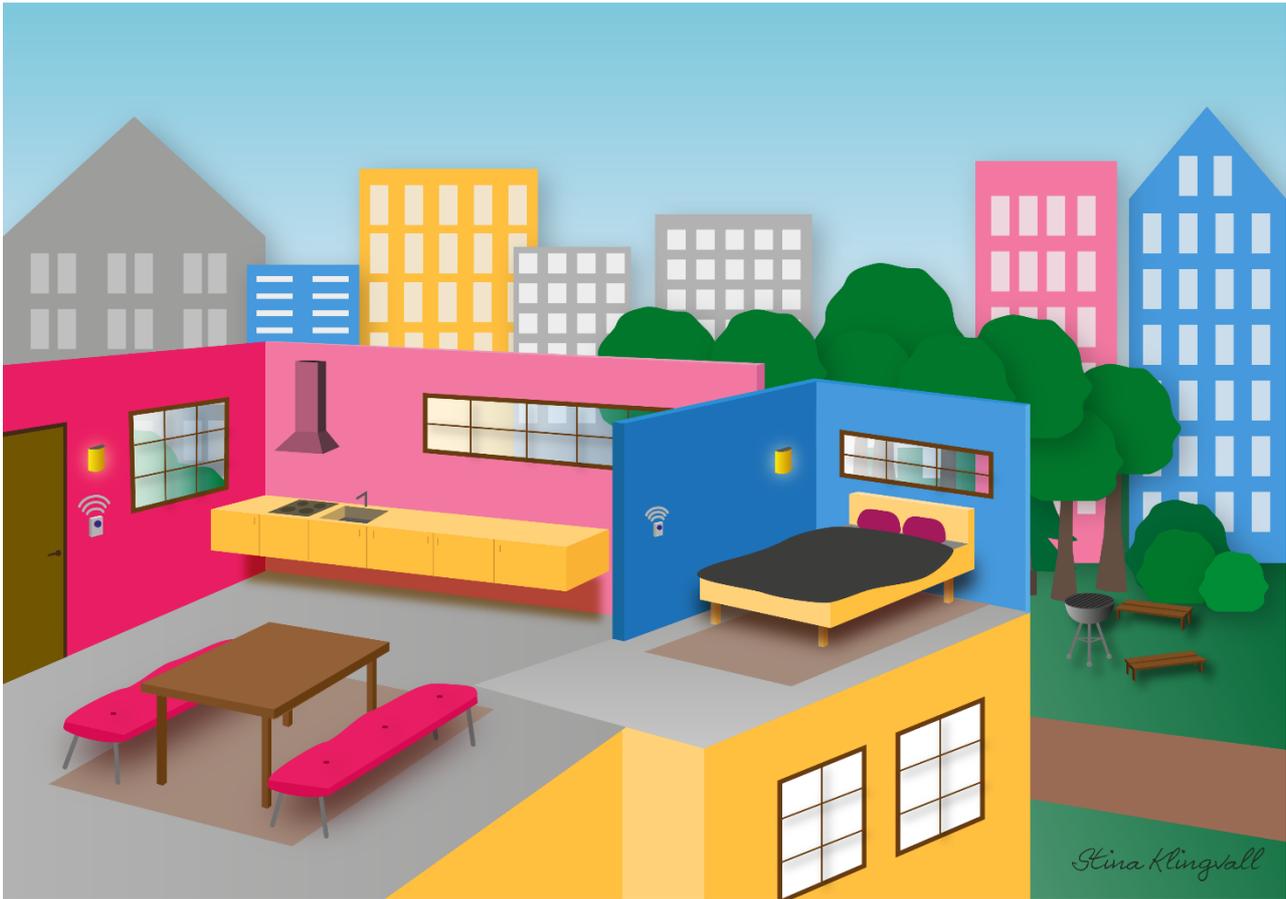




CHALMERS



Exploring User Needs for Smart Urban Homes

A cross-sectional study of housing needs
and obstacles for their realization

*Master of Science Thesis
in the Management and Economics of Innovation Programme*

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MASTER'S THESIS E 2016:004

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Cover: Conceptualizing the Smart Urban Home
[The illustration conceptualizes the user needs
for Smart Urban Homes that were identified in this study.
Sketch by Stina Klingvall, 2016. See pp. 92.]

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Abstract

The concept of homes are constantly developing, including the recent development of so-called Smart homes, characterized by adding Information and Communications Technology (ICT) to the home. One bias of the development of Smart homes is that it has been focused on what is feasible from a technological perspective. Therefore, this study aims to complement the understanding of Smart homes by exploring the user perspective, focusing on identifying the housing needs of young people in urban environments in Sweden, as well as exploring the obstacles that exist for meeting these needs.

A cross-sectional study has been conducted, combining qualitative contextual interviews that identify people's housing needs as well as their contexts, with a quantitative survey that prioritized and validated the needs. The needs were then analyzed in order to identify their underlying meaning. Among the most important findings were that many of the most important needs are basic, including the desire to have natural light from several direction and having a secluded sleeping space. Several of the underlying meanings were identified as traditional, like having the home to achieve relaxation and social contact, but there were also nascent needs, like saving time and allowing flexibility to support an active lifestyle. Additionally, experts in the housing industry were interviewed to identify obstacles for fulfilling the needs and what could be done to address the obstacles. Some of the most important obstacles were found to be incentives and the current market situation and a gap in the knowledge about users.

Further, the general understanding of Smart homes was discussed in relation to the results about needs and obstacles as well as earlier research about Smart homes. The conclusion was that the current definition of what encompasses Smart homes means that Smart home solutions only are able to meet some of the users' important needs, as many of the needs are traditional and not solvable through "smart technology". This implies that the concept of Smart homes should be seen as one component in the future development of homes, rather than the natural development of the whole concept of homes. Despite this, the study also found several user needs that has potential to be met by developing Smart home solutions based on ICT. By applying the user perspective, several areas of improvement for the design and development of Smart home products could be identified, like focusing on ease-of-use and targeting early adopters.

The study was conducted between September 2015 and January 2016 and was done in collaboration with the Royal Swedish Academy of Engineering Sciences, IVA, as a part of their ongoing project 'Attractiveness for Sustainable Growth'.

Keywords: Smart homes, User needs, Housing industry, Contextual interviews, Mixed method

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1 Introduction

1.1 Background

The concept of a home fulfills many of our most fundamental and universal human needs. However, the way we choose to construct our homes can vary considerably through time and across different places. From a business perspective, a home can both be seen as a product that is purchased and used and as a service that is continuously consumed over time, due to the large scope of what a home encompasses. As other product and services, the home is developing and subject to innovation over time. According to Bayus (2008), successful innovation are shaped by three driving forces, and they are highly relevant for the innovation of homes. One force is desirability, to better fulfill needs and adapt to ever-changing societal conditions and lifestyle. Another force is salability, adapting to what is possible in the marketplace, taking things like industry structure and regulation into consideration. A third driving force is feasibility, which is shaped by the continuous development of better solutions and technology, for example better construction techniques, materials and housing arrangement. Bayus (2008) argues that successful innovation is shaped by all three forces, and need to be at the same time feasible, desirable and salable.

One leading trend of the development of technology in general during the last decades has been an increasing digitalization, fueled by Moore's law and leading to an unprecedented level of connectedness between devices and people and fundamentally changing the way we communicate and access information (Narayan & Narayan, 2006). This digital development has had an impact on the home as well. In the intersection of home innovation and the advance of information and communication technology lies what is often called "Smart Homes". There is not yet a unanimous definition of the concept, but a comprehensive definition provided by Aldrich (2003, pp. 17) defines Smart Home as *"a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security, entertainment, healthcare, education, and communication through the management of technology within the home and connections to the world beyond."* Smart Homes can be seen as an attempt to innovate the home as a product as it contains new features compared to conventional homes.

Looking at the general discussion and definitions of Smart homes, it can be said that the development primarily is driven by what is technologically feasible (Hargreaves & Wilson, 2013), similar to many other technical products (Bayus, 2008). It is important to note that less is known about the user perspective and what kind of Smart Homes that are actually desirable

by prospective customers (Haines et al., 2007) and how Smart Homes can be salable in the housing market, meeting actual market demands (Solaimani et al., 2013) and overcoming obstacles. This study aims to complement the understanding of Smart homes, currently focused on what is feasible, by also explore the aspects of desirability and salability. When looking at these factors, the study will apply a user perspective to investigate user needs for homes and houses in general, with a later discussion of what this means for Smart homes, rather than using the Smart homes as starting point. This is an important distinction. In this report, the question is if Smart homes are a desirable and salable solution for homes in general, rather than taking “Smart solutions” for granted and asking what specific desirability and salability that can be derived from Smart homes.

Understanding desirability for homes and housing is essentially to understand what needs that exist for homes and housing. There exists earlier research in this area, but it is primarily done in the area of preference-based surveys conducted by developers rather than understanding needs and their underlying meaning (Researcher at Chalmers, 2015). Exploring customer needs is both about identifying them, but also understanding what they mean, which has to do with the underlying meaning and what the customer want to achieve (Bayus, 2008). In order to explore this, it is important to use different methods, not only traditional market-research methods (Bayus, 2008).

In order to gain an understanding of residents’ current and nascent needs related to their housing, we have conducted a cross-sectional study with a mixed-method design. First, ten qualitative, contextual interviews were conducted in which the interviewees were interviewed in their home, to get a snapshot picture of what people say that they want, but also to understand the context of their life and how they live. The interviews led to a longer list of needs that were analyzed with the Kano-model (Bayus, 2008) and prioritized and validated in a quantitative survey with a larger group of 97 respondents. The highest-ranked needs were then analyzed using the FCE-model (Bayus, 2008) in order to identify their underlying meaning. Among the identified needs were timeless needs like a secluded sleeping space, mixed with novel needs related to technology like automatic temperature regulation. The underlying meanings of the needs were identified as partially traditional like having the home to achieve relaxation, good health, and social contact but also nascent like saving time and allowing flexibility to support an active lifestyle.

In order to understand the salability aspect, it was important to understand what obstacles that face the fulfillment of the identified needs. To understand this, five experts in the housing

industry were interviewed in order to find obstacles for innovation and development in the housing industry. The identified obstacles were then mapped with the most important needs from the needs study and analyzed with focus on which obstacles affected which needs and why, and what could be done to address the obstacles. Some of the most frequent obstacles for fulfilling the needs were found to be incentives and the current market situation as well as a gap of knowledge about users. This part of the study was qualitative and smaller in extent and depth compared with the needs study.

Finally, the results about the needs and obstacles are discussed in the perspective of the general understanding of Smart homes, relating to earlier research and definitions of Smart homes. The central conclusion was the home is important to fulfill many basic, traditional needs for people and that they are not always fulfilled to a full extent today. Many of the technological solutions paired with what is currently seen as Smart homes do not address these traditional needs, but could be a part of solving nascent needs. There is potential for this type of technological Smart homes to be successful, but it should take user perspective more into consideration, focus on addressing the issues that it can solve and identify people that are more prone to have these issues, rather than aspiring to be a grand solution to the development of the home as a general concept.

1.2 Purpose and Research Questions

To summarize, the purpose of this study was to explore housing needs and obstacles in their fulfillment, in order to complement the knowledge and research on homes and Smart homes.

The guiding research questions to fulfill this purpose were therefore:

1. What current and nascent housing needs do young Swedish people have?
2. What obstacles exist for supplying housing that meets these needs?
3. How do the results relate to our understanding and the potential of Smart homes?

Related sub questions for the first research question were which needs that are considered to be most important and how they can be interpreted, and for the second research question, which obstacles that affect most needs and what could be done about it. A sub question for the third research question is how the user perspective can be incorporated into the concept of Smart homes. Overall, the main focus of the report has been on the first research question.

1.3 Collaboration and Initiation of the Study

This study has been performed in collaboration with the Royal Swedish Academy of Engineering Sciences, IVA, as a part of their ongoing project ‘Attractiveness for Sustainable

Growth'. The project follows two earlier projects about national and regional innovation, and aims to propose measures to increase the competitiveness and attractiveness of Swedish industry. One part of the project has been to identify four key areas in which Sweden has a strong knowledge base and potential to become a leading international actor, and subsequently work to strengthen Sweden's position within each of these areas.

The focus of this study has been to complement IVA's project within one of these areas; Smart Urban Homes. Within this area, IVA is collaborating with actors in the housing industry, including governmental organizations, to develop criteria for land allotment aiming to stimulate the development of innovative building projects. The criteria are being established through interviews with municipalities, counties, firms in the industry, and housing residents. This study is contributing to IVA's project by providing suggested criteria from the housing residents' perspective, thus adding the user perspective to the project.

In order to limit the scope of the study and to fit in with the request from IVA, the focus of the study was young people between 20-30 years old, living in urban environments and in Sweden.

1.4 Disposition

This section provides an overview of the subsequent chapters of the report.

2. Housing Industry and Current Projects

This section gives an overview of the housing industry in Sweden, including different forms of tenure and current building projects that have been relevant for the study.

3. Literature Overview

This chapter will describe previous research in relation to two of the major topics of the study; Smart Homes and Understanding Customer Needs.

4. Analytical Framework

This chapter evaluates how the research in this study relates to the earlier research presented in the previous chapter, as well as what models will be used to analyze the empirical findings in order to address the research questions.

5. Research Methodology

This section describes the research strategy and design of the study, as well as a comprehensive description of the different stages of data collection and analysis. The section ends with reflections upon the validity, reliability, and generalizability of the method.

6. Finding and Analyzing User Needs

This chapter gives an extensive description of the findings and analysis in relation to the first research questions about user needs. It describes the focus group and its outcome, the needs found in the contextual interviews and the survey results, together with an in-depth analysis of the most important needs.

7. Finding and Analyzing Obstacles for Meeting User Needs

This section answers the second research question of what obstacles that exist for supplying housing that meets the identified needs, based on expert interviews and analysis.

8. Discussion

This section will reflect and discuss on the findings and analysis of the study, in relation to the research questions posed in the introduction.

9. Conclusions

This section presents the main conclusions that can be drawn from this study.

2 Housing Industry and Current Projects

This section gives an introduction to relevant industry-specific terminology used in the report and provides an understanding of the housing industry and its current state in the Swedish context.

2.1 The Housing Industry in Sweden

In this study, the housing industry is used as a term to define the industry and actors that are part of the process of developing and managing residential buildings. This includes construction companies, the real estate business, architectures, engineering consultancies, and parts of the manufacturing industry (Bröchner & Kadefors, 2009). Additionally, for the purpose of this study suppliers of consumer products that are often pre-installed in homes such as kitchens and bathrooms and some lighting installations are also included in the housing industry.

In building projects, the developer is the customer that takes the initiative to start a new project. The developer also defines the requirements, division of responsibilities, and the organization for the project. In the housing industry, there are many actors that can be considered customers. In addition to the developer, the residents or users of a building can also be considered customers. The residents are rarely controlling the building process themselves, even though there are cases where residents are developing housing for themselves. (Bröchner & Kadefors, 2009.) In this study, the terms residents and users are used interchangeably, and they are also the customers that are primary in focus.

Building projects are normally realized as temporary connection between different actors and companies within the industry, as building projects are tied to a geographic place. The developer is responsible for procurement of the different companies that are involved in the project. Building projects have special characteristics, such as the large size of the products, the long lifespan of buildings, buildings' considerable impact on the environment, and their central societal role in providing homes and other activities that define communities. (Bröchner & Kadefors, 2009.)

The housing industry in Sweden is characterized by certain specific conditions, primarily the extreme climate zone which requires considerable heating, and a low population density that puts relatively high requirements on transportation infrastructure. Sweden also has a long tradition of secondary residence, where holiday homes are common. (Bröchner & Kadefors, 2009).

The form of tenure is defined as the way in which a resident disposes of his or her housing (Boverket, 2014). In Sweden, the main forms of tenure are rented apartments, ownership homes, cooperative apartments and cooperative rental apartments. In this study, a simplified definition of different types of tenure was used that was considered to better suit the purpose of identifying needs related to housing. The forms of tenure that were included in the study are rental apartments (swe: hyresrätt), cooperative apartments (swe: bostadsrätt), ownership homes (swe: äganderätt), student apartments (swe: studentlägenhet), sublet apartments (swe: andrahands-hyrning), and lodging (swe: inneboende). Student apartments can be seen as a type of rental apartments, with the difference that they are only available for students and often purpose-built to fit the needs of students. Moreover, in this study, ownership homes only include villas, as ownership apartments still are a rare form of tenure in Sweden (Boverket, 2014).

2.2 Housing Needs Research in the Swedish Context

Regarding what is known about housing needs in the Swedish context, they seem to be rather consistent over time. The functionalistic architecture perspective expressed in 1931 gave the following list of requirements for the home, as described by Bröchner & Kadefors (2009).

- A healthy and sunny location
- Enough air and space for the residents
- Secluded sleeping space for everyone
- A common space where everyone can gather
- Preferably an outdoor space
- An undisturbed room for studies
- Comfortable and enough space for cooking
- Suitable resources to accommodate work
- Good hygiene devices to support care of the body

These preferences were found to be consistent with a more recent study from 2003, with the addition of a large and well-equipped kitchen (Bröchner & Kadefors, 2009; Werner, 2003).

Additionally, the current research about housing needs has been described as preference-based, focusing on surveys and topics like willingness-to-pay. This type of research is typically not explorative and can be insufficient in relation to finding deeper meaning of needs and changing needs (Researcher at Chalmers, 2015).

2.3 Current Smart Home Initiatives in Sweden

This section gives an overview of two current housing projects in Sweden that have been important sources of reference and industry orientation in this study.

2.3.1 HSB Living Lab

HSB Living Lab is a research arena where nine collaborating partners and three main collaborating partners aim to find solutions for the homes of the future. The main collaborating partners are Chalmers University of Technology, the cooperative housing association HSB, and Johanneberg Science Park. HSB Living Lab is a third generation Living Lab that will be a home for students and guests researchers from June 2016. It is constructed as a movable building with five stories, and research and testing of innovations is planned to be ongoing on the site for 10 years. One of the project goals is to create new knowledge within social, economic, and ecological sustainability as well as new smart technological solutions that can be used in future housing production. (HSB Living Lab, 2015.)

Some criticism that have been raised towards the project is that despite some innovative solutions such as a common laundry studio on the entrance floor, the building is still quite conventional from an architectural perspective, and that there is a technology push approach focusing on accelerating new building technologies, without much connection to market pull. (Researcher at Chalmers, 2015).

2.3.2 Riksbyggen Positive Footprint Housing®

Riksbyggen Positive Footprint Housing® is an interdisciplinary knowledge lab as well as a physical demo project resulting in a cooperative apartment building block in Gothenburg called Brf Viva. The apartments in Brf Viva will be sold from February 2016 and onwards. (Riksbyggen, 2016. Positive Footprint Housing® – för en mer hållbar framtid.) Riksbyggen is a cooperative business that develops and manages properties in Sweden (Riksbyggen, 2016. Om Riksbyggen). Riksbyggen is the developer and the coordinator in the project, but the project also includes researchers, students, businesses, citizens and the City of Gothenburg. The project aim is to improve the environmental, social, and economic sustainability while developing a commercially viable housing cooperative, and to transfer learnings from the project to the company and partners. (Riksbyggen, 2016. Positive Footprint Housing® – för en mer hållbar framtid.)

Some criticism towards Riksbyggen Positive Footprint Housing® has been raised by local special interest groups regarding the placement of the buildings on the land allotment. The

criticism concerns the green area that the buildings are located on and the connection to the existing developments. The groups bring up the noise perspective, where placing the buildings closer to the nearby developments would decrease the road noise, and the lacking connection to the existing developments and roads. Moreover, they expressed criticism towards the reduction of green areas in the local neighborhood as a result of the development. (Hösmad, 2013.)

3 Literature Overview

This chapter describes previous research in relation to two of the major topics of the study; Smart Homes and Understanding Customer Needs.

3.1 Smart Homes

This section introduces the concept of Smart homes, the industry that can be defined around smart homes as well as different perspectives on Smart homes in the academic literature.

3.1.1 Definitions of the Smart Home Concept

The concept of “Smart home” is central to this thesis, together with related concepts like “smart house” and “smart living”, which sometimes are used interchangeably. There are no widely accepted, uniform definitions of these concepts and the usage of terms vary in different contexts, such as in media, commercially and academically. Therefore, in this section we will present an overview of definitions used by different scholars.

The first official use of the term Smart home was in 1984, by the American Association of House Builders (Harper, 2003). The concept is tightly associated with home automation and interactive technologies (Ricquebourg et al., 2006; Cook, 2012; Harper, 2003), which can be linked back to the 1960’s when “wired homes” emerged in the hobby scene as a predecessor to the Smart home concept (Harper, 2003). Before the concept of Smart homes emerged in the consumer market in the 1980’s, a similar concept of building automation existed in the office building segment (Peine, 2008). However, an implication of taking the idea of building automation to the consumer market was that the value of automating home environments was less evident than for office environments. In the office building segment, the rationale for outsourcing and paying for facility management was more intuitive (Peine, 2008).

Another difference between home automation and Smart homes is that Smart home technology includes both the building itself and its contents, whereas building automation is constrained to the functions of the building. This is partly due to the technological progress within information and communication technology (ICT) that took place at the same time as building automation was introduced into the consumer field, allowing integration of products within the building as well. (Peine, 2008.)

A comprehensive definition of Smart homes is provided by Aldrich (2003, pp. 17):

“A Smart Home can be defined as a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote

their comfort, convenience, security, entertainment, healthcare, education, and communication through the management of technology within the home and connections to the world beyond.”

In Aldrich’s (2003) definition, the automated technology connects the Smart home with the outside world, which according to Solaimani et al. (2013) implies a broader meaning of the Smart home concept than merely automation of home appliances and systems. Therefore, Solaimani et al. (2013) proposes the term Smart Living to be used rather than Smart Home, as the focus is on living in a wider perspective than within the home environment alone.

The following table provides an overview of the different definitions of Smart homes provided by the different scholars presented in this and the following sections.

DEFINITIONS OF SMART HOMES

Author	Term used	Definition
Hargreaves & Wilson, 2013. pp. 1769	Smart home	“Key means by which households can optimize their use of energy-consuming appliances in order to save energy and money.”
Ricquebourg et al. (2007).pp. 1	Smart home	“A smart home can be described by a house which is equipped with smart objects, a home network make it possible to transport information between objects and a residential gateway to connect the smart home to the outside Internet world. Smart objects make it possible to interact with inhabitants or to observe them.”
Cook, 2012. pp. 1579	Smart home	“In the home, the idea is that computer software playing the role of an intelligent agent perceives the state of the physical environment and residents using sensors, reasons about this state using artificial intelligence techniques, and then takes actions to achieve specified goals, such as maximizing comfort of the residents, minimizing the consumption of resources, and maintaining the health and safety of the home and residents.”
Aldrich, 2003. pp. 17. (This definition is also used by Solaimani et al.,2013. pp.2)	Smart home	“A Smart Home can be defined as a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security, entertainment, healthcare, education, and communication through the management of technology within the home and connections to the world beyond.”
Balta-Ozkan et al., 2012. pp. 362.	Smart home	“A smart home is a home equipped with a communications network, linking sensors, domestic appliances, and other electronic and electric devices, that can be remotely monitored, accessed, or controlled, and which provide services that respond to the needs of its inhabitants.”
Demiris et al., 2008. pp. 120.	Smart home	“A residence equipped with technology that enhances the safety of patients at home and monitors their health conditions.”
GhaffarianHosseini, 2013, pp.2.	Smart house	“The concept of a smart house focuses on two constituents: it has to be fully integrated with ambient intelligence environments, and it

has to base on the interrelations between the users and environments.”

Peine 2008, pp. 509.	Smart home	“Smart Home refers to the use of Information & Communication Technology (ICT) in the home to facilitate the interoperability of household products and services in a built entity.”
Taylor et al., 2007. pp. 392.	Smart home	“Technology that is not offering intelligence, but is only offering people in homes further resources to act and think. It is this thinking, in the hearts and the minds of the occupants, that should make a home smart and not the technology embedded within.”
DTI Smart Homes Project (2003) (via Blumendorf, M. 2013, pp.154)	Smart Home	“A dwelling incorporating a communications network that connects the key electrical appliances and services, and allows them to be remotely controlled, monitored or accessed.”

Table 1

3.1.2 Characteristics of Smart Homes

The concept of Smart homes can refer to different types of housing, including standalone houses and apartments (Balta-Ozkan et al., 2013). Hargreaves & Wilson (2013; pp. 1769-1770) identify three core characteristics of the concept of Smart homes:

1. Monitoring through sensor networks to gather information about the state of the domestic context and its residents.
2. Control mechanisms using communication between devices to enable automation and remote access.
3. User interfaces via in-home displays, personal computers, tablets and smartphones to enable users to set preferences/goals as well as to provide information and feedback to residents about these preferences/goals.

According to Cook (2012) Smart homes can offer many benefits for the residents, including customized lighting and temperature, monitoring energy consumption, maintaining health and safety, and automated reminders of tasks. Moreover, Ricquebourg et al. (2007) states that the Smart home concept has evolved so that almost all electrical components or devices in the home can be included in the system. This includes domestic appliances such as washing machines and refrigerators, electronic devices such as phones, televisions, and laptops, as well as electric devices such as toasters and light bulbs (Balta-Ozkan et al., 2013). The devices are in turn connected through a network commonly referred to as a “home area network” which enables remote control of all components in the Smart home (Balta-Ozkan et al., 2012, pp. 362).

3.1.3 The Smart Home Industry

The operationalization of Smart homes cuts across different industries that can broadly be defined as home automation, household products and services, and ICT's (Peine, 2008). Peine (2008) describes the Smart home industry as a multi-industry setting, which is organized around a number of well-evolved industries as well as along the supply chain of Smart homes. An implication of this setting is that the development of the Smart home industry requires coordination of the different industries and their heterogeneity for innovation and knowledge creation.

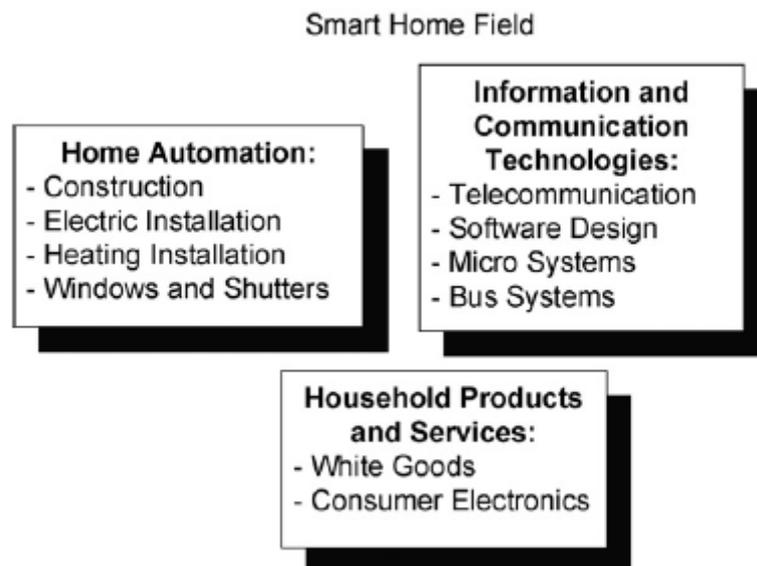


Figure 1 Overview of the Smart home industry (Peine, 2008)

3.1.4 Perspectives on Smart Homes in the Academic Literature

According to Solaimani et al. (2013), the academic literature on Smart homes is dominated by a technological perspective. Although financial, organizational, and service domains also exist, these streams of literature are also influenced by the technological perspective. Hargreaves & Wilson (2013) also identifies a significant overweight towards engineering and technology on the topic of Smart homes by using a discipline-based division of the literature into engineering and technical sciences, medical and health sciences, and social sciences. Therefore, technology is considered to be the most researched aspect of Smart homes, and the area of Smart homes is characterized by a technology push (Hargreaves & Wilson, 2013).

The concept of Smart homes is also used within the medical and health science literature (Hargreaves & Wilson, 2013), for example Demiris et al. (2008, pp. 120) who defines Smart

homes as “*a residence equipped with technology that enhances the safety of patients at home and monitors their health conditions*”. Within this stream of literature, the aging population and concurrent goal to control healthcare costs are two main factors driving the development and diffusion of Smart home technologies (Demiris et al., 2008).

Solaimani et al. (2013) argue that it is necessary to focus on a wider range of aspects of Smart homes besides the technological perspective, for the concept to move from exploration to exploitation. They suggest several topics for further research within the organizational, business, and service perspectives and among other things highlight an evaluation of the actual market demand for Smart homes as an area of investigation. Haines et al. (2007) state that visions for technological solutions often lack connection to an understanding of the user needs. They argue that technology designed for the home context in many cases disregard the users and the social context of the use. Moreover, Hargreaves & Wilson (2013) state that improving the understanding of the users of Smart home technologies is a critical success factor for the uptake of these technologies.

Within social sciences, the smartness is not seen to be inherent within the technology as such, but instead arises as a product of the meeting between the technologies and the inhabitants’ daily life (Taylor et al., 2007). In general, the social science literature on Smart homes emphasizes the importance of seeing the user as an active agent instead of being passive in relation to the Smart home technologies (Hargreaves & Wilson, 2013).

3.1.5 Sustainability of Smart Homes

GhaffarianHoseini et al. (2013) states that one of the main goals with Smart homes is to use intelligent building design to create sustainable buildings and enhance the quality of life of the users of the buildings. One of the main means for achieving sustainability of Smart homes, according to the article, is reducing the energy consumption of buildings. However, the authors argue that local characteristics such as environmental and socio-cultural values are often overlooked in relation to Smart homes.

Blumendorf (2013) addresses some of the challenges related to the sustainability of Smart homes. He acknowledges that technology can play a role in sustainability transitions, but that Smart home technologies face important sustainability challenges related to increased energy consumption, electronic waste, short product lifespans, toxic contents, and social aspects such as user frustration and a lacking focus on human needs.

3.2 Understanding User Needs

The following section discusses previous literature regarding understanding user needs. This will provide the background for developing the analytical framework that will be presented in (4. Analytical Framework) and used to analyze the empirical findings in relation to the first research question of understanding current and nascent housing needs.

3.2.1 Definition of Needs

Bayus (2008) describe customer needs as descriptions of benefits that customer's desire, basically what the customer wants. He draws partially on Griffin & Hauser (1993) who have a perspective of product development and the method of Quality Function Deployment (QFD), and describe customer needs as *"a description, in the customer's own words of the benefit to be fulfilled by the product or service"* (Griffin & Hauser, 1993, pp. 4). Furthermore, Bayus (2008) say that needs are long-term and that the customer not always can recognize the needs and describe them verbally.

3.2.2 The Importance of Understanding Customer Needs

The literature often associates understanding customer needs with innovation and product development. Cooper (1999) writes that understanding the voice and needs of the customer is crucial to create successful products, although it is often lacking in many company's development efforts. Henard and Szymanski (2001) also write that meeting customer needs is one of the main predictors for performance in the launch of new product in a more quantitatively oriented study. Bayus (2008) write about successful innovation and puts customer needs in perspective by describing that new products need to be at the same time feasible, salable and desirable. Feasible products are products that can be created, for example from a technical perspective and salable describe whether or not products can be sold on the market, taking things like industry structure and channels into consideration. Desirability, on the other hand, describes if the product is desired and meet any needs from customers. Furthermore, Bayus (2008) describe that it often is easy for companies to come up with products that are feasible and salable, but they often miss out on understanding what customers need and desire, leading to failure in the market.

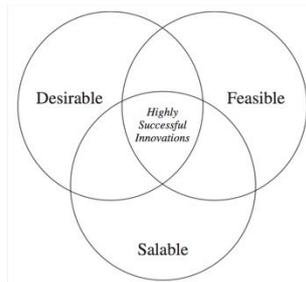


Figure 2 Desirable, feasible, and salable (Bauys, 2008).

Set in a larger perspective of the whole product development process, identifying and understanding customer needs is often depicted in the beginning of the process, feeding into later stages of establishing target requirement and specifications (Bayus, 2008). Bayus (2008) write that traditional marketing research methods often not directly address understanding customer needs, but rather focuses on later stages in the product development process, such as measuring attributes and characteristics of products, which tends to result in products that are in similar trajectories as current ones.

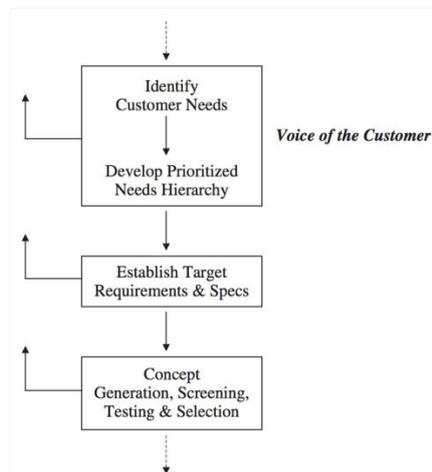


Figure 3 The fuzzy front-end of new product development (Bauys, 2008, p.122).

3.2.3 Finding Customer Needs

Finding customer needs can be challenging and requires suitable methods. Bayus (2008) argue that two types of needs can be distinguished; articulated needs that customers can easily express, and unarticulated needs that customers have difficult to verbalize. Articulated needs can be found using traditional market research methods like focus groups and surveys, whereas unarticulated needs require other methods than traditional, including ethnography, observation and contextual interviews. As traditional marketing methods typically are easier to use, it is

tempting to only look at articulated needs, but doing so will lead to missing out many important unarticulated needs (Bayus, 2008).

Szwejcowski et al. (2011) proposes that customers have hidden needs and describe how well different market research methods can uncover them. They describe hidden needs as needs that customers have difficult to articulate and that are difficult to find, similarly to the unarticulated needs from Bayus (2008). They argue that common market research methods like focus groups and surveys often identify needs that are implicit in the questions asked and are poorly suited for finding hidden needs. Goffin et al. (2012) write that one problem with focus group sessions in external locations is that the respondent could behave differently than how they otherwise would and that the researcher can miss cues from the environment of where a product or service is consumed. This is line with Bayus (2008), who notes that customer needs are context dependent, with regards to where and how products are used. A more context-based research method is ethnographic market research, that is based on a combination of observation and contextual interviews, where the researchers conduct semi-structured interviews in the environment where the respondents use a product or service (Goffin et al., 2012), which can yield more open and honest answers from the respondent compared to for example focus groups. The ethnographic method has its roots in social science and Szwejcowski et al. (2011) show that this method can provide deeper, original insights, although it is time-consuming and difficult to analyze. In order to counter the resource-intensiveness, Goffin et al. (2012) recommend that they are performed on a limited number of customers to gain insights on hidden needs and that the needs then are confirmed with a larger sample using traditional research techniques. Rosenthal and Capper (2006) also discuss ethnographies and have the perspective of product innovation, especially the front end. According to the authors, ethnographic research is a good way to gain user-centered perspectives in the early phase of the product innovation cycle. They also describe how the product development field have evolved from only viewing the technical specifications of products, to also regarding usability and finally looking at the social context in which products are used, noting that a broader perspective reveal more product opportunities. Ethnographic methods are well suited for this, as they provide a broader description of the environments of the user.

Bayus (2008) further writes about the importance of interpreting customer needs from the data that customers provide, which is especially important when interpreting unarticulated needs. It is also important to translate the data into a hierarchy of needs, in which methods like KJ analysis and affinity diagrams can be used (Bayus, 2008).

3.2.4 Analyzing and Understanding Customer Needs

When identifying and researching customer needs, one aspect that is important to note is that there are different ways to analyze and categorize needs. In addition to articulated and unarticulated/hidden needs as described earlier, this section will present two other ways of analyzing needs.

The Kano Model

The Kano model of customer satisfaction shows another way of classifying needs, based on how much they delight the customer (Bayus, 2008). The Kano model defines three different types of needs, as described in the following table, adopted from Bayus (2008) and Sauerwein et al. (1996).

CLASSIFYING NEEDS ACCORDING TO THE KANO MODEL

Need type	Description
Basic needs (Must-be requirements, order qualifiers, hygiene factors)	Needs that must be met in a product. Basic needs are often taken for granted and not mentioned by the customer, but customer will be greatly dissatisfied if they are absent. However, fulfillment above a certain level does not lead to higher customer satisfaction.
Performance needs (one-dimensional requirements, main needs)	For these needs, customer satisfaction is proportional to the level of fulfillment. If they are not met, the customer will be dissatisfied, but in contrast to basic needs, higher performance will give higher satisfaction. These needs are often measurable and explicitly mentioned by customers.
Exciting needs (Attractive requirements, order winners)	These needs are not expected by the customer and are usually not explicitly expressed by the customer. They would not be missed if they are absent, but will lead to additional customer satisfaction if available and can be order winners.

Table 2

According to Sauerwein et al. (1996), the Kano model is useful to understand customer requirements in relation to product development as it explains how different requirements satisfies the customer, helps prioritize different requirements and gives guidelines for differentiation. Another important aspect of the Kano model is that it assumes customer needs change over time and that what are Exciting needs today could be Performance needs and eventually Basic needs in the future (Bayus, 2008). Air conditioning for cars was an exciting need when it was introduced but is a basic need today, for instance. This has important consequences for innovation, *“customer expectations increase over time and, consequently, firms must continually strive to better understand evolving customer needs in order to stay competitive.”* (Bayus, 2008, pp. 126).

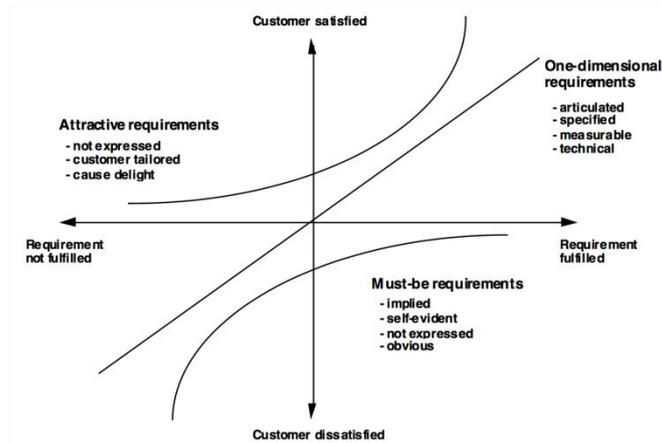


Figure 4 The Kano model (Sauerwein et al., 2008)

The FCE-model

Bayus (2008) also describe another model of understanding customer needs, as based on Shillito (2001). The model describe three different levels of customer needs based on different levels of abstraction; Features, Consequences and desired End-states, in this article called the FCE-model. The following table describe the three types and their characteristics. One important aspect of the FCE-model is that addressing the different levels typically result in different types of innovation (Bayus, 2008). Focusing on the more concrete feature-level typically leads to incremental change, whereas targeting the innovation on the deeper levels can create more interesting innovation.

THE FCE-MODEL

Type	Description	Characteristics	Innovation
Feature	What the customer describe that they want	Concrete, short-term	Incremental change
Consequence	Consequence or what you want to happen when using a product	Emotional	Creative and novel changes in existing products
Desired end-state	Underlying purpose and goal	Abstract, long-term	Creative and radical changes, new product-market structure

Table 3

The following table gives an example of breaking down the needs for an umbrella using the FCE-model.

EXAMPLE OF THE FCE-MODEL APPLIED TO AN UMBRELLA

Features	Consequences	Desired end-states
Large canopy/circumference	Protection from rain and wind	Move outside regardless of weather
Sturdy construction	Easy to pack	
Comfortable grip		
Easily foldable		

Table 4

4 Analytical Framework

This chapter evaluates how the research in this study relates to the earlier research presented in the previous chapter, as well as what models will be used to analyze the empirical findings in order to address the research questions. A comprehensive overview of how the Analytical Framework has been used in combination with the Research Methodology is presented in the next chapter, 5. Research Methodology.

4.1 A User Perspective Approach on Smart Homes

Based on the literature review, it could be concluded that the technological perspective of Smart homes is dominating the research within this area, and that there is a need to focus on a wider range of perspectives for the concept of Smart homes to move from exploration to exploitation. Haines et al. (2007) and Hargreaves & Wilson (2013) highlight user needs and the context of use as critical success factors for the adoption of Smart home technologies. Therefore, this study aims to complement the previous research on Smart homes with a focus on the user perspective, and in particular to improve the understanding of user needs related to Smart homes.

In order to provide a comprehensive picture of the user needs, this study takes a broad perspective of the concept of Smart homes. Connected to the third research question, to update the understanding of Smart homes, the concept of Smart homes is not defined in the beginning of the study, but instead discussed in chapter 8. Discussion, based on the research findings. This is motivated by the possibility that the current definitions of Smart homes are affected by the dominating technological research perspective on the topic, and using these definitions can mean that aspects that are important from a user perspective gets left out. In conclusion, to improve the understanding and consideration of user needs related to Smart homes, the definition of Smart homes must also be shaped by the user perspective.

In this study, the investigation of user needs related to Smart homes is not constrained to the current definition of Smart homes. Instead, the study attempts to identify the current and nascent user needs related to housing in general and the connection and interface between the home and its context. This approach intends to complement the current definitions of Smart homes with the user perspective (see Figure 4), as well as identify promising areas for creating solutions for Smart homes based on actual needs. Hopefully, a concurrent focus on users and technology in the Smart home discourse can increase the possibilities of creating feasible, desirable, and salable solutions that stimulates the spread and adoption of Smart homes.

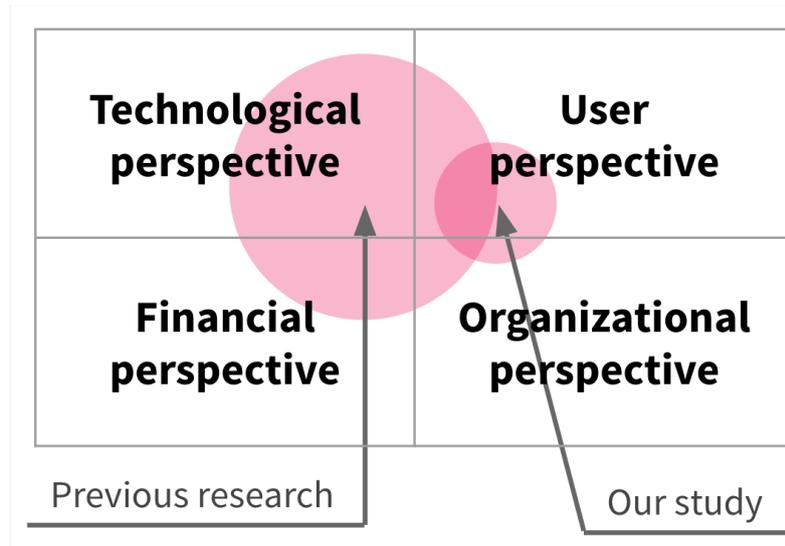


Figure 5 Perspectives on Smart homes in current research and this study.

4.2 Exploring and Analyzing User Needs

As the perspective on Smart homes is broadened to include understanding user needs, the study will rely on previous research and models in relation to user and customer needs. The theory will be applied in the specific context of the home as a product, so with the definition of what needs are by Bayus (2008), a major area for the research will be what different people want with their homes. Bayus (2008) explain that understanding user needs is important for successful innovation and that articulated and unarticulated needs are found using different methods. In this study, there will be a mix of methods, using a focus group, contextual interviews and a survey to identify and prioritize both types of needs.

Both models presented in 3.2.4 Analyzing and Understanding Customer Needs will be used to categorize, analyze and interpret the empirical data, using the home as the “product” to investigate. The Kano model will be used in order to understand how the different needs related to the home relate to user satisfaction and in order to make needs comparable. The need to categorize comes as a consequence from that interviewing leads to a lot of data and interviewees often do not prioritize what they say that they want directly. That the Kano model makes needs more comparable could be illustrated with an example; if someone would need to choose between having a basic need in their home such as proper temperature and an exciting need such as a balcony, they would always choose the basic need as it would lead to dissatisfaction if absent, which likely would lead to exciting needs being ignored. However, exciting needs are still important as they can be seen as nascent needs, becoming performance needs or basic needs in the future, so it is important to only compare them with other exciting needs. Furthermore,

the FCE-model of features, consequences and desired end-states will also be used in order to understand the underlying meaning of the customer needs. As the model suggests, the customer might explicitly say they want a feature like a big kitchen, but not why they want it, what they want to happen and what they want to achieve. These factors will be found using the interview method with probing questions, but also through interpretation by the researchers, in order to find the consequences and end-states of the needs. A reason for why this is important is that, according to Bayus (2008), only addressing features primarily lead to incremental change in innovation, whereas addressing on consequences or end-states could lead to more creative and radical ideas.

5 Research Methodology

This section gives a description of the research strategy and design of the study, as well as a comprehensive and detailed description of the different stages of data collection and analysis. The section ends with reflections upon the validity, reliability, and generalizability of the method.

5.1 Research Strategy

Research strategies are often divided into qualitative and quantitative research, or a mix of both (Bryman & Bell, 2011). Additionally, the relation between theory and research can be described as inductive, deductive (Bryman & Bell, 2011) or abductive (Timmermans & Tavory, 2012). As the three research questions of this study differ in their nature and contain several different aspects, a mixed method of both qualitative and quantitative research (Feilzer, 2010), as well as a mix of inductive, deductive and abductive reasoning was used, as described in the following table.

OVERVIEW OF RESEARCH STRATEGY

	Inductive	Abductive	Deductive
Qualitative	RQ1: Finding needs RQ2: Finding obstacles	RQ1: Explaining needs RQ2: Mapping of needs and obstacles	RQ3: Understanding of Smart homes
Quantitative	RQ1: Survey		

Table 5

Qualitative research usually emphasizes words over quantification and is often used to generate theory (Bryman & Bell, 2011). Qualitative research is usually considered suitable in nascent, explorative research areas (Edmondson & McManus, 2007). Quantitative research puts an emphasis on quantification in the collection and analysis of data and is often used to test theories (Bryman & Bell, 2011). A mixed method combines both qualitative and quantitative research methods and enables combining exploratory and confirmatory research within the same study (Easterby-Smith et al., 2012). In this study, a mixed method strategy was used by combining qualitative interviews and a focus group with a quantitative survey. The qualitative methods supported the aim of the study to explore user needs and obstacles for meeting the needs, and the quantitative survey consequently identify which of the user needs that can be generalized to the larger population. According to Easterby-Smith et al. (2012), the two main aspects to consider when conducting a mixed method study are the relationship between the two methods

regarding sequencing and dominance. This study is dominated by the qualitative method, which was considered suitable for the initial exploratory part of the study, followed by the quantitative method which was used to assess which of the identified user needs that applied to a larger population. The main focus on the qualitative method also supports the aim of creating a deeper understanding of user needs in housing.

The process of deduction is a process in which existing theory is used to generate a hypothesis which is tested on data, possibly leading to a revision of the theory (Bryman & Bell, 2011). The process of induction on the other hand, start with a data observation that is used to infer conclusions and make new theory (Bryman & Bell, 2011). The process of abduction starts with consequences and identifies explanatory hypotheses to explain the consequences (Timmermans & Tavory, 2012). Abduction can also be called Inference to the Best Explanation (Douven, 2011) and requires the researcher to alter between induction and deduction to make a logical connection between data and theory (Feilzer, 2010). The first research question of finding needs was partially inductive and partially abductive. The aspect of identifying the needs was inductive, as observations were made through interviews in order to make a conclusion of the general situation. The aspect of explaining the needs was abductive, as it involved finding explanations and reasons why the interviewees experienced their needs, using a theoretical model, the FCE model. Similarly, the second research question of obstacles for supplying the needs was also a mix of inductive and abductive reasoning. Again, identifying the obstacles were primarily inductive, as primary data was gathered through interviews in order to gain an understanding. The abductive element was when the obstacles were used to explain why the needs from the first research question were not fulfilled. The third research question of understanding Smart homes was primarily answered through deduction. A literature review was done in order to understand how Smart homes are seen and defined today, and the data and conclusions from the other research questions were used to make a revision of this understanding of Smart homes, although no explicit hypothesis was formed.

5.2 Research Design

The research design is a way to organize the research activities in order to achieve the aim of the research (Easterby-Smith, 2012). The following figure gives an overview of the research design for this thesis, including both the research activities, analytical framework, and the research questions.

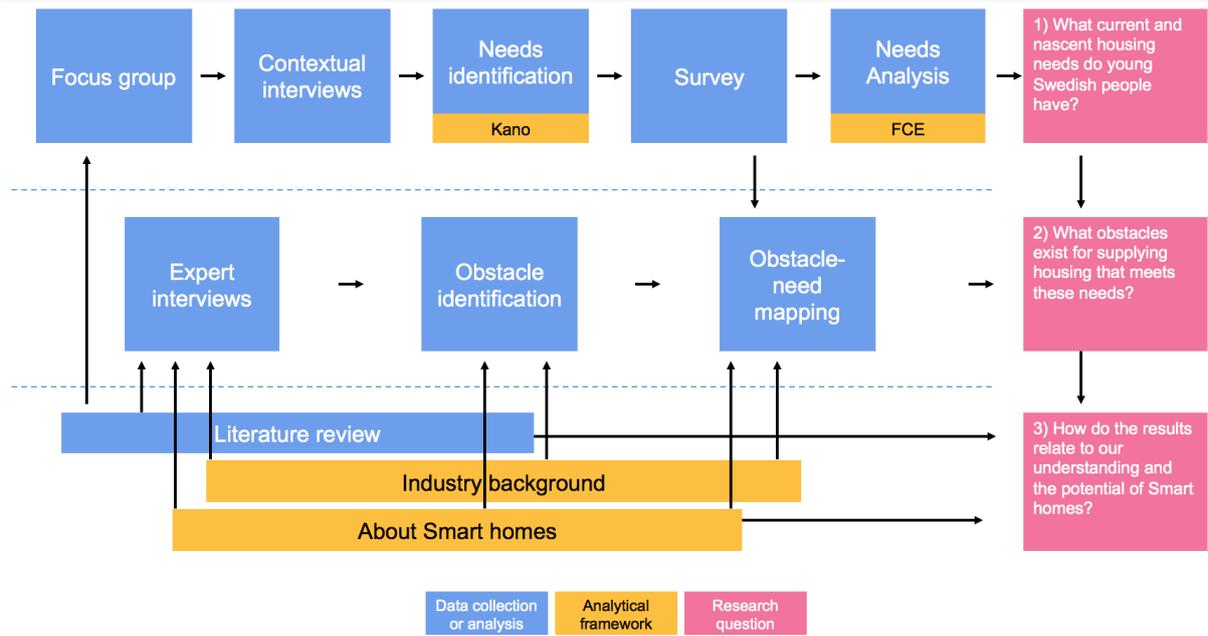


Figure 6 Overview of research design

Currently, the research within Smart homes is dominated by the technological perspective, and the user perspective is missing in many cases or is not covered to the same extent as the technological perspective (see 4.1.4 Perspectives on Smart Homes in the Academic Literature). Therefore, the main research question in this study is to identify the users’ current and nascent housing needs.

The unit of analysis for the main research question are young people living in urban areas in Sweden, as local conditions can be considered to have an impact on the user needs related to housing, and as it correlates to the overall aim of IVA’s project which is also focused on the Swedish context. The decision to focus on the needs of people in urban areas in Sweden was decided in dialogue with IVA. Young people was considered the most interesting target group as they represent a younger generation and therefore might have new, or different needs compared to older age groups.

Conducting interviews with a sample that is similar to the target group was considered the best way to investigate this research question, as it would support the exploratory approach to finding user needs and provide a deeper understanding of the needs. This was enabled by the interview method as it allows for open-ended questions, follow-up questions, and inclusion of contextual factors into the data collection. The interviewees that were approached were part of the target group, which was important as user needs were seen as subjective and local in nature. Moreover, the process of getting access to interviewees within this group was straightforward, as a networking approach based on the researchers' social networks could be used. A number of interviews were conducted in order to achieve a broad picture of user needs, because of the subjectivity of user needs, the needs were not compared to each other but the result of each interview added to the total understanding of user needs. In order to increase the generalizability of the user needs, the needs that were identified through the interviews were verified using a survey with a larger sample of people in the same target group.

The second research question was to identify the obstacles for supplying housing that meets the needs that were identified in the first research question. In this case, conducting interviews was also considered the most suitable method in order to get a deep understanding of the housing industry and the obstacles that it faces. Moreover, to be able to relate the obstacles to the user needs, which were considered to be local and context dependent in their nature, the Swedish context was also the scope of inquiry for identifying the obstacles. The obstacles were also seen as local to the Swedish industry context, why interviewees acting in the Swedish housing industry were approached. In addition to identifying obstacles, these interviews were also used as a way of gaining knowledge about the industry. In order to include both the academic and practitioner perspective, interviews were carried out with representatives of both these groups.

The third research question was to relate the needs and obstacles identified in the previous research questions to the concept of Smart homes. This research question was investigated through a literature review of previous research on the topic. It was considered suitable to research previous literature on the topic in order to get an international perspective on the concept. The concept of Smart Homes was seen as a construct that has been developed by the industry, and by relating to previous research but not limiting the scope of inquiry to the previous definitions of Smart homes, the results of the study could be used to add to the current definitions.

The interview data was analyzed using qualitative methods, which supported the aim to understand the meaning of the data rather than the frequency of certain issues. The survey was

analyzed based on frequency of the selected needs, and differences between respondents' characteristics. Subsequently, the findings from the interviews and the surveys were combined to answer the first and second research questions. The third research question was answered by reflecting on the findings in comparison to the results of the literature review.

The study was cross-sectional in order to capture the current user needs at the time of investigation, which is in line with the approach of the overall project by IVA, aiming to spark change and progress within the area of smart urban housing based on the current situation. Moreover, to understand the user needs and the obstacles for meeting the needs it was considered appropriate to look at more than one case, as the needs vary between different users and there are several actors to take into account when investigating obstacles.

5.3 Data Collection and Analysis

The following section describes the various stages of data collection and analysis that has been taken throughout the study. The table below gives an overview of the various steps that have been taken to collect and analyze data during the whole research process.

OVERVIEW OF DATA COLLECTION AND ANALYSIS ACTIVITES

Moment	Type	Content	Outcome	Time
Focus group	Data collection, analysis	Focus group with 4 participants	Initial data on housing preferences Topics for contextual interview templates	2015-09
Literature review	Data collection, analysis	General literature review of the housing industry, smart homes and analyzing user needs	Input for interview templates General industry information	2015-09-2015-10
Expert interviews	Data collection	Interview with 5 experts in the housing industry	Interview data	2015-09 - 2015-10
Contextual interviews	Data collection	Interview with 10 young residents in their homes in Gothenburg, Stockholm and Malmö	Interview data	2015-10 - 2015-11
Needs identification	Analysis	KJ-analysis of interview data from Contextual interviews, categorized after area and Kano analysis	List of 39 needs in three categories	2015-11
Survey	Data collection, analysis	Online-based survey , 97 participants	Ranking of 30 needs based on survey	2015-12-

Needs analysis	Analysis	In-depth analysis of the 6 highest ranked Exciting and Main needs respectively, based on FCE model	Analysis of underlying factors of the 6+6 needs	2016-01
Obstacle identification	Analysis	Analysis of the Expert interviews to identify obstacles for fulfillment of needs	Obstacles for fulfilling housing needs	2016-01
Obstacles-need mapping	Analysis	Mapping of the obstacles and the selected 6+6 needs	Matrix of the obstacle-need mapping, analysis of the relations	2016-01

Table 6

5.3.1 Introductory Focus Group

An introductory focus group was held during 1.5 hours on the 21st of September, with four participants and the two researchers as focus group facilitators. A focus group is a group interview that explores a certain topic (Bryman & Bell, 2011). The focus group had two main purposes, first to investigate what preferences the participants have when it comes to their homes and second to find themes and topics to investigate further in the subsequent ethnographies. Through different exercises, the participants' attitude towards performing activities in their home or outside and sharing functions with other people was explored, both through discussion and through design. The possibility of having group discussions and a cooperation exercise were the main reason for choosing the focus group method, as it different perspectives as well as a joint construction of meaning on housing and sharing (Bryman & Bell, 2011).

The four focus group participants were selected based on their previous experiences, as is typical for focus groups (Bryman & Bell, 2011). The experiences were in housing, and all participants had lived both in Sweden and abroad as well as alone and in shared apartments. There was also an equal mix in gender, and the participants had been living in an urban environment for some time. All participants were students, who are part of the target group of young people in the larger study, but also made it possible to conduct the focus group during office hours. The participants were all familiar to one or both of the focus group facilitators, but only two of the participants were familiar to each other on beforehand.

The focus group was divided into four parts; introduction of the project and participants, an individual exercise followed by group discussion, a group exercise, and lastly a final group discussion and reflection. The first exercise of the focus group explored how and where the participants would prefer to do everyday activities such as cooking, studying, taking care of hygiene and sleeping. The participants individually placed the activities in a matrix on a print-

out, where they could select if they preferred doing the activity in their home or away on one axis, and by themselves or with other people on the second axis, see Appendix A -Activity Matrix for an example. This was followed by a group discussion to try to find patterns and reasons for why the activities were placed where they were. The second exercise built on the first one, but with a focus on cooperation and design. The participants had a hypothetical scenario where they were to move in together in a shared apartment which they would design by themselves. The group was first given time to discuss how they would want to organize and design various activities, the participants were then each given an activity that they would design on a piece of paper and present to the others for feedback, and lastly they would put it all together to a design of an apartment. See Appendix A for a drawing of the final result. The concluding discussion and reflection allowed the participants to discuss the outcome of the exercises and general topic around housing and was moderated by the facilitators.

The results from the focus group were documented by transcript notes and pictures, and all sketches and other material used by the participants were saved and documented. As noted, the purpose of the focus group was both to obtain result and to guide later research. Consequently, some of the findings from the focus group are evident in the needs analysis (6.3 Needs Analysis), but the primary use was that it guided the creation of the interview template for the contextual interviews.

5.3.2 Literature Review

The purpose of the literature review was to investigate earlier research in the fields of Smart homes, the housing industry in general and user studies. This information was needed to get an understanding of the areas, all of which were rather unfamiliar to the researchers beforehand, to identify the focus and scope of the study, to understand what research that previously had been done and to design the rest of the study and the interview templates for later interviews.

The literature review was primarily done by probing research databases like Google Scholar for keywords like “Smart homes”, “Smart housing”, “user needs” and similar, identifying relevant articles and investigating what literature they referred to. The outcome of the literature review were the chapters “3 Literature Overview” and “4 Analytical Framework”, but also had an influence on all the other chapters, including the research questions.

5.3.3 Expert Interviews and Obstacle Identification

In-depth interviews with academics and practitioners in the housing industry were conducted in the initial phase of the study. The purpose of the interviews was to gain an understanding of the housing industry and its challenges, as well as previous academic research about user needs

in the area of the housing industry. Moreover, the interviews provided an overview of current state of the art projects within the areas of smart and sustainable homes. The interview participants were selected to include people with a broad knowledge of the housing industry as well as people with specific knowledge about different challenges, aspects, or projects within the area. One of the interviewees had previously been involved in IVA's project and could therefore provide perspectives based on the overall project aim.

In total, five expert interviews were conducted, see Appendix B for a description of the experts. Each interview lasted between half an hour and two hours, and both researchers were participating in each of the interviews. Two of the interviewees were academics, and three practitioners within the industry. The interviews were semi-structured using a topic guide, which is a list of topics to be covered throughout the interview. This method allows for deviation from the order of the topics to explore interesting answers further, while ensuring that all the issues get covered (Easterby-Smith, 2012). The in-depth interview method provides a possibility for the researchers to understand the views of the interviewee as well as the underlying reasons and meaning behind these viewpoints (Easterby-Smith, 2012).

The obstacle identification was subsequently done in three steps. First, a detailed summary of each interview was created based on the researchers' notes as well as voice recordings of the conducted interviews. The interview results were used, together with the focus group results, as a basis for the contextual interviews as well as a basis for identifying obstacles for meeting the prioritized needs. Secondly, based on the summaries, an extensive list of the identified possible obstacles was created (Appendix B). Although based on the expert interviews gathered early in the study, this part was done later in the study after the needs analysis was conducted. It was done in this order because the way in which the obstacles would be identified was not clear until after the needs analysis, which happened in the later stages of the study. Finally, the extensive list of the obstacles was subsequently shortened by grouping and combining similar or equal obstacles. A total list of 18 identified obstacles was created, which was then used for the mapping of needs and obstacles. The obstacles that were not found to hinder any of the prioritized needs were also removed, and a final list of nine obstacles were created (see 7.1 Identified Obstacles).

5.3.4 Contextual Interviews

With the purpose of investigating both articulated and unarticulated needs and understanding the deeper meaning of the user needs, contextual interviews were conducted with people in the target group (see 1.3 Collaboration and Introduction of the Study). As previously described in

3.2.3 Finding Customer Needs, contextual interviews are suitable for identifying unarticulated needs. In-depth interviews make it possible to find information about both what the interviewees say and what they do, for example which room they prefer to hold the interview in and how they behave in their home. Therefore, this method makes it possible to find both the needs that the users can verbalize and the needs that the users have difficulties verbalizing.

The context of the interviews was set to the participant's home. This way the interviewees could be in an environment where they feel comfortable and behave as they normally do in their homes, and since the home is the focus of inquiry, contextual cues from the home environment can be found. Being in the home can make it easier for participants to express themselves, by for example adding a physical demonstration of an issue or topic to their verbal description, and it can work as a reminder of certain needs. In addition to this, the general life context of the interviewees was also probed with question on their lifestyle.

Observational methods were not used to full extent, although elements of observation were part of the contextual interviews. For example, the researchers were able to observe how the garbage rooms were designed, the surroundings of the buildings, how the interviewee behaves in the home etc. The main reasons for not utilizing observational methods to a greater extent were that it can be very time-consuming, and because the home is a private area it could be difficult to get access to and to conduct observations in the home for integrity reasons. Lastly, the home is a broad scope of investigation, and therefore it would be difficult and very time-consuming to observe all aspects of the home environment.

Ten contextual interviews were conducted over a period of one and a half months. In line with Goffin et al. (2012), the number of in-depth interviews were limited in order to make best use of the available time and resources. The number of interviews was also a requirement from IVA. The interviews were designed with an exploratory aim of gaining insights on the users' articulated and unarticulated needs, for later verification through a survey with a larger number of participants. The interviews were semi-structured using a topic guide (see Appendix C), and relied heavily on probe questions to identify the underlying meaning behind the answers. Each interview lasted between one and two hours. Both researchers participated in each interview, and the interviews were documented by notes, voice recording and photographs.

The interviewees were selected using a theoretical sampling strategy to obtain a group of users where different parameters were represented, in regards to city of residence, gender, occupation, housing situation et cetera. Two interviewees were also specified by IVA based on their knowledge about smart and unconventional housing. For a more detailed overview of the

interviewee characteristics see 6.2.1 Interviewee Presentation. The interviewees were targeted using a network approach, based on the researchers' personal and professional networks. This method was considered suitable as it requires trust and a personal connection to let someone into one's home for an in-depth interview. It was also a convenient approach based on the fact that the researchers themselves fit into the target group, and therefore had plenty of connections with people in the same demographic group.

The results from each interview was summarized based on the notes and voice recordings. The interview data was later used in the Needs identification as well as later in the Needs analysis.

5.3.5 Identifying User Needs

The identification of user needs was the step in which the raw interview data from the contextual interviews were analyzed in order to identify needs that could be prioritized in the survey. The process of analysis of the contextual interviews was designed with shifts between collection and analysis. When half of the interviews had been conducted, a preliminary analysis was conducted to identify potential gaps in the collected data as well as to identify hypotheses for further investigation in the remaining interviews. This approach was useful in order to find topics that needed additional focus in the remaining interviews in order to get a comprehensive picture of the user needs. The analysis of the data from the contextual interviews was done using the KJ method, which resulted in nine different categories of needs (see Appendix C).

The KJ method was developed as a result of difficulties to interpret ethnographic data, and is a teamwork-based analysis tool for qualitative data (Scupin, 1997). This method includes several steps. First, information from the interviews are written on individual notes, with one concept or thought on each note. These notes are then shuffled and subsequently grouped into emerging groups. In this step of the KJ method, using a non-linear and non-logical method is emphasized, and the grouping process is repeat and gradual until all the notes are placed in up to ten different groups. (Scupin, 1997.) The KJ method was useful as an open approach to analyze the data, where themes and insights were identified based on the data itself to allow for more intuition and without predefined themes and ideas (Easterby-Smith et. al, 2012).

After the categories of needs had been identified using the KJ method, the categories were expanded into elaborate analysis of each category of needs using the interview data. As an example, various interviewees' experiences related to one need, for example the relationship to neighbors, was summarized in one section, highlighting both similar as well as contrasting opinions and including explanations and illustrative examples. From the nine categories of

needs, 93 user needs could be identified. This long list of 93 needs was then reduced to 39 needs based on the criteria in the following list:

- **Similarity:** Needs that were similar or related were merged
- **Generalizability:** Needs that were not likely to be common in the target population were eliminated
- **Relevance:** Needs that were not considered to be actionable and in scope for the greater IVA project were eliminated
- **Served:** Needs that were considered to be already served were eliminated

The two researchers first independently rated each need in accordance to the criteria and then discussed needs in which there were differing opinions. After this, the remaining 39 criteria were categorized into three different categories using the Kano model (see 3.2.4 *Analysing and Understanding Customer Needs*), out of which two categories with 30 criteria were included in the survey.

5.3.6 Survey

A survey study was conducted in order to prioritize among the 30 final needs found in the Contextual interviews and to verify the result with a larger sample than the ten interviews. The survey was constructed in such a way that the respondents could select up to ten needs from the list of 30 needs, based on which of the options they wanted in order to enjoy their future home. There were also background questions as well as interest questions, in order to see the characteristics of the sample and to be able to perform different analysis of the results. 97 final survey responses were recorded between the 10th of December 2015 and the 22nd of December 2015. Having a survey to prioritize among the needs was suggested by IVA.

About the Sample

The survey was semi-open as anyone could participate in the study, although it required access to a link. The sample of the respondents was primarily based on the network of the researchers. The target population of the survey was the same as for the whole study, people in the ages from 20 to and including 30, living in Swedish urban environments.

In the initial stage, personal requests to fill in the survey were made to contacts of the researchers known to be within the target population. There was an intentional effort to not only select participants from the same groups (for example university classes), although this could not be completely avoided. As the number of respondents grew, the response sample was continuously monitored to ensure that respondents from different groups based on the seven

background questions (see Appendix D) were represented. As shortages were detected (there were at times a deficit of respondents who were female, not from Gothenburg and working, respectively), the researchers deliberately reached out to respondents known to be in the low-represented quotas. Participants belonging to groups with low representation were also asked to spread the survey to their acquaintances with matching profiles, based on the assumption that people with certain characteristics tend to cluster, with the added benefit of adding respondents not known to the researchers.

The aim of the survey was not to make any statistically significant conclusions of the larger population, nor to be completely representative of the target group of young urban people in Sweden, but to verify and prioritize the needs with a larger sample than the ten interviewees. The focus was to make the major categories of each background question represented with at least ten respondents¹, although no statistical quota figures were used to make the categories proportionate with the larger population as in Quota sampling (Bryman & Bell, 2011). This explains why there are more respondents from Gothenburg than Stockholm, even though Stockholm has a larger population than Gothenburg. For a complete overview of the sample and its characteristics and proportions, see Appendix D.

There were 105 responses in total to the final survey, but 8 were removed due to being out of the sample scope by residing abroad, not living in urban areas or being under 20 or over 30 years, resulting in 97 usable responses. Although a larger sample would be better from a statistical perspective, the sample size was deemed sufficient for time reasons because no major differences could be seen in the results as more respondents were added in the later stages of the sampling. The sample size was also influenced by IVA, who suggested having at least 75 responses. After the survey was closed, some new categories were formed with grouped responses to eliminate categories with very few responses, which helped making comparisons between sub-groups.

- Cities except for Gothenburg and Stockholm were grouped into “*Other*” due to the rest of the cities only having 1-6 respondents
- Age group was grouped in “<25” and “>=25”
- Housing situation was grouped with “Other” responses like “*living with sister*” was grouped into “*living with friends*”.

¹ Exceptions were groups that were considered small in the whole population and whose special characteristics were not considered important for the study, such as people on parental leave (1 participant), living in villas (4) or living in their parental homes (3).

Due to the non-probability and network-based sampling, and limited sample size, one has to be careful with what conclusions to draw from the survey. No strong conclusions can be drawn of the needs of the population of young people in Sweden, although it does provide an indication of what needs that are more and less popular. During the analysis, few major differences could be identified in the needs selected between different sub-groups, which indicates that the outcome is likely not to differ considerably from a random-sample, although this cannot be said for sure without conducting a larger, more rigorous study.

About the survey

The survey was online-based and created using the tool Google Forms. Several different versions of the how to rank the needs was tested with the help of independent testers, and the final version was selected based on ease-of-use and rank-ability of the results. To provide an incentive to participate, the respondents could voluntarily participate in the lottery of movie tickets upon filling in the survey. The five sections of the survey as well as the questions and format can be found in Appendix D. The survey was anonymous and all sections required mandatory responses, except for the comments and suggestions. For the need selection, at least one need had to be filled in. All questions and options were in a fixed order, including the needs.

After closing the survey, the analysis of the survey results was made in Google Sheets, which is integrated with Google Forms. The respondents could select up to ten needs (each need could only be selected once by each respondent) and the total number of selections per need was counted in order to rank the need from 1-30, with the need with most selections being ranked as number 1. The need ranking was compiled in a table and graph, see 6.3 Needs Analysis. For a thorough description of the results, see Appendix D. Additionally, the sample was analyzed with regards to the background questions and interest questions, resulting in Appendix D.

5.3.7 Needs Analysis

The deeper needs analysis based on the FCE-model from 3.2.4 *Analyzing and Understanding Customer Needs* was made on the six highest ranked Exciting and Main needs from the survey respectively. The idea was to take the selected needs, who were formulated on a concrete Feature-level, and analyze the underlying consequences and desired end-states of the features. The interview data arranged by category from the needs identification phase of the Contextual interviews were used to find examples and explanations from the interviewees in order to identify the underlying meaning of the features. It should be noted that this method is largely subjective as it aims to interpret the explicit needs from the interviewees. In order to reduce this subjectivity, the Contextual interviews had a consistent use of probe questions to let the

interviewees explain the deeper meaning and motivation of their answers themselves, although there would still be times when the researchers had to interpret this in retrospect.

Additionally, the survey data was also analyzed for each of the high-ranked need using pivot tables in order to find if there were any proportional differences among groups based on the background and interest questions in who had selected a certain need. This could for example be if a larger proportion of people living alone or with friends had selected a need, or if the participants who agreed to a statement in the interest questions to larger extent selected a need compared to those who disagreed with the statement.

5.3.8 Obstacle-Need Mapping

During obstacle-need mapping, the obstacle that were identified from the Expert interviews were mapped with the 12 high-ranked needs identified in the Survey and analyzed in the Needs analysis. This was done through the researchers' reasoning of which obstacles are likely to hinder which needs, taking into consideration the longer description of the obstacles from the Expert interviews and the analysis of the needs. The result was put into a matrix (see 7.2 Obstacles and Needs Analysis) to give a clear overview, and a more thorough analysis were written about the obstacles that affected most needs and the needs that were affected by many and few obstacles.

This analysis was also rather subjective, first in defining each obstacle and each need, and then deciding which of them were related. If more time were given, a way to make this analysis more rigorous would be to clearly define each obstacle and make a smaller expert survey of the mapping, letting knowledgeable industry representatives give their opinions and motivations.

5.4 Reflections on Method

The following section presents the reflections on the research method from the perspectives of validity, reliability, and generalizability. These concepts are used to examine the accuracy and quality of the research (Easterby-Smith et. al., 2012),

5.4.1 Validity

From a validity perspective, the main issue to evaluate is whether a sufficient number of perspectives has been included in the study (Easterby-Smith et. al., 2012). The empirical research conducted in this study consists of two different set of interviews, and one survey. Measures were taken to ensure that the sample for the contextual interviews and survey represented most important groups of the population, by for example selecting interviewees based on characteristics such as age, gender, and city of residence.

However, a network-based non-probability sampling were used in the survey and the contextual interviews. This is likely to have introduced a researcher bias, as the researchers' personal networks were used as a basis for finding interviewees and respondents. This bias is believed to particularly concern the level of education, field of work, and socio-economic backgrounds of the participants, as the majority of the interviewees had relatively similar backgrounds as the researchers. Nevertheless, measures were also taken to reduce this bias by approaching interviewees that were second-hand contacts to the researchers, and two interviewees were identified by IVA. In the case of the survey, the sample bias can be considered to be smaller, as the respondents were encouraged to forward the survey to people in their network, which is believed to have had a positive impact on the representativeness of the sample.

Moreover, it was believed that to be able to get access to interviewees that are willing to let researchers into their homes for a one or two hour long interview, the interviewees need to have a personal connection to the interviewers. Another option could have been to provide the interviewees with a reward for participating, which was done in the form of a cinema ticket lottery in the survey.

The sample size of ten in the contextual interviews is considered to be sufficient, as it made it possible to include users with all the different forms of tenure that were included, and as the researchers experienced some extent of saturation in the findings during the last few interviews. Moreover, being able to get a deep understanding and insight about the user needs was prioritized above a maximized number of interviews, as that supported the aim and approach of the study.

Regarding the expert interviews, the sample size was five, which could be considered to be rather low given the number of actors and academic research areas that could provide relevant information about the obstacles within the housing industry. However, this was not the main part of the study, and the findings from the expert interviews are only considered as indicative in the analysis and discussion of the results. A suggestion for the next step could be to verify the identified obstacles, and which obstacles are related to which needs, with academics and practitioners in the Swedish housing industry.

5.4.2 Reliability

From a reliability perspective, the main issue to evaluate is whether similar observations can be reached by other observers (Easterby-Smith et. al., 2012). The needs that were identified in the study were in line with previous research in the area and within the Swedish context, with a number of new additions. Many of the user needs appear to be constant or slow-changing over

time. This insight, together with the consistency between the result in this study and previous research, similar observations are likely to be reached by other observers investigating the needs for the same target group. One important aspect however is the semi-structured contextual interviews, which due to the possibility to probe into interesting topics makes it difficult to repeat the interviews and achieve the same answers.

However, the analysis of the interview data opens up for some extent of subjectivity, which has an impact on the identified needs. The use of mixed methods worked to counteract the subjectivity in the identification of needs, as the prioritization of needs was done by the survey participants. Using the survey for the prioritization of needs was considered to improve the reliability of the results, as a relatively large sample was achieved and as the researchers did not have any impact in the outcome of the result, other than the possible sample bias discussed in the previous section.

Moreover, detailed summaries of the empirical data and the different stages of analysis is provided in this report, which gives transparency to the collection and analysis of qualitative and quantitative data within this study.

5.4.3 Generalizability

From a reliability perspective, the main issue to evaluate is whether the sample is sufficiently diverse to allow inferences to other contexts (Easterby-Smith et. al., 2012). The results are largely dependent on the Swedish housing conditions and context, which implies that the findings and conclusions from this study are not directly transferrable to other countries. However, the general recommendations for design and development of solutions with a user perspective are an exception, as they are considered to be less context-dependent.

Regarding the generalizability of the needs to other age groups and more rural areas, the results are considered to be sufficiently diverse to make some inferences to these contexts. For example, a majority of the identified obstacles are not specific to urban areas. The majority of the needs, except the needs that correspond to the environment outside of the apartment such as a common outdoor space, are also not specific to urban areas or young people in particular. However, the results are primarily valid the target group that are included in the study, as young and older people are believed to have different attitudes to their homes and differences in their overall lifestyles.

6 Finding and Analyzing User Needs

This chapter gives a rich and extensive presentation of the findings and analysis in relation to the first research questions about user needs. The chapter is structured in three parts. The first part describes the focus group and its outcome which helped formulate the interview template for the contextual interviews. The second part describes the contextual interviews and the needs that they uncovered, together with the survey results that showed which were most important. These most important needs are then analyzed more thoroughly in the third part.

6.1 Focus Group Results

The focus group was conducted with two main purposes; first to investigate what preferences the participants have when it comes to their homes and second to find themes and topics to further investigate in the subsequent contextual interviews.

The main findings from the participants in the focus group were the following:

Doing things in the home or away and together or alone

- Activities like spending spare time, cooking and eating are preferably done together as it is more fun.
- Taking care of chores is rather done alone, not together with others. Some chores, for example laundry, can be seen as rituals, they not only have a practical purpose but also a relaxing purpose.
- Some prefer to study away from home because it is easier to concentrate, but some like that it is convenient to be at home.
- It is important with a balance in the time spent at home compared to being away.

Living together

- When living together, it is important to both have common areas for socializing, but also to have an own room and be able to shut the door when you want to.
- The kitchen is viewed as an important social area when living together.
- Avoiding boredom and anonymity are key reasons for living together.
- Being able to choose who you live with is an important factor, but not always easy with current systems for getting an apartment.
- There is a shortage of shared apartments in Sweden, especially in good locations, leading to people wanting to live together instead live alone.
- It is positive to have an open home where you can invite friends over.

- Smart design can be used to take care of commonality issues - for example cooking, hygiene and laundry.

A further description of the focus group methodology can be found in 5.3.1 Introductory Focus Group, and examples of the results can be found in Appendix A. The findings were used to formulate the interview templates used for the subsequent contextual interview, see Appendix C.

6.2 Contextual Interviews & Survey Findings

Ten contextual interviews were conducted by the researchers over a period of two months. The interviews were held in the homes of the interviewees in Stockholm, Gothenburg and Malmö and each interview lasted between one and two hours. The results from the contextual interviews formed the basis for the identified user needs, which were subsequently verified and prioritized over a larger sample through a survey.

6.2.1 Interviewee Presentations

In this section, an overview of the sample for the contextual interviews as well as a presentation of each interviewee is given. The interviewees' have been given fictitious names in order to maintain their anonymity. The following figure gives an overview of the sample for the contextual interviews, based on different parameters:

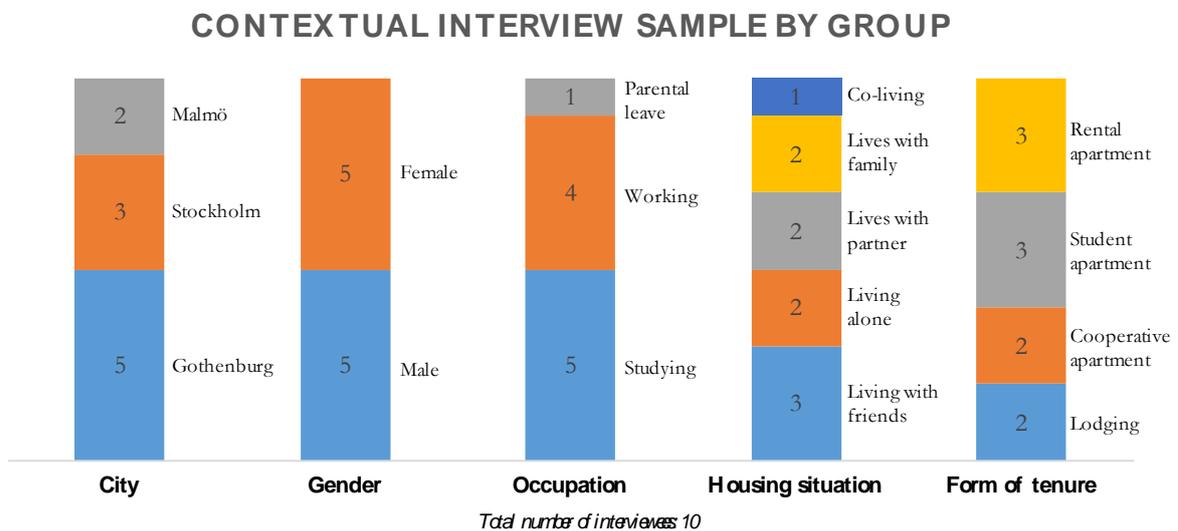


Table 7

Alice is a 25 year old woman, she is working and lives in a suburb of Gothenburg together with two of her friends who are in a couple. The apartment has two bedrooms, one that is Alice's room and one that is shared by the couple. Alice appreciates living with her two friends, as she has someone to come home to and talk to about her day, but based on previous experiences she would not want to share an apartment with people that she does not already know from before moving in. Alice and her flat mates have furnished the apartment together, and have a cleaning rota to share the responsibility for keeping the apartment tidy. A benefit with the apartment layout is that the shower and toilet are in two different rooms, which makes it possible to use the bathroom when someone else is in the shower. Another plus with the layout is the rich inflow of natural light. Alice thinks it is important to have a balance between being in the city, where she is surrounded by people and can go to cafés, and being in nature which gives her inspiration and a feeling of freedom.



Anna is 26 years old and has recently started her first job after graduation. She lives in a newly-built two room apartment in central Stockholm. She found it difficult to get into the housing market in Stockholm, as it is a high speed market with high demand. She bought her current apartment without a viewing, only having seen pictures and a show flat in the same building. Her first



impression when coming into the apartment was that it felt a bit like a bunker, as it only has windows in one direction, and is on a low-level floor, facing tall buildings opposite. She has a balcony which she appreciates a lot, it gives a feeling of freedom that is important in an apartment, which can feel a bit enclosed otherwise. Anna thinks it is important to separate work from her spare time, and wants to be able to relax when she is at home. She also enjoys having friends over, as she wants to utilize her apartment and think it is a good way of getting to know people better. She has previously lived together with friends, but for a long-term home she wants to live on her own or with a partner. One of the benefits that she has found with living in a new build home is that there are plenty of plugs and light fixtures, which makes it easy to decorate.

Christoffer is a 25 year old man, who is living in a student apartment together with two friends. In parallel with studies, he also runs an internet-based business. Christoffer values efficiency over most other things, and wants services to be on standby so he can optimize his time and do not have to schedule things in advance unless it is something important. He also wants to minimize the time he spend on household chores, in order to be able to spend more time on work, studies and spare time. In the area where Christoffer lives there have been some crime-related incidents lately, one man was cut in the head with a knife a couple of days before the interview, and one of Christoffer's roommates had been attacked by a man with a knife a few months earlier. Christoffer's other roommate felt that living a few stories up in the building made her feel safer after the incidents. Another downside with their home was problems with noise from other apartments, but a well-functioning recycling room and evening sun on the balcony were benefits. In Christoffer's building, the neighbors use a Facebook group to communicate with each other, which had become very popular and a forum for discussing things related to the area and the building, as well as selling and borrowing items.



William is a 24 year old student who lives with his girlfriend in a student apartment in Gothenburg. He is interested in technology and builds drones on his spare time. Even though the apartment only has one bedroom and a kitchen, he thinks that the apartment feels like a two bedroom home as the room is shaped as a U which divides it into two. He does, however miss having more secluded space. He would want a room where he can shut the door in order to not disturb or be disturbed by his partner if she sleeps early or he needs to study for example, and that he can decorate himself without having to compromise. William thinks that esthetics, good design and good quality are very important, having some famous designer decoration. He says that the positive thing about good design is difficult to explain, but that it feels good inside when there is something that is well-designed.



Michael is 25 years old and just started his first job after graduation. He still lives in a student apartment with one room and a kitchen together with his girlfriend in Gothenburg. Michael feels troubled about his housing situation as he cannot continue staying in his student apartment for long, he has used a deliberate strategy to maximize his queuing days and applied to university courses he might not attend just to be able to stay. Michael enjoys handicraft and building things, having rebuilt some wardrobes in his apartment and the house of his parents. He enjoys building things more than buying things, saying that he enjoys it and the sense of pride in making something on his own. He also think it is important to feel a connection with where he lives, saying that he gets inspired by living in the city and seeing people do things. He also finds it inspiring to live in a house where other has lived before, saying that it gives a good perspective to know that others have lived in the same place and lived their lives with their challenges.



Martin is 30 year old and the father of a little girl. He is currently living in a cabin next to his parents' house in a scenic location outside of Stockholm, and he also has a mobile home that he utilizes during the summer. Martin has plenty of experience from the housing industry and is currently leading the development of a new housing concept, where the home is a service and the people living there will be able to easily move between different sites. Martin has over the

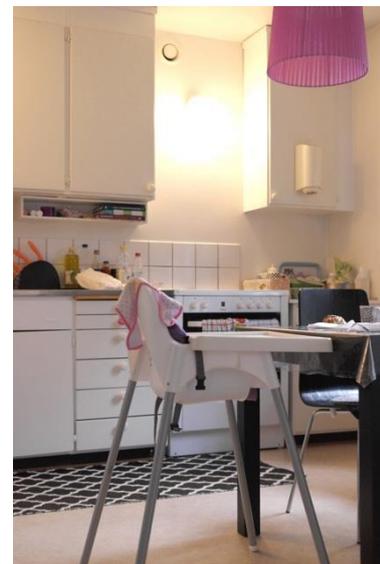


last years worked to create a slightly unconventional lifestyle that suits his values and priorities. He is trying to keep his living costs as low as possible to be able to have a flexible work that allows for freedom and focus on his family, travels, and realizing his dreams. Living close to his parents is a great benefit when having young children, as they can offer support with for example babysitting. Martin is critical to the norm of the nuclear family, and states that homes are built for the nuclear family even though that is not the way young people are living today. For Martin, one of the most important things with his home is to be able to lock the door and leave, so he values low maintenance. His home is in a semi-rural location outside of the city, and he commutes into the city and stays there overnight one or two days a week, to be able to enjoy the perks of the city such as meeting with friends and going to the gym. However he appreciates to have his home close to the nature, and even more so after having had a child.

Erik is a 29 year old man living in a shared house in the city center together with eleven other people. Erik likes to live in the city center as he can be spontaneous, and if he forgets something at home he can easily go back and get it. He appreciates the undemanding and spontaneous socializing that comes with sharing a home, and find it inspiring to live with people that are like-minded. One drawback of sharing a house is that it can be difficult to have peace and quiet, as the people in the house often have different energy levels at different times. Therefore, he appreciates having his own bedroom in the house that gives him privacy when he is not in a social mood, and he does not have to keep his things in perfect order in the room. The co-living is not structured in a way that they have fixed times or schedules for house meetings, which he appreciates as it gives flexibility. However, there are a set of common rules related to for example doing the dishes and having people to stay over. Erik thinks that working from home works better when there are other people around, as it pushes and inspires him to work. A cleaner comes once a week to Erik's house to clean the common areas, and he appreciates not having to clean the shared spaces, something that could be a potential source of conflict with the housemates.



Jelena is a 25 year old woman who is living together with her husband and their young daughter. They recently moved to a larger apartment to get more space for their family, and are dreaming about living in a villa. Jelena thinks that the previous apartment was fresher, and the landlord was better, but prioritized having more space. They were able to exchange their old apartment for this one through a website, which made it relatively easy to find the new home. In the new apartment, she has been experiencing some problems with getting help from the landlord with maintenance. For example, the doors to the kitchen cupboards are starting to fall off, something that the landlord has been reluctant to help with, which has led them to take care of the issue themselves by buying new hinges. Jelena has a great interest for interior decoration, and does not mind to spend time on cleaning the apartment. She also appreciates having a washing machine in the apartment, particularly when having a young child. However, the insulation is not sufficient so they are often disturbed by neighbors, something that is extra problematic when having children. Jelena and her family has a car that they use every day, as she finds the public transport too expensive to be an attractive option.

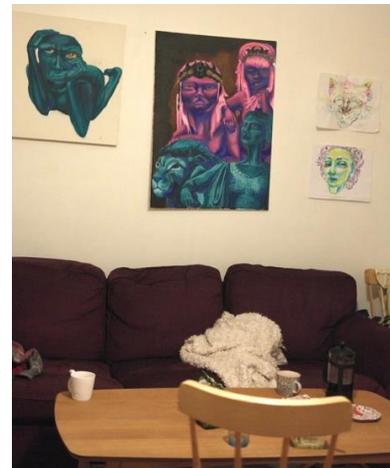


Molly is 22 years old and is studying in Malmö, where she lives together with her cat. Her current apartment is her first own home and she is relatively new to the city. Molly thinks that it is worthwhile to live alone for a period in her life, and sees her home as a calm place for relaxation, but also appreciates having her friends close by and inviting them over. Molly grew up close to the sea, and sometimes misses jogging tracks and green areas in her current neighborhood. The two main features that she considered when she



bought the apartment, was that it was central and quiet. In her previous apartment she had trouble sleeping because of the noise, which made that extra important when finding this apartment. The house was built in the 1930's, and she thinks that the high ceilings and windows from two directions makes it feel larger and more airy. She would like to have a secluded sleeping space, such as an alcove, as her apartment only has one room. Molly's housing association have a system where residents get a payback on their rent if they use less heating, and she has a device for tracking it. She appreciates this, particularly as she uses less heating compared to some of her neighbors that live in larger apartments. Molly has a shared laundry room, which she thinks works well except that she sometimes have problems with allergy from washing detergent and softener residue.

Beatrice is a 25 year old woman living together with her sister in a one room apartment with a sleeping alcove. She is a student and has quite recently moved to Malmö from Gothenburg. Comparing the two cities, she said that it is easier to find housing in Malmö, and as the city is more compact everyone uses a bike or walks. She is very unhappy with her current apartment, and is soon about to move. She has problems with noise from a supermarket warehouse below her apartment, and there are also issues with ventilation and maintenance. She is however happy with the layout of her current apartment, and likes to have an area that is just for sleeping. Beatrice previously lived in a cooperative



apartment, and prefers it to a rental apartment as she finds it more affordable and that she has more control over her housing costs, as she can for example decide on her own when to renovate and what to invest in. She also has a great interest in decorating and renovating, which she cannot develop in a rental apartment. One drawback of the cooperative apartment however was that she worried about whether it would drop in value. Beatrice is minded about her privacy in the home, she feels that having someone else cleaning her home would be intruding on her integrity, and she sometimes avoid having people over as she feels a need to tidy up in the apartment and store away her private things such as dirty laundry before someone comes over.

6.2.2 Identified User Needs

Based on the results from the KJ method, 92 individual needs could be formulated and divided into nine different classes. The needs were classified according to the Kano model (see 5.3.7 Needs Analysis) into basic but underserved needs, main needs, and excitors (see table below).

CLASSIFICATION OF NEEDS

Need character	Explanation	Number of needs in category
Basic but underserved needs	Needs that are basic and critical for residents' satisfaction of their homes, but not currently fulfilled to a large extent. The needs will not lead to higher satisfaction if above a certain level.	9
Main needs (Performance need)	Housing needs that are underserved, general to a larger group of users, relevant to the project scope and critical to fulfill. Will lead to dissatisfaction if absent and increased satisfaction if higher.	12
Excitors	Needs that improves the user satisfaction of their home, but that will not lead to dissatisfaction if unfulfilled. The excitors are needs that may become main needs or basic needs of the home in the future.	18

Table 8

The number of needs were reduced from 92 to 39 in order to reach a manageable amount of needs for the survey. This was done according to predefined criteria, see 5.3.5 *Identifying User Needs*. The survey was used to prioritize among the 39 identified needs. Each need received a number of points based on the number of respondents that had selected the need. The basic but underserved needs were considered to be previously known and likely to be prioritized by all users, overshadowing the other needs, and were therefore not included into the survey.

The survey resulted in a prioritization of the needs, based on how frequently they were selected as desirable by the respondents. The result of the prioritization reflects the expectation that the needs characterized as main needs would be prioritized higher than the needs that were characterized as excitors. Table 9 shows the list of the 30 needs that were included in the survey, as well as their score.

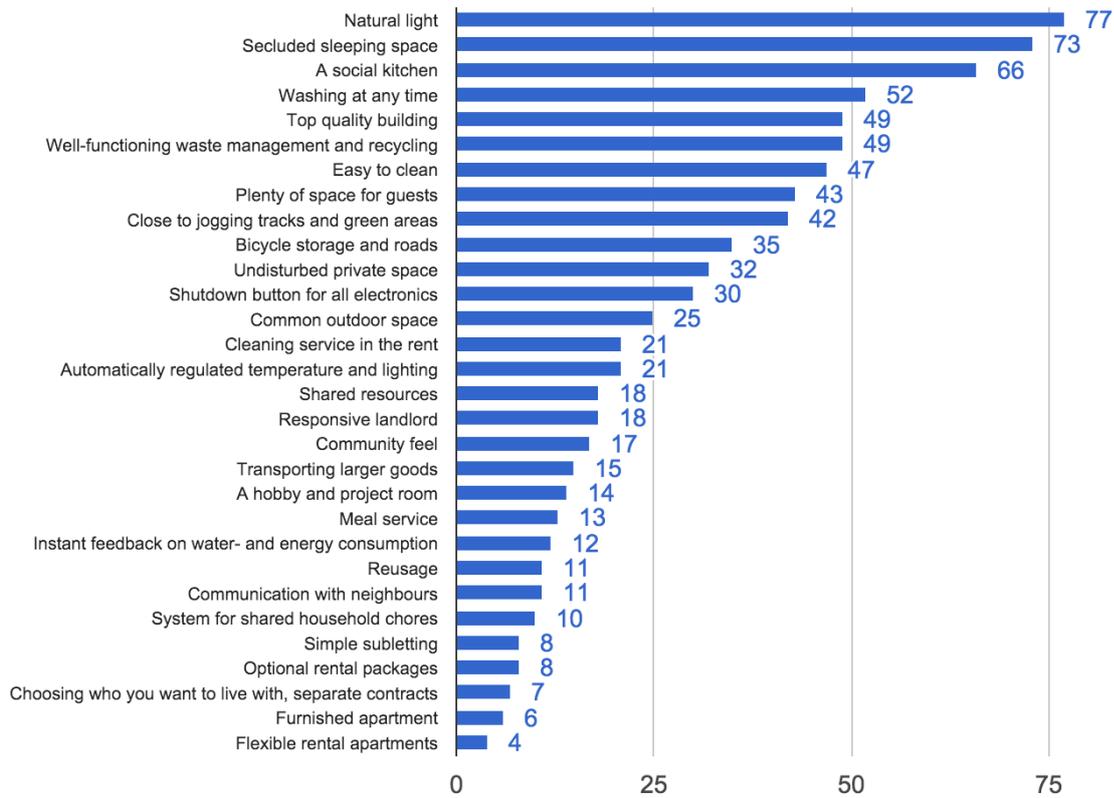
NEEDS THAT WERE INCLUDED IN THE SURVEY

Prioritized in Survey	Need	Description	Kano (Main need (M), Exciter (E))	Survey score
x	Natural light	Getting light into the apartment from two or more directions to get a dynamic natural light.	E	77
x	Secluded sleeping space	Secluded space for sleeping (sleeping alcove, sleeping loft or bedroom)	M	73
x	A social kitchen	A big kitchen to be able to cook with friends and guests	M	66
x	Washing at any time	Being able to do laundry at any time without booking in advance	M	52
x	Top quality building	Buildings of high quality and long-lasting materials that age well and require little maintenance.	E	49
x	Well-functioning waste management and recycling	Well-functioning waste management close to the apartment with clear and effective recycling possibilities	M	49
x	Easy to clean	Easy to clean and tidy up in the entire apartment	M	47
x	Plenty of space for guests	Having or being able to create space for inviting people over	M	43
	Close to jogging tracks and green areas	Easy access to nearby jogging tracks and green areas	M	42
	Bicycle storage and roads	Convenient access to secure bicycle storage and bicycle roads	M	35
	Undisturbed private space	Having a private space without being disturbed and disturbing others	M	32
x	Shutdown button for all electronics	A function to shut down all devices and electronics with a single click when leaving the home	E	30
x	Common outdoor space	Common outdoor areas for barbecues etc.	E	25
x	Cleaning service in the rent	Group contract in the building for cleaning service in the apartment.	E	21
x	Automatically regulated temperature and lighting	Automatically regulated temperature and lighting than can be controlled with simple settings	E	21
	Shared resources	Shared resources like cars, clothes and other things that can be borrowed/rented in the house	E	18

Responsive landlord	Easily getting in touch with from and action from the landlord when having issues	M	18
Community feel	A sense of community with the people you live close to	E	17
Transporting larger goods	Access to a mode of transportation that is suited for transporting goods, such as furniture etc.	E	15
A hobby and project room	A room in the building or apartment for projects and hobbies such as plants, carpentry, and DIY.	E	14
Meal service	Having the possibility to get cooked meals delivered to your door without cooking, with a group deal in the house	E	13
Instant feedback on water- and energy consumption	Precise and timely feedback about energy and water consumption	M	12
Reusage	Possibility to collect things that others throw away for reuse, for example furniture, cookware, and utensils.	E	11
Communication with neighbors	To have a way of communicating with the neighbors around issues related to the building and surrounding area, such as incidents or buying and borrowing items	E	11
System for shared household chores	A digital system to make it easy to share and divide household chores in a shared housing	E	10
Simple subletting	Homes and contracts that are adapted for being able to sublet in an easy way, both long-term and short-term	E	8
Optional rental packages	Option to influence the features and services that you pay for in an apartment	E	8
Choosing who you want to live with, separate contracts	Possibility to choose which people you live with and having contracts that are adapted for sharing an apartment	M	7
Furnished apartment	Having the possibility to rent or buy a decorated apartment, with possibility to select between different interior styles.	E	6
Flexible rental apartments	Possibility of time-limited rental contracts that can be rented during a short time, without having to give up queuing time	E	4

Table 9

NEED RANKING FROM SURVEY



Number of surveyees choosing the need

Figure 7

The table below shows the needs that were categorized as basic, but underserved, meaning that there are cases when these needs are not fulfilled. These needs are considered to be general for all users, and they are basic which means that they do not provide additional customer satisfaction when they are fulfilled, but only dissatisfaction when they are not fulfilled. The needs were identified in the contextual interviews, with the addition of the need for adequate ventilation and air quality which was added based on the comments from the survey (see Comments from Survey below).

NEEDS CHARACTERIZED AS 'BASIC, BUT UNDRSERVED'

Need	Description
Efficient public transport connections	Time efficient public transport with as few changes as possible, during both day- and night time
Getting home safely	Getting home safely, particularly during night time
Close to work, grocery store, etc.	Having things that one need to reach every or almost every day within 10 minutes walking distance, such as work, grocery store, and exercise possibilities
Safe, accessible external storage	Secure and easily accessible storage for things that cannot be stored inside the apartment
Good and affectable indoor temperature	Adequate and affectable indoor temperature
Good ventilation and air quality	Adequate ventilation and indoor air quality ²
Possibility to personalize the home	Having the possibility to easily put a personal touch on the home, through furniture, textiles, paintings etc.
Soundproofing, internal and external	Good soundproofing between rooms, apartments, and outside
No clear view from the outside	No clear view into the apartment from outside
Easily getting a new apartment	A feeling of assurance of being able to find a new apartment in case of a changed life situation or needs

Table 10

Comments from Survey

The survey contained an open question that attempted to find any needs that had not been captured by the contextual interviews. The following needs were found through this question:

- Adequate ventilation and air quality, particularly in the bathroom
- A beautiful facade and entrance
- Availability of car parking
- Grocery store, gym, and public transport in the proximity
- High quality of white goods, basins, taps etc.
- A balcony or glazed balcony
- Close distance to family and friends
- A storage space or unit close to the apartment

² This need was added based on the survey comments.

6.3 Needs Analysis

To understand the most important needs more thoroughly, this section makes a deeper analysis of twelve needs, the six highest prioritized main needs and exciter needs, respectively. Although there were other main needs that were more popular than the least popular of the six exciter needs, it is important to also consider the exciter needs as they can provide an improved user satisfaction and potentially evolve into main needs in the future, according to Bayus (2008). Therefore, the six highest ranked needs from each of these categories were further analyzed.

The analysis of the needs is presented in the following way: first, the need is described together with insights from the contextual interviews and the focus group. Second, the FCE-model is applied to understand the feature, consequence, and end-state of each need. Lastly, the need is analyzed based on the survey result.

The following tables give overview of the prioritized and analyzed main and exciter needs:

PRIORITIZED AND ANALYZED MAIN NEEDS

Main needs	Description
Secluded Sleeping Space	Secluded space for sleeping (sleeping alcove, sleeping loft, or bedroom).
A Social Kitchen	A big kitchen to be able to cook with friends and guests.
Washing at Any Time	Being able to do laundry at any time without booking in advance.
Well-functioning Waste Management and Recycling	Well-functioning waste management close to the apartment with clear and effective recycling possibilities.
Easy to Clean	Easy to clean and tidy up in the apartment.
Plenty of Space for Guests	Having or being able to create space for inviting people over.

Table 11

PRIORITIZED AND ANALYZED EXCITER NEEDS

Exciter needs	Description
Natural Light	Getting light into the apartment from two or more directions to get a dynamic natural light.
Top Quality Building	Buildings of high quality and long-lasting materials that age well and require little maintenance.
Shut Down Button for All Electronics	A function to shut down all devices and electronics with a single click when leaving the home.
Common Outdoor Space	Common outdoor areas for barbecues etc.
Cleaning Service in the Rent	Group contract in the building for cleaning service in the apartment.
Automatically Regulated Temperature and Lighting	Automatically regulated temperature and lighting that can be controlled with simple settings.

Table 12

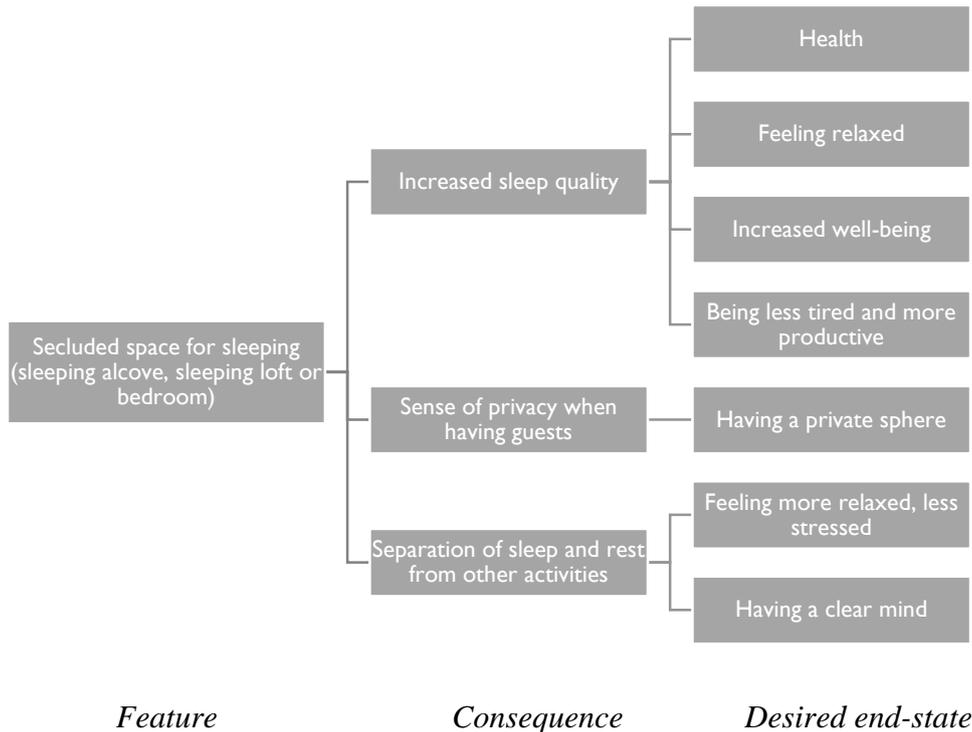
6.3.1 Prioritized Main Needs

Secluded Sleeping Space (73 points)

This need refers to having a separate, secluded space for sleeping, compared to for example having the bed directly in the living room which is also quite common. Three of the interviewees said that they like having or would like to have a sleeping alcove. According to the interviews, the main benefit with having a separate area only for sleeping is that it increases sleep quality. One interviewee said that he occasionally did work in his bedroom, but would prefer to only sleep there. Another interviewee said that she appreciated having a separate bedroom, especially when having guests as it makes the sleeping area more of a private area, without the need for cleaning.

In regards to the survey results, this need was clearly more important for people living with friends and with partners than with people living by themselves, with 88%, 77% and 71% choosing the need respectively, although this was still important for all groups relative to other needs. This is natural as having a secluded sleeping space provides a bigger benefit both in terms of privacy and being undisturbed when living together. Overall, when designing sleeping areas, it both seems important to think of having an undisturbed area to allow good sleep and relaxation but also to have an area that allows a feeling of privacy, both for people living alone but especially for larger apartments for couples or flat shares.

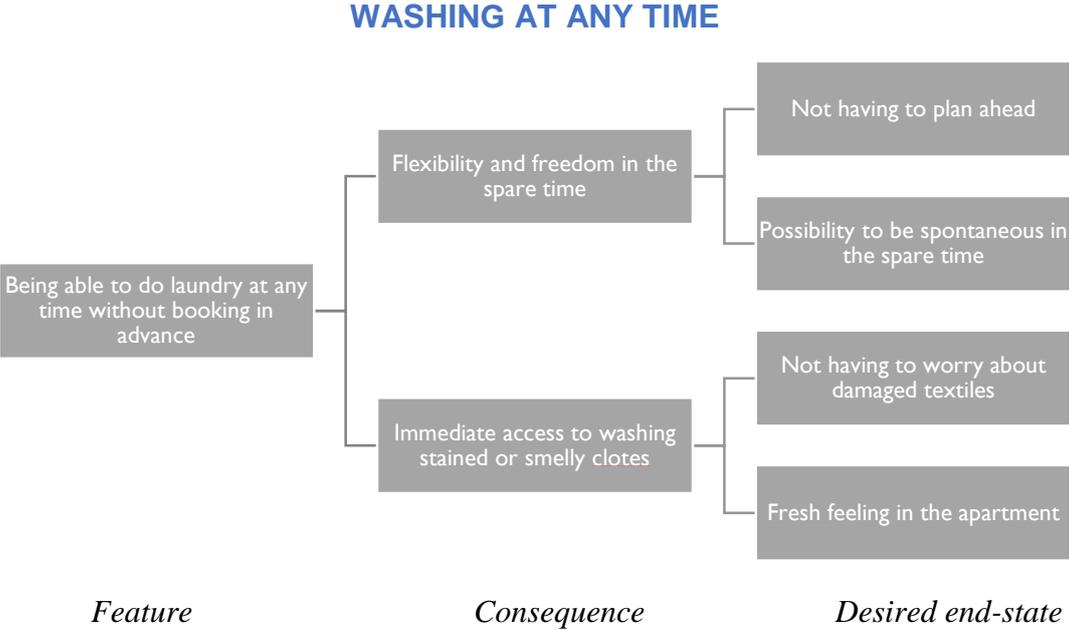
SECLUDED SLEEPING SPACE



A Social Kitchen (66 points)

This need was mentioned both in the focus group, a couple of the interviews and confirmed in the survey. Several of the interviewees and the focus group participants said that they viewed the kitchen as a social area and that it was used for cooking and eating together as well as just hanging out. Both interviewees living by themselves and interviewees living with friends said that they enjoyed having friends over for dinner and interviewees living with friends also said it was good for socializing in a casual way. Another reason for having a big kitchen was mentioned by an interviewee who is a student, who complained that his kitchen was too small and that students often needs bigger kitchen because they want to make big batches of food to save time and money.

Similarly, having immediate access to get rid of for example wine-stains was mentioned by another interviewee. The interviewees who had shared laundry rooms in their apartment buildings were generally happy with how that worked, even though one interviewee who recently started his first job after University explained that he had difficulties finding a washing slot as he can no longer do laundry during day time. The interviewees who had washing a machine in their apartment thought that it worked very well.



When analyzing the interviews, there seems to be two underlying needs for washing at any time, not having to plan ahead and being able to wash at any time. It is worth noting that these needs to a large extent also can be fulfilled with a shared laundry room, as flexibility and access are not depending on having the washing machine inside the apartment. For example, having dedicated washing machines that cannot be booked and can only run shorter programs could be a way to make it possible for immediate or almost-immediate laundry, and simply having more laundry rooms so that there is less likelihood of having to book laundry time several days in advance. A solution such as this could give some more flexibility, while still saving space and resources. A digital system to keep booked times and see what machines that are available could also help meeting this need.

The need to be able to wash at any time was highly prioritized in the survey. This need was equally as often selected regardless of the respondents’ housing situation, for example whether they lived with friends or alone. However, only 30% of respondents living in a student apartment selected this need compared to between 50% and 75% for respondents with other

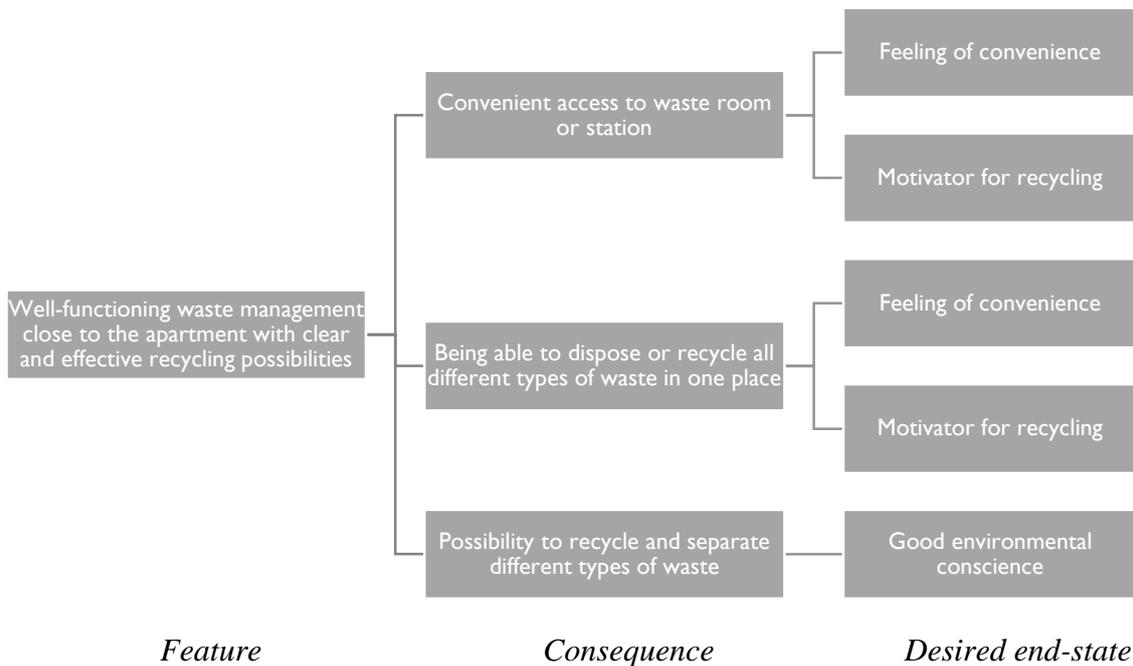
types of tenure. Two different reasons for this could be found in the interview results. Student apartments were often found to have more sophisticated washing rooms with online booking, washing rooms on each floor and a lower number of apartments per washing rooms. Having well-functioning washing rooms with good availability could be a reason why less of the respondents living in student apartments selected the need compared to other forms of tenure. Moreover, the interview results showed that students found it to be easier to find available washing slots as they have a more flexible schedule. Students can decide to stay home and do their washing during daytime, whereas most workers only have time to do their washing on weekends or weekday nights, which concentrates the demand for washing slots to these times.

Well-functioning Waste Management and Recycling (49 points)

The topic of waste management and recycling possibilities were brought up in four of the interviews, and the need for easy and convenient waste management was highly prioritized in the survey. The conditions for well-functioning and convenient disposal of household waste was found to vary between different buildings as well as different parts of the country. One of the interviewees who had lived in different cities over the last years had found large regional differences in the conditions and possibilities for waste-management and recycling. She explained that she felt strange when she moved from one place where all types of waste were separated, to a different place where there was no possibility to separate food waste from other types of waste. Another interviewee showed his waste room as a part of the contextual interview, and mentioned that it was functioning very well. This waste room was located inside the building, on the ground floor, and it had containers for all different types of waste as well as a spot for bulky waste.

Two of the interviewees said that waste management and recycling needs to be easy and convenient in order to be carried out properly. These two factors often means that the waste disposal station should be located very close to, or ideally inside, the building, and that all types of waste should be possible to dispose of in the same place. Two of the interviewees had experience from waste rooms which were not well-functioning, which had led to people dumping all kinds of things in the room or disposing of things in the wrong place because there was no container for the specific type of waste that they had.

WELL-FUNCTIONING WASTE MANAGEMENT AND RECYCLING



No significant differences could be found between different groups in the survey for this need. The finding when analyzing the interviews is that there often is both a will and knowledge from many of the interviewees to handle waste and recycling in a good way, but convenience and a good system is important and a lack thereof can be a big obstacle in carrying it out.

Easy to Clean (47 points)

Among the interviewees, there were varied views on household chores and cleaning. Three of the interviewees said that they cleaned quite often and enjoyed it. They would say that they find cleaning relaxing and that they enjoy the result afterwards, giving harmony for the eye and for the mind. Three other interviewees conversely stated that they wanted to spend as little time as possible on doing household chores like cleaning, in order to have more time for leisure or work, even though they did enjoy the result of having a clean apartment. One person who previously had renovated several apartments said that he always tried to implement solutions to make it easier to clean, like wall-mounted toilets and wax on the floor to make it more robust. Even though these two groups of interviewees had varied opinions on the time spent on cleaning, it is likely that they both would enjoy having it easy to clean as they both enjoyed the result of having a clean apartment. Having it easy to clean could also facilitate living together, as interviewees said that it is a potential source of conflict when living together.

EASY TO CLEAN



Feature

Consequence

Desired end-state

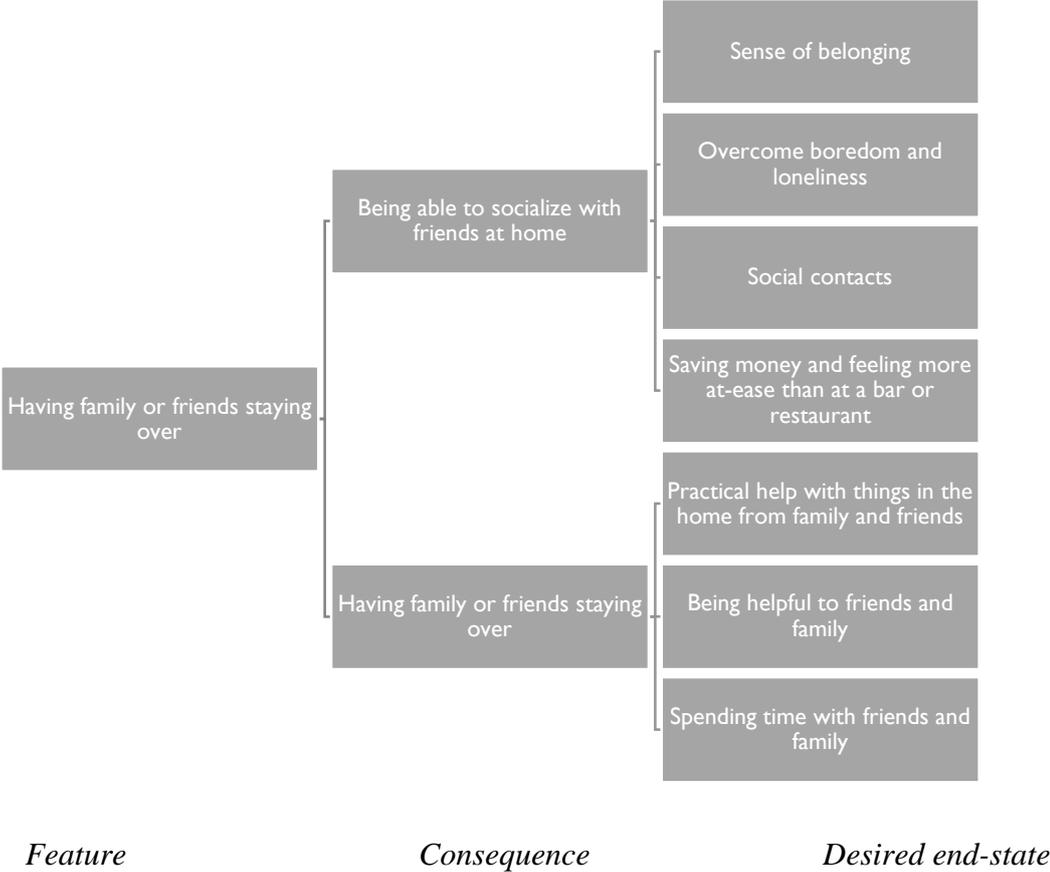
In our analysis of the interviews, the need of easy to clean both has the consequences of spending less time on cleaning and easier achieving the result of having a clean apartment, which have different underlying end-states. As the survey had an introductory question where the respondents could choose whether or not they appreciate spending time on household chores, these two consequences could be compared. Interestingly, there were approximately equally many respondents who do and do not appreciate spending time on household chores, and they were equally likely to choose the need of easy to clean. Similarly to the interviews, this shows that having easy to clean is important regardless of if someone appreciate spending time on household chores, as they could still enjoy the result of having a clean apartment.

Plenty of Space for Guests (43 points)

Several of the interviewees enjoyed having friends over for dinner or as guests. One interviewee said that her best memory from her apartment was when she had a big crayfish party with friends there, and that she was surprised that they all could fit even though it is a fairly small apartment. She is living on her own, and another interviewee who also lives alone said that she also enjoys having friends over, just for hanging out or for having dinner. She said it is a good way to utilize the apartment, is cheaper than paying for an expensive dinner at a restaurant and that she appreciates having an open layout with the kitchen and eating area when having guests. Another interviewee who lives with friends also said that he and his flat mates often have dinner parties because they have the largest apartment among their friends and that spending time with friends at home feels more undemanding than being in a bar. One interviewee who is living with his partner said that he finds it a bit difficult to have friends over as they live in a studio apartment, which means that he does not have a secluded space to spend time with friends.

Another aspect of having guests is to have people stay over. One of the interviewees said that her parent-in-laws sometimes stay over in their apartment when they come to help taking care of their granddaughter. She said that she would not utilize a guest apartment in case it was available in the building, as she wants the guests to stay with her, and said this was also more common in the country where her parents and parent-in-laws are originally from. Another interviewee, however, described how she had to decline her sister and her family to come visit as she did not have enough space. She states that for her, having access to a guest apartment would be an ultimate solution, as she can make breakfast, lunch, and dinner for her guests, but still have a private space and space for them to put their things.

PLENTY OF SPACE FOR GUESTS



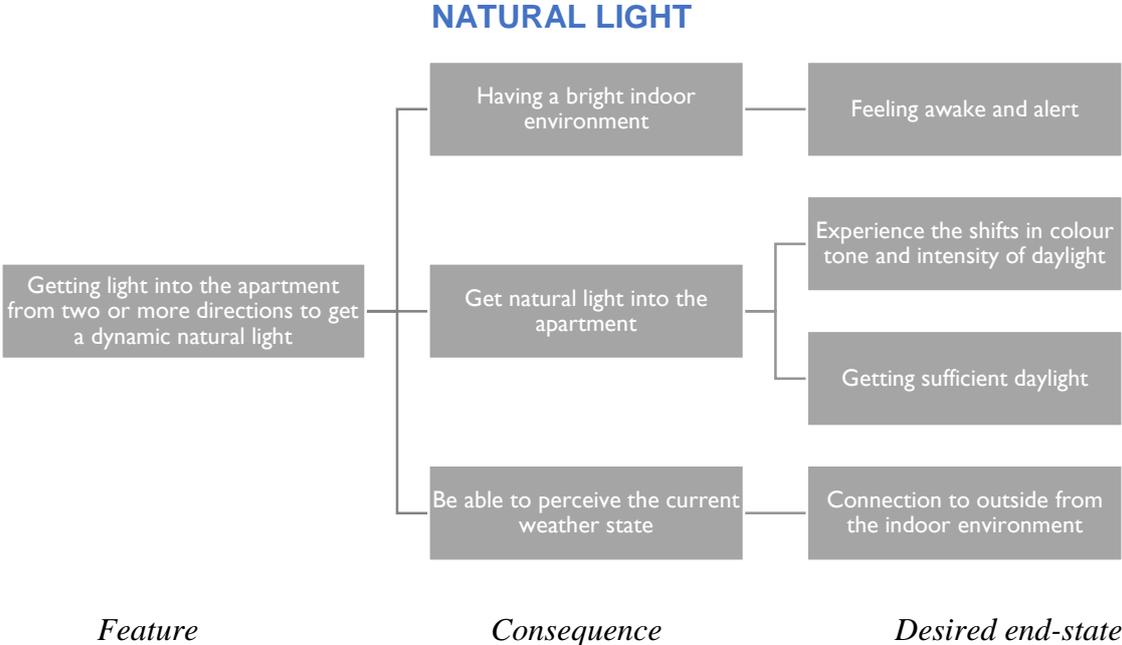
The social aspect of this need is quite similar to the aforementioned social kitchen, although the aspect of having people stay over is different. Here it is also worth noting that this does not necessarily mean that apartments need to be designed with big, otherwise unused guest areas, but this can also be achieved by having flexibility and a layout and furnishing that allows the resident to make space for guests when it is needed. Furthermore, one difference in the survey

was that women chose this need to a slightly larger extent than men (51% vs 38%), indicating that they find this more important than men.

6.3.2 Prioritized Exciters

Natural Light (77 points)

The need for natural light from more than one direction was brought up in three of the interviews and confirmed in the survey. One interviewee mentioned that she appreciated having windows facing two opposite directions. Another interviewee who only had windows in one direction said that she thought that it, in combination with living on the second floor and having another high rising building opposite, felt a bit like living in a bunker. A third interviewee mentioned that one of the things she appreciated the most with her apartment was that it had a good flow of natural light into the rooms.

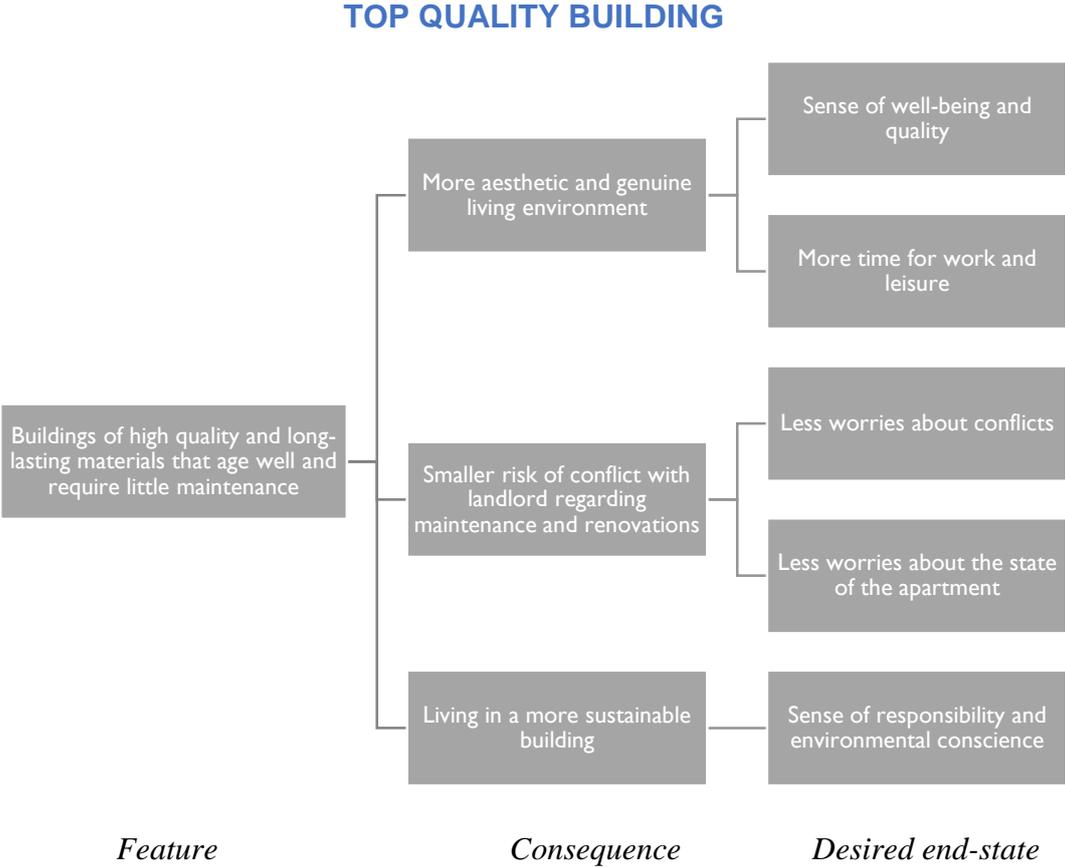


The answers from the interviews and the analysis indicates that the flow of natural light into the apartment plays an important role for residents’ wellbeing. Sufficient natural light both provides a connection with the outside environment and current weather state, and makes the apartment itself feel more bright and airy. This need was the highest prioritized in the survey, which shows the importance of the layout and placement of windows when designing apartments. There was no notable difference in how often this need was selected between different forms of tenure, except for lodgers who selected the need slightly less often. However, among people that were 25 years and older, 83% selected this need, compared to 71% of people

under 25, which indicates that this need is slightly more important for the older half of the target group.

Top Quality Building (49 points)

One interviewee brought up the benefits of using wood as building material, and explained that he believe it is the most sustainable building material from an energy and environmental perspective. Another interviewee mentioned that she thinks that it is important to build with high quality and long-lasting materials to minimize the need for maintenance and renovations. Several of the interviewees mentioned that they had problems getting in touch with the landlord and getting help from the landlord with fixing things in the apartment. This issue could be one reason behind the need for less maintenance in the apartment. However, the general awareness of building materials appeared to be low among the interviewees. Two of the interviewees mentioned that they had not thought about what material their building was made of, and only one of the interviewees had considered the sustainability aspect of different building materials.



Two different groups of end-states can be identified when analyzing the need for high quality and long-lasting materials. High quality brings a sense of well-being, and can also mean a more

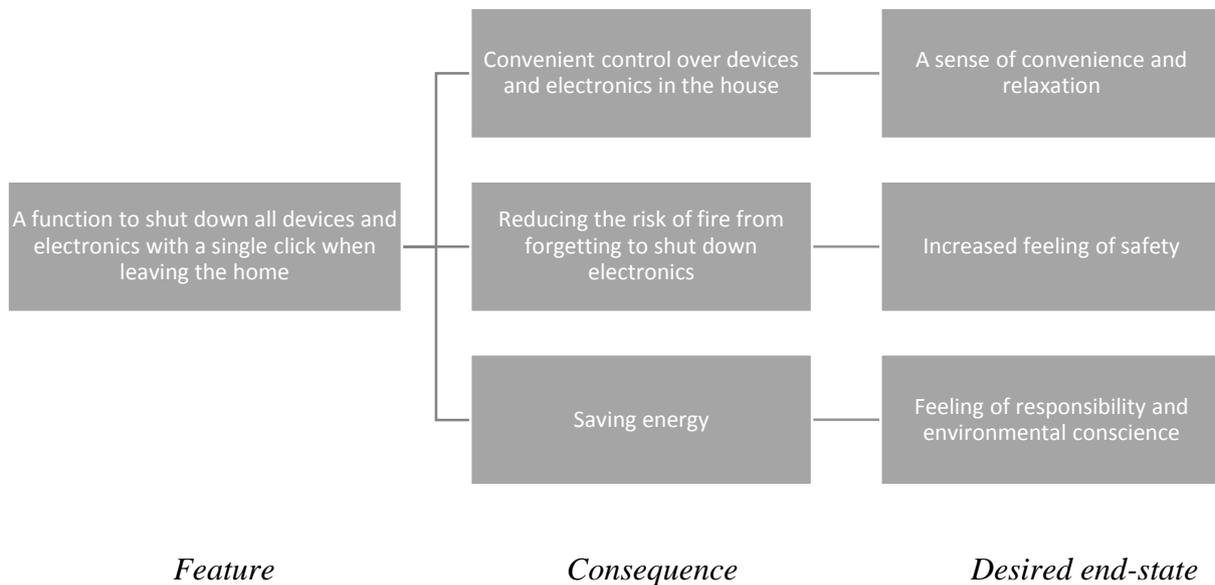
aesthetically appealing living environment. However, another reason that was also brought up in the interviews is that it means having to spend less time on maintaining and renovating the apartment because of things that break or wear. This need was selected by half of the respondents. Among these, students selected the need to a slightly higher degree than workers, 56 percent of students versus 43 percent of workers selected the need. One possible reason for this could be that student apartments are often built with lower quality than average, in order to make them affordable, which could be a reason that the students in the sample prioritized this need to a greater extent than people in the workforce.

The results from the survey and the interviews points towards the importance of high quality and a long-term perspective on buildings and apartments. In addition to the benefits of less maintenance for residents and property managers, it also satisfies the need for a genuine, sustainable, and aesthetic living environment.

Shutdown Button for All Electronics (30 points)

The need for simultaneous shutdown of devices and electronics when leaving the home was brought up in one of the interviews, where the interviewee was positive towards the idea. A function for shutting down all devices and electronics at once could save electricity and prevent potential fire risks from forgetting to shut off things like irons and hair straighteners. However, the general opinion among the interviewees was that they did not feel like they could achieve an effect on the electricity bill depending on how they used their electronic devices in the home. The reasons for this was that the electricity bill was relatively cheap regardless of their level of consumption, and that it arrived sometime after the actual consumption so that it was difficult to keep track of how their behavior related to the electricity consumption. Therefore, it could be argued that the reason behind this need is primarily convenience, reducing the risk of electronics catching fire, and being sustainable through saving energy rather than saving money on lowering the electricity consumption.

SHUTDOWN BUTTON FOR ALL ELECTRONICS



This need was only mentioned in one of the interviews, but it became one of the prioritized needs in the survey. One reason for this could be that it is not something that is prevalent in households today, and therefore not something that is on the interviewees' minds. However, when this need is presented in the survey format, a significant share of the respondents selected this need. Interestingly, among the respondents who selected this need, there was no notable difference between the number who agreed with the statement that they often take initiative to purchase new technology to the home and those did not agree with this statement. This indicates that the need for this function does not only exist among those who are interested in purchasing new technology. Another reason for this result could be that this function is something that is believed to be preinstalled in the apartment, and thus require no purchasing and installation by the residents.

Common Outdoor Space (25 points)

The topic of common outdoor area did not seem very important for the interviewees. One of the interviewee said that one of his best memories from his apartment is from when he had a barbeques in the shared patio in his apartment complex, he enjoyed the feeling of it and that there would be neighbors walking by and talking. Another interviewee said that she sometimes could miss having a common area for example for barbeques in her current apartment, but also that she had one in her previous apartment and did not use it a single time during the years when

CLEANING SERVICE IN THE RENT



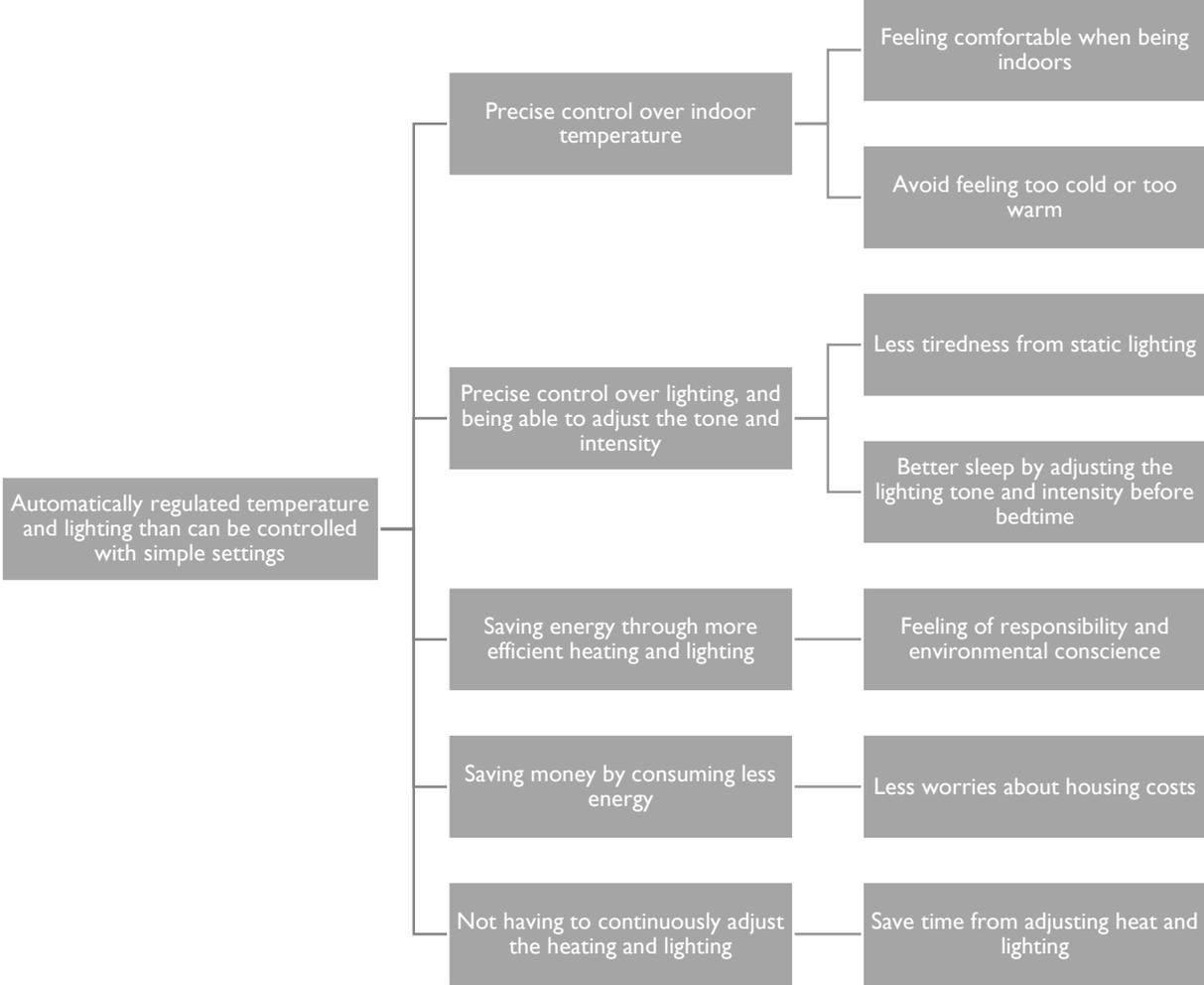
The need for a group contract for cleaning service in the building was prioritized, but not highly, in the survey. There is potential to reach a lower price for cleaning service in the apartment by organizing it as a group contract for the building, and charging it as an add-on to the rent for those residents who are interested. Among the respondents selecting this need, there was no significant difference in the amount of men and women. However, a noticeable difference was that respondents who said that they appreciate doing household chores were less likely to choose this need compared to respondents who did not enjoy doing household chores, with 13% and 32% selecting the need respectively. This is easy to understand as people who do not enjoy cleaning rather would let someone else do it, but is different from the need of having easy to clean which was as popular in both groups.

Automatically Regulated Temperature and Lighting (21 points)

Four of the interviewees stated that they had problems with the temperature in their apartments, that it was too cold in some parts of their apartments during some parts of the year. For one interview it became cold close to the windows, as he lived in a house with somewhat lacking insulation, and another interviewee had problems with cold floors as the area below her apartment was not heated and the insulation was lacking. Another interviewee stated that he found it very strange that the regulators on radiators are so imprecise, and that it is difficult to regulate the temperature with the current radiators. He also stated that he would like the temperature, humidity, and light in the apartment to be automatically regulated. He explained that he would appreciate not having to do it on his own but he also believed that it could be done more efficiently if it was automatic. Moreover, he explained that good indoor temperature and humidity could reduce sickness, and that automatic lighting could adapt the tone of light depending on the mood and the time of day. Another interviewee said that she would like to

have an automatic light system that could be controlled with simple settings, but that she did not have the time and energy to learn how to install and set it up.

AUTOMATICALLY REGULATED TEMPERATURE AND LIGHTING



Feature

Consequence

Desired end-state

This need was brought up in the interviews and prioritized, but not highly, in the survey. Based on the interview results, it is common to have problems with the apartment being too cold. It is possible that this need is stemming from a desire to have more control over the indoor temperature, as it is something that residents usually have little control over as it is determined by factors such as insulation, sufficient radiators, and the landlord turning on the heating early enough in the fall or winter. However, based on the interview results there is also a need for being able to have a more precisely adjustable indoor light.

7 Finding and Analyzing Obstacles for Meeting User Needs

This section shows the results from the expert interviews, which answers the second research question of what obstacles that exist for supplying housing that meets these needs, and analyzes the implications these obstacles have on meeting the needs as well as describes the findings from the perspectives of different readers.

7.1 Identified Obstacles

Five interviews were conducted with experts in the housing industry in the beginning of the study. The interviewees were researchers and practitioners in the industry, and each interview lasted between half an hour and two hours. The results from the expert interviews provided an overview and understanding of the industry and knowledge about ongoing projects that were relevant for this study.

The results also provided insights relevant for understanding the conditions and potential for supplying housing that fulfil the identified needs. The expert interview data was summarized for each interviewee, and based on the findings from the expert interviews obstacles for meeting the identified user needs could be identified. The obstacles are a result of the researchers' interpretation and understanding of the results and the housing industry. In this section, the obstacles that were identified for supplying the 12 prioritized needs will be described.

The following nine obstacles were found to be relevant for explaining the conditions for supplying housing that fulfil the prioritized needs.

OVERVIEW OF IDENTIFIED OBSTACLES

Obstacle	Description
Incentives and current market situation	The particularity of the industry structure and current market situation have several consequences. Oftentimes the company who builds a building will not be the same as the company that will manage the building, which has a consequence for the incentives of how to build in regards to quality. Furthermore, there seems to be an under-supply and housing shortage in the market, which means lower incentives to take risk and innovate. Also related to incentives are the pricing mechanisms, where the norm is to sell per square meter, meaning that there are low incentives for builders to provide common areas that be considered as public goods, as they are difficult to charge a higher price for.
User knowledge gap	There is a knowledge gap in the industry regarding the full picture of different users' needs. This is partly due to the primary focus on preference-based user research, which does not provide deep insights into the user's' needs and behavior in their homes, and

	partly because there is little involvement of the users in the design process. The result of this is that there are user needs that are unknown, and therefore also unfulfilled, and that the perspective of the people who are going to live in a building is missing in the design process.
Insufficient willingness to pay	There are user needs that exist but with no or insufficient willingness to pay for these among residents.
Rules and regulations	Rules and regulations can in some cases hinder innovative housing as well as housing targeted towards certain segments. For example, it is difficult to build low-priced buildings and the parking norm creates a lock-in as to how to provide transportation solutions for residents.
Lack of competence	A lack of competence among actors in the industry can in some cases be an obstacle for fulfilling user needs, for example technical competence in electronics and IT. Another example could be among property managers and residents regarding installation of smart technologies. Lack of competence among developers and buyers is sometimes a hindering factor that leads to a lack of requirements regarding sustainable and high-quality housing.
Lagging design and innovation process	The design and innovation process in the housing industry is lagging behind compared to other industries, regarding for example user involvement. One reason for this could be current undersupply in the market, which means that it is a seller's market and thus a lack of incentives for developing effective innovation processes and providing innovative housing. Another contributing factor could be that the industry also has longer development cycles and higher risks compared to other industries.
Maintenance	When there is a shared responsibility for maintenance, for example regarding common areas or resources, maintenance can become an issue. Difficulties with maintenance of certain housing features or solutions can also be a reason that technically advanced features are not implemented.
Resident behavior and lack of information	A lack of information and knowledge among buyers can be a hindering factor for sellers to provide and capitalize on solutions that are difficult for buyers to assess and experience, such as sustainable and non-hazardous building materials and high quality. Lack of knowledge and resistance to change can also be hindering factors for residents to create housing that suits their needs. There is little variety among housing, patterns and social structures affect what type of housing is being built, who lives together, and how apartments are decorated and planned.
Smart home standards	The lack of standards and dominant designs for smart technologies lead to a hesitation to invest in and install smart home technologies in buildings.

Table 13

7.2 Obstacles and Needs Analysis

The following section aims to combine the nine previously identified obstacles with the twelve analyzed needs in order to understand which needs are affected by which obstacles. This is in relation to the second research question of what obstacles that exist for supplying housing needs that meets the identified current and nascent housing needs.

The following matrix provides a mapping of which obstacles that hinders respective need, based on the data from expert and contextual interviews as well as the researchers' analysis. Also provided are the number of needs each obstacle affect and how many obstacles each needs are affected by, as well as the survey score for the different needs. These parameters will be the basis of more in-depth analysis of the most impactful obstacles as well as the needs that require more and less effort to fulfill.

When interpreting the matrix, focusing on the need perspective of this matrix could be better for construction companies and developers, seeking to understand which needs that face more and fewer obstacles for realization, whereas focusing on the obstacle perspective could be better for policy-makers or industry-wider actors, who want to understand which obstacles to target in order to have a larger effect on the whole industry.

MAPPING OF NEEDS AND OBSTACLES

Needs	Survey Score	Obstacles Sum	Incentives and current market situation	User knowledge gap	Insufficient willingness to pay	Rules and regulations	Lack of competence	Maintenance	Lagging design and innovation process	Resident behavior and lack of information	Smart home standards
			8	7	6	5	5	5	4	4	2
Shutdown button for all electronics	30	8									
Auto-regulated temperature and lighting	21	7									
Well-functioning waste mgmt. and recycling	49	5									
Natural light	77	4									
Top quality building	49	4									
Cleaning service in the rent	21	4									
Plenty of space for guests	43	4									
Common outdoor space	25	3									
A social kitchen	66	2									
Washing at any time	52	2									
Easy to clean	47	2									
Secluded sleeping space	73	1									

Table 14

The following section makes a deeper analysis of the obstacles that has the biggest effects as well as the needs that have the most as well as the fewest obstacles for realization. The focus is on understanding the relation between the obstacle and the needs as well as what can be done to overcome the obstacles.

7.2.1 Main Obstacles That Hinder Realization of the Prioritized Needs

Incentives and Current Market Situation

The overall obstacle of incentives and the current market situation seems to be the obstacle that affects most of the analyzed needs. In our analysis, this obstacle consists of four underlying issues. The first is that the builder and property manager often are different actors, which means that builder not always have strong incentives to build long-term quality as they are not directly concerned with the life-length and cost of maintaining the building. This directly relates to the need Top quality building. One complicating factor could be that the market is rather opaque and that it is difficult to know what good quality actually is in the long run, and that the life-cycle of the buildings are so long that the first buyer of the house not always have the incentives to consider quality the same way as subsequent owners that could come decades later. The second issue is also related to the industry structure and that some solutions that require new competence, for example electronics and IT for automatic temperature regulation or shutdown button, could fall between the seats of builders and the company with the new, specific competence. Both are dependent of each other to solve the issues, but there could be a deadlock if no one takes the initiative to start. A way to address the first issue could be to be more informed and knowledgeable of what constitutes good quality, as well as a to thoroughly assess the total cost of ownership or life-cycle cost of housing, in order to see the long-term costs. Another way is to have increased cooperation between partners, in order to find mutually beneficial solutions, which also is a solution to the second issue. A good example of this is HSB Living Lab (see 2.3 Current Housing Projects in Sweden), where there have been several parties involved in construction, maintenance, electronics and IT and appliances working together to implement new solutions in areas like common areas and measurement sensors. For the second issue, having a new actor that acts as a system integrator could also be a solution.

A third issue in this obstacle that affects some needs are the lack of incentives to provide common areas since they are difficult to include in the price in a market that is largely driven by square-meter prices. This affects common outdoor space as well as waste management and recycling and to some extent washing at any time and the aspect of common washing rooms. This could be addressed by consumers striving to get more information about common areas, but since the sellers do not have the incentives to provide it, it could be a good idea to strive

towards an industry standard to make it more comparable. Lastly, there is a general lack of risk-taking and innovation that comes from the market situation where it is easy to sell new apartments without doing anything new, due to the big undersupply in combination with that building requires a lot of capital, which itself reduces willingness to take risks. The last issue is difficult as it is strongly rooted in the industry, but special stimulation in forms of grants or subsidies are a way to reduce the risks of trying something new and has already been implemented to some extent.

User Knowledge Gap

The user knowledge gap was found to be a quite common obstacle that affects some main needs like secluded sleeping space, but even more exciting needs like natural light. Luckily, this obstacle seems to be rather easy to address as it primarily concerns actions that different companies can undertake on their own, like changing their ways of working with market research and user involvement, perhaps with similar methods of contextual interviews as provided in this report. However, for many actors in the housing industry the developer is the customer, and the user is an indirect customer, which could affect their ability and incentives to engage with the users.

Willingness to Pay

Insufficient willingness to pay is a critical obstacle and difficult to address. This report and survey has purposefully avoided working with issues related to costs and willingness to pay, partially in order to understand underlying needs independent of these factors and partially because these factors are thought to be more well-researched by industry actors already. However, in order to operationalize the needs, willingness to pay is difficult to come around. It is especially difficult for exciting needs, as it is part of their definition that they would not lead to customer dissatisfaction if left out. Ways to address this obstacle could be to find cost-efficient solutions in order not to increase the price, try to find targeted segments of the market with higher willingness to pay for a specific need or to reframe a solution into something that someone is willing to pay for or can save money on. Example of the latter could be that automatically regulated temperature and lighting by itself might not be something that someone would pay extra for, but it could be more attractive if it can be proven to be economic beneficial by reducing energy costs

Rules and Regulations

Rigid and strict regulations for how to build things have often been cited as an obstacle for satisfying needs. For example, strict rules of accessibility imposes certain limitations on the

layout of the apartment, affecting both the needs for plenty of space for guests and a social kitchen. When it comes to shut down button and automatic temperature and lighting regulation, there could also be safety rules and regulation which are of course important, but could be a limitation, similar to the lack of standard. Lack of regulation could also be an issue, hindering the fulfillment of certain user needs such as proximity to recycling stations, which could be too long if left unregulated. Rules and regulations have also been mentioned as one of the reasons for why there is a housing shortage and inflexibility in the market, in turn leading to the undersupply which also causes other obstacles like lagging design and innovation process and lack of incentives. Addressing this obstacle is a complex task, but on a high level, assessing which rules and regulation that are outdated, has the most negative impact and finding compromises should be the right way to go.

7.2.2 Main Needs and their Obstacles for Realization

Technology-Related Needs

One finding from the analysis is that it is challenging to realize the two needs that mostly can be related to the technology-centric perspective of a Smart home; the need for a shutdown button for all electronics and the need for automatically adjusted temperature and lighting. This is because they both face many obstacles, eight and seven out of nine respectively. Several of the obstacles work in tandem here; because of the technological nature required to create these solutions, current actors (both in construction, maintenance and residents) have a lack of competence and because of the industry structure, there might not be strong incentives for actors to satisfy this. On top of that, there is also an unclear willingness to pay for this as well as the obstacle that there is no clear industry standard for Smart homes, which in turn increases uncertainty and risk for providing the solutions. These factors, in combination with the fact that the survey result for them were smaller than for some other needs, indicate that implementing these solutions have a weak effort-reward ratio and can help explain why these solutions have yet to take off substantially in the market place. To address the issues, it seems like filling the competence gap for all actors as well as working towards a standard are important steps.

Needs with Few Obstacles

There are also so-called low-hanging fruits, needs that seem relatively easy to fulfil but that can have high impact on the user satisfaction, when looking at the survey results. The need for secluded sleeping space for example was the second highest ranked need but only seem to have one obstacle, knowledge user gap. For this need, it means that the reason the need is not currently fulfilled is because actors in the industry are not aware of the importance of this need. Creating a secluded sleeping space in apartments should not necessarily mean increased costs,

as it is a question of planning the layout, and hopefully this study can highlight this seemingly important need.

Furthermore, easy to clean was also an important need with few obstacles. The researchers identified a lagging design and innovation process, meaning that a better design and innovation process probably could come up with better ways to make apartments easy to clean. Another factor here is that residents probably also lack knowledge and information about the most efficient ways to decorate, furnish and tidy their apartments from a cleaning perspective, which could be addressed by proactive information. Notable is that this, as well as secluded sleeping space, probably would not add much to the cost of the apartment, thus not being hindered by residents' willingness to pay.

Washing at any time also seem to be a need with few obstacles. The analysis in this case refers to having a shared washing room, as there are no major obstacles in realizing the need with a washing machine in every apartment except for space and cost reasons, which does not appear to be an obstacle as companies can easily charge extra for an apartment with a washing machine. As noted in the needs analysis, shared washing rooms seem working well for residents that have more sophisticated, well-designed washing rooms and booking systems, as well as a larger number and more accessible washing rooms. The obstacles identified here are firstly that many do not have well-designed washing rooms and booking systems, and secondly that the builder do not have any strong incentives to provide more washing rooms as it costs and takes up space that could be used for creating more sellable apartments instead. These issues could be addressed by spreading the best practices of how to design washing rooms and by perhaps strive for an industry-wide standard of disclosing how for example how many residents per washing machine there are in an apartment to make it more comparable.

Highly Prioritized Needs

The need for a social kitchen with possibilities to cook and eat together with friends was a highly prioritized need, with two identified obstacles. One important finding regarding this need is that in contrast to having a spacious and social kitchen, no interviewees expressed a wish to have a large and spacious bathroom or bedroom. This implies that the need is not simply to have more space overall, but that the size of the kitchen could be expanded without expanding the size of the apartment by making other, less social, rooms such as the bedroom and bathroom smaller. This leads to the other identified obstacle for this need, rules and regulations. Current building rules imposes accessibility requirements, which means that bathrooms and bedrooms become larger than what would be necessary for residents without disabilities. By creating

smart layouts even smaller apartments could harbor a social kitchen and entertaining space and improve the user satisfaction.

The most important need identified in this study was the need to have natural light coming into the apartment from two or more directions. Several obstacles for meeting this need could be identified. Firstly, there is a user knowledge gap, meaning that the actors in the industry does not appear to be aware of the importance of this need. Moreover, the current market situation in combination with an insufficient willingness to pay were identified as obstacles for meeting this need. The current undersupply of apartments in many markets imply that builders do not have incentives to provide needs that cannot easily be translated into an increased willingness to pay or into the most common parameters for comparing apartments. Another obstacle that was identified is lack of competence, meaning that designing apartment buildings where every apartment has windows in two or more directions can be an architectural challenge. However, this study hopes to highlight the importance of this need, in order for it to become prioritized among actors in the industry.

7.2.3 Summary of Main Obstacles and Main Needs

The following table provides a summary of the potential action in addressing the main obstacles and highest prioritized needs.

OVERVIEW OF MAIN OBSTACLES AND NEEDS

Obstacle/Need	Potential action
Incentives and Current Market Situation	<ul style="list-style-type: none"> • More information about what good quality is • Measures like total cost of ownership or life-cycle cost to better consider whole total cost • Increased cooperation between actors, both builders and property managers as well as builders and ICT providers • New actor that integrates systems, especially ICT and construction • Industry standard to make it more comparable with common areas not included in the square meter measurements • Stimulation and grants to encourage innovation and risk-taking
User knowledge gap	<ul style="list-style-type: none"> • Implementing similar user needs research methods like this report • Considering the final user, not only the developer
Willingness to Pay	<ul style="list-style-type: none"> • Find cost-efficient solutions that do not increase the price • Find segments of the market with higher willingness to pay • Reframe solutions to future cost-savings
Rules and Regulations	<ul style="list-style-type: none"> • Assessing which rules and regulation that is outdated and has the most negative impact.
Technology-Related Needs	<ul style="list-style-type: none"> • Fill the competence gap for all actors • Work towards industry standards
Secluded sleeping space	<ul style="list-style-type: none"> • Create increased awareness of need
Easy to clean	<ul style="list-style-type: none"> • Improve design process of how the apartments are designed • Increase knowledge for residents of how to furnish more efficiently
Washing at any time	<ul style="list-style-type: none"> • Spread best practices of how to design washing rooms and booking systems • Industry standard of information of how many residents per washing machine
Social kitchen	<ul style="list-style-type: none"> • Change regulation for how bathrooms and bedrooms needs to be allow different layouts
Natural light	<ul style="list-style-type: none"> • Increase knowledge of the need • Address architectural challenge of providing several windows without adding too much cost

Table 15

8 Discussion

This section will reflect and discuss the findings and analysis of the study, in relation to the research aim of complementing the understanding of Smart homes with the user perspective. The questions of what housing needs Swedish people have, what obstacles that exist for supplying housing that meets these needs and how these factors relate to the understanding and potential of Smart homes will be discussed.

8.1 Understanding the User Needs

One of the central questions of the study has been to explore and understand current and nascent housing needs for young people in Sweden, in relation to the concept of the home in general. This is described as the desirability dimension by Bayus (2008). The needs ranking and the Needs analysis (6.3 Needs Analysis) can be seen as answers to this question on a high level, but this section will go further into interpreting and discussing these results.

8.1.1 Identifying User Needs

One overall impression from looking at the results from both the Contextual interviews and outcome from the Survey is that although there certainly are needs that are new or nascent, many of the needs not very novel or surprising. After all, having a home is a very fundamental human need, and our fundamental needs does not change much over time. Indeed, factors like natural light, secluded sleeping space and common areas for socializing are quite similar in our study and in the 1931 study, more than 80 years ago (Kadefors & Bröchner, 2011). In terms of the FCE model, many of the desired end-states reflect our fundamental needs and are fairly stable over time. However, the features, seen as means to fulfill the needs, and the consequences that the features create change over a shorter time horizon, affected by ever-changing societal conditions, lifestyle and technology. Understanding the balance between our basic, fundamental needs and the features that can be used to fulfill them is the key in understanding how to develop the concept of homes into something increasingly attractive that can support the residents' lifestyles. Using a cross-sectional method, this study has aimed to shed light on what features that people want today, by making a snapshot of people's needs and wants related to housing, but also understanding the context of their lives and homes.

When looking at the highest ranked needs directly, putting them together into a theoretical apartment would give a quite interesting result. Interior-wise, it would be an apartment that bathes in natural light from several directions and has much social space, including a big kitchen and a common outdoor area. The larger size of the social areas are weighed up by having a

smaller, but secluded, sleeping space. The apartment would be designed to be easy to clean and has the possibility to include cleaning service in the rent. The house would be of highest build-quality and with well-designed utilities for waste management and recycling, and perhaps a modern washing setup where the residents never have to wait long for a laundry time. It would also have some novel technological features, namely a shutdown button for electronics and automatically regulated temperature and lighting. For a visualization of this theoretical apartment, see 8.1.3 Conceptualizing the Smart Home.

According to this study, an apartment with these characteristics would be in-line with the needs of young people today. Even though this is quite theoretical, it does highlight some interesting findings. One is the balance between socializing and having a private sphere, shown by the needs of space for guests and a big kitchen as well as the secluded sleeping space. The needs of washing at any time, easy to clean and cleaning service on the other hand shows something interesting about the view on chores and that many consider it desirable to spend little time on them and being able to integrate them into the daily life in an easy way. Looking at the highest ranked need, natural light from several directions, and well-functioning waste management and recycling, which was also a highest ranked need, this shows that there are several important needs that are neither complex nor new, but still considered unfulfilled or lacking by many people. The needs classified as basic but underserved also points on several needs that are basic and well-known, yet still not fulfilled, for example to be able to get home safely at night, having good ventilation in the apartment, and efficient public transport connections to and from the home. All of this together with the lengthier descriptions of the interviewees and their opinions, gives interesting insights in the various ways young people live today and how they see their current housing.

Looking more broadly on which needs were ranked higher from the survey data, it was clear that main needs were generally ranked higher than excitors, even though this separation was not clear to the survey participants. Of the 10 highest ranked needs, 8 were main needs and 2 were excitors, and from the 10 lowest ranked needs, the relation was the opposite. This makes sense in relation to the Kano model that were used to arrange the categories. Main needs will lead to dissatisfaction if absent which Excitors will not, so it is logical that they will be ranked higher when compared to each other.

A general trend was that many needs that were more concrete in their nature, such as layout issues or waste management, were highly ranked, whereas more conceptual needs like furnished apartment or simple subletting were lower ranked. The obvious explanation is that the former

were considered to be more important, but another explanation is that it was difficult for the respondents to picture the needs that were new or more conceptual in nature, and that these were therefore not selected to the same extent. This does not necessarily mean that the lower ranked needs are irrelevant in the perspective of the users, but given the setup of the survey where the respondents could only select up to ten needs, these were lower ranked. A different setup where the respondents were asked to rate each need individually, or discuss what they liked or disliked about each need could have given another result.

8.1.2 Analyzing User Needs with the FCE-Model

The needs that were identified in the contextual interviews could primarily be categorized into the features level of the FCE-model (see 4. Analytical Framework). However, based on the contextual clues and observations together with the interview summaries it was also possible to identify needs on the consequence and end-state levels of abstraction. However, this analysis can be seen as more subjective than the needs identification, as the abstraction between levels of needs were made by the researchers, and because the interviewees in many cases did not articulate their needs on the consequence or end-state levels.

By understanding the end-states, the underlying purpose and goals of the most important features could be understood. This understanding can be argued to increase the possibility of creating successful solutions related to housing, as the designer or producer can get a fuller understanding of the task that the product or service is designed to solve. In contrast, if the focus would instead be only on the features level, which is arguably often the case when relying only on less rich data such as surveys, a redesigned or new product or service that does not fulfill the needs on a consequence and end-state level could be launched, which would be likely to have a much smaller chance of being successful on the market. In summary, it is important that a solution not only fulfill all the needs on the feature level to be competitive, but that the needs on the consequence and end-state level are also considered.

When analyzing the end-state level of the prioritized needs, two groups of needs could be identified. These groups of needs were characterized as *traditional needs* and *nascent needs*. Both these groups can be seen as areas of needs where the home plays an important role in fulfilling the needs, and thus are important to consider when creating housing solutions. The first group of needs, traditional needs, includes the need for health, social contact, well-being, and relaxation, and are seen as relatively stable over time. These needs correspond to features such as a secluded sleeping space and factors such as temperature and light. Another important theme is around social contact and a sense of belonging, where features such as common areas

outdoors and having space to socialize in the home can fulfill these needs. Looking at the traditional needs as a group, it can be concluded that the home plays an important role for recovery and socialising, perhaps as a contrast to the business of everyday life.



Figure 8

The second group of needs, nascent needs, includes the need for efficiency, flexibility, and saving time, and are seen as new or upcoming needs that develop as a consequence of the modern busy urban lifestyle. These needs correspond to features such as being able to do laundry at any time, easy cleaning and tidying of the apartment, well-functioning waste management, automatic light and temperature, and one button to shut down all the electronic devices. Convenience and the possibility to save time spent on household chores were important themes in the group of nascent needs, together with the possibility to be spontaneous and not having to schedule things in the spare time.

This finding is interesting as some of the interviewees expressed that as they experience high demands and a tight schedule at work, the home became even more important as a stress-free zone where no planning is required. This is an aspect that should be considered in housing development that is targeted towards young people in particular, as the patience for activities that require booking, scheduling, and inconvenience appears to be small. One example that highlights this finding was the waste and recycling facilities, where one interviewee stated that waste management has to be easy and in a convenient location, otherwise the motivation for correct recycling will not be strong enough for people to do it. Another example was that two interviewees stated that they did not want to commit to laundry bookings et cetera in their spare time, as that would limit their possibility to be spontaneous.

When considering the two groups of needs, traditional and nascent, together, a potential tradeoff between the fulfillments of the two groups of needs can be distinguished as they are somewhat opposite in nature. The features and solutions that can be developed to realize the need for convenience and saving time, which are important nascent needs, could potentially hinder the realization of the need for relaxation and well-being in the home. One example of this is that the introduction of smart home technologies into the home could potentially increase the stress of the residents, as connected devices could require input and attention from the residents. Therefore, it is important to consider both the traditional and nascent needs, and also the potential tradeoff between realizing these two groups of needs when developing new housing solutions.

Lastly, another theme is around connection to nature and having a good environmental conscience. Features such as natural light from two or more directions as well as outdoor space fulfill needs related to connection to nature. Moreover, features such as long-lasting buildings with high quality, and energy-saving solutions can bring the users' a better environmental conscience. These are values that are important to consider, particularly in an urban environment.

8.1.3 Conceptualizing the Smart Home

The following sketch was done to conceptualize some of the identified needs into a Smart Home, in order to visualize the findings.



Figure 9

8.2 Understanding Obstacles for Meeting User Needs

This section will discuss the second research question, which relates to the obstacles that exist for meeting the current and nascent needs of young Swedish people, or in other words, what is required to make homes salable (Bayus, 2008).

The results from this study has indicated that the main obstacles for realizing the prioritized user needs are incentives and current market situation, user knowledge gap, willingness to pay, and rules and regulations. These obstacles are considered to be largely context dependent to the Swedish housing industry, but to a certain extent general and therefore applicable outside of the target group of young people in urban areas.

The incentives and current market situation was found to be the obstacle that hindered most of the prioritized needs, and is related to the complexity of the home as a product and the introduction of new competence areas such as electronics and ICT into the housing industry. The later aspect is likely to require increased cooperation between actors or the emergence of a new actor that acts as a system integrator to be able to deliver a product that includes a considerable amount of ICT and electronics. The pricing mechanisms and under-supply that characterizes parts of the Swedish housing market are also issues that impact this obstacle, which could be solved by special subsidies or grants to encourage innovation and risk-taking.

A knowledge gap among actors in the industry concerning their users was another obstacle that appeared to hinder several obstacles. This could partly be explained by the actor structure where the developer is the customer of many actors in the industry, whereas the users are merely an indirect customer of these companies. This implies that the connection and knowledge about the users are hindered by the indirect contact between actors and users.

Another important obstacle is the insufficient willingness to pay, that was identified as an issue hindering the realization of some of the user needs. Despite this, these needs still exist, and possible ways to address this obstacle could be cost-efficient solutions, niches or customer segments, or changing the business model.

Rules and regulations have also been identified as an important obstacle, primarily regarding building regulations on the layout, a lack of standards for smart technology in the home, and the under-supply that is characterizing the current market. However, thorough investigations into the rules and regulations impacting the Swedish housing industry are beyond of the scope of this study, and is therefore subject for further verification before any conclusions should be drawn.

The identified obstacles in this study have partly provided an answer to the second research question, although the limited number of interviews with practitioners and academics in the industry implies that additional obstacles could exist that have not been identified in this study. Moreover, no verification of the identified obstacles and their hindrance of the identified needs with practitioners and academics has been conducted within the scope of this study. Therefore, suggestions for future research within the area are to verify the obstacles and the mapping between needs and obstacles, and subsequently further explore solutions on how to overcome the obstacles to be able to meet the prioritized user needs.

8.3 A Broader perspective on Smart Homes

This section discusses the results in relation to the third research question, how the results from this study relate the understanding of the concept of Smart homes.

8.3.1 The User Perspective on Smart Homes

One of the aims with this study was to complement the research on Smart homes, which is currently dominated by a technological perspective, with the user perspective. In order to take this perspective, this study has related to previous definitions of Smart homes, but not limited the scope of inquiry about Smart homes to these definitions. Instead, needs related to housing overall were investigated. This resulted in a number of prioritized needs that could not directly be connected to the previous scope of the Smart home concept, but also needs that are related to the current definitions of Smart homes.

Among the prioritized needs, three needs stand out from the others based on their clear connection to the current definition on Smart homes: automatically regulated temperature and lighting, a shutdown button for all electronics, and the possibility for washing at any time. These are all needs that can be solved or aided by the introduction of Smart home technologies. For example, being able to see the availability of washing machines in a shared laundry room from a smartphone app, or being able to remotely control the washing machine to switch from washing to drying without having to go to the laundry room could be examples of solutions that work towards meeting this need.

However, one important finding related to technological solutions in the home, primarily based on the contextual interviews, was that there generally appeared to be a low willingness to pay for some technological products for the home within the target group, which is something that need to be considered when developing Smart home solutions. Furthermore, another factor that need to be taken into account when developing Smart home solutions is something that was mentioned by several interviewees, which is that the extensive time and engagement that is

needed for installation and setup of technological products and devices is a factor that hinders them from buying these products.

One example is that one interviewee explained that she would like to have a sound system, but that she did not have the time nor the energy to read up on how to install it and do the installation. This indicates that producers of Smart home technologies should package the products so that installation and setup is included, or can be done without any previous knowledge or experience, to increase the desirability and salability of their products on the broader consumer market. In many cases, for example with the need for automatically controlled temperature and lighting, the product need to be installed in the building phase. In this case, the customer and the user are different actors, and the main issues from the user perspective is their willingness to pay, and the usability and maintenance of the product or service.

Another finding in this study was that on the consequence and end-state level of needs related to housing, two groups of underlying needs related to housing could be identified. These were traditional needs and nascent needs as presented in 8.1.2, which showcased the tradeoff between different needs that users want their home to fulfill. On one hand, being able to relax and socialize in the home is important, and on the other hand solutions that make the home convenient and saves time on chores and maintenance are important. This implies that there is a tradeoff between the needs related to the sometimes stressful and time efficient lifestyle of young people in urban areas today, and the home as a stress-free zone that offers well-being and relaxation.

Moreover, this study has shown that there are individual differences in the needs related to housing, and this adds a layer of complexity when developing Smart homes. Instead of attempting to find one solution that fits all users, it can be valuable to segment the users or develop niche housing targeting a smaller group of users for example users who want to minimize the time they spend on household chores. Another suggestion is to leave things up to the user, so that they can decide what features they prefer from a variety of different features or settings. Lastly, the results from the contextual interview highlighted the value of having personal items in the home, and creating a home over a period of time by collecting different pieces at different time. This aspect is something that needs to be considered when developing solutions for Smart homes, to find a balance between the pre-installed and defined aspects of a home and the freedom to build a personalized home that is changing with its inhabitants over time.

In this study, one aim was to complement the user perspective on Smart homes with a deeper understanding of the user needs, in relation to technology designed for the home context and the context of the use. We believe that we have succeeded with this aim, as our method has focused on the users and contextual factors in their homes, and that our findings have shed light on different levels of the users' needs as well as suggestions for steps to create more user oriented solutions for Smart homes.

8.3.2 Implications for the View on Smart Homes

This section will discuss what the findings of this study imply for the understanding and definition of Smart homes. It will argue that the current view of what Smart homes are and what it can do is questionable, but also points towards how it can be successful.

In order to address this, we will begin to frame the question in the light of what a home actually is. As previously noted, the home fulfills both basic, and traditional needs as well as nascent needs, and the ways that they are achieved change over time. A home can also be seen as a product, and similar to how other products develop over time by becoming increasingly effective in meeting customer needs, homes can also be said to develop over time as it becomes better in meeting the needs of residents.

In relation to this, much of what is generally called Smart homes refers to a specific type of homes that have added technological aspects, especially Information and Communications Technology (ICT), as discussed in 4.1 A User Perspective Approach on Smart Homes. The most extreme proponents for these Smart homes make claims that they are the new generation of homes that will replace conventional homes. However, when this is put in the perspective of this study's findings with the two groups of underlying needs, traditional needs like health and well-being as well as nascent needs including saving time and being flexible, we believe that the understanding of what this type of Smart homes can achieve needs to be changed. We believe technology and specifically ICT is one type of solution that can be suited for solving some of the nascent needs, but is not well suited to solve most of the traditional needs.

It seems difficult for Smart homes with ICT to solve some of the important, traditional needs identified, both on a feature level and on an end-state level. For example, how could ICT make it possible to have natural light, a secluded sleeping space or a social kitchen, the three highest ranked needs from the survey? Furthermore, ICT solutions are probably also not the best way to address the end-states of these needs, like feeling relaxed, having private space, social contact or feeling connection to outside from indoors. There is however, a potential for ICT to address some of the nascent needs, such as saving time and allowing more flexibility, for example

through remote monitoring or other time-saving functions. Nevertheless, if one were to frame Smart homes as the logical and natural development of the whole concept of homes, one would make the error of having a set of solutions looking for problems. A better way to develop the concept of homes would be to focus on all the different, important needs and problems and try to find the best solutions for them, regardless of whether they include “smart technology” or not. Terminologically, it would be strange to call this type of home that meets all important needs regardless of technology, for a “Smart home”, as it simply is a “better home”. Smart technology and ICT could definitely be a part of the puzzle to create the future, better home as it can solve some of the nascent needs, but it also needs other solutions than can better address the traditional needs.

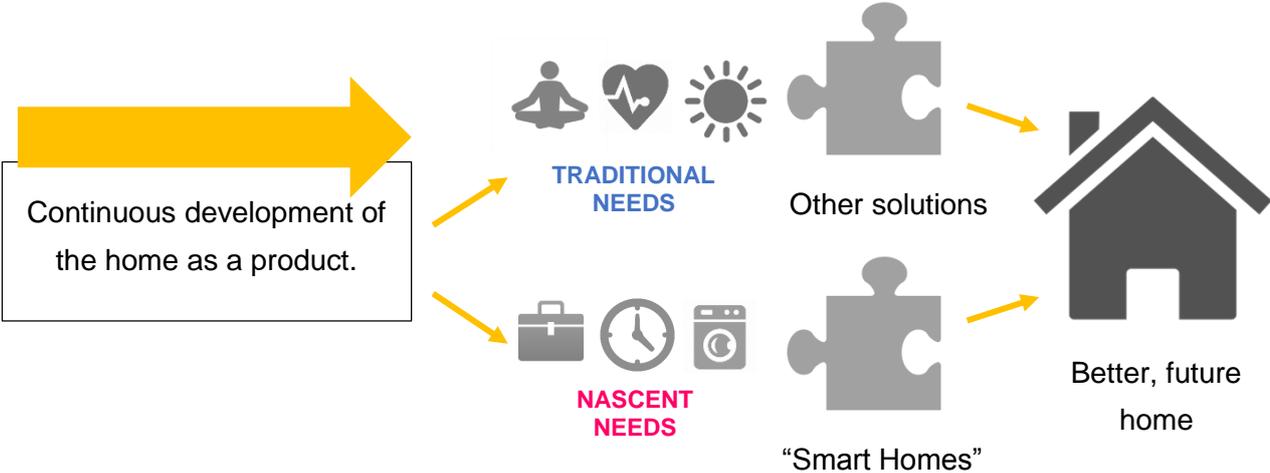


Figure 10 Describing the development of the home as a product, and the development of future homes. Smart homes could solve some nascent needs, but other solutions are also required to create better future homes.

From an industry actor or academic perspective, it is understandable that many companies or researchers want to promote their solution of Smart homes as the solution to all housing needs, as they have their specific competence and resources and it is natural for them to want to apply it where possible. From a market perspective however, it seems more logical that the market, meaning the people that actually are going to pay for and live in the homes, would spend their money on needs that they think are important. This could perhaps also help explaining why there has not been a significant mass-market breakthrough of Smart homes yet, despite there being talks about it for a long time. Of course coupled with many other obstacles as described earlier, one key factor could quite simply be that the market does not value the solutions to the

problems that Smart homes provide enough, as they do not address their important, traditional needs. This could also be understood in the context of the Kano model. Consistent with the findings in the survey, it seems unlikely that someone would want excitors, which is what many features from Smart homes provide, when their basic needs are not yet filled. It would be like trying to sell an umbrella with a digital thermometer when it is not even waterproof.

It is understandable that it is alluring to develop technological solutions to problems that are easy to solve, as many of the more important, fundamental needs remains unsolved because they face fundamentally difficult obstacles. For example, there is always a tradeoff between cost and quality, there are public goods-issues with common areas and there is the dilemma of having regulation that protects weaker groups but is hindering for others. On top of that there are obstacles in the industry like big investments and long product life cycles. These things make the fundamental issues difficult to solve, but it still seems unwise to believe that providing new solutions through Smart homes that solves problems that are less important can compensate for not solving the more important problems.

Despite this perspective of the fallacy of seeing Smart homes as the solution to all needs to the home, there is still a role that the technology in Smart homes can play when it comes to developing better homes, although more limited. Even though it might not have the best solutions for the traditional needs, it can still be successful if it finds the right target groups for the nascent needs that it actually can solve. Understanding the role that Smart homes can play also gives the technology better conditions to succeed in what they actually can change in a good way.

There are important factors to consider for the technology in order to succeed. One is, as mentioned earlier, to identify the types of users who have a higher preference for the needs that the technology can solve and less problems with the issues that it cannot solve. Although underlying needs are quite similar for most people, the nuances and features can vary much between people and it would be important to identify early adopters which are more receptive to what Smart homes could offer. This could be technology-friendly people who do not have other issues with their housing. Apart from this, designing the solutions with the user in mind, in order to produce user-friendly solutions is important.

It should also be said that not all “smart technologies” are the same. As discussed above, technology without clear benefits for users face challenges for adoption. However, there are also technologies that might not have clear individual user benefits, but where other benefits are important, such as benefits for society or the environment, for example saving energy in the

home or using environmentally-friendly materials and building processes. These technologies have other strong reasons to get adopted than clear benefits for the individual residents, but might on the other hand face challenges and obstacles due to the vague or unclear individual incentives for adoption. The expert interviews and investigated current housing projects in Sweden gave a consistent picture of emphasizing sustainability aspects in new housing developments and research. Therefore, we argue that the sustainability aspect of Smart homes should be more emphasized in the future development of the Smart home concept, given its focus in the industry and the challenges that Blumendorf et al. (2013) address related to the sustainability of Smart homes.

8.4 Reflections on Research Aim

This section will reflect and discuss the findings and analysis of the study, in relation to the research aim of complementing the understanding of Smart homes with the user perspective. The questions of what housing needs Swedish people have, what obstacles that exist for supplying housing that meets these needs and how these factors relate to the understanding and potential of Smart homes will be discussed.

The aim of the research has been to complement the understanding of Smart homes with the user perspective, and this has been done by investigating three research questions. The answer in relation to the first research question of what housing needs young Swedish people have can be broken down in several parts. The long list of 39 needs from the contextual interviews and their ranking in the survey answers the question on a surface-level, and tells things like that natural light and social kitchen are important needs and that there are other basic needs that are currently not fulfilled. When looking at the question on a deeper level, taking into consideration the underlying aspects and motivations of the needs, the finding is that there is an interesting dynamic between timeless, traditional needs related to health, well-being and relaxation, as well as more emerging, nascent needs related to saving time and flexibility. Even though different people exhibit various levels of the two groups of needs depending on lifestyle, it is an interesting finding which says that some things are unchanged, while some things evolve over time.

In relation to the second research question about obstacles for fulfilling the needs, the main findings are that the incentives & current market situation, user knowledge gap, insufficient willingness to pay and rules & regulation are the main obstacles that need to be addressed to fulfil the prioritized user needs. Important action to address this could be increased cooperation

between actors, to develop the user needs research methods and to strive for cost-efficient solutions that do not increase the price for the customer.

The general understanding of Smart homes has been complemented as part of the third research question. By adding the user perspective, several points have been made in addition to the current understanding of Smart homes. The most important is that technologically focused Smart homes only can solve some of the needs that people have related to housing, primarily the identified group of nascent needs, but they are however not as well suited to solve traditional needs like well-being and relaxation. This means that it is difficult to see Smart homes as the natural development of the whole concept of the home, as it only solves some of the current problems that homes have. Furthermore, in order for Smart homes to be able to solve the problems that they are fitted to solve, it is important to better consider the user perspective in developing solutions and also to find ways to integrating the technology into the construction of homes, in which bridging competence between the housing sector and ICT sector is one important factor.

9 Conclusions

This study has explored the user needs related to housing in the in the Swedish urban context, with a focus on the needs of young people. The goal of the study was also to identify potential obstacles for meeting these needs to be able to explain why these needs are not currently being met. This was done by creating an understanding of the housing industry in Sweden. Moreover, the concept of Smart homes has been investigated from a user perspective, aiming to complement the research in this area that is largely dominated by a technology perspective.

This study has addressed the user perspective on the concept of Smart homes, and by a mixed method of contextual interviews and a survey, it has been possible to identify the most important needs that young people in urban areas have related to housing. We found that the current definition of what encompasses Smart homes means that Smart home solutions are only able to meet some of the users' most important needs, namely nascent needs including saving time and having flexibility. However, many of the important needs for housing are traditional like health, relaxation and well-being and were found to have been quite stable over the last 80 years, and do not have a clear connection to the concept of Smart homes. These conclusions imply that the concept of Smart homes should be seen as one component in the future development of homes, rather than the natural development of the entire concept of homes.

Despite the limited role that this implies for the concept of Smart homes in the overall development of homes, this study also found several user needs that has great potential to be met by developing Smart home solutions based on automation and ICT. It could be concluded that the user perspective provides a deeper understanding of the users and the context where Smart home products can be used. By applying this perspective, the study could identify several areas of improvement for the design and development of Smart home products that could improve the possibility of creating Smart homes that will be successful on the market. These could be focusing on the packaging of the product to make it easy to install, targeting niche users with higher interest and not limiting the opportunities for the residents to customize their homes.

Another important factor for developing solutions that meet the user needs is to understand the obstacles that exist within the industry. Strong conclusions about the obstacles for meeting the identified needs could not be drawn in this study, as that would require further investigation and verification, but indicative results and explanations could be identified. The primary obstacle that could be identified was the current market situation in Sweden, including a

somewhat non-purposive actor structure and an under-supply on the market leading to lack of incentives for innovation and risk-taking.

This study also aims to highlight the usefulness of certain methods for understanding user needs, such as focus groups with users, contextual interviews, the Kano model and the FCE-model. These methods, in combination with involvement and personal contact with the actual users, provide deep insights and understandings which are valuable to develop successful products and services for housing in general and Smart homes in particular.

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10.1.1.1 Interview sources:

Researcher at Chalmers (personal communication, September 21, 2015).

Appendix

This chapter contains data that complements the findings in the main report.

Appendix A: Focus Group

Activity matrix

Example of result from Activity matrix.



Figure 11 Example of result from Activity matrix.

Resulting drawings from focus group

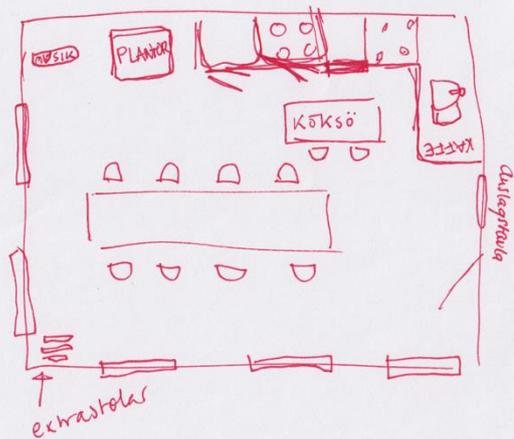


Figure 12 Drawing of the whole apartment.

ÄTA & LAGA MAT

Designa aktiviteten!
Designa hur en lösning för den här aktiviteten i ert gemensamma hem.

Tid: 3 minuter



- egen kaffestation
- flera kylar
- snygg hylla - kokböcker, vin
- ljus - många fönster, bra belysning
- kTHsodling
- sopsortering
- anslagstavla
- möjlighet till gäster, utdragbart bord
extra stolar
- diskmaskin
- musikanläggning



Figure 13 Drawing of the activity Eating and cooking.

Appendix B: Expert interviews

Interviewed experts

#	ORGANIZATION
1	Chalmers (Department of Service Management)
2	Chalmers (Department of Architecture)
3	HSB (working with HSB Living Lab)
4	Riksbyggen (working with Riksbyggen Positive Footprint Housing®)
5	Riksbyggen (working with sustainability)

Obstacle - long list and examples

CATEGORY	SHORT DESCRIPTION	EXAMPLES
External factors	Rules and regulations	<p>Difficult to build cheaper as same rules apply to all housing, at the same time don't want "slum" areas. Difficult to build cheap particularly for rental apartments</p> <p>Also difficult to affect the price by for example leaving parts of an apartment for the buyer to finish is difficult as it still need to pass the inspection, might also not be cost effective compared to making 130 similar bathrooms for example.</p> <p>Parking norm, have to build a certain number of parking spaces for each apartment, which is expensive and takes up space.</p> <p>Takes too long to get land to build on</p> <p>Slow legislation process when it comes to hazardous and environmentally harmful chemicals.</p>
External factors	Voice in the discussions	<p>The ones with money and power have the privilege of formulating the problem in the discussion, the needs of young people can be different compared to what is being discussed as the needs of young people.</p>
External factors	Process	<p>The process makes it expensive to build, particularly rental apartments, have to improve in this area</p>
External factors	Price levels	<p>Does not work to have a max price for new development apartments as the price will go up when the first owner sells onwards anyway</p>
External factors	Infrastructure	<p>The cities are built for cars, but good public transport and cycling is important for designing good homes. When extending the metro for example the building companies are closely involved</p>
Industry structure	No incentives for providing	<p>Actor structure/level of vertical integration</p>

Industry structure	Lack of incentives for innovation	Sales are going very well so firms don't feel the need to innovate
Industry structure	Lack of long-term perspective	Developers who build and sell do not have incentives for making long-lived buildings that are easy to maintain.
Industry structure	Difficulties to capitalize on providing a solution to the need	E.g. difficult with common areas, apartments with lot of common areas get higher square meter prices, depends on what they buyer prioritizes. Riksbyggen takes the risk in this situation and want to learn from it
Industry structure	No holistic sustainability assessment of buildings	“miljöbyggnad guld” does not take into account all aspects of sustainability such as mobility, social sustainability and the construction site
Industry structure	Definitions of smart homes	No uniform definition of the concept smart homes
Industry structure	Lagging design and innovation process	The design and innovation process in the housing industry is lagging behind compared to other industries
Internal for companies in the industry	Knowledge gap	Unaware of the needs
Internal for companies in the industry	Lack of competence	Among developers, constructors, residents.
Internal for companies in the industry	Risk aversion	Risk aversion among actors due to large investments, under-supply (sellers' market). Risk aversion among buyers due to resale possibilities.
Internal for companies in the industry	Misguided creativity	Creativity in the industry is targeted towards creating “150 different bathrooms” instead of designing something new such as a system for sharing.
Internal for companies in the industry	Learning	Transferring learnings from projects is a challenge
Internal for companies in the industry	Lack of user involvement	Homes are not designed primarily with the people who are going to live there in mind, preference-based user research.
Residents	Housing as status mark	The housing as an important status mark becomes problematic in creating sustainable housing
Residents	Insufficient willingness to pay	
Residents	Maintenance	Difficulties in maintaining shared resources in the building such as a greenhouse, enthusiasts may take care of it initially but can be difficult later on.
Residents	Lack of information	People are unaware of how chemicals in the built environment affect them, and it's difficult to appropriate the cause of for example cancer to specific chemicals from the built environment for example
Residents	Tradition and resistance to change	Housing is very similar allover and what is being built is affected by patterns and social structures.

Appendix C: Contextual interviews/needs

General contextual interview template

The interviews were semi-structured, so the interview template was not followed strictly. Additionally, the template would be customized for the different interviewees depending on their characteristics.

Introduction

Introduce the project, IVA and Attractiveness for Sustainable Growth and focus on Smart Urban Homes

Questions

Current housing

- Could you please tell us about your current housing?
- How do you live currently?
- When did you move in?
- How did you get your current home, was it easy/difficult? What options were there?
- Why do you live like you do now? (Shared home etc.)
- How does it differ from your previous housing? What is similar?

The rooms

- Which rooms are there, how are they used? When are you there?
- What do you think about the size and form of the rooms?
- What do you think about the layout?
- Which is your favourite room? Why?

Form of tenure/the house

- Are you knowledgeable about the maintenance that is planned/will be carried out in the future?
- What do you think about your housing cost? Is it good value for money?
- Are there any common areas to use?

The housing cooperation (bostadsrättsförening) (Optional)

- What is your relation to your housing cooperative?

Rental apartment (optional)

- What do you think about living in a rental apartment?
- Possibility of affecting interior and personalize, enough or would do you want more?
- If student apartment: what consequence does it have that it is a student apartment?

Living alone (optional)

- Why did you choose to live by yourself?
- Have you lived alone before? Have you lived together with other people before?
- Where do you like to meet friends and family?
- At home, away, with friends?

Living with friends (optional)

- Why did you chose to live in a shared apartment?
- How well is the apartment suited for living together?

Living as a couple (optional)

- How come you chose to live together?
- How well is the apartment suited for living as a couple?

Living together (optional)

- Did you have previous experience of living together from before?
- Did it affect the decision to live together?
- Please tell how you think about
 - Food & purchasing
 - Economy
 - Cleaning & laundry
 - Socializing
 - What are the benefits with sharing?
- Are there any conflicts or problems that you have encountered before?

What is good/bad things with your current housing?

- What do you think about
 - Location/area

- Number of rooms, size and form
- Style/design of the apartment and decoration
- What are your best memories from your housing? How did it feel?
- When have you been the most irritated on your housing? Why
- What in this apartment are you the happiest with?
- What would you like to change? What would you do if you got 40 000 SEK? If you got 1 million SEK?

Dream home

- What is your dream home?

Lifestyle

- What does the concept of “home” mean to you?
- How much time do you want to spend at home? More or less than you do today?
- What does your home say about you as a person?
- Does it say a lot, or is it independent?
- Weekdays/weekend - is it any differences between how you use your home?
- Rituals - are there any chores you do that work like rituals? (I.e. washing, doing dishes etc.)

Work (optional)

- How has your relation to your home changed since you started working?
 - Cost, area, what you do at home
 - Less time
- Is the time you spend at home more or less important if you work a lot?

Around the apartment

- Which modes of transportation do you use?
- How does your transport to and from the home work?
- Is it too long/short?
- How would you want to transport to and from the home?
- Accessibility, what is available in the vicinity etc.
- Do you feel safe when getting to and from the home?
- Do you feel safe in your home?
- How do you do to be outside? (Balcony, common outdoor area, talking a walk etc.)

- Is it good?
- What could be better?
- Would you want to be more or less outside?
- What is your relation to your neighbours?
- How would you want it to be?
- Do you prefer living in the city or outside? Why?

Consumption/maintenance

- How much time do you spend on cleaning and maintaining the home?
- Would you like to spend more or less?
- What things do you need help from others with fixing in the home?
- How do you think the maintenance of the house works?
- What kind of electricity do you have?
- What happens with the trash?
- What do you know about electricity, heat and water consumption?
- Have you done anything to change your consumption lately?
- Do you worry about chemicals in the home? From furniture, the house etc.

Two exercises

Needs exercise (see template below)

Choose 5 of these needs that you find most important!

- How can each need be satisfied in the home?
- What functions do you need to meet these needs?
- What needs can only be met outside the home?
- What would be required for these needs to be met in the home instead, or is it not preferable?
- Are there any of the needs that could be satisfied outside the home instead?

Choose your home! (See template below)

You can choose one of the following housing-scenarios

- How would you imagine living in this place? Money would not be a factor!
- Why did you choose the one you chose?

Needs exercise

Choose the 5 needs that you think are most important (circle them)

safety	simpleness	excitement
community	independence	quietness
loneliness	inspiration	appreciation
fun	esthetics	self fulfillment
relaxation	nature	contact
belongingness	passion	

Choose your home!

Live on a boat	Live with 20 friends	Live in a tent
Live on the 50th floor	Self-sufficient farm	Room as a service (access to a network of homes in different places)
Live in a hotel	Live on a deserted island	Live with your home, extended family
Live in a tree	Live with your hobby	The automatic home
Live on the upper floor of a shopping mall (everything for free)	Live in a castle	

Result of KJ Method

The following categories of needs were created using the KJ method for analyzing the contextual interview data.

Category	Description
Living together or alone	Needs related to common spaces and to living in a shared apartment.
Home and context	Needs related to creating a home and to the fundamental aspects of having a home.
Work, leisure, and lifestyle	Needs related to work, relaxation, and lifestyle.
Availability and local environment	Needs related to amenities, transport, and the surroundings of the home.
Layout and rooms	Needs related to specific rooms and the overall layout of the apartment.
Interior and homely feel	Needs related to interior decoration, light and dimensions, appliances, and maintenance.
Building and housing administration	Needs related to the design of the building, waste, water, and energy management, and maintenance and services in the building.
Living and housing situation	Needs related to the tenants housing situation, the process of finding a place to live, and security of tenure.
Technology	Needs related to how technological features affect or could improve the home.

Table 16 categories of needs.

Full list of needs

Category	Need
Living together or alone	Having the possibility to create a secluded space for spending time with guests in a shared apartment
Living together or alone	Having or being able to create space for inviting people over
Living together or alone	Being able to be by yourself without being disturbed and disturbing others
Living together or alone	Common outdoor areas for example for barbeques
Living together or alone	Shared gym in the building
Living together or alone	Common resources like cars, clothes and other things that can be borrowed
Living together or alone	Possibility to choose which people you live with
Living together or alone	Possibility to work from home together with other people
Living together or alone	Having clear, common rules when living together
Living together or alone	A sense of community with the people you live close to

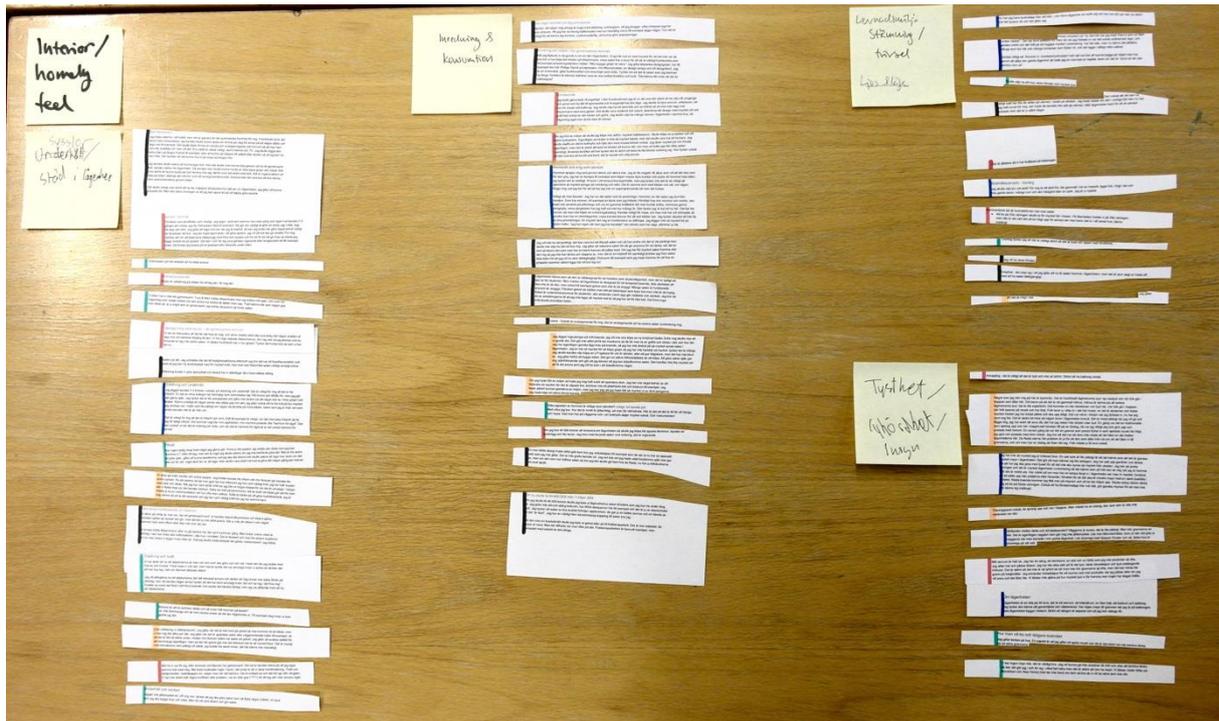
Living together or alone	The possibility for extended family to stay over
Home and context	To be able to have a place called home
Home and context	To feel safe in the home
Home and context	To be able to relax in the home
Home and context	To be able to have a private space
Home and context	Having the possibility to put a personal touch on the home, through furniture, textiles, paintings etc.
Home and context	A building that has features that makes it feel homely, rather than primarily being optimized for efficient use of space
Home and context	Buildings of high quality that age well
Work, leisure and lifestyle	The possibility to work or study from home without distractions
Work, leisure and lifestyle	Being able to relax while being at home
Work, leisure and lifestyle	For the home to be an effortless environment
Work, leisure and lifestyle	The possibility to create a home that suits your values and lifestyle
Availability and local environment	Easy access to nearby jogging and walking tracks
Availability and local environment	Easy access to nearby green areas
Availability and local environment	Being able to use bicycle for transportation to and from home
Availability and local environment	Convenient access to bicycle storage, with or by bicycle
Availability and local environment	Secure bicycle storage in or by the building
Availability and local environment	Public transport with as few changes as possible
Availability and local environment	Access to a mode of transportation that is suited for transporting goods, such as furniture etc.
Availability and local environment	Time efficient public transport possibilities during both day- and night time
Availability and local environment	Getting home safely, particularly during night time

Availability and local environment	Having things that one need to reach every or almost every day within 10 minutes walking distance, such as work, grocery store, and exercise possibilities
Availability and local environment	A balance between being at home and outside of home
Layout and rooms	Sleeping alcove, sleeping loft or bedroom only for sleeping
Layout and rooms	Plenty of space in all rooms
Layout and rooms	Open layout for easy interaction
Layout and rooms	Separate rooms to avoid disturbing
Layout and rooms	Washing room and toilet in two separate rooms
Layout and rooms	Plenty of storage in the apartment
Layout and rooms	A place to put clothes and other things currently in use
Layout and rooms	Storage area, outside the apartment but in the building
Layout and rooms	A big kitchen to be able to cook with friends
Layout and rooms	Good views from the windows
Layout and rooms	Space-efficient solutions for radiators and doors
Layout and rooms	Having a balcony
Layout and rooms	A hobby room for small projects
Layout and rooms	A guest room for visitors
Layout and rooms	Access to a guest apartment for visitors
Interior and homely feel	A good opportunity to customize the apartment by decorating etc.
Interior and homely feel	Good flexibility and opportunities to personalize by furnishing and decorating the walls
Interior and homely feel	Renting or buying a furnished apartment
Interior and homely feel	Features and decoration of the apartment that is aligned with the character of the area and building
Interior and homely feel	Brightness and light in the apartment
Interior and homely feel	Getting natural light into the apartment from two or more directions
Interior and homely feel	High ceiling height for an airy feeling
Interior and homely feel	Old character and personality
Interior and homely feel	Good soundproofing from external noise
Interior and homely feel	Good soundproofing from noise within the apartment

Interior and homely feel	No clear view into the apartment from outside
Interior and homely feel	A system to make it easy to share household chores
Interior and homely feel	Having a dishwasher
Interior and homely feel	Cleaning and household services
Interior and homely feel	Easy to clean and tidy in the apartment
Building and housing administration	To be able to easily put things up on the walls, such as shelves and artwork
Building and housing administration	To have natural materials, such as wood as building material
Building and housing administration	When building in concrete, the walls should not be too thick as that gives a boxed-in feeling and interferes with phone reception
Building and housing administration	High building quality and long-lasting materials
Building and housing administration	Be able to get in touch with the landlord, in an easy and approachable way
Building and housing administration	Quick and convenient measures from the landlord after reporting an issue
Building and housing administration	Possibility to participate in the housing association board also for residents with long or odd working-hours
Building and housing administration	To have a way of communicating with the neighbors around issues related to the building and surrounding area, such as incidents or buying and borrowing items
Building and housing administration	Privacy and anonymity in relation to the neighbors
Building and housing administration	A secure outer door with limited access for non-residents
Building and housing administration	Limited possibilities for neighbors and people passing by to see into the apartment
Building and housing administration	Secure storage for things that cannot be stored inside the apartment
Building and housing administration	Well-functioning waste management with clear and effective recycling possibilities
Building and housing administration	Possibility to collect things that others throw away for reuse
Building and housing administration	Precise and timely feedback about energy and water consumption
Building and housing administration	Adequate heating and possibility to influence the indoor temperature

Building and housing administration	Being able to do laundry at any time
Building and housing administration	Having the possibility to get cooked meals without cooking
Building and housing administration	Cleaning service in the apartment
Living and housing situation	Flexibility in rental contracts, not having to give up queuing time for getting an apartment short-term
Living and housing situation	Option to influence the features and services that you pay for in an apartment
Living and housing situation	Homes that are adapted for being able to sublet in an easy way
Living and housing situation	Contracts and rules that are designed for being able to sublet the apartment in an easy way, both short and long term
Living and housing situation	A feeling of assurance of being able to find a new apartment in case of a changed life situation or needs
Living and housing situation	A form of tenure that is adapted for friends sharing an apartment
Technology	Easy to setup, fast internet access
Technology	Automatically regulated temperature
Technology	Automatically regulated lightning
Technology	A function to shut down all devices when leaving the home

Illustration of KJ method in action



Appendix D: Survey

Survey questions

SURVEY QUESTIONS

Introduction	Description about the study and the survey.
<p>Background questions</p> <p>Select one, option for free-text other (except age)</p>	<p>How old are you?</p> <p>What gender do you identify with?</p> <p>In which city do you currently live?</p> <p>What is your current housing situation?</p> <p>What best describes your current form of tenure?</p> <p>What is your main occupation?</p> <p>What is your highest completed education?</p>
<p>Interest questions</p> <p>Agree/disagree</p>	<p>I often take initiative for purchasing new technology to the home</p> <p>I value the flexibility of easily being able to change home over seeing it as a long-term investment</p> <p>I appreciate spending time on chores and fixing at home</p> <p>I have started a company or plan to start a company within the next five years</p> <p>I value separating work and leisure over having a work where I can work whenever and wherever I want</p>
<p>Need selection</p>	<p>Which of the following things would you want to better enjoy your future home?</p>

Select up to ten out of 30 needs (see appendix X or table X in empirical findings)

Comments and suggestions

Free text, not mandatory

Do you have other housing needs not included in the survey? Please write them here in that case.

Feel free to leave comments!

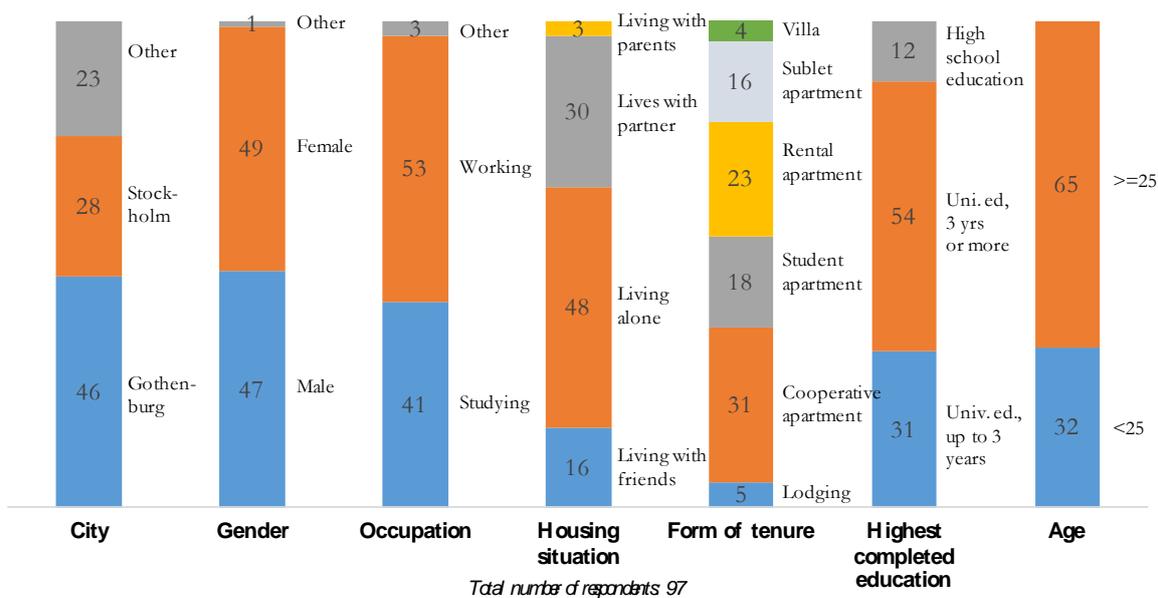
Table 17 survey questions.

Survey respondent information

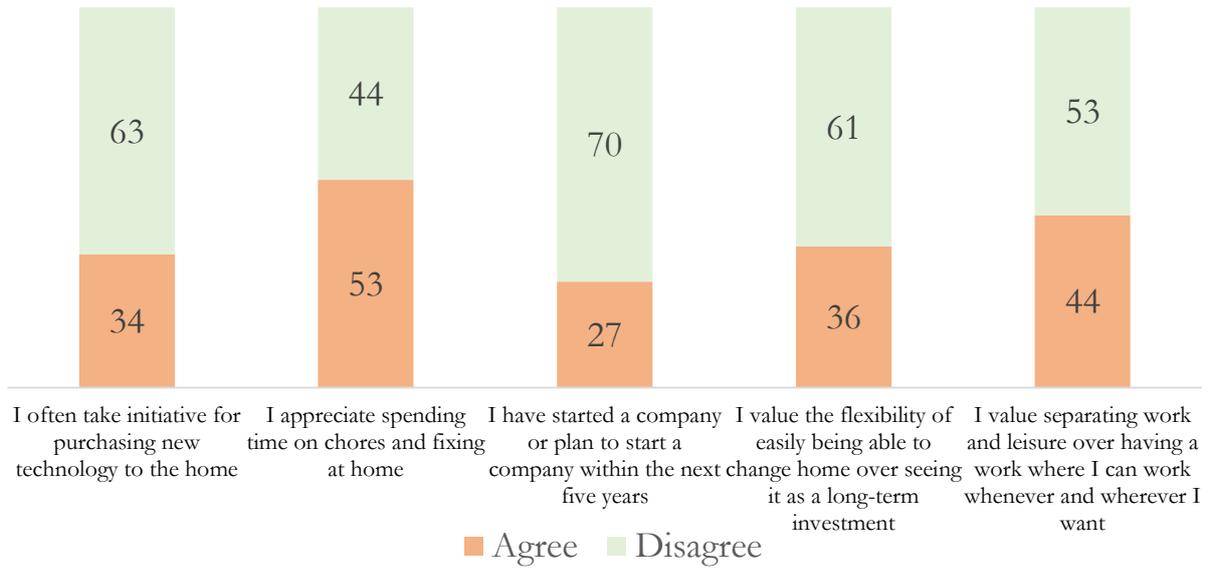
GENERAL SURVEY DATA

Average number of needs selected per respondent	8.60
Average age	25.29 years
Standard deviation, age	2.33 years
Total number of final respondents	97

SURVEY SAMPLE BY GROUP



SURVEY SAMPLE BY INTEREST QUESTIONS



Full survey results

English short	Count	% of all answers	% of respondents	Need rank	Kano type	Category	English long
Natural light	77	9.2%	79.4%	1	Exciters	Interior and homely feel	Getting light into the apartment from two or more directions to get a dynamic natural light.
Secluded sleeping space	73	8.8%	75.3%	2	Main need	Layout and rooms	Secluded space for sleeping (sleeping alcove, sleeping loft or bedroom)
A social kitchen	66	7.9%	68.0%	3	Main need	Layout and rooms	A big kitchen to be able to cook with friends and guests
Washing at any time	52	6.2%	53.6%	4	Main need	Building and housing administration	Being able to do laundry at any time without booking in advance
Top quality building	49	5.9%	50.5%	5	Exciters	Home and context	Buildings of high quality and long-lasting materials that age well and require little maintenance.
Well-functioning waste management and recycling	49	5.9%	50.5%	5	Main need	Building and housing administration	Well-functioning waste management with clear and effective recycling possibilities
Easy to clean	47	5.6%	48.5%	7	Main need	Interior and homely feel	Easy to clean and tidy up in the entire apartment
Plenty of space for guests	43	5.2%	44.3%	8	Main need	Living together or alone	Having or being able to create space for inviting people over
Close to jogging tracks and green areas	42	5.0%	43.3%	9	Main need	Availability and local environment	Easy access to nearby jogging tracks and green areas
Bicycle storage and roads	35	4.2%	36.1%	10	Main need	Availability and local environment	Convenient access to secure bicycle storage and bicycle roads
Undisturbed private space	32	3.8%	33.0%	11	Main need	Living together or alone	Having a private space without being disturbed and disturbing others
Shutdown button for all electronics	30	3.6%	30.9%	12	Exciters	Technology	A function to shut down all devices and electronics with a single click when leaving the home

Common outdoor space	25	3.0%	25.8%	13	Exciters	Living together or alone	Common outdoor areas for barbecues etc.
Cleaning service in the rent	21	2.5%	21.6%	14	Exciters	Interior and homely feel	Group contract in the building for cleaning service in the apartment.
Automatically regulated temperature and lighting	21	2.5%	21.6%	14	Exciters	Technology	Automatically regulated temperature and lighting than can be controlled with simple settings
Shared resources	18	2.2%	18.6%	16	Exciters	Living together or alone	Shared resources like cars, clothes and other things that can be borrowed/rented in the house
Responsive landlord	18	2.2%	18.6%	16	Main need	Building and housing administration	Easily getting in touch with from and action from the landlord when having issues
Community feel	17	2.0%	17.5%	18	Exciters	Living together or alone	A sense of community with the people you live close to
Transporting larger goods	15	1.8%	15.5%	19	Exciters	Availability and local environment	Access to a mode of transportation that is suited for transporting goods, such as furniture etc.
A hobby and project room	14	1.7%	14.4%	20	Exciters	Layout and rooms	A room in the building or apartment for projects and hobbies such as plants, carpentry, and DIY.
Meal service	13	1.6%	13.4%	21	Exciters	Building and housing administration	Having the possibility to get cooked meals delivered to your door without cooking, with a group deal in the house
Instant feedback on water- and energy consumption	12	1.4%	12.4%	22	Main need	Building and housing administration	Precise and timely feedback about energy and water consumption
Reusage	11	1.3%	11.3%	23	Exciters	Building and housing administration	Possibility to collect things that others throw away for reuse, for example furniture, cookware, and utensils.
Communication with neighbors	11	1.3%	11.3%	23	Exciters	Building and housing administration	To have a way of communicating with the neighbors around issues related to the building and surrounding area, such as incidents or buying and borrowing items

System for shared household chores	10	1.2%	10.3%	25	Exciters	Interior and homely feel	A digital system to make it easy to share and divide household chores in a shared housing
Simple subletting	8	1.0%	8.2%	26	Exciters	Living and housing situation	Homes and contracts that are adapted for being able to sublet in an easy way, both long-term and short-term
Optional rental packages	8	1.0%	8.2%	26	Exciters	Living and housing situation	Option to influence the features and services that you pay for in an apartment
Choosing who you want to live with, separate contracts	7	0.8%	7.2%	28	Main need	Living together or alone	Possibility to choose which people you live with and having contracts that are adapted for sharing an apartment
Furnished apartment	6	0.7%	6.2%	29	Exciters	Interior and homely feel	Having the possibility to rent or buy a decorated apartment, with possibility to select between different interior styles.
Flexible rental apartments	4	0.5%	4.1%	30	Exciters	Living and housing situation	Possibility of time-limited rental contracts that can be rented during a short time, without having to give up queuing time

