topic the current supply is not known. Only the expected supply 2040 and the demand to 2040 are known, which are used to establish the level of match. In this model this is implemented as follows:

Variable	Demand 2040	Attractiveness	Plans to 2040	Level of match
Housing concept X	%	Limited Attractive	No room for this concept../	Some level of match due to limited attractiveness and no plans to 2040

STEP 8. This step is equal to step 7, only these level matches are depending on household composition and not on gender.

STEP 9. This step is about the recommendations concerning the level of match per variable. These recommendations are not shown in the model but are written as conclusion. The recommendations gives insight how a better level of match could be achieved or to confirm a level of match.

3.3. CONCLUSION

This chapter explained the methodology used for this research. A mixed-method approach is selected that merges the data of both qualitative and quantitative research approaches. The quantitative approach is a data analysis to determine the demand of the target group in 2019. The Bayesian Belief Network is used to predict the expected demand in 2040 based on the demand in 2019, for different scenarios. The qualitative approach exists of a case study design, and uses existing information and interviewing to determine the supply and the size of the target group (55+ population) in 2040 living in the case study areas. Figure 3.8 shows a overview of the total mixed-method design.

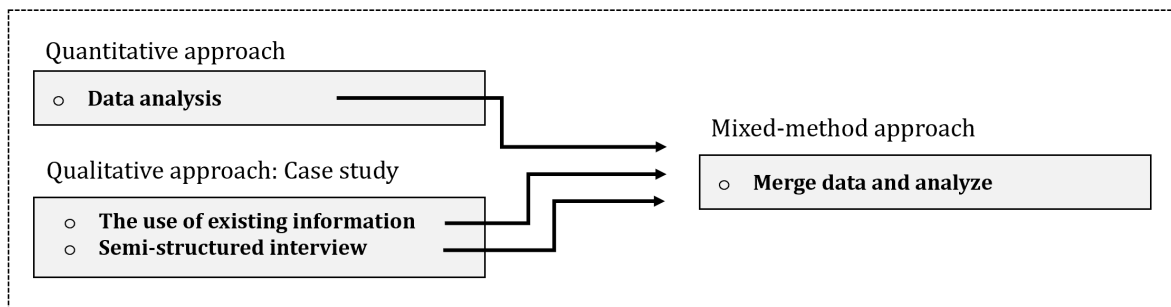


Figure 3.9. Overview of the research design and method

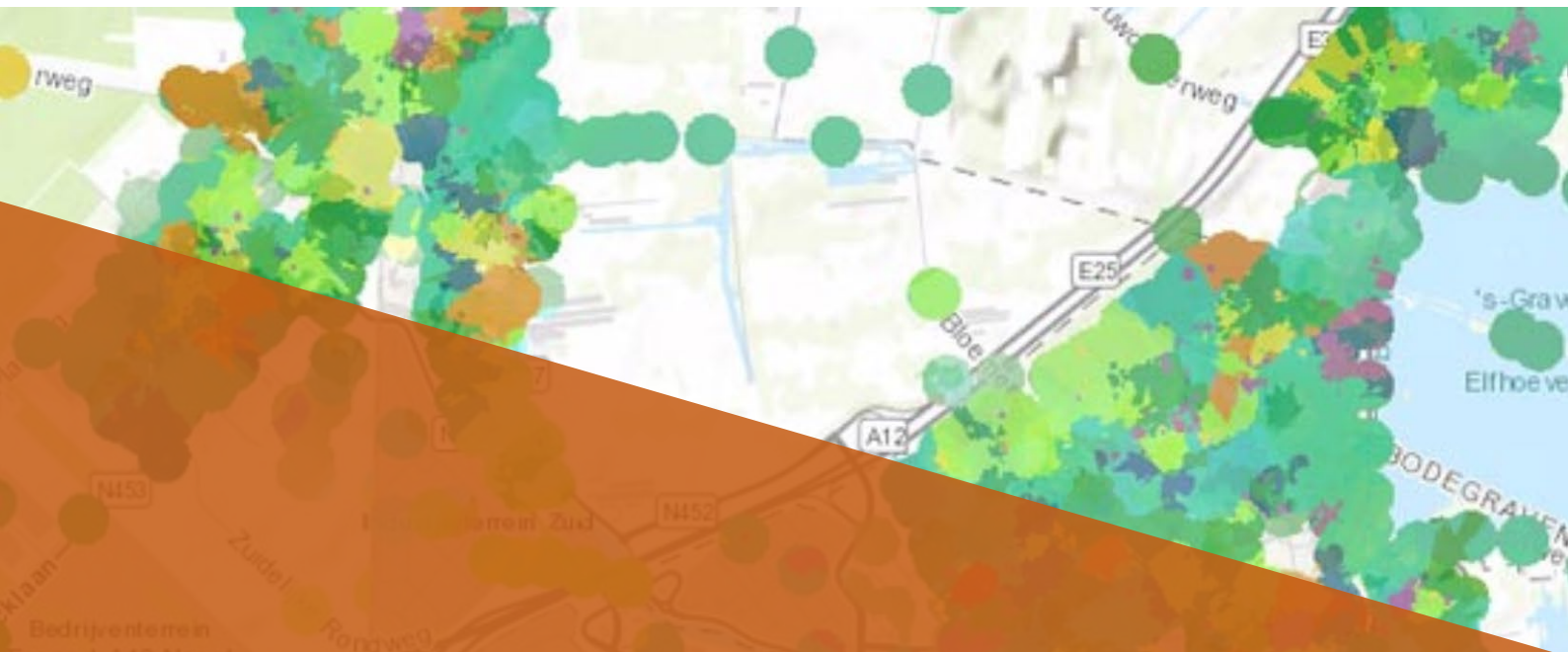
In next chapter is explained which data is used for the quantitative data analysis, and for the qualitative case study.

4. DATA

The previous chapter explained the methodology for this research. It is based on a model in which various variables and factor are combined and connected to come to the expected level of match in 2040. This chapter describes the data (sources) that are used as input for this model, and a division is made between data sources for the qualitative part of this research and the quantitative part of this research.

First, about the data sources for the qualitative part of this research. This could be divided into two parts: existing data and data from interviews. Existing data is a collective term for local data banks, websites, and published documents or reports. The local data banks show the current supply of a neighborhood, the current population of a neighborhood (and their characteristics like household, age and gender) and show the prognosis for the population of a neighborhood. The websites give further information about the current supply, and the published documents and reports give information about the vision and ambition of the policymakers for a neighborhood. Sections 4.1.1., 4.1.2. and 4.1.4. describe the data banks, websites and published documents and reports and explain the links to the variables of this research. Section 4.1.3. describes the interviews as a data source, for this research, to get more knowledge about the future of a neighborhood to establish supply in 2040.

Section 4.2. zoom-in into the quantitative data source that is used for this research. The *Grote Omgevingstest* is implement ed to analyze the demand of the target group. The section describes the selection of a neighborhood category, the outliers and the thresholds of the data set, and ends with the net size of the data set.



SCREENSHOT OF DE GROTE OMGEVINGSTEST: in this figure data of the data set is processed into a map which shows characteristics of residents in an area (Springco Urban Analytics, 2019).

4.1. QUALITATIVE DATA: CASE STUDY

In this research, case studies will be implemented in the model to give insight into the future demand and supply of 55+ housing at a neighborhood scale. Therefore, first, qualitative data is used to determine the current housing stock, the future housing stock, the facilities in the living environment, and the prognosis of the target group. This section describes the data for these parts.

4.1.1. DATA ABOUT THE CURRENT HOUSING STOCK

Existing data is used to determine the current housing stock of the selected neighborhoods. A part of the existing data has been collected on the public data bank websites of the municipalities of where the case studies take place: The Hague and Rotterdam (Den Haag. incijfers.nl and Rotterdam. buurtmonitor.nl). These websites publish detailed data about housing and population per neighborhood per year. For the following variables, data has been collected from these data banks:

- Housing property
- Housing typology
- Ratio new-build and existing housing stock

Another part of the existing data has been collected from other websites than the data banks of the municipalities. Two websites are used to get insight into the supply of care housing. The number of care houses (all concepts) is collected from the website *ZorgkaartNederland*: a public website of the *Patiëntenfederatie Nederland*. This federation represents 200 patiënt- en consumer organizations in the Netherlands and has the goal to make care possible and easy to find (*ZorgkaartNederland*, nb). The second website is called: *Zorgopkaart*. On this website a dataset of TNO is published about the number of adjustable housing. Appendix 1 explains the methodology and assumptions for adjustable housing by TNO. To recap, these two data sources give information about the supply of:

- Care housing

Appendix 3 describes all the data variables in detail. It explains the different options for the variables and the definitions.

4.1.2. DATA ABOUT THE EXISTING FACILITIES IN THE LIVING ENVIRONMENT

This research also includes the facilities in the living environment to determine the demand for people from the age of 55. For this purpose, existing data has been used. Various online data sources are used to collect all the available facilities in the living environment, and these locations are placed in an online google-map to get an overview. Various websites have been used as data sources to establish the number of facilities, of which the following two were used most often: opentot.nl and walkscore.com. These websites show where facilities are located in the neighborhood. The existing data gives information for the following facility variables:

- Sport
- Groceries
- Fashion
- Community center
- General practitioner
- Catering industries
- Culture
- Public transport stops

- Parks/Green

The definitions of these variables are described in appendix 3.

4.1.3. DATA ABOUT THE FUTURE HOUSING STOCK

As written in the methodology, qualitative expert interviews are done to get insight into the future supply of the housing stock, facilities and housing concepts. In appendix 2 shows the elaborations of these interviews. The following topics are discussed and are the foundation on which the questions for the interviews have been prepared:

- Population characteristics: this topic is about the residents of the neighborhood. The population ratio could transform in income, social-economic status, household composition (one-person, two-person and more than two-person household), level of education, gender and age.
- Living environment: this topic is about the area around the place where people are living, including the facilities in the neighborhood like, for example, sport-facilities, general practitioners and grocery shops. Also the mobility according to public transport is discussed.
- Housing stock: this topic implements the size of the housing stock, housing property and housing typology. Next to that, in this topic housing concepts as high rise, CPO and DIY housing are discussed.
- Care and services: this topic is the basis for the discussion about the implementation of the extramuralisation policy for the specific case study area. It is about the types and number of care-housing (concepts) in the neighborhood.

Next to the expert interviews, existing data sources are used to get more insight in the future supply. These existing data sources are vision- and plan documents of the municipality or province of the selected neighborhoods. For *Bouwlust/Vrederust Plan gebied Zuidwest Den Haag* is used. For insight in the future supply in IJsselmonde the following documents have been consulted: *Woonvisie Rotterdam: Koers naar 2030 agenda tot 2020*, *Nationaal plan Rotterdam Zuid Uitvoeringsplan 2019-2022*, *Woonbron: presentatie afspraken 2019*, *Horecagebiedsplan IJsselmonde*, *Detailhandel IJsselmonde* and *Visie 2030 blijvend in beweging*. Appendix 5 summaries these documents.

4.1.4. DATA ABOUT THE TARGET GROUP

Similar to the data about the current housing stock, public data bank websites of the municipalities of The Hague and Rotterdam have been used to collect data about the target group. It shows the current composition of the target group according to household, gender and age and gives prognosis how the population will develop to 2035 according to:

- Household composition
- Age
- Gender

Due to the goal of this research (to get insight into the level of match in 2040), the following formula is used to make a valid assumption of how the population will develop further to 2040:

$$X_{2040} = X_{2019} * (1 + Y)^{2040-2019} \quad (1)$$

In this formula X_{2040} is the population in 2040, X_{2019} is the current population in 2019, and Y is the average growth per year in the period from 2018 to 2035. This formula determines the future size of the households per category and the size of per gender. The size, for both categories, is

determined for the age group between 55 to 74 years old and for the age group of people from the age of 75.

In chapter three (methodology) is explained that this research uses two scenarios. The first scenario is based on the results of the prognoses and complemented with the formula (1), which is shown above. Scenario two is a variant of the first scenario, but with a stronger increase. This means that for category gender a stronger increase in life expectancy for men is expected, relative to scenario 1, which makes that in scenario two the men population becomes even as big as the woman group. For example, table 4.1. shows that in Bouwlust the increase in men (between 55 to 74 years old) is 30,5% in scenario 1 and 35,70% in scenario 2. The bolded percentages show the difference in relative increase between 2019 and 2040.

Table 4.1. The relative increase in population per subgroup to 2040. The increase is relative to the number in 2019. Focused on gender.

Gender	Den Haag Bouwlust/Vrederust			Rotterdam IJsselmonde		
	year	2019	2040	Δ 2019 - 2040	2019	2040
Men (55-74)						
Scenario 1	100,0%	130.05%	30.05%	100,0%	116.2%	16.21%
Scenario 2	100,0%	135.70%	35.70%	100,0%	117.76%	17.76%
Men (75+)						
Scenario 1	100%	137.1%	37.08%	100,0%	152.65%	52.65%
Scenario 2	100%	173.25%	73.25%	100,0%	184.36%	84.36%

Concerning households, scenario two is based on a stronger increase of one-person households than in scenario 1; the assumption is made that the number of one-person households is 120% bigger to 2040 relative to the increase in scenario 1. Table 4.2. shows the results of this stronger increase. The bold percentages show the relative growth between 2019 and 2040. To note: because the total number of households is similar for both scenarios, the number of couples and households with children decreases if one person households increase. For example, in Bouwlust/Vrederust in scenario 1, it is expected that number of one-person households (age between 55 to 74 years) increases with 14,7%, and in scenario 2 the increase for this subgroup is 37,67%. This percentage in scenario 2 is based on the expected number of one-person households in 2040 in scenario 1 multiplied the assumption of 120%.

Table 4.2. The relative increase in population per subgroup to 2040. The increase is relative to the number in 2019. Focused on households

Households	Den Haag Bouwlust/Vrederust			Rotterdam IJsselmonde		
	year	2019	2040	Δ 2019 - 2040	2019	2040
One-person household (55-74)						
#			2530			
Scenario 1	100%	114.7%	14.7%	100%	128.60%	28.60%
#		$2530 * 120\% =$	3036			
Scenario 2	100%	137.67%	37.67%	100%	154.32%	54.32%
One-person household (75+)						
Scenario 1	100%	146.9%	46.9%	100%	130.22%	30.22%
Scenario 2	100%	176.3%	76.3%	100%	156.27%	56.27%
Couple (55-74)						
Scenario 1	100%	90.5%	-9.5%	100%	95.85%	-4.15%

Scenario 2	100%	65%	-35%	100%	69.13%	-30.87%
Couple (75+)						
Scenario 1	100%	213.5%	113.5%	100%	120.44%	20.44%
Scenario 2	100%	123.66%	23.66%	100%	86.87%	-13.13%
With children (55-74)						
Scenario 1	100%	178.8%	78.8%	100%	130.84%	30.84%
Scenario 2	100%	129%	29%	100%	94.37%	-5.63%
With children (75+)						
Scenario 1	100%	269.5%	169.5%	100%	188.79%	88.79%
Scenario 2	100%	194.57%	94.57%	100%	136.17%	36.17%

The impact of the percentage growth per subgroup, for category gender and household, is relative to the size of the groups. Chapter 5 shows in detail the size of the subgroups per case study location.

4.2. QUANTITATIVE DATA ANALYSIS

Next to the more qualitative data, this research also uses quantitative data. This section describes these quantitative data. This data is used to determine the preferences and attractiveness for housing, facilities in the living environment and housing concepts, of people from the age of 55.

4.2.1. DATA SET: DE GROTE OMGEVINGSTEST

This research implements quantitative data of the *De Grote Omgevingstest*. This dataset is realized following a big-scale survey, where people were questioned about their preferences, experience, behavior and decision motives on the field of housing and the living environment. The data collection had taken place between begin of May and the end of July 2018. The respondents are residents living in the province of South-Holland in the Netherlands. In total 48,477 surveys are completed successfully. People are selected randomly; however, it has been controlled that the total sample is representative of the population in the selected province. It is important to note that also people who are looking for a house in the province are implemented in the survey. The people of the sample are informed to participate, beforehand with a personal invest letter, and by texts and advertisements in local newspapers, via an email from social housing corporations, and by motivation by telephone.

There is a threshold determined to be representative. On the scale of municipalities the minimal reliability must be 85% with an accuracy margin of 5%. This threshold results in a minimum of 210 surveys per municipality. In a neighborhood (minimum 1,000 houses) minimal 3% of the households are surveyed: minimal 75 households per 1,000 houses.

SELECTION OF THE DATA SET

This research analyzes two neighborhoods. Both neighborhoods are categorized as residential environments with low- and high rise in the data set of *De Grote Omgevingstest*. Therefore a selection is made in the data: this research only uses the data of people that are living in this neighborhood category. Next to that, a second selection is made about age, in line with the target group: only people who are 55 years old and older are selected. These two selections (neighborhood and age) lead to the net data-set of, in total, 5,863 respondents for this research.

OUTLIERS IN THE SELECTED DATA SET

The respondents filled in the data set their ideal housing preferences and living environment preferences. Some restrictions are made in the data set to keep it realistic: outliers with unrealistic or unfeasible preferences have been deleted. Therefore, three filters are implemented in the dataset:

The first filter is about social housing, which is one of the options for housing in the data set. In the Netherlands people with a relatively high income are not eligible for social housing. Aedes (nb) states that in the Netherlands, households (with two or more people) that earn more than 30,800 euros (in 2019) are excluded for social housing. For this reason, people in the data set with an income higher than 3000 or higher, are filtered out of the data set. The threshold of 3000 euros per month is made because, in the dataset, the lower category is 2500 to 3000 euros per month. So, a part of that group is eligible for social housing.

Table 4.3. Total data set after filtering out the outliers

	Age group 55 to 74	Age group 75 and older	Total
Selected size data set gross	5.129	734	5.863
Number outliers Filter 1	58	0	58
Number outliers Filter 2	22	0	22
Number outliers Filter 3	12	1	13
Selected size data set net	5.037	733	5.770

The second filter in the data set focuses on housing type preferences. People with a relatively low income (lower than 1050 euro per month) have more limitations in their choice for housing typologies. In an urban environment of Rotterdam and The Hague, it is unfeasible to live in a detached house with a relatively low income is unfeasible. People with a relatively low income and with this specific preference for housing are filtered out of the data set.

In line with the second filter, in this research people with a low income (lower than 1050 euros per month) are excluded from private care housing. Private care housing is a relatively expensive kind of care housing, and therefore not financially feasible for this group.

For the last two filters, only people with the age of 55 to 65 are excluded. From the age of 65 people could have a low income because of the AOW but could have more financial possibilities (earned in their working life period) which could be used as additional capital. Table 4.3 shows all the effects of the filters on the data set.

THRESHOLD IN THE SELECTED DATA SET

The number of respondents per subgroup needs to be big enough to get useful results. Therefore there is a threshold of minimal 85 respondents per subgroup in the data. These subgroups are formed with the variables household and age and between gender and age. For two subgroup the threshold of 80 respondents is not reached.

The first subgroup that has not enough response, is the subgroup of women older than 75: in total 56 women have answered the questions about the preferences for facilities in the living environment. Nevertheless, a clear statement can be made out of the limited respondents because 51 of the 56 have answered the same preferences, which gives an applicable preference for this research.

The second subgroup is about people older than 75 in a household with children. In the data set only seven respondents belong to this subgroup, and therefore not possible to establish the preferences for subgroup. For this reason, this subgroup is excluded from this research. Although this group is eliminated, the research about people from the age of 55 is operable because of the size of this eliminated subgroup. In 2019, in Bouwlust/Vrederust 35 of the 13,906 households (0.25%) are a household with children older than 75 years. In 2040, it is expected that 0.9% of the households in Bouwlust belong to this subgroup. In IJsselmonde 158 households of the 30,186 households (0.52%) in 2019 and 0.9% in 2040, belong to this subgroup. So because the size of this subgroup is very small, the possible impact on the results is minimal, and this subgroup could be excluded from this research without problems in the results.

NET SIZE OF THE SELECTED DATA SET PER SUBGROUP

Appendix 4 shows, all the variables of this research. The variables are set up per topic with all the possible options per variable. Table 4.4 shows the net size of the selected data set per subgroup. The subgroup household with children above the age of 75 is excluded from this research because only seven respondents are included in the data set.

Table 4.4. The number of respondents per subgroup for this research. Above Gender and age. Under Household and age.

	Men	Woman	Total
Age 55 – 74	2577	2455	5032
Age 75+	467	264	731
Total	3044	2719	5763

	One person HH	Couple HH	With children HH	Total
Age 55 – 74	578	593	181	1352
Age 75+	58	71	7	136
Total	636	664	188	1488

The total respondents of the topic household and gender are smaller than total number of respondents. Some respondents did not answer the questions about households or gender, and therefore, not used for the topic household or gender.

4.3. CONCLUSION

This research uses various data sources to determine the demand and the supply of people from the age of 55 concerning housing, living environment facilities and housing concepts. Qualitative data is divided into existing data and data from interviews. The existing data give insights into the current supply and the prognosis of the target group. The interviews give insight into the future supply of housing, facilities in the living environment and housing concepts. Next to that, this research used quantitative data to get insights into the preferences and needs of the target group. Table 4.5. shows an overview of the qualitative data and quantitative data linked to the variables.

Table 4.5. Overview of all the different data sources for this research.

Qualitative data	Variables	Source
Data about existing supply	Housing property (2019)	Public data banks of municipalities
	Housing typology (2019)	Public data banks of municipalities
	New-build/ existing housing (2019)	Public data bank of municipalities
	Care housing (2019)	ZorgkaartNederland and ZorgopKaart (TNO)
	Facilities (2019)	Various websites with maps
	Housing concepts (2019)	<i>Unknown</i>
Data about the supply	Housing property (2040)	Expert Interview and plan documents
	Housing typology (2040)	Expert Interview and plan documents
	New-build/ existing housing (2040)	Expert Interview and plan documents
	Care housing (2040)	Expert Interview and plan documents
	Facilities (2040)	Expert Interview and plan documents
	Housing concepts (2040)	Expert Interview and plan documents
Data about the target group	Target group (2019)	Public data banks of municipalities
	Target group (2040)	Public data banks of municipalities (prognosis extrapolated)
Quantitative data		
Data about the demand of the target group		Selection of De Grote Omgevingstest

5. RESULTS

This chapter describes the results of the expected level of match in 2040 according to housing, facilities in the living environment, and housing concepts. These insights are needed to establish to what extent the housing stock and the surrounding living environment suite with the preferences and needs of the 55+ population. A suitable housing stock and living environment for the 55+ population could have a positive impact on the stagnation of the housing market.

In the model the level of match is composed of expected supply in 2040 and the expected demand in 2040 of the 55+ population. This chapter shows, first, the results about the expected supply in 2040, and second the outcomes of the demand of the 55+ population in 2040. This supply will be subtracted from the demand to determine the expected level of match in 2040, which is the last part of this chapter.

This process, of calculating the expected level of match in 2040, is done twice. This research selected two case study locations, which are both categorized as Residential neighborhood with low- and high rise. For both locations, the results are calculated. First, the results for the case-study about Bouwlust / Vrederust, second the results of the case study IJsselmonde are described.

Per case study the results will be described as follows. First, the current supply according to housing and facilities in the living environment is described. Second, the future expected supply of the housing stock and facilities in the living environment in 2040 are added. As next step, the results of the current and future demand will be described. To conclude, the level of match is shown per case study. Section 5.1. shows an overview of all these steps to come to the needed results.



CONCEPT KOP-STAARTWONINGEN: life-cycle housing from 2011. The idea of this project is to create a house with two sides; one with all the primary needed rooms like kitchen, living room and kitchen. The other side, called the 'staart' is the part of the house which is flexible depending on the preferences and needs of the people that are living in the house (manneninderuimte.nl, 2019)

5.1. READING GUIDE RESULTS

This chapter shows the results that give insights into the future level of match. In chapter 3 (Methodology) is explained that the model exists of multiple steps to come to the result. Each step generates a sub-result that contributes to calculating the total level of match. This paragraph gives an overview of all the steps that lead to the final level of match.

Figure 5.1. explains which steps should be taken in this research. It shows that for the supply side, first the current supply is determined (step 1), which contributes to establishing the future supply in step 2. Steps 3 to 6 generate the demand for the 55+ population in 2040. In these steps, a division is made for the demand concerning gender/age and household/age. So, there are two different results for demand. Steps 7 and 8 are about the level of match. This is calculated by subtracting the demand (according to gender/age) or demand (according to household/age) from the expected supply in 2040.

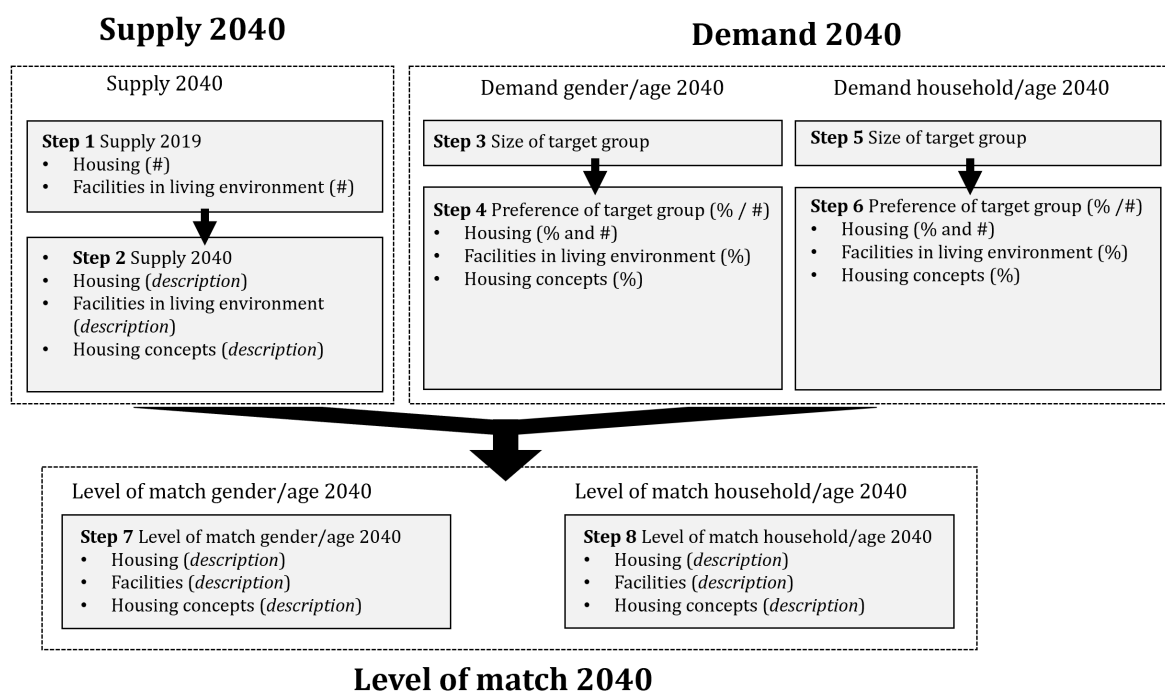


Figure 5.1: Overview of steps to determine the results

In the next sections, the model is used to research two case studies. Each section goes through all the steps, as described in figure 5.1. The two case studies are both neighborhoods categorized as *Neighborhood with low- and high rise*.

5.2. BOUWLUST/VREDERUST

The first case study is about the neighborhood Bouwlust / Vrederust in the southwest of The Hague. This section shows the results of this case study. Starting with the results of the supply, then the demand and finally the expected level of match in 2040.

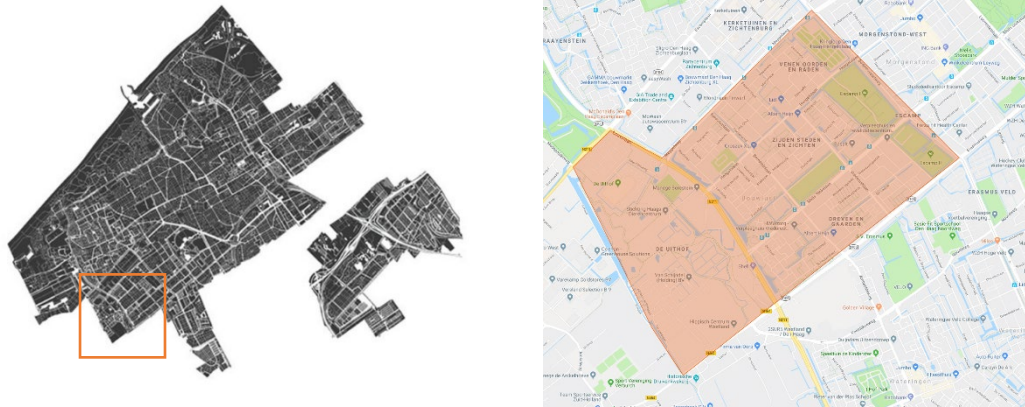


Figure 5.2: Location Bouwlust / Vrederust in The Hague. Left the city of The Hague. Right zoom in into the neighborhood. (Stadskaart and Google maps, 2019)

5.2.1. THE SUPPLY

To determine the level of match, the supply and the demand are needed. This section describes the supply in 2040 concerning housing, facilities in the living environment and housing concepts. First, the current supply is described (step 1), and from that starting point the expected situation in 2040 is described (Step 2).

STEP 1: THE CURRENT SUPPLY

Bouwlust / Vrederust is a neighborhood with relatively a lot of social housing: 66% of the housing stock. 22% are occupied houses, 8% are rental houses for the private market and 1% of the housing stock is unknown. In this neighborhood, one housing type is dominant; 62% of the houses are apartments without an elevator. Most of these are built before 1970 and are four-level apartment complexes (see figure 5.3). 16% are single-family dwellings, of which 5% are corner houses. Only 120 semi-detached houses and 130 detached houses can be found in this neighborhood; together 2% of the total housing stock. These typologies were located at the corner of the neighborhood in the area called De Uithof. Since 2010, 407 new constructions are build, which is 3% of the housing stock. Looking at care housing shows that 4,727 houses (37% of the housing stock) are suitable for living independently without care and services. 134 apartments belong to a housing complex with services, 55 houses are found in a care-housing complex. Private care housing options aren't present in the neighborhood. All results are shown in table 5.1.



Figure 5.3: Cross between the Groenezijde and the Noorderzijde in Bouwlust / Vrederust. Typical 4 level apartment complexes (Google maps, 2019)

Concerning facilities in the living environment the following results are found. On average 7,6 public transport stops per km² can be found, because there are various tram- and bus lines in and at the corner of the neighborhood. Per km², There are on average 2,5 sports facilities: in the southwest, in the northeast and in the middle of the neighborhood is room for sports fields, which explains this result per km². In the neighborhood are two shopping areas present, which result in an average of 1,5 grocery facilities per km². The other facilities have a result of 1,0 or lower per km² on average (see table 5.2).

STEP 2: THE FUTURE SUPPLY

In the Bouwlust / Vrederust, a big-scale restructuring program is planned, which leads to an increase in the density of the housing stock and more attention for occupied housing, resulting in a significant expected increase in the amount of occupied housing. The number of social rent houses and private rent houses will also grow but to a lesser extent. The expectation is that the restructuring program will also lead to a change in the housing typology ratio: a lot of the apartments without elevator will be renovated or reconstructed to apartments with elevator. Therefore the number of apartments with elevator increases strongly and the number of apartments without elevator will therefore decrease. Since room for senior housing is planned, that type will also increase strongly. The restructuring program also gives more room for single-family dwellings as well, which leads to an increase in single-family dwellings and in single-family corner dwellings. Due to the restructuring plans a significant amount of new constructions for housing is expected in the neighborhood and parts of the (old) existing houses will be demolished, to make room for these new developments. For care housing, differences are expected for housing without care and services: more houses will be sufficient for longer independent living. Lastly, the amount of extramural housing with services will increase. Table 5.1. shows the results of the future supply related housing:

Table 5.1: The supply for housing in the Neighborhood Bouwlust / Vrederust. The current supply and the expected changes to 2040 are shown.

Variable	Option	The current supply (#)	Changes for the future supply
Housing property	Owner-occupied housing	3300	Increase
	Social rent housing	8469	Small increase
	Private rent housing	971	Small increase
	Other	151	
Housing type	Ground floor app.	143	Increase
	App./flat with elevator	2428	Strong Increase
	App./flat without elevator	7957	Strong decrease
	Single-family dwelling	1487	Increase
	Semi-detached house	120	No change
	Detached house	130	No change
	Sing family dwelling corner	584	Increase
	Other	42	
	<i>Senior housing</i>		Strong increase
New developments	Existing housing stock	12484	Decrease
	New constructions	407	Strong increase
Care Housing	Without care or services	4727	Strong Increase
	Extramural housing with services	134	Increase
	Private care housing	0	No change
	Extramural care housing	55	No change
	Other		

Focusing on the expected supply of facilities in the living environment the following results are stated. The amount of sports facilities and public transport stops is very good and will not change. The number of grocery stores is good and will increase a little because of the plan to create more retail in the bigger streets of the neighborhood. Because of these improvements at the bigger streets, the score of fashion facilities, catering industry facilities and culture facilities will increase a little and will be more than sufficiently available in the neighborhood. The community centers, parks, and general practitioners will not change in their amount. The following table shows the results of the expected supply of facilities in the living environment:

Table 5.2: The supply for facilities in the living environment in the Neighborhood Bouwlust / Vrederust. The current supply and the expected changes to 2040 are shown.

Facilities in living environment	Density per km ² 2019	Plans to 2040
Facility Sport	2.5	No changes planned
Facility Groceries	1.5	small increase around the bigger streets
Facility Fashion	0.5	small increase around the bigger streets
Facility community center	0.3	No changes planned
Facility general practitioner	0.8	No changes planned
Facility Catering industry	2.0	small increase around the bigger streets and in Uithof
Facility Culture	0.3	Small increase due to the increase in density
Facility PT stop	7.6	unchanged and will be faster
Facility Park	1.0	No changes planned

The last topic of the expected supply in 2040 is housing concepts. As result of the interviews and existing data can be stated that there will be room for housing concepts like shared facilities/living, CPO projects or a combination of both. The expectation is that there will be limited possibilities for transformation and high rise. There is no room for housing concepts on or next to water. The table (Table 5.3) below shows the result for the expected supply of housing concepts.

Table 5.3: The supply for housing concepts in the Neighborhood Bouwlust / Vrederust. The plans to 2040 are shown.

Housing concepts	Plans to 2040
Concept Shared living/facilities	In line with the possibility for CPO also room for shared living in the restructure areas.
Concept water	No plans or room for this concept
Concept DIY housing	Not named as possible concept
Concept CPO	There is room for CPO in the restructure areas.
Concept Transformation	Only transformations planned from older care homes to modern extramural care apartments.
Concept High Rise	Small increase in high rise because of the wanted increase in density

To summarize, it is expected that the supply in 2040 will change compared to 2019 due to the restructuring of the neighborhood, with a strong shift in housing, increase in facilities and more room for various housing concepts.

5.2.2. THE DEMAND

Opposite of the supply is the demand of the neighborhood. In this section the results of this side are shown. As written in chapter 3 (methodology), there are two different approaches, both with two scenarios (as possible demand for 2040 for the case studies). One of the approaches is executed with the variables gender and age and the other approach is executed with the variables households and age.

STEP 3: THE SIZE OF THE TARGET GROUP WITH VARIABLES GENDER AND AGE

As start the size of the target group is determined. Table 5.4 shows the current amount of men and women and the expected amount of men and women in 2040. In scenario 1, it is expected that the rise of men will be stronger than the rise in percentage of women. Both now and in 2040, it is visible that more women than men are in the target group. In scenario 2, the increase of life expectancy of men will be stronger than expected in scenario 1 and the number of men is leveled with the women. The residual group are the people (men and woman) that are younger than 55 years old.

Table 5.4: The size of the population per subgroup in the Neighborhood Bouwlust / Vrederust in 2019 and 2040 for two scenarios.

Population Den Haag Bouwlust/Vrederust			
year	2019	2040	Δ 2019 - 2040
(M55.) Men (55-74)	#	#	#
(M55.S1) Scenario 1	2,571	3,343	+772
	100,0%	130.05%	+30.05%
(M55.S2) Scenario 2	2,571	3,489	+918
	100,0%	135.70%	+35.70%
(W55.) Woman (55-74)			
(W55.S1) Scenario 1	2,767	3,489	+722
	100,0%	126.1%	+26.09%
(W55.S2) Scenario 2	2,767	3,489	+722
	100,0%	126.09%	+26.09%
(M75.) Men (75+)			
(M75.S1) Scenario 1	818	1,121	+303
	100%	137.1%	+37.08%
(M75.S2) Scenario 2	818	1,417	+599
	100%	173.25%	+73.25%
(P4.) Woman (75+)			
(W75.S1) Scenario 1	1,386	1,417	+31
	100,0%	102.25%	+2.25%
(W75.S2) Scenario 2	1,386	1,417	+31
	100,0%	102.25%	+2.25%
Residual group			
Persons (0 - 55)	21,564	20,378	1,186

STEP 4A: PREFERENCES OF THE TARGET GROUP WITH VARIABLES GENDER AND AGE (%)

In step 4A, the size results are multiplied with preferences for the housing stock, facilities in the living environment and housing concepts. These preferences are determined following the Bayesian Belief Network. Figure 5.4 shows the results of this scenario thinking technique concerning gender/age. It shows the outcome of the 'what-if' limitation for men between the age

55 to 74. Figure 5.4A is about the housing preferences, figure 5.4B is about the importance for facilities in the living environment and figure 5.4C is about the attractiveness of housing concepts. These outcome are adaption of the standard networks, which is shown in appendix 8.

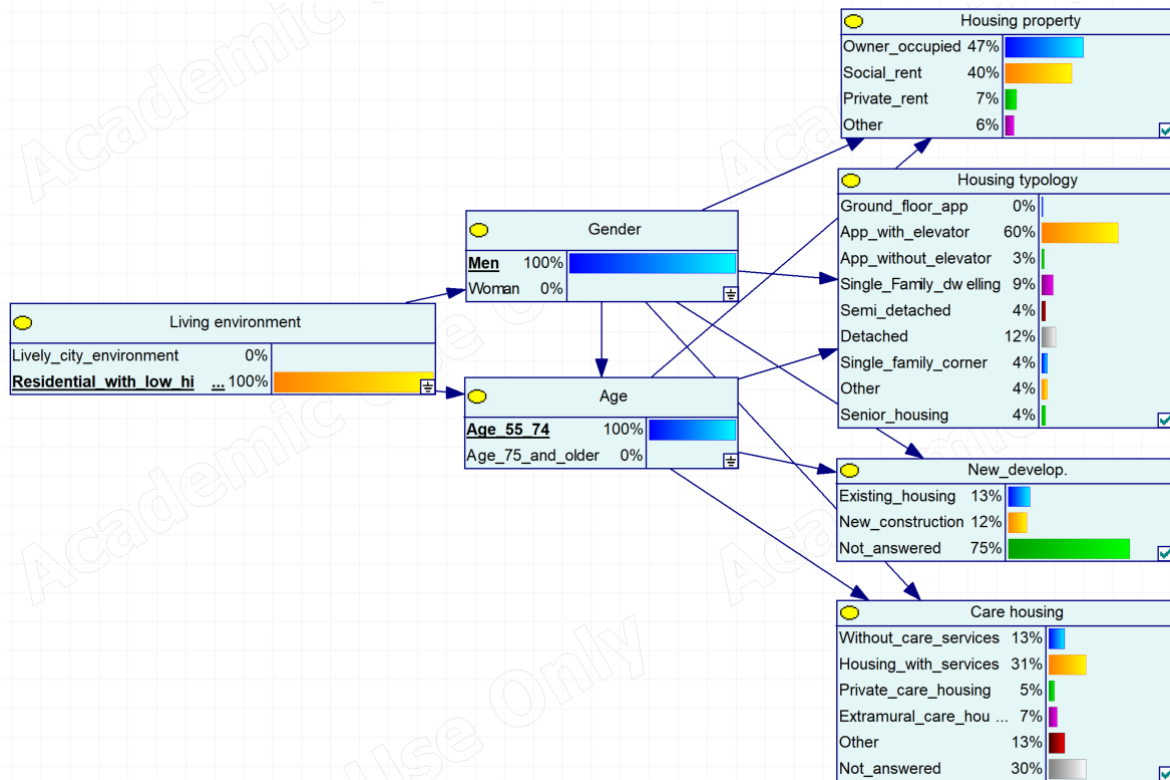


Figure 5.4A: Adaption in the Bayesian Belief Network to identify the preference for housing. In this case, for men between the age of 55 to 74.

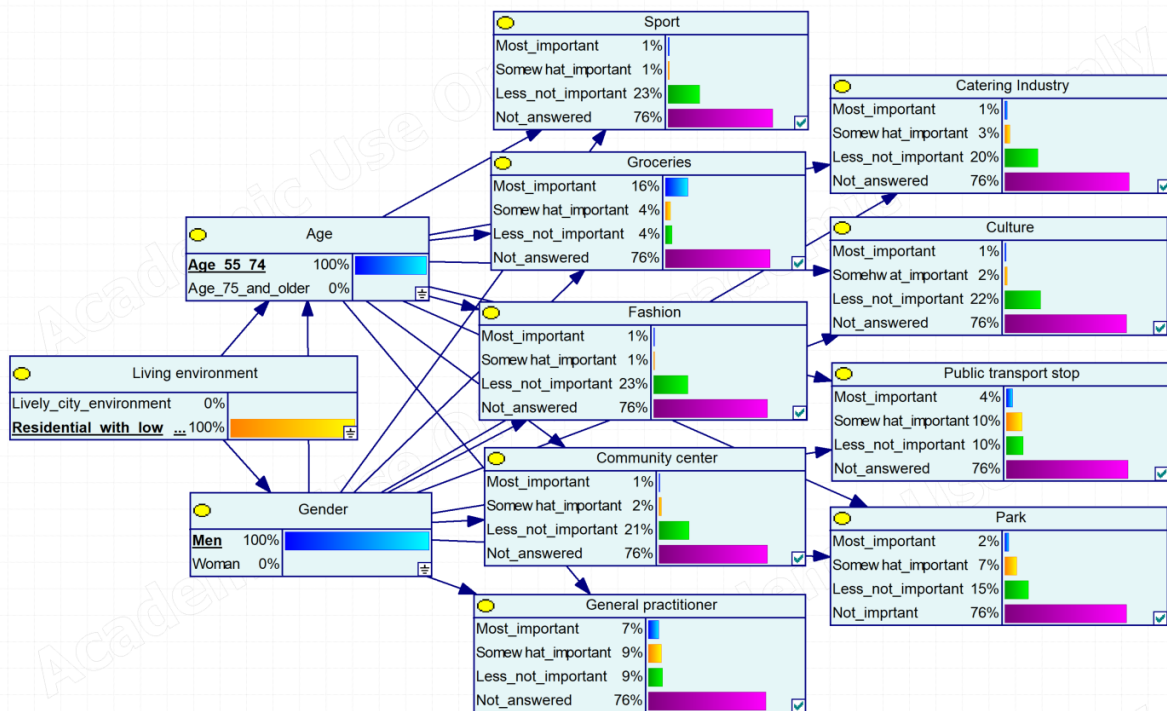


Figure 5.4B: Adaption in the Bayesian Belief Network to identify the importance of facilities in the living environment. In this case, for men between the age of 55 to 74.

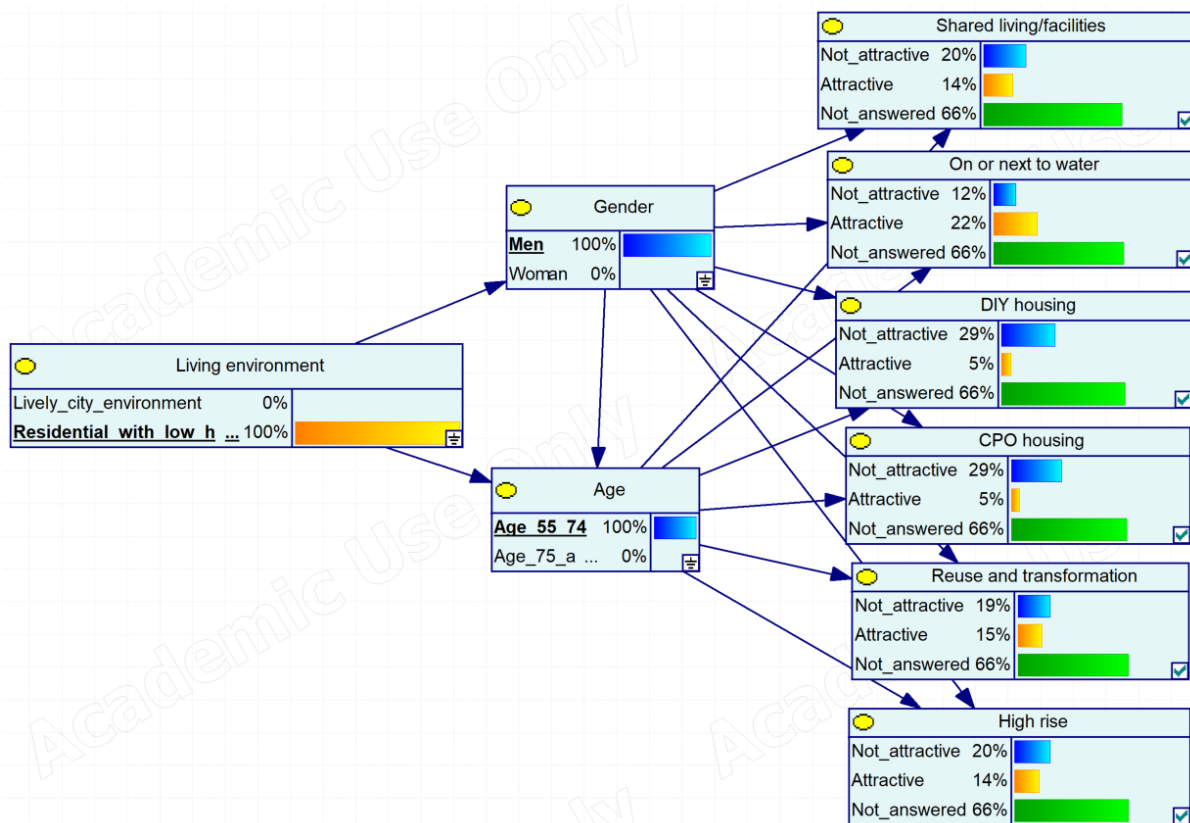


Figure 5.4C: Adaption in the Bayesian Belief Network to identify the attractiveness of housing concepts. In this case, for men between the age of 55 to 74.

In figure 5.4 is shown the results of the Bayesian Belief Network. This network visualizes the preferences for a specific sub-group of the 55+ population, which is in this figure men between 55 to 74 years. This analysis is done for all sub-groups according to gender/age, living in a residential neighborhood with low- and high rise. This results in the outcomes that are explained per topic.

First the topic housing and starting with scenario 1. It is expected in 2040 that 48.5% of the people of the target group have preference to live in a social rent house, followed by 36.9% for occupied housing and 7.0% for private rent housing (the others are unknown). It is expected that 62.1% of the people prefer to live in apartments with elevator, 8.7% want to live in a single-family dwelling, 8.5% prefer a detached house and the other percentages are divided over the other typologies. The result of the preference to live in new construction or in an existing house is almost fifty-fifty. Zooming in on care-housing, it is expected to 2040 that most of the people want to live in extramural housing with services (47.5%). Comparing these results with scenario 2, the ratio of preference for housing property is almost the same. Also the percentages for preferences for housing typologies are the same. Furthermore, the results of preferences of new developments and care housing are similar with scenario 1 as well. The table below shows the demand per variable of housing:

Table 5.5: The expected preferences for housing in 2040 of people from the age of 55 living in Bouwlust / Vrederust, for two scenarios.

Variable	Option	Scenario 1	Scenario 2	
Housing		Demand 2040 (%)	Demand 2040 (%)	Δ Scenario 1 -2 (%)
Housing property	Owner occupied housing	36.9	37.1	+0.2
	Social rent housing	48.5	48.2	-0.3

	Private rent housing	7.0	7.1	+0.1
	Other	7.6	7.5	-0.1
Housing type	Ground floor app.	0.6	0.6	0.0
	App./flat with elevator	62	62.4	+0.4
	App./flat without elevator	2.3	2.2	0.0
	Single family dwelling	8.7	8.6	-0.1
	Semi-detached house	2.6	2.6	0.0
	Detached house	8.5	8.5	-0.1
	Sing family dwelling corner	3.5	3.4	0.0
	Other	5.9	5.8	-0.1
	<i>Senior housing</i>	5.8	5.8	-0.1
New develop.	Existing housing stock	50.8	50.7	-0.1
	New constructions	49.2	49.3	0.1
Care Housing	Without care or services	14.7	14.8	0.1
	Extramural housing services	47.5	47.2	-0.3
	Private care housing	7.1	7.1	0.0
	Extramural care housing	12.5	12.8	+0.3
	Other	18.2	18.1	-0.1

Table 5.6 gives insights in the importance of facilities in the living environment. The importance percentage gives an indication of how many people of the population find it important to have a facility in their (nearby) living environment. High percentages indicate that many people find it important to have this facility in the (nearby) living environment. Looking at the facilities preferences, it is shown that availability of groceries in the living environment is most important, followed by general practitioner and public transport stops. The other facilities are answered as less important. The results shows that the stronger increase in life expectancy of men (difference between scenario 1 and 2) do not give a difference in preferences. The table 5.6 shows the demand for facilities in the living environment.

Concerning the demand for housing concepts, it is found the following two concepts have the highest percentage in attractiveness: the concept of housing on or next to water, and the concept to transform or reuse a building for housing. These concepts are the most attractive in both scenarios, followed by the housing concept in which facilities or even the whole housing is shared. The less attractive concepts are DIY housing (in which people construct their own house) and CPO (Housing concept about developing a housing-complex together). Also for these topics it can be stated that the differences between the scenarios is minimal. Table 5.7. shows the results of the attractiveness of housing concepts.

Table 5.6: The preferences for facilities in the living environment of people from the age of 55 living in Bouwlust / Vrederust, for two scenarios.

Variable	Scenario 1	Scenario 2	Δ Scenario 1 -2 (%)
	Importance 2040 (%)	Importance 2040 (%)	
Facilities in the living environment			
Facility Sport	4.0	4.0	0.0
Facility Groceries	55.3	55.2	-0,1
Facility Fashion	4.1	4.1	0.0
Facility community center	6.1	6.1	0.0
Facility general practitioner	30.5	30.4	-0.1
Facility Catering industry	6.6	6.6	0.0
Facility Culture	5.1	5.1	0.0
Facility PT stop	22.9	22.8	-0.2
Facility Park	12.2	12.2	-0.1

Table 5.7: The preferences for housing concepts of people from the age of 55 living in Bouwlust / Vrederust, for two scenarios.

Variable	Scenario 1		Scenario 2	
	Attractiveness 2040 (%)	Attractiveness 2040 (%)	Attractiveness 2040 (%)	Δ Scenario 1 -2 (%)
Housing concepts				
Concept Shared living/facilities	43.1	42.7		+0.4
Concept water	59.6	59.4		+0.2
Concept DIY housing	12.9	12.9		0.0
Concept CPO	13.7	13.6		+0.1
Concept Transformation	41.9	41.6		+0.3
Concept high rise	33.7	33.7		0.0

STEP 4B: PREFERENCES OF THE TARGET GROUP WITH VARIABLES GENDER AND AGE (#)

In the section about the supply (section 5.2.1.), the housing variables are established in exact numbers (table 5.1). Therefore the demand for the housing variables in this section need to be transformed from percentages into exact values. That is why, these percentages are multiplied with the size of the target group. Per subgroup the preferences are multiplied with the number of people per sub group. The sum of these calculations per subgroup gives the exact value per variable. In table 5.8. the exact expected demand in 2040 for the target group (people from the age of 55) is shown in the first column (*Demand 2040 (from age of 55 year)*) per scenario. Next to that, the demand of people that are not a part of the target group are included in the table (*Residual group*). The demand in 2040 of this residual group also influences the level of match, because these people are also living in the neighborhood and inhabit the houses. Care housing is excluded because of the assumption that the residual group does not play a big role in care housing.

The sum of the demand in 2040 of the target group and the demand of the residual group are both shown in the last column (*Demand incl. 2040*) per scenario. This table shows the ratio of the demand of the target group compared to total demand of the total population in the neighborhood Bouwlust / Vrederust. In the table is shown that the residual group has a relative big impact on the demand for owner-occupied housing. 62% of the people younger than 55 years old have the preference to own a house. The residual group do also influence the housing type ratio. The expected total demand in 2040 for single-family dwelling increases strongly because of this group. For new development the ratio for existing or new-build housing are in line with preferences of the target group.

To recap, the demand (of the target group and for the total population) is relative big for social housing and owner occupied housing. The target group has a strong preference for apartments with elevators and a relative small preference for single-family dwellings. It is the residual group with a relative strong preference for single-family dwellings. For care housing the target group has a relative strong preference for extramural housing with services. Concerning facilities in the living environment, facilities for groceries, general practitioner and public transport are considered important. The most attractive housing concepts on behalf of the target group, are shared housing concept and housing on or next to water.

Table 5.8: The number of people according to the preferences of people from the age of 55 living in Bouwlust / Vrederust, for two scenarios.

Variable	Option	Scenario 1	Scenario 1	Scenario 2	Scenario 2	
		Demand 2040 (from age of 55 year)	Demand incl. 2040	Demand 2040 (from age of 55 year)	Demand incl. 2040	
Housing property	Owner occupied housing	2,726	8,271	2,722	,8267	
	Social rent housing	3,587	6,082	3,542	6,037	
	Private rent housing	518	858	523	863	
	Other	564	1,127	554	1,117	
Housing type	Ground floor app.	48	65	47	65	
	App./flat with elevator	4,562	6,529	4,534	6,501	
	App./flat without elevator	165	452	162	448	
	Single family dwelling	638	2,883	625	2,870	
	Semi-detached house	189	985	188	984	
	Detached house	628	2,578	615	2,564	
	Sing family dwelling corner	256	1,320	250	1,314	
	Other	434	1,016	423	1,004	
	<i>Senior housing</i>	429	429	418	418	
	New developments	Existing housing stock	3,752	7,882	3,703	7,833
		New constructions	3,640	8,453	3,602	8,415
	Care Housing	Without care or services	226	226	229	229
Extramural housing with services		734	734	733	733	
Private care housing		110	110	111	111	
Extramural care housing		193	193	199	199	
Other		280		281		

Table 5.9: The preferences for housing of people younger the age of 55 (residual group) living in Bouwlust / Vrederust.

Residual group (-55 year) in Bouwlust / Vrederust			
Variable	Option	Preference	Demand 2040
Housing property	Owner occupied housing	62%	5,545
	Social rent housing	28%	2,495
	Private rent housing	4%	340
	Other	6%	563
Housing type	Ground floor app.	0%	18
	App./flat with elevator	22%	1,967
	App./flat without elevator	3%	286
	Single family dwelling	25%	2,245
	Semi-detached house	9%	796
	Detached house	22%	1,950
	Sing family dwelling corner	12%	1,064
	Other	7%	581
	<i>Senior housing</i>		
New developments	Existing housing stock	46%	4,130
	New constructions	54%	4,813

STEP 5: THE SIZE OF THE TARGET GROUP WITH VARIABLES HOUSEHOLD AND AGE

Just as for the demand according to the variables gender and age, also for the demand according to households and age the target group needs to be established, so that the demand for housing, facilities in the living environment and housing concepts can be determined. In table 5.10, the target group is split out in different kind of households and different age group. The sum of these subgroup gives the total target group: the expected number of households per subgroup in 2040.

For scenario 1 is shown that the one-person households in the age category 55 to 74 increases with 14.7% into 2040, to 2,530 households. The number of couples in this age group is decreased in 2040 with -9.5%. It is expected that the number of households with children in this target group will increase strongly: 78%. For households from the age of 75 and older is shown that all 3 subgroups will increase. The one-person households and households with children will increase relative strongly, but the strongest increase can be found for couple households (113.5%). Important to note is that these increases are relative, since the amount of households of the older age group is smaller than the younger group. In scenario 1, the age group between 55 to 75 years holds 4816 households and the older group from the age of 75 have 2,579 households. For scenario 2: 4,686 in the first age group and 2,708 in the second age group.

Table 5.10: The target group according to households and age in 2019 and 2040 of Bouwlust / Vrederust,

Households Den Haag Bouwlust / Vrederust			
year	2019	2040	Δ 2019 - 2040
(OPH55.) One-person household (55-74)	#	#	
(OPH55.S1) Scenario 1	2205	2530	+325
	100%	114,7%	+14,7%
(OPH55.S2) Scenario 2	2205	3036	+831
	100%	137,67%	+37,67%
(OPH75.) One-person household (75+)			
(OPH75.S1) Scenario 1	1205	1770	+565
	100%	146,9%	+46,9%
(OPH75.S2) Scenario 2	1205	2125	+920
	100%	176,3%	+76,3%
(CH55.) Couple (55-74)			
(CH55.S1) Scenario 1	966	874	-92
	100%	90,5%	-9,5%
(CH55.S2) Scenario 2	966	631	-335
	100%	65%	-35%
(CH75.) Couple (75+)			
(CH75.S1) Scenario 1	417	714	+297
	100%	213,5%	+113,5%
(CH75.S2) Scenario 2	417	516	+99
	100%	123,66%	+23,66%
(WCH55.) With children (55-74)			
(WCH55.S1) Scenario 1	790	1412	+622
	100%	178,8%	+78,8%
(WCH55.S2) Scenario 2	790	1020	+230
	100%	129%	+29%
Residual group (0 - 55)	8262	8943	

STEP 6A: PREFERENCES OF THE TARGET GROUP WITH VARIABLES HOUSEHOLD AND AGE (%)

In this step results of the size (step 5) are multiplied with preferences for housing, facilities in the living environment and housing concepts. This step is similar with step 4A in this research. The preferences are analyzed with the Bayesian Belief Network. Figure 5.5 shows an adaption of the standard network and give the result of the subgroup one-person household between 55 to 74 years old. The standard network is the basis of which this adaptations are done, and is shown in appendix 8.

Figure 5.5A shows an visualization of the preference of the 55+ population living in Bouwlust / Vrederust. Figure 5.5B indicates a overview of the importance that facilities are nearby in the living environment for this 55+ population, and figure 5.5C shows the demand for housing concepts.

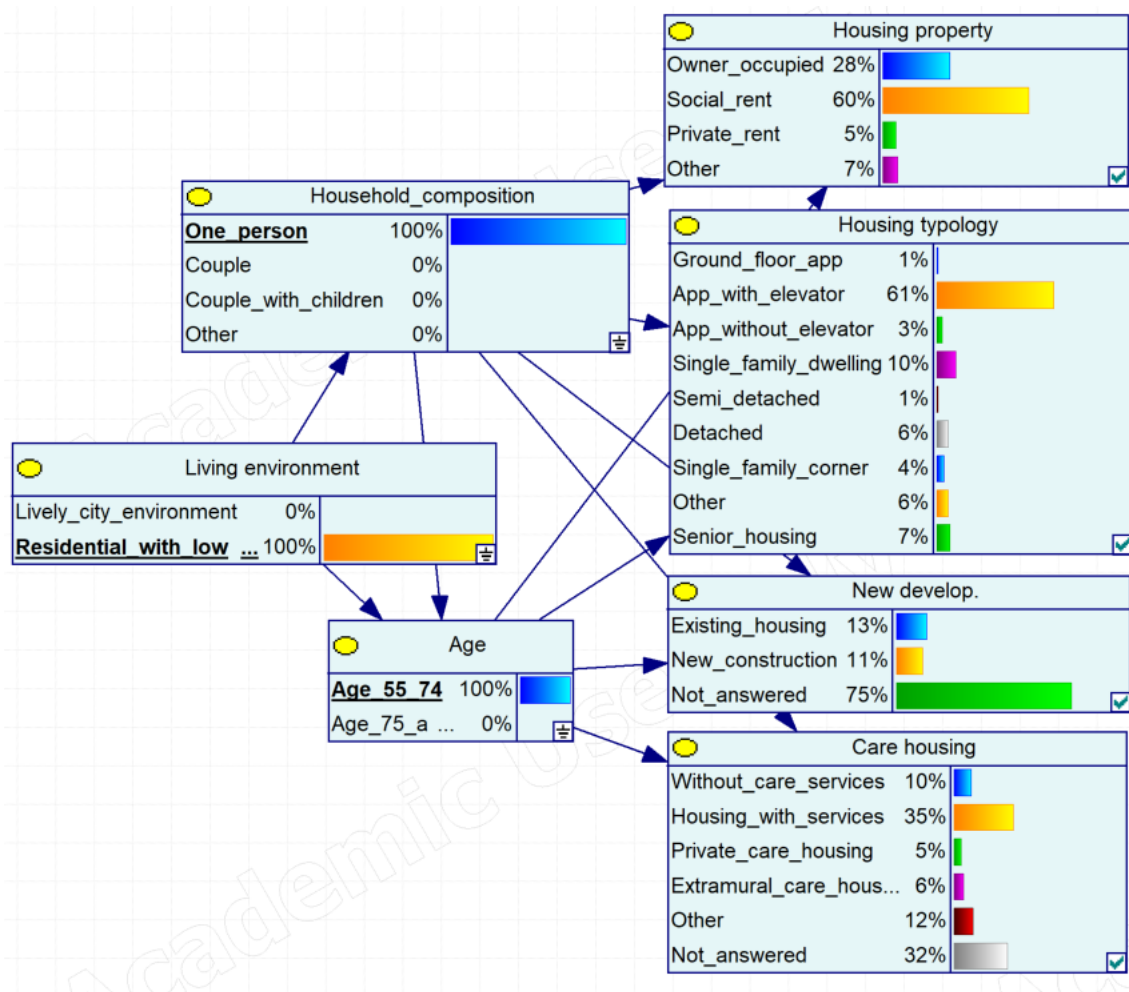


Figure 5.5A: Adaption in the Bayesian Belief Network to identify the preference for housing. In this case, for one-person household between the age of 55 to 74.

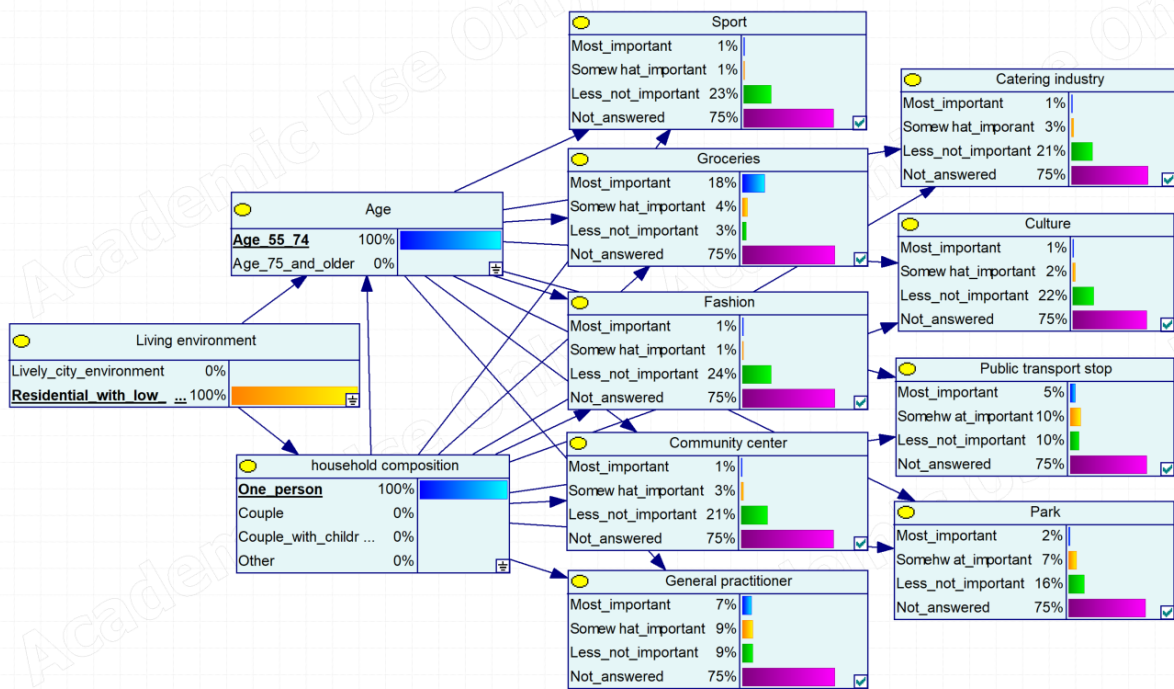


Figure 5.5B: Adaption in the Bayesian Belief Network to identify the importance of facilities in the living environment. In this case, for one-person household between the age of 55 to 74.

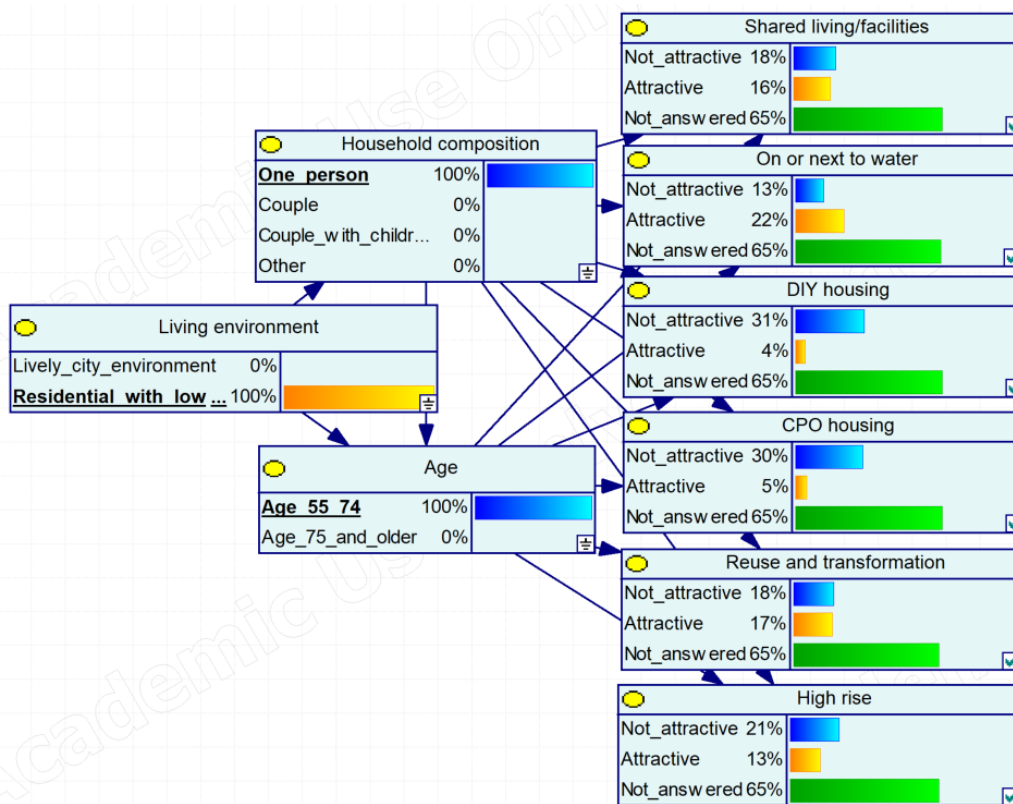


Figure 5.5C: Adaption in the Bayesian Belief Network to identify the attractiveness of housing concepts. In this case, for one-person household between the age of 55 to 74.

These networks are used to indicate the demand per subgroup according to household/age. In the example (figure 5.5) the results are linked to the subgroup: one-person household between 55 to 74 years. For this research, all the subgroup are analyzed in this network. The results are described per topic, starting with the topic housing.

First the results of scenario 1: more than half of the people prefer to live in social housing, followed by 32.9% that prefer to live in an owner occupied house. Most people would like to live in an apartment with elevator (60.4%) and only 13.8% prefers to live in a single family dwelling (combined with corner houses). The preferences for new-build house instead of an existing house is almost 50%. For care housing a strong preference is shown for extramural housing with services (46.8%) and 19% for others (e.g. living in house with family). Comparing scenario 1 with scenario 2, it is shown that there is a small difference in housing property: more people prefers social housing (+2.1%). There is also an increase in demand visible for apartments with elevator (+1.3%). No differences (more than 1%) are visible for new developments and care housing.

Table 5.11: The preferences for housing of people from the age of 55 for two scenarios. According households/age.

Variable	Option	Scenario 1	Scenario 2	
Housing		Demand 2040 (%)	Demand 2040 (%)	Δ Scenario 1 -2 (%)
Housing property	Owner occupied housing	32.9	30.8	-2.1
	Social rent housing	52.1	54.2	+2.1
	Private rent housing	7.5	7.5	0.0
	Other	7.5	7.5	0.0
Housing type	Ground floor app.	0.9	0.9	0.0
	App./flat with elevator	60.4	61.8	+1.3
	App./flat without elevator	2.3	2.3	+0.1
	Single family dwelling	9.5	8.9	-0.5
	Semi-detached house	2.5	2.1	-0.4
	Detached house	7.9	7.3	-0.6
	Sing family dwelling corner	4.3	4.0	-0.3
	Other	6.3	6.2	-0.1
	<i>Senior housing</i>	6.0	6.5	+0.5
New develop.	Existing housing stock	52.0	51.9	-0.1
	New constructions	48.0	48.1	+0.1
Care Housing	Without care or services	14.2	13.9	-0.3
	Extramural housing services	46.8	47.1	+0.3
	Private care housing	7.6	7.7	+0.1
	Extramural care housing	13.4	13.7	+0.3
	Other	18.0	17.5	-0.5

Looking at facilities in the living environment the following demand is expected in 2040: starting with scenario 1 is shown that most households answered that groceries facilities in the living environment are considered most important (55.2%), followed by the general practitioner (29.5%). Compared to scenario 2, minimal differences are visible.

Table 5.12: Demand for facilities in the living environment for 55+ population in Bouwlust / Vrederust, for two scenarios. According households/age.

Variables	Scenario 1	Scenario 2	
	Importance 2040 (%)	Importance 2040 (%)	Δ Scenario 1 -2 (%)
Facilities in living environment			
Facility Sport	4.1	4.0	-0.1
Facility Groceries	55.2	55.3	+0.1
Facility Fashion	3.9	4.0	+0.1
Facility community center	6.2	6.4	+0.2
Facility general practitioner	29.5	29.2	-0.3
Facility Catering industry	6.6	6.7	+0.1
Facility Culture	4.1	4.4	+0.3
Facility PT stop	21.5	21.5	+0.0
Facility Park	12.9	12.4	-0.5

According to the housing concepts, in scenario 1 the most attractive housing concept is housing on or next to water, followed by shared living/facilities and housing concept of transformation. Housing concept water has a score of 58.7%, which means that 58.7% of the 55+ population find concepts attractive. The concepts of DIY housing and CPO are less attractive for the 55+ population living in residential neighborhood with low and high rise, due to the fact that on 13.5% of the target group state this concept is attractive for them. Comparing these results of scenario 1 with scenario 2, there are found some differences. It shows that the attractiveness decrease for housing concept water, DIY housing and CPO housing concepts. In other words it, the demand of these three housing concepts decrease if the trend of individualism increase stronger than in scenario 1. The housing concepts of shared facilities/living, transformation and high rise become more attractive in scenario 2.

Table 5.13: The preferences for housing concepts of people from the age of 55 living in Bouwlust / Vrederust, for two scenarios. According households and age.

Variables	Scenario 1	Scenario 2	
	Attractiveness 2040 (%)	Attractiveness 2040 (%)	Δ Scenario 1 -2 (%)
Housing concepts			
Concept Shared living/facilities	43.1	43.7	-0.6
Concept water	58.7	57.9	+0.8
Concept DIY housing	13.5	12.6	+0.9
Concept CPO	13.5	12.7	+0.8
Concept Transformation	42.4	43.1	-0.7
Concept high rise	33.7	34.2	-0.5

STEP 6B: PREFERENCES OF THE TARGET GROUP WITH VARIABLES HOUSEHOLD AND AGE (#)

Similar as the results for gender/age, the outcomes for housing variables are transformed into exact values (table 5.14). The percentages are multiplied with the size of the target group. Per subgroup the preferences are multiplied with the number of people per sub group. The sum of these calculations per subgroup gives the exact value per variable. In table 5.14. the exact expected demand in 2040 for the target group (people from the age of 55) is shown in the first column (*Demand 2040 (from age of 55 year)*) per scenario. Next to that, in this table also the residual group is included due to the fact this group also influence the demand for housing in 2040 in the neighborhood Bouwlust / Vrederust.

The sum of the demand 2040 of the target group and the demand of the residual group are shown in the last column together (*Demand incl. 2040*) per scenario. This table shows the ratio of the demand of the target group compared to total demand of the total population in the neighborhood Bouwlust / Vrederust.

Table 5.14: The demand in 2040 for scenario 1 and 2. With a calculation exclusive and inclusive the residual group, living in Bouwlust / Vrederust. According households and age.

Variable	Option	Scenario 1	Scenario 1	Scenario 2	Scenario 2	
		Demand 2040 (from age of 55 year)	Demand incl. 2040	Demand 2040 (from age of 55 year)	Demand incl. 2040	
Housing property	Owner occupied housing	2,406	7,951	2,262	7,807	
	Social rent housing	3,806	6,301	3,973	6,468	
	Private rent housing	548	888	553	893	
	Other	548	1,112	548	1,112	
Housing type	Ground floor app.	64	82	67	85	
	App./flat with elevator	4,407	6,374	4,520	6,488	
	App./flat without elevator	164	450	172	458	
	Single family dwelling	693	2,937	655	2,900	
	Semi-detached house	182	978	152	948	
	Detached house	577	2,526	531	2,481	
	Sing family dwelling corner	311	1376	290	1354	
	Other	458	1039	454	1035	
	<i>Senior housing</i>	435	435	475	475	
	New developments	Existing housing stock	3,797	7,927	3,804	7,934
		New constructions	3,504	8,317	3,523	8,336
	Care Housing	Without care or services	231	231	231	231
		Extramural housing with services	761	761	783	783
Private care housing		124	124	129	129	
Extramural care housing		218	218	228	228	
Other		293		291		

Table 5.15: The preferences of the residual group in 2040 living in Bouwlust / Vrederust. According households and age.

Residual group (-55 year) in Bouwlust / Vrederust			
Variable	Option	Preference	Demand 2040
Housing property	Owner occupied housing	62%	5,545
	Social rent housing	28%	2,495
	Private rent housing	4%	340
	Other	6%	563
Housing type	Ground floor app.	0%	18
	App./flat with elevator	22%	1,967
	App./flat without elevator	3%	286
	Single family dwelling	25%	2,245
	Semi-detached house	9%	796
	Detached house	22%	1,950
	Sing family dwelling corner	12%	1,064
	Other	7%	581
<i>Senior housing</i>			

The results of the demand for housing variables including the residual group shows that the number of owner-occupied housing increases strongly to a total of 7,951 in scenario 1 and 7,807 in scenario 2. Also the number of social housing increases strongly because of the residual group. In total the biggest demand for housing typologies is for apartments with elevator. This typology is not the biggest preference for the residual group (22%). In other words, the target group (55+) influences the demand for apartments with elevator strongly. The preferences of the residual group lead to a strong increase in demand for single family dwelling and for detached housing.

5.2.3. LEVEL OF MATCH

Now that the results of the supply and the demand are established, the level of match could be made. In this section the supply and demand will be compared which gives the result of the level of match for the variables housing, facilities in the living environment and housing concepts. There are 4 results: 1) the level of match focusing on gender age in scenario 1, 2) the level of match focusing on gender and age in scenario 2, 3) the level of match focusing on households and age in scenario 1 and 4) the level of match focusing on households and age in scenario 2. The following table 5.16 shows the level of match according to housing, table 5.17 shows the level of match according to facilities in the living environment and table 5.18 shows the level of match according to housing concepts. The outcomes in the tables show the level of match in 2040 without intervention. The last column shows the expected invention which influences the level of match positively or negatively.

Table 5.16: The expected level of match in 2040 in Bouwlust / Vrederust of housing.

Variable	Option	Gender S1	Gender S2	Households S1	Household S2	For all options
Housing		Level of Match 2040	Level of Match 2040	Level of Match 2040	Level of Match 2040	Plans to 2040
Housing property	Owner occupied housing	-4971	-4967	-4651	-4507	Increase
	Social rent housing	2387	2432	2168	2001	Small increase
	Private rent housing	113	108	83	78	Small increase
	Other	-976	-966	-961	-961	0
Housing type	Ground floor app.	78	78	61	58	Increase
	App./flat with elevator	-4101	-4073	-3946	-4060	Strong Increase
	App./flat without elevator	7505	7509	7507	7499	Strong decrease
	Single family dwelling	-1396	-1383	-1450	-1413	Increase
	Semi-detached house	-865	-864	-858	-828	No change
	Detached house	-2448	-2434	-2396	-2351	No change
	SFD corner	-736	-730	-792	-770	Increase
	Other	-974	-962	-997	-993	0
	Senior housing	-429	-418	-435	-475	Strong increase
	New dev.	Existing housing stock	4602	4651	4557	4550
New constructions		-8046	-8008	-7910	-7929	Strong increase
Care Housing	Without care or services	4501	4498	4496	4496	Strong Increase
	Extramural services	-600	-599	-627	-649	Increase
	Private care housing	-110	-111	-124	-129	No change
	Extramural care housing	-138	-144	-163	-173	No change
	Other					

Table 5.17: The expected level of match in 2040 in Bouwlust / Vrederust of facilities in the living environment.

Variable	Gender S1	Gender S2	Households S1	Household S2	For all options
Facilities in the Living environment	Level of Match 2040	Level of Match 2040	Level of Match 2040	Level of Match 2040	
Facility Sport	5 (4%)	5 (4%)	5 (4%)	5 (4%)	No changes planned
Facility Groceries	4 (55%)	4 (55%)	4 (55%)	4 (55%)	small increase around the bigger streets
Facility Fashion	3 (4%)	3 (4%)	3 (4%)	3 (4%)	small increase around the bigger streets
Facility community center	3 (6%)	3 (6%)	3 (7%)	3 (7%)	No changes planned
Facility general practitioner	2 (30%)	2 (30%)	2 (30%)	2 (29%)	No changes planned
Facility Catering industry	5 (7%)	5 (7%)	5 (7%)	5 (7%)	small increase around the bigger streets and in Uithof (hotel)
Facility Culture	3 (5%)	3 (5%)	3 (4%)	3 (4%)	Small increase due to the increase in density
Facility PT stop	5 (23%)	5 (23%)	5 (21%)	5 (21%)	unchanged and will be faster
Facility Park	3 (12%)	3 (12%)	3 (13%)	3 (12%)	Unchanged and high importance to keep this level of green

Table 5.18: The expected level of match in 2040 in Bouwlust / Vrederust of housing concepts.

Option	Gender S1	Gender S2	Households S1	Household S2	For all options
Housing Concepts	Attractiveness 2040	Attractiveness 2040	Attractiveness 2040	Attractiveness 2040	
Concept Shared living/facilities	quite attractive (43%)	quite attractive (43%)	quite attractive (43%)	quite attractive (44%)	and it is expected there are possibilities to implement
Concept water	Quite attractive (60%)	quite attractive (60%)	quite attractive (59%)	quite attractive (58%)	but no possibilities expected
Concept DIY housing	Not to less attractive (13%)	Not to less attractive (13%)	Not to less attractive (14%)	Not to less attractive (13%)	but not named as possible concept
Concept CPO	Not to less attractive (14%)	Not to less attractive (14%)	Not to less attractive (14%)	Not to less attractive (13%)	and it is expected there are possibilities to implement
Concept Transformation	quite attractive (42%)	quite attractive (42%)	quite attractive (42%)	quite attractive (43%)	and limited possibilities to implement (only care housing)
Concept high rise	Limited Attractive (34%)	Limited Attractive (34%)	Limited Attractive (34%)	Limited Attractive (34%)	and limited possibilities to implement

The next paragraphs explain the results of this research. It is divided in level of match according to gender (step 7) and according to households (step 8). Starting with level of match according to gender.

STEP 7: LEVEL OF MATCH ACCORDING TO GENDER

This section describes the results of the level of match focusing on gender and age in scenarios 1 and 2. First, the results show that the differences between the two scenarios are minimal. It could be concluded that the outcomes are almost similar. Therefore, the following descriptions about the results concerning gender/age, apply to both scenarios.

There is far too less owner-occupied housing available in the housing stock. Although the level of match will decrease leading up to 2040 due to plans of policymakers, still shortages are expected for owner-occupied housing. For social housing it is the opposite is expected. The supply for social housing is bigger than the demand, and it is expected that up to 2040 the number of social houses will increase more. The difference between supply and demand for private rent housing is minimal in 2040. Looking to housing typologies, there are big shortages for apartments with elevator, and there is an overplus for apartments without elevator. It is expected that this mismatch will become much smaller, because of strong investments in apartments with elevator up to 2040. There is a mismatch for detached housing (more than 2000); however the results about the residual group show that this mismatch is mainly because of the strong demand of the residual group for detached housing. The same applies to single-family dwellings because most of the expected shortages could be linked to the residual group. It is expected that restructuring plans will increase the number of single-family dwellings, which in turn decreases the expected shortages. For new-build houses it is stated that there is a big mismatch to be expected in 2040 if no new developments are taking place. The prediction is a shortage of 8000 houses; however a strong increase is taking place, the shortages will limit in 2040. Concerning care housing, it is expected there are too many houses without care, and this number will probably increase even more up to 2040. On the contrary, there is a negative mismatch for the other care housing options. The expected demand for extramural housing with services is higher than the expected supply in 2040, but plans are limited.

The level of matches for facilities in the living environment is scored per facility in a range from 1 to 5. This score is depending on the importance and number of facilities. There is a good match expected for sports facilities, grocery facilities, public and transport facilities. The score for sport is 5 because there are relative many sports facilities and there is low demand. In other words, the facilities are more than sufficiently available in the neighborhood. For grocery facilities is expected that up to 2040 the supply will increase more, which leads to a better level of match. Notable is that the number of general practitioner facilities does not match with the importance level of the target group. People of the target group found it relatively important to have a general practitioner nearby in the living environment. However there are relatively few general practitioners located in Bouwlust / Vrederust, and there are no changes expected for this facility into 2040. The facilities' culture and fashion have a score of 3. The prediction is that this score will increase to 2040 due to the construction plans of policymakers for the neighborhood.

Table 5.18 shows the level of match concerning housing concepts. It indicates that the housing concepts water is most attractive to implement for the target group. However, a big mismatch is expected in 2040 because there are no possibilities to implement this concept. A match is expected for the concept of shared living/facilities in 2040 because 43% of the target group states these concepts are attractive, and the policymakers indicate that there is room for this concept. There is also a match expected for DIY housing: with a score of 13% this concept is less attractive, and the policymakers have no plans to strive for this concept in 2040. The concept of CPO has the

same attractiveness; however, policymakers have the ambition to create room for this concept in 2040, which leads to an expected mismatch in 2040. For the housing concepts called transformation and high-rise, some level of match is expected in 2040 because of the limited attractiveness and the limited plans to implement this concept in 2040.

STEP 8: LEVEL OF MATCH ACCORDING TO HOUSEHOLD

This section explains the level of match, shown in tables 5.16, 5.17 and 5.18, concerning household/age. Other than for the scenarios of gender/age, bigger changes are found between the scenarios of household/age. The results, including the differences, will be explained per topic.

Starting with the topic of housing. It shows that the level of match for owner-occupied housing is very negative. However it is expected that these shortages will be limited up to 2040 due to plans of policymakers, but still the expectation is that the level of match will be negative in 2040. The difference between scenario 1 and scenario 2 is that if the number of one-person households increases stronger, the negative mismatch for owner-occupied housing decreases with 150 houses in 2040. This difference in level of match between the scenarios is reflected in social housing. The level of match for social rent housing is positive but will decrease in an overplus if one-person households increase stronger, as shown in scenario 2. For the variables concerning housing typologies no significant differences between the two scenarios of households are shown. For housing typologies, it is stated that there is a negative mismatch expected between apartments with an elevator and a positive mismatch expected for apartments without elevator. Although it is expected that the range in mismatch will decrease strongly for both kinds of apartments because of scheduled restructuring plans. The level of match of single-family dwelling is negative but will be smaller in mismatch in 2040, also due to the restructuring plans. For detached housing there is a big mismatch expected, and this mismatch will not change up to 2040. This mismatch is primarily due to preference of the residual group and not because of the target group. The mismatch pattern for new developments is similar to outcomes for gender: there is a stronger demand for new-build than the expected supply in 2040 (depending on the number of new developments). When it comes to care-housing, the differences between the scenarios are minimal. There is a strong positive mismatch expected for housing without care or services and a negative mismatch expected for extramural with services. This negative mismatch for extramural with services will decrease because of the increase in the supply for this variable up to 2040.

Looking at the facilities in the living environment, the differences between the scenarios are minimal. The outcomes depending on household are similar to the outcomes depending on gender. It shows that the biggest negative mismatch is for facility of general practitioner: these are considered relatively important but are on average not located nearby in the neighborhood. This lack of general practitioner facilities results in a score 2 (out of 5), and the prediction is that this will not change up to 2040. The outcomes for facilities for sports, groceries and public transport are most positive. It is expected that the number of these facilities is (very) good in 2040, with a score 4 or 5 (out of 5).

The last topic is housing concepts. The outcomes in the level of match of housing concepts depending on households are almost the same with the outcomes in the level of matches depending on gender. Differences between the scenarios are minimal, as well. It is shown that housing concept water is the most attractive but not named as possible concept up to 2040, which results in a negative mismatch. CPO is the least attractive, however it is expected there will be possibilities to implement this concept up to 2040, which results in an overplus.

5.2.4. CONCLUSION

In section 5.2., is explained the results concerning the level of match for the case study location Bouwlust / Vrederust. The level of match is researched in two ways: according to gender/age and household/age. The results indicate that the outcomes depending on household/age are relatively similar to the outcomes depending on gender/age. For both approaches the following outcomes are found:

It is expected that there are multiple positive mismatches in 2040, which means an overplus, and there are numerous negative mismatches in 2040, which indicate a shortage. Restructuring plans up to 2040 will affect the expected mismatches; however, it will not solve all the mismatches. Concerning the topic housing, the most significant negative mismatches are expected for owner-occupied housing, apartments with elevators, new build houses and extramural housing with services. Looking at facilities in the living environment the biggest negative mismatch is expected for the facility general practitioner. For housing concepts, the biggest negative mismatch is expected for housing on or next to water in Bouwlust / Vrederust in 2040.

Scenario thinking has shown that a stronger increase in life expectancy of men will not have impact on the level of matches in the case study about Bouwlust / Vrederust in 2040. The trend of individualism has minimal effect on the level of match and is found in the results.

5.3. IJSSELMONDE

The second case study is about the city district IJsselmonde in the south of Rotterdam. IJsselmonde consists of Oud-IJsselmonde, Groot-IJsselmonde, Beverwaard and Lombardijen. This section describes the results of this case study. Starting with the supply, followed by the demand and then finally the expected level of match in 2040.

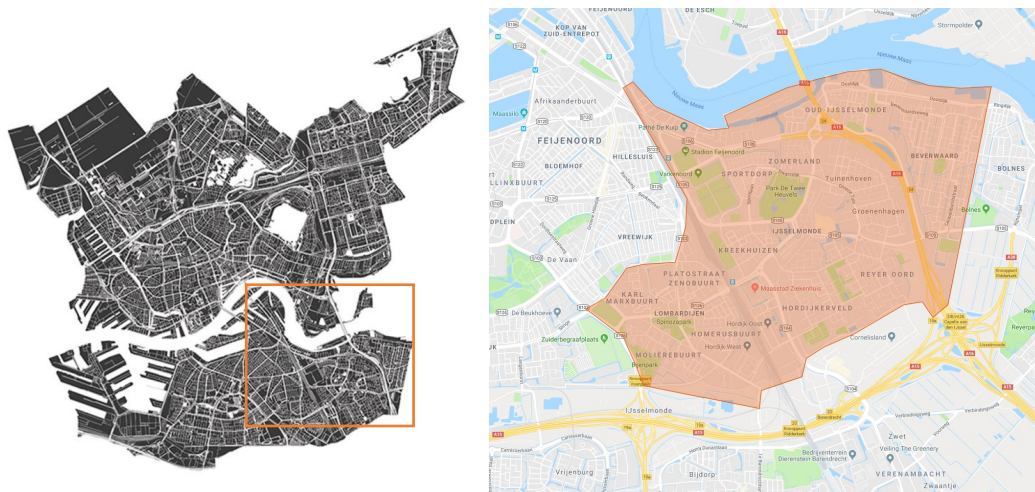


Figure 5.6: Location IJsselmonde in Rotterdam. Left the city of Rotterdam. Right a zoom into the neighborhood. (Stadskaart and Google maps, 2019)

5.3.1. THE SUPPLY

The expected level of match in 2040 is calculated by comparing the supply and demand for the variables housing, facilities in the living environment and housing concepts. In this section the supply for IJsselmonde is described in 2019 and the expected supply in 2040.

STEP 1: THE CURRENT SUPPLY

In IJsselmonde, most of the houses are social housing (49%). Approximately one-third is owner-occupied housing (35%), and with 16% private rent housing is the smallest group of housing property. More than half of the housing stock consists of apartments or flats (56%). 25% of the housing stock are apartments or flats with an elevator and 31% are apartments or flats without elevator. Circa 26% of the housing stock are single-family dwellings. There are only a few semi-detacheds or detached houses in the neighborhood of IJsselmonde. Since 2010, 954 houses were developed, and therefore only 3% of the housing stock is categorized as new constructions. When it comes to care-housing, in the neighborhood, there are more than 16,000 houses suitable for living without care or services, 506 extramural housing with services, 104 private care houses, and 774 extramural care houses. All the exact numbers are shown in table 5.19.



Figure 5.7: Cross between the Liviusstraat and the Sophoclesstraat in IJsselmonde. Typical 5 level apartment complexes. (Google maps, 2019)

The second topic of the supply is about the facilities in the living environment. Table 5.20 shows the number of facilities per km². In IJsselmonde, there are relatively many sports facilities (4.6 per km²) and public transport stops (5.0 km²), of which two train stops (Lombardijen and Stadion). There is, on average more than one grocery facility per km² (1.4) and almost three catering industry facilities per square kilometer. The other facilities are less than one per square kilometer on average in IJsselmonde.

STEP 2: THE FUTURE SUPPLY

The municipality called IJsselmonde is a so-called 'pivot point' neighborhood. There is a risk for degradation of the livability in the neighborhood. Therefore, restructuring plans are ongoing or will take place in the future, which influences the supply to 2040. This section describes the expected line of the future supply.

Let's take a look at the topic of housing first. In 2019, social housing is a big part of the housing stock. In the restructuring plans of the municipality, the number of social housing will decrease, and the number of private rental housing will strongly increase because the policymakers state that there is a shortage of housing for the middle segment in the neighborhood. The focus for upgrading the middle segment will be on rental housing, and the number of owner-occupied housing will increase minimally to 2040. Concerning housing typologies, the municipality strives to keep the ratio single-family dwellings and multi-family dwellings in line with the current ratio. Therefore the number of single-family dwellings will increase to a minimal extent: mainly in the development area called Feyenoord city. The number of apartments without elevator will decrease and make place for more apartments with elevator and senior housing in IJsselmonde. This plan is already in progress, but due to the extramuralisation policy it is expected that this will continue up to 2040. This policy of extramuralisation leads to a strong increase in housing without care or services. Next to that, the is expected that the number of extramural housing with services will increase up to 2040. All these plans described above will lead to an increase in new constructions and, therefore, to a decrease in the existing housing stock.

Table 5.19: The supply for housing in the Neighborhood IJsselmonde. The current supply and the expected changes to 2040 are shown.

Variable	Option	The current supply (#)	Changes for the future supply
Housing property	Owner-occupied housing	9,981	Small increase
	Social rent housing	13,918	Decrease
	Private rent housing	4,686	Strong increase
	Other	93	
Housing type	Ground floor app.	1,868	No change
	App./flat with elevator	7,098	Increase
	App./flat without elevator	8,880	Decrease
	Single-family dwelling	7,003	Small increase
	Semi-detached house	567	No change
	Detached house	274	No change
	Sing family dwelling corner	2,465	Small Increase
	Other	523	
	<i>Senior housing</i>		Strong increase
New developments	Existing housing stock	27,724	Decrease
	New constructions	954	Increase
Care Housing	Without care or services	16,811	Strong Increase
	Extramural housing with services	506	Increase
	Private care housing	104	No change
	Extramural care housing	774	No change
	Other		

The second topic is about the facilities in the living environment. Table 5.20 shows that not many plans need to be expected up to 2040, which will increase the density of the facilities. The prediction is that sports will be more diverse and flexible and, therefore, it is expected that sports facilities will be more multifunctional, so there is no change expected in the density of sports facilities but rather in the multifunctionality of these facilities. When it comes to grocery and fashion facilities, the municipality strives for good management to make sure good quality of these facilities is continued. There is no change in quantity expected to 2040. It is expected that the number of community centers will increase because of the concepts of *Ouderen Hubs* and *Feyenoord Hubs* in Rotterdam. In IJsselmonde it is likely that the number of catering industry facilities will rise up to 2040 because the municipality wants to increase the livability with plans for more catering industry in the neighborhood. There are no changes planned for culture and public transport. According to parks, it is important to retain the green atmosphere in IJsselmonde, but no change in quantity.

Table 5.20: The supply for facilities in the living environment in the Neighborhood IJsselmonde.

Facilities in living environment	Density per km ² 2019	Plans to 2040
Facility sport	4.6	No changes expected
Facility groceries	1.4	No changes expected
Facility Fashion	0.9	No changes expected
Facility community center	0.3	Increase
Facility general practitioner	0.2	No changes planned
Facility catering industry	2.9	Small increase
Facility culture	0.3	No changes planned
Facility PT stop	5.0	No changes planned
Facility park	0.7	No changes planned

The last topic is housing concepts (Table 5.21). There are relatively small plans for shared living. This type is only named in combination with new possible care housing concepts. For housing concepts on water, no plans are expected due to the strength of the *Nieuwe Maas*. DIY housing is not named as a possible concept, while CPO is mentioned and thus possible up to 2040. It is expected that transformation concept has limited possibilities: it is mentioned that in mixed-used areas, shops could be transformed into other functions, where old care homes and old schools are pointed as possible transformational objects. There are no plans for high rise in IJsselmonde: it is not in line with the current character of the neighborhood.

Table 5.21: The supply for housing concepts in the Neighborhood IJsselmonde. The plans to 2040 are shown.

Housing concepts	Plans to 2040
Concept Shared living/facilities	Small increase is noted, combined with new concepts for care housing
Concept water	No plans or room for this concept
Concept DIY housing	Not named as possible concept
Concept CPO	There is room for CPO
Concept Transformation	Only transformations planned from older care homes and in mixed use areas from shops to other functions.
Concept High Rise	No plans for this concept

To recap, the restructuring plans of IJsselmonde will create a difference between the current and the future supply of the neighborhood. There will be a decrease in the ratio of social rent housing and a strong increase in private housing. The ratio of single-family dwellings and multi-family dwellings will not change, but the extramuralisation policy will give another ratio in housing typologies due to the ambition to have more elderly-proof housing. In general, the number of facilities will not change strongly, and the possibilities for specific housing concepts are limited, except for CPO.

5.3.2. THE DEMAND

In the previous section, the supply for housing, facilities in the living environment and housing concepts were described. In this section the demand of the target group will be explained. The demand will be determined with two approaches (with both two scenarios): one demand dependent on gender/age and the other demand dependent on household/age. This is similar to the case study about Bouwlust / Vrederust in The Hague.

STEP 3: THE SIZE OF THE TARGET GROUP WITH VARIABLES GENDER AND AGE

To start, the size of the target group is determined. Table 5.22 shows the current number of men and women and the expected amount of men and women in 2040 in IJsselmonde. In scenario one is expected that the growth of men will be stronger than the growth of women, but it still is expected that the total women population is bigger. In scenario two, the growth of men's life expectancy is increased to the same level as women: in this scenario men and women will have the same life expectancy and, therefore the same size as target group.

Table 5.22: The size of the population per subgroup in the neighborhood IJsselmonde in 2019 and 2040 for two scenarios.

Population Rotterdam IJsselmonde			
year	2019	2040	Δ 2019 - 2040
(M55.) Men (55-74)	#	#	#
(M55.S1) Scenario 1	6,338	7,365	+1,027
	100.0%	116.2%	16.21%
(M55.S2) Scenario 2	6,338	7,464	+1,126
	100.0%	117.76%	17.76%
(W55.) Woman (55-74)			
(W55.S1) Scenario 1	6,577	7,464	+887
	100.0%	113.48%	13.48%
(W55.S2) Scenario 2	6,577	7,464	+887
	100.0%	113.48%	13.48%
(M75.) Men (75+)			
(M75.S1) Scenario 1	2,046	3,123	1,077
	100.0%	152.65%	52.65%
(M75.S2) Scenario 2	2,046	3,772	1,726
	100.0%	184.36%	84.36%
(P4.) Woman (75+)			
(W75.S1) Scenario 1	3,381	3,772	391
	100.0%	111.57%	11.57%
(W75.S2) Scenario 2	3,381	3,772	391
	100.0%	111.57%	11.57%
Residual group			
Persons (0 - 55)	50,148	50,0926	-778

STEP 4A: PREFERENCES OF THE TARGET GROUP WITH VARIABLES GENDER AND AGE (%)

These sizes per subgroup are multiplied with the preferences for housing, facilities in the living environment and housing concepts. The results according to the topic housing are shown in table 5.23. The scenario 1 column below exhibits that social housing has the biggest demand (48.8%). Apartments with elevator are the biggest group in demand according to housing types. The ratio new-build and existing houses are almost similar. For care housing it is stated that there is a big demand for extramural housing with services (47.3%). Comparing scenario 1 with scenario 2, there are small differences. It shows that the demand for apartments with elevator increase more, with 0.4%, and the demand for extramural housing decrease with 3%. This decrease leads to an increase of 3% in extramural care housing.

Table 5.23: The expected preferences for housing in 2040 of people from the age of 55 living in IJsselmonde.

Variable	Option	Scenario 1	Scenario 2	
Housing		Demand 2040 (%)	Demand 2040 (%)	Δ Scenario 1 -2 (%)
Housing property	Owner-occupied housing	36.3	36.1	-0.1
	Social rent housing	48.8	48.9	0.0
	Private rent housing	7.2	7.3	+0.1
	Other	7.7	7.7	0.0

Housing type	Ground floor app.	0,7	0.7	0.0
	App./flat with elevator	62.6	62.9	+0.4
	App./flat without elevator	2.2	2.2	0.0
	Single-family dwelling	8.4	8.4	-0.1
	Semi-detached house	2.5	2.5	0.0
	Detached house	8.3	8.2	-0.1
	Sing family dwelling corner	3.4	3.4	0.0
	Other	5.9	5.9	-0.1
	<i>Senior housing</i>	5.9	5.9	-0.1
New develop.	Existing housing stock	50.7	50.6	-0.1
	New constructions	49.3	49.4	+0.1
Care Housing	Without care or services	14.6	14.6	+0.1
	Extramural housing services	47.3	47.1	-0.3
	Private care housing	7.1	7.1	0.0
	Extramural care housing	13.0	13.3	+0.3
	Other	17.9	17.9	-0.1

The following table (5.24) shows the expected preferences in 2040 for facilities in the living environment of expected target group. It shows that the proximity of groceries, general practitioner and public transport are the most important facilities for the target group. The differences between the scenarios are minimal.

Table 5.24: The expected preferences for facilities in the living environment in 2040 of people from the age of 55 living in IJsselmonde, for two scenario.

Variables	Scenario 1	Scenario 2	
Facilities in the living environment	Importance 2040 (%)	Importance 2040 (%)	Δ Scenario 1 -2 (%)
Facility sport	4.0	4.0	0.0
Facility groceries	55.2	55.1	-0,1
Facility fashion	4.1	4.1	0.0
Facility community center	6.2	6.2	0.0
Facility general practitioner	30.3	30.2	-0.1
Facility catering industry	6.6	6.6	0.0
Facility culture	5.1	5.1	0.0
Facility PT stop	22.7	22.5	-0.2
Facility park	12.0	11.8	-0.1

Table 5.25 exhibits the preferences for housing concepts. The most attractive concepts is housing on or next to water, with respectively 58.7% in scenario 1 and 58.5% in scenario 2. Less attractive are the housing concepts DIY housing and CPO housing (around 13%). In the last column is calculated the differences between the scenarios: the differences are small with the biggest range for concept of sharing (0.4%).

Table 5.25: The expected preferences for housing concepts in 2040 of people from the age of 55 living in IJsselmonde, for two scenario.

Variable	Scenario 1	Scenario 2	
Housing concepts	Attractiveness 2040 (%)	Attractiveness 2040 (%)	Δ 2019 – 2040 (%)
Concept Shared living/facilities	42.8	42.4	+0.4
Concept water	58.7	58.5	+0.2
Concept DIY housing	12.6	12.6	0.0
Concept CPO	13.3	13.1	+0.2
Concept Transformation	41.5	41.2	+0.3
Concept high rise	33.5	33.4	+0.1

STEP 4B: PREFERENCES OF THE TARGET GROUP WITH VARIABLES GENDER AND AGE (#)

The section about the supply of the topic housing showed that the results are established in exact numbers instead of percentages. Therefore the demand for housing in table 5.23 will also be transformed into exact numbers. The results of this transformation are shown in table 5.26. In this table also the residual group (population of IJsselmonde with age between 0-54) is implemented in the columns *Demand incl.*, since this group also influences the demand for housing in IJsselmonde. Table 5.27 shows the preferences of the residual group.

It is shown that the residual group has a relatively big impact on the demand for owner-occupied housing: 62% of the residual group have the preference to live in owner-occupied houses (more than 10,000 people). The demand for apartments with elevator was already big according to the target group, but also relative many people from the residual group have preference for this housing type (22%), which leads to a relative big demand. The demand of the residual group leads to a relative big demand for single-family dwellings (incl. corner houses) and detached houses.

To summarize, the demand for owner-occupied housing is the biggest of the variable housing property, but it is the residual group that makes up this big demand. The most popular housing type apartments with an elevator. And according to care housing, there is a big demand for extramural housing with services. For facilities, the most important variables are groceries, general practitioners and public transport. The most attractive housing concepts are DIY housing and CPO.

Table 5.26: The number of people that have preferences for housing variables. IJsselmonde. Two scenarios.

Variable	Option	Scenario 1	Scenario 1	Scenario 2	Scenario 2
		Demand 2040 (from age of 55 year)	Demand incl. 2040	Demand 2040 (from age of 55 year)	Demand incl. 2040
Housing property	Owner occupied housing	4,315	14,564	4,299	14548
	Social rent housing	5,810	10,422	5,813	10425
	Private rent housing	857	1,486	874	1502
	Other	916	1,958	913	1954
Housing type	Ground floor app.	79	112	79	113
	App./flat with elevator	7,400	11,037	7,440	11077
	App./flat without elevator	261	790	258	786
	Single family dwelling	998	5,147	990	5,139
	Semi-detached house	298	1,769	297	1,768
	Detached house	983	4,586	970	4,574
	Sing family dwelling corner	400	2,368	396	2,363
	Other	702	1,776	694	1,769
	<i>Senior housing</i>	702	702	695	695
	New developments	Existing housing stock	6,031	13,666	6,022
New constructions		5,862	14,757	5,870	14,766
Care Housing	Without care or services	379	379	387	387
	Extramural housing with services	1,129	1,229	1,242	1,242
	Private care housing	185	185	189	189
	Extramural care housing	337	337	350	350
	Other	465		472	

Table 5.27: The preferences for housing of the residual group (population younger than 55 year) living in IJsselmonde.

Residual group (-55 year) in IJsselmonde			
Variable	Option	Preference	Demand 2040
Housing property	Owner occupied housing	62%	10,249
	Social rent housing	28%	4,612
	Private rent housing	4%	628
	Other	6%	1,041
Housing type	Ground floor app.	0%	33
	App./flat with elevator	22%	3,637
	App./flat without elevator	3%	529
	Single family dwelling	25%	4,149
	Semi-detached house	9%	1,471
	Detached house	22%	3,604
	Sing family dwelling corner	12%	1,967
	Other	7%	1,074
<i>Senior housing</i>			
New developments	Existing housing stock	46%	7,634
	New constructions	54%	8,896

STEP 5: THE SIZE OF THE TARGET GROUP WITH VARIABLES HOUSEHOLD AND AGE

Next to the demand with the variables gender and age, also the demand with the variables household and age is calculated in this research. In this section these results are shown and explained per table. In table 5.28, the target group is split out in different kinds of households and different age groups. The sum of these subgroups gives the total size of the target group: the expected number of households per subgroup in 2040.

It is exhibited that in scenario one the number of one-person households (55 to 74 years) increases with 28,60% to 2040, and the number of one-person households (75+) increases with 30,22% to 2040 in IJsselmonde. The number of couples (between age of 55 to 74) decreases a little and the number of couples (75+) increases with 241 households to 2040. The size of households with children (55-74 years) increases with 30,84%. In scenario 2, the increase of the number of one-person households is stronger compared to scenario 1. This stronger increase of one-person households leads to a stronger decrease in number of couple households and households with children: the total number of households stays equal because the number of houses in IJsselmonde does not change between the scenarios.

Table 5.28: The target group according to household and age in 2019 and 2040 of IJsselmonde for two scenarios.

Household Rotterdam IJsselmonde			
year	2019	2040	Δ 2019 - 2040
(OPH55.) One-person household (55-74)	#	#	
(OPH55.S1) Scenario 1	2389	3072	683
	100%	128,60%	28,60%
(OPH55.S2) Scenario 2	2389	3686	1298
	100%	154,32%	54,32%
(OPH75.) One-person household (75+)			
(OPH75.S1) Scenario 1	2961	3856	895
	100%	130,22%	30,22%

(OPH75.S2) Scenario 2	2961	4627	1666
	100%	156,27%	56,27%
(CH55.) Couple (55-74)			
(CH55.S1) Scenario 1	1452	1392	-60
	100%	95,85%	-4,15%
(CH55.S2) Scenario 2	1452	1004	-448
	100%	69,13%	-30,87%
(CH75.) Couple (75+)			
(CH75.S1) Scenario 1	1181	1423	241
	100%	120,44%	20,44%
(CH75.S2) Scenario 2	1181	1026	-155
	100%	86,87%	-13,13%
(WCH55.) With children (55-74)			
(WCH55.S1) Scenario 1	1420	1858	438
	100%	130,84%	30,84%
(WCH55.S2) Scenario 2	1420	1340	-80
	100%	94,37%	-5,63%
Residual group (0 - 55)	8262	8943	

STEP 6A: PREFERENCES OF THE TARGET GROUP WITH VARIABLES HOUSEHOLD AND AGE (%)

These outcomes are multiplied with the preferences for housing, facilities in the living environment and housing concepts. Table 5.29 shows the results of the demand according to housing. For scenario one it is stated that more than 50% of the people prefer to live in social housing (52.4%). Most of the people have the preference to live in apartments or flats with elevator (62.2%) and according to care housing almost half of the people prefer to live in extramural housing with services. The results for scenario 2 are comparable with scenario 1. However, some differences are shown between the scenarios: increase in one-person households in the target group (difference between scenario1 and scenario 2) leads to an increase in preference for social housing and a decrease for owner-occupied housing. Also the demand for apartments with elevator increases a little (1.2%).

The second topic is about facilities in the living environment. The demand for this topic (according to the variables household and age) is shown in table 5.30. It shows that the target group thinks that most important facilities in the living environment are groceries, general practitioners and public transport. The differences between the scenarios are minimal.

Table 5.31 shows the demand concerning topic three: housing concepts. It shows that housing concept water is the most attractive concept for the target group of this research, in both scenarios. The least attractive housing concepts are DIY housing and CPO housing. The differences between the scenarios are for all variables minimal, but the relatively biggest differences can be found for the variables: Concept water and DIY housing. In other words, if the number of one-person households increase stronger than expected, the attractiveness for housing concepts water and DIY housing decreases the most. Concepts shared living/facilities, transformation and high rise become more attractive.

Table 5.29: The preferences for housing of target group in IJsselmonde, for two scenarios. According to household and age

Variable	Option	Scenario 1	Scenario 2	
Housing		Demand 2040 (%)	Demand 2040 (%)	Δ Scenario 1 -2 (%)
Housing property	Owner occupied housing	31.9	29.9	-2.1
	Social rent housing	52.4	54.4	+2.0
	Private rent housing	8.0	8.1	+0.1
	Other	7.6	7.6	0.0
Housing type	Ground floor app.	0.9	0.9	0.0
	App./flat with elevator	62.2	63.4	+1.2
	App./flat without elevator	2.1	2.2	+0.1
	Single family dwelling	8.6	8.1	-0.6
	Semi-detached house	2.3	1.9	-0.4
	Detached house	7.5	6.9	-0.6
	Sing family dwelling corner	3.9	3.6	-0.3
	Other	6.2	6.1	-0.1
	<i>Senior housing</i>	6.3	6.8	+0.5
	New develop.	Existing housing stock	51.5	51.3
New constructions		48.5	48.7	+0.2
Care Housing	Without care or services	14.0	13.6	-0.4
	Extramural housing services	46.4	46.6	+0.3
	Private care housing	7.7	7.8	+0.1
	Extramural care housing	13.5	14.8	+0.4
	Other	17.5	17.1	-0.4

Table 5.30: The preferences for facilities in the living environment of target group in IJsselmonde, for two scenarios. According to household and age

Variables	Scenario 1	Scenario 2	
Facilities in the living environment	Importance 2040 (%)	Importance 2040 (%)	Δ Scenario 1 -2 (%)
Facility sport	4.1	4.0	-0.1
Facility groceries	54.6	54.7	0.0
Facility fashion	4.0	4.0	0.0
Facility community center	6.5	6.7	+0.2
Facility general practitioner	29.1	28.7	-0.4
Facility catering industry	6.8	6.9	+0.1
Facility culture	4.2	4.4	+0.3
Facility PT stop	20.7	20.6	-0.1
Facility park	12.1	11.6	-0.5

Table 5.31: The preferences for housing concepts of target group in IJsselmonde, for two scenarios. According to household and age

Variables	Scenario 1	Scenario 2	
Housing concepts	Attractiveness 2040 (%)	Attractiveness 2040 (%)	Δ Scenario 1 -2 (%)
Concept Shared living/facilities	42.3	43.0	-0.7
Concept water	56.6	55.6	+1.0
Concept DIY housing	12.8	12.0	+0.8
Concept CPO	12.2	11.5	+0.7
Concept Transformation	41.3	42.0	-0.7
Concept high rise	33.1	33.5	-0.4

STEP 6B: PREFERENCES OF THE TARGET GROUP WITH VARIABLES HOUSEHOLD AND AGE (#)

The last step gives the exact numbers of the demand for housing, since the supply of housing is also in exact numbers instead of in percentages. Next to that, the demand of the residual group for housing is also added to get the total demand for housing in IJsselmonde, because people younger than 55 years old also affect the total demand. It shows that owner-occupied housing is the most popular option of housing property. Although this demand is strongly influenced by the residual group. The preferences of the residual group also lead to a stronger demand for single-family dwellings and detached housing.

Table 5.32: The demand in 2040 for scenario 1 and 2 according to housing. The demand is shown inclusive the residual group and exclusive the residual group.

Variable	Option	Scenario 1	Scenario 1	Scenario 2	Scenario 2	
		Demand 2040 (from age of 55 year)	Demand incl. 2040	Demand 2040 (from age of 55 year)	Demand incl. 2040	
Housing property	Owner occupied housing	3,700	13,949	3,487	13,735	
	Social rent housing	6,078	10,690	6,356	10,967	
	Private rent housing	931	1,559	944	1,572	
	Other	884	1,925	888	1,929	
Housing type	Ground floor app.	102	135	107	140	
	App./flat with elevator	7,224	10,860	7,418	11,055	
	App./flat without elevator	249	777	260	789	
	Single family dwelling	1,002	5,151	944	5,093	
	Semi-detached house	270	1,741	228	1,699	
	Detached house	866	4,469	805	4,409	
	Sing family dwelling corner	452	2,419	422	2,389	
	Other	719	1,794	718	1,792	
	<i>Senior housing</i>	726	726	793	793	
	New developments	Existing housing stock	5,971	13,605	5,992	13,627
		New constructions	5,629	14,525	5,692	14,587
	Care Housing	Without care or services	399	399	400	400
Extramural housing with services		1,323	1,323	1,371	1,371	
Private care housing		219	219	230	230	
Extramural care housing		413	413	437	437	
Other		500	0	503	0	

To summarize: This section showed the demand for housing, facilities in the living environment, and housing concepts in two ways: one based on the variables gender and age, and one based on the variables household and age. There is a high demand for owner-occupied housing and social housing and, apartments with elevator. Concerning care housing, extramural housing with services is relatively popular for the target group in IJsselmonde. Looking at the facilities, groceries, general practitioners, and public transport are all important facilities to have nearby in the living environment according to the target group. For the topic housing concepts, housing on or next to water is the most attractive option. DIY housing and CPO are by far the least attractive housing concepts for the 55+ population in IJsselmonde.

5.3.3. THE LEVEL OF MATCH

In the previous sections, the supply and demand according to housing, facilities in the living environment and housing concepts are described. In this section, the supply and demand are compared to give insights into the level of match. The level of match is shown in four columns: according to gender in scenario 1, according to gender in scenario 2, according to household in scenario 1 and according to household in scenario 2. The last column gives insights into the expectations of how the supply will develop up to 2040.

Three tables are shown below, which exhibit the level of match per topic. In the next pages, the level of match according to gender and the level of match according to household will be explained.

Table 5.33: The expected level of match of housing in 2040 in IJsselmonde.

Variable	Option	Gender S1	Gender S2	Households S1	Household S2	For all options
Housing		Level of Match 2040	Level of Match 2040	Level of Match 2040	Level of Match 2040	Plans to 2040
Housing property	Owner occupied housing	-4583	-4567	-3968	-3754	Small increase
	Social rent housing	3496	3493	3228	2951	Decrease
	Private housing	3200	3184	3127	3114	Strong Increase
	Other	-1865	-1861	-1832	-1836	
Housing type	Ground floor app.	1756	1755	1733	1728	No change
	App./flat with elevator	-3939	-3979	-3762	-3957	Increase
	App./flat without elevator	8090	8094	8103	8091	Decrease
	Single family dwelling	1856	1864	1852	1910	Small increase
	Semi-detached house	-1202	-1201	-1174	-1132	No change
	Detached house	-4312	-4300	-4195	-4135	No change
	Sing family dwelling corner	97	102	46	76	Small increase
	Other	-1253	-1246	-1271	-1269	
	Senior housing	-702	-695	-726	-793	Strong increase
New developm.	Existing housing stock	14058	14067	14119	14097	Decrease
	New constructions	-13803	-13812	-13571	-13633	Increase
Care Housing	Without care or services	16432	16424	16412	16411	Strong Increase
	Extramural housing services	-723	-736	-817	-865	Increase
	Private care housing	-81	-85	-115	-126	No change
	Extramural care housing	437	424	361	337	No change
	Other					

Table 5.34: The expected level of match of facilities in the living environment in 2040 in IJsselmonde.

Variable	Gender S1	Gender S2	Households S1	Household S2	For all options
Facilities in the Living environment	Level of Match 2040	Level of Match 2040	Level of Match 2040	Level of Match 2040	
Facility sport	5 (4%)	5 (4%)	5 (4%)	5 (4%)	No changes expected
Facility groceries	4 (55%)	4 (55%)	4 (55%)	4 (55%)	No changes expected but focus on good quality
Facility fashion	3 (4%)	3 (4%)	3 (4%)	3 (4%)	No changes expected but focus on good quality
Facility community center	3 (6%)	3 (6%)	3 (7%)	3 (7%)	Increase (Ouderen hub/Feyenoord hub)
Facility general practitioner	2 (30%)	2 (30%)	2 (30%)	2 (29%)	No changes planned
Facility catering industry	5 (7%)	5 (7%)	5 (7%)	5 (7%)	Small increase
Facility culture	3 (5%)	3 (5%)	3 (4%)	3 (4%)	No changes planned
Facility PT stop	5 (23%)	5 (23%)	5 (21%)	5 (21%)	No changes planned
Facility Park	3 (12%)	3 (12%)	3 (12%)	3 (12%)	No changes planned

Table 5.35: The expected level of match of housing concepts in 2040 in IJsselmonde

Option	Gender S1	Gender S2	Households S1	Household S2	For all options
Housing Concepts	Attractiveness 2040	Attractiveness 2040	Attractiveness 2040	Attractiveness 2040	
Concept Shared living/facilities	quite attractive (43%)	quite attractive (42%)	quite attractive (42%)	quite attractive (43%)	Small increase is noted, combined with new concepts for care housing
Concept water	Quite attractive (59%)	quite attractive (59%)	quite attractive (57%)	quite attractive (56%)	No plans or room for this concept
Concept DIY housing	Not to less attractive (13%)	Not to less attractive (13%)	Not to less attractive (13%)	Not to less attractive (12%)	Not named as possible concept
Concept CPO	Not to less attractive (13%)	Not to less attractive (13%)	Not to less attractive (12%)	Not to less attractive (12%)	There is room for CPO
Concept Transformation	quite attractive (42%)	quite attractive (41%)	quite attractive (41%)	quite attractive (42%)	Only transformations planned from older care homes and in mixed use areas from shops to other functions.
Concept high rise	Limited Attractive (34%)	Limited Attractive (33%)	Limited Attractive (33%)	Limited Attractive (34%)	No plans for this concept

STEP 7: LEVEL OF MATCH ACCORDING TO GENDER

This section describes the results of the level of match focusing on gender and age. First, an assumption is given about the differences between scenario 1 and scenario 2 according to gender/age. The outcomes between the scenarios are minimal when it comes to housing, facilities in the living environment and housing concepts. The differences are 1% or less. Therefore, the following description about the level of match according to gender involves both scenarios.

The level of match for owner-occupied housing is relatively very negative: there is a big shortage in 2040 if no action or developments take place. It is expected that the shortage will decrease a little up to 2040; however, still a negative outcome is expected. For private rental housing, it is expected, there is a surplus in 2040, and this surplus will increase even more because of the plan to develop more private rent for the middle segment in the neighborhood. Concerning housing typologies, the results show that the level of match for apartments with elevator and detached housing is relatively very negative. For apartments with an elevator, it is expected that the shortage will decrease up to 2040. The lack of detached housing will not change, but it is important to note that this negative level of match is mainly because of the residual group and not because of the target group in this research. Looking into new developments the demand for new-build is much bigger than the expected supply in 2040: this gives a negative level of match. The extramuralisation policy leads to a very positive level of match for housing without services and care, and a relative big negative level of match for extramural housing with services.

Looking at the level of match concerning facilities in the living environment, a mismatch is expected for the general practitioner facility. There is a relatively big demand but relatively less supply (density per km²). Grocery facilities are the most important facility but could have a better level of match: score 4 out of 5. This score will not increase to the maximum of 5, because no plans are expected to increase the number of grocery facilities in the neighborhood.

Concerning housing concepts, the most attractive concept is housing concept of living on or next to water. Unfortunately, it is not expected that this concept will be implemented up to 2040, which results in a strong negative mismatch. The least attractive concepts are DIY housing and CPO housing (13%), for the 55+ population living in IJsselmonde in 2040. For DIY housing, this leads to a level of match in 2040: the demand is low and no plans to invest in this housing concept. The opposite is true for CPO housing: the demand is low, but there are plans to implement this concept in the neighborhood up to 2040, which results in an expected positive mismatch. In between the most and least attractive housing concepts are concepts of shared living/facilities and transformation. For these concepts some level of match is expected in 2040: The concepts are quite attractive and the plans are limited plans to implement these concepts.

To summarize, for the 55+ population in 2040 living in IJsselmonde various mismatches are expected. For housing, multiple mismatches are expected up to 2040. For facilities, only a strong mismatch is expected for general practitioners, and focusing on housing concepts the biggest mismatches are expected for Concept water and Concept CPO.

STEP 8: LEVEL OF MATCH ACCORDING TO HOUSEHOLDS

Next to the level of match according to gender/age, there is also a level of match calculated according to households/age. This section explains the outcomes concerning household/age, for three topics: housing, facilities in the living environment and housing concepts. In contrast to the differences between the scenarios according to gender/age, the results of the two scenarios according to households shows some differences.

Starting with the results of the topic housing for scenario 1. There is a mismatch expected for the variable housing property. There are plans to increase the number of private rental housing in IJsselmonde; however, there is a big negative mismatch for owner-occupied housing in the neighborhood. Comparing this expected mismatch in housing property in scenario 1 with scenario 2, it can be stated that in scenario 2 the mismatch of housing property will decrease. For housing type a negative mismatch is expected for apartments with an elevator, but there are plans to invest in this typology to 2040, which will limit the expected negative mismatch. A contrast can be found for apartments without elevator: a very positive mismatch is found, but this will decrease to 2040 in line with the ambition to increase the number of apartments with an elevator. Next to that, there is a big negative mismatch expected for detached housing, but previous section noted that this mismatch is mainly due to the demand of the residual group. Comparing both scenarios, it shows that the mismatch for apartments with elevator becomes bigger in scenario 2. Focusing on new developments it is shown that there is a strong negative mismatch for new-build homes. It is expected that this mismatch will decrease because of new development, but this mismatch will not totally be solved. According to care housing a mismatch is found for housing without care and services, and extramural housing with services. The municipality focuses on live longer independent home, while the preference of the target group is to live in a complex with services. This mismatch is expected to increase to 2040.

Focusing on the level of match for facilities in the living environment, it shows that the differences between the scenarios are minimal. In other words, a stronger increase in one-person households minimally influences the demand for facilities in the living environment. It is found that the most important facilities are groceries and general practitioners. The number of grocery facilities is relatively good, which gives a match (4 out of 5). The supply for general practitioners is relatively low and leads to a mismatch now and also in 2040 since no changes are planned (score 2 out of 5).

For housing concepts, the results show that the differences between the scenarios are minimal, as well. It indicates that the attractiveness for concept water and DIY housing decrease a little. And the attractiveness for concept shared living/facilities, transformation, and high rise will increase a little. The most attractive concept is Housing on or next to water, but policymakers did not name this concept, and therefore a mismatch is expected in 2040. The least attractive concepts are CPO and DIY. The ambition of the policymakers to invest in CPO housing will lead to a mismatch in 2040 for CPO.

5.3.4. CONCLUSION

In conclusion, the results according to gender and according to household are relatively similar to each other with the same expected mismatches. In the neighborhood of IJsselmonde a relative big mismatch is expected for housing (housing property, housing type, new developments, and care housing). The mismatch according to facilities in the living environment is limited with only a relative big mismatch for general practitioner facilities. Lastly, there are two missed opportunities (negative mismatch) for DIY housing and high rise.

5.4. GENERAL CONCLUSION OF RESULTS

In this chapter is described the results of the level of match for two case studies: Bouwlust / Vrederust and IJsselmonde. The results address three topics: housing, facilities in the living environment, and housing concepts. The expected level of match in 2040 is calculated by a model (explained in chapter 3). In this model, the supply and demand are established and subtracted from each other, from which the expected level of match in 2040 is calculated.

Both case-study researches showed a similar supply: housing is dominated by apartments with or without elevator and the number of facilities is relatively high. The plans for the supply up to 2040 differs per case study. For example, in Bouwlust / Vrederust, the number of owner-occupied housing will increase, and in IJsselmonde, the number of private rental housing will increase. Both locations strive for a shift in housing stock to decrease number of apartments without elevator and increase number of apartments with an elevator. Concerning care-housing the expected supply in 2040 is comparable.

The demand is composed of two steps: the expected size of the target group and the preferences of that target group. Both-case studies showed that the target group increases up to 2040, due to aging. The preferences of the target group are established by the Bayesian Belief Network and similar for both studies. For example, strong demand for apartments with elevators, and extramural housing with services. The most important facilities are grocery and general practitioners, and the most attractive housing concept is housing on or next to water. The results of the demand also showed that the differences between the scenarios are minimal.

Subtracting the supply and demand leads to the expected level of match in 2040. The results have shown that multiple mismatches, negative and positive, are expected up to 2040. This applies to both case-study researches. Not all the (mis)matches are comparable between the two locations. This is depending on the restructuring plans of the policymakers which have impact on the future supply. Besides that, there are some small differences in percentage in the current supply and composition of the target group, which also affects the expected level of match in 2040.

In the next chapter, these results are used to formulate conclusions about the level of match up to 2040, in the neighborhood Bouwlust / Vrederust and IJsselmonde. Recommendations are described to react on the expected mismatches.

6. CONCLUSION

This research started with the following problem definition: there is a stagnation in the Dutch housing market. The older population is playing a role in that stagnation, and that role is increasing because of the double aging process and extramuralisation policy in the Netherlands. The number of movements of the 55+ population is decreasing, partly because of the shortage of attractive and appropriate housing for the 55+ population. Therefore, this research has developed a model that gives insight into the level of match of housing for the 55+ population, at a neighborhood scale in 2040. It shows to what extent there is a level of match between the expected supply and expected demand in 2040 in a specific neighborhood.

Section 2.4. explained that this research is focusing on residential neighborhoods with low- and high rise housing. This kind of neighborhood is dealing with socio-economic challenges, and therefore, there are plans made and ongoing to upgrade the livability in these neighborhoods. These restructuring plans were the occasion for zooming-in into this kind of neighborhood. Two case study locations are chosen, which are classified as residential neighborhoods with low- and high rise housing: Bouwlust / Vrederust and IJsselmonde. For these neighborhoods data is collected out of different sources to determine the expected demand and expected supply up to 2040. These data functioned as input for the model to establish the level of match in 2040 for these neighborhoods. The previous chapter explained the results of the model and showed multiple expected mismatches up to 2040 according to housing, housing concepts, and to less extent for facilities in the living environment. In addition, it is found that the trend of increase in life expectancy of men will not affect the level of match up to 2040. The trend of individualism has a minimal effect on the level of match in 2040, for housing and housing concepts.

This chapter describes the conclusion of this research following the steps of the model: first housing supply, second the demand, and ending with the level of match and recommendations about the level of match. Recommendations are given to realize a better match in 2040. If an optimal match is achieved between the supply and demand of the 55+ population, it is expected that more movements will take place, and the stagnation in the housing market will decrease up to 2040. Next to that, this chapter describes the limitations and possibilities for practical implementation of this research model. The model makes it possible to calculate the expected level of match of any neighborhood, any period in time, and for any target group, given that data is available as input.



TYPICAL HOUSING BOUWLUST / VREDERUST: This housing blok is located in the middle of the neighborhood. At the Wolvenrade nearby the Hengelolaan. A block of 4 levels, Built between 1960 and 1970. The apartments have on average a surface of 70 m² with a small balcony. (Funda.nl, 2019)

6.1. SUPPLY 2040

This section describes the conclusion of this research about the supply of housing and the living environment in residential neighborhoods with high- and low rise housing in 2040. This sub-conclusion is established by using the mixed-method model to show the expected future supply in 2040 for this kind of neighborhood. The supply-conclusion refers to the first sub-goal of this research: clarifying the future expected housing stock and the surrounding living environment in 2040. Therefore the following two sub-questions are asked:

- What is the current supply for 55+ housing?
- To what extent do plans and policies influence the supply to 2040?

These questions are asked in the form of case-study research. Two case study-locations are researched that both are categorized as a residential neighborhood with high- and low rise housing. The locations are Bouwlust / Vrederust and IJsselmonde. These outcomes are used to answer the conclusion about the supply in 2040, and therefore, to get insights into the future expected supply in 2040 in this kind of neighborhood.

This research focuses on three topics: Housing, facilities in the living environment and housing concepts. The following conclusions about the supply in 2040, give insight into the expected supply of these topics. It starts with the topic of housing.

The residential neighborhoods with high- and low rise in the Netherlands, are mainly developed during the 1960s, as an expansion of the cities. Therefore, although some new developments have taken place since that time, most of the existing houses have construction year of that period; there are relatively few new constructions (construction year 2010 or younger). The architectural landscape is dominated by apartment complexes (circa 70%), mostly without elevator. There are some single-family dwellings, mostly in form of terraced housing (circa 20%). The number of semi-detached or detached housing is very low. The percentage of social housing in this kind of neighborhood is relatively high (more than 50%). And according to care housing, in the housing stock is a focus on housing that is suitable to stay when disabilities occur and receive care at home. The number of houses with (care)services is limited.

These neighborhoods, developed between 1945 and 1960, have problems linked to lower socioeconomic status. Policymakers know this problem and restructuring plans are established or ongoing, and it is expected this will affect the housing stock to 2040. First, it is expected that because of new developments, the number of new-build houses will increase. The percentage of social housing will decrease due to increase of other housing properties: for Bouwlust / Vrederust municipality strives for more owner-occupied housing in 2040 and in IJsselmonde is the ambition to create more private rental housing. The extramuralisation policy will also affect the housing stock to 2040: It is expected that many of the *apartments/flats without elevator* will be transformed into *apartments/flats with elevator* to make them more senior-friendly (increase of number of *senior housing*). This will lead to more room to let people stay home when disabilities occur and receive care at home. In addition, due to the growth of the older population, it is expected that number of housing-complexes with (care)services will increase to 2040. The restructuring plans will lead to small increase in single-family dwellings (terraced housing) but no change in number of semi-detached or detached housing. These housing typologies are seen as unsuitable for these neighborhoods, nowadays and in 2040.

The second topic in this research is about the facilities in the living environment. According to the supply to 2040, it is researched which facilities are relatively often located in the neighborhood and could be seen as nearby, and which facilities aren't. The density per km² gives an indication how close (on average) the facilities are for the inhabitants in the neighborhood. In general ,

neighborhoods with high- and low rise have a relatively high density of the following facilities: sports, grocery, catering industry and public transport stops (more than 1.0 location per km²). Facilities like for fashion, culture, general practitioner and community centers have a lower density in these neighborhoods. It is expected that, due to the restructuring plans of these neighborhoods, the number of catering industry facilities will increase to 2040, to increase the livability in the public domain. For the other facilities, uniformity isn't found in this research by comparing the two case studies. Bouwlust / Vrederust strives for a higher density in housing, which leads to more facilities (mainly grocery, culture and catering industry) in the living environment to 2040. In IJsselmonde, the focus is on the increase in quality of the facilities and therefore, no increase in density is expected, except for catering industry and community centers. In common is the ambition to increase livability in these neighborhoods by increasing the number or quality of facilities.

The third topic is housing concepts. It is expected that, due to the restructuring plans and policies, there is room for CPO housing concepts in this kind of neighborhood in 2040. Next to that, due to the extramuralisation policy (which leads to vacancy), room is expected for some transformations from old care homes to normal housing or to extramural care housing. It is not expected that in neighborhood with high- and low rise housing, the percentage of high rise will increase up to 2040. The current ratio is seen as typical for this kind of neighborhood and should not differ to 2040. Nevertheless, the municipality of The Hague stated that some increase in high rise is inevitable due to ambition to increase density of housing in this neighborhood. Rotterdam does not have this ambition. Last, there is no room expected for the housing concepts: housing on or next to water and DIY housing.

6.2. DEMAND 2040

The second sub-goal in this research is to clarify the demand in 2040 by defining the size, and the preferences of the people from the age of 55 years living in a residential environment with low and high rise housing. To achieve this sub-goal three sub-research questions are established. Starting with the first sub-question about the expected size of the 55+ population in 2040:

- What is the expected prognosis of the size of the 55+ population in 2040?

Based on the prognosis of Bouwlust/ Vrederust and IJsselmonde, it can be stated that the 55+ population will grow to 2040 in a residential neighborhood with low- and high rise housing (Bouwlust / Vrederust +4,8% and IJsselmonde +1,7%). The 55+ population becomes around a quart of the whole population in the neighborhood. Of this group, it is expected that life expectancy of woman is higher than for men, which results in ratio of around 52% women and 48% men of the 55+ population. Next to that, it is expected that the trend of individualism among 55+ population is visible in this kind of neighborhood: most 55+ people are living in a one-person household in 2040 (circa 55%).

After the size of the target group is established, the demand for this group is requested, according to three topics: housing, facilities in the living environment and housing concepts. Therefore the following sub-research question is as follows:

- What is the demand of the 55+ population (concerning housing, facilities in the living environment, and housing concepts)?

First housing, on Residential neighborhoods with low- and high rise housing, most of the people of the target group, have the preference to live in social housing (circa 50%), followed by owner-occupied housing (circa 35%). Concerning housing types, apartments with elevators are the most

popular (circa 60%), followed by single-family dwellings (circa 16%, included corner houses). Circa half of the target group has the preference to live in new-build houses. According to care housing, most of the people prefer to live in extramural housing with services (circa 47%).

According to the facilities in the living environment, the 55+ population states that the most important facilities to have nearby are grocery, general practitioner and public transport stop facilities (all score >21% in importance for having nearby). The less important facilities are fashion, sports, catering industry and culture facilities (all score <7% in importance to have nearby).

Concerning housing concepts, the concept of housing on or next to water is the most attractive concept for the 55+ population living in residential neighborhood with low- and high rise housing (circa 60%), followed by the concepts of shared housing (around 43%) and concept of transformations (circa 42%). The least attractive housing concepts are DIY housing and CPO housing, with both a score of circa 13%.

The third part of determining the demand of the 55+ population in 2040 is about the trends and factors that affect the 55+ population and, therefore, indirect on demand. The following sub-research question is used:

- What are the factors and trends that influence the 55+ population, which affects the demand for housing of this target group, and to what extent?

This sub-question is answered by using the Bayesian Belief Network. Separate subgroups (e.g. men or one-person households) are selected in the network to show the specific demand of these subgroups, and to determine the effect on the demand if a subgroup changes in size. It could have impact on the demand if a trend is stronger up to 2040 than is expected in the general prognosis. In this research two trends/factors are used: the trend of individualism and the trend of a stronger increase in life expectancy of men, compared to increase in life expectancy of women. Concerning life expectancy, it is found that a stronger increase in life expectancy of men (than is stated in the prognosis) does not lead to difference in demand of the target group in 2040.

Focusing on the trend of individualism, which indicates the increase of one-person households, it is found that there is a minimal impact on the demand if the number of one-person households increases stronger than expected in the prognosis, (increase of +120% compared to the general prognosis). The demand for owner-occupied housing decrease and the demand for social housing increase (circa +2%). The preference for apartments with elevator increases (circa +1.2%) and the demand for single-family dwellings (inclusive corner houses) decreases.

Concerning housing concepts, it is shown that a stronger increase in one-person households leads to small increase in the attractiveness of housing concepts shared living/facilities and transformations (circa +0.7%). The attractiveness's decrease for concept water (circa -0.9%), DIY housing (circa - 0.8%), and CPO decreases (circa -0.8%). The preferences for facilities do change minimal to none.

For policymakers, it is essential to take this trend of individualism into account. If the number of one-person household increase strongly, more social housing and apartments with elevator are preferred. These one-person households of 55+ years and older could tempt more to move (compared to other kinds of households) with housing concepts shared living/facilities and transformations.

6.3. LEVEL OF MATCH 2040

The main goal of this research is to determine the expected level of match (according to housing, facilities in the living environment, and housing concepts) between the future expected supply and future expected demand of the 55+ population in 2040. This section describes the conclusion for this goal by answering the main question of this research:

- To what extent is there a match between the future expected supply and the future expected demand for the 55+ population in 2040?

HOUSING

Concerning housing property, a negative mismatch is expected for owner-occupied housing in 2040 and a positive mismatch for social housing. Because of restructuring plans in this kind of neighborhood, the number of social housing will decrease to 2040. In Return, in Bouwlust / Vrederust the number of owner-occupied housing will increase, and in IJsselmonde the number of private rental housing will increase to 2040. In this case, Bouwlust / Vrederust reacts better to the expected demand, due to the expected negative mismatch for owner-occupied housing.

For housing typologies, it is expected there will be a negative mismatch for apartments/flats with an elevator and a positive mismatch for apartments/flat without elevator. The scale of the restructuring plans determines to what level the apartments/flat without elevator will be transformed into houses with elevator, which determines the final level of match. For (semi)-detached housing a strong negative mismatch is expected in 2040, but this is mainly due to the preferences of the residual group and less because of the target group. According to new-build housing, a negative mismatch is expected in these neighborhoods in 2040, due to the fact that half of the 55+ population prefers to live in new-build housing. This level of mismatch is dependent on the scale of the restructuring plans: the number of new developments to 2040.

According to care housing, there is a strong mismatch expected in residential neighborhoods with high- and low rise in 2040. The government strives and invest in letting people living home when disabilities or limitations occur, and receive care at home. Therefore, the number of houses that are suitable to continue living will increase strongly, but the demand is limited to this care-housing option. The strongest demand for the 55+ population is for extramural housing with (care)services. It is expected that the supply for this concept of care housing will increase in 2040, but not enough to prevent a negative mismatch in 2040.

FACILITIES IN LIVING ENVIRONMENT

In general, it is expected that there is a match between expected supply and demand for facilities in the living environment in 2040 for the 55+ population living in a residential neighborhood with high- and low rise. Except for the general practitioner facility; for this facility, a negative mismatch is expected in 2040. The target group (55+ population) found it relatively important to have a general practitioner facility nearby in the living environment; however, on average, this facility isn't nearby in the living environment. Moreover, no changes are planned to decrease this negative mismatch in 2040.

HOUSING CONCEPTS

There is a negative mismatch expected for the housing concept: housing on or next to water in 2040 in residential neighborhood with low- and high rise housing. This housing concept is very attractive, but not named by policymakers, as possible concept to implement. Furthermore, there is a positive mismatch expected for CPO housing. This concept is the least attractive housing concept for the target group. However, policymakers strive to implement this housing concept up to 2040 in these kinds of neighborhoods. Concerning the other housing concepts is found a degree of match up to 2040: shared living/facilities and transformation are quite attractive, and there

are some plans to implement these concepts. DIY is less attractive and is not names as possible concept, which also leads to a degree in match.

6.3.1. RECOMMENDATIONS FOR THE LEVEL OF MATCH

The previous paragraph described the conclusion about the expected level of match in 2040 between supply and demand for the 55+ population living in a residential neighborhood with low- and high rise housing. These conclusions are based on the results of the mixed-method model, and give insights into the level of match according to housing, facilities in the living environment and housing concepts. This section describes recommendations that react to the expected mismatches to create a better level of match in 2040. Therefore, the main question is complemented with the following research question:

- To what extent is there a match between the future expected supply and the future expected demand of the 55+ population in 2040? *And (if needed), how can a better match be reached?*

HOUSING

This research has shown that policymakers have the ambition to decrease the number of social housing in the neighborhoods, which have a positive effect on the overplus of social housing (based on demand). In return, it is advisable to strive for more owner-occupied housing, instead of an increasing number of private rental housing. For this point, Bouwlust / Vrederust will have a better level of match in 2040 for housing property than IJsselmonde. Rotterdam focuses on an increase in private rental housing in 2040. So, it is recommended to replace a part of social housing (circa 25%) for owner-occupied housing. Specific for Bouwlust / Vrederust is it recommended to build more owner-occupied housing to create an optimal match (circa 2,500 houses). In IJsselmonde it is recommended to do not invest in an increase of private rent houses, and replace a part of this housing property into owner-occupied housing (circa 1,000 houses) for a more optimal match according to housing property in 2040.

The focus of the restructuring plans are well, concerning the housing typologies. The expected increase in apartments/flat with elevators and a decrease in apartments/flats without elevators is in line with the demand of the 55+ population in 2040. However, the scale of the transformations to apartments/flat with elevators should be relatively high to realize the optimal match between supply and demand for the 55+ population in 2040; circa 50% of the apartments without elevator should be transformed to apartments with elevator. Next to that, this research has shown that there will be shortages for (semi) detached housing in this kind of neighborhood. Nevertheless, this lack is mainly because of the demand of the residual group, so for this research, it isn't needed to focus on an increase in this housing typology.

There is a mismatch expected for the number of new-build housing in these neighborhoods in 2040. It is essential to be ambitious during the restructuring, to create more attractive and appropriate housing for the 55+ population. So more new-build housing, or existing housing with new-build standards, will be developed in these neighborhoods. In the optimal situation in 2040, half of the housing stock is new-build.

Concerning care housing, a strong mismatch is expected, and therefore recommendations are needed. Research has shown that policymakers strive for an increase in the supply of suitable housing to let people living home when disabilities or limitations occur. However, the 55+ population has a strong preference for extramural housing with (care)services. The interviews with policymakers indicate that the number of extramural housing complexes with (care)services will increase to 2040, but it is expected this will not be sufficient. It is recommended to invest more in extramural housing with (care)services and decrease the high ambition for continuing

living at home when disabilities occur. Specific for Bouwlust / Vrederust, the development of circa 600 extra extramural houses with (care)services are needed. And in IJsselmonde circa 780 extra houses are needed in 2040.

FACILITIES IN LIVING ENVIRONMENT

The conclusion about the level of match has shown that, in general, it is expected that there is match for the facilities in the living environment in 2040. The residential neighborhoods with high- and low rise are developed with proper attention for all the needed facilities, and this continues to 2040. The only mismatch is expected for general practitioner facilities in the living environment in 2040. The 55+ population indicates that it is important to have a general practitioner nearby in the living environment. It is not easy to increase the number of general practitioners in the neighborhood due to the commercial side of this facility (minimal needed number of patients). However, flexibility in locations, like working on different locations during the week, leads to increase in level of match for general practitioners. In that case, residents will experience that the general practitioner is more close to them in the living environment. This results in more attractive and appropriate housing for the 55+ population in 2040.

HOUSING CONCEPTS

Attractive housing concepts contribute to tempt the 55+ population to make a step in the housing market. Suitability of attractive housing concepts helps to create attractive and appropriate housing for the 55+ population in 2040. The conclusion about the level of match, showed a strong negative mismatch for housing on or next to water in 2040. Policymakers do not strive, and there are limited possibilities, to develop this housing concept, although this concept is very popular. It is recommended to, where possible, create possibilities to implement this housing concept. The housing concepts shared living/facilities and transformation have a degree of match in 2040: there are limited plans to implement this concept, and the concepts are seen as quite attractive. However, it is important to keep attention for these concepts during the restructuring plans, to be aware the supply is sufficient enough in 2040 for a part of the 55+ population. Next to that, there is a positive mismatch found for CPO housing. It is not recommended to continue the ambition to create room for CPO up to 2040, focusing on the target group of this research.

FINAL CONCLUSION

The starting point for this research was the fact that the housing market is stagnated and young starting households can not enter the housing market. The older population is playing an important role in this problem, partly because of the decrease in movements of this age group. The impact of this age-group on the flow of the housing market will increase up to 2040 due to double aging and extramuralisation policy. It is found that the decrease in movements is partly because of the shortage of attractive and appropriate housing for the 55+ population. Therefore, it is needed to provide insight in the preferences of this age group up to 2040, and to adjust the housing stock (if needed), to stimulate the number of movements of this target group, and to tempt the 55+ population to do a next step in the housing market.

For that reason, this research has developed a model which shows to what extent there is a match expected between the future expected supply and future expected demand for the 55+ population in residential neighborhoods with high- and low rise housing, in 2040. This lead to multiple expected mismatches up to 2040 according to housing, housing concepts, and to less extent for facilities in the living environment. In addition, it is found that trend of increase in life expectancy of men will not affect the level of match up to 2040. The trend of individualism has a minimal effect on the level of match in 2040, for housing and housing concepts.

For the expected mismatches in 2040, recommendations are given to realize a better match in 2040. If an optimal match is achieved between the supply and demand of the 55+ population, it

is expected that more movements will take place, and the stagnation in the housing market will decrease up to 2040.

In conclusion, this paragraph explains a possible scenario of a situation with an optimal match in 2040. This research started with the problem that the young starting households could not enter the housing market. It is known that young starting households have the preference to live in single-family dwellings (circa 37%), followed by (semi)detached houses (circa 31%). Nowadays around 30% of the 55+ population in a residential neighborhood with high- and low rise housing, is living in single-family dwellings. Nevertheless, this research showed that only circa 12% of 55+ population has the preference to live in this housing typology. If policymakers create the optimal 55+ supply up to 2040, by implementing all the outcomes of this research, 18% of the single-family dwelling becomes free for the young starting household. In that situation, there is sufficiently attractive and appropriate available for the 55+ population, which results in an increase in movements of the 55+ population out of the single-family dwellings. More young starting families have the chance to move in into a single-family dwelling. In addition, the preference of young starting households to live in (semi)detached housing will not be reached in residential neighborhood with high- and low rise, because policymakers state that this typology does not fit in this kind of neighborhood.

6.4. LIMITATIONS AND FUTURE RESEARCH

The previous section described to what extent the level of match (for housing and surrounding living environment) is expected in 2040 for the 55+ population, living in residential neighborhoods with high- and low rise housing. This conclusion is completed, despite some uncertainties and limitations, and therefore, some assumptions are made. This section describes the limitations of this research and clarifies how future research could reduce the limitations of this research. Starting with one uncertainty due to forecasting.

FORECASTING

"Prediction is very difficult, especially about the future". A quote from Niels Bohr in 1970.

The first limitation of this research is the forecasting approach. In this research, the expected demand and expected supply are determined for the year 2040, due to the expected peak of the aging progress in 2040 in the Netherlands. This forecast is a difficult factor for this research: situations are researched that have not yet taken place. Results are established with plans, policies, and prognosis to 2040, which could be categorized as assumptions instead of actual data of facts. Kooiman, et al (2016) state that prognoses are based on the current knowledge (of lifecycle developments, economic developments, (international) political developments and social-cultural developments) and used to forecast the future, but it should be taken into account that prognoses have an element of uncertainty, and how longer the period of time for the prognosis, how stronger the uncertainty. Different scenarios are used in this research to deal with this uncertainty. However, it is still important to take into account that forecasting is a limitation for this research due to the uncertainty of the future.

In this research, the municipalities of the case study locations are interviewed to get insights into the future supply of housing and living environment. During the interviews, the policymakers told the policies and plans for the case study locations for 2040. In this research, the assumption is made that these plans and policies will be all implemented up to 2040. Political uncertainty and the impact of other stakeholders in the future are not included in this research. More in-depth research about the future supply can be done by doing interviews with other institutions or businesses, that are involved in the neighborhood. Because of the high percentage of social

housing, interviews with housing associations can lead to more in-depth information about the future supply. It also helps to interview project developers that are active in the neighborhood: they co-determine the future housing concepts of this neighborhood.

Prognoses are used to establish the size of the target group per case study to determine the demand of the target group in 2040. Exact numbers are used to sum up how many people will live in the neighborhood, including the ratio men/women and the composition of households. These prognoses are taking into account the demographic trends, but there is a limitation due to the uncertainty effect. Next to that, the prognoses give predictions up to 2035, but this research focuses on the year 2040. Therefore the numbers are extended up to 2040 to determine the size of the target group in 2040. The published expected yearly grow up to 2035 is used to calculate the target group up to 2040.

MOVING PATTERNS

In the literature study, the theory of aging in place is explained. According to this theory, for this research the assumption is made that people who are living in a specific neighborhood nowadays also have the preference to live there in the future (2040). This assumption is used to establish the expected demand of the target group in 2040: the current demand of people who are living in a residential environment with low- and high rise is used to determine the future demand of people who are living in that kind of neighborhood. It is uncertain that this kind of person will be the same as 2040. Because of various factors, a neighborhood could get another atmosphere that attracts other kinds of people to a neighborhood with another demand. In this research, it is not included that due to migration patterns the neighborhood could differ in the future.

EXISTING DATA

In this research, the future supply is determined by collecting the current supply and adding factors that influence this current supply. The current supply is collected by using existing data. It is possible that existing data is not complete or exact up to date. Especially for care housing, it is possible that a private care housing concept is not found and, therefore, not implemented in the data set of the current supply. The assumption is made that the current supply is discoverable in existing data online. For this research, the limitation is set up, that it is possible some information is not found and therefore some input could miss. In further research, a more detailed analysis of the exact supply could help to make the level of match even more precise.

LIMITED SOLUTION OF THE STAGNATED HOUSING MARKET FLOW DUE TO AVAILABLE VARIABLES

The problem definition explained that there is a stagnation in the housing market. The elderly keep living in spacious houses that are attractive and suitable for starting households. One of the reasons that the elderly stay in these houses is because of the lack of attractive and appropriate housing. In this research, insights are given in the preferences of these people to determine a housing stock that is attractive and appropriate for the 55+ population. However, only preference-variables have been researched of which data was available: housing (housing property, typologies, new-build and care housing), facilities in living environment and housing concept. There are multiple extra variables conceivable that are part of the attractiveness of a house. The limited available data makes that only the variables about housing, facilities in the living environment are researched. Therefore, the bounded available data was a limitation of this research according to the demand side of this research. An in-depth analysis of other variables gives a more detailed overview of attractive and appropriate housing of the 55+ population. Other factors that also affect the attractiveness of a house are, for example, social cohesion, livability, architecture, living surface, and affordability. In addition, a good financial situation is also a critical variable to create willingness to move.

FOCUS ON OTHER KINDS OF NEIGHBORHOOD

This research is using case-studies to do in detail research about the supply and demand on a neighborhood scale. This detailed research asks for a degree of time to found out all the input (supply and demand) for the model to establish the level of match. Because of this timeconsuming component of the research, only one specific kind of neighborhood is researched: a residential neighborhood with high- and low rise housing.

Further research can be done with other kinds of neighborhoods. The demand-input for this additional researches is collected in the *Grote Omgevingstest* of Springco. This data set exists of 9 different living environments: from urban living environment in the center of a city to the rural living environments of smaller villages. It is possible to use this research model for one of the other living environments by implementing the specific demand and supply for that kind of living environment into the model. The differences between possible new research about another living environment and the results of this research, show the possible similarities and differences between neighborhoods in the Netherlands according to the level of match.

6.5. PRACTICAL IMPLEMENTATION

This research shows a model that gives insights into the expected level of match between the expected supply and expected housing demand in 2040, of a neighborhood. There is a focus on *Residential neighborhood with low- and high rise housing*. This is one of the living environments that could be analyzed. Although, nine types of living environments are described and it is explained that all neighborhoods in the Netherlands could be divided into one of those living environments. In other words, for all these types of living environments in the Netherlands, data is available about the specific preferences of the people who are living in that kind of neighborhood. Next to that, this research focuses on the target group: 55+ population. However, it is possible to select any age-category out of the demand data set because all ages are represented in the data.

Furthermore, this research looked at the year 2040 due to the expected peak of the aging process in the Netherlands. However, it is possible in this model to choose any year to focus on. The only limitation is that, how further the focus is in time, how stronger the forecasting uncertainty.

So, in the model the target group, neighborhood type, and period in time are adaptable for any location in the Netherlands. In other words, this research has generated a model that makes it possible to calculate the expected level of match of a specific neighborhood, any period in time, and for any target group. The model places different layers over each other, making them comparable which leads to insight in the situation of a specific location.

With the high demand for more housing, increasing housing prices and stagnation in the housing market, it is useful to use this model to get more knowledge about the situation of specific neighborhoods: now or in the future. It helps to program a suitable supply (housing stock and living environment) that fulfill the diverse demand of the current and future population. The possibility to use scenarios helps to make policymakers aware of the possible consequences of demographic trends. All to create a housing stock that fits the best for all the age groups in a neighborhood.

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APPENDIX

Appendix 1: TNO software: adjustable housing

Appendix 2: Interviews with experts

Appendix 3: Definition of variables

Appendix 4: Overview all variables with options an codes

Appendix 5: Summary about the future supply in Bouwlust / Vrederust

Appendix 6: Summary about the future supply in IJsselmonde

Appendix 7: Data set with all variables per subgroup

Appendix 8: Screenshot Bayesian Belief Networks







APPENDIX 1: TNO SOFTWARE: ADJUSTABLE HOUSING

This appendix explains the TNO classification system, which is used for this research to determine the number of houses that is suitable to continue living when disabilities occur.

TNO developed a classification system that gives insight into the ratio of not-adjustable versus adjustable housing. Therefore a division is made of 3 main groups. 1) not adjustable housing: houses that have not the possibility to adjust, to meet the needs of people with mobility limitations within an acceptable price. An example of this group is portico housing and upstairs apartment: relative big investments are needed to make it possible to enter these houses. The second group is 2) suitable and adjustable houses that meet the needs of people with mobility limitations (like ground floor apartments and houses, houses with elevator and terrace houses with possibility for stairlift) and 3) specific adjusted and designed houses like ADL-housing and protected care-housing. ADL means *Algemeen dagelijkse levensverrichtingen* (daily life operations): activities that people do daily and is in line with basic life needs. The list of ADL is: Eating, drinking, going in and out of bed, walking and moving, relaxing, sport and leisure activities, social contact, sex, dressing up and undressing, talking, listening, going to the restroom, regulation of body heat, physical hygiene and driving a car.

Different references realize the classification: 1) BAG-format (2015) with 7,5 million houses that are in use (included are some housing and building characteristics like construction year), 2) 3D Gebouwhoogte NL (2014); where all the height of buildings are determined to predict the number of floors, 3) Toeris (CIBG, 2016) to classify the houses with scores and 4) TNO research if classification according 1 to 3 wasn't possible (9% of the housing).

Adjustable housing is classified from 0 to 5. 0 and 1 are not and very limited adjustable. Terrace housing with (possibility for) stairlift has a score of 2. Ground floor housing and housing with elevator have a score 3. Specific adjusted and designed ADL-houses have a score of 4 (help and service nearby), and protected housing with intensive care service have a score of 5. Housing with a score of 5 has no accessibility limitations for people with mobility limitations, and those houses are connected with a care institution.

	Niet-aanpasbare woning		Aanpasbare woning		Specifieke woning	
Aantal sterren		*	**	***	****	*****
Woning kenmerken						
Woningtoegang is bereikbaar zonder trap	nee	ja	ja	ja	ja	ja
Ongelijkvloerse woning, traplift mogelijk (nultreden)		nee	ja			
Gelijkvloerse woning (nultreden)			nee	ja	ja	ja
Rolstoelwoning				nee	meestal	meestal
ADL-woning					ja	ja
Voorbeeld	Bovenwoning van portiekflat zonder lift	Rijwoning traplift niet mogelijk	Rijwoning traplift wel mogelijk	Galerijflat met lift Benedenwoning	Fokuswoning Aanleunwoning	Beschermd wonen Verzorgd wonen

Figuur 1: Classificatie woningvoorraad op toegankelijkheid en aanpasbaarheid

APPENDIX 2: INTERVIEWS WITH EXPERTS

Interview Bouwlust/Vredelust

Topics	Questions
1. Population characteristics	<p>1.1. Do you expect differences in the population composition of the neighborhood? <i>We think that in this neighborhood there will be more diversity: more high educated people will come and live here.</i></p> <p>1.2. Do you have the ambition to change the population composition of the neighborhood? <i>We strive to more create a more diverse neighborhood with a wider scope of housing pricing classes with more own occupied housing and more expensive housing. To get more high educated people in the neighborhood, which also have higher income. We do not strive to change or influence the household compositions in the neighborhood. We do not take household adjustments into account.</i></p>
2. Living environment and mobility	<p>2.1. In which neighborhood-category should this neighborhood be categorized? <i>The name of residential area is correct. This we stays the same in the future. This neighborhood will not change to another neighborhood category.</i></p> <p>2.2. Do you expect differences in the facilities in the living environment of the neighborhood? <i>The facilities will be in line with plan zuidwest Den Haag. That is part of regiodeal binnenlandse Estkamp, which is a kind of living-deal.</i></p> <p>2.3. Do you have plans/ambitions according to the public transport in the neighborhood? <i>We are focusing on building new constructions nearby public transport stops. This plan is not specific focused on elderly but more for the starters. We are in doubt if this fits for elderly. Because, elderly wants to have minimal 2 bedrooms and bigger houses, and the new housing nearby public transport stops is big.</i></p> <p>2.4. Do you have plans/ambitions according to car use in the neighborhood? <i>We think that car use will increase among the elderly. They are longer mobile than in the past. But we try to stimulate public transport among elderly. Living closer to facilities and public transport stops could help.</i></p>
3. Housing stock	<p>3.1. Do you have the ambition to change the amount of houses in the housing stock? Or are changed planned? <i>In this neighborhood new and more housings are planned. All part of the redevelopment of west. There are a lot of portic flats from the 60s without elevator, which need to be renovated or changed. The houses are in relative bad status and have problems with for example mold. And they are not sustainable. This to make more houses suitable for the elderly in the future; but implementing elevators and more comfort in the houses.</i></p> <p>3.2. What is the policy about transformations of buildings into housing? <i>There is room to transform old buildings. Old care homes will be transformed to independent elderly housing (Extramural); independent housing with care facilities on the ground floor. We do not expect transformations from other function to housing in this neighborhood.</i></p> <p>3.3. What is the policy of CPO projects? <i>There is really room for this kind of projects. Certain if it is in line with restructure. An example is groups-housing. The housing corporation Vestia already stimulated this in The Hague. This groups housing with maximal 20 persons and not only elderly.</i></p> <p>3.4. Are there planned changes in the (ratio) housing typologies? <i>In this neighborhood apartment complexes are appositely, but not to high. These appartement are suitable for elderly, the single-family dwellings aren't. But, we</i></p>

	<p><i>do not push the elderly out of the single-family dwellings, we only stimulate them to move to apartment. This ambition is also part of the restructure plan. There is a ambition for more density in housing for this area. This fits with the plan for apartments in this neighborhood.</i></p> <p><i>Other typologies of housing will not by developed in this neighborhood: the exception are senior housing. But these are in line with the apartment policy in the neighborhood. These apartment need to be suitable for elderly.</i></p> <p>3.5. What is the ambition/plans for the ratio <i>single-family dwellings and multi-family dwellings</i>? <i>In this neighborhood, there should be room for single-family dwellings (also called city houses) and for apartments. The current ratio of single-family dwellings and multi-family dwellings is fine and will not change.</i></p> <p>3.6. What is the ambition of <i>high rise</i>? <i>Well, there is a density challenge: there is a high pressure so high rise is needed. But not too high.</i></p> <p>3.7. What is the policy of <i>adjustable housing</i>? <i>The current percentage is not that high because of a lot of portic apartments without elevators. This percentage need to increase. The housing of the 60s need to be renovated or adjusted for to make them suitable for the elderly.</i></p> <p>3.8. What is the policy/plans according to the ratio <i>rent/own occupied housing</i>? And which <i>price categories</i>? <i>The current ratio is fine. But in the future some more owner occupied housing will be added to the neighborhood. The increase in owner occupied housing will be relative cheap houses for starters. No housing of 500.000 euro and more. Next to that the amount of private rental housing will increase, but therefore is the goal to have no rental housing above 1.500 euro per month. Expensive rental houses do not fits in this neighborhood.</i></p> <p>3.9. What is the policy according to (new) <i>housing concepts</i>? <i>Well, the knarrenhof project is interesting but not suitable for The Hague (or Bouwlust/Vrederust), because of the high density. There are plans to transforms buildings into care-housing complexes: a place to let people live with a low need in care. Possible with the option to share facilities.</i></p> <p>3.10. What are the plans/ambitions of <i>new constructions</i>? <i>There are plans to create new houses in De Raden en De Zichten. There is also a pilot for new housing in the Lozerlaan: a old care home into extramural care housing. And new housing in Erasmuspark.</i></p> <p>3.11. Are there plans that influence the amount of housing on water (housingboat) or housing directly next to water? <i>In this neighborhood are no plans to create housing next to or in water.</i></p>
<p>4. Care and services</p>	<p>4.1. What is the ambition/policy according to <i>care-housing</i> (concepts) in this neighborhood? <i>In the neighborhood transformations take place: old care homes will be transformed to independent elderly housing (extramural): independent housing with care facilities and services on the ground floor. In this neighborhood Staedion have plans to create independent apartment with services and facilities.</i></p> <p><i>These is the ambition for groups-housing, where people helps each other (informal care). But there is nothing definitive. In this ambition is room for care facilities on the ground floor: a place from where care will be given at home. In this neighborhood no hotel concepts will be placed, because this do not fits in this kind of neighborhood.</i></p> <p>4.2. Do you implement the “stay longer home/<i>extramuralisation</i>” policy in this neighborhood? How? <i>We strive that people live longer independent at home and receive care, until high age. We strive for more life-cycle housing or a house without stairs.</i></p>

	<p><i>But if the costs to make a house suitable is more than 10.000, we advise people to move out their house. We want to help with the movement.</i></p> <p>4.3. What is the ambition/policy according to <i>online services/domotica</i> in this neighborhood?</p> <p><i>We believe in it, but we are also cautious. We think that it helps if sensors are placed in the houses. Only the problem is: who pays for it. But it helps to let people to live longer independent.</i></p>
5. Facilities	<p>5.1. How do you think about facilities in the living environment of this neighborhood?</p> <p><i>The facilities in this neighborhood will change in line with the total project of Plan Zuidwest Den Haag regiodeal binnenlands Estkamp.</i></p> <p>5.2. What is your ambition for mobility, together with public transport and (bus/metro/tram)stops?</p> <p><i>We think car use will increase among elderly and this group will be more mobile. But we strive to let people live closer to Public transport stops and nearby facilities.</i></p> <p><i>Next to that we have the ambition to build nearby trainstations. But this is not available in this neighborhood.</i></p>

Interview IJsselmonde

Topics	Questions
1. Population characteristics	<p>1.1. Do you expect differences in the <i>population composition</i> of the neighborhood?</p> <p><i>We have more attention for aging on city scale. For the neighborhood IJsselmonde we focus on people from the age of 65 or maybe 75. People with the age of 55 are still vital.</i></p> <p>1.2. Do you have the ambition to change the <i>population composition</i> of the neighborhood?</p> <p><i>IJsselmonde is risky neighborhood. It is not bad but there are changes it will become worse. Therefore we have the ambition for more diversification.</i></p>
2. Living environment and mobility	<p>2.1. In which <i>neighborhood-category</i> should this neighborhood be categorized?</p> <p><i>I agree this category but we think it is nicer to use the title: green living environment. It is a place with a spatial design with a lot of green.</i></p> <p>2.2. Do you expect differences in the <i>facilities</i> in the living environment of the neighborhood? Shops, care/cure,</p> <p><i>We believe that it is more important to increase the connection between elderly people and the shops. So no increase in amount of shops is expected. The past have proved that more shops is not a good financial business case. For example, maybe good idea to implement again the SRV car to bring groceries. For social community centers we focus on 'Ouderenhub' a central place for the elderly with care and welfare.</i></p> <p><i>Focus on leisure we do not want to increase the amount of facilities but move the facilities closer to the housing. In the future elderly live closer to the facilities.</i></p> <p><i>We want to change the public domain to make facilities better accessible and closer to the people.</i></p> <p>2.3. Do you have plans/ambitions according to the <i>public transport</i> in the neighborhood?</p> <p><i>We.</i></p> <p>2.4. Do you have plans/ambitions according to <i>car use</i> in the neighborhood?</p>

	<p><i>We want to decrease the dependency of car use special on the crosses with public transport. Places were public transport lines come together, there no car use.</i></p> <p><i>For elderly, a lower parking norm is stated. No special ambition. The city is growing with creates a bigger mobility question. Car use should be smarter. The parking norm need to be lower and will be lower.</i></p>
<p>3. Housing stock</p>	<p>3.1. Do you have the ambition to change the <i>amount of houses</i> in the housing stock? Or are changed planned? <i>This will not increase in the neighborhood. It is a qualitative question instead of a quantitative question for this neighborhood. We strive to create a better flow in the housing market but not in increase in amount of houses. Especially in the social domain, an increase is expected to 2020. To 2030 more housing is needed for the middle segment (which 2/3 is suitable for elderly). The increase in housing is focusing on elderly and on people in the social domain. And most are for rent.</i></p> <p>3.2. What is the policy about <i>transformations</i> of buildings into housing? <i>This is difficult. Most of the complexes are private property. But we strive to transform the care homes (together with the housing corporations). If a complex will be transformed for older people is dependent on the facilities in the neighborhood. That is important.</i> <i>It is possible to transform old schools; we think it is good to combine this with CPO.</i></p> <p>3.3. What is the policy of <i>CPO projects</i>? <i>This should and is always possible. Therefore we help active to facilitate this concept. But the room for development is limited.</i></p> <p>3.4. Are there planned changes in the (ratio) <i>housing typologies</i>? <i>More elderly-proof housing in the neighborhood.</i> <i>But overall I think the ratio housing typologies will not change in this neighborhood. That is the character of the neighborhood. The exception are single-family dwellings in the Feyenoord city.</i> <i>The composition and combination of low and high rise will not change.</i> <i>We think it works to have homogene housing blocks in a diverse housing neighborhood.</i></p> <p>3.5. What is the ambition/plans for the ratio <i>single-family dwellings and multi-family dwellings</i>? <i>No changes expected. The current situation is characteristic for this neighborhood and will be the same.</i></p> <p>3.6. What is the ambition of <i>high rise</i>? <i>We do not strive for high rise in this neighborhood. No change from now.</i></p> <p>3.7. What is the policy of <i>adjustable housing</i>? <i>More houses need to be adjusted for elderly to live, strive to 2 star housing.</i></p> <p>3.8. What is the policy/plans according to the ratio <i>rent/own occupied housing</i>? And which <i>price categories</i>? <i>There is ambition to increase the housing stock with mostly rental housing (mostly for social and middle segment: rent to 1000 euro).</i> <i>More social housing (to 720 euro) and middle segment rent.</i></p> <p>3.9. What is the policy according to (new) <i>housing concepts</i>? <i>Well, this in line with new policy of extramuralisation. There will be more concepts for elderly. For example pink elderly. We active facilitate this.</i> <i>Because of extramuralisation, new concepts will be implemented but no sure how this will develop. Option for sharing.</i></p> <p>3.10. What are the plans/ambitions of <i>new constructions</i>? <i>There will be new construction for social housing and middle segment. 18.000 new build houses (20% social, 30% middle, 30% high, 10% top). Rent for social and middle.</i></p>

	<p>3.11. Are there plans that influence the amount of housing on water (housingboat) or housing directly next to water? <i>There will be no housing on water. Therefore the water is too heavy.</i></p>
<p>4. Care and services</p>	<p>4.1. What is the ambition/policy according to care-housing (concepts) in this neighborhood? <i>It were care homes and private rent in the past. Now and in future more focus on extramuralisation: let people live home long as possible. But also inbetween: semi collective and sharing. We do not focus on one specific care housing concept. We are open for all options. But no big number of care houses.</i></p> <p>4.2. Do you implement the “stay longer home/extramuralisation” policy in this neighborhood? How? <i>We have the ambition that more houses are elderly proof. This means that they have at least 2 stars (stairlift). In IJsselmonde are relative many apartments but not all are suitable for the elderly, so more elderly proof housing is needed.</i></p> <p><i>For extramuralisation we have the ambition that people could live longer in their known neighborhood, not specially in their known house. If it is possible to make more housing suitable with the Wmo. If it become too expensive, better to move but in the well-known neighborhood. Collaboration with the housing corporations is crucial.</i></p> <p>4.3. What is the ambition/policy according to online services/domotica in this neighborhood? <i>Young elderly are known with domotica. We do not believe that people above the 75 year will be good with domotica. Next to that we think Physical meetings are important for people.</i></p>

APPENDIX 3: DEFINITIONS OF THE VARIABLES

Households

One-person household: Someone who is living alone in a house. Also, people who are living in institutional are a one-person household in this research.

Two-person household: A couple living together in a house.

Household with children: One or two adults living with one or more children together in a house.

Other: People that want to keep their household composition private for this research.

Gender

Men: An adult human male

Woman: An adult human female

Housing type

Ground floor apartment: An apartment on the ground floor in a building with more floor levels.

Apartment/flat with elevator: An independent house with routing via a lift, in a building with more floor levels.

Apartment/flat without elevator: An independent house with routing via stairs, in a building with more floor levels. Including a porch house, maisonette, basement, and upstairs-apartment.

Single-family dwelling (terraced housing): A house that is occupied by one family or household, or that is designed for one family or household. In this research a terraced house and corner house.

Semi-detached house: A house that is joined to another similar house on only one side.

Detached house: A house that is not connected to any other building

Senior-house: Housing that is designed or adjusted for possible physical discomfort. In this research, a combination of life cycle housing, suitable for disabled persons, special 55+ housing, sheltered housing.

Other: housing that does not fit in the above-described options (for example, tiny housing, group homes, living wagon, recreation housing, houseboat, or bungalow). Or if people do not have or don't want to share any preference of statement about housing type.

Housing property

Owner-occupied housing: A house that has been bought by the people who live in it.

Social rent housing: A house that is owned by a local government or non-profit organization, and that is rented to people who have low incomes.

Private rent housing: A house for which rent must be paid to the owner of the house to live in the house. The owner of the house does not live in the house.

Other: People who do not want to give information about their housing property status or do not know.

New developments

Existing housing stock: houses that are previously inhabited or used by someone else. For this research houses before 2010 are existing housing stock.

New constructions: New-build house, modern and new housing. For this research, houses that are built from the year 2010.

Care housing

Without care or services: The preference of people to stay home and do not move for care(services). Or the preference to live in a specific 55+ house or senior house (Housing that is designed or adjusted for this age group), which is not a part of a complex with services or care. According to the research of TNO, all houses with a score of 2 (single-family dwelling with stairs lift) or score of 3 (a house without stairs, e.g. apartment with elevator, ground floor apartment or bungalow).

Extramural housing with services: independent housing adjusted for seniors in a complex with the possibility to use shared care(services).

Private care housing: Housing in a complex, which is a combination of intramural and extramural care-housing. The level of care could be adjusted to the needs of the inhabitants. This variant is more luxurious and has more a hotel feeling — mostly small scale complexes.

Extramural care housing: housing in a complex with ever-present care intern. Sheltered housing (aanleunwoning) and care homes (bejaardentehuis) are included in this option.

Other: preference for living in a house with family and get informal care. Or people without any preference for care housing

N.A. : no reaction is given by the respondent

Facilities in the living environment

Sports: a location or building where sports activities are organized and performed. Sports fields, gym, specific sports buildings, sports associations or sports club.

Groceries: Shop that sells items or food, which are for daily use — supermarket, bakery, butchery or drugstore.

Fashion: Shop that sells items like clothing, jewelry and shoes.

Community center: A place where people from a particular community can meet for social, educational or recreational activities. Usually in a building owned by the municipality.

General practitioner: A building where a doctor is located. A doctor based in the community who treats patients with minor or chronic illnesses and refers those with serious conditions to a hospital.

Catering industry: Location or building where people go out for food, drinks, or to sleep. Hotels, restaurants, and cafés.

Culture: a location where cultural activities take place. E.g., Cinema, Theater, concert hall, library, or pop podium.

Public transport stop: a location where public transport (bus, tram, metro or train) stops to transport people to other locations.

Park: A large public garden or area of land, used for recreation with green.

Housing concepts

Shared living / facilities: a complex or building where people live together, or live independent and share facilities.

Living next to or on water: housing with architectural focus on water (sea, river, lake, or ditch) — included boathouses.

DIY housing: In this research, this concept means that people construct or renovate a home by themselves.

CPO: development of a complex of houses that is commissioned by the future residents of the project.

Transformation: the reuse (from another function to housing) of a building.

High rise: A building with multiple levels. In this research, the definition of Zandbelt (2011) is used: A building with a height higher than the trees; Normally higher than 25 meters. Based on this 25 meters, and on the assumption that a level is 3 meters high, high-rise is a building with more than eight levels.

APPENDIX 4: OVERVIEW OF ALL VARIABLES WITH OPTIONS AND CODES

Variable	Option	code	#
			7341
Living environment	lively city environment	0	1513
	residential environment with low- and high rise	1	5828
Age	55 to 74	0	6472
	75 and older	1	869
Gender	Men	0	2863
	Woman	1	3466
Household	One-person household	0	2798
	Couple	1	3672
	Couple with children	2	843
	Other	3	84

Variable	Option	Code	#
Housing property	Owner occupied housing	0	2884
	Social rent housing	1	3502
	Private rent housing	2	479
	Other	3	476
Housing type	Ground floor apartment	0	45
	Apartment/flat with elevator	1	4453
	Apartment/flat without elevator	2	154
	Single family dwelling	3	722
	Semi-detached house	4	211
	Detached house	5	667
	Senior house	6	373
	Bungalow	7	15
	Houseboat	8	23
	Single Family dwelling corner	9	298
	Other	10	380
New developments	Existing housing stock	0	909
	New constructions	1	892
	N.A. (not answered)	2	5540
Care Housing	Without care of services	0	835
	Extramural housing with services	1	2522
	Private care housing	2	365
	Extramural care housing	3	538
	Other	4	1027
	N.A.	5	2054

Facilities in the living environment

Variable	Option	Code	#
Sport	Most important	0	63
	Somewhat important	1	51
	Less important to not important	2	1652
	N.A.	3	5575
Groceries	Most important	0	1227
	Somewhat important	1	275
	Less important to not important	2	264
	N.A.	3	5575
Fashion	Most important	0	43
	Somewhat important	1	55
	Less important to not important	2	1668
	N.A.	3	5575
Community Center	Most important	0	66
	Somewhat important	1	176
	Less important to not important	2	1524
	N.A.	3	5575
General practitioner	Most important	0	510

	Somewhat important	1	658
	Less important to not important	2	598
	N.A.	3	5575
Catering industry	Most important	0	77
	Somewhat important	1	196
	Less important to not important	2	1493
	N.A.	3	5575
Culture	Most important	0	42
	Somewhat important	1	128
	Less important to not important	2	1596
	N.A.	3	5575
Public transport stop	Most important	0	318
	Somewhat important	1	725
	Less important to not important	2	723
	N.A.	3	5575
Park	Most important	0	151
	Somewhat important	1	479
	Less important to not important	2	1136
	N.A.	4	5575

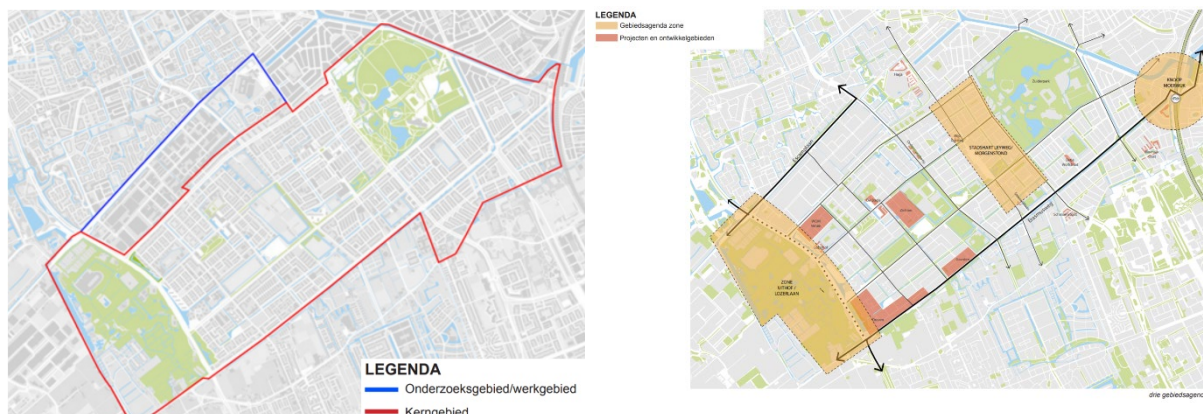
Housing concepts

Variable	Option	code	#
Shared living/facilities	Attractive and interesting	1	1052
	Not attractive and interesting	0	1457
	N.A.	2	4832
Living next to or on water	Attractive and interesting	1	1579
	Not attractive and interesting	0	930
	N.A.	2	4832
DIY housing	Attractive and interesting	1	348
	Not attractive and interesting	0	2161
	N.A.	2	4832
CPO collaboration housing project	Attractive and interesting	1	365
	Not attractive and interesting	0	2144
	N.A.	2	4832
Transformation	Attractive and interesting	1	1072
	Not attractive and interesting	0	1437
	N.A.	2	4832
High rise	Attractive and interesting	1	874
	Not attractive and interesting	0	1635
	N.A.	2	4832

APPENDIX 5: A SUMMARY ABOUT THE FUTURE SUPPLY IN BOUWLUST/VREDERUST

This chapter describes a summary of the plans of the municipality for the area Zuidwest. Bouwlust / Vrederust is a part of this area. This existing data is used because it gives more insights about the future expected housing stock and about the expected level of facilities in the living environment.

Reference: Gemeente Den Haag (2019). Bestemming Zuidwest Gebiedsverkenning. Retrieved from: [https://denhaag.raadsinformatie.nl/document/7638235/1/RIS302569 Bijlage - Verkenningen en vervolgstappen Den Haag Zuidwest](https://denhaag.raadsinformatie.nl/document/7638235/1/RIS302569_Bijlage_-_Verkenningen_en_vervolgstappen_Den_Haag_Zuidwest)



In *Coalitieakkoord Den Haag, stad van kansen en ambitie* is stated that Zuidwest is one of the development areas of the city. This classification as development area is the starting point for this document. The document describes that in *Zuidwest* the density of the housing stock will increase and that the housing stock will be more diverse in housing property composition (less social housing and more private market housing). The goal is to make the area more attractive for middle and high-income populations. It states that the amount of social housing should not increase, but because of the high demand for social housing also some more social housing will be developed. This increase in density of the housing stock will take place around the Leyweg, which isn't a part of the case study area. But also De Gaarden, Dreven en Zichten are designated for more density of the housing stock. The bigger city streets are the places for this increase in housing.

According to public transport: lines 4 and 9 will be improved and become faster. The focus is on the area around the Leyweg (outside the case study area). However, these lines are also routing through the case study area, so the quantity of public transport will not increase, but the quality will.

It is expected that the number of facilities will increase due to the increase in density of housing. This increase in density will increase the demand, which makes it more attractive for retail to invest in this area. The focus is on the Leyweg, which is not a part of the case study. Also, the Melis Stokelaan, Meppelweg, and Uithof are focus location to implement the strategy for more housing and facilities. These last three are in or at the side of the case study location. There should be more room for shops, catering industry, markets, sport, entertainment, leisure, culture, and education. The focus for Uithof is extra room for leisure, hotels, and recreation. The plan is to keep the parks and green on the same high level to keep the green atmosphere of the neighborhood. The document is stated that the amount of sports facilities, social facilities, and care facilities is sufficiently available in the area.

APPENDIX 6: A SUMMARY ABOUT THE FUTURE SUPPLY IN IJSSELMONDE

In this appendix, a summary of the plans of the municipality for the area IJsselmonde is described. This existing data description give more insight in the future expected housing stock, facilities in the living environment and housing concepts in IJsselmonde

WOONVISIE ROTTERDAM: KOERS NAAR 2030, AGENDA TOT 2020
Gemeenteraad Rotterdam, d.d. 15 december 2016.

In this document is stated that the area IJsselmonde (together with Charlois and Feijenoord) is part of herstructuring program of Steigers op zuid. Together with Particuliere woningeigenaren en Corportaties. Goal is to increase the quality of the housing stock.

Last years apartments without elevator are renovated or demolished for apartment with elevator or single-family dwellings.

Decrease in apartments without elevator and replace of apartments with elevator and single family dwellings. These houses are more future proof.

NATIONAAL PLAN ROTTERDAM ZUID. UITVOERINGSPLAN 2019-2022

Cornelisse, E., Fraai, K., Harkhoe, S., Kroos, A., Lubbers, B., Pastors, M., Smits, E., Van der Wees, L. (2019) Nationaal plan rotterdam zuid.

In 2011 a project is started to increase the livability in Rotterdam South. IJsselmond is located in the south of Rotterdam and included in this project. There is started with renovating the bad particular housing stock.

The plan is to develop minimal 3 and maximal 5 Feyenoord hubs in the neighborhood in South. These hubs are community centers.

There is the ambition to increase the value of shops and the area. A better quality and a solution for the vacancy. And make the supply of shops more divers: different kinds of groceries.

About the housing stock: more possibilities to move in the area if people increase social or economic. Of the 90.000 houses, 35.000 houses will be improved by renovation or demolition to new-build. 1/3 of the housing stock will be improved. Therefore focus on the existing housing stock: 12.000 social housing, 23.000 private housing. Increase in number of owner-occupied houses, and increase in WOZ value and decrease in bad housing.

WOONBRON: PRESENTATIEAFSPRAKEN 2019

Woonbron (2019). Presentatieafspraken 2019. Woonbron, concerparticipatieraad Woonbron en de gemeente Rotterdam.

Municipality and Woonbron state that it is better to have a housing stock which is better in balance in Rotterdam. Extra effort is needed to create a housing stock that is better balanced on neighborhood scale. Balance between social, middle and high segment. For Groot-IJsselmonde (part of IJsselmonde) is stated that there is a high concentration of social housing and too less middle and high segment. Woonbron have the ambition to create in Groot-IJsselmonde a better balance.

Woonbron has the ambition to help with the extramuralisation policy of the government: the facilitate if houses need to be adjusted for the needed care of elderly.

HORECAGEBIEDSPLAN IJSSELMONDE

Gemeente Rotterdam (2019). Gemeentebld. Vaststelling HORECA gebiedsplan IJsselmonde 2019-2021.

To goal is to create an attractive horeca policy to give more entrepreneurs the chance to start with horeca in the neighborhood to increase the livability. There is room for new horeca- concepts like flexible horeca (that changes of location).

The municipality strives to create a more energetic neighborhood.

DETAILHANDEL IJSSELMONDE GEBIEDSKOERS

Gemeente Rotterdam (2017). Gebiedskoers Detailhandel 2017-2020 IJsselmonde

- Keizerwaard: increase of the quality of the supply. No expansion or upscale.
- Spinozaweg: It is possible that shops transform to antohter function in this area: it is a mixed area, where changes could take place.
- Beverwaard winkelcentrum: Important to keep this shoppings center in good condition. No big increase expected.
- Pliniusstraat: Last years expansion had take place in this area. For now the focus is on management.
- Prinsenplein: No expansion expected because of the proximity of Keizerwaard. Focus on management.
- Stadionsweg / Veranda: Bigscale development is going on. Shopping policy will be determined in line with the developments.

VISIE 2030 BLIJVEND IN BEWEGING

Rotterdam sportsupport (n.b.). Blijvend in beweging. Onze visie op 2030.

It is expected that the demand for sporting will differs over time. This is important to develop a good sport supply. It is expected that sport supply will be more flexible and more diverse. Sport facilities will be more multifunctional.

APPENDIX 7: DATA SET WITH ALL VARIABLES PER SUBGROUP

DATA SET OF PEOPLE IN RESIDENTIAL NEIGHBORHOOD WITH LOW- AND HIGH RISE

Living Environment		Housing	Facilities	Concepts
Residential neighborhood with low- and high rise	Gender	Table 1	Table 2	Table 3
	Household	Table 4	Table 5	Table 6

TABLE 1

lft.cat.doelgroep * geslacht Crosstabulation

		geslacht		Total
		0	1	
lft.cat.doelgroep	0	2577	2455	5032
	1	467	264	731
Total		3044	2719	5763

TABLE 2

Facility X * gendernr * lft.cat.Nr Crosstabulation

			gendernr		Total
			0	1	
0	Facility X	0	26	18	44
		1	20	22	42
		2	592	534	1126
		Sum	638	574	1212
		3	1970	1908	3878
	Total	2608	2482	5090	
1	Facility X	0	3	3	6
		1	1	2	3
		2	107	51	158
		Sum	111	56	167
	3	356	208	564	
Total	467	264	731		
Total	Facility X	0	29	21	50
		1	21	24	45
		2	699	585	1284
		Sum	749	630	1379
	3	2326	2116	4442	
Total	3075	2746	5821		

TABLE 3

Concept X * gendernr * lft.cat.Nr Crosstabulation

			gendernr		Total
			0	1	
0	Concept X	0	536	616	1152

		1	357	256	613
		Sum	893	872	1765
		2	1715	1610	3325
	Total		2608	2482	5090
1	Concept X	0	133	64	197
		1	43	25	68
		Sum	176	89	265
		2	291	175	466
	Total		467	264	731
Total	Concept X	0	669	680	1349
		1	400	281	681
		Sum	1069	961	2030
		2	2006	1785	3791
	Total		3075	2746	5821

TABLE 4

Ift.cat.doelgroep * samenstelling.cat3 Crosstabulation

		samenstelling.cat3			
		0	1	2	Total
Ift.cat.doelgroep	0	578	593	181	1352
	1	58	71	7	136
Total		636	664	188	1488

TABLE 5

Facility X * householdnr * Ift.cat.Nr Crosstabulation

			householdnr			
Ift.cat.Nr			0	1	2	Total
0	Facility X	0	16	19	9	44
		1	20	17	5	42
		2	423	563	139	1125
		Sum	459	599	153	1211
		3	1390	1987	488	3865
	Total		1849	2586	641	5076
1	Facility X	0	2	3	1	6
		1	1	2	0	3
		2	67	88	3	158
		Sum	70	93	4	167
		3	241	315	9	565
	Total		311	408	13	732
Total	Facility X	0	18	22	10	50

	1	21	19	5	45
	2	490	651	142	1283
	3	1631	2302	497	4430
Total		2160	2994	654	5808

TABLE 6

Concept X * householdnr * lft.cat.Nr Crosstabulation

lft.cat.Nr		householdnr			Total
		0	1	2	
0	Concept X 0	403	591	155	1149
	1	255	294	60	609
	Sum	658	885	215	1758
	2	1190	1700	425	3315
Total		1848	2585	640	5073
1	Concept X 0	81	111	4	196
	1	33	34	1	68
	Sum	114	145	5	264
	2	197	261	8	466
Total		311	406	13	730
Total	Concept X 0	484	702	159	1345
	1	288	328	61	677
	2	1387	1961	433	3781
	Total	2159	2991	653	5803

Shortage:

Households that are living with children (samenstelling.cat3=2) with an age older than 75 years (lft.cat.doelgroep=1)

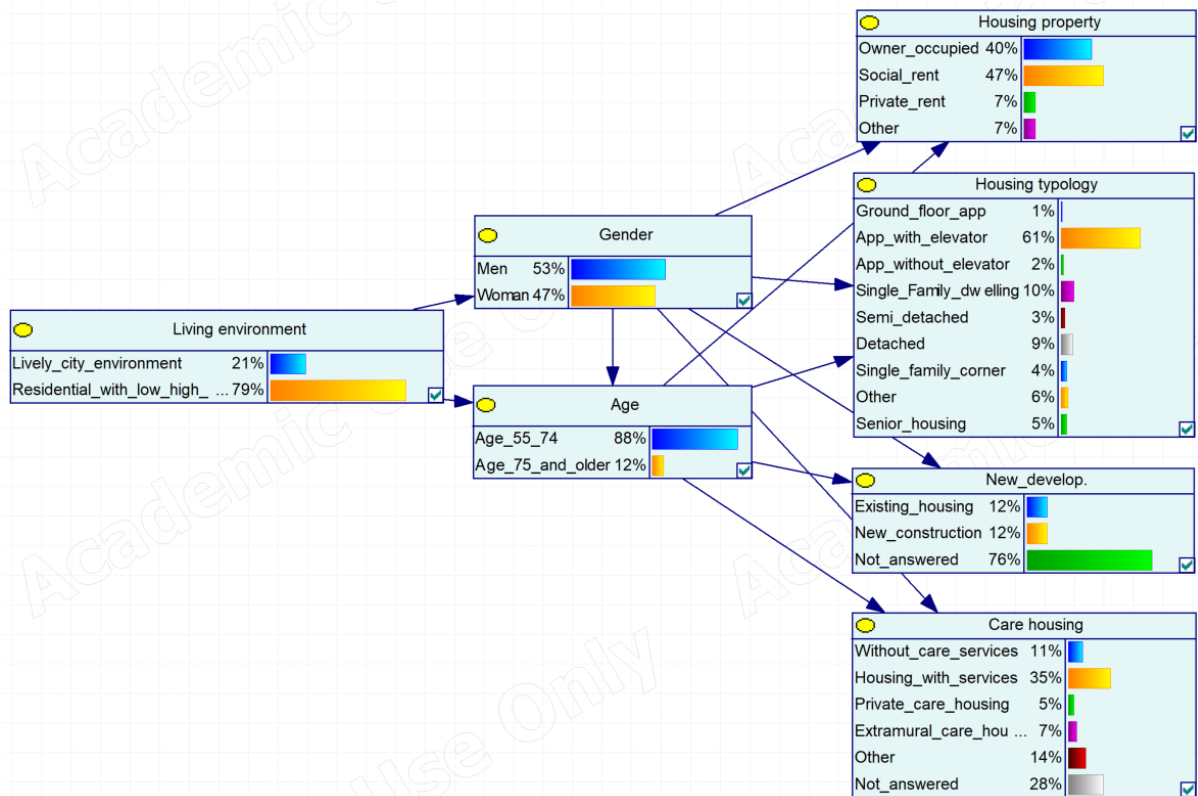
Solution:

- Exclude this group out of the research target group (this group is significant smaller than other household compositions): 35 households of the 13906 total in Bouwlust (0,25%) in 2019 and expected 0,67% in 2040. In IJsselmonde 158 households of the 30186 total (0,52%) and expected 0,9% in 2040.
- Expand this group with also the preferences of households with children with a age older than 75 years. In the total data set of the DGOT are in total 72 respondents in the group: household composition=with children and with agegroup=75andolder. Of this group, 23 people answered the questions about housing concepts and 17 people answered the questions about facilities preferences.

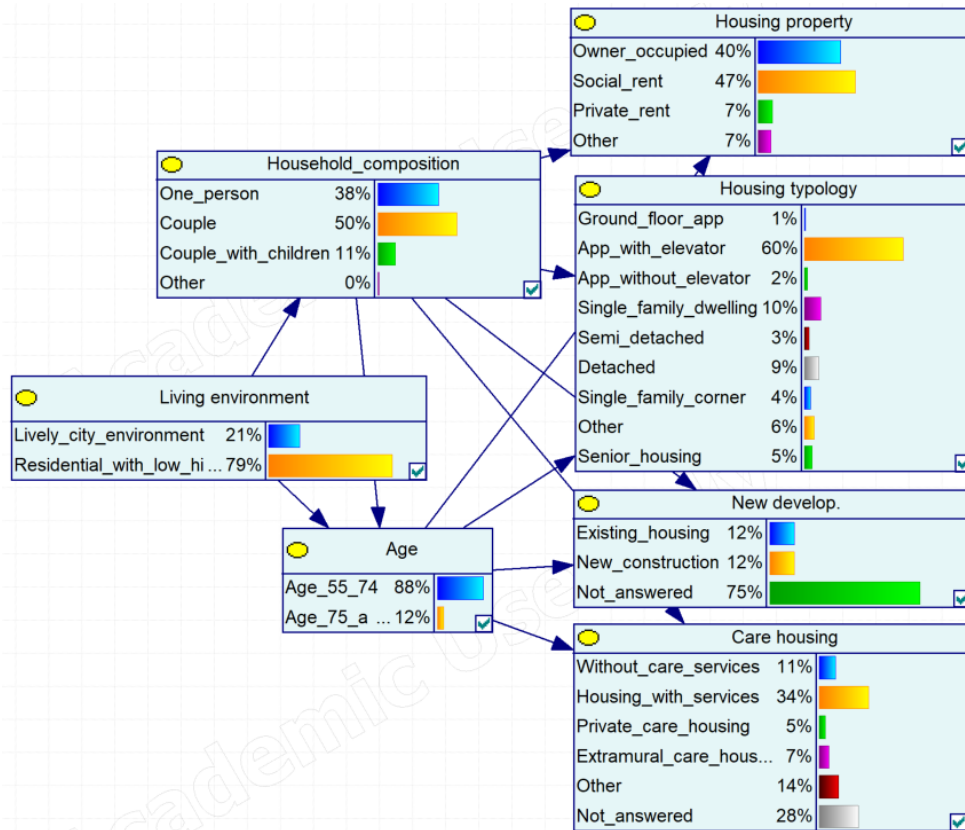
Conclusion: Expanding still give a limited result. Therefore, the option to go for excluding is better. This will give a limited deviation due to the small size of the group: less than 1%.

APPENDIX 8: BAYSIAN BELIEF NETWORKS

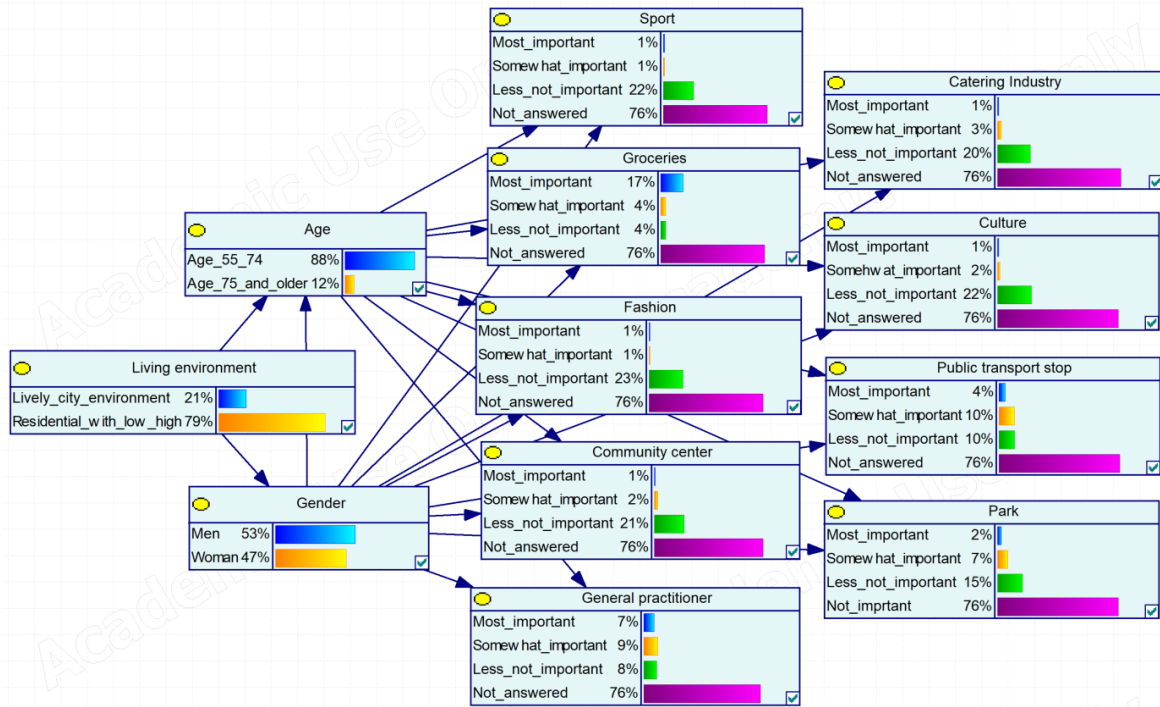
HOUSING PREFERENCES DEPENDING ON GENDER



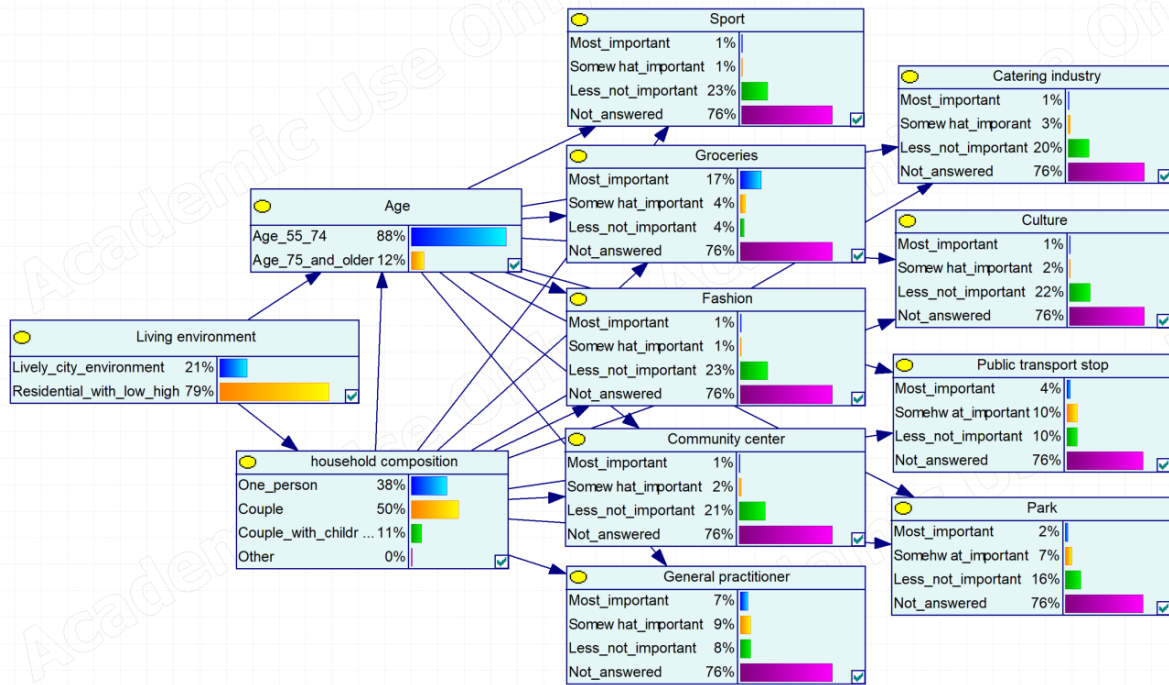
HOUSING PREFERENCES DEPENDING ON HOUSEHOLD



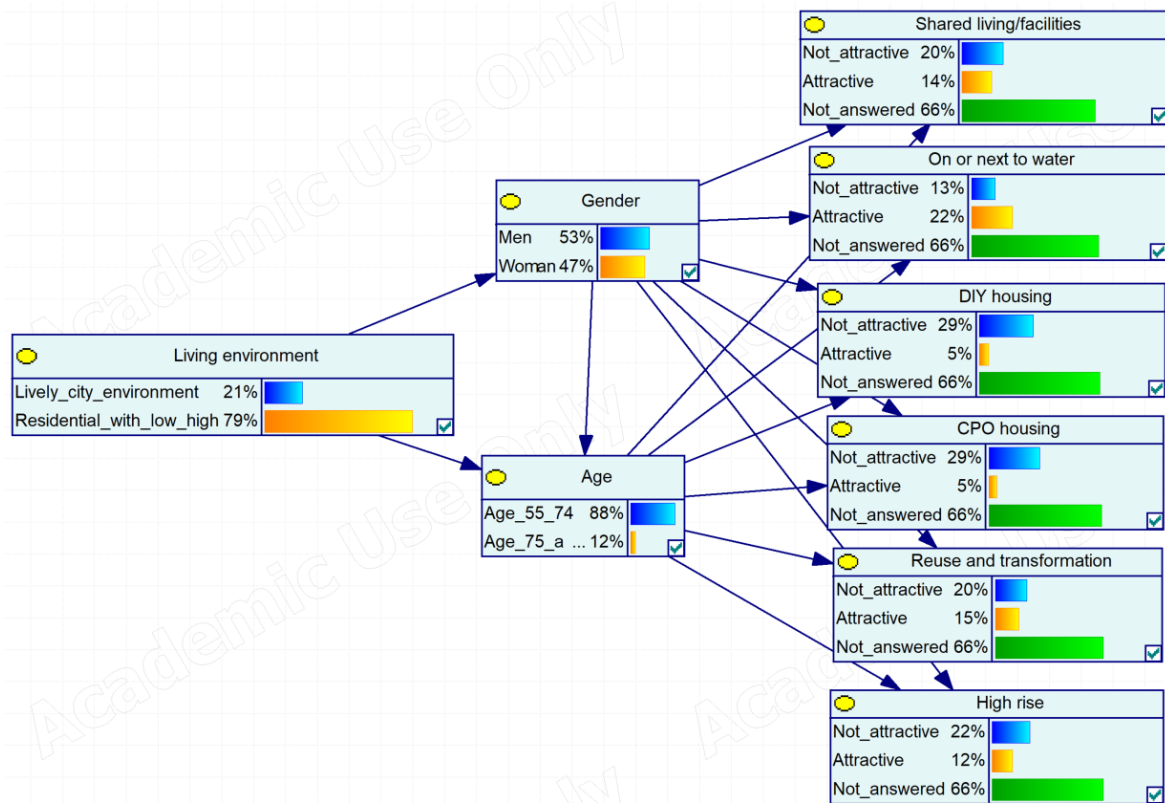
FACILITIES PREFERENCES DEPENDING ON GENDER



FACILITIES PREFERENCES DEPENDING ON HOUSEHOLD



HOUSING CONCEPTS PREFERENCES DEPENDING ON GENDER



HOUSING CONCEPT PREFERENCES DEPENDING ON HOUSEHOLD

