EINDHOVEN UNIVERSITY OF TECHNOLOGY

Identifying successful characteristics in concept housing solution for the Dutch social housing market

Researching New Housing Concept as a solution for problems on the Dutch social housing market.

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"*Problems are not stop signs, they are guidelines*."
Robert Schuller

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Preface

This research concludes my graduation project for my master 'Construction Management and Engineering' at Eindhoven University of Technology. During my bachelor and master, it became clear that the social housing market is facing unique challenges. These challenges arose as a result from downsizing in de construction industry and new environmental goals set by the government. There is a need for smarter, faster constructed and more sustainable houses to ensure the social housing market can thrive and perform their social task, namely: providing lower income families with low rent housing solutions.

A quick study into the problems and housing solutions offered by the market, showed that there is already a possible solution. The solution offered comes in the form of industrialised housing concepts. Housing concepts that unlike their previous versions, the shipping container house, are hard to distinguish from a house build using traditional methods. These new housing concepts (NHC) are characterized by high levels of industrialisation, better quality control and the use of less (on-site) labour.

Based on the fact that the problem and possible solution were clear, I started to wonder why the solutions weren't implemented. It quickly became clear that the NHC were simply too new, they still had to prove themselves to consumers. Social housing corporation did not know whether NHC would achieve the expected cost savings and if it would meet their and their tenants needs.

Based on these two unknowns, I was determined to do research into a relatively unknown area for me, to expand my knowledge on the subject with innovative and possible high impact potential. In order to contribute to the social housing market, this research focused on identifying the characteristics which are essential for assessing the success potential of NHC's. When it would be proven NHC had the potential to lower cost and development time without sacrificing the other needs from tenants and corporations it could revolutionize the housing industry. And potentially by doing so, solve one of the industry's and potentially societies biggest problems.

I hope this graduation thesis will provide new insights and inspire you.

Enjoy reading!

Daan Bijman

Amsterdam

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Creating the Thesis here before you has been made possibly by the help and input from multiple professionals. To that end I would like the opportunity to share my appreciation about the involvement of some key individuals.
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Secondly, I would like to share my appreciation for the input and involvement of professionals working at Eigen Haard. Knowledge from specialist helped me to quickly become familiar with difficult aspects of the social housing real estate problems and development process. I am especially grateful for the discussions with and feedback and input from Nicole de Vrij. These were essential in setting up and preforming solid academic research. Her motivation to finding a solution for corporation's problems was extremely inspiring and refreshing.

Lastly, I would like to thank my family for supporting me and my girlfriend, Eva Haspels, for helping my write this thesis. Her expertise, thoughts and feedback have been crucial in allowing me to write a final thesis worthy for finishing a Master study.

Thank you all for your help, patience and expertise.

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Abstract

Increased sustainability requirements and construction prices complicate the production of new social housing. The problems this causes worsen due to a sharp increase in the demand for social housing within metropolitan areas. This difference between supply and demand creates problems for the affordability and sustainability goals of social housing corporations (SHC)
By identifying key performance indicators (KPIs) of social houses, social real estate developer can identify fitting new housing concept (NHC) which might offer a solution to the problems. These KPI are found using a mix of literature study, survey analyses, desk research and interviews with stakeholders. By identifying matches between the KPI's of social housing and the characteristics of NHCs, potentially successful NHC can more easily be identified.

Survey results identified with high certainty the specific KPIs of social housing tenants. These results are used to pinpoint important characteristics of NHCs. When supplemented with information about the KPIs of other stakeholders a list of 14 characteristics can be established.

It can be concluded that, NHCs have the potential to offer a fitting solution for current social housing problems. Unclear however is the financial effect of developing housing using NHCs and the long term viability of NHC projects.

It is recommended to perform further research which focuses on the financial aspects of social housing development using NHCs. A case study could also help to draw a comparison between the results of comparable traditional and NHC development projects.

Management summary

Creating affordable and sustainable housing for low-income families is the main objective of most social housing corporations (SHCs). Growing demand, higher construction costs and stricter laws and regulations have made realising these goals harder for SHCs. As a result, queues for social housing are increasing, which in turn counteracts the work done to increase an SHC's sustainability score. This study aims to identify the potential role new housing concepts (NHCs) can have as a solution to these problems. In theory, the increased industrialisation and prefabrication associated with NHCs would result in lower costs, shorter construction times and increased uniformity within the real estate portfolio.

To identify which NHCs match SHC ambitions, the most important key performance indicators (KPIs) of all stakeholders were researched. This was done by analysing survey results and the literature, supplemented with information from interviews with social real estate developers.

The literature study accepted the hypotheses that the primary focus of SHCs is affordability and sustainability. It also highlighted their other primary objective: to ensure neighbourhood vitality. This discovery of another primary objective increased the value of tenant KPIs in the NHC evaluation process. Lastly, the literature study also proved that, in the future, sustainability demands on new housing projects will increase.

To obtain a better understanding of tenant KPIs, results of a large-scale survey were analysed. This analysis showed, with a high degree of certainty, that six housing characteristics influence a tenant's evaluation of social housing. These six characteristics are level of upkeep, spatial layout, size of dwelling, dwelling appearance, level of insulation and level of noisiness.

Interviews and desk research results identified a number of objective and subjective KPIs SHCs use when evaluating NHCs. The most important KPI is the total construction cost per unit. The reasons for this are the stricter legislation and regulations related to SHC construction and increased construction costs. It was also discovered that social real estate developers noted NHC design flexibility as an important characteristic, because of the need to have an NHC which can comply with different municipal building size demands and the binding appearance evaluation by the welfare committee.

Using these results, it was concluded there is a strong connection (R^2 = 0.6962) between specific stakeholder KPIs and NHC characteristics. This connection can be used to identify potential successful NHC solutions to SHC problems.

The study also highlighted the need for future case study research into the objective benefits of NHCs compared to the results of traditional building projects. Further studies could confirm or invalidate the role of NHCs as a solution for current SHC problems.

Dutch management summary

Het creëren van betaalbare en duurzame woningen voor gezinnen met lagere inkomens is de voornaamste doelstelling van een woningbouw corporatie. Door een groeiende vraag, stijgende bouwkosten en strengere wet en regelgeving is het lastiger geworden deze doelstelling te realiseren. Als gevolg hiervan nemen de wachttijden voor een sociale huurwoningen toe, wat verdere verslechtering van corporaties hun duurzaamheidsscores tot gevolg heeft.
De doelstelling van dit onderzoek was het bestuderen of nieuwe concept woningen (NHC) een uitkomst kunnen bieden voor de betaalbaarheids- en duurzaamheidsambities van corporaties. In theorie zouden deze woningen door gebruik te maken van meer industrialisatie en prefabricatie lagere kosten, korte bouwtijd en iets meer uniformiteit tot gevolg hebben.
Om te onderzoeken welke NHC matchen met de ambities van corporaties is er door middel van een enquête, een literatuur studie en het houden van interviews een beeld gevormd van de eisen (kritische prestatie indicatoren (KPI's)) van de betreffende stakeholders. Deze stakeholders zijn naast de corporatie zelf, ook de huurders die huren en meebeslissen over de koers van een corporatie.
De literatuur studie bevestigde dat de voornaamste focus van corporaties ligt op betaalbare en duurzame woningen, echter werd duidelijk dat ook een leefbare buurt een doelstelling is. Deze ontdekking geeft meer waarde aan de betrekking van de KPI's van huurders bij de analyse van NHC. Tot slot werd tijdens de literatuur studie duidelijk dat de duurzaamheidseisen van toekomstige woningen zullen worden aangescherpt.
Om een beter beeld te krijgen van de huurder KPI's zijn de enquête resultaten van een grootschalige klant tevredenheids-enquête onder huurders van corporatie Eigen Haard geanalyseerd. Hieruit kwam naar voren dat met een zekerheid van 69% gesteld kan worden dat een 6-tal factoren de tevredenheid van huurders over hun huurwoning word bepaald. Deze zes factoren op afnemende mate van belang zijn: Mate van onderhoud, Indeling van de woning, Grootte van de woning, Uitstraling van het gebouw, Mate van isolatie en tot slot de Gehorigheid van de woning.
Door middel van interviews en desk research werd vastgesteld dat er verschillende objectieve en subjectieve prestatie indicatoren voor NHC vanuit het oogpunt van corporaties. De belangrijkste indicator hiervan is de prijs per wooneenheid (p.p./unit). De reden hiervoor zijn de eerder genoemde aangescherpte wet en regelgeving en stijgende bouwkosten. Verder is gebleken dat vastgoed ontwikkelaars in dienst bij corporaties de ontwerp flexibiliteit van het NHC aanmerken als belangrijke eigenschap. Als verklaring hiervoor werden de gemeentelijke eisen omtrent de afmetingen van bebouwing en bindende beoordeling door de welstandscommissie gegeven.

Aan de hand van de resultaten kan geconcludeerd worden dat er een sterke relatie is tussen specifieke KPI's en NHC eigenschappen. Hieruit blijkt dat aan de hand van deze relatie, de slagingskansen van een NHC kunnen worden afgeleid.

Vanuit het onderzoek komt de aanbeveling voor corporaties om te kijken naar de objectieve voordelen van NHC in relatie tot traditionele project resultaten. Deze objectieve voordelen zullen het uiteindelijke succes van NHC als middel voor de huidige problematiek verder aantonen of ontkrachten.

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Comprehensive list of all Figures in the order they appear in the paper.

List of Acronyms

List of all used Acronyms mend to make reading the thesis easer in alphabetical order.

BUCP	Basic Unit Cost Price	The price of a single NHC unit in basic trim
CH	Concept Housing	Older NHC That still use on site pouring and minimum prefab
CHIP	CH Innovation Project group	A group of three EH RED experts that also study NHC
EH	Eigen Haard	A large SHC in Amsterdam
HC	Housing Concepts	A range of housing or construction formats
KPI	Key Performance Indicator	A variable which a person of group view as most valuable
KTV	Customer satisfaction	Based on Dutch translation, official title of the tenant survey
NHC	New Housing Concepts	(partially) prefabricated predesigned housing concepts
RED	Real Estate Developers	Experts in initiating and developing construction project.
SH	Social Housing	Non-profit houses created for lower income households
SHC	Social housing Corporation	A corporation with the main goal of creating SH
SHT	Social housing Tenant	The intended tenant(s) for Social housing

Chapter 1- Introduction

1.1 Context

1.1.1 Introduction

'Housing is absolutely essential to human flourishing. Without stable shelter, it all falls apart' (Desmond, n.d.). This quote by American sociologist Matthew Desmond symbolises the importance of social housing. Without a home for lower-income and less fortunate individuals, the welfare state that is the Kingdom of the Netherlands cannot exist as it does today.

The objective of all Dutch social housing corporations (SHCs) is to provide needed affordable housing to lower-income households. In addition to affordable housing, sustainability is important to ensure social housing can also be provided to future generations. These goals of affordability and sustainability have become more difficult to achieve in recent years, due to several recent problems.

1.1.2 Problem statement

Increased queuing for affordable social housing is one of the main problems. A study has shown that queuing induces inefficient matching of households and housing, because of heightened willingness to pay for housing (Van Ommerena & Van der Vlist, 2015). This inefficient matching in turn has negative effects on the outcome of all housing energy efficiency projects. Projects which are initiated to address the sustainability performance of Dutch social housing. The increasing queue for a social house is due to an increase in demand and a decrease in supply. The increase in the demand used to be partially explained by refugees looking to be housed in Amsterdam. Additionally, Amsterdam's social housing industry is experiencing a decrease in the stock of social houses (Woonbond, 2017). This increase in demand and decrease in supply is resulting in an overheated social housing market. Not only is the social housing market affected, Amsterdam's private housing market is also overheated, causing a sharp increase in land prices in the Dutch capital (Couzy & Damen, 2018; Hentenaar, 2016).

Normally, queuing issues could be combatted by 'simply' building more houses, but recent problems prohibit SHCs from applying this solution. The first of these problems is a result of the 2015 housing law (Dutch: *Woningwet2015)*. To balance out the unprofitability of some social housing projects, SHCs developed real estate for the private market to rent or sell. Profits from these projects were used to recoup losses on social housing projects, allowing for more projects to be undertaken (Smit, 2016). This practice, however, is no longer possible, due to the 2015 Woningwet, which allows SHCs to develop only social housing.

An additional challenges is the implementation of the 'lessor levy' (Dutch: *verhuurdersheffing*). The method of compensating for social housing losses with private housing profits changed in 2013. At that time, the Dutch government adopted the lessor levy law. This law requires owners, whether individuals or businesses, of more than 50 rental properties below the income threshold (Dutch: *liberatisatiegrens*) (rent of < €710 per month in 2018) to pay tax on their combined market value (Rijksoverheid, 2019). The intended goal of this law was to generate extra taxes, to reduce the budget deficit of the Dutch government and to create a healthier real estate market. However, a recent study by the *Centrum voor Onderzoek van de Economie van de Lagere Overheden (COELO)* has proven that this financial measure disrupts the market it wants to keep healthy. Namely, the law has created an increase in rent prices, making social housing unaffordable for some, while making it less attractive to construct new cheaper housing solutions (Veenstra, Allers, & Garretsen, 2016).

The third major problem the development and construction sectors are facing is the reduced workforce capacity. Currently, the construction and real estate industry is having structural problems. This industry is responsible for creating, maintaining and demolishing real estate. The construction industry has always been an essential part of social housing market activities. A recent development within the construction industry is an extreme increase in the amount of work. This increase is an effect of projects having been delayed during the financial crisis (2007–2010) (De Nederlandse Bank NV, 2010). While this looks like a positive development, the timing and the intensity of the amount of work for the industry is overwhelming. During the financial crisis (Dutch: *Kredietcrisis*), construction companies had to downsize on a massive scale to remain viable given the loss of work. Because of this downsizing, construction companies currently do not have the labour force to handle all available new projects (Cobouw, 2018), resulting in scenarios in which they increase prices or have to turn down projects. This effect is further strengthened by the Dutch government reinstating the Crisis and Recovery Act (Dutch: *Crisis en herstelwet*), a law which facilitates the quicker approval of applications for new real-estate projects. The question is whether this will help the economy or only enlarge the problems for the construction industry (Rijksoverheid, n.d.).

1.1.3 Research objective

To find a solution to create affordable and sustainable housing, SHCs are searching for different approaches to creating houses. These approaches are known as new housing concepts (NHCs). The term NHC covers all housing concepts being developed that differ from past or current approaches. The NHC idea was introduced into the scientific world as early as 1985 (De Borger, 1987). Since then, the concept has become more relevant (Broto, 2002). However, currently most examples of NHCs (e.g., container houses) are either small-scale endeavours by wealthy or creative individuals or temporary solutions to house students or refugees (NDSM, n.d.).

The NHCs that SHCs are experimenting with are usually summarised within a definable framework. These NHCs can be stacked to reduce the amount of land required when building multiple units. To increase the quality and reduce the price, most NHC units are built, either completely or partially, from prefabricated parts in factories and not on-site. An additional positive effect is that the prefabrication of parts reduces the amount of labour needed for construction.

Due to the use of prefabricated parts, NHCs have the potential to be an fitting solution for SHCs' problems. Currently, NHCs have been used mostly on a small scale, although they have the potential to be a viable solution for large-scale projects as well. It is only now, when more traditional methods of development and construction are insufficient, that the possible demand for NHCs and, thereby, their viability are increasing. The most prominent downside to NHCs, is the fact that they are unproven on a large scale. This lack of proof of concepts makes SHCs reluctant to apply the concepts. To prove NHCs on a large scale, this study investigates the advantages and disadvantages of their adoption by SHCs.

1.2 Research goals

The two main goals of this research are to find answers for the research questions and test the hypotheses. Doing so provides crucial insight into possible effective strategies to help with the Dutch social housing market's problems.

1.2.1 Research questions

As noted in the previous section, the Dutch social housing market is under stress due to three key problems that prohibit the development of affordable and sustainable housing. Current real estate development methods are insufficient at combating workforce, land price and sustainability problems. This study has been conducted to obtain data to discover whether NHCs might help SHCs to achieve their affordability and sustainability goals. New housing concepts might do so by addressing production costs, production time and sustainability aspects.

The main research question is this: How can new housing concepts (NHCs) accommodate the requirements of the tenant and the affordable and sustainable production ambitions of social housing corporations (SHCs)?

To develop a complete and well-substantiated answer to this question, the following four sub-question have been formulated:

1. What are NHCs, and how do they differ from conventional housing attributes?
To categorize and identify valuable data about NHCs, it is important to obtain an overview of the differences between traditional houses and NHC houses as well as to extend the understanding of NHCs to clarify their inherent benefits and restrictions.

2. What requirements do tenants have in rental housing characteristics?
Dutch SHCs are, in most cases, customer satisfaction-driven organisations. To measure the success of NHCs, tenant's key performance indicators (KPIs) are identified and then used to judge NHCs.

3. What are SHCs' ambitions, and how are they related to rental house characteristics?
SHCs have specific requirements for housing (e.g., cost, square-metre size, energy levels and materials used). To judge the performance of NHCs, it is important to identify a corporation's goals and ambitions. After identification, goals and ambitions can be translated to measurable KPIs, which can be used in comparing the effects of traditional and NHC building methods.

4. How could NHCs help to meet the requirements and ambitions of both tenants and SHCs?
Those KPIs identified by answering the second and third sub-questions make it possible to rate, judge and compare several NHCs to the outcomes of traditional building projects. The results from analysis using the KPIs may help reveal whether NHCs can help in combating SHC problems.

The main goal is to identify whether NHCs can help solve problems in the Dutch metropolitan social housing market. The focus is on the problems of increased queuing, a shortage in the workforce, higher energy and sustainability goals, and increased construction cost and time. The focus herein is on variables SHCs can affect, such as chosen build concept, instead of variables that cannot be affected, such as local and national policies.

1.2.2 Research hypotheses

In answering the research questions, several hypotheses are tested. The first of these is a null hypothesis which states that no relation exists between the beneficial aspects of NHCs and the problems observed in the social housing market. If the null hypotheses is confirmed, it can be concluded that either NHCs are not a fitting solution or no suitable NHC currently exists and thus a solution from an alternative field is required.

Three other hypotheses also tested are as follows:

1. A mix of elements is a requirement for a high-scoring NHC, and those which have a narrow focus on a single element will be found less applicable.
2. The most and possibly only important criteria for social housing tenants are the rent price and the size of their house. Other housing characteristics such as sustainability and appearance are not important to them.
3. NHCs outperform most traditional construction solutions, where they can be compared

1.3 Research framework

1.3.1 Research boundaries

To ensure the research results from this study are applicable for the Amsterdam social housing market, the research objectives and limitations have been defined. A research framework has been created using the following limitations:
The research focuses on development in the metropolitan areas. The main reason to for this is the high concentration of the problems listed above within these areas. A secondary reason is the relevance of research data made available by the SHC Eigen Haard (EH). Eigen Haard operates only within the Amsterdam metropolitan area, which makes their data mostly relevant for comparable areas. Adding data from other areas would cause problems because of the differences in land prices and in other regional factors, such as laws and regulations, which would cause less reliable research results.

To collect information that qualifies as a representative random sample, a good mix of respondents for the tenant KPI study had to be found. Sources and tactics from EH were adopted to retrieve the maximum amount of relevant tenant data. The chosen research method for obtaining data is a survey that offers discrete response options. The survey was distributed only among EH tenants. Surveying non-EH tenants could have led to a mixed survey output because of variability in the policies of different SHCs.
Gaps in research data because of the lack of previous research might be inevitable and are compensated for with expert interviews. To bridge the gap between available research data and workplace knowledge, directly interviewing experts in the fields of real estate development (RED) is the most pragmatic approach. Such interviews were done as a second step only in scenarios in which insufficient data was available within the scientific community.

To ensure the this research yields long-term sustainable solutions, research limitations have been selected for the adoption of NHCs. First, the research focuses on long-term solutions: for example, a building concept with a lifespan of at least 30 years. This is of major importance because of the permanent nature of the housing problem. Sources such as Broto (2002) and De Borger (1987) have offered different interpretations of the meaning of NHC. The interpretation used during this research focusses on building concepts with a factory-produced shell (e.g., concrete, wood-frame or steel-frame). The Casco is part of a predesigned concept house produced as a whole or assembled on-site. The pre-installation of piping, insulation and or other attributes is preferred but not a

prerequisite to classify as an NHC. This high amount of prefabrication is chosen to ensure that factors such as climate-controlled concrete pouring and assembly line production are present.

These kinds of attributes offer a theoretical benefit over traditional building projects. Lastly, only concepts that focus on creating new housing are taken into account. Retrofitting and large-scale renovation concepts are not considered. Complex performance from retrofitting and renovation projects depend significantly on the base structure the project is implemented on.

1.3.2 Research relevance

To obtain the desired data, a mixture of qualitative and quantitative research methods were selected. This has ensured that the obtained data is representative of a large majority of the Dutch social housing market. It has also ensured that an accurate representation of the data used by, professionals operating in this sector, was used to make conclusions. Lastly, this also ensures that the results are up-to-date and validated by experts.

To develop a solid research basis, a focused literature study can help to pinpoint more accurately the problem, draft and test solutions. This research features three literature study sections. The first was used to increase the overall problem comprehension by making an assessment of the current social housing market in Amsterdam and it tenants groups. This first part, which is in the second chapter, also serves as a source for the data tested in the survey. The second part of the literature study was performed to analyse and substantiate the survey output data (e.g., to help to answer why people choose what they choose by examining factors such as age, income, living environment and culture). Lastly, a literature study was conducted to obtain KPIs which can be used to test and compare NHCs.

One of the differentiating factors between social housing and private housing organisations is their objective. Where private housing organisations are focused on direct profit, the primary goal of SHCs is the quality of life for tenants. Since the focus is on quality of life, it is important to include the needs of tenants in this research. Much research has already been done by Nauwelaerts de Agé (2010), Kroon (2013) and Bondrager (2016) into the social housing market and tenants. The original intent in this study had been to collect and analyse data on tenant needs using survey techniques to those used by Bondrager (2016). In the end, data from an existing customer satisfaction (KTV) survey was used. There were two reasons existing survey data was chosen. First, the same population had participated in a survey with a similar goal just months prior, so the survey data was up to date and relevant. Secondly, the consensus this researcher reached with company experts was that surveying the same population so soon after the previous survey would result in very low participation ratings.

Aside from survey data, expert knowledge is a valuable part of the study. The scientific world has looked at published work as a main source of information, which tends to have a delaying effect on taking into account the latest market developments. To obtain the most up-to-date data, social housing and concept development experts were interviewed and consulted. The interviews were prepared and executed using proven methods (Baker et al., 2012; Gubrium & Holstein, 2001) to ensure the data gathered is applicable to qualitative part of the research. These experts are EH's in-house specialist or people operating in the social housing field. All of them were contacted via EH's or my personal network. The consensus was that, by first obtaining relevant, up-to-date information in the earlier stages of research, the interviewer could ensure the interviews would be interactive, and interview output value could be maximized'. Lastly, contact was made during the final phase of the study with the interviewed persons to confirm all stated points and assumptions were correct.

1.3.3 Research design

The research data was gathered via four different research methods: literature study, desk research, survey questionnaires and expert interviews. The literature and desk research methods used external sources to obtain new or additional phase-dependent subject information. This was done by either reading research reports, in the case of the literature review, or by consulting online and offline information sources from EH, market parties, interest groups or government agencies. The survey questionnaire method was used to obtain insight into the Social Housing Tenant (SHT) group, as this was not possible by other methods due to insufficient data being available via other sources. Lastly, expert interviews as a research method were used when other methods provided insufficient insight.

To ensure research deadlines were met, a clear structure was established. This approach split the information-gathering phase of the study into three phases. Every new research phase was started by a literature study to obtain preliminary information. A desk research phase was then completed to identify possible data already indexed by EH or the market.

The three research phases were as follows;

Concept Inventory

The first phase was designed to index developed NHCs. This was done by first using specific Internet and article searches. The focus here was on data from experts and on the data available from the 10 largest construction firms operating in the Netherlands according to CoBouw (2018). This list of NHCs was finally discussed with experts from EH's RED department. This was done to ensure the list was complete, to gain insight from expert experience with NHCs and to have a first look at RED KPIs.

Tenant KPI Inventory

Secondly, a tenant KPI inventory phase was planned. This was done using an initial literature study followed by desk research. The initial plan had been to use the results from these preliminary steps in a survey to be distributed among EH's tenants. However, after these results showed that the KPIs to be surveyed were the same KPIs EH was planning to research, it was decided that executing two similar surveys would provide no added value, and that EH's surveys results would be used as a source. Information gathered during these preliminary steps was, however, used to interpret EH's survey data. The desk research data also served as a basis for the next phase and was considered in drawing conclusions at the end of the study.

EH KPI Inventory

The third phase focused on EH's KPIs and was performed concurrently with the Tenant KPI phase. This concurrency was chosen to enable possible discoveries from both phases to be interchanged. The third phase followed the same structure as the Tenant KPI phase, the main difference being that after a short literature study, experts were consulted and internal documents were analysed.

1.4 Methodology

1.4.1. Introduction

This section elaborates on and explains the rationale for the methodologies used in this study. To ensure a well-informed conclusion can be drawn by the end of this thesis, a mix of quantitative and qualitative research methods are implemented. These are the research methods: a large-scale survey, desk research, interviews with several stakeholders and brainstorming sessions with real estate developers. The first method was selected to ensure a well-formed consensus could be constructed about the needs and preferences of one of the most important stakeholders.

The desk research was essential in obtaining basic knowledge and information about the subject at an early stage of the study. The brainstorming sessions and interview were chosen to provide context for information learned during the desk research and obtained via the survey results. These sessions and interviews also allowed discussion of ideas and views of experts working in the field. The following sections provide more specific arguments about the chosen research methods.

1.4.2 Large-scale tenant survey

1.4.2.1. Motivation to use tenant survey

When a survey is performed on a large scale, data from it can provide insight into a subject with extremely high external validity. For this reason, the survey is the second most used data gathering technique for studies (University of Minnesota, 2019). Self-completion surveys give respondents time to consider their answers, refer to records and/or consult with others (Muhammad Sajjad Kabir, 2016). It is because of these advantages that the data from an EH survey was used to determine the preferences of EH's tenants. The main goal of this survey was to identify tenant satisfaction factors: in other words, which housing characteristics do EH tenants value the most?

1.4.2.2. Data analysis

To ensure data from the tenant survey would provide a clear indication of the needs and preferences of tenants, a simple regression analyses was used to analyse the survey data. This method is used to identify correlations between variables. The data analyses were performed using a version of the SPSS software. To ensure data analyses were performed correctly, results were discussed with Dr. Yuri van der Oord, EH's in-house lead data analyst.

1.4.3 Interview and brainstorming sessions

1.4.3.1 Motivation to use interviews and brainstorming sessions

To ensure data and information is interpreted correctly, interviews and brainstorm sessions were selected as a research method. They were used to gather new data but primarily to confirm assumption and discuss ideas. Both the brainstorm sessions and interviews were non-scripted and mainly focused on freely forming and expressing ideas and interpretations.

1.4.3.2 Interviews and brainstorming data gathering

The interviews were held with five social real estate experts working at EH. They are Suzanne Bonarius, Gerbrand van Rootselaar, Hans Stolze and Peter Visser, all real estate developers. Interviews were also held with Ir. Nicole de Vrij a former real estate developer and now manager of EH's project realisation department. The brainstorm session was held with the members of the Concept Housing Innovation Project (CHIP) group, a project group made up of Bonarius, van Rootselaar and Stolze. Joining this brainstorm session was Ir. De Vrij, who specialises in project and process management.

1.4.3.3 Interview and brainstorming data analysis

Data from the interviews came in the form of feedback on the researcher's assumptions and comments on the trajectory of the literature study. The data in most cases functioned as a guideline and because of this required little to no analysis.
As for the data gathered from the brainstorm session, this data served as input for the study. The most prominent examples are the data gathered about the SHCs' objectives, working methods and the KPIs that can be derived from them. A brainstorm session was also used to establish valuable attributes of NHCs that needed to be adopted into the NHC matrix (see appendix 1.)

This data was acquired by presenting the members of CHIP with an extensive list of housing attributes, which the members then ranked. This ranked list was truncated at a point where CHIP members agreed attributes lower on the list were no longer deemed to be of great importance.

1.4.4 Desk research

1.4.4.1 Motivation to use desk research

The study of NHCs is a very topical subject, currently not yet researched by many people other than those that have developed them for the market. This makes finding studies that have researched the subject from the perspective of social housing difficult. To obtain data on NHCs suitable for SHCs, desk research was selected as the best research method. Because NHCs can be seen as a product, it is assumed that the producing party will most likely be inclined to advertise its product. Desk research is an excellent way to find and contact these producers and potentially gather more than the basic product information.

1.4.4.2 Securing desk research data

It is reasonable to expect not all producers of NHCs are eager to share details of their NHC development process. This process most likely required a financial investment from them, and the outcomes, in the form of a developed NHC, could be considered a company secret. Ensuring NHC producers that their development data would not go to competitors was a crucial step in obtaining data via desk research. This was achieved by using EH credentials in the form of an EH email and postal address. Furthermore, contact from experts working at EH was another way to get in contact with NHC developers or producers.

1.5 Reading guide

This thesis describes the steps that were taken to collect sufficient data to give a substantiated answer to the main research question. The chapters largely follow the chronological order in which the steps they describe were performed. It must, however, be noted that most research activities were performed only partially sequentially with considerable overlap and parallel development. All chapter focus on an individual problem and/or solution. The goal of these stand-alone chapters was to ensure parts of the thesis can be read and understood independently. It must, however, be noted that some subject background information and abbreviations can be found only in previous chapters. A comprehensive list of all abbreviations is placed at the beginning of this research on page 11.

The first chapter describes the process as it was selected before the start of the research. This chapter provides insight into what drove the research initiative and background information about the problems and possible solutions. Among the most important components in Chapter 1 are the main research question and sub-questions.

Chapter 2 describes the preliminary theoretical research done after the proposal to obtain a better subject understanding. This second chapter mostly describes the results from two months of literature and desk research. Results mentioned within this chapter are built or expanded upon in chapters 3, 4 and 5.

Chapter 3, 4 and 5 were (partially) performed sequentially. All three chapters explain an information-gathering process using different methods or a mix of methods. In the end, all three chapters also give partial conclusions on the gathered information and how it helps to provide substantiated answers to research sub-questions.

Besides describing different research methods, the chapters are also focused on different aspects of the research. Chapter 3's main focus is on obtained knowledge about existing NHCs on the market, Chapter 4's focus is on Tenant KPIs and Chapter 5's focus is on SHC KPIs.

In chapter 6, the partial results from Chapters 4 and 5 are used to judge the NHC inventory developed in Chapter 3. Chapter 6 looks at how NHCs perform when using the found KPIs as a benchmark. The interim conclusion formed at the end of this chapter provides the basis for Chapter 7.

The final chapter reflects on the information gathered, the interim conclusion and the research process. Chapter 7 provides answers to the main research question and sub-questions by using the information from Chapters 1 through 6. This chapter also provides a critical analysis of the performed study and recommendations for future research.

Chapter 2 – Preliminary theoretical research

To answer how new housing concepts (NHCs) accommodate the requirements of the tenants and the affordable and sustainable production ambitions of social housing corporations (SHCs), the second chapter focuses on NHCs. The goal is to describe NHCs and investigate how they differ from conventional housing solutions. This research categorises and identifies valuable data about NHCs and traditional houses. The NHC as a concept and NHCs' inherent theoretical benefits and restrictions are also investigated.

Specifically, this chapter describes the theoretical research which has been performed to gain insight into the key concepts in this project. To draw conclusions about the affordability and sustainability of NHCs, a theoretical framework needed to be created. This framework answered these questions: *What is an NHC? Who are NHCs' stakeholders?* and *In what environment will NHCs be applied?*
Section 2.1 provides insight into different definitions of an NHC and explains which definition is used during this research. Preliminary research has shown that different market parties use many different definitions. To ensure the NHC framework model will be used well in the field, the definition is essential. Additionally, a clear definition will ensure future research result can successfully build upon results from this study.
The second and third sections elaborate on the stakeholders and shareholders of NHCs. In this part of the chapter, the 'consumers' and end users of NHCs are explained as well as how their involvement influences the performance judgement of NHCs.
In the final section, the use of the term sustainability is clarified. This section also explains how sustainability affects the potential relative performance of NHCs. Lastly, this section elaborates on current laws and regulations related to construction in the Netherlands and Amsterdam.

2.1 Concept houses

2.1.1 Concept housing definition

The need for a single clear definition comes from the need to build upon research results with new findings and future developments. A lack of definition could lead to future incompatible NHC results being used, giving inaccurate results. The clear definition will also ensure that anyone who desires to implement the research results can successfully develop plans, set expectations and tackle problems.

Within the construction industry, the term 'housing concepts' (HC) has many definitions. These definitions include housing concepts which focus on accommodating people, such as this: 'housing is a building or part of a building where a household can live all year round and which meets certain statutory requirements, including also residential address' (Henilane, 2016).

Other definitions interpret housing as the constructing of a dwelling, such as a 'design concept that recognizes, respects, values and attempts to accommodate the broadest possible spectrum of human ability in the design of all products, environments and information systems' (OIKODOMOS, 2011).

Many of these definitions share a common consensus (Robinson, Scobie, & Hallinan, 2006). The consensus is that NHCs are housing designs that have a level of completion. This can mean that the NHC is a fully developed design or a flexible design of which only the core components are fully developed. To ensure the used NHC definition would match with that of SHCs, an expert interview was conducted with Nicole de Vrij, manager of project realisation at the SHC Eigen Haard (EH). De Vrij explained that SHCs define NHCs as structures built from a predeveloped design, using prefabricated parts with a limited amount of design adjustability and meant for permanent occupation. She stated: '*Many construction companies label their concepts as new housing concepts the trick is identifying truly progressive concepts*'. Stolze (2019) elaborates on these by explaining: '*During my time at a construction company NHC were used to start a conversation with a RED company and once the dialogue was established the opportunity was used to promoted traditional building concepts. Back than (early 2000's) NHC were mainly used to get a foot in the door'.*

SHCs view NHCs as products the design of which has been perfected over the years and that could be ordered similarly to other consumer products (e.g., cars and home electronics). During a later conversation, a real estate development (RED) expert revealed that some construction companies apply the NHC or concept house term to their product to create extra appeal for it, although in actuality these so-called NHC products still employed a great deal of on-site concrete pouring. By wrongfully applying this title, these NHCs were more flexible and therefore could be used at more RED projects.

The inclusion of these sorts of NHCs would mean that a core benefit of NHCs, the controlled work site would not apply. This discovery led to the demand for all concrete to be produced off-site within the definition. The pouring of concrete foundation work on-site does not exclude a concept from being an NHC.
Creating a workable NHC definition that combines these theoretical benefits of NHCs, requires that a few key characteristics be included. These key characteristics are these:
- *largely predesigned*, meaning the majority of the design work has already been done, which saves time and creates clarity about the design cost;

- *fully developed design*, meaning the production process has been fully developed and optimised, providing few production time risks;

and

- *constructed using off-site prefabricated building piece(s)*. Ensuring that this characteristic is integrated has several benefits. First, pouring prefab elements off-site ensures that weather does not influence concrete pour quality or time. Secondly, pouring off-site will drive construction companies to industrialize their pouring activities, which raises the likelihood of gaining industrialization benefits such as decreased cost and time. And lastly, pouring off-site will mean that to create high-quality

work, designs must be fully developed, because it is difficult to make last-minute alterations to industrialised pouring activities.

Combining the definitions mentioned in this paragraph leads to the creation of the definition used in this study. During this research a single definition has been used for an NHC:

A largely predesigned and partly or fully developed housing design constructed using a single or multiple construction pieces that are prefabricated off-site.

2.1.2 Concept housing goal

The main reason NHCs have been selected by SHCs as a possible solution is the theoretical advantages they hold compared to building using traditional methods. The most common comparison is made between car manufacturing and the construction industry. What is used as a basis for hypotheses in these studies is the transition of the car manufacturing industry from a one-off to assembly line to fully automated industry to lower production cost and time (Gann, 1996). Case studies have shown that standardisation and pre-assembly can have irrefutable advantages in production costs when a product is continuously developed (Gibb, 2001; Razzaghmanesha et al., 2016).

In addition to these cost and time savings, most prefabricated adoption studies support the consensus that prefabricated construction parts have higher quality and can be created more quickly (Lewis, 2000; Morgan & Liker, 2006). Some studies also support the conclusion that using prefabricated parts can reduce overall construction waste, making it even more attractive for SHCs with sustainability goals (Tam, Tam, Zeng, and William, 2007).

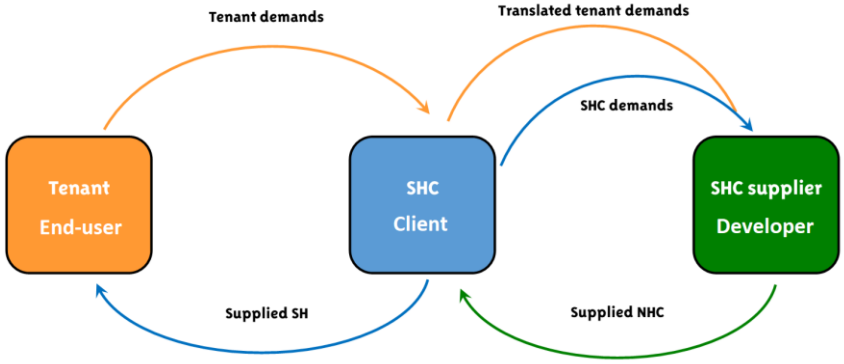
2.1.3 Concept housing stakeholders

Most traditional construction projects have two main stakeholders: a client who wants to have something constructed and a builder who is able and willing to construct the desired complex. This is the same for projects in which the client looks for a builder and projects in which a builder looks for a customer for its development project. The relationship between these stakeholders changes slightly when the client is not the end user. In such cases, clients have to find a balance between their personal preferences and the end users' preferences. In the case of social housing, the social housing tenants (SHTs) are the end users, SHCs are the clients, and the builders are medium or large construction companies.

The predeveloped characteristic of NHCs changes the relationships between project stakeholders even more. No longer will client and builder create a fitting solution for the combined client and end-user demands. When considering NHCs, clients (e.g., SHCs) must look for the NHC on the market that best fits the combined demands. In the case of developing with an NHC, the role of the SHC RED changes from product and project developer to customer and product expert.

These experts have to translate subjective SHT demands (e.g., nice appearance, pleasant layout) into objective NHC demands (e.g., minimum width, best exterior finish). These objective tenant demands together with SHC demands then have to be negotiated with NHC suppliers (see Fig. 1).

Fig 1.
Stakeholder relationship between tenant, SHC and SHC suppliers (construction companies).



2.1.4 Concept housing suppliers

The suppliers or developers of NHCs are mostly medium or large construction companies selling the concept as a regular product. The construction company's relationship with an SHC can be compared to that of a consumer and a developing producer (e.g., Apple, BMW). Construction companies have a number of reasons to develop and produce NHCs for the housing market. The most obvious incentive is financial. The second reason is to supply market demands. Commercial housing projects which were proposed during the financial crisis have found momentum in the last couple of years. The primary reason for this renewed incentive to develop is low interest rates and the previously mentioned increased demand. To meet these demands, construction companies are now advertising quickly realisable housing solutions. These housing solutions are less flexible; however, they do fit well with the large-scale projects REDs and municipalities want.
While reducing construction time is in the interest of companies and developers, only construction companies truly benefit from reducing the workforce needed. Because of the current high demand for skilled construction labour, workforce prices have gone up.

By reducing the required workforce needed to build a house, significant cost savings can be realised. A third reason why companies are motivated to invest in NHCs, besides cost and time savings, is the fear of falling behind. Studies have shown that companies that invest too little or too late can lose their connection to the market. Such companies then have to invest much more money and time than their competitors to catch up (Spulber, 2008).

The final motive for the development of sustainable NHCs by construction companies is their own sustainability goals. Many of the larger construction companies have set progressive sustainability goals for 2030 or 2050 (Heijmans Nederland B.V., 2017; Koninklijke VolkerWessels NV, 2018; Royal BAM Group nv, 2018). To achieve these goals, their products and production methods need to be made more sustainable.

2.2 Tenant needs

2.2.1 Tenant background

Although SHC tenants have changed over the years, they have always been tenants who require help to find good housing. By definition, an SHT is a person who, for various reasons, does not have the financial carrying capacity to find a house on the open housing market.

Currently, SHTs are defined as people living in a social house with a maximum gross yearly income of €42,436 (price level 2019) (Rijksoverheid, 2019). The Dutch government further divides these people into two categories depending on their income. The lower-income group is made up of people with a maximum gross yearly income of €38,035 (price level 2019), whereas the middle-income group consists of people with a gross yearly income between €38,035 and €42,436 (price level 2019). People living in social housing with a yearly income greater than €42,436 are referred to as *scheefhuurders*, or crooked tenants. These tenants are defined by the fact that there is a crooked ratio between their income and the portion of it that they spend on their rent (Rijksoverheid, 2018). Crooked tenants generally enter social rent dwellings when their income is below the income threshold. Their income then increases over time, creating the before mentioned crooked ratio. Due to tenant protection laws in the Netherlands, SHCs are unable to evict these crooked tenants solely because their gross income is too high. There are no concrete figures on the total number of crooked tenant; some studies estimate that in 2015 less than 14.6% of SHC tenants were crooked tenants (Woonwijze, n.d.). In total, SHCs rent homes to approximately one third of Dutch households (see Fig. 2) (Kullberg, 2018).

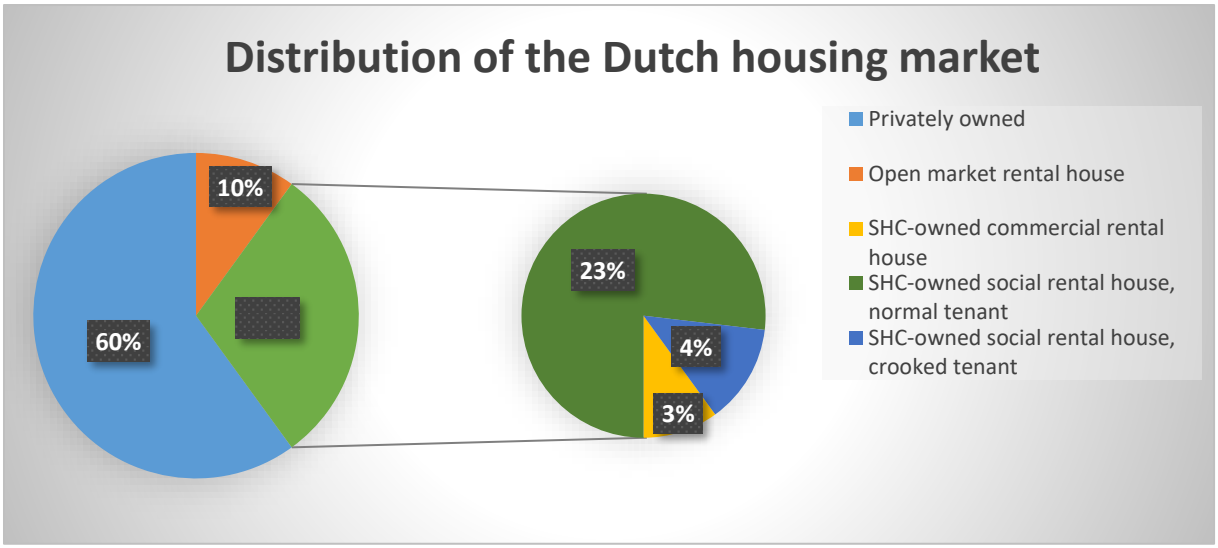


Fig 2. *Division of the Dutch housing market, based on data from Kullberg (2018).*

2.2.2 Tenant objectives

As can be assumed from their defining characteristic, SHTs would strive to get a rent which matches their lower-than-average income (County, 2012). Because maximum prices of Dutch social housing are defined by a point system, a lower rent will most likely mean a dwelling with a lower score on the points system (Rijksoverheid, n.d.). There is a possibility for SHCs to diverge from this system and offer housing for a lower price than it is worth according to the point system. However, asking less rent will make it hard for SHCs to perform their development tasks, and thus is not a sustainable financial policy.
Social housing tenants' objectives can be observed by studying commentary of SHTs on dwellings. SHT complaints are a sign of a mismatch between dwelling characteristics and SHT expectations.

A recent report by *De Woonbond*, or The Tenants Union, (2018) looked at what dwelling characteristics most tenants judge negatively. Tenants' negative judgements about SHCs were not focused on high rents but on the quality and maintenance backlog of their dwellings. Low dwelling quality, difficulty getting maintenance needs met and high rent are some of the issues developers of NHCs promise to address with the products they advertise (FijnWonen, 2019; VolkerWessels, 2019). On top of that, developers promise a shorter construction time, resulting, even with the current workforce shortage, in a high build rate and thus more available houses (Rikkert, n.d.; VWVastgoed, n.d.).

2.2.3 Measurable tenant KPIs

To predict the effects of NHCs on the SHT, having insight into tenant preferences is crucial. By using KPIs, the performance of NHCs can be benchmarked. This benchmarking is critical to judging NHCs and seeing how well they meet the desires of the end user. A recent study by Van den Bos shows that tenants value nine housing characteristics (Bos, 2018). Van den Bos derived these nine characteristics from results of a study he had commissioned from Motivaction (2017). Motivaction's (2017) study indicated that a total of 11 KPIs influenced tenant happiness (see Fig. 3).

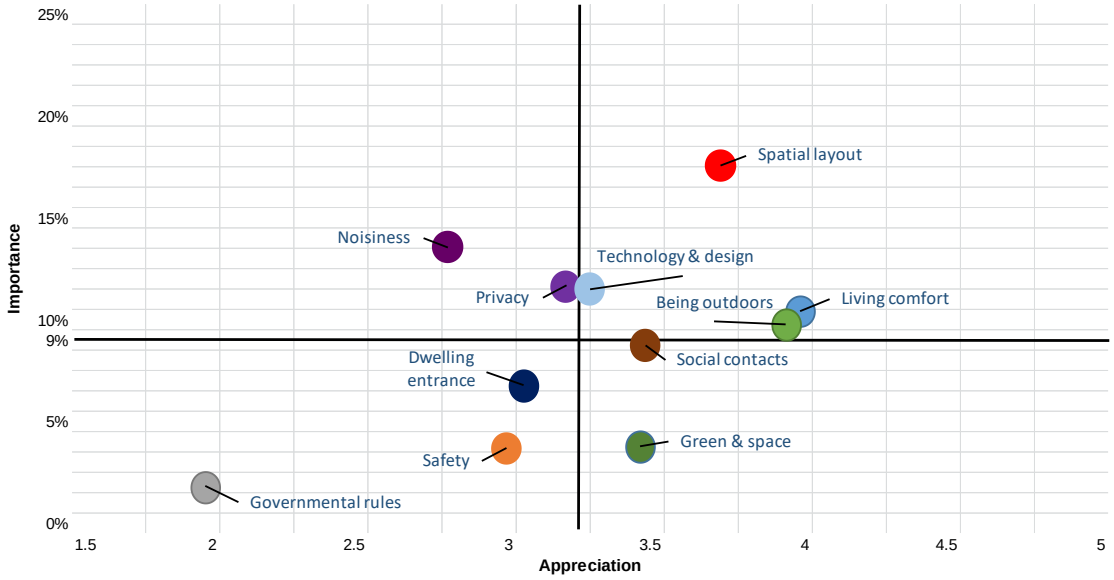


Fig 3. *Tenants' 11 happiness factors* (Motivaction, 2017).

Chapter 4 focuses on the possibilities for measuring these KPIs and characteristics. The following explanations of the nine housing characteristics are based on descriptions obtained from innovator and NHC developer Rick van den Bos.
Van den Bos's interpretations are, despite being well founded, only a limited view on the characteristics. Other NHC developers could have based their NHCs on alternative information or developed them with a slightly different end user in mind. These nine characteristics were chosen because they and the study on which they are based (Motivaction, 2017) were focussed on creating housing for SHTs. These characteristics functioned as boundary conditions for Van der Bos and the Royal BAM Group when creating the NHC Thorb. Explanations are all based on the currently unpublished report '*De 9 Geluksfactoren*' (Bos, 2018).

LOCATION
The location has a large influence on living experience and determines how much people want to live in a given home. Congestion, crime rates and other social unrest will deter people from living there. Quiet green spaces or proximity to a city or village centre, on the other hand, increase living pleasure. These are the common denominators influencing location preferences; the exact nature of location appreciation differs between households.

SOCIAL INTERACTIONS
Social contact within a neighbourhood greatly affects the happiness individuals experience from their living location. When considering social contact, this is mainly seen as the ease with which people come in contact with neighbours.

SAFETY and SECURITY
Measures put in place to protect against fire and burglary hazards have a large influence on the level of security people experience in their homes. However, most people already feel safe in their current house, creating a situation where safety and security aspects are only valued after they have been violated. This unawareness of safety aspects makes it hard to measure their effect.

LIVING COMFORT
Among all characteristics, Bos (2018) designates living comfort as the aspect that has the most influence on how much people feel at home in a dwelling. Measurable aspects affecting living comfort are variables such as the levels of humidity and house drafts, the overall temperature and the ease with which the dwelling can be kept clean. During their research, Bos and Bam found a number of complaints tenants had about things that negatively affected living comfort. These were bad insulation, slamming doors, house draft via doors and windows, windows that only open to one position, mould and bad smells as a result of bad ventilation, and difficult-to-regulate dwelling temperature.

GREEN and OUTDOORS
Personal outdoor space is essential for living comfort. This need for personal outdoor space is especially true in urban areas. Although a garden is seen as a preferred option, it is seen as a luxury in the city. Within dense urban areas, balconies or a roof terrace are also seen as very pleasant.

FINANCE
Other objective characteristics influencing living comfort are financial aspects. Most tenants spend 40% of their net monthly income on living expenses (e.g., rent, energy bills and/or maintenance). Decreasing tenant expenses by lowering energy bills and rent prices as a result of lower construction and maintenance costs and better insulation will have a positive effect on living comfort.

PRIVACY
Noise disturbance was observed as one of the biggest causes of frustration. No noise disturbance and outsiders not being able to look into ones dwelling greatly contribute to a sense of privacy. It is this sense of privacy which research by Bos (2018) has pinpointed as determining roughly 12% of a tenant's overall living comfort (see fig. 3)

SPACE and PLAN
Space and planning is the second most important characteristic contributing to a tenant's level of living comfort. The main elements affecting the level of living comfort in this category are the floor area of the living space and the way the dwelling provides a spacious feeling. Size and a spacious feeling affect tenants because they determine the way they can store items, invite people over or have space for hobbies.

TECHNOLOGY and DESIGN
Interior design is an important aspect for tenants because they experience it, more so than exterior design, as an expression of their personality. Technology integration, on the other hand, is a less important aspect. The possession of technology is mainly seen as nice to have, if all need-to-haves have been taken care of.

2.3 Corporation needs

2.3.1 Dutch social housing history

Many of today's SHCs in the Netherlands started as associations, so-called *Woonverenigingen*, or housing associations. Other SHCs started out as either partnerships or foundations. While there are legal differences between SHCs that are associations, partnerships and foundations, they are all publicly seen as the same. These housing associations, as they were all publicly referred to, were most commonly established by stakeholders. These stakeholders were usually individuals or groups that strove to improve the quality of life (QoL) of the working class. The first of these Dutch SHCs was *Vereeniging ten behoeve der Arbeidersklasse te Amsterdam (VAK)*, established in 1852.

By 1901 the Netherlands had approximately 40 SHCs that tried to improve working-class housing without any government support. This autonomous approach changed in 1901 with the arrival of the *Woningwet 1901* (Housing Law of 1901). The Woningwet was a response by the Pierson cabinet to conclusions in the report '*Het vraagstuk der volkshuisvesting'* (Drucker, Greven, & Kruseman, 1896). In their conclusion in this report, Drucker, Greven and Kruseman recommended the introduction of state-provided loans for SHCs. These low-interest government loans would allow SHCs to improve the QoL by renovating or demolishing units and building better working-class dwellings (Elsinga, et al., 2014).

The government support in the form of low-rent loans led to the creation of more SHCs and the first municipally managed SHC in the following years. The effects of the Woningwet 1901 and the increase in the number of SHCs helped to create 1 million social houses between 1901 and 1940.

The housing shortage caused by the Second World War saw the Dutch government make drastic changes. The government, in the form of the first Drees cabinet, gave SHCs a central role in solving the housing crisis. This central role came with more interference of the central government, which now subsidised, planned, distributed and controlled all SH projects. This extra government interference changed SHCs' autonomous and private character, making them a governmental tool.

Between 1947 and 1985, the housing portfolios of Dutch SHCs grew from 196,000 to 1.6 million units. This increase in the number of houses SHCs owned meant that their combined share of the Dutch housing market grew from 9% (1947) to 30% (1985) and even peaked at 42%. By the year 2000, Dutch SHCs' housing assists had grown to 2.36 million dwellings.

The 1990s saw the Dutch government transforming the SH sector, from what was a governmental financially supported and controlled sector back to private and market-operating businesses. Instead of subsidising SHC projects, an institution was put in place to offer guarantees for banking loans. These guarantees were provided by the *Waarborgfonds Sociale Woningbouw (WSW)*, or Social Housing Construction Guarantee Fund, established in 1984. By offering WSW guarantees on projects, SHCs were able to get low-rent loans for development and redevelopment projects. In cases where these low-rent loans were not enough, SHCs were responsible for attracting investors on the open market.

During the last 20 years, the roles, responsibilities and restraints of SHCs have changed multiple times. At the turn of the century the role of SHC was expended further. The Dutch government also tasked SHCs with creating modal and high-income rent homes and owner-occupied houses. The demand for SHCs to create more-profitable housing types also meant more investment freedom was granted to SHCs. These increased freedoms and the financial incentives led to the creation of increasingly more-profitable high-priced rental houses. This shift in SHC policy eventually led to the 2012 Vestia scandal, with the SHC Vestia at the centre, that unveiled administrative and policy problems at many Dutch SHCs (de Jong, 2013; Dohem & Konig, 2014). The result of the parliamentary conclusion of this affair was the *Woningwet 2015* (2015 Housing Law). The Woningwet 2015 once again limited the ability of SHCs to develop profitable open-market rent and sale dwellings.

2.3.2 SHC goals

The goals of an SHC are determined by legal boundaries, its relationship to its tenants and an SHC's individuals goals. Because the goals of individual SHCs can differ, the conclusions in this section might not be representative for all SHCs. To draw the conclusions in this section, the goals of some of the largest Dutch SHCs have been combined (Portaal, 2019; Ymere, 2016; Eigen Haard, 2016).
Most SHCs have a set of six or seven goals that can be divided between 1) core activities and 2)

boundary requirements. Core activities are goals that are focused on providing matching housing for as many people as possible. Boundary requirements, on the other hand, are less focused on the SHC's core tasks and more on creating and maintaining a financially healthy organisation that functions as a safety net for a vulnerable group.

Core activities

The core activities SHCs focus on is performing their original function within the framework created by the government. As explained in the previous section, many SHCs were initially created to provide housing for the 'lower-income working class'. The definition 'working class' might no longer be relevant, as most SHCs now focus on helping all vulnerable groups that have trouble finding housing. These vulnerable groups currently still consist of people with a low income but also individuals or households in need of extra medical care at home or status holders (the politically correct term for legal refugees with a residence permit). This shift to a broader target audience is reflected in the SHC goal to house as many people as possible (see Fig. 4). What has not changed over the years is SHCs' focus on constructing houses of high quality. When creating good-quality housing, SHCs also try to do it in such a way that it leads to attractive neighbourhoods.

Boundary requirements

The second set of SHC goals are a result of government oversight of the sector, a changing environment, an industry benchmark tool and a willingness to strive for good service. Government oversight can be seen as a cause for SHCs to have sound financial performance as a secondary goal. To retain some government support, SHCs need to demonstrate financially healthy policy. Ensuring financial health means making safe investments and striving for a high level of administrative transparency. For SHCs to benchmark their performance, Aedes, the industries umbrella organisation, has developed specific tools. These SHC tools benchmark performance based on, among other things, the level of tenant satisfaction. Because of this benchmark method, tenant satisfaction is an important SHC KPI (see Chapter 5, 'SHC KPIs', for a more extensive explanation). Lastly, SHCs have an ambition to make sure their target group members are provided good housing now and in the distant future. To ensure this future housing ambition can be achieved, SHCs have adopted two goals within their boundary requirements. Not only must their financial policy be healthy to ensure they have the financial resources to develop housing now and in the future, SHCs also strive to make as many sustainable environmental choices as possible. Making sustainable environmental choices means choosing sustainable materials, building concepts and working processes.

Fig. 4 shows the relationship between SHC core activities and boundary requirement goals. The figure is an adaptation from Eigen Haard's goals and ambitions model (Eigen Haard, 2016).

Fig 4. *SHC core activities and secondary and tertiary objectives based on a model of Eigen Haard (2016).*

2.3.3 Current problems

For years, the financial crisis plagued the construction market because of a stagnation of real estate investments. This lack of investment caused many construction companies to declare others were bought up by foreign conglomerates (Cobouw, 2018). It is believed that the financial crisis is now a thing of the past, according to Theo Kocken, professor of risk management at the Public University of Amsterdam(Sas, 2018). As a result, the construction companies that survived the crisis believe it is now their time to grow and take advantage of the large number of construction projects that were put on hold during the crisis. This project boom has resulted in an imbalance between supply and demand, with a sharp increase in construction prices as a result (Cobouw, 2019).

On top of these higher construction prices, legislation passed in 2015 also makes it harder to compensate SH development cost with profits from private sector developments. Common practice from before the Woningwet 2015 introduction saw SHCs use profits from private housing projects to balance out losses on SH projects. This law prohibits large SHCs from performing economic activities other than those that are seen as their core activities. These noncore activities are summarised as non-DAEB (DAEB being a Dutch abbreviation for *Diensten van Algemeen Economisch Belang*, or services of general economic interest). With the Woningwet 2015 in place, SHCs are only allowed to perform non-DAEB projects if commercial operators in the market are unwilling to take them on (Aedes, 2016; Rijksoverheid, 2015).

Besides higher construction prices and a lower return on their development projects, SHCs are also required to pay an extra tax on rental income. This new tax, the *Verhuurdersheffing* (lessor levy), was introduced as a measure to help with the national deficit during the financial crisis. However, it is

currently still in effect and results in a sum of €1.7 billion that is paid to the treasury and not invested in new SH (KPMG, 2013; Rijksoverheid, 2019).

2.3.4 Current strategy

The current housing crisis, which is characterized by, among other things, increased queuing for SH and a sharp increase in-house prices, is a result of the cyclical upturn in the construction industry and social housing regulations implemented by the government. SHCs it's umbrella organization (Aedes) have not yet found a fitting solution for the problem. Studies commissioned by Aedes have also failed to find a fitting solution (COT , 2014). This researcher agrees with economic experts that collaboration between governing bodies and SHCs is the only way to find a solution for the housing crisis (Hendricks, 2018).

2.4 Sustainability goals

Sustainability is a hot issue. Companies communicate increasingly about their environmental goals and positions, even if they are not linked to their core business (Kolk, 2003). This is a direct result of an increased interest of consumers in environmental awareness and sustainable choices (CBS, 2018). This section elaborates on sustainable trends on a global, national and industry level.

2.4.1 Global trends

'*In the last 15 years, the world has looked at the future and predicated a smart and green evolution'* (Vos & Meekes, 1999). Studies have proven irrefutably that more green space, especially in dense urban areas, has significant benefits to health, happiness and thermal and water management (oberndorfer, et al., 2007; Thomaier et al., 2015).

The lessons learned from these and similar studies have influenced housing trends. Four of these new housing trends can be seen as among the reasons which explain the emergence of NHCs (D'arpino, 2015; Koutsogiannis, 2018).

Tiny houses

The tiny house movement, or small houses, is an American architectural and social trend based on the belief that people do not require much living space and that smaller houses are more affordable and have a smaller environmental impact. While no exact definition of the term tiny house exists, the common consensus is that a house must be between 15 and 50 m^2 to be a tiny house and no bigger than 90 m^2 to be a small house. A trend within the tiny house movement is to build houses on a movable chassis so they can easily be relocated (Wilkinson, 2011).

Roof efficiency

Much research has already been done into the effects of green roofs. Green roofs' most prominent characteristics are that they contribute to better urban thermal and water management. They also provide significant benefits in improving air quality (Bottalico, et al., 2016; Speak, Rothwell, Lindley, & Smith, 2012). A downside of a green roof compared to a conventional roof finish is the initial cost. This is because a green roof requires a waterproof durable base layer, effectively doubling initial costs (Dakdekker-Weetjes, n.d.).

Besides creating green roofs, another trend is to use empty roofs for placing photovoltaic (PV) panels. As is the case with green roofs, placing PV panels requires a higher initial investment. However, unlike green roofs, PV panels lead to a cost reduction or even an extra source of income. A recent study concluded that the Netherlands can provide 50% of its energy needs by placing PV panels on all suitable roofs (Broersen, 2018).

Adaptive reuse
Not a trend but more a general change in the construction industry is the move from location redevelopment (demolition and rebuilding) to location transformation or reuse strategies. When considering a reuse strategy, REDs start by analysing the flexibility and overall condition of a building's shell. If this analysis shows that the casco is flexible enough, it can be given a new or a better function (e.g., from industry or office complex to apartments). The benefits of reuse are a possible reduction of development time and of CO2 production. The CO2 reduction is mainly realised by a lack of demolition and rubble transport activities. Reusing the existing casco also ensures no new casco, and in some cases no new foundation, has to be created. This casco reuse further decreases costs and CO2 production. There are two main reasons REDs still choose location redevelopment. The first of these is casco inflexibility. In some cases the existing casco is not flexible enough to allow for high-QoL dwellings that tenants expect and SHCs want to provide. Casco inflexibility can be caused by characteristics such as support beams or concrete columns in unwanted locations. The second reason to choose redevelopment over reuse is the level of certainty. The uncertainty with reuse is due to the fact that not all complex drawings are up to date. Making reuse project assumptions based on old drawings can prove costly when problems occur during construction because old drawing prove to be inaccurate (Bullen, 2007; Campbell, 1996).

Sector goes digital
The final construction industry trend is the transformation to a more digital working methodology (Leviäkangas, Paik, & Moon, 2017). The construction sector has become more digital since the widespread integration of workplace computers. The sector's adoption of email, digital construction drawings and calculation programs revolutionized the construction and RED sectors in the 1970s (Eastman, Tiecholz, Sacks, & Liston, 2011). Recent advances in the development of 3D (concrete) printers and construction project scanning drones have started a new era of construction digitalisation. These trends have the potential effect of improving the distributing and securing of information. Some technology developments also create the possibility to produce buildings using radically new methods. These new production methods could contribute to meeting increasingly strict safety and sustainability demands (Kothman, 2016; Bos, Wolfs, Ahmed, & Salet, 2016).

2.4.2 National goals
The Dutch National government has set a total of 17 Sustainability Development Goals (SDG's) for the year 2030. While most of these goals are focussed on increasing the welfare of the entire population and reducing unwanted situations (e.g., poverty, hunger), some can be applied to the real estate industry (REI) (KcWJ, 2019), which is a large consumer of energy and materials (Morrow, et al. 2015; Forum, 2018). The REI 'products' also have a long-term effect on sustainability goals because they might be used for decades or even centuries. The SDGs that the REI can help achieve are 7) affordable and clean energy; 9) industry, innovation and infrastructure; 11) sustainable cities and communities; and lastly 12) responsible consumption and production. These goals have already started influencing housing development policy.

The most obvious goal among these is SDG 7, affordable and clean energy, which for the REI means the transition from fossil fuel in the form of natural gas to electricity for cooking and heating in private houses. The Dutch government has revoked the requirement for new houses to be supplied with a natural gas connection (Rijksoverheid, 2017). This has created the option to develop all-electric houses, which in theory would be safer and cheaper to develop and maintain (Gibson, 2017; Lobet, 2017).

Besides the possibility of their developing all-electric houses without being required to, real estate developers will also be forced to innovate by the Dutch government, which is increasing the sustainable housing requirements dictated by the *Bouwbesluit 2020* (building code 2020). Bouwbesluit 2020 will, among other things, force the replacement of Energy Performance Coefficient (EPC) as the building energy performance indicator. The new building grading label, BENG (*Bijna Energieneutrale Gebouwen*, or almost energy-neutral building), will be a big factor in this new building code and uses a new method for measuring building performance (Rijksoverheid, Energieprestatie - BENG, 2019). The three main pillars upon which the BENG grading system is based are as follows:

- the maximum energy requirement in kWh per m^2 user surface per year,
- the maximum primary fossil fuel consumption in kWh per m^2 user surface per year and
- the maximal share of renewable energy as a percentage.

The measuring of fossil fuel consumption as a performance gauge is one of the main reasons all-electric houses are being developed even though doing so at this time is voluntary.

2.4.3 Market developments

As a response to increasing energy prices and sharpened housing building codes, developers have looked at NOM (*Nul op de Meter* or zero on the meter) houses as a fitting solution (CBS, Energierekening 334 euro hoger, 2019).) The term NOM is used to describe houses which, in theory, create as much energy during a year as they consume (Rijksdienst voor Ondernemend Nederland, n.d.).

One of the incentives for housing corporations to lower energy costs of tenants is the possibility to be compensated for their investment in sustainability by a legal rent increase (Aedes, 2016). This compensation incentive is called the *Energie Prestatievergoeding (EPV)*, or energy performance compensation, and can vary in size. In order for corporations to perform renovation activities and request an EPV, the current tenant or 70% of tenants living in a complex have to agree (huurcommissie, 2016; Rijksoverheid, 2016).

2.5 Summary

This chapter provides the results from the preliminary theoretical research done during the first stages of this study. The focus of the first part of the theoretical research was to collect information to define the term NHC. The result was a combined and comprehensive NHC definition: *A largely predesigned and partly or fully developed housing design constructed using a single or multiple construction pieces that are prefabricated off-site'.* During this first research, it became clear that two groups judge the overall success of NHCs: the tenants who would live in NHCs long term and SHCs that 'buy' NHCs from construction companies. Because these two stakeholder groups judge NHC performance, knowing their needs is crucial for assessing performance on a theoretical basis before an NHC is bought or constructed. This first stage also highlighted the importance of sustainability characteristics as an NHC KPI.

Chapter 3- inventory of concept houses

To ensure a complete overview of the NHCs developed by the market, a large index of available NHCs was compiled. This chapter looks at the NHCs found using a combination of desk research and reaching out to experts and to the 20 largest construction companies in the Netherlands (Cobouw, 26 November 2018). This NHC overview will aid with drawing conclusions about the match between market supply and NHC characteristic demands.

3.1 Housing solutions

3.1.1 Concept housing definition

The assessment of available NHCs on the Dutch market has shown that a large number of different interpretations of NHCs exist. A list of all found and assessed NHC interpretations is in Appendix 1. The established definition for an NHC – '*A largely predesigned and partly or fully developed housing design constructed using a single or multiple construction pieces that are prefabricated off-site'*– can be applied to all assessed concepts. The assessed concepts, however, still show much variability in their creative solutions.

To create a valuable overview of the NHCs and to best be able to benchmark them, 20 characteristics were selected by which an NHC could be defined:

1.	Period	Is the NHC meant for temporary or permanent occupation?
2.	Brand	Brand of the NHC
3.	Type	Model or type of the NHC
4.	Developer	Developer of the NHC
5.	Housing type	Type can be either: Ground-bound or high rising houses
6.	Housing subtype	Subtype can be, e.g. apartment, single family house etc.
7.	Construction type	The type of construction used
8.	Stacking potential	The potential to stack multiple NHC units
9.	GIA (m^2)	Gross internal area in m^2
10.	NLA (m^2)	Net leasable area in m^2
11.	NHC width	The width of the NHC
12.	EPC value	The NHC score in term of energy efficiency
13.	Construction time	The average time it takes to construct or assemble the NHC
14.	Level of prefabrication	The level of prefabrication done to the NHC (range 1–4)
15.	NOM	Does the NHC (potentially) qualify as NOM?
16.	EPC < 0.0	Does the NHC (potentially) qualify as EPC < 0.0?
17.	Natural gasless	Does the NHC (potentially) qualify as gasless?
18.	BENG	Does the NHC (potentially) qualify as BENG?
19.	Cost (m^2 NLA)	Cost per m^2 NLA
20.	BUCP	Basic unit cost price

These 20 characteristics have been selected to match previously indexed SHT and SHC KPIs. To collaborate the assumed relation between characteristics and KPIs, the list was than altered using input from a brainstorming session with social housing experts and professional REDs. Non-selected characteristics were not chosen because information on them was not available or was too subjective or because experts deemed them irrelevant. The exceptions to this rule are price per housing unit and construction or assembly time per housing unit. The NHC matrix which houses the indexed NHCs uses these 20 characteristics as selectable variables (see Appendix 1. New Housing Concept matrix).

To judge and possibly select an NHC for a specific real estate project, an overview of essential concept characteristics is paramount. Several brainstorm sessions with a group of RED professionals from the SHC EH helped create the basis for a comprehensive list of concept specifications. These specifications have been divided into the categories sustainability, dimensional and additional specifications. The next three sections elaborate on these specifications.

3.2 Sustainability

Due to an increased global awareness of sustainable development, NHC sustainability characteristics are among their most important characteristics. Not only can these characteristics help meet municipal, company or end-user demand, they are also an excellent way to stand out among the NHCs on the market.

3.2.1 National and municipal sustainability demands

For social and commercial REDs to obtain a building permit for the development of houses and apartments, their projects must meet a large number of demands (Gemeente Amsterdam, (n.d.); Rijksoverheid, (n.d.)). These permit demands range from subjective aspects such as fitting in with the scenery to objective aspects such as complying with the building code (van Gerwen, 2010) (Kenniscentrum InfoMil, (n.d.); Rijksoverheid, (n.d.)). In recent years, the building code and national and local governments have have emphasized more heavily that projects should meet sustainability goals.

Since 1995, the Dutch government has used the *EPC* to benchmark these sustainability requirements (RVO, (n.d.); nen.nl, 2016). The EPC benchmark is based on the energy consumption, where EPC 1.0 is equal to average energy consumption of a house in 1990. Since its introduction as a part of a building permit, the norm for housing development has been raised twice.
In 2006 the maximum was set at an EPC value of 0.8; this was changed five years later to a maximum of 0.6. The last adjustment happened in 2015, when the ministry raised the bar to allow a maximum EPC value of 0.4 (SenterNovem, 2008).
On the 2nd of January 2017, the Dutch Minister of Infrastructure and Environment introduced the 15th section of the Crisis and Recovery law. This latest addition to the law allowed the cities of Amsterdam and Den Haag to require lower EPC values before granting a building permit. Amsterdam used the ability and set a new criterion of EPC <= 0.2 (Cobouw, 2017).

To reduce the Netherlands' dependence on fossil fuel for heating and cooking at home, the Dutch government has implemented the law *Voortgang Energietransitie (VET)*, or Progress Energy Transition. This law, which was approved on the 26th of April 2018, came into force on the 1st of July 2018 and serves as an addition to the Electricity Law of 1998 (Ministerie van Economische Zaken en Klimaat, 2018). The addition of VET means that building permit requests for new buildings submitted after June 2018 will not be allowed to request a gas connection (Aedes, 2018).
The choice to abandon natural gas will see new Dutch houses make the transition to electricity as their main source of power. This transformation increases the likelihood of houses with a large enough roof surface to place sufficient PV panels to become self-sufficient (Laan, 2018).

3.2.2 Company sustainability requirements

In addition to the sustainability transformation being powered by legal changes, many SHCs have also set their own, most of the time even higher, sustainability goals. The first goal is getting all SHC assets to a minimum energy label B. This can be achieved by increasing housing insulation, upgrading heating equipment and adding PV panels as a source of sustainable energy. The final goal for SHCs is to ensure a 100% CO2 neutral housing portfolio by 2050. To help achieve this goal, the route map

2050 (*route kaart 2050*) has been developed (Aedes , 2017). The route map 2050 is a result of several studies that highlight the potential scenarios SHCs could take to achieve CO2 neutrality by 2050. These findings have been presented by Aedes and discussed with SHCs in developing the roadmap. These studies show that to achieve the 2050 goals, SHCs have the choice of three options (Haytink & Valk, 2017):

- A stepwise approach, in which small improvements are made and, during the return on the sustainability investment via the EPV, further improvements are made if the assets show potential. The upside of this approach is that it is cost effective, as only complexes with good potential see high investment. The downside of this approach is the small steps towards the sustainability goals.
- A leap-wise approach, in which a massive upgrade of a complex or house directly make it NOM or energy neutral. The downside is the inability to get a sufficient return on the investment via the EPV, but the upside is the direct achievement of sustainability targets.
- An external approach that supports overall energy neutrality by compensating for buildings that cannot be sufficiently upgraded. The approach advocates the maximal upgrade of the thermal shell of the building and creating the required energy through another project in the area. The benefit is the ease with which this approach can be implemented. The downside is that is does not fix unsustainable complexes but merely tries to compensate for them.

To stimulate SHCs to invest in a more sustainable real estate portfolio, the Dutch government has approved the use of EPV on NOM projects (Ministerie voor Wonen en Rijksdienst, 2016). The EPV is an additional fee tenants pay to an SHC for living in a, in theory, energy-cost-free dwelling. The income from the EPV on NOM projects should be an extra incentive for SHCs to improve dwelling sustainability. The benefits for tenants is the fact they in the end pay less for a NOM dwelling with EPV than for an energy efficient dwelling with a monthly energy bill (Rijksoverheid, 2016; Aedes, 2016).

Lastly, SHCs can have their own requirements on the sustainability levels of specific materials used within renovation and/or new construction projects. A common requirement is the use of wood with a FCS label, which indicates the wood was harvested and the forest managed in a sustainable manner.
This and similar requirements are very SHC-dependent; not meeting this kind of requirement is not always a deal-breaker. However the notion is that the more sustainability labels a concept has, the higher the chance it will meet individual SHC requirements.

3.2.3 Future sustainability solutions

Although some SH projects already struggle to meet sustainability and budget targets, the consensus is that sustainability requirements will only intensify over time, as they have in the past (RVO, 2018). This trend can be observed in the case of the EPC requirement explained in section 3.2.1 (see Table 1). The role of the EPC benchmark will in the future be taken over by BENG. Currently BENG's introduction is set for the 1st of January 2020. Programming problems, however, have slowed the transformation of NTA8800, the document elaborating on BENG requirements, into a calculation tool. This delay in the transformation of NTA8800 might mean that the implementation deadline of January 1st 2020 will not be achieved.

Starting date	Miniml EPC values
01-01-1996	1.4
01-01-1998	1.2
01-01-2000	1
01-01-2006	0.8
01-01-2011	0.6
01-01-2015	0.4

Table 1. *EPC labels have become stricter over the years. This is a visual representation of information from RVO (2018).*

In addition to stricter requirements on energy usage, a trend can also be observed in the sustainable use of materials. Circularity, the reuse or sustainable use of materials, is becoming more important for companies with high sustainability goals. There are currently no minimal requirements on the circularity of a building's design. However, supporters of circularity point out that circular real estate development also has financial benefits, because of the higher end value of building materials and components.

3.3 Dwelling specifications

Besides the sustainability requirement an NHC meets, SHCs will also look at the dimensional specifications when considering NHCs. To compare NHCs, the most common objective quantitative specification is the amount of gross floor area (Dutch: *Bruto-vloeroppervlakte*, or *BVO*). This specification in combination with the usable floor area (Dutch: *Gebruiksvloeroppervlakte*, or *GBO*) gives insight into the form factor: 'a number that tells about the factor of efficient use of floor space' (De Regie B.V., 2013).
Social housing case studies projects in Leiden and Uithoorn proved the need for information about the specifications construction width and building size. Within the case study in Leiden, SHC Portaal was requested by the municipality to create a social housing solution for a small lot between existing buildings. The beech size was the limiting factor within this project, where the new building had to fit perfectly between existing houses. The second case study in Uithoorn was a social housing project with an NHC, where the use of heavy lifting cranes on-site required a large building side. This case study and the fort flowing specification are even more valuable for this research because the large majority of NHCs use heavy lifting cranes for prefabricated panels.
The final specification is that of prefabrication level. This does not directly influence an NHC's goodness-of-fit with a potential project, but it does provide insight into the level of customisation possible, the construction time and the susceptibility to unworkable days.
All these specifications were discussed and agreed upon during a brainstorming session with EH's CHIP group.

3.4 Additional characteristics

To make the NHC matrix a valuable tool which provides an SH RED with enough information, some additional NHC characteristics were integrated. The most important one of these is the addition of basic unit cost price (BUCP). BUCP is the minimal cost of a single NHC unit with a minimal project size of 10 single household homes or 12 apartments. These costs are defined excluding land price, foundation work (including ground loops, excavation and piles), connection fees for utilities, architectural cost and taxes. This characteristic is not only a first indication of project feasibility, it is also a great benchmarking tool for comparing traditional and NHC projects.

The last characteristic agreed upon with CHIP is flexibility. NHC flexibility is defined by the number of NHC beech sizes and material possibilities. A flexible NHC that can be constructed using a greater variety of building heights and widths is more likely to fit the requirements and therefore be chosen for a RED project.

3.5 Matrix layout

During the NHC stock-taking phase of the study, a matrix was a natural result from combing through the collected concepts and ordering them using the characteristics mentioned in the previous sections. During meetings with the CHIP group and other RED specialists, an agreement was reached that the inventory needed remodelling. By remodelling the matrix, it could become a valuable and easy to use tool with a more understandable interface for RED experts to select fitting NHCs for potential projects. This section elaborates on this process and the excluded and included characteristics in the matrix.

3.5.1 Integrated and excluded concept housing characteristics

When inserting the collected NHCs into the NHC matrix, a number of characteristics were used as selectable variables and some were dropped. Included in the final version of the NHC matrix were 24 NHC characteristic-based variables. These 24 variables provide insight into the NHC properties and their distinctive characteristics (see Table 2).

Variables were selected in consultation with experts from SHC EH. All included variables were chosen because of their relevance to SHC's tender selection criteria (De Vrij, Stolz, Bonarius, & van Rootselaar, 2019). These criteria are a low price or good price/quality ratio. Other criteria are spatial and material demand from other divisions within EH and that the building must match the surroundings and preferably contribute to the welfare within the neighbourhood. Lastly, there are sustainability demands which focus on the future energy use and the materials used.

Group	Variables					
Product	Brand	Type	Developer			
Type	House type	House subtype	Construction type	Stacking potential		
Construction aspects	GFA (m2)	Area of use (m2)	Width	EPC	Constrcution time	Level of prefab.
QoL	Target group	Living comfort	Finish			
Sustainability potential	NOM	EPC $\leq$ 0.0	Gasless	BENG		
Cost	Cost p./m2 GFA	BUCP				
Case specifics	Contract	Notes				

Table 2. *NHC characteristics included in NHC matrix.*

The characteristics that were not integrated into the NHC selection tool were flexibility and circularity. The first of these, flexibility, was not integrated because of a loss of information when converting it to an ordinal or interval variable. It can be argued that to assess individual NHC flexibility, high-level or RED expertise and experience are needed. Because of this expertise requirement, it is not possible to project an NHC's flexibility onto a simple ordinal scale. Trying to divide NHCs into generic categories would lead to the specific information about an NHC's project site specifications, its effect on urban infrastructure, combination possibilities and many more characteristics being lost in the process.

The second excluded characteristic was circularity. Although there are interval-based measuring tools for circularity, circularity levels or scores are not included by many NHC developers. Most developers use personal preferences in indicating circularity level. These circularity indications vary from % reuse of material to simply stating 'NHC developed using a circularity aim or intent'.

3.5.2 Concept housing matrix

The concept houses matrix (see appendix 1) is an inventory created as a complete overview of NHC products currently on the Dutch market.

For example: for a specific type of Heijmans's NHC, Huismerk, the matrix shows that the brand is *Huismerk*, the type is *B.02*, and the developer is *Heijmans*. The matrix also shows that this particular type is a *Ground-bound house* of the subtype *Single-family home* which uses *Prefabricated concrete elements* as the main form of construction and that this NHC *Cannot be stacked*.

One of the matrix's main added values is in allowing the comparison between traditional concepts and NHCs. Using the matrix's NHC characteristics filter options, an NHC shortlist can be created. This shortlist will provide REDs with a comprehensive list of NHCs that meet their minimum project criteria.
The matrix consists of up to seven categories housing all the NHC characteristics criteria. These categories are: party, type, specifications, intended end user, sustainability, cost and others. Most categories house basic information about the party who has developed the NHC, what its target audience is and what it cost. This information is in most cases objective, and input was directly received from the developing party. The category *type* is an exception to this rule because it contains objective information divided using a system created using EH expert input. This system divides NHCs using two types, eight subtypes and four construction methods.

The main housing types are

- ground-bound houses, which typically feature a front door on the ground floor and limited stacking capability (one or two units high), and
- high-rise buildings, which are usually stacked three or more layers high.

The subtypes are

- one-family houses, which are basic one-family stand-alone or terraced houses;
- up and down houses, houses which consist of two houses within one Ground Bound House, with one house having access to the lower level and garden and one house on the second floor and attic;
- back-to-back houses are houses where two houses share a common back wall;
- lifecycle resistant housing, which is a type of single-floor housing on the ground floor, mostly intended for the elderly and handicapped;
- container or studio, which uses a specific grid layout to improve transportability and stacking capability;
- apartment, an apartment with no predetermined exit method;
- gallery flat, an apartment which allows access to houses via an outdoor gallery; and
- portico flat, an apartment part of a complex which allows access to houses via a central core of staircases, lift and apartment front doors.

The established construction methods are

- steel-frame construction, which uses a steel (exo)skeleton;
- concrete skeleton construction, a construction based on a prefabricated concrete skeleton;
- wood skeleton construction, which uses a skeleton made primarily from wood; and
- prefabricated concrete construction system, which uses prefabricated walls and floors which only require on-site assembly.

To ensure the matrix's long-term value, its content will have to be periodically updated. Constant updates of NHC characteristics info as well as adding new and removing no longer available NHCs will ensure long-term value. An added benefit of periodical updating is the possibility to include new RED experience.

3.5.3 Matrix shortcomings

According to expert feedback the NHC matrix provides a clear overview of available NHCs on the Dutch market, and most selection criteria are included in the model. However, desk research and contact with market parties proved that comparable cost information is difficult to secure. Market parties are unwilling and unfamiliar with product benchmarking outside tender procedures. This results in a lack of price information and difficult-to-compare NHCs. A second shortcoming of the matrix is the lack of expert feedback. RED expert feedback will help to make subjective NHC characteristics measurable. This information can only be added over time, as RED experts work with the NHCs.

3.6 NHC collection analysis

The matrix shows that there are currently many products on the Dutch market fitting the established definition of NCHs. Almost half of these, 43 out of 92, have been created by established construction and/or development companies considered to be among the largest in the industry (CoBouw, CoBouw 50 2018, 2018). An additional 35 are developed by established smaller construction companies, which believe NHCs are a gap in the market and a new way to profile themselves. The remaining 14 are developed by specialised companies. These are construction, design and/or project development companies, that are created around their NHC product.
A slight minority of 45.7% of the NHCs are ground-bound single-family homes. These products greatly differ in size, level of prefabrication and price. Of the remaining concepts, 32% are stackable housing concepts designed using shipping container dimensions. The reason behind this is these are the maximal width and length of transportable goods not restricted by law from driving at specific hours (RDW, (n.d.)). The remaining 22% are other ground-bound dwellings (13%) and partially prefabricated apartments not developed around shipping container dimensions (9%).

3.7 NHC conclusion

This chapter, 'Inventory of concept houses', described the process of creating a clear overview of the NHC products currently offered by the market. During the process of obtaining NHC information and RED expert feedback, the goal was to find an answer for the research sub-question *What are NHCs and how do they differ from conventional housing solutions?* The first part of this sub-question was answered in this chapter. NHCs are 'A largely predesigned and partly or fully developed housing design constructed using a single or multiple construction pieces that are prefabricated off-site' It was concluded that many current housing products on the market fit this description. Noteworthy was the high level of variation between the NHC designs. Not only were there two types of houses, there were also eight subtypes and four different construction types.

While making the inventory, meetings with RED experts also provided insight into SHC KPIs. These insights into valued NHC characteristics are elaborated on in chapter 5, 'Social Housing Corporation KPIs'.

Chapter 4 – Tenant KPIs

The core objective of most SHCs is providing affordable and sustainable homes for their tenants. Because of this, the goal of increasing tenant satisfaction is one of SHCs' most important criteria for selecting KPIs. This chapter explains which tenant KPIs influence tenant satisfaction, and thus SHC performance. Chapter 2 discussed the KPIs of tenants as suggested by available studies. However, most of these studies focused on non-social or open-market tenants. This chapter uses the previously gathered information and supplements it with data and conclusions from a large-scale survey of social housing tenants. Combined, this information can be used to create a framework to look at social housing tenant satisfaction.

4.1 Added benefits for tenants

4.1.1 Theoretical benefits

Several studies have shown that tenants have a clear set of preferences when evaluating a social rent house. The most important of these preferences or KPIs are the spatial layout, a sense of security and the surroundings and community (Bos R. v., 2018; Mullins et al., 2001; RentFax, n.d.). It can be concluded that the construction method which scores the best on these KPIs is most appealing to tenants. Studies also show that rent price is one of the least commonly named KPIs. There are two possible explanations for this. The first explanation could be the fact that most studies are performed by or on the behalf of landlords. Their financial goal (e.g., the rent they ask) is not a factor they are willing to change. Because of this, those studies would mostly focus on possible housing variables landlords are willing to change. Secondly, the explanation could be the fact that rent prices of Dutch social houses are regulated and based on the score within the dwelling appreciation system (Dutch: *woningwaarderingsstelsel*, or *WWS*). The WWS is a comprehensive binding guideline for dwelling appreciation. The score dictates the maximum price of a social dwelling (Huurwoningen.nl, (n.d.)). Lowering rent prices will therefore lead to a lower quality house.

4.1.2 Benefits according to housing corporations

All development choices of SHCs are made with the best outcome for their tenants in mind. Six goals, formulated in SHC policy plans, function as guidelines for these choices (Eigen Haard, 2019). These six goals are as follows: ensure a flexible organization, ensure a financially healthy organization, try to satisfy all tenants, create participating stakeholders, try to house as many people as possible, try to house people in good-quality homes and, lastly, try to ensure the development of desirable neighbourhoods.
The basic advantages of NHCs, as concluded from the literature study, are that NHCs can help SHCs to achieve three of these goals. Some NHCs might also help with other goals, but those effects could be seen as indirect or unintentional effects.

The first goal is to build as many houses as needed to serve the growing shortage of SH and to compensate for the demolishing of old, low-quality houses. The increase in production rate of NHCs compared to traditional houses could help with this problem. This increase in production rate is caused by a decrease in construction time. The reason NHCs can be constructed more quickly is due to time-consuming elements of the construction process being created faster in the more efficient prefabrication stage of the NHC building process. These prefabricated elements can then be transported from stock directly to the construction site.

The increased industrialisation of the NHC production process is seen by many NHC producers and proponents as a good sign. They see it as an indicator that the construction industry will go through the same transition as the computer and car industries (Coffey & Thornley, 2006). In both the computer and car industry, the introduction of lean methodology and higher levels of industrialisation led to cost and time reductions. The expected effects on production cost and time in the construction industry might further exceed expectations when considering the synergy effects with building information modelling (BIM) and other computer developments (Schmidt & al., 2015) . Two concrete examples of this industrialisation and synergy effect are Dijkstra Draisma's investment in an automated brick-laying robot and the overall integration of BIM in SHC tenders (de Architect, 2016; NRC, 2018).

The second and third SHC goals NHCs can help achieve are ensuring a financially healthy organization and trying to house people in good-quality homes. By reducing the cost of construction and development, an NHC can help an SHC to either create a financially healthier organisation or put investment resources into housing quality instead of quantity. The financially healthier organisation can be created because investment costs are reduced, and the return on the relevant investment is increased, in turn increasing the investment efficiency. The good-quality homes goal can be achieved be reinvesting the development savings into the development of higher quality homes.

Some experts argued that NHC also helps with creating pleasant neighbourhoods to live in, a second SHC policy plan goal. This would be the case if construction cost savings were reinvested into the neighbourhood development. However, there is no empirical evidence to support this assumption. It is therefore concluded that NHCs do not directly contribute to the creation of a pleasant neighbourhood.

4.2 Tenant appreciation survey

The best method to gain insight into tenant preference is not by looking at the theoretical benefits and benefits according to SHCs but instead by questioning social tenants about their preferences. These tenant preferences are best gathered using a large-scale survey. When performed on a large scale, data from a survey can provide insight into a subject with extremely high external validity. It is because of this that a survey is the second most used data gathering technique for studies (University of Minnesota, 2019). Using self-completion surveys gives respondents time to consider their answers, refer to records and/or consult with others (Muhammad Sajjad Kabir, 2016). It is because of these advantages that the data from an EH survey was used as a source of information on the preferences of EH's tenants. The main goal of the survey had been to identify tenant satisfaction factors – in other words, which housing characteristics EH tenants value the most.

4.2.1 Survey data

The EH tenant survey started in November 2018 and ended the 1st of January 2019. After 2 months, 13,421 of EH's 55,000 households had filled in the survey, a 24.4% response rate. After screening 13,421 datasets, 7,809 were found to be useable (58.2%). The main exclusion criterion was tenants responding with 'no opinion' (Van der Oord, 2019). The survey targets were to ensure an overall confidence level of 90% with a margin of error of 1%. The resulting minimal sample size was calculated to be 6,023 respondents.

In total, 42 questions were asked in the survey. The questionnaire was a mix of ordinal, nominal and ratio questions (see appendix 2). The survey also had open questions in which respondents could elaborate on given answers. However, only results from closed questions were used for the analysis. This choice was made to ensure no subjectivity was included when transforming open-question answers into closed-question results.

All tenants belonged to the group social tenants, meaning they occupy social housing. All respondents rented SH in Amsterdam and the surrounding areas.
EU privacy laws prohibit personal data from being integrated into the results without individual permission (Autoriteit Persoonsgegevens, 2018). Due to this requirement, the survey opted to not include personal data. This exclusion prevents the survey results from reflecting gender, income, background or education level.

4.2.2 Data analysis

The survey data (see Appendix 3, survey data summary) was analysed using a multiple regression analysis. The survey looked at 10 pre-assigned tenant preferences. The preferences were dictated by the branch organisation, to ensure accurate benchmarking of results between SHCs. By cross-checking the scores tenants gave on these preferences, a ranking was established. This method gave the data properties results seen in Table 3 and Table 4.

Data of the regression	
Multiple correlation coefficient *R*	0.834433345
R-squared	0.696279007
Adjusted smallest squared	0.695889522
Standard error	0.871000375
Observations	7,809

Table 3. *Data of the regression analysis performed on the KTV survey data.*

Variance analysis

	Degrees of Freedom	*Squared sum*	*Average Squared*	*F*	*Significance F*
Regression	10	13,562.14569	1,356.214569	1,787.687987	0
Storing	7,798	5,915.887608	0.758641653		
Total	7,808	19,478.03329			

Table 4. *Data of the variance analysis of the KTV survey data*.

The significance threshold used for all independent variables was set at 0.05.

4.2.3 Survey results

Using the results from the survey analysis (see Table 5), six of the selected housing characteristics were identified as KPIs due to their having *P*-values < 0.05. The outcome showed tenants' top six preferences in housing characteristics.

	Coefficient	***Standard error***	***P-value***
Intersection	1.401480881	0.046128813	1.01E-191
The state of upkeep of your dwelling	0.374651977	0.008125641	0
The layout of your dwelling	0.174619997	0.007901237	5.00E-105
The size of your dwelling	0.151504275	0.007247847	1.88E-94
The appearance of your living complex	0.092146909	0.006648577	3.61E-43
The level of insulation of your dwelling (warmth)	0.045851637	0.005959597	1.60E-14
The noisiness of your dwelling	0.035672995	0.005204213	7.69E-12
The cleanliness of your stairwell	-0.00277215	0.007347461	0.705965715
The burglary safety of your dwelling	-0.003015805	0.006906081	0.6623495
The level of upkeep of your stairwell	-0.00630278	0.008110093	0.43709235
The security of your stairwell	-0.007626735	0.006782186	0.260825132

Table 5. *Survey results on tenant KPI ranking.*

The top six social tenant KPIs are;

1. level of upkeep,
2. spatial layout,
3. dwelling size,
4. dwelling appearance,
5. level of insulation and
6. level of noisiness.

This top six list shows which characteristics of social housing were most important to tenants in existing social housing. Except for level of upkeep, all characteristics in the top six were also highlighted by the literature study as being important characteristics (Chapter 2.2). The four remaining tenant preferences – cleanliness of common areas, level of burglary prevention, level of upkeep of common areas and level of security of common spaces – showed little interest on the part of tenants and are not further elaborated on.

Using the results of the tenant survey, more and less valuable characteristics for NHCs according to SHTs can be identified. This information can then be used to improve NHCs in such a way that they better help with increasing tenant satisfaction scores (chapter 3.5.1). This selection process was already done for most KPIs in the top six in Chapter 2.2.3. An example is the KPI spatial layout, which is a characteristic of a house which has a smart layout – in other words, uses the available space intelligently.

Level of upkeep, however, was not highlighted as a tenant KPI, and thus no clear NHC housing characteristic was selected during the preliminary literature study.
Several studies state that quality of design, materials and equipment are characteristics that influence the level of upkeep (De Silva et al., 2012; Lam et al., 2010; Singh et al., 2010). This finding can be used to conclude that a well-designed house, using high-quality materials and installations, is most likely to be the best basis for a future low level of upkeep. An explanation for the unusually high preference for level of upkeep might be survey respondent bias. Some survey respondents might have felt that rating upkeep as most important would affect maintenance intervals. The tenants might have reasoned that giving answers pointing to dwelling size as the most important variable, would not have a direct noticeable effect, as size and spatial layout cannot be altered within existing houses. Dwelling upkeep, by contrast, was a factor an SHC could directly affect by increasing the maintenance budget of a complex.

4.3 Conclusion

During the literature study it was established that the most important tenant KPIs were spatial layout, sense of security and the surroundings and community. The literature study also showed that most studies did not look at rent prices when identifying KPIs.
It was also concluded that SHCs believe that NHCs can help with the shortage of available housing. In their policies, SHCs indicate that they believe providing more available housing is an important KPI for tenants. Survey findings indicated that there is a clear tenant KPI top six. From these KPIs, it was concluded that tenants prefer a well-designed house, using high-level materials and installations as well as dwellings which appear to be and/or are large. These finding rejected the hypotheses that tenants only focus is on rent prices and dwelling size.

Chapter 5 – Social housing corporations KPIs

The main goal of this chapter is to gain insight into the KPIs of SHCs when they are looking to validate a building concept (new or traditional). This chapter describes the final data gathering section of the study. In previous chapters, SHC objectives (chapter 2.3) and what SHCs believed to be tenant KPIs (chapter 4.1.2) were discussed. In this chapter, information on the KPIs of SHCs is presented. The first phase of this process consisted of desk research meant to gather information about SHC requirements. The gathered information was then used to identify specific SHC KPIs.

5.1 General housing requirements

Desk research and observing project development in the RED department of SHC EH showed there are three main housing requirements almost all construction projects must comply with. These requirements are the building code, building integration into the surroundings and municipal project requirements. The following three sections discuss these requirements and how they affect NHCs.

5.1.1 Building code

The primary requirements for a building concept is its compliance to the applicable building code. The current building code in the Netherlands, Bouwbesluit 2012, functions as a baseline for almost all construction projects (Rijksoverheid, 2011). The building code requirements can be divided into four categories: safety, health, usability and sustainability.
The safety category focusses on escape routes, fire retardant and preventing burglary. These aspects correspond to NHC characteristics such as the correct use of doors and materials.
The category health's main goal is occupant well-being in the house during normal use. This category focusses on noise and mould reduction and ensuring a healthy environment with enough sunlight and fresh air. Characteristics of NHCs that help accomplish this are heat exchangers, ventilation and insulation. These are considered by some as the most difficult requirements. The difficultly is in the conflict in trying to insulate and ventilate at the same time. This duality is best accomplished by good-quality heat exchangers and proper heat and sound insulation.

The third category, usability, is measured by objective values. This categories contains requirements such as minimum height and width and where specific housing elements can and cannot be placed in a house. This requirement relates to the housing characteristic housing dimensions and special layouts.
Lastly the category sustainability is also easily measurable because it contains objective requirements values, such as the maximum energy usage to keep a house heated. An NHC characteristic which is made critical because of this is the EPC.

Development projects can be excluded from meeting building code requirements only in areas designated by the municipality. This is normally done for experimental reasons, as is the case at the Green Village at the Technical University Delft. Another frequently used reason is to provide creative builders the chance to build their own unconventional house in outlying areas. In both cases, commercial large-scale development is impossible to realise. Because of this, it can be reasonably assumed that all NHCs need to meet the building code requirements to be used on a significant scale.
The current building code is due to be replaced in 2020. It is currently unclear what the new building code requirement will be. One of the few things which is already clear is the integration of BENG as mentioned in Chapter 2. It is unclear how this new building performance label will be measured and how it will affect NHC performance.

5.1.2 Integration into surroundings

The second requirement RED professionals mention as a point of resistance is the welfare committee (Dutch: *welstandscommissie*). This independent committee advises municipalities on the appearance of projects and how they fit in with the scenery. This advice is a requirement in most municipalities to receive a building permit. There are exceptions, such as the municipality Boekel (Municipality Boekel, 2004) and the Steigereiland Area in Amsterdam (Gemeente Amsterdam, 2016). The main complaint mentioned about the welfare requirement is the subjectivity of the assessment. Most welfare committees are made up of construction and architectural professionals that want to maintain a balance between old and new building types within an area. What they highlight as essential design elements within new projects are subjective characteristics, such as, for example, the colour of cladding used. A recent example is the negative welfare assessment of construction plans for the NHC MorgenWonen in Uithoorn. In this specific case, the negative assessment was due to the absence of a chimney, a building component which is no longer needed because of the transition from natural gas to electric heating installations, as mentioned in Chapter 2 (Stolze, 2019). To increase the chance an NHC will receive a positive review from the welfare committee, design flexibility can be identified as an important NHC characteristic.

5.1.3 Other municipality demands

Municipality requirements are more objective than welfare, but also much less regulated than both welfare and building code requirements. These requirements have to do with the municipal vision in an area. How a municipality wants to see an area developed can vary strongly by municipality. Municipalities can also change after 4 years when, through elections, new city and town council members are chosen (Van Denzen & Havermans, 2019). Requirements municipalities can place on SHC projects are, for example, parking space norms, target tenant preferences, maximum building heights and general complex appearance.

5.1.4 Summary

This section showed that housing development projects in the Netherlands must meet three requirements. The first requirement is the 2012 building code. The specific requirements within the building code are there to ensure safe and energy-efficient housing is created. NHC characteristics that are important because of these requirements are good insulation and safe and healthy design. Second, the appearance of the developed complex is regulated by the welfare committee. They advise municipalities on whether the project will fit in within with the surroundings. It was concluded that their advice is partially subjective. To increase the chance an NHC will receive a positive recommendation from the welfare committee, some design flexibility is an absolute prerequisite. Lastly, it was concluded that the municipality itself is known to place constrains on RED projects: for instance, on aspects such as parking space norms, target tenant preferences, maximum building heights and general complex appearance. The last three of these aspects can be directly linked to specific NHC characteristics. Table 6 shows the three relevant SHC KPIs and the four NHC characteristics that were derived from them.

SHC KPI	NHC characteristic
Comply to building code	Complies to building code
Integration into surrounding	Design flexibility
Other municipality demands	Design flexibility
Other municipality demands	Dimensional flexibility

Table 6. *Indexed SHC external KPI and the related NHC characteristics*.

5.2 National sustainability ambitions and trends

The RED industry is, as mentioned in Chapters 1 and 2, going through a period of increased sustainability awareness. Project developers, construction companies and end users have all increased their sustainability demands. The effect of this sustainability trend is that, for an NHC to perform well, it needs to have good sustainability characteristics. This section looks at the most important sustainability ambitions, trends and demands and how they relate to NHC characteristics. The sustainability characteristics named in this chapter are additional demands on top of the previously named three requirements or future NHC demands.

5.2.1 Circularity

Circularity or circular economy is the oldest of the additional sustainability demands. Its definition and measuring methods have changed much since its introduction in 1966. The core principles of circularity are opposite to those of linear business thinking (see Fig. 5 (Weetman, 2016)). In a circular system, resource input, waste and energy leakage are minimised. This is done by slowing and closing energy and material loops.

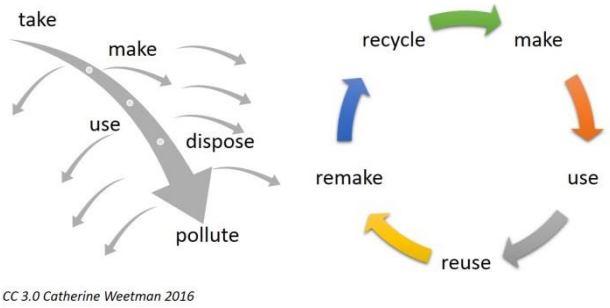


Fig 5. *The difference between linear and circular business thinking visualised. Made by Weetman (2016).*

A way to achieve this is through long-lasting designs, smart maintenance, refurbishing, and recycling. The core concept behind circularity is that nothing is lost, only transformed within a closed loop. A practical example of this within NHC can be the reuse of the housing shell or the ability to move NHCs to a different area where they are most needed.

The most commonly used method to measure complex circularity is the *Mileu Prestatie Graadmeter (MPG)*, or environment performance gauge. This is, however, adopted by only some government departments. The difficultly with measuring circularity is the fact that circularity goals can differ between using 100% reused materials or reusing 20% of material without any recycling or retooling needed (significantly lowering the amount of energy inherent in the reuse). It is reasonable to expect that in the coming years the government will play a key role in determining a circularity measuring tool, according to (Van Rootselaar, 2019). There have thus far been only a select number of projects that needed to meet circularity requirements. It is, however, suspected by experts that circularity will become a more frequently added requirement as resources become scarcer and sustainability goals increase (Gausta, Krystofik, Bustamante, & Badami, 2018).

5.2.2 NOM

The NOM is an additional sustainability demand which is used increasingly within the SH sector. In contrast to circularity, NOM focuses on sustainable energy and material consumption not during production but rather during usage. For a house to qualify as NOM, it must produce as much energy as it uses during normal usage periods. This includes, among other things, heating, lighting and normal energy consumption. This can be achieved by reducing the energy consumption and increasing the energy production characteristics of the house.

Within EH, this is realised in most cases by a highly insulated airtight outer shell, heat exchangers, ground water heat pumps and PV panels on the roof which convert sun energy into electricity. Despite its focus on sustainability only during usage, compared to circularity's focus on lifecycle sustainability, NOM is seen as a more important KPI than circularity. This has to do with the financial benefits for developer, constructor, owner and end user: financial benefits from the EPV for developer and owner, lower energy bills for the end user and higher installation revenue for constructors.

5.2.3 BENG

In contrast to NOM, the BENG standard is a future mandatory building permit requirement. As mentioned before, the new building code, due to go into effect January 1st 2020, will use BENG as its main energy efficiency criteria (RVO, 2019). As the name implies, buildings will have to be almost completely energy neutral to qualify as BENG. It is assumed that this will mean future projects will produce houses which are close to the same level as NOM houses. The Dutch *Rijksdienst Voor Ondernemend Nederland (RVO)*, or National Service for Entrepreneurial Netherlands, has published the requirements for BENG (2019). These demands are housed in the *Nederlandse Technische Afspraken*, or Dutch Technical Agreements, 8800. However, the calculation software needed to assign BENG labels to housing designs is currently still under development (Aedes, 2019). This combination of a closing implementation deadline, the absence of calculating software and a predetermined requirement to implement into the building code creates uncertainty for NHC developers. To maximise the chances NHCs will meet BENG requirements, they should be designed to be as energy efficient as possible.

5.2.4 Summary

In this section, an exposition of additional and future sustainability requirements was presented. The requirements that were highlighted are expected to, or in the case of BENG will, become requirements for future RED projects. The conclusion drawn is that additional sustainability requirements are measured using three methods. Circularity is measured by looking at the amount of resources and energy used to produce, the overall lifespan and the amount of waste produced in the end. The other two requirements, NOM and BENG, both look at energy consumption, the two main differences being that NOM-certified houses allow SHCs to request an EPV of tenants, and BENG looks only at energy efficiency and not energy production characteristics of a house. Table 7 shows all of the relevant SHC KPIs and the NHC characteristics that were derived from them.

SHC KPI	NHC characteristic
Energy efficiency	EPC
NOM	NOM
Sustainable material usage	Circulairity

Table 7. *Indexed SHC sustainability KPIs and the related NHC characteristics*.

5.3 Social housing corporation internal demands

This section describes the objective and subjective KPIs SHCs have defined for themselves when judging NHCs. The findings reported here have been gathered with a mix of desk research, experience from interviews with EH personnel and meetings with EH's CHIP group.

5.3.1 Objective social housing requirements

The objective SHC KPIs result from SHC ambitions and a need to make smart, substantiated choices. The first objective goal is ensuring the development and/or exploitation plans meet investment guidelines. These guidelines are put in place to ensure money is invested sensibly, and risks are within acceptable levels. One of the most commonly used metrics to ensure smart investments is the internal rate of return (IRR). This value represents the return on an investment over time. The minimum IRR required varies per project. High-risk projects require a higher IRR than low-risk projects. The minimum IRR is usually provided by company or external project control experts. The IRR is made up of three components: the size of the investment, the time over which it is made and the time over which it is returned in the form of revenue. SHC KPIs related to this are size of investment, exploitation period and project risk level. These KPIs can be translated into NHC characteristics. The KPI size of investment is related to building cost, exploitation period is related to building quality and project risk level is related to number of reference projects and project size.

The second objective goal of SHCs is to limit construction time. Limiting construction time will, in theory, allow SHC to build houses faster. This is considered essential in a time of increasing housing shortages. As mentioned before, shorter construction times also have a positive effect on overall project financial outcomes. The NHC characteristic influencing this KPI is construction time.

Lastly, experts from EH (De Vrij, Stolz, Bonarius, & van Rootselaar, 2019) mentioned house and material quality as an important SHC KPI. Stolz explained: '*Some product look good on photo's or flyers, but up-close show the potential downside of higher levels of industrialisation. Implementing these concepts can have a severe negative effect on tenants perceived Quality of Life'*. This importance can be traced back to material's quality effecting its appearance, functionality, lifespan, cost and, in some cases, the ease with which it is maintained. Of these attributes, most are objective and can thus be measured and compared. To ensure a minimum level of material quality, EH uses a material list. This list of material requirements is integrated into all their project tenders. It requires housing designs to comply to the materials listed or use materials of a comparable level of quality. The NHC characteristic that can be related to this KPI is 'complies to material list'. The size and complexity of the material list make it impossible to check and confirm whether an NHC has the characteristics to match with the material list. It can therefore be argued that no single NHC characteristic relates to this SHC KPI.

5.3.2 Subjective housing requirements

The NHC experts at EH highlighted objective KPIs as the most important housing benchmark. However, the cases they mentioned also referred to the integration of subjective NHC assessment requirements, such as a good façade finish, which in a specific case scored high on durability and cost saving but was seen by experts as ugly and unwanted. The reasoning behind this was that tenants prefer housing which appears to be of high quality and onto which they can project some personal qualities (Marcus Cooper, 2006). Linking the subjective preferences to a measurable interval scale would make it possible to compare subjective NHC characteristics. Also, many SHCs have 'providing good housing' as a subjective policy goal. To make this subjective goal measurable, EH created 'Livingcoasters'. These living templates are a guideline for minimum room size and dimensions, depending on the intended tenant group. Meeting living coaster demands is a must; extra space is an advantage. However, creating larger houses means increased cost and construction time. It is because of this that the SHC KPI 'meeting living coaster demands' is best translated into the NHC characteristic matching living coaster dimensions closely.

5.3.3 Summary

The SHC KPIs applied to NHCs can be divided into two categories: objective and subjective. The objective KPIs are requirements such as a construction costs, project risks and exploitation period. Subjective KPIs are material and/or component finish and appearance. What becomes clear is that SHCs are interested in NHCs which are low in production costs, have lower project risks, have a long exploitation period and are not inferior to traditional housing in terms of appearance. Table 8 shows all of the relevant SHC KPIs discussed in this section and the NHC characteristics that were derived from them.

SHC KPI	NHC characteristic
Size of investement	Building cost
Exploitation period	Building quality
Exploitation period	Exploitation period
Project risk level	Number of reference projects
Project risk level	Project size
Development time	Construction time
Living coaster demands	Matching living coaster dimensions

Table 8. *Indexed SHC internal KPIs and the related NHC characteristics*.

5.4 Conclusion

Studying SHC KPIs reveals three influencing elements: namely, general housing requirements, sustainability trends and SHC internal requirements. The first of these general housing requirements mainly focusses on requirements put in place by national and local governments. Sustainability trends primarily shows an increasing interest in sustainability goals. Lastly, studying SHC requirements shows that requirements from different SHC departments influence SHC RED KPIs.

Studying the influences on these three KPIs unveiled a large number of additional SHC KPIs. Using expert input, all SHC KPIs could be linked to specific NHC characteristics they are affected by (see Table 9).

SHC KPI	NHC characteristic	Type of critiria	KPI origin
Comply to building code	Complies to building code	Objective	Government
Integration into surrounding	Design flexibility	Subjective	Municipality
Other municipality demands	Design flexibility	Subjective	Municipality
Other municipality demands	Dimensional flexibility	Objective	Municipality
Energy efficiency	EPC	Objective	Government*
NOM	NOM	Objective	Internal
Sustainable material usage	Circulairity	Subjective	Internal
Development time	Construction time	Objective	Internal
Exploitation period	Building quality	Subjective	Internal**
Exploitation period	Exploitation period	Objective	Internal
Living coaster demands	Matching living coaster dimensions	Objective	Internal***
Project risk level	Number of reference projects	Objective	Internal
Project risk level	Project size	Objective	Internal
Size of investement	Building cost	Objective	Internal****

* Government/municipality; Amsterdam is the only municipality with a stricter requirement (EPC < 0.2).
** Internal/government; other building code rules might apply to temporary housing.
*** This is a KPI highly specific to EH.
**** Internal/ government; the Authority housing corporations demand low-risk investments.

Table 9. *Summary of all SHC KPIs and the NHC characteristics they are affected by.*

Chapter 6 – The match between concepts and KPIs

This chapter is dedicated to the comparison between the indexed lists of stakeholders KPIs and the list of NHCs and their characteristics. By cross referencing these results, the most valuable characteristics for SHCs can be highlighted.

6.1 Tenant KPIs

Results described in Chapters 2 and 4 have illustrated the theoretical and perceived needs and desires of SHTs. Their preferences can be summarised in the top six KPIs that influence their judgement of houses.
The KPI with the largest effect is 'the state of upkeep of your dwelling'. This KPI focuses on the level of maintenance and number of defects in the house. It can be argued that this is not a KPI for which the NHC performance can be easily measured. However, the overall condition is affected by the ease of maintenance and the build quality of the NHC. For example, a higher quality NHC will have fewer maintenance issues over time, leading to a better overall condition. This means that the overall state of a dwelling can be measured via the overall quality of the NHC.

Survey data showed that the second and third KPIs scored almost equally when measuring level of importance of tenants' preferences. The second most important KPI is 'dwelling layout'. This can be measured by the maturity of the NHC. An NHC that has gone through several iterations is more likely to have a mature and fully developed layout. The third KPI, 'size of the dwelling', is an objective variable and therefore easier to measure when judging NHCs. The size of dwelling is usually described in the user gross floor space (or GBO), measured in square metres (m^2).

The fourth relevant KPI is the 'dwelling appearance'. Studies have highlighted the importance of dwelling appearance on the level of personal satisfaction (Baba & Austin, 1989; McDonell, 2007; Soen, 1979). This KPI can be perceived and therefore can be measured in two distinct ways. The first way is looking at the dwelling as a personal representation and living domain. RED experts refer to this as a house with character, a good finish or nice appearance (De Vrij, Stolz, Bonarius, & van Rootselaar, 2019). These are mostly subjective observations but can be measured by converting to objective interval scaling. Aspects that improve dwelling appearance are characteristics such as the use of architectural details, an alternating design or the use of attractive materials (e.g., wood or stucco). The second way of measuring is assessing the effect of 'dwelling appearance' on neighbourhoods. A common example in Dutch neighbourhood development is the Amsterdam district of Bijlmermeer. This district in southeast Amsterdam is known for its architecture and philosophy of building large housing complexes quickly and cheaply, which helped combat the housing crisis that emerged after the Second World War. The identity-less building blocks combined with the lack of population diversity led to many social problems. To address these problems, Amsterdam's municipality is demolishing and renovating the building blocks and combining flats with ground-bound houses (Bodaar, 2006; Helleman & Wassenberg, 2004; Wassenberg, 2013).

The final two housing KPIs are 'level of insulation' and 'noisiness' of a house. In line with the KPIs that rank second and third, the fifth and sixth KPIs score almost equally when ranking importance. There are two ways the level insulation can influence a tenant's perception of the quality of housing. The first is on a personal level by influencing the perceived warmth of the dwelling. For example, a cold floor, a draft and a house which warms up slowly are all downsides of low levels of insulation. The second way is on a social level. This is the consequence of low levels of insulation leading to more heating, which is bad for the environment. In turn, this might negatively affect the perceived quality of a house. The last KPI is the level of noisiness perceived by tenants. This also can be influenced by the level of insulation, however, this is a characteristic most commonly originating

from the chosen construction method. A more solid shell formed by concrete construction or a steel backbone will more easily pass on noise to an adjacent house (Mao & Pietrzko, 2013).
The addition of these last two KPIs is mostly due to the EH's survey input. No scientific studies have been done into the last two KPIs as SHT KPIs. This deviation between the theoretical and survey highlighted KPIs can be explained by the age of houses of some tenants who were survey respondents. Their older houses might produce annoyances which do not occur in modern houses. This can be explained by the fact that current building code legislation (Chapter 3.4) tries to prevent most noise problem for tenants (Berghuis, van der Graaf, & van Overveld, 2017).

6.2 Social housing corporation KPIs

Meetings with SHC managers and SHC vision documents all highlight the same KPIs. The primary SHC KPI used is tenant happiness, sometimes referred to in literature by the term QoL (Satsangi & Kearns, 1992), although QoL looks at not only an individual's living conditions but all factors that influence a tenant's performance. Whereas tenant KPIs tend to focus on individual living aspects, SHC KPIs focus on all living characteristics of tenants. These characteristics which are better covered by the KPI QoL are characteristics such as physical health, family, education, employment, wealth, security and freedom, religious beliefs, and the environment (Barcaccia, 2013) (see Fig. 6).

This broader look at what determines one's QoL is what drives SHCs to look beyond creating houses and to try to create balanced neighbourhoods. To do so successfully, an integral plan is always created with input from the municipality and interest groups.

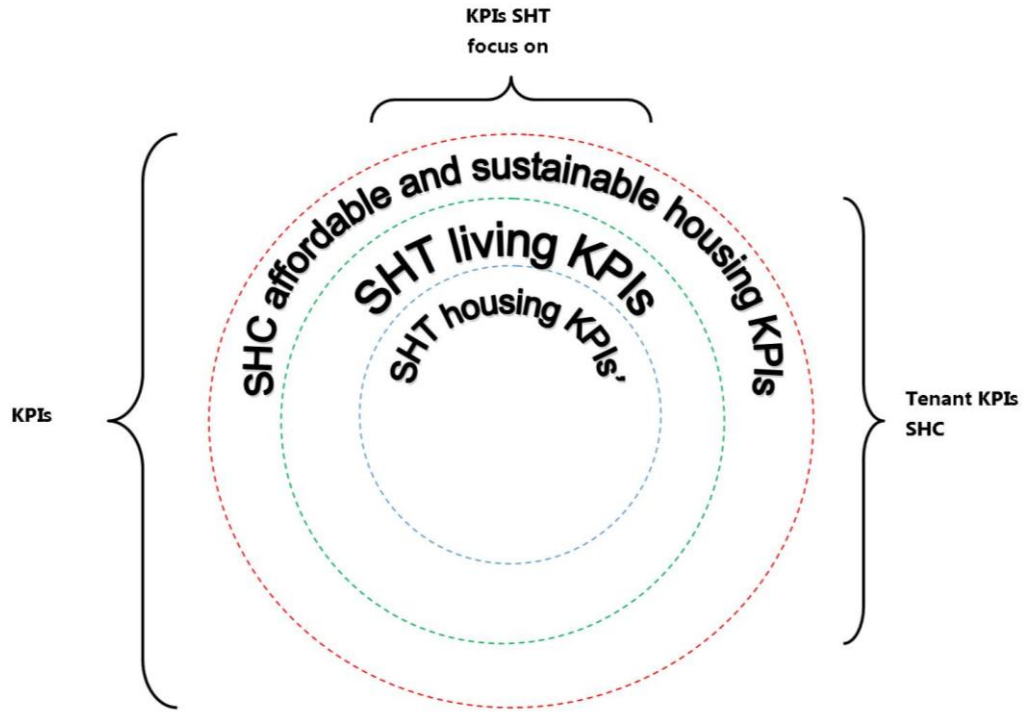


Fig 6. *Visual representation of overlap among all SHT KPIs, SHT KPIs that SHCs focus on and how these are represented in an SHC's core objective.*

A sustainable financial policy is essential for SHCs to ensure they can achieve their housing objectives now and in the future. The Woningwet 2015 put guidelines in place that limited the SHC financial policy possibilities. For example, SHCs are no longer allowed to create higher profit, free-market mid-section houses (Rijksoverheid, De Woningwet 2015 In vogelvlucht, 2015).

To increase the chances of realizing a profit from social housing projects, SHCs in many cases select the lowest prices during tenders. Thus, price is one of the most important characteristics SHCs look at when evaluating an NHC.

The price of an NHC, however, is only one variable providing insight into project cost. The IRR on investment and the overall initial gross and/or net efficiency over investment (Dutch: BAR and NAR) provide more insight in most situations (Dekker, 2018). These values are important indicators for REDs when considering housing solutions and are affected by variables such as construction cost, rent prices and the maximum exploitation period. Meetings with the members from CHIP showed that the maximum exploitation period is typically divided into two categories. These categories are temporary or short-term housing (<20 years) and permanent or long-term housing (>50 years). Exploitation periods between 21 and 49 years are never typically selected. This is because, unlike with short-term housing, an exploitation period between 21 and 49 years has no building code exemptions. The second reason is that given this lack of exemptions to the building code, it is difficult to make projects with exploitation periods between 21 and 49 years profitable.

The final SHC KPI reflected in their NHC selection criteria is sustainability characteristics. To provide good housing in a healthy environment, it is essential to maintain or improve the state of the environment. To this end, most SHCs have adopted environmental goals in their development and corporate strategies. Because of these goals, NHCs with highly positive environmental characteristics have more added value for SHCs.

6.3 Summary new housing concepts

During the period of February to June 2019, a total of 98 NHCs were available on the Dutch market and were indexed. Of these, 96 were developed for permanent (50+ years) exploitation periods, and the remaining two were developed for temporary exploitation periods (>20 years). By studying the indexed NHCs, it can be concluded which KPIs the developers of the NHCs believed to be the most important for SHTs and SHCs. It is reasonable to assume that concepts are developed to match with needs of the customer, in this case the SHC. However, it can also be reasonably expected that concepts with little to no profitability will not be developed. This is due to the profit objective of the party developing the NHC. For this reason, an NHC will always match developer profit and consumer (SHC and SHT) KPI needs.
This section looks to enable consumers to differentiate among the NHCs on the market. Placing all 98 within a framework makes it easier to draw comparisons between NHCs and their characteristics.

Rik van den Bos used flexibility as a scale to differentiates between available concepts (Van den Bos, 2019). Using this scale, he differentiated between volumetric and sectional concepts. On one side of the scale, a volumetric unit is a completely developed concept with minimal flexibility but high industrialisation potential. On the other side of the scale, sectional concepts have a base or parts which are completely developed to reduce cost but are more flexible, allowing for higher potential production numbers.

Using Van den Bos's scale as a starting point, a framework was created that allowed for enough differentiating insight while remaining clear oversight over the values of the NHCs. Using input from EH's REDs and SHC KPIs, the single scale used by Van den Bos was further divided into three subscales: construction method, sustainability of concept design and urban applicability. Using these three subscales as axes creates a framework. At the intersection point of the framework's axes, the three subscales represent Van den Bos's volumetric side of the scale.

On the other side, where all three subscales are at a maximum score, they represent the sectional concept side of his single-axis scale.

The goal and appearance from the developed framework (see Fig. 7) was based on Abell's framework (Nijssen & Wouters, 2018). This framework was chosen because of its ability to provide direct insight into a product's placement along the market's important axes. By supplementing market demand with SHC and SHT KPIs, the model can easily be adapted, and the following three scales appear:

1. construction method (completely prefabricated <-> traditional (brick laying))
2. sustainability of concept design (traditional <-> progressive sustainability)
3. urban applicability (urban (stackability) <-> rural (standard design))

Within these scales, the influence of the tenant KPIs can best be observed by the addition of the urban applicability score, which provides insight into the stacking potential and flexibility of a concept. It can be concluded that a higher degree of concept flexibility suggests a concept with a higher potential to match the tenant's dwelling size and appearance KPIs. On the sustainability of concept design scale, an NHC score is proportional to its insulation level, which relates to the tenant KPI of level of insulation and possibly also noisiness of a dwelling.

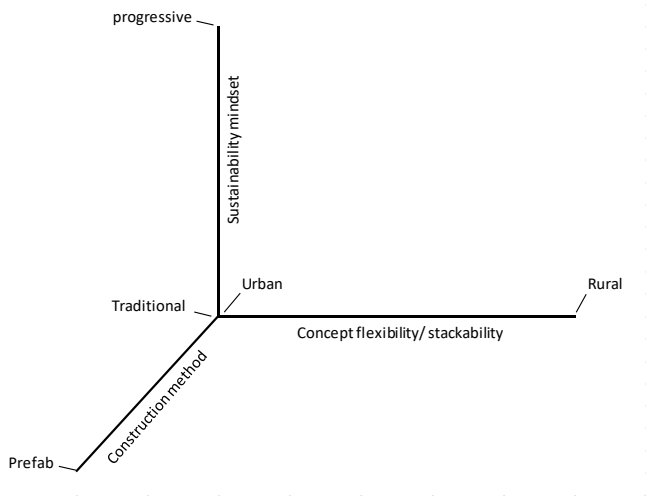


Fig 7, *NHC product framework based on Abell's framework as explained by Nijssen and Wouters (2018)*

By defining the three scales with ordinal and interval scales, it becomes possible to define a specific NHC's position within the frame work. This, in turn, will help in identifying which NHCs are the best fits to address specific social housing problems.
The following levels of measurement are used for the three scales;

For defining the flexibility scale, five ratio measuring points were used (urban high compact four+ layers, urban medium high three layers, compact, rural linked and stand-alone). These five levels were selected based on the five housing sub-types used in the Netherlands (Delft, 2019). This scales is meant to provide insight into the potential to use a specific NHC in a specific scenario or location. For instans a score of 5 translates to stand alone NHC, a concept which is hard to apply within a densely populated city. On the other side of the scale a score of 1 will imply a urban high compact 4 layer concept, a concept which might look at of place in more rural communal areas. Alternative flexibility scales could have been based on floor space and façade finish flexibility. Both of these were not chosen because matching floor space flexibility is a simple dichotomous variable which does not

add value when applied over the complete project portfolio. Façade finish was not selected because it is subjective and difficult to measure.

For the construction method scale, a five-point interval scale was used (levels 1 through 5). The number of levels were selected to create a clear differentiating outcome while preserving the overall common core of all NHCs. Scores on this scale were based on the core construction method and level of prefabrication involved. The use of interval versus a ratio scaling does mean that no mathematical conclusion can be draw about final NHC scores (e.g. a score of 4 on the construction scale does not translate to a NHC which is a twice as tradition building method as a NHC with a score of 2 on the similar scale).

The scoring matrix was constructed by indexing known construction methods and ranking them based on level of work performed off-site in the prefabrication phase. A score of 1 meant a house is constructed on-site using traditional materials and method. A score of 5 was given to NHCs that are constructed off-site and use advanced construction materials or methods.

Lastly, for the sustainability scale, a four-step ordinal scale was used (basics, EPC $\leq$ 0.20, circularity or NOM, circularity and NOM). These scoring criteria were selected after a quick scan of the most and least used sustainability attributes applied to recent (<2 years) and current construction projects. Most NHCs have optional sustainability aspects; the maximum optional abilities were taken into account when assigning sustainability scores.

Using these scales, collected NHCs were provided with objective scores and placed within the differentiating framework. Most scores could be provided by analyzing NHC product information files a acquiring input from RED with experience with the particular NHC. Using these result a cluster analyses has been performed, the results of which are display in a Dendrogram (see appendix 4). With the NHCs placed within the framework, differences between them can be easily observed. As expected, clusters of NHCs can be observed despite the framework's 100 (5 x 4 x 5) possible positions (see Appendix 4 (see Fig. 8)).

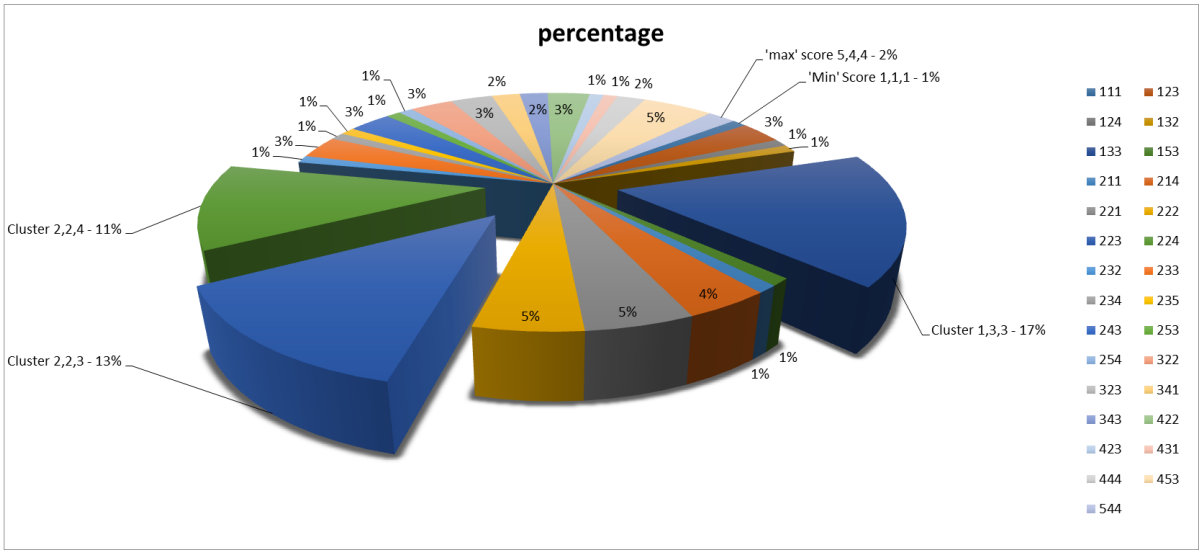


Fig 8. *Variance in NHC scores illustrated, with large clusters, maximum and minimum scores highlighted.*

The most notable observation is the existence of three prominent NHC groups, each of which comprises more than 10% of the indexed NHCs. The first is a group which includes 17% of all indexed NHCs. These NHCs score 1 out of 5 on construction method, 3 out of 5 on flexibility and 3 out of 4 on sustainability.
The second and third most prominent groups include 13% and 11% of all NHCs. In these two groups, NHCs score 2 out of 5 on construction method and flexibility and 3 (first cluster) or 4 (second cluster) out of 4 on sustainability.
The other most notable observation is that no NHC has the maximum score (5, 5, 4), and only one has the minimum score(1, 1, 1). This outcome means that no NHC currently exists which uses a high-to-all prefabricated construction method, allows for construction in urban or highly built-up areas, and is highly progressive about its sustainability objectives. A conclusion which also can be drawn from this is that a social housing developer in a densely metropolitan area will always have to compromise between building method and sustainability when looking for an advanced NHC.

Examples of minimal scoring/ high volumetric NHC example is the NHC Waarder Riant by BAM (see Fig. 9).

Fig 9. BAM Waarder Riant project Stationstuin, Barendrecht (BAM, 2019)

6.4 Preliminary analysis and conclusion

6.4.1 Preliminary analysis

Observing the NHC inventory matrix (see appendix 1), it is clear that there currently is a large variety of NHCs on the market. Between February and July 2019, a total of 98 NHCs were indexed. As mentioned above, based on their objective scores, NHCs are clustered within the NHC characteristics framework. The 98 NHCs occupy a total of 29 unique places within the Abell-based framework (see Fig. 8). These 29 unique locations within the three-dimensional framework correlate with 29 unique NHC differentiating scores, which are based on the predetermined measuring levels.
When comparing the NHC characteristics to the different stakeholder KPIs, it becomes clear that different NHCs have been designed to focus on KPIs of different stakeholders. Clear examples of this are the NHCs from Heijmans (Huismerk (2,2,3)) and BAM (Wooncollectie (1,3,3)), two of the Netherlands' largest construction companies. Both companies developed NHCs which might appeal to the end user because of their size and overall traditional appearance (see Fig. 10) (BAM Wonen, 2017; Heijmans N.V., 2019). These are the opposite of the NHCs from Barli (Barli Base), with a framework score of 3,4,1. Barli's NHCs are clearly designed to be appealing to large-scale housing organisations. This because of their low cost, fast production time and high stack ability potential, making them ideal for efficiently housing large numbers of tenants in an urban area (see Fig. 11).

Fig 10. *BAM Wooncollectie type G.*

Fig 11. *Barli Base 10x4.*

6.4.2 Conclusion

When analysing to see whether NHCs match the KPIs from the NHC's stakeholders and shareholders, the following conclusion can be drawn.
Almost all tenant or SHC KPIs are accommodated by one or multiple NHCs. Pinpointing a single NHC as 'best' is impossible because of the high number of variables and preferences in play when judging NHCs. In a matrix based on Abell's framework, however, an NHC can be given a specific position within the market. This specific position allows REDs and other stakeholders to easily identify differences among an increasing number of available NHCs. By quickly identifying possible interesting NHCs, REDs should be better able to choose an NHC which matches specific project needs.
This can help with the adoption of NHCs and with identifying NHCs that are suitable for benchmarking against traditionally developed and constructed houses.

What was observed from the NHC framework scores was that despite the high degree of variability among NHCs, clustering does occur. Most notable is the fact that three large clusters of medium-scoring NHCs exist, while only small numbers of NHCs get a maximum or minimum score. What also can be concluded from this is that many parties developing NHCs choose to develop a moderate-scoring NHC. This is most likely due to the inherent drawbacks of creating an NHC which is either too specialised (high NHC framework scores) or universal (low NHC framework scores). The drawback of a high framework score being the low scope of potential applications, which lowers the chances of a quick return on the investment made to develop the NHC. A universal scoring NHC has the drawback of not being able to clearly differentiate itself against traditionally developed and constructed houses. This means that for a universal NHC to become appealing, it most offer a price advantage, which again lowers the chances for a quick return on the development investment.

Chapter 7 – Conclusion and discussion

This final chapter serve as the closing section of this graduation study. This thesis offers added value to social housing corporations (SHCs) which are considering using new housing concepts (NHCs). The results can be used to substantiate the use of NHCs to address current SHC problems.

In this chapter, the research objective is restated, and the most important findings are summarised and explained. Additionally, sections of this chapter elaborate on the research relevance and recommendations for municipalities, NHC developers and social real estate developers (REDs). Lastly, recommendations for future research are provided.

7.1 Research question

The main aim of this study was to identify how NHCs accommodate the requirements of the tenants and ambitions of SHCs. This research focused on identifying characteristics of NHCs which are valuable for Dutch SHCs. The current increase in queuing for social housing is affecting neighbourhood vitality, the overall quality of life (QoL) and the effectiveness of energy efficiency projects. Conventional solutions to this problem are made difficult by the Woningwet 2015 and the high prices in the construction market. The NHCs are seen as a fitting solution. Their theoretical benefits are based on results from similar transitions by the computer and car industries. To substantiate the choices of SHCs using NHCs, this study aimed to identify matches between NHC characteristics and SHC key performance indicators (KPIs). Results could also be used by NHC developers to develop NHCs that better match market needs. Data was obtained by applying three data gathering techniques. The most-used data gathering method was in-depth literature study. This was performed not only to create a level of basic understanding but also to obtain more specific subject information and clarification. Survey results were analysed to gather tenant information. The data from this analysis provided fundamental insight into the KPIs of social housing tenants (SHTs). Lastly, interviews and brainstorming sessions with social REDs provided information and context about SHC KPIs. Using the gathered data, the main research question and sub-questions could be answered.

Before being able to answer the main research question, answers to the sub-questions had to be formulated. The first sub-question was this: **What are NHCs, and how do they differ from conventional housing attributes?**

New housing concepts are housing solutions which are pre-developed and engineered. They utilise a high number of prefabricated components and implement industrialisation ideas from other industries in the construction industry. Their potential benefit resides in their lower construction cost and time when implemented on a large scale. The potential drawbacks are a reduction in customisation and individuality of the end product, which potentially reduces the number of construction projects to which they can be applied.

The second sub-question was this: **What requirements do tenants have in rental housing characteristics?**

Tenants of social housing in urban areas identify six requirements as important to them. These are *level of upkeep, spatial layout, dwelling size, dwelling appearance, level of insulation* and *level noisiness.* Using data from a large-scale survey among tenants who rent social housing from Eigen Haard, this list of six top housing characteristics was established.

Also essential to providing a complete answer to the main research question was this sub-question: **What are SHCs' ambitions, and how are they related to rental house characteristics?**

The ambitions and goals of most SHCs are to create as many housing opportunities for tenants as possible and, while doing so, to improve the QoL within a neighbourhood. To fulfil these goals, SHCs need to make smart investments and look for opportunities to reduce their development and operational costs. Reduced construction cost and time both have a large effect on the development costs of new housing. These savings can then be used to develop more housing or to invest in the QoL within a neighbourhood. A second high-ranking ambition of SHCs is the development and stimulation of sustainable solutions. Many SHCs have adopted the consensus that environment-friendly and sustainable housing raise the perceived QoL within a neighbourhood. By obtaining a clear overview of the most important tenant preferences social RED are able to better develop housing which attends to tenant needs. The insight into these tenants preference was obtained by the results of the tenants survey and the addition of Van der Bos's framework results.

Lastly, insight needed to be obtained into the final sub-question: **How could NHCs help to meet the requirements and ambitions of both tenants and SHCs?**

The use of NHCs can help SHTs and SHCs achieve their ambitions by lowering cost and development time, which translates to a higher quality product for a given price compered to more traditional construction solutions. The theoretical benefits of building larger, faster and higher quality housing at the same price allows NHCs to directly address some of the most important KPIs of SHTs and SHCs.

Combining the information obtained in answering the research sub-questions allows us to answer the main research question:

How can new housing concepts (NHCs) accommodate the requirements of the tenant and the affordable and sustainable production ambitions of social housing corporations (SHCs)?

It has become clear that specific NHC characteristics could be pinpointed which which largely respond to SHT and SHC KPIs (see Chapter 3.1.1). These characteristics, 20 in total, could all be associated with or were derived from SHT and SHC KPIs. One of the characteristic designated as most important was product construction cost. Other highly important characteristics were sustainability potential, construction method and concept flexibility.

The importance of NHC cost cannot be overstated. Due to current regulations put in place by the Woningwet 2015, SHCs' main strategy to ensure good project profitability has become impossible to apply. The main strategy of SHCs was to develop profitable housing options to finance less profitable social housing projects. This, combined with the high demand in the construction market, which has led to higher construction prices, lowered overall project profitability. For new housing projects to meet companies' risk and profit demands, low construction prices are crucial. Lastly, lower NHC cost will also help ensure housing can be kept affordable for tenants, meeting one of SHCs' main goals.

The second most important group of NHC characteristics are its sustainability aspects. These are important because of SHCs' sustainability goals and increasing government sustainability requirements. Sustainability characteristics can be split into two categories based on importance. The first category represents hard requirements such as a low EPC, gas-free installations and, from 2020 onward, BENG labels. The second category includes optional sustainability requirements such as NOM, POM and circularity. These second-tier sustainability characteristics are also believed by some to be potential future government and municipal demands.

The last two of the most-valued NHC characteristics are of lesser importance to SHC policy goals and apply more to NHC applicability in urban (re)development. These characteristics are construction method and concept flexibility.

The importance of construction method is grounded in the fact that specific construction methods have fundamental characteristics that influence an NHC's performance. For instance, wood construction can be done with high levels of industrialisation and with excellent sustainability scores. However, it is more expensive to construct with wood than with steel or concrete, and wood has maintenance demands most SHCs are not familiar with. On the other hand, steel or concrete construction is less sustainability conscious but does allow for cheap multi-story constructions. Finally, it was concluded that concept flexibility is also an important NHC characteristic. Expert interviews revealed that flexibility in the concept's layout and appearance can have a large effect on the chances that an NHC will meet location requirements. The layout and appearance should be based on municipal preferences for the height, size and cladding of a complex and on the requirements of the independent welfare committee for an area.

It has become clear that the Dutch NHC market was larger than reports and conversations with RED experts initially indicated. While initial reports concluded that the Dutch NHC market consisted of between 20 and 40 products, six months of desk research revealed more than 100 different NHCs. Selecting only concepts meant for exploitation for longer than 20 years and those from large construction companies or which had already been constructed narrowed down the list to 98 NHCs.

7.2. Conclusion

To conclude, the best way for NHCs to accommodate the requirements of the tenant and the ambitions of SHCs is by designing their housing concept with the KPIs as a framework. By giving special attention to those KPIs highlighted as most influential, NHC manufacturers can fine-tune the performance of NHCs for specific stakeholder requirements. This could lead to products which better match tenant cost and layout needs as well as SHC sustainability and affordability goals. Research results show a large number of NHCs currently on the market which, to varying degrees, match specific KPIs. No single NHC can be highlighted as 'the best' because of varying assessment parameters.

This conclusion is in line with the general consensus formulated in the hypotheses section of the research proposal. In the hypotheses, it was stated that a mix of factors would be essential for a successful NHC. This hypothesis was accepted during the research. Also as expected, cost, QoL and social benefit were among those characteristics related to stakeholder KPIs. It can be concluded, however, that some hypotheses were not supported. For instance, the assumption that rent price and size were the only important tenant KPIs was not in line with this study's results. Survey data showed that level of upkeep and location KPIs were at least as important. Furthermore, a hypothesis assumed that NHCs would outperform traditional projects on almost all levels. This assumption was based on the fact that most NHC developers are traditional builders, which would provide them with the insight to create a competitive product that would outperform traditional building concepts. This hypothesis was rejected, because NHC developers used their NHCs not to improve upon their current product but to create a differentiating product meant for different projects. The final hypothesis that was rejected by this study was related to NHC adoption. It was assumed that tenant unwillingness to accept NHC as an adequate housing solution was a major problem preventing NHC adoption. However, research results indicated that it is SHC reluctance, due to the absence of reference projects, which is holding back NHC adoption progress as a solution for social housing problems.

7.3. Relevance

The added value of the research conclusion is the potential impact the results have on the Dutch social real estate sector and the scientific real estate field. This section discusses societal and scientific relevance of results.

7.3.1. Practical relevance

Conclusions about NHCs highlighted in the previous section give an indication of the potential societal relevance of these results. Research results showed that NHCs can reduce project cost and time. These potential benefits come at a time when the Dutch social housing sector is facing social development problems.
The increased use of NHCs, with their higher level of industrialisation, might also change regular construction project processes over time. In turn, this might lead to the theoretical benefits of lower costs for common parts and a faster adoption of sustainability considerations in the Dutch housing stock.

7.3.2. Scientific relevance

The research findings also have scientific relevance. The findings show a clear link between NHC characteristics and KPIs. This link can be the basis for future studies into the improvement of social housing development projects. Additionally, findings can be used when studying tenant and neighbourhood satisfaction problems. Furthermore, the results can be of added value when researching new construction methods for the social housing sector, such as 3D concrete printing. Lastly, findings presented in this report provide insight into the work of the Dutch social housing sector. These findings can be used when researching policies that influence the social housing market. The results from this study also aid in closing a scientific research gap when studying the Dutch social housing market in relation to building methods. Until now, most studies related to this topic were either dated or based on foreign results. The few studies that are not out dated or irrelevant either were extremely specific – for example, focussing only on methods such as 3D concrete pouring – or too general, comparing a general aspect of social housing to free-market houses. This study helps to provide a general oversight of the industry's inner workings along with information on specific potential solutions for the industry's problems.

7.4. Recommendation for research

The methods and results from the current study can be viewed as an exploratory study into the development of a possible solution for the problems of the Dutch social housing market. Using qualitative and quantitative methods and sources, insight into current social housing development methods is provided. The main subject researched and accepted by the study is the potential benefit of NHCs for the social housing market. Research extending this work is recommended to ensure better applicability of research results and to increase the success of NHCs as a possible solution for SHC problems. Several research recommendations are listed below that could aid with the successful implementation of research results.

During this research, it became clear that SHCs were reluctant to invest millions of euros in projects using unproven NHCs. This is because small profit margins force SHCs to choose proven and safe methods. This reluctance to invest in unproven methods makes NHCs less likely to provide a fast return on the investment of NHC developers. This, in turn, has the effect of increasing NHC prices, which further increases SHC reluctance. This vicious circle of cause and effect is one of the main factors pinpointed by REDs limiting the growth and potential of NHCs. A study researching actual NHC benefits compared to traditional building methods could, depending on the results, convince

more SHCs to experiment with NHCs and thus break the circle. This research could be essential for the success of NHCs in the Dutch market.

A second study recommended to build on the current research results would better match tenant and SHC requirements to NHC characteristics. Current research only looked at KPIs highlighted by previous research, which were then used to identify which characteristics are considered valuable. A new study could use the current research results to better question tenants to gain insight into their KPIs and could use discrete choice modelling to better identify valuable NHC KPIs for all SHC departments. This might provide more reliable results than the methods used in the current study, which identified tenant KPIs through analysis of a tenant satisfaction survey and SHC KPIs through literature and desk research refined by RED feedback and input.

Additionally, research into the expected changes in environmental and sustainability requirements could highlight NHCs with more future potential. A clear trend highlighted in the current research is the increase in environmental and sustainability requirements and preferences. Tenants, governments agencies, municipalities and SHCs all want to work towards a more sustainable future. In previous years, this has led to increasingly high sustainability demands. Building NHCs which meet current and potential future demands will prevent the need for future retrofitting of houses. Avoiding these retrofitting projects can save millions of euros in renovation and upgrading costs. Furthermore, the adoption of NHCs has the potential to aid tenants in their personal sustainability goals, it might provide good publicity, and it could mean SHCs can act quickly when new sustainability subsidies become available.

Finally, during this research it became clear that most NHCs are for single-family terraced houses or for stackable grid or container apartment designs. Both these type of houses can be quickly and efficiently constructed on vacant building sites. In the Amsterdam metropolitan area, concepts that are flexible enough to fit within unconventional building plots, potentially between existing buildings, could be more valuable. A study into a potential concept that looks at the requirements of constructing within a crowded area could be extremely valuable.

7.5 Research limitations

This researcher faced a number of limitations. Most of these limitations were related to the nature of this research serving as a graduation thesis. Because this research was for a graduation thesis, it was planned to be fulfilled within one semester or five months. Not included in this timeframe was the time required to write the research proposal and perform the most preliminary literature studies. These activities were considered part of the set-up procedure for the research proposal and were started in the summer of 2018, a half year before the start of the research.

As a result of the limited fulfilment time of the research, the number of methods could be used to gather quantitative data. This limit was the main reason that, after the decision was made to use EH's survey data, no new large-scale surveys could be begun. If time had been no constraint, discrete choice modelling techniques could have been used to collect more RED data. If more time had been available, RED techniques and KPIs of SHCs in Amsterdam could have been examined in greater depth. It became clear from my experience at SHC EH that fully understanding a RED's method takes time. A final limitation was also time related and focused on the NHC analysis. The methods used here mainly focused on end-user (SHC and tenant) perspectives. To ensure a fast adoption of NHCs as a fitting solution and better understanding of NHC characteristics, a look into the motives of NHC developers is also important. This could have been gained from several in-depth interviews with NHC developers, such as Finch, Slokker, Ballast-nedam and BAM.

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Appendix

All large documents that support the research but are to big to fully include into the thesis. E.g. survey questionnaire (in order of references)

Appendix 1. New Housing Concept matrix

This appendix is a representation of the NHC matrix. A document which houses info on all 98 NHC's indexed between February and June 2019. Information from this matrix has been used as a benchmark for NHC and general statements on the current NHC market are based on information found in this matrix.

	Partij			Type				Specs						Intended end-user			Sustainability				Cost		Overige (/ verwaarloosbaar)	
Periode	Merk	type	Ontwikkelaar	Type woning	Sub type	Constructie	Stapelbaar	bvo (m2)	gbo (m2)	Beuk maat	epc	Bouwtijd	Prefab afwerkings niv	Type	Woon genot	Afwerking	NOM	EPC <0,0	gasloos	BENG	Kosten (m2 BVO)	BUCP	Contract	Overige
Permanent	Barli Base	10*4	Barli	HB	Con	HSB	Ja	40		4			4						Ja			€ 42,500		
Permanent	Barli Base	8*4	Barli	HB	Con	HSB	Ja	32		4			4						Ja			€ 34,500		
Permanent	(af)TOP	appartement	hendriks coppelmans	HB	App.	HSB	Ja		70				2				Op.							
Permanent	(af)TOP	Woning	hendriks coppelmans	GGB	EGW	HSB	Nee		70				2				Ja					€ 72,000		
Permanent	(af)TOP	woning GV	hendriks coppelmans	GGB	EGW	HSB	Nee		112				2				Ja					€ 81,000		
Permanent	(af)TOP	Woning XL	hendriks coppelmans	GGB	EGW	HSB	Nee		92				2				Ja							
Permanent	BasisWonen	2LPd	Trebbe	GGB	EGW	PBC	Nee		64-69-74-79-84	4,2-4,5-4,8-5,1-5,4			2				nee				#WAARDE!	Variable		
Permanent	BasisWonen	1LK	Trebbe	GGB	EGW	PBC	Nee		74- 79- 84	4,8-5,1-5,4			2				Ja, kleinste nee				#WAARDE!	Variable		Circulair(isch)
Permanent	BasisWonen	2LK	Trebbe	GGB	EGW	PBC	Nee		82-89-96-102-109	4,2-4,5-4,8-5,1-5,4			2				Ja, 2 kleinste nee				#WAARDE!	Variable		Circulair(isch)
Permanent	beterBASIShuis	EGW	Koopmans	GGB	EGW	PBC	Nee	n.b	n.b		0.4	n.b.	2				n.b.	Ja	€ -	Ja	#WAARDE!	€ 77,091	Bouwteam	
Permanent	beterBASIShuis	BeBo	Koopmans	GGB	BeBo	PBC	Nee	n.b	n.b		0.4	n.b.	2				n.b.	Ja	€ -	Ja	#WAARDE!	€ 61,367	Bouwteam	
Permanent	beterBASIShuis	RAR	Koopmans	GGB	RAR	PBC	Nee	n.b	n.b		0.4	n.b.	2				n.b.	Ja	€ -	Ja	#WAARDE!	€ 54,327	Bouwteam	
Permanent	Budget	Wijwoning	hendriks coppelmans	GGB	EGW	HSB	Nee		125				2				Op.							
Permanent	Circular house	SVP	Jan Snel	HB	app.		Ja (5)	18 - 28 - 37		3 - 4,5 - 6			4											C2C 94% circulair
Permanent	Continu Wonen		Hemink	GGB	EGW	SFB, PBS	Nee					20wd.	4											
Tijdelijk	Cube	Cubestee	Friso Bouwgroep	HB	App	HSB	Ja	36		6			4											
Permanent	DD Wonen	Dijkstra Draisma	Dijkstra Draisma	GGB	EGW		Nee						2			5 (hans)	Op.	Ja	Ja		#DEEL/0!			Circulair ontwerp
Permanent	De Boomerang	Sustainer Homes	Sustainer Homes	HB	Multi	HSB	Ja					1a2wwd/ 1a 2	4				Op.	Ja	Ja					Circulair ontwerp
Permanent	De Boomerang	Sustainer Homes	Sustainer Homes	GGB	Multi	HSB	Ja					1a2wwd/ 1a 2	4				Op.	Ja	Ja					Circulair ontwerp
Permanent	de Snelwoning	5,4L	Jan Snel	GGB	EGW		nee	152	113	5.4		20 wk totaal	3				Ja							
Permanent	de Snelwoning	5,4S	Jan Snel	GGB	EGW		nee	100	68	5.4		20 wk totaal	3				Ja							
Permanent	de Snelwoning	6,0L	Jan Snel	GGB	EGW		nee	169	126	6		20 wk totaal	3				Ja							
Permanent	de Snelwoning	6,0M	Jan Snel	GGB	EGW		nee	111	100	6		20 wk totaal	3				Ja							
Permanent	de Snelwoning	6,0S	Jan Snel	GGB	EGW		nee	111	76	6		20 wk totaal	3				Ja							
Tijdelijk	de Snelwoning	5,4M	Jan Snel	GGB	EGW		nee	100	90	5.4		20 wk totaal	2											
Permanent	DUO woning	Barli	Barli	GGB	EGW	HSB	Ja**	57		3.75			5				Op.	Op.	Ja			€ 58,600		
Permanent	FijnWonen 101	Van Wijnen	Van Wijnen	GGB	EGW (1Lk)		Nee		84-89				3				Op.		ja					Mooie projecten veel flexibiliteit in het ontwerp
Permanent	FijnWonen 201	Van Wijnen	Van Wijnen	GGB	EGW (2LK/PD)		Nee		103-109-115				3				Op.		ja					
Permanent	FijnWonen 301	Van Wijnen	Van Wijnen	GGB	EGW (2LK)		Nee		118-125				3				Op.		ja		#DEEL/0!			2400 extra kosten voor stapel configuratie
Permanent	Finch	De Groot Vroomshoop	Finch	HB	App.	HSB	Ja (7+)	60- 80- 120					4						Ja					Circulair
Permanent	Finch	De Groot Vroomshoop	Finch	HB	Con	HSB	Ja (7+)	20- 25- 30- 40					4						Ja		#WAARDE!			Circulair
Permanent	Flexibel comfort	VBI	Consolis	HB		BSB	Ja						2						Ja		#DEEL/0!			Dankzij de prefab bouwmethode wordt er 30% efficiënter gebouwd en met het unieke DSS (DoorStapelSysteem) kan dat nog sneller
Permanent	Het Spaarhuis	EGW	Slokker	GGB	EGW	PBC	Nee	n.b	89		0.4	wwd 1d.	3	verzakken-en-lekken-101271324?utm_source=Vakm			Op.	Op.	€ 10,300	Op € 6,500	#WAARDE!	€ 73,300	Bouwteam	
Permanent	Het Spaarhuis	BeBo	Slokker	GGB	BeBo	PBC	Nee	n.b	62		0.4	wwd 1d.	3				Op.	Op.	€ 6,500	Op € 3,200	#WAARDE!	€ 59,500	Bouwteam	
Permanent	Het Spaarhuis	RAR	Slokker	GGB	RAR	PBC	Nee	n.b	65		0.4	wwd 1d.	3				Op.	Op.	€ 5,300	Op € 2,500	#WAARDE!	€ 56,200	Bouwteam	
Permanent	Hodes	Zorgwoning	Hodes Huisvesting	GGB	LLB	SFB, PBS	Nee						5											
Permanent	Hodes	Miniwoning	Hodes Huisvesting	GGB/ HB	App/ Con	SFB, PBS	Ja (3)	27.75, 33,3		3.77		10 dagen	5				Op.		Ja					gesproken op 18-06 zeer aangenaam geeft aan goed te luisteren naar klanten
Permanent	Hodes	Basiswoning	Hodes Huisvesting	GGB	EGW	SFB, PBS	Ja (3)	44.2, 53.2, 63		7.37		10 dagen	5				Op.		Ja					
Permanent	Hodes	Pluswoning	Hodes Huisvesting	GGB	EGW	SFB, PBS	Ja (3)			7.6		10 dagen	5				Op.		Ja					
Permanent	Hoogwonen Trebbe	Trebbe	Trebbe	HB	GF	PBC	Ja (3-6)		34-70		0.4		2				Nee				#DEEL/0!			
Permanent	Hoogwonen Trebbe	Trebbe	Trebbe	HB	FCO	PBC	Ja (3-6)						2				Nee							C2C principe (Circulairiteit), BENG 2
Permanent	House2Start	De Mors	Volkerwessels	GGB	EGW	PBS	Nee		41			2 wd.	4				Nee (energieneutr	Ja	Ja			€ 81,174		Circulair oogmerk
Permanent	HSB	EGW	HSB	GGB	EGW	PBC	Nee	140	89		0.4		2				OP	n.b	Op. € 9,170	OP € -	€ 537.26	€ 75,217	Bouwteam	C2C 94% circulair
Permanent	HSB	BeBo	HSB	GGB	BeBo	PBC	Nee	84	65		0.4		2				OP	n.b	Op. € 18,340	OP € -	€ 1,341.94	€ 112,723	Bouwteam	C2C 94% circulair
Permanent	HSB	RAR	HSB	GGB	RAR	PBC	Nee	152	112		0.4		2				OP	n.b	Op. € 9,170	OP € -	€ 363.03	€ 55,180	Bouwteam	C2C 94% circulair
Permanent	Huismerk	B.05	Heijmans	GGB	EGW	PBC	Nee	93 - 105	63 - 76		0.4	60 wd.	2				Op.		Op. € 3,600	Ja		€ 78,750		
Permanent	Huismerk	B.01	Heijmans	GGB	EGW	PBC	Nee	105 - 183	75 - 139		0.4	60 wd.	2				Op.		Op. € 3,600	Ja	#WAARDE!	€ 80,500		
Permanent	Huismerk	B.02	Heijmans	GGB	EGW	PBC	Nee	93 - 116	82 -103		0.4	60 wd.	2				Op.		Op. € 3,600	Ja		€ 82,500		
Permanent	Huismerk	B.04	Heijmans	GGB	EGW	PBC	Nee	140 - 174	122 - 155		0.4	60 wd.	2				Op.		Op. € 3,600	Ja		€ 103,750		
Permanent	Huismerk	B.06	Heijmans	GGB	EGW	PBC	Nee	128 - 144	95 - 108		0.4	60 wd.	2				Op.		Op. € 3,600	Ja		€ 88,500		
Permanent	Huismerk	B.07	Heijmans	GGB	LLB	PBC	Nee	130 - 138	96 - 102		0.4	60 wd.	2				Op.		Op. € 3,600	Ja		€ 85,500		Woonkeur (rolstoel)
Permanent	Huismerk	B.08	Heijmans	GGB	EGW	PBC	Nee	140 - 174	114 - 143		0.4	60 wd.	2				Op.		Op. € 3,600	Ja		€ 101,250		
Permanent	Huisvanu	Plegt-vos	Plegt-vos	GGB	EGW	PBC	nee						2				Op.							
Permanent	Jan Snel	Jan Snel	Jan Snel	HB	Con	PF	Ja (5+)	36- 45- 54	21- 24 - 30		0.4	10units/ p.d.	3							Op	#WAARDE!			
Permanent	Jan Snel Huizen	Jan Snel	Jan Snel	GGB	Con	SFB	Ja (2-3)				0.4		3			8 (daan)			Ja	Nee				
Permanent	ModulairBouwen	Plegt-vos	Plegt-vos	HB	Con	SFB	Ja (4)		27- 30 - 50		0.38		2								#DEEL/0!			
Permanent	MorgenWonen	MorgenWonen	Volkerwessels	GGB	EGW	BSB, GPO	Nee					wwd 1d.	4				Ja		Ja		#DEEL/0!			Circulair (heb persoonlijk mijn vraagtekens bij)
Permanent	Nezzt Single	De Meeuw	De Meeuw	HB	App.	BSB	Ja (12)	47.5	42.5	6.6	<0.3		2					Op.	Ja	Op.	€ -			Circulaire basis
Permanent	Nezzt Single Care	De Meeuw	De Meeuw	HB	LLB/ App.	BSB	Ja (12)	47.5	42.5	6.6	<0.3		2	ZBh				Op.	Ja	Op.	€ -			Circulaire basis
Permanent	Nezzt Studio	De Meeuw	De Meeuw	HB	Con	BSB	Ja (12)	25.9	21.8	3.6	<0.3		2					Op.	Ja	Op.	€ -			Circulaire basis
Permanent	Nezzt Studio+	De Meeuw	De Meeuw	HB	Con	BSB	Ja (12)	31.7	27	3.3	<0.3		2					Op.	Ja	Op.	€ -			Circulaire basis
Permanent	Nezzt Together	De Meeuw	De Meeuw	HB	App.	BSB	Ja (12)	59.4	53.4	9.9	<0.3		2					Op.	Ja	Op.	€ -			Circulaire basis
Permanent	Nezzt Together +	De Meeuw	De Meeuw	HB	App.	BSB	Ja (12)	71.3	65	9.9	<0.3		2					Op.	Ja	Op.	€ -			Circulaire basis
Permanent	Optiowoning		van Wanrooij	GGB	EGW		Nee		111	4,8-7,8	0.4		2+				Ja		Ja			€ 132,000		
Permanent	PCS	Appartementen	Dura Vermeer	HB			Ja (4+)						2				Op.				#DEEL/0!			
Permanent	PCS	Grond Gebonden	Dura Vermeer	GGB			Nee						2				Op.							
Permanent	PlusWonen V1	Volkerwessels	Volkerwessels	HB	App., GF, PF	PBC	Ja	82.87	71	6.9 - 7.8 (0.3 stappen)	0.4		2											
Permanent	PlusWonen V1	Volkerwessels	Volkerwessels	GGB	EGW	PBC	Nee			4.2 - 8.4 (0.3 stappen)	0.4		2											
Permanent	PlusWonen V2	Volkerwessels	Volkerwessels	HB	App., GF, PF	PBC	Ja	111.07	98	6.9 - 7.8 (0.3 stappen)	0.4		2											
Permanent	PlusWonen V2	Volkerwessels	Volkerwessels	GGB	EGW	PBC	Nee			4.2 - 8.4 (0.3 stappen)	0.4		2											
Permanent	PlusWonen V3	Volkerwessels	Volkerwessels	HB	App., GF, PF	PBC	Ja	54.51	48	6.9 - 7.8 (0.3 stappen)	0.4		2											
Permanent	PlusWonen V3	Volkerwessels	Volkerwessels	GGB	EGW	PBC	Nee			4.2 - 8.4 (0.3 stappen)	0.4		2											
Permanent	PlusWonen V4	Volkerwessels	Volkerwessels	HB	App., GF, PF	PBC	Ja	28.91	24	6.9 - 7.8 (0.3 stappen)	0.4		2				Op.	Op.	Ja	Op.				
Permanent	PlusWonen V4	Volkerwessels	Volkerwessels	GGB	EGW	PBC	Nee			4.2 - 8.4 (0.3 stappen)	0.4		2				Op.	Op.	Ja	Op.				
Permanent	RawModule	Hoogbouw	Thorb & BAM	GGB	Multi	SFB	Nee	93	70				4							*	€ 1,211.94	€ 112,710		
Permanent	RawModule	Laagbouw	Thorb & BAM	HB	App.	SFB	Ja	93	62				4							*	€ 1,211.94	€ 112,710	Turn-key	
Permanent	Skinny house	SVP	Jan Snel	GGB	EGW		Nee	31 - 62		3.26			1				onwaarschijnlijk							
Permanent	Slokker Innovate	Con.	Slokker	HB	Con	SFB	Ja (7)		24,8-30,3				2				n.b.			Ja	#DEEL/0!			
Permanent	ThinkWonen	HB	Think	HB	Alle	SFB	Ja	Alles mogelijk	Alles mogelijk	Alles mogelijk	0		5				Ja	ja	ja					Vrij ontwerp
Permanent	ThinkWonen	LB	Think	GGB	Alle	SFB	Nee	Alles mogelijk	Alles mogelijk	Alles mogelijk	0	8 maanden	5				Ja	Ja	Ja			€ 107,500		Vrij ontwerp
Permanent	ToPlan	NOM woning	Janssen de Jong	GGB	LLB		Nee		84		0.4		2				Ja		Ja			€ 169,500		
Permanent	Uitkijkwoning	Barli	Barli	GGB	EGW	HSB	nee	80.6	65	4.5			4				Op.	Op.	Ja			€ 69,250		
Permanent	Ursem	CLT	Heddes	HB	Con	HSB	Ja (5)	50		4	0.4		5				Op.							Circulair hout gebruik
Permanent	Ursem	IDB	Heddes	HB	Con	PBC	Ja (23)	38		4	0.4		5				Op.				€ -			
Permanent	Ursem	IDH	Heddes	GGB	Con	HSB	Ja (2)	57.6		4	0.4		5				Op.							
Permanent	Ursem	IDS	Heddes	HB	Con	PBC	Ja (5)	50		4	0.4		5				Op.							
	VDM Woningen		VDM	GGB	EGW	HSB	Nee	?- 126-?	67 - 86,7 - 104,4				2									€ 102,000		
Permanent	Waarder Riant	Waarder Riant	BAM	GGB	EGW	Tunnel	Nee						1								#DEEL/0!			
Permanent	Wooncollectie	Type B	BAM	GGB	EGW	PBS	Nee	144.1	110.4	5.1		80 dagen	3			3 Stijlen	Op.							Referenrie project De Bongerd
Permanent	Wooncollectie	Type A	BAM	GGB	RAR	PBS	Nee	94.3	83.9	5.7		80 dagen	3			3 Stijlen	Op.							
Permanent	Wooncollectie	Type C	BAM	GGB	EGW	PBS	Nee	162.3	126.5	5.4		80 dagen	3			3 Stijlen	Op.							Referenrie project De Bongerd
Permanent	Wooncollectie	Type D	BAM	GGB	EGW	PBS	Nee	201.6	161.6	6		80 dagen	3			3 Stijlen	Op.							Erg groot
Permanent	Wooncollectie	Type E	BAM	GGB	2onder1kap	PBS	Nee	208.3	159	8		80 dagen	3			3 Stijlen	Op.							Erg groot
Permanent	Wooncollectie	Type F	BAM	GGB	2onder1kap	PBS	Nee	200.6	134.9	5.7		80 dagen	3			3 Stijlen	Op.							
Permanent	Wooncollectie	Type G	BAM	GGB	EGW	PBS	Nee	139.1	119.4	8.1		80 dagen	3			3 Stijlen	Op.							Erg groot
Permanent	Wooncollectie	Type H	BAM	GGB	2onder1kap	PBS	Nee	244.9	172.4	6		80 dagen	3			3 Stijlen	Op.							Erg groot
Permanent	Wooncollectie	Type V	BAM	GGB	EGW	PBS	Nee	248	175	6		80 dagen	2			3 Stijlen	Op.		Ja		€ -			
Permanent	Woonsteate	Toren 4x3	Koopmans	HB	App.	SSB	Nee	64	71		0.4	16 wk	3					Op.	€ 3,000	Op € 5,000	€ 1,906.25	€ 122,000	Turn-key	afgebakend concept met een 3x4 app opbouw tot op heden geen grootschalige flexibiteit mogelijk.

Appendix 2. KTV survey questionnaire

This appendix shows the questionnaire used for EH's KTV survey. In total the questionnaire exist of 49 questions. Based on answers given by respondents the survey added extra questions which ask for more in-depth information.

Vragenlijst EIGEN HAARD BEWONERSONDERZOEK 2018

Uitnodigingsmail.

[Totaalnaam]],

Hierbij nodig ik u graag uit om deel te nemen aan het Eigen Haard BEWONERSONDERZOEK 2018.

U heeft hierover ongeveer twee weken geleden van mij een aankondiging per mail ontvangen.

Klik hier om deel te nemen aan het BEWONERSONDERZOEK 2018

Het invullen van de vragenlijst kost u ongeveer 15 minuten van uw tijd. Het onderzoek is volledig anoniem. Wij kunnen dus niet zien welke antwoorden u heeft gegeven.

Onder de deelnemers verloten wij na afloop van het onderzoek een maand gratis huur!

Anoniem, maar toch een winnaar kiezen?

Ja, dit is mogelijk. In de onderzoeksapplicatie kunnen wij zien wie er hebben deelgenomen, maar niet wie welke antwoorden heeft gegeven. Uit alle mensen waarvan we zien dat ze hebben deelgenomen, trekken wij na afloop een winnaar. Heeft u hier toch nog vragen over, stuurt u dan gerust een e-mail naar team Klant- en Marktonderzoek.

Met vriendelijke groet,

Yuri van der Oord

team Klant- en Marktonderzoek

Eigen Haard

Blok 1: Tevredenheid Woning

1.1. Woont u in een woongebouw met een met gedeeld trappenhuis en/of andere gemeenschappelijk binnen- en of buitenruimten?

- ❑ Nee, geen gemeenschappelijke ruimten (bijvoorbeeld bij eengezinswoning)
- ❑ Ja, namelijk:

(meer antwoorden mogelijk)

- Portiek
- Galerij
- Tuin/gemeenschappelijk buitenruimte
- Centrale entree
- Kelder-/Box-gang
- Centrale postkasten
- Lift
- Anders, namelijk:

1.2. Er volgen nu een aantal kenmerken over uw woning. Kunt u deze kenmerken een rapportcijfer geven van 1 tot en met 10? *(waarbij: 1 = zeer slecht; 10 = zeer goed)*

In welke mate bent u tevreden over:	Rapportcijfer of 'weet niet/ n.v.t.'
❑ uw woning in zijn geheel	.....
❑ de staat van onderhoud van uw woning	.....
❑ de grootte van uw woning	.....
❑ de indeling van uw woning	.....
❑ de gehorigheid van de woning	.....
❑ de mate waarin de woning geïsoleerd is (warmte)	.....
❑ de inbraakveiligheid van de woning	.....
❑ [indien 1.1 = ja] de uitstraling van het woongebouw waarin u woont	
❑ [indien 1.1 = ja] de beveiliging van het trappenhuis en/of andere gemeenschappelijke ruimten	.....
❑ [indien 1.1 = ja] het schoon zijn van het trappenhuis en/of andere gemeenschappelijke ruimten	.....
❑ [indien 1.1 = ja] de onderhoudsstaat van het trappenhuis en/of andere gemeenschappelijke ruimten	.....

1.3. [als woning geheel < 7] U geeft uw woning in zijn geheel een matig of slecht cijfer. Kunt u aangeven waarom?

.....
.....
.....

1.4. [als gehorigheid < 7] U geeft de gehorigheid van de woning een matig of slecht cijfer. Kunt u aangeven waarom en waar u dan het meeste last van heeft?

.....
.....
.....

1.5. [als uitstraling < 7] U geeft de uitstraling van het woongebouw een matig of slecht cijfer. Kunt u aangeven waarom?

……
……
……

1.6. Wat is volgens u **het grootste probleem** in uw woning of in uw woongebouw?

……
……
……

o Geen problemen

Blok 2: Tevredenheid Buurt

2.1. Nu volgen onderwerpen over uw woonomgeving en de leefbaarheid in uw buurt. Aan u weer de vraag rapportcijfers te geven voor de verschillende onderwerpen.

(waarbij wederom: 1 = zeer slecht; 10 = zeer goed)

Hoe tevreden bent u over:	Rapportcijfer of 'weet niet/ n.v.t.'
❑ uw buurt als geheel	.....
❑ het aanbod van winkels	.....
❑ het aanbod van speelvoorzieningen	.....
❑ het aanbod van basisscholen	.....
❑ het aanbod van sportgelegenheden	.....
❑ het aanbod van parkeervoorzieningen	.....
❑ het aanbod van zorgvoorzieningen	.....
❑ de toegankelijkheid van uw buurt voor mensen die minder goed ter been zijn. bv. stoepen, hekjes, trappen (1 = zeer ontoegankelijk, 10 = zeer toegankelijk)	.....
❑ de hoeveelheid groenvoorziening (bomen, planten, bosjes en grasveldjes)	.....
❑ onderhoud van de groenvoorziening (bomen, planten, bosjes en grasveldjes)	.....
❑ de schoonheid/netheid van uw buurt	.....
❑ de veiligheid in uw buurt overdag (1 = zeer onveilig, 10 = zeer veilig)	.....
❑ de veiligheid in uw buurt 's avonds (1 = zeer onveilig, 10 = zeer veilig)	.....
❑ de mate waarin uw buurt 's avonds en 's nacht goed wordt verlicht	.....
❑ In welke mate voelt u zich thuis in de buurt? (1=helemaal niet, 10= helemaal wel)	.....

2.2. Hoe vindt u dat de buurt waar u woont zich de laatste 2 jaar heeft ontwikkeld?

- ❑ Achteruit gegaan
- ❑ Ongeveer hetzelfde gebleven
- ❑ Vooruit gegaan
- ❑ Geen mening, weet ik niet

2.3. Hoe denkt u dat de buurt waar u woont zich de komende jaren zal ontwikkelen?
(op een schaal van 1 tot 10 waarbij 1=zeer slecht/negatief en 10=zeer goed/positief)

.....

Graag uw toelichting:

.....
.....
.....

2.4. Wat vindt u **het leukst** aan uw buurt?

.....
.....
.....

2.5. Naast uw oordeel over de woning en woonomgeving is het voor ons ook belangrijk om te weten of u te maken heeft met verschillende vormen van overlast. Ook dit graag via een rapportcijfer van 1 t/m 10.

Met een 10 geeft u aan helemaal geen overlast te ervaren, een 1 staat voor zeer veel overlast.

	Rapportcijfer of 'weet niet'
❑ rapportcijfer voor overlast van uw buren	.....
❑ rapportcijfer voor overlast van andere (groepen) mensen dan uw buren	.....
❑ rapportcijfer voor overlast van verkeer	.....
❑ rapportcijfer voor overlast door vervuiling	.....
❑ rapportcijfer voor overlast door criminaliteit	.....

❑ rapportcijfer voor overlast door vandalisme .....

2.6. [als overlast buren < 7] U geeft de overlast van buren een matig of slecht cijfer. Kunt u aangeven waarom en waar u dan het meeste last van heeft?

.....
.....
.....

2.7. [als overlast van anderen dan buren < 7] U geeft de overlast van andere mensen dan buren een matig of slecht cijfer. Kunt u aangeven van wie of van welke groepen u overlast ondervindt en waar u dan het meeste last van heeft?

.....
.....
.....

2.8. Wat is volgens u **het grootste probleem** in uw buurt?

.....
.....
.....

o Geen problemen

Blok 3: BETROKKENHEID

3.1. Hoe gaan verschillende groepen mensen in uw buurt met elkaar om?

(op een schaal van 1 tot 10, waarbij 1=zeer onprettig en 10=zeer prettig)

.....

3.2. Hoe beoordeelt u de betrokkenheid van de buurtbewoners bij de buurt?

(op een schaal van 1 tot 10 waarbij 1=helemaal niet betrokken en 10=zeer betrokken)

.....

3.3. Hoe betrokken voelt u zichzelf bij de buurt?

(op een schaal van 1 tot 10 waarbij 1=helemaal niet betrokken en 10=zeer betrokken)

.....

3.4. Kunt u aangeven of u de volgende dingen weleens doet in uw buurt?

o	Portiek of eigen straatje schoonmaken
o	Boodschappen en/of andere klusjes doen voor buurtbewoners
o	Overlast melden bij Eigen Haard (via huismeester, wijkbeheerder of telefonisch)
o	Bij vakantie van een buurtbewoner op de woning of huisdieren passen
o	Mantelzorg voor bewoner(s) in de buurt
o	Uitje of etentje organiseren voor buurtbewoners
o	Meedoen aan of organiseren van opruimacties of opschoonacties
o	Deelname aan een bewonerscommissie
o	Buurtbewoner(s) helpen met administratie

o	Nog iets anders, namelijk:
o	Nee, dit soort dingen doe ik niet in mijn buurt

Blok 4: Sociale contacten en zelfredzaamheid

4.1. Wat vindt u van het aantal sociale contacten dat u heeft in de buurt?

o	Te weinig
o	Voldoende
o	Te veel

4.2. Hoeveel mensen kent u in de buurt die u kunt benaderen als er iets is waar u hulp bij nodig heeft?

o	Daar ken ik niemand goed genoeg voor in de buurt
o	Eén of twee buren/ buurtbewoners
o	Drie tot vijf buren/buurtbewoners
o	Meer dan vijf buren/ buurtbewoners

4.3. In welke mate kan uw huishouden zichzelf redden, zonder hulp van anderen, zoals vrienden, familie of instanties?

(10 = ik kan me helemaal redden zonder hulp en 1 = ik kan me helemaal niet redden zonder hulp)

	Cijfer: ……..

4.4. Hoe is de gezondheid van u en uw eventuele huisgenoten het beste te omschrijven?

o	Er zijn geen gezondheidsproblemen
o	Er zijn af en toe gezondheidsproblemen, maar die zijn niet ernstig
o	Er zijn af en toe gezondheidsproblemen, die het doen en laten wat kunnen beperken
o	Er zijn blijvende gezondheidsproblemen die het doen en laten soms wat kunnen beperken
o	Er zijn blijvende gezondheidsproblemen die het doen en laten ernstig beperken
o	Wil ik niet zeggen

4.5. Heeft u of iemand in uw huishouden hulp van onderstaande instanties of personen?

(meer antwoorden mogelijk)

o	Nee, geen hulp nodig *Ex*
o	Nee, maar ik wél behoefte aan hulp voor/van: ……..
o	Ja, van Thuiszorg
o	Ja, van buren
o	Ja, van familie, vrienden en kennissen
o	Ja, van Sociaal wijkteam
o	Ja, van financiële hulpverlening (hulp bij administratie, schulden, budget)
o	Ja, van andere personen/ instanties, namelijk: ……..
o	Wil ik niet zeggen *Ex*

4.6. Welke uitspraak past volgens u het best bij uw situatie:

o	Deze woning is te duur voor mij, ik houd (bijna) geen geld over voor mijn levensonderhoud
o	Deze woning is redelijk duur voor mij, ik kan rondkomen maar niet veel extra's doen
o	Deze woning past qua kosten goed bij mijn financiële situatie
o	Ik zou best meer kunnen betalen voor een andere/betere huur- of koopwoning
o	Wil ik niet zeggen

Blok 5: Verhuisgeneigdheid

5.1. Wilt u (of moet u) binnen 1 jaar gaan verhuizen?

- ❑ Ja, zeker
- ❑ Ja, misschien
- ❑ Nee --> ga naar Blok 6.

5.2. Wat zijn voor de belangrijkste redenen om te willen verhuizen?

(meer antwoorden mogelijk, maximaal 5 antwoorden)

□	vanwege sloop of renovatie
□	wil groter wonen
□	wil kleiner wonen
□	wil kopen in plaats van huren
□	wil mooier/beter wonen
□	wil dichter bij familie/vrienden wonen
□	heb geen of een te kleine tuin/balkon
□	omstandigheden in het huishouden (samenwonen, gezinsuitbreiding, scheiding, overlijden, kinderen uit huis)
□	omstandigheden in werk of studie (locatie)
□	woning is te duur
□	mijn gezondheid
□	mijn leeftijd
□	woning niet gelijkvloers/te veel trappen
□	slechte kwaliteit woning
□	huurcontract loopt af
□	buurt bevalt niet (meer)
□	ruzie met of overlast van de buren
□	Nog een andere reden, namelijk:…….

5.3. Voor wat voor huishoudsamenstelling zoekt u dan een woning?

- ❑ Alleenstaand/ alleenwonend
- ❑ Samenwonend/ gehuwd zonder kinderen
- ❑ Samenwonend/ gehuwd met kinderen
- ❑ Eenoudergezin
- ❑ Anders, namelijk:…….

5.4. Wilt u in uw huidige gemeente (voor Ymere en De Alliantie: Amsterdam) blijven of liever naar een andere gemeente?

- ❑ Bij voorkeur in huidige gemeente blijven → ga naar vraag 5.6.
- ❑ Bij voorkeur ergens anders gaan wonen

5.5. Naar welke gemeente(n) zou u willen verhuizen?

(meer antwoorden mogelijk)

- ❑ Aalsmeer
- ❑ Almere
- ❑ Amstelveen
- ❑ Amsterdam - voor Ymere en De Alliantie deze optie weglaten
- ❑ Diemen
- ❑ Haarlem
- ❑ Haarlemmermeer
- ❑ Purmerend
- ❑ Uithoorn
- ❑ Zaanstad
- ❑ Andere gemeente, namelijk:

5.6. Wilt u de toekomstige woning kopen of huren?

- ❑ Alleen kopen
- ❑ Alleen huren
- ❑ Liever kopen, eventueel huren
- ❑ Liever huren, eventueel kopen
- ❑ Geen voorkeur

5.7. [niet tonen als 5.6. is “alleen kopen”] Wat voor kale huurprijs zou u bereid zijn maximaal maandelijks te betalen?

- ❑ Sociale huurwoning (tot 711 euro per maand), maximale huurprijs:
  ……
- ❑ Vrije Sector huurwoning (vanaf 711 euro per maand, maximale huurprijs:
  ……
- ❑ Weet ik niet

5.8. [niet tonen als 5.6. is “alleen huren”] Wat voor koopprijs zou u bereid zijn maximaal te betalen in euro's?

- ❑ Maximale koopprijs: ……

❑ Weet ik niet

Blok 6: Klanttevredenheid en klantwensen Dienstverlening ALLEEN VOOR EIGEN HAARD

6.1. Er volgen nu enkele vragen over de dienstverlening van Eigen Haard.
Zou u deze willen beoordelen aan de hand van een rapport cijfer van 1 tot 10?
(Ook hier staat een 1 weer voor zeer slecht en een 10 voor zeer goed).

Welk rapportcijfer geeft u voor:	Rapportcijfer of 'weet niet'
❑ Het nakomen van afspraken door Eigen Haard	.....
❑ De service/ dienstverlening van Eigen Haard in totaal	.....
❑ Het erop kunnen vertrouwen dat Eigen Haard snel met een antwoord of oplossing komt*	.....
❑ Het Eigen Haard Magazine dat u 4 keer per jaar ontvangt	.....

6.2. Heeft u de afgelopen 6 maanden **zelf contact opgenomen** met Eigen Haard?

❑ Ja

❑ Nee --> naar blok 7

6.3. Waarover heeft u **de laatste keer** contact gehad met Eigen Haard? Eén antwoord mogelijk.

❑ Een vraag over een andere woning, huren of huurbetaling

❑ Een reparatieverzoek

❑ Een overlastmelding over buren (bijvoorbeeld m.b.t. geluid/ stank van buren, onrechtmatige bewoning, zorgmeldingen, kraak, drugs)

❑ Een overlastmelding over de omgeving (bijvoorbeeld buurt, verkeer, hangjongeren, vuil of geluid/ stank op straat, dealers/ zwervers op straat etc.)

❑ Een klacht over de dienstverlening van Eigen Haard

❑ Andere reden, namelijk: ……

6.4. Op welke manier heeft u **de laatste keer** contact opgenomen met Eigen Haard?

❑ Telefonisch

❑ Aan de balie op het hoofdkantoor

❑ Schriftelijk

❑ E-mail/Internet

- ❑ Chat
- ❑ Contact in de buurt met beheerder/huismeester
- ❑ Woonwinkel
- ❑ Anders namelijk …..

6.5. Er volgt nu een aantal vragen over de kwaliteit van de dienstverlening van Eigen Haard. Ik leg u een aantal onderwerpen voor. Zou u deze willen beoordelen aan de hand van een rapport cijfer van 1 tot 10?
Toelichting: Ook hier staat een 1weer voor zeer ontevreden en een 10 voor zeer tevreden.

[Onderstaande aspecten indien 6.4 = Telefonisch]	Rapportcijfer of 'weet niet'
❑ De telefonische bereikbaarheid	.....
❑ De snelheid waarmee u antwoord heeft gekregen op uw telefonische vraag	.....
❑ De kwaliteit van het antwoord dat u heeft gekregen op uw telefonische vraag (vraag goed beantwoord)	.....
❑ De klantvriendelijkheid van de medewerker die u heeft geholpen aan de telefoon	.....
❑ De deskundigheid van de medewerker die u heeft geholpen aan de telefoon	.....
[Onderstaande aspecten indien 6.4 = Aan de balie]	.....
❑ De snelheid waarmee u werd geholpen aan de balie	.....
❑ De kwaliteit van het antwoord dat u heeft gekregen (vraag goed beantwoord)	.....
❑ De klantvriendelijkheid van de medewerker die u heeft geholpen aan de balie	.....
❑ De deskundigheid van de medewerker die u heeft geholpen aan de balie	.....
[Onderstaande aspecten indien 6.4 = Schriftelijk, email]	.....
❑ De snelheid waarmee u een inhoudelijke reactie kreeg	.....
❑ De kwaliteit van het antwoord dat u heeft gekregen (vraag goed beantwoord?)	.....
[Onderstaande aspecten indien 6.4 = Chat]	.....

- ❑ De snelheid waarmee u een inhoudelijke reactie kreeg .....
- ❑ De kwaliteit van het antwoord dat u heeft gekregen (vraag goed beantwoord?) .....

Blok 7: Duurzaamheid ALLEEN EIGEN HAARD

7.1. In welke mate vindt u dat Eigen Haard een duurzaam imago heeft?
(Van 1 tot 10, waarbij 1= helemaal geen duurzaam imago en 10 = zeer duurzaam imago)

Cijfer: …… o Geen mening

Bij Eigen Haard willen we de komende tien jaar duizenden woningen energiezuiniger maken. Dit doen we in het project Samen verduurzamen. We brengen daarbij energiebesparende maatregelen aan in de woning, zoals muur- en vloerisolatie, nieuwe ramen/deuren/kozijnen. Dit alles tegen een zeer geringe huurverhoging: de huurverhoging is 50% van de te verwachten energiebesparing. Dus stel dat u 20 euro per maand aan gas gaat besparen, dan is de huurverhoging voor deze ingrepen 10 euro.

7.2. [als energielabel is DEFG] Bent u geïnteresseerd in energiebesparende maatregelen bij gelijkblijvende of lagere woonlasten?

- o Ja
- o Nee
- o N.v.t. mijn woning is al verduurzaamd
- o N.v.t. ik woon in een energiezuinige woning
- o Weet ik niet

7.3. Wat is voor u de belangrijkste reden om mee te doen aan verduurzaming van de woning?

- o Comfortverbetering (minder tocht, minder kou)
- o Kostenbesparing
- o Beter voor het milieu (minder CO_2 uitstoot)
- o Veiligheid (goede ventilatie, luchtkwaliteit, geen koolmonoxide gevaar)

Blok 8: Achtergrondkenmerken ALLEN

Tot slot volgen er nu nog enkele achtergrondvragen. Ook uw antwoorden op deze vragen blijven anoniem. Deze vragen worden gebruikt om vergelijkingen tussen bijvoorbeeld leeftijdsgroepen, inkomensgroepen en huishoudentypes te maken.

8.1. Wat is uw leeftijd in jaren?

- ❑ …….
- ❑ Wil ik niet zeggen

8.2. Wat is uw huishoudsamenstelling?

- ❑ Alleenstaand/ alleenwonend
- ❑ Samenwonend/ gehuwd zonder kinderen
- ❑ Samenwonend/ gehuwd met kinderen
- ❑ Eenoudergezin
- ❑ Anders, namelijk:…….
- ❑ Wil ik niet zeggen

8.3. Wat is het niveau van uw hoogst voltooide opleiding?

- o LO (Lagere school, LAVO, VGLO)
- o LBO (LBO, LTS, LEAO, ITO, Huishoudschool, LLO)
- o MAO (MAVO, IVO, MULO, ULO, 3 jr HBS, 3 jr VWO, 3 jr VHMO, VMBO)
- o MBO (MTS, UTS, MEAO)
- o HAO (HAVO, VWO, Atheneum, Gymnasium, NMS, HBS, Lyceum)
- o HBO (HTS, HEAO, Post-HBO, Wetensch. kand., Univers. onderwijs kand.)
- o WO (Universitair onderwijs, Doctoraalopleiding, Masters)
- o Wil ik niet zeggen

8.4.a. Heeft u zelf op dit moment betaald werk?

- o Ja, in loondienst
- o Ja, als zelfstandige of freelancer
- o Nee, ik ben student/ scholier
- o Nee, WAO, WW of bijstandsuitkering
- o Nee, met de VUT, AOW, gepensioneerd, rentenier
- o Nee, en ik heb geen uitkering
- o Wil ik niet zeggen/ weet ik niet

8.4.b. [indien niet ‘alleenstaand’, ‘eenoudergezin’, ‘anders, namelijk’ of ’wil niet zeggen’ beantwoord in vraag 7.2]

Heeft een ander gezinshoofd op dit moment betaald werk?

- o Ja, in loondienst
- o Ja, als zelfstandige of freelancer
- o Nee, maar geen uitkering (studenten met studiefinanciering mogen hier ook onder)
- o Nee, WAO, WW of bijstandsuitkering
- o Nee, met de VUT, AOW, gepensioneerd, rentenier
- o Wil ik niet zeggen/ weet ik niet/ n.v.t.

8.5. Tot welke bevolkingsgroep(en) rekent u zichzelf? ALLEEN EIGEN HAARD EN DE ALLIANTIE

- o Nederlands
- o Westerse bevolkingsgroepen (Europa, USA, Australië, Oekraïne, (Wit) Rusland enz.)
- o Turks
- o Marokkaans
- o Surinaams
- o Antilliaans
- o Overige niet-westerse bevolkingsgroepen (Azië, Afrika, Zuid-Amerika, Midden-Amerika enz.)
- o Wil niet zeggen/weet niet

8.6. In welke van de volgende inkomensklassen valt uw brutogezinsinkomen per jaar?
(totaalbedrag aan inkomsten op uw Belastingformulier)

- ❑ Minder dan € 22.400,-
- ❑ € 22.401 - € 30.400,-
- ❑ € 30.401 - € 36.798,-
- ❑ € 36.799 - € 41.056,-
- ❑ € 41.057 - € 51.000,-
- ❑ Meer dan € 51.000,-
- ❑ Wil ik niet zeggen

8.7. Ontvangt u momenteel huurtoeslag?

- o Ja
- o Nee
- o Weet ik niet/ wil niet zeggen

8.8. Dit was de laatste vraag van het onderzoek. Heeft u tot slot nog vragen of opmerkingen voor ons?

- ❑ …….
- ❑ Geen opmerkingen

Hartelijk dank voor uw deelname.

Nog een hele prettige dag toegewenst!

Appendix 3. EH's KTV survey Data

This appendix houses the results from Eigen Haard's KTV survey. Due to size of the file a small selection of results has been depicted here. Also due to the confidential nature of the information some data is left out. To view the complete data set permission is required from Housing Association Eigen Haard te Amsterdam. To obtain the complete dataset email Yuri van de Voort Head researcher at Housing assoisiation Eigen haard at Y.vd.voort@eigenhaad.nl or the auteur D. Bijman at daan.bijman@gmail.com or d.bijman@eigenhaard.nl .

This appendix shows the publicly available results from the first 5 of 13.412 respondents

Part 1

EINDDATU	WONING_GEDEELD_A1	WONING_	WONING_	WONING_	WONING_	WONING_	WONING_	WONING_	WONING_	OPENWONII	Postcode	Plaats	Aanbiedinç	Aanbiedinç	Bouwdatun	Ingangsdatum (additioneel)	Soort eenh	Type	Technisch type
01-11-18	1	0	0	0	0	0	0	0	0	NULL	1182 EK	AMSTELVEEN			1992	01-05-15	Woning	E.G.WONING	E.G.WONING
11-12-18	0	0	1	0	1	1	0	1	0	NULL	1083 XX	AMSTERD	SOC	REGULIER	1962	07-06-07	Woning	ETAGEWON.	ETAGEWON.
28-11-18	0	0	1	0	0	0	0	0	0	NULL	1061 HX	AMSTERD	VS	REGULIER	2015	01-03-15	Woning	ETAGEWON.	ETAGEWON.
29-11-18	1	0	0	0	0	0	0	0	0	NULL	1104 MH	AMSTERDAM			1984	04-11-96	Woning	E.G.WONING	E.G.WONING
18-12-18	0	0	0	0	0	0	0	0	1	BENEDENW	1095 XN	AMSTERD	SOC	REGULIER	1930	01-05-01	Woning	ETAGEWON.	ETAGEWON.
01-11-18	1	0	0	0	0	0	0	0	0	NULL	1191 AW	OUDERKE	SOC	REGULIER	2007	23-11-17	Woning	ETAGEWON.	ETAGEWON.
18-12-18	0	1	0	0	1	1	0	0	0	NULL	1018 SK	AMSTERD	SOC	REGULIER	1900	24-01-06	Woning	ETAGEWON.	PORTIEK

Part 2

pe	IZO	IZO actief	WF	WF actief	DW	DW actief	EH wijknr	EH wijk	AALSMEE	Weeg gem	Weeg totaa	subsidiabe	label na mu	streefhuur	pnt_totaal	da_kamers	v
G	nee	nee	nee	nee	nee	nee	62	Patrimonium		1.093391	0.933643	853.28	LB VRIJE	1000	198.75	3	
.	nee	nee	nee	nee	nee	nee	55	Buitenveldert Oost + Z		0.897446	0.997426	586.54	LB DOOR\	597.3	156.25	4	
.	nee	nee	nee	nee	nee	nee	22	De Kolenkit		1.165601	1.295454	973.44	LB VRIJE	850	228.25	3	
G	nee	nee	nee	nee	nee	nee	7	Bijlmer Oost		0.888662	0.987663	634.88	LB DOOR\	597.3	172.25	4	
.	nee	nee	nee	nee	nee	nee	51	Indische buurt: Noord		1.091929	1.213575	435.18	LB DOOR\	482.3	144	3	
.	nee	nee	nee	nee	nee	nee	69	Ouderkerk aan de Am		0.968318	0.806746	605.28	LB DOOR\	640.14	173.75	3	
	nee	nee	nee	nee	nee	nee	12	Czaar Peterbuurt		0.772456	0.858511	340.9	LB DOOR\	482.3	133.5	2	

Part 3

woz_waarc	pnt_oppervlakte_vertrekken	pnt_oppervlakte_overig	pnt_energie	administatieve_eigenaar	EI-inschatting	Pre-label	EI afgemeld	Energielabel afgemeld	LEEFCAT
269000	57	18.75	32	NIET_DAEB	1.13	A	1.2	B	Ouder dan 55 jaar
220000	58	5.25	15	DAEB	1.55	C	1.41	C	35 tot en met 55 jaar
407000	66	6	32	NIET_DAEB	0.87	A	0.87	-	35 tot en met 55 jaar
184000	68	5.25	22	DAEB	1.32	B	1.48	C	35 tot en met 55 jaar
230000	38	0	0	DAEB	1.68	C	-	-	Ouder dan 55 jaar
210000	51	3.75	32	DAEB	1.24	B	-	-	Wil niet zeggen
200000	36	4.5	15	DAEB	1.5	C	1.55	-	35 tot en met 55 jaar

Appendix 4. NHC framework cluster analysis results

This appendix shows the cluster analyses result performed of IBM SPSS 23 within a Dendrogram. A simplified summary of these results is also illustrated by Fig 8. (*Variance in NHC scores illustrated, with large clusters, max. and min. scores highlighted).*