Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Architecture and Design
Department of Architecture and Technology

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Social and architectural values in sustainable plus-energy buildings and neighbourhoods

Exploring the residents' perceptions

Master's thesis in MSc Sustainable Architecture
Supervisor: Niki Gaitani
Co-supervisor: Sladjana Lazarevic, Ørjan Brudal
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Abstract

The importance of creating well-designed buildings and neighbourhoods is widely recognised, as is the necessity to focus on environmental, economic, and social sustainability in order to achieve good architecture. While there is an agreement on the benefits brought by good design that achieves these goals, it is harder to find a clear definition of what the value of design actually is. The somewhat subjective nature of design value and its multi-faceted character present a clear obstacle in reaching a common definition, and this leads to a simplified understanding of design value that prioritises the more objective and measurable aspects.

Still, the creation of holistically good architecture entails a full comprehension of the value of design and its meaning for all the stakeholders involved. The aim of this thesis is to investigate different interpretations of design value and to reach a common and comprehensive definition. Multiple EU-funded projects are also considered, to verify how their assessment frameworks reflect their understanding of design value. The focus is then shifted to the end-users of the built environment, and their perception of the value of design is questioned. The introduction of a case study selected from one of the previously introduced European projects allows to test the understanding of design value in a practical setting, and to conduct an in-depth qualitative exploration of an otherwise intricate and complex topic. The chosen case study, t' Houdhtof / Maatschappelijk Mooi, is of declared environmental, economic, social and architectural quality: the focus is thus shifted on the user's perspectives, to question how they truly perceive the value of the space. This investigation is carried out through a survey, that specifically targets the user's point of view on social and architectural values: these aspects of design value have a fundamental subjective facet, and surveying people's perception is essential to achieve a comprehensively good architecture.

Acknowledgements

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To my first family back in Italy: thank you to my mum and dad, who always push me out of my comfort zone, and welcome me back in their arms whenever I need it. Thank you to my grandma, who is always excited to hear about my life and celebrates each and every one of my accomplishments, no matter how small they are. And to my friends: despite having lived far from you for the past two years, you have always been by my side, and your friendship has supported me more than I could ever express. I have missed you so much, and cannot wait to come back to you.

Finally, to Trondheim: you have taught me independence, and that I am capable of making it on my own. You have also taught me the importance of human connections, and of keeping those you love close to you. Thank you for your sunsets and your forests, and, above all, thank you for your people.

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1. Introduction

1.1. Motivation

Well-designed buildings and neighbourhoods are recognized as a way to achieve healthy and sustainable communities (Serin et al., 2018). Some sources also draw a direct connection between “good design” and “value”, stating that design provides value through the development of buildings and places that improve the quality of life of their users (Scottish Government, 2013), while others recognise good design as a key aspect of sustainable development (MHCLG, 2021).

While there is an agreement that good design can enhance the general quality of a space, for example through the development of a good street network, mixed-use buildings, and public open spaces (Welsh Government, 2017), it is harder to find a common definition of what, exactly, constitutes the value of design. The difficulty of finding a common definition of “design value” does not, however, justify not looking for it, as having a shared understanding of what makes a certain design “valuable” is fundamental to promoting a truly sustainable built environment (Royal Danish Academy, 2017).

Indeed, there are several projects funded by the EU’s research and innovation funding programme Horizon 2020 that support the creation of more sustainable buildings, neighbourhoods, and cities (European Commission, n.d.). All of these projects aim for a high-quality built environment, and evaluate their success in meeting their goals through assessment frameworks based on Key Performance Indicators. These indicators target the specific goals set by each project, often without considering all the necessary aspects to ensure a comprehensive good design. More specifically, aspects such as social and architectural values are regularly overlooked, in favour of more easily measurable elements such as economic and environmental values.

1.2. Aim and research questions

Considering the lack of clarity around the definition of “design value”, it is not surprising that different European projects have their own interpretation of the value they want to

reach, and of the different focus areas that are needed to reach this value. However, an incomplete understanding of the value of design can lead to a built environment whose quality is lacking and is therefore not truly sustainable. For this reason, this thesis aims to find the answers to two research questions:

(1) How is the value of design considered and reflected upon in the built environment?

(2) What is the users' perception of the value of design, and specifically of its social and architectural aspects, in a sustainable plus-energy neighbourhood?

The first part of the thesis will be composed of a literature review, while the second part will be carried out through the selection of a case study and a survey.

This thesis is not free of limitations: firstly, it is inarguable that the task of finding a universal definition of design value is a hard one, as proven by the conflicting literature concerning this topic. Design value is also, at least partially, affected by subjective opinions, and reaching a common definition that transcends subjectivity and considers all possible areas of design is complex. Secondly, the survey method also carries a set of restraints: since the survey is carried out online, it means that people that are uncomfortable using technologies are less likely to answer. Also, the questions and answer options may be interpreted differently by the respondents, leading to unclear data. Nonetheless, considering the limited time available and the potentially large population sample, it was decided that conducting a survey over interviews would be the best option.

1.3. Thesis outline

This thesis is composed of seven chapters in addition to the introduction.

Chapter 2 gives an overview of the methodologies used to find the answers to the research questions previously described.

Chapter 3 explores the question of what design value is, analysing different explanations that have been given throughout history and reaching a common definition that encompasses all aspects of design: environment, economics, social performance, and architectural quality. The challenge of defining design value at different scales is also

discussed, and the complexity of measuring design value and its subjective dimension is acknowledged.

Chapter 4 questions the understanding of design value by six selected European projects (Cultural-E, +CityxChange, ARV, syn.ikia, CITYkeys, and SmartEnCity) that aim for the development of a more sustainable built environment at different scales. Through the analysis of these projects and their assessment frameworks, the difficulty in considering design value from the user's perspective emerges. A total of 14 Key Performance Indicators introduced by the analysed assessment frameworks are selected to be further considered in the following section.

Chapter 5 introduces the case study of t' Houdthof / Maatschappelijk Mooi, syn.ikia's Dutch demo projects. After a general explanation of syn.ikia's mission, a more specific description of the demo project is provided, alongside the definition of its core concepts and ideals. This is followed by an analysis of the case study from an architect's point of view: what emerges through this analysis is useful to understand how the experiences of the users may differ from what emerges from the technical drawings.

Chapter 6 provides an in-detail explanation of the survey that is developed to evaluate the 14 KPIs selected in Chapter 4, with regard to the case study introduced in Chapter 5. The goal of the survey, shaped on the model of Post Occupancy Evaluation, is to assess the user's perception of architectural and social values in t' Houdthof / Maatschappelijk Mooi. The choice of each KPI is motivated, and the questions that compose the survey are described.

Chapter 7 illustrates the results of the survey, and provides a discussion aiming to answer the second research question of this thesis.

Chapter 8 is the conclusion of this thesis, where the findings of previous chapters are reviewed. A brief section suggesting possible future developments of this research is also included in this chapter.

2. Methodology

To find the answers to the research questions set in Section 1.3, three different methods are employed: literature review, case study, and survey.

2.1. Literature review

For the first part of this thesis, which corresponds to the first research question, relevant literature is identified and systematically reviewed: this is considered the best methodological tool to evaluate the theoretical considerations around the theme of design value in the built environment. Considering that this theme is very wide and difficult to define, it is important to provide an overview of this topic and its interpretation in literature. The discussions and reflections around design value are then used to reach a common definition, which is the starting point for answering the second research question posed by this thesis.

To gather significant literature from reliable sources, different databases were searched. The databases considered were ScienceDirect, JSTOR, Google Scholar, and ResearchGate, and the keywords listed in Table 1 were searched. The literature that emerged from this search was screened, first by considering the titles and keywords, and later by reading the abstracts. These methods allowed to eliminate a significant amount of not relevant literature; the remaining sources were considered when depicting the different understandings of design value. The purpose of this review was not to cover all articles and research ever published on this theme, but rather to combine different perspectives and insights on what the value of design is.

The second part of the literature review aims at investigating the understanding of design value in EU-funded research projects. To do so, the KPIs included in their assessment frameworks are analysed and compared to each other, considering the perspectives highlighted in the previous section. Publications by EU-funded projects typically do not appear in the databases previously mentioned, so a different method had to be used to find relevant projects. It was decided to start from the project syn.ikia, which is coordinated by NTNU, and consider the other projects listed in its network. By doing this and by integrating the search by using Cordis, a website that provides information on all

EU-supported research activities, it was possible to identify a total of five other projects that published their assessment frameworks and whose analysis would be relevant for the goals of the thesis.

Databases	Keywords
Google Scholar	Architectural value
JSTOR	Architectural quality
	Architectural worth
ResearchGate	Building value
ScienceDirect	Built environment value
	Design value
	Design worth
	Good architecture
	Value of architecture
	Value perception architecture
	Value perception design
	Value perception built environment

Table 1. Databases and keywords searched for the literature review

2.2. Case study

The second part of the thesis introduces a case study, which allows to conduct an in-depth qualitative exploration of the otherwise intricate and complex topic of design value. In particular, the case study analysis focuses on the social and architectural aspects of design values, whose definition is one of the results of the literature review, and specifically on their perception from the user's perspective. The case study is chosen among the demo cases promoted by the six European projects previously considered, and the choice of t' Houdhtof / Maatschappelijk Mooi (syn.ikia) is motivated at the beginning of Section 5.

The selection of a case study allows to put the theoretical information gathered through

the literature review into practice, and to test the understanding of design value in a practical setting. The choice of a case study of a declared high standard of environmental and economic value, and that prides itself on its social and architectural quality, means the focus can be shifted to the users' point of view, to question whether the stated high worth of the project is indeed experienced by its residents.

2.3. Survey

The user's perspective in the selected case study of t' Houdhtof / Maatschappelijk Mooi is investigated through a survey. Because of the question's scope, the target population was identified as the residents of the case study; considering that this target population is not particularly large, it was not considered necessary to define a sample, and it was decided that all the residents would be delivered a copy of the survey. The current population of t' Houdhtof is of 36 tenants, and 9 people answered to the survey, which corresponds to a fourth of the target population.

The development of the survey started from the analysis of the European project ARV's report *D8.1 Monitoring, evaluation, and impact assessment frameworks* (Grazieschi et al., 2022), and specifically of its Questionnaire 1, which is tailored to the residents of the area of intervention and focuses on social and architectural qualities. It was decided to use this questionnaire as a guideline, even though the case study belongs to syn. ikia and not to ARV, because ARV's assessment framework was based on syn.ikia's, and it was then expanded and improved to add additional sections, such as that on architectural KPIs. The questionnaire is modified to target the specific KPIs that focus on architectural and social quality and that are identified in Section 4, and it is adapted to the characteristics of the chosen case study.

The survey was written using the online tool Google Forms, which allowed for an easy distribution of the questionnaire to the residents of t' Houdthof / Maatschappelijk Mooi via e-mail, in collaboration with the coordinator of the project. The questionnaire is in English, but the project coordinator provided a Dutch translation to make sure that all respondents could have a clear understanding of the questions.

The option of conducting interviews was initially considered, but ultimately it was decided

against it: while interviews allow to clarify questions and ask follow-up information if necessary, they entail a lack of anonymity, which may cause the respondents to answer less truthfully. Moreover, there is more risk of bias from the researcher standpoint, and the respondents may find it difficult to hold a conversation in English, which is not their mother tongue. However, considering that a total of 9 people answered the survey, it can still be valuable to collect more data on how the residents of the case study perceive design value: such a small sample size combined with the subjective nature of interviews could be ideal to gather significant additional information.

3. The value of design

There is an intuitive understanding of the value of “good” architecture, often defined in terms of functionality, aesthetic, and performance of a building, and of how it affects its occupants. However, this value is considered hard to measure, first and foremost because it is hard to universally agree on the meaning of the word. Moreover, the value of architecture can have different meanings depending on who is looking at it: for an investor, good design can result in a higher rental value, for a developer it means quicker permissions and a more efficient construction process, and for a user good design can produce better health and well-being (Serin et al., 2018). The aspect of time also plays a vital role when investigating the value of design, as its short-term benefits are significantly different from its long-term ones, and they vary for each stakeholder.

Another question that arises is about the definition of value itself: is it an objective or a subjective element? In the first case, it could be more easily measured by considering the inherent properties of a building such as its size and orientation, that can result, for example, in good or bad accessibility and functionality. If however, the value of design is assumed to be a subjective value, it can be argued that it is determined by how it affects the achievement of a desired goal (Schropfer et al., 2020). In some literature, the word “value” is described as the measurable worth or quality of something (Serin et al., 2018), but it must also be recognized that the value of design goes beyond monetary or energy calculations, and it should include all the values derived from a place, including the ones that are more socially or culturally grounded. Other sources (Chiaradia et al., 2017) also define “value” as “worth”, but emphasising how “worth” is a way of assessing whether something matters, and how it matters, to individual people, thus putting the focus on the subjective nature of design value.

It is clear that the question of what good architecture is cannot be answered unequivocally, but just because there are multiple possible answers it does not mean that the question should not be asked.

This thesis wants to investigate the value of design as perceived by the final users, and how it may affect their comfort and well-being. This is heavily influenced by subjective opinions and the difficulty in measuring such personal considerations may be the reason why the research on building occupants and their perceptions has been limited (Schropfer

et al., 2020). Furthermore, many studies on user experiences of the built environment and its effects on their life focus on tertiary buildings, for example, investigating how indoor environmental quality affects work performance and psychological well-being in office buildings (Chen et al., 2020; Elnaklah et al., 2020). Studies on the perception of architecture by the dwellers of residential buildings are lacking.

3.1. In search of a common definition

The difficulty in finding a universal definition of good architecture has been challenged by several people through the centuries, and the most well-known definition of good design might be the one given by the Roman architect Vitruvius in the first century B.C. In his work *De Architectura*, he stated that all buildings must have three attributes: *firmitas*, *utilitas*, and *venustas*, i.e., strength, utility, and beauty.

Two millennia later, the President of the Royal Institute of British Architects Sir Alexander John Gordon claimed that good buildings should exhibit long life, loose fit, and low energy (Gordon, 1972). Known as the 3L Principle, this definition of good architecture somewhat overlaps with the one given by Vitruvius: strength and long life both fall under the category of “durability”, while utility and loose fit are different ways of describing “adaptability”. The main difference in the two definitions can be found in their third element: while the Roman architect recognized beauty as a fundamental aspect of good design, in modern times this has been replaced by “low energy”, i.e., sustainability. Other studies have tried to give an even more tangible and objective definition of good architecture, by linking the performance of the building with respect to the 3L Principle to its average life cycle cost (LCC) per square metre (Langston, 2014). The durability and adaptability of a building result in lower maintenance and refurbishment costs, while its energy efficiency suggests lower energy needs and consumption. It is therefore possible to draw a connection between a good architecture that follows the 3L principle and also has a good economic value.

It can be argued that good architecture must also be defined in relation to its physical surroundings and to the cultural and societal context, that it “should speak of its time and place” (Gross et al., 1993) while also being able to transcend the boundaries of its context and aim for universal understanding. Of no smaller significance, it must be

remembered that good architecture can lead to increased satisfaction, productivity, and comfort for building users.

While Alexander Gordon's definition of good architecture was not particularly popular among his peers, as the sustainable development movement arose in the following years it was embraced more and more. As the world's environmental consciousness grew, the 3L Principle continued to gain popularity. At the same time, more focus was given to the low energy aspect, with the promotion of new green buildings, while less importance was given to long life and loose fit (Langston, 2014). The three aspects, however, must be given equal importance, as a low-energy building with a short life span and low flexibility cannot be considered truly sustainable, nor a good example of good architecture. On top of that, the importance of creating a beautiful built environment and its effects on people's perceptions must not be forgotten.

Overall, it can be concluded that the aspects that comprise a good architecture are both subjective and objective, and include durability, utility and adaptability, sustainability, economic viability, social, cultural, and aesthetic quality. However, it is not possible to define universal values for each of these aspects that would always result in good architecture, as this should respond to the specific constraints of its context and to the needs of its users. Architects should strive to design buildings that are long-lasting while incorporating the flexibility necessary to accommodate future changes and minimising their energy footprint, culminating in an aesthetically pleasing built result in a positive relationship with its physical and cultural context (Murray, 2011).

Three of the seven aspects of good architecture mentioned above overlap with those commonly known as the "triple bottom line" of design value (Serin et al., 2018), i.e., economic value, environmental value, and social value. These are also commonly known as the three pillars of sustainability (Purvis et al., 2019), but a truly sustainable built environment that positively impacts the quality of life of its users must also perform well in terms of durability, utility and adaptability, cultural quality, and aesthetic quality. These can be grouped under the category of "architectural value", which should constitute the fourth bottom line of design value.

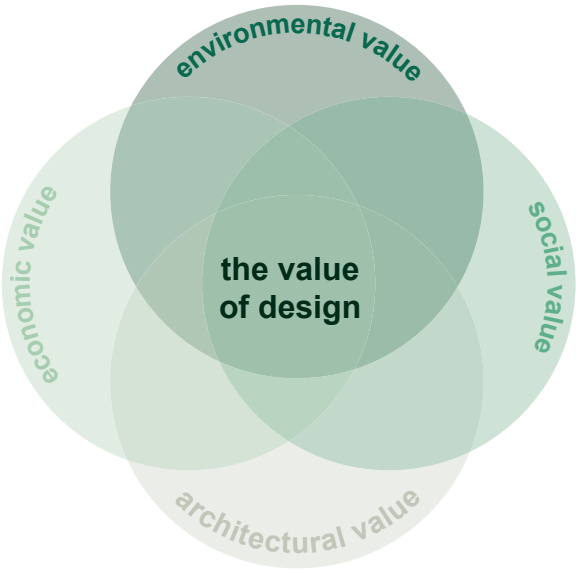


Figure 1. The value of design

3.1.1. The economic value of the built environment

The relevance of the economic aspect in architecture is clear and goes without saying: cost is an important part in the construction of buildings, and a high price may hinder the pursuit of environmental sustainability and other vital elements of good design (Langston, 2014). Good architecture cannot ignore its financial implications, both related to construction and maintenance, or else it will be unattainable in the practical realm.

The economic value of architecture has different meanings for different actors: for building owners and investors, it is important that the construction costs of a building do not exceed its worth; building users give bigger importance to low operational costs, and their perception of the property's worth dictates what rent they are willing to pay (Loe, 2000). Good architecture must take into account the interests of all these actors, to deliver a product that satisfies their expectations to the highest possible level.

When other aspects of good architecture, such as its ecological value, are added to the equation, it becomes even harder to aim for a specific economic goal. Indeed, from an economic perspective, sustainable construction changes business patterns from a linear to a cyclic process (Zhou & Lowe, 2003), creating one of the economic challenges to sustainable construction. One may argue that a building designed according to the principles of sustainability will make up for the higher construction costs with a longer life span and lower operational costs, bringing the overall life cycle cost down (Langston,

2014). However, these long-term profits are uncertain and unreliable, and constitute another challenge to environmentally sustainable construction together with higher capital costs and a lack of accurate cost information (Zhou & Lowe, 2003).

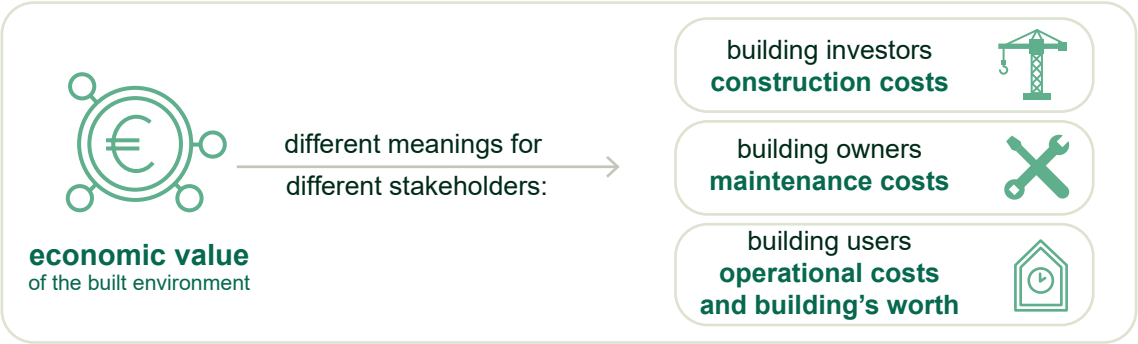


Figure 2. Economic value

3.1.2. The environmental value of the built environment

The building sector is responsible for 34% of energy demand and 37% of CO_2 emissions globally, and these numbers change to 40% and 36% respectively when looking at the European context (UN environment programme, 2022). Of no smaller importance, in Europe the construction sector accounts for about 50% of all extracted materials, and for 35% of total waste generation (European Commission, n.d.). These numbers mean that the gap between the environmental performance of the building sector and the European goal of decarbonization by 2050 is widening (UN environment programme, 2022), and that there is an urgent need to rapidly cut emissions and improve the energy performance of the building stock.

The environmental aspect of architecture is therefore of critical importance in this historical period, and the challenges of creating a more sustainable built environment are many. The environmental value is defined in relation to the impacts of the built environment on the natural environment and is typically tied to more general concerns about sustainable development, i.e., *"building an environment which meets the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland, 1987). While money is used to measure the architecture's economic value, carbon is widely accepted as the currency of its environmental value (Serin et al., 2018).

Some of the elements that contribute to the environmental value of architecture are its use of materials, its greenhouse gas emissions, and its energy consumption (Schropfer et al., 2020). The environmental value of architecture is also related to its resilience: good architecture should be resilient against extreme weather conditions and critical natural events. Another element of environmental value is connected to lifestyle, more specifically exploring how certain urban forms can encourage residents and visitors to adopt a more sustainable lifestyle (Dittmar et al., 2007), for example by walking or cycling instead of driving. Well-designed environmentally friendly buildings and neighbourhoods have the potential to connect people to nature, thus having a positive impact on their health and well-being (Serin et al., 2018). Here it is possible to point out an overlap between the environmental and social value of architecture, and how they both influence people's enjoyment of their surroundings.

Figure 3. Environmental value

3.1.3. The social value of the built environment

Good architecture should deliver more liveable and sociable spaces, and hereby lies its social value. The social value of architecture is strictly related to social equity (Dawson & Higgins, 2009), as design affects every member of society, and a well-designed place has the opportunity to improve the quality of everyday life for all its users. For example, good design can improve the accessibility and inclusivity of a place (Design Council, 2017), allowing people to access it regardless of their physical (dis)abilities or economic conditions. As reported by the Welsh Government, *"Good design is inclusive design, and inclusive design should be an integral part of the design process"* (Welsh Government, 2017).

The social value of the built environment tends to be defined in terms of the creation of job opportunities related to new construction (Serin et al., 2018), but greater acknowledgement should be given to the way in which design, especially at the neighbourhood scale, impacts the local community and affects wider social issues, such as social cohesion and inclusion.

An inclusive society, one where every individual has the opportunity to take part in public life and access the needed services, is packed with social interactions. These social activities are deeply dependent on the quality of the built environment (Gehl, 2011): while the physical framework does not directly affect the quality and the intensity of interactions, architects and planners can influence the ways in which people meet (Gehl, 2011). The interactions between different groups can increase the social cohesion of a community (Woodle, 2018); it follows that inclusive and quality design can counteract social and spatial exclusion, and it can be the first step toward a segregation-free urban environment.

At the neighbourhood scale, physical infrastructures are fundamental for the development and maintenance of social connections. The argument for the design of “social infrastructures” recognises that quality public spaces make urban districts and cities alive, and contribute to their social life (Klinenberg, 2018). These types of places are crucial as they create an opportunity for strangers to meet and interact, to feel welcome and included, and eventually create strong bonds between the population (Latham & Layton, 2019). In this sense, social infrastructures can prevent social isolation and they provide a place where people can come together despite their differences, another efficient way of opposing social segregation (Latham & Layton, 2019).

On top of promoting social inclusion and cohesion, the social value of the built environment includes a range of other values going from health and well-being to successful public transport, from access to services and amenities to safety. These factors are often intangible, and sometimes hard to measure, as they have a significant subjective aspect. Despite the difficulty in quantifying them, the benefits of the social value of design are clear, as it shapes and supports the local community in its everyday functions (Alzahrani et al., 2016).

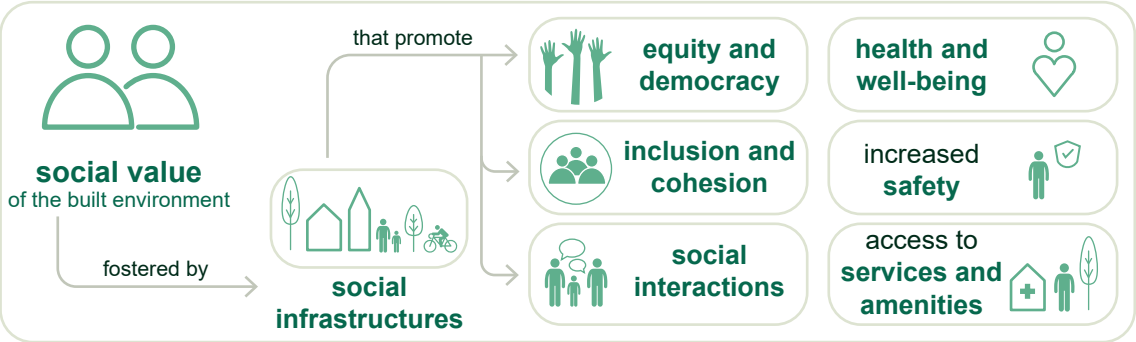


Figure 4. Social value

3.1.4. The architectural value of the built environment

In section 3.1, the architectural value of design was described as being composed of four different aspects: durability, utility and adaptability, cultural quality, and aesthetic quality. These are all building attributes that affect the building's overall quality and value.

Durability, called *firmitas* by Virtuvius and "long life" by Alexander Gordon, is the ability to last for a long time without damage (Cambridge Dictionary, n.d.). More specifically, for the construction industry, there is also a focus on being able to maintain the same level of performance for which a building was designed, throughout its whole service life. The service life of a building does not only have repercussions on its architectural value, but it also has environmental and economic consequences.

Utility and adaptability are part of the functional value of architecture. First and foremost, a building should satisfy the needs of its current users, and its design should reflect the needs that derive from its use. The different objectives of a school, a hospital, and an apartment building necessarily result in different design choices; here is where the value of utility lies. At the same time, good architecture does not only look at the needs of the present, but its design layouts should support a longer lifecycle of the building (Schropfer et al., 2020). For this reason, flexibility and adaptability are fundamental values of good design, as they allow to accommodate for future changes (Murray, 2011). Considering the 3L Principle by Alexander Gordon, this would be a meeting point between loose fit and long life, as these two aspects are deeply interconnected and interdependent.

The cultural value of architecture lies in its nature as a public good, and in how it affects both its interior and its surroundings (Schropfer et al., 2020). Good architecture should

enhance the community value, and in this sense, it is closely linked to the social value. The cultural value of architecture also includes its heritage value: this refers to the inherent value of the architectural, cultural, and historical heritage on which the development is taking place (Serin et al., 2018). A built environment with heritage value should integrate with the surrounding environment and speak of its collective cultural consciousness and identity. The heritage value also has a strong social component, as it is also motivated by the desire to allow future generations to continue experiencing the heritage and culture of a certain place (Scottish Government, 2013).

While architectural value should not be only determined by aesthetics, the perceived attractiveness and beauty of a place are important aspects of its value (Wheeler et al., 2014). Not only does the perceived aesthetic quality of a space influence the well-being of its users (CABE, 2010), but beautiful buildings are also more likely to last longer, as they will be taken better care of (Royal Danish Academy, 2017). In this sense, the aesthetic quality of architecture affects its durability, and in turn its sustainability: as people tend to make a greater effort to look after buildings that they consider beautiful (Royal Danish Academy, 2017), these are the ones that last longer.

Figure 5. Social value

3.2. The challenge of scale

Of fundamental importance to having a complete overview of design value is to understand the significance of scale. Indeed, design value is discussed at a variety of different scales (Serin et al., 2018), and its meaning and implications change accordingly. According to a source, design should include everything that goes *"from the city to the spoon"* (Wheeler et al., 2014), passing from houses to transport, from infrastructures to landscape design.

It is therefore not easy to understand the impacts of design at different scales, and the challenge of defining the exact scope and scale of good architecture is one of the main difficulties associated with measuring design value (Carmona et al., 2002).

There is an agreement that discussing design value at the neighbourhood scale is beneficial (Serin et al., 2018), firstly because it allows to go beyond the single building, where the scope would be too narrow to understand all the implications of design (Welsh Government, 2017), but it also limits the focus to an area where single design choices can still be influential (CABE, 2003). Concentrating on the neighbourhood scale also allows us to consider the issue of urban density and its implications (Savills, 2015), such as mobility and access to services and amenities. The possibility to focus on such wider urban design issues is counteracted by the safety of avoiding the complexity of design in wider urban or regional scales (Welsh Government, 2017). Considering the user perspective, neighbourhoods are valuable to those who live there, as the design conditions of a neighbourhood can promote civic pride and a sense of belonging (CABE, 2010).

One challenge that can arise when focusing on the neighbourhood scale is that the spotlight is on what happens inside the neighbourhood, and not on how its design may influence the surrounding areas. For example, new developments and the resulting improvement of the local urban setting may contribute to inequality in the neighbouring areas (Serin et al., 2018). Another difficulty is in defining the boundaries of a certain neighbourhood, and in the definition of neighbourhood itself (Burns & Kahn, 2005).

3.3. The challenge of measuring design value

The complex nature of design value, whose different aspects have been described in the sections above, results in the difficulty of defining it as a single number that could be used to affect decision-making. To solve this challenge, there is a tendency to turn to the traditional and consolidated language of economic value used in real estate (Chiaradia et al., 2017), as the connection between architectural design and its economic implications seems most obvious. However, not all aspects of design can be best discussed in economic terms: while it can be tempting, and at times possible, to put a price tag on the architectural or social forms of value, this can be useless for design decision-making, as

its benefits and results' implications are often difficult to measure (Chiaradia et al., 2017). While design value cannot be understood simply in economic terms, this understanding of "design as net benefit" (Graeber, 2001) is still useful, as this economic description allows us to turn the abstract notion of value into a measurable instrument.

As far as the environmental value of design is concerned, there is a general agreement on using carbon as its currency (Serin et al., 2018). It is then relatively easy to measure and compare the performance of different building projects in terms of energy consumption and production, greenhouse gas emissions, or air quality. More difficult is to measure the implications that the built environment has on its users' lifestyle, which can be considered as part of its environmental value (Dittmar et al., 2007). However, it is still relatively easy to verify if a new development, for example, reduces car dependency and promotes sustainable mobility, by comparing the situations in the neighbourhood before and after its completion.

Far more complex to measure are the social and architectural values of design, which are shaped by personal beliefs and cultural preferences, which are in turn influenced by the urban spaces (Serin et al., 2018). To have a holistic understanding of design value, it is fundamental to understand that it is experienced from a variety of perspectives, and at several different spatial scales. This is why it is impossible to have a universal understanding of what spatial quality is (Khan et al., 2014): different stakeholders can have contrasting perceptions of what a good built environment is (Carmona et al., 2002), and this makes it even more difficult to measure the value of design. The subjectivity that characterizes the ways in which the built environment is valued, which are not transparent nor comparable (Wheeler et al., 2014), results in scepticism about the very idea of objective design value.

3.4. Subjectivity and user experience in architectural and social values

The necessity of putting the focus on the experiences of the users stems from the subjective nature of the architectural and social values of design. This can be difficult to do sometimes, as the range of stakeholders involved in the design process can result in the role of the user being overlooked (Serin et al., 2018). Nevertheless, user experiences

are of crucial importance when defining value.

An extremely valuable tool to understand the value of design from a user perspective is Post-Occupancy Evaluation (POE)(CABE, 2010; Hay et al., 2020), which allows one to assess the actual outcome of a design process and its quality after its completion. POE is described as the process of going back to a building after its construction has been completed, to understand to what extent it meets the needs of its occupants, as well as its impact on the wider community and environment (Hay et al., 2018). During this process, different stakeholders are asked to make observations about their experiences of buildings, and how these affect different values that are taken into account (Hay et al., 2020). The strength of POE lies in the fact that it can be adapted to gather exactly the information needed by the designers or developers, and it can be used to assess intangible aspects of user experiences such as equity and identity.

POE is useful in effectively evaluating the architectural and social qualities of residential developments (Hunstone et al., 2018), however it is still very rarely used (Serin et al., 2018). The necessity of bringing POE into mainstream was highlighted in 2018 by the Architects' Council of Europe, that recognized it as a key tool for both architects and clients to support the quality of projects and to identify economic, environmental, social, and cultural value (ACE, 2018). As perfectly summarized in a report by the Royal Institute of British Architects, *"Post-Occupancy Evaluation is about putting people and their needs first. We can't make an environment that is good for people without knowing what they want, and making sure that they receive it from our designs"* (RIBA et al., 2017).

4. The value of design in European projects

The European Union has recognized the urgent necessity of focusing on the built environment to tackle climate change and to achieve the UN's Sustainable Development Goals (European Commission, n.d.). The research in this field has been promoted by the funding programme for research and innovation Horizon 2020, thanks to which several projects concerning sustainable buildings and smart cities have been developed. These projects focus on a variety of scales and specific topics, ranging from circularity to energy production, but they all share the overarching goal of promoting a more sustainable built environment.

In section 3, the different aspects that compose "good design" have been identified as its economic value, environmental value, social value, and architectural value. The aim of section 4 is to find out if all these parameters are considered by a selection of Horizon 2020 project, as this can be an indication of whether they have a holistic understanding of "good design", or if they focus on only some of its aspects. This will be done through an analysis of the assessment frameworks of the six selected European projects, to discover which parameters have been given the most importance.

4.1. Key Performance Indicators

The assessment frameworks of the selected Horizon 2020 projects have been developed to evaluate their results. These frameworks are composed of Key Performance Indicators (KPIs) which are a set of quantifiable measures that reflect a project's goals, and that can be used to evaluate the project's performance and progress in achieving these goals over time (Mosca & Perini, 2022).

Originally, KPIs were used in business administration, however, in recent decades the KPIs approach has become an increasingly popular tool to measure the sustainability level of construction projects (Kylili et al., 2016). KPIs are particularly suitable to evaluate these types of projects because the sustainability of a building or a district is dependent on numerous parameters, and the possibility to consider all of these aspects in a single assessment framework promotes a more holistic view of sustainability in the built environment (Mosca & Perini, 2022). Moreover, since KPIs are always tied to a

specific goal or target, this approach can be easily modified and adapted to respond to the specific objectives of each project.

This performance-based approach to the concept of sustainability typically focuses on the three pillars of sustainable development: economic viability, environmental protection, and social equity (Purvis et al., 2019). Considering the focus of the six selected projects on the built environment, it could be expected that they also focus on the fourth and last aspect of good design, architectural value. Moreover, the high flexibility of the KPIs approach allows one to modify and expand each assessment framework depending on the specific targets of its project. As will be shown in the next section, this results in other categories of KPIs being added on top of the three traditional ones.

4.2. European projects and their assessment frameworks

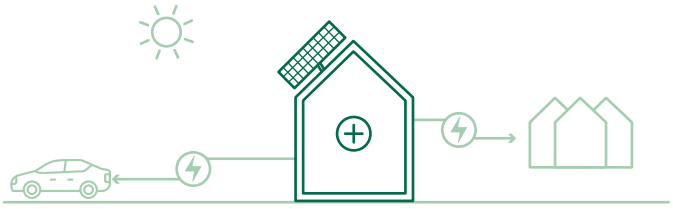
Six Horizon 2020 projects were selected to compare their assessment frameworks, and to find out if matters of social sustainability and architectural quality were taken into consideration.

The chosen projects, listed by scale, are the following ones:

- Cultural-E: Plus Energy Buildings (2019-2024)
- +CityxChange: Positive Energy Blocks (2018-2023)
- ARV: Climate Positive Circular Communities (2022-2025)
- Syn.ikia: Sustainable Plus Energy Neighbourhoods (2020-2024)
- CityKEYS: Smart Cities (2015-2017)
- SmartEnCity: Smart Zero CO2 Cities (2016-2022)

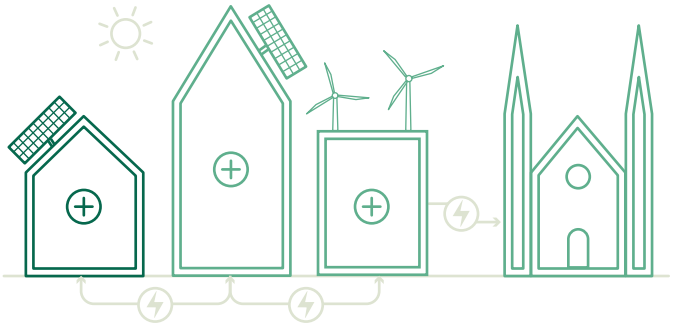
These projects focus on different scales, from single buildings to cities, and they have different goals with respect to sustainability. By analysing their assessment framework, it will be possible to verify if the social and architectural aspects of design value were also part of their targets.

Building scale: Plus Energy Buildings



- on-site generation of energy from Renewable Energy Sources
- produces more energy than it consumes
- feeds RES-based energy to the grid or to surrounding buildings

Block scale: Positive Energy Blocks



- at lest 3 connected buildings with an average yearly positive energy balance between them
- on-site generation of energy from RES
- excluding embodied emissions
- can integrate existing building stock, not all the buildings in this block have to be plus energy

District scale: Climate Positive Circular Communities
Sustainable Plus Energy Neighbouhroods

- an urban area with an average yearly positive energy balance
- achieves net-zero greenhouse gas emissions (only CPCC)
- on-site generation of energy from RES
- is energy flexible and energy efficient
- focuses on social sustainability and circular economy (only CPCC)

City scale: Smart Cities
Smart Zero CO_2 Cities

- sustainable, smart, and resource-efficient urban environments
- its carbon footprint and energy demand are kept to a minimum
- local generation of RES-based energy
- use of digital solutions to make networks and services more efficient
- more interactive and responsive city administration

Figure 6. The four scales on which the six selected European projects act (Ahlers et al., 2019; Belleri et al., 2023; Glicker et al., 2022; Hawila et al., 2022; Salom et al., 2022).

4.2.1. Cultural-E: Plus Energy Buildings

Cultural-E is coordinated by the Italian research centre Eurac and includes 17 European partners. This project will build four multifamily housing demonstration cases in four European countries (France, Germany, Italy, Norway), with the goal of establishing guidelines for designing Plus Energy Buildings (PEBs) in different socio-cultural and climatic contexts. The focus of Cultural-E is on the building scale, and more specifically on residential buildings. By analysing how differences in context influence the use of housing around Europe, Cultural-E will develop design tools and policy recommendations for the promotion of PEBs.

To evaluate the performance of the four demonstration cases, an assessment framework composed of 27 KPIs was developed. These are subdivided into six categories, namely economic impact (7), environmental impact (3), social impact (7), energy (2), indoor environmental quality (4), load matching and grid interaction (4).

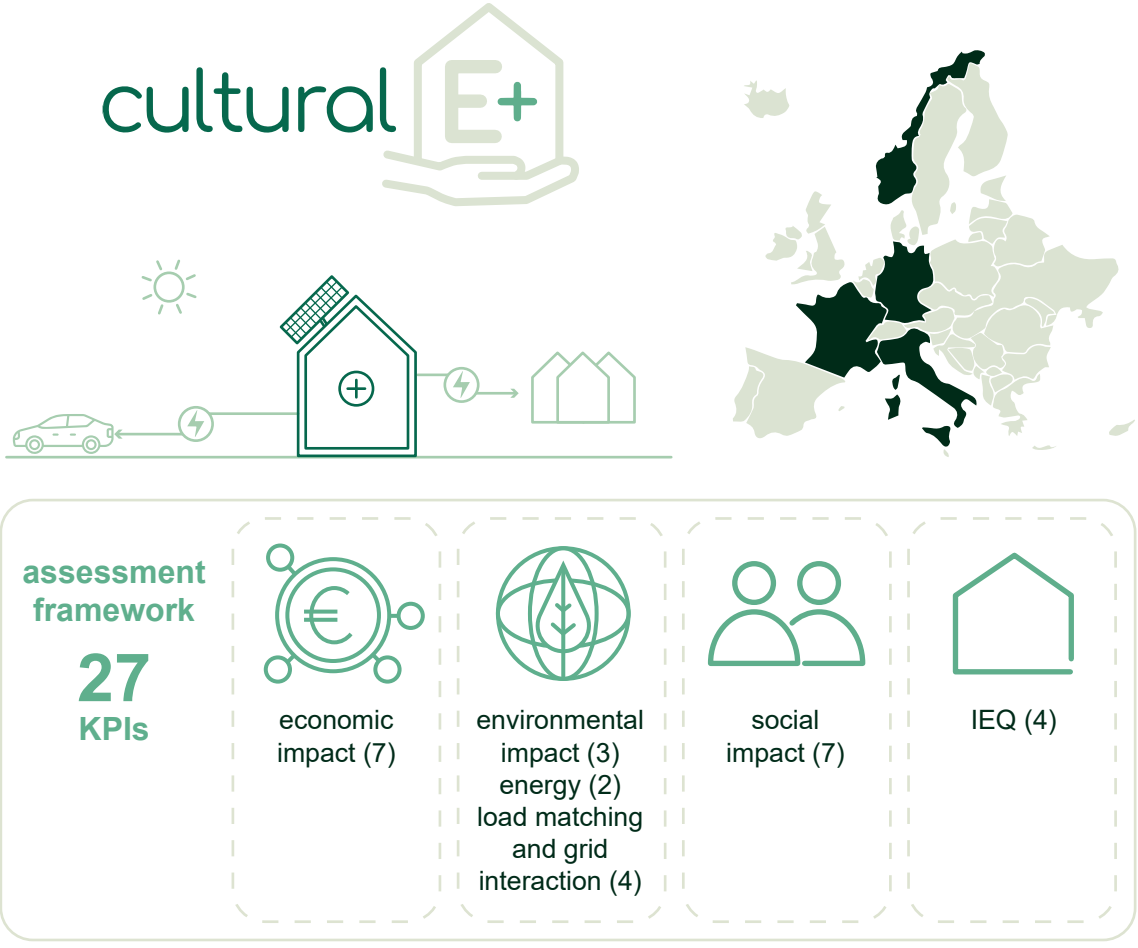


Figure 7. Graphic representation of Cultural-E project. (*Cultural-E*, 2019)

4.2.2. +CityxChange: Positive Energy Blocks

+CityxChange (Positive City ExChange) is hosted and led by the Norwegian University of Science and Technology (NTNU) together with two Lighthouse Cities, Limerick (Ireland) and Trondheim (Norway). Within +CityxChange, 11 demonstration projects are being promoted in the two “Lighthouse Cities” and in five other European “Follower Cities”. Through the demonstration projects, different energy efficiency initiatives will be developed, with the final goal to create Positive Energy Blocks, eventually leading to Positive Energy Districts and Cities.

To measure the technical and socio-economic impacts of the interventions carried out in the two Lighthouse Cities, an assessment framework was developed. This is composed of 33 KPIs subdivided into three themes: integrated design and planning (7), common energy market (19), communityXchange (7).

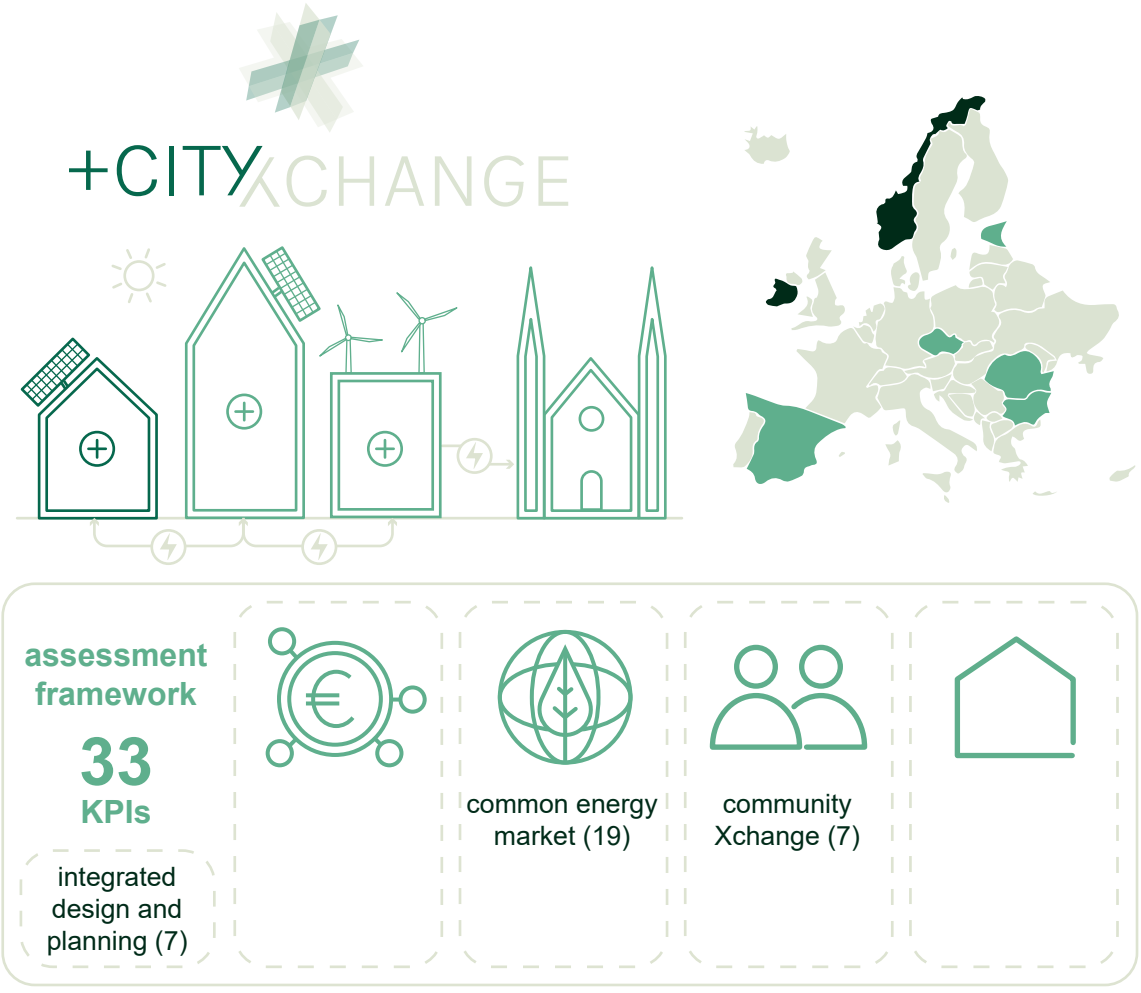


Figure 8. Graphic representation of +CityxChange project. (*+CityxChange*, 2018)

4.2.3. ARV: Climate Positive Circular Communities

ARV is led by the Norwegian University of Science and Technology (NTNU) in collaboration with 35 partners from eight different European countries. The goal of this project is to promote the implementation of Climate Positive Circular Communities (CPCC), which are described as urban areas aiming to net zero greenhouse gas emissions, that are energy flexible and that promote circular economy and energy flexibility. ARV has also selected six demonstration communities to be developed into CPCC; these are located in 6 different European countries (Czech Republic, Denmark, Italy, Norway, Spain, and The Netherlands), and they were chosen to showcase how CPCC can be implemented in different climates and contexts.

To guide the design and the implementation, as well as to evaluate the performance, of these six demonstration communities, and eventually of other CPCCs, ARV has developed an assessment framework. This is composed of 36 KPIs divided into six categories: economics (4), environment (4), social (11), energy (5), architecture (10), and circularity (2).

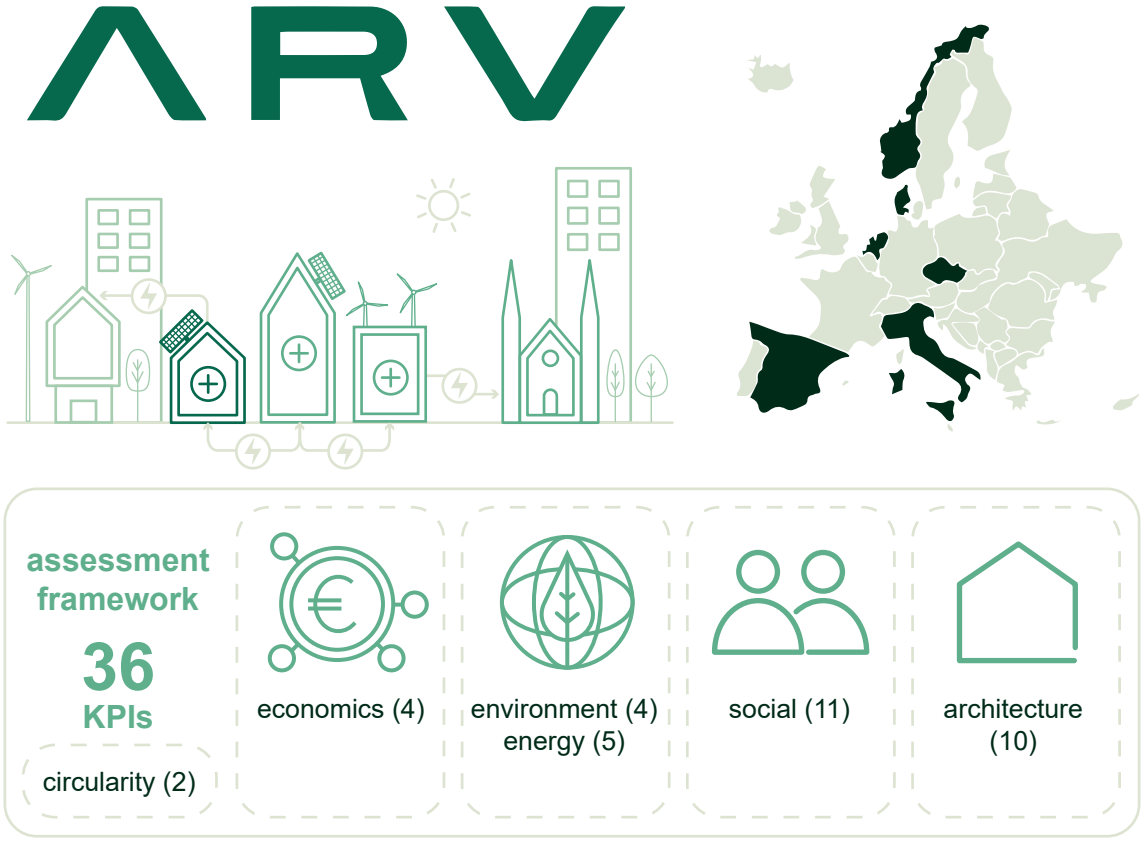


Figure 9. Graphic representation of ARV project. (*ARV*, 2022)

4.2.4. Syn.ikia: Sustainable Plus Energy Neighbourhoods

Syn.ikia is also led by the Norwegian University of Science and Technology (NTNU), in collaboration with 12 partners from six European countries. Its goal is to promote the development of Sustainable Plus Energy Neighbourhoods (SPENs), as a way to improve the access to affordable housing while transitioning to a low-carbon and energy-efficient built environment. As part of the syn.ikia project, four plus-energy demo projects in four different European countries (Austria, Spain, Norway, The Netherlands) and climates are being developed, analysed and monitored.

To guide the design process and to monitor the performance of SPENs, syn.ikia has developed an assessment framework. This is composed of 38 KPIs divided into 5 categories: economic performance (11), energy and environmental performance (9), social performance (8), indoor environmental quality (8), and smartness and flexibility (2).

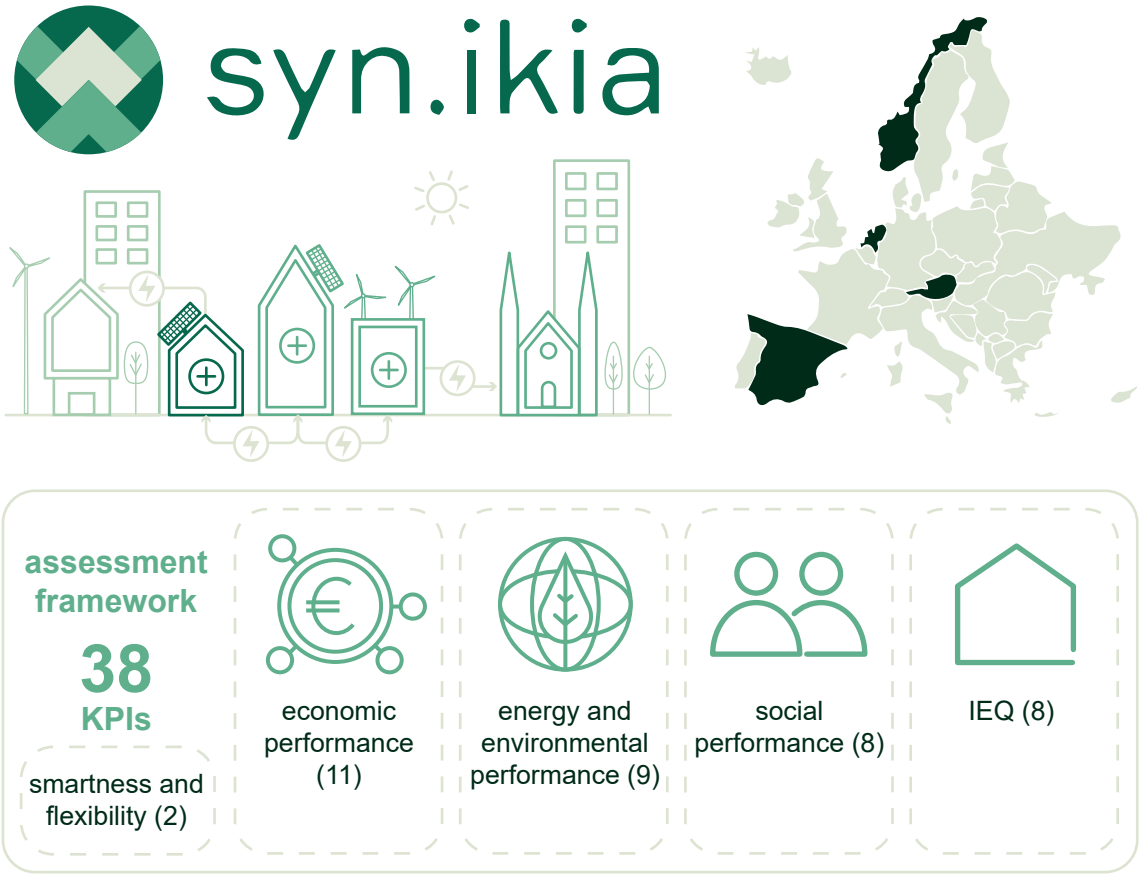


Figure 10. Graphic representation of syn.ikia project. (*syn.ikia*, 2020)

4.2.5. CITYkeys: Smart City performance measurement system

CITYkeys' goal was to develop a holistic performance measurement framework for European smart cities, to allow for a harmonized monitoring and comparability of the different activities implemented. CITYkeys was coordinated by the Technical Research Centre of Finland (VTT), in collaboration with eight other European partners. CITYkeys did not directly promote the development of demonstration projects, but around 50 European cities participated in the project through feedback and testing.

CITYkeys focused on the assessment of both smart cities and of smart cities projects: the latter were defined as projects that transform the transtition to smart cities, i.e., cities that efficiently use available resources to improve the quality of life of their citizens, to better their energy efficiency, to build a green economy, and to foster local democracy. According to this definition, four axes of sustainability are identified: people, planet, prosperity, and governance. CITYkeys' assessment framework to evaluate smart cities projects is composed of 101 KPIs divided into 5 themes: prosperity (18), planet (25), people (27), governance (13), and propagation (18).

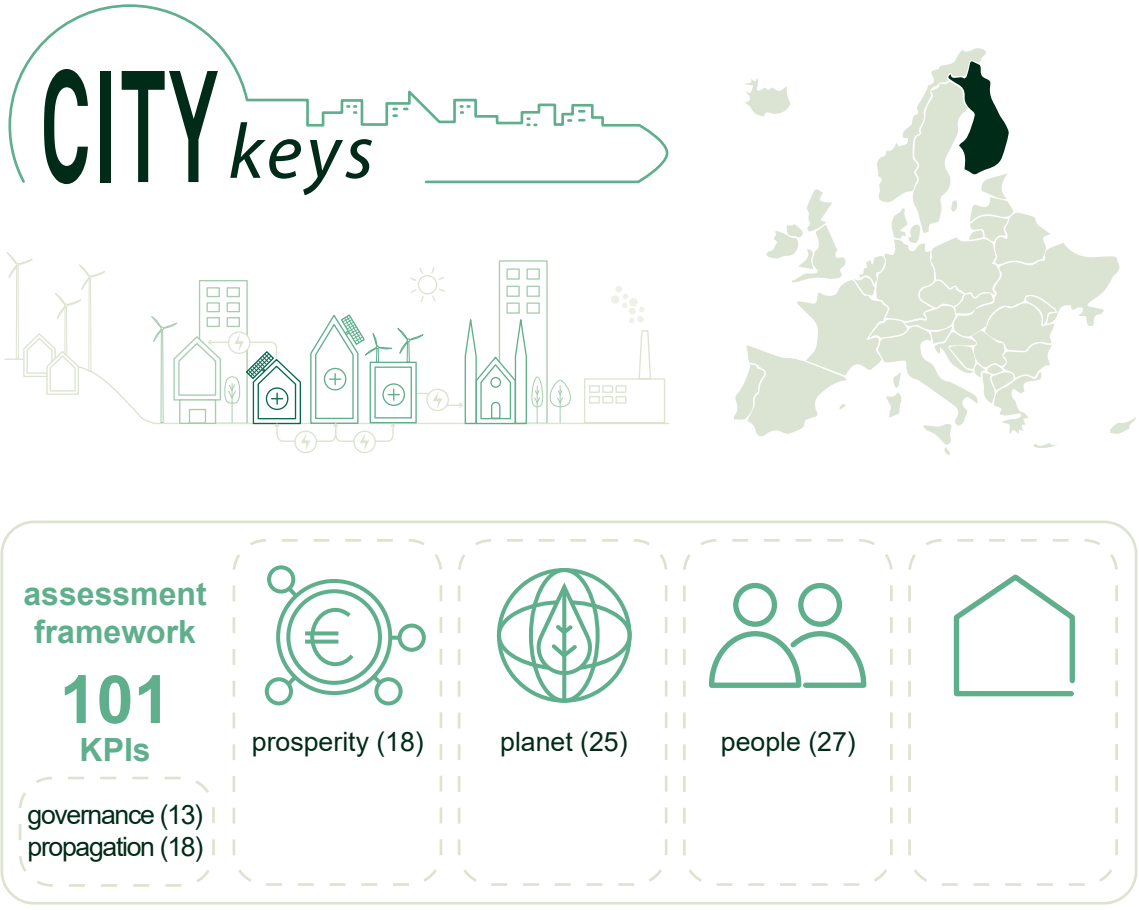


Figure 11. Graphic representation of CITYkeys project. (Bosch et al., 2017)

4.2.6. SmartEnCity: Smart Zero CO2 Cities

SmartEnCity was a project coordinated by TECNALIA Research & Innovation in collaboration with 35 partners from six European countries. Its goal was to develop a replicable approach to transform European urban areas into sustainable and smart cities. These cities would have to keep their carbon footprint and energy demand to a minimum, and their limited energy demand would have to be met by renewable energy produced locally. To achieve this goal, a series of actions were undertaken in three Lighthouse Cities (in Spain, Estonia, and Denmark) and later replicated in two follower cities (in Italy and Bulgaria). Each city developed separate actions to respond to its specific needs in the fields of energy efficiency, mobility, and ICT. Involving the citizens and having an open communication with them was also considered crucial to the success of the project.

To evaluate the renovation actions carried out in the Lighthouse Cities, an assessment framework was developed. This was composed of 59 KPIs divided into four categories: economic (8), environmental (7), social (26), and technical (18) indicators.

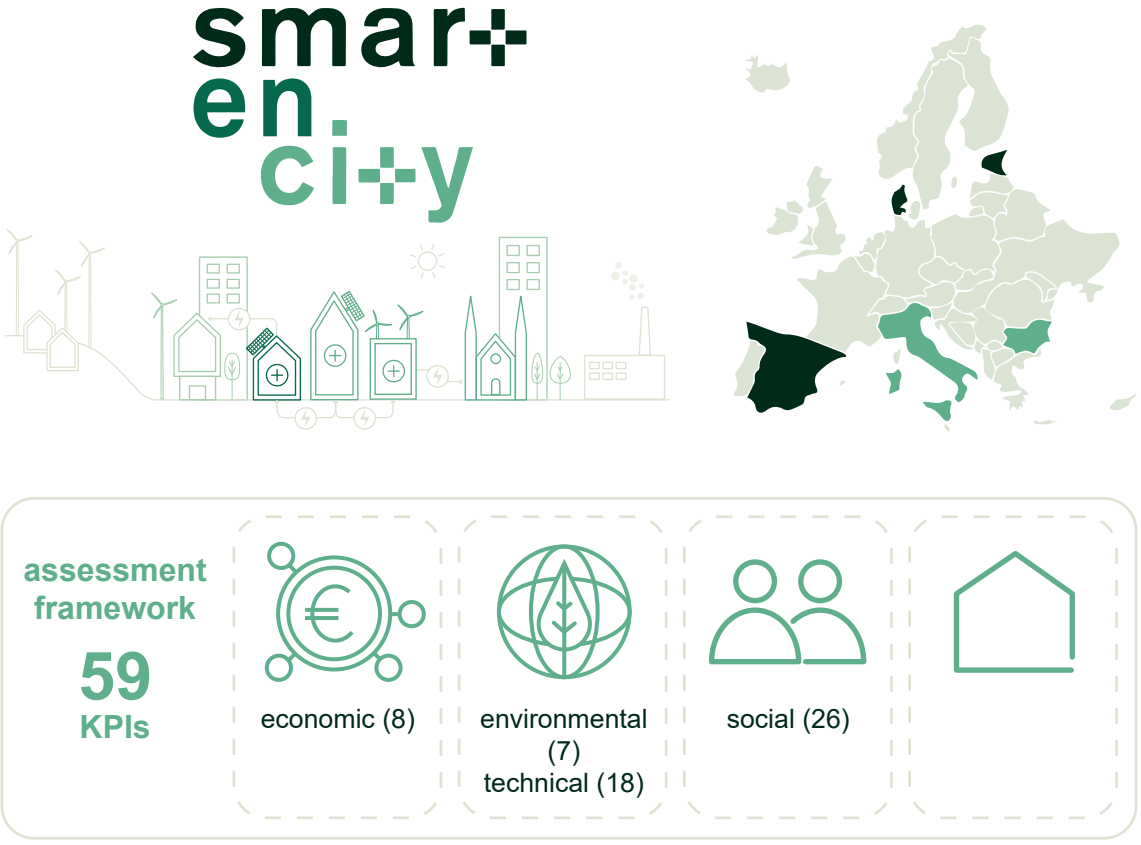


Figure 12. Graphic representation of SmartEnCity project. (*SmartEnCity*, 2016)

4.3. Comparison of assessment frameworks

The differences in the projects' scales and objectives result in a wide variety of KPIs used in their assessment frameworks. Specifically, many projects want to evaluate their economic, environmental and social impacts, but the importance given to these aspects differs. Moreover, every project has one or more additional KPIs categories that aim to assess a specific target of the project, that is not shared by the others.

In general, the six projects group their KPIs in a variety of categories with different names, but through a more accurate analysis of the assessment frameworks it is possible to find some overlapping. Overall, all the KPIs used in the six projects can be grouped into four categories related to the four aspects of design value, plus a fifth category for case-specific KPIs.

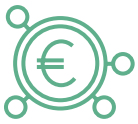
	cultural E+	+CITYXCHANGE	ARV	syn.ikia	CITY keys	smarten city
	7	4	4	11	18	8
	9	15	9	9	25	21
	7	7	11	8	27	26
	4	/	10	8	/	4
case specific	/	7	2	2	31	/
total	27	33	36	38	101	59

Table 2. Overview of the KPIs included in the six assessment frameworks, classified in the four classes of design value.

4.3.1. Comparison of economic KPIs

cultural E+	+CITYXCHANGE	ARV	syn.ikia	CITY keys	smarter city
investment cost	€M investment savings	global cost	investment costs	increased use of local workforce	investment
energy cost, operational	new investments generated	energy renovation rate	share of investments covered by grants	local job creation	grants
maintenance cost	new jobs created	new jobs created	maintenance related costs	fuel poverty	total annual costs
pay back period	annual return on investment	construction time reduction	requirement related costs	cost of housing	total annual revenues
life-cycle cost			operation-related costs	green companies involved	net present value
net present value			other costs	green public procurement	internal rate of return
total cost of ownership			net present value	CO_2 reduction cost efficiency	dynamic payback period
			internal rate of return	financial benefit for end user	economic payback period
			economic value added	net present value	
			payback period	internal rate of return	
			nZEB cost comparison	payback period	
				total cost vs. subsidies	
				involvement of extraordinary professionals	
				stimulating an innovative environment	
				quality of open data	
				new startups	
				improved inter-operability	
				decreased travel time	

Table 3. Comparison of economic KPIs

The economic value of architecture is universally recognised, and its objective nature means that it is easily quantifiable. Still, the economic perfomance of a building has widely different implications for different stakeholders, and it is not easy to keep everyone's perspective into account. Nonetheless, Table 3 shows that all six European projects have a holistic understanding of the economic value of the built environment: KPIs such as "investment cost" and "share of investments covered by grants" acknowledges the point of view of stakeholders. "Maintenance cost" and "economic value added" recognise the needs of the building owners, while "operation-related cost" and "cost of housing" are significant for the end users. Overall, it can be said that all six assessment frameworks show a clear understanding of the importance of the economic value of architecture.

4.3.2. Comparison of environmental KPIs

cultural E+	+CITYXCHANGE	ARV	syn.ikia	CITY keys	smarter city
primary energy	CO_2 emission reduction	non-renewable energy	non-renewable energy balance	reduction in annual energy consumption	delivered energy
final energy	NO_x emission reduction	renewable energy ratio	renewable energy ratio	reduction in lifecycle energy use	primary energy
self-generation	% RES self-supply	grid delivered factor	grid purchase factor	reduction of embodied energy	density of energy demand
self-consumption	renewable energy integration	net energy/ net power	load cover factor	increase in local RE production	load profile electricity demand
peak export	% district level production	flexibility index	supply cover factor	CO_2 emission reduction	load profile thermal energy demand
peak import	new DPEBs realised	life-cycle GHG emissions	net energy/ net power	reduction in lifecycle CO_2 emissions	specific yield
total GHG emissions	improved energy efficiency	air pollution from energy consumption	peak delivered power	maximum houry deficit	calculated energy demand vs. energy consumption
GHG emission reduction	thermal recovery	dust during retrofitting	connection capacity credit	local freight transport fuel mix	dwellings managed by ICT solutions

CO_2 emissions	% energy grid failures	noise during retrofitting	total GHG emissions	increased efficiency of resources consumption	number of sensors in buildings
	% distributed energy resources traded			share of recycled input materials	data managed and controlled in the district
	% peak load reduction			share of renewable materials	use of information generated by end consumers
	RES storage capacity			share of recyclable materials	degree of energetic self-supply
	% electric mobility			life time extension	share of renewable energy
	participants in the energy market			reduction in water consumption	power interruption avoided
	reduction in payback period			increase in water reuse	CO_2 emissions
				water self-sufficiency	cumulative energy demand
				increase in compactness	climate change
				food self-sufficiency	ecotoxicity
				climate resilience measures	human toxicity
				NO_x emission reduction	fossil depletion
				PM2,5 emission reduction	ecological footprint
				reduced exposure to noise pollution	
				reduction in solid waste collection	
				increase in green and blue space	

				increased ecosystem quality and biodiversity	

Table 4. Comparison of environmental KPIs

Considering the criticality of this historical period, and the declared focus of these six projects on sustainability, the importance given to the environmental aspect is no surprise. All six projects consider energy as a relevant element, both evaluating energy consumption ("improved energy efficiency", "calculated energy demand vs. energy consumption") and targeting local renewable energy production ("renewable energy ratio", "self-generation". "increase in local RE production"). GHG emissions are also considered a key element when evaluating the environmental performance, with KPIs such as "CO_2 emissions" and "life-cycle GHG emissions" being present in multiple frameworks. Matters of resilience and material choice are less commonly studied; similarly, the effects of the environmental value on people's lifestyle is not given much consideration.

4.3.3. Comparison of social KPIs

cultural E+	+CITYXCHANGE	ARV	syn.ikia	CITY keys	smar+ en ci+y
consumer engagement	community participation events	democratic process	access to services	access to basic healthcare	age of inhabitants
social compatibiliy	citizen observatories	social inclusion	affordability of energy	encouraging a healthy lifestyle	highest level of completed education
ease of use for users	community participation actions	social engagement	affordability of housing	waiting time	nationality
advantages for users	innovation labs	demographic composition	democratic legitimacy	reduction of traffic accidents	inhabitants per house
advantages for stakeholders	positive energy champions	social interaction and cohesion	living conditions	reduction in crime rate	households without employment
people reached	organisations with sustainable energy approach	safety and security	social cohesion	improved cybersecurity	households receiving subsidies

local job creation	demo projects in follower cities	energy and environmental consciousness	personal safety	improved data privacy	household net monthly income
		affordability of energy	energy consciousness	access to public transport	size of the household
		affordability of housing		quality of public transport	ownership structure
		access to sustainable mobility		improved access to vehicle sharing	building types
		access to services and amenities		extention in bike route network	construction year categories
				access to public amenities	years of occupancy in current home
				access to commercial amenities	size of the dwelling
				incr. in online government services	residents project satisfaction
				flexibility in delivery services	residents information satisfaction
				access to educational resources	residents involvement degree
				environmental awareness	energy awareness
				digital literacy	information accessibility
				people reached	technical solution satisfaction
				consciousness of citizenship	ICT satisfaction
				participation of vulnerable groups	aesthetical satisfaction
				diversity of housing	energy saving satisfaction
				connection to cultural heritage	comfort conditions

				design for a sense of place	energy bill reduction
				increased use of groundfloors	business models
				access to urban public outdoor areas	further investments in energy projects
				access to green space	

Table 5. Comparison of social KPIs

All six projects have some KPIs that fall into the “social” category, but their interpretation of what constitutes the social value of architecture varies widely. The focus on promoting a built environment that is more liveable and sociable, and that has positive repercussions on the local community, is shared particularly by the last four projects. This is not surprising, as these are the projects that focus on bigger scales, where it is easier to study social behaviours (Serin et al., 2018). Through the analysis of these KPIs, 5 indicators were chosen to be further studied in the next sections of this thesis, which focuses on the users’ perception of the social value of architecture in a sustainable neighbourhood. The selected indicators are:

- Democratic process and social engagement
- Demographic composition
- Social interaction and cohesion
- Safety and security
- Access to sustainable mobility, services, and amenities

4.3.4. Comparison of architectural KPIs

cultural E+	+CITYXCHANGE	ARV	syn.ikia	CITY keys	smar+ en ci+y
indoor air quality		aesthetics and visual qualities	carbon dioxide		internal air comfort

thermal comfort		flexibility and adaptability	predicted mean vote		internal relative humidity
visual comfort		sufficiency and adequacy of space	predicted percentage dissatisfied		internal air speed and distribution
acoustic comfort		solar and daylight access	temperature		thermal comfort
		accessibility	relative humidity		
		indoor air quality	illuminance		
		thermal comfort	daylight factor		
		overheating risk	sound pressure level		
		acoustic comfort			
		outdoor comfort			

Table 6. Comparison of architectural KPIs

All six assessment frameworks took into account, to varying degrees, economic value, environmental value, and social value, which constitute the three pillars of sustainability and also the “triple bottom line” of good architecture. However, as argued in Section 3, a truly sustainable built environment must have a high architectural value too. As shown in Table 6, two out of six projects do not consider any architectural indicator in their assessment frameworks. Of the remaining four project, three considered only the traditional elements of Indoor Environmental Quality (IEQ), which are indoor air quality, thermal comfort, visual comfort, and acoustic comfort. Syn.ikia has more indicators, but they all fall into the sub-category of IEQ. IEQ is often considered because its parameters can be monitored and evaluated objectively; however it is still important to not only look at the absolute values, but also to ask users about their perception of IEQ. The only projects that considers architectural value, at least partly, as defined in Section 3, is ARV: here it is possible to find, for example, KPIs such as “aeshetics and visual quality” and “flexibility and adaptability”. The complexity of looking at the subjective aspects of architectural value is clear, and so is the difficulty in explaning what exaclty makes a building beautiful or adaptable. Nonetheless, the users’ perception of architectural value

must be acknowledged, and this is done in the next sections of this thesis. For this purpose, the following 9 KPIs have been selected to be further studied:

- Aesthetics and visual qualities
- Flexibility and adaptability
- Accessibility
- Sufficiency and adequacy of space
- Outdoor comfort
- Indoor air quality
- Solar and daylight access
- Acoustic comfort
- Thermal comfort

5. Case study

To find the answer to the second research question of this thesis, “What is the users’ perception of the value of design, and specifically of its social and architectural aspects?”, it was decided to select a case study from the demo projects promoted by the six European projects previously studied.

Firstly, it was necessary to decide which scale to focus on: as shown in Figure 6, the six projects target different scales, from the building scale of Cultural-E, to the city scale of CITYkeys and SmartEnCity. Considering the focus of this thesis on the social and architectural aspects of design value, it was decided to dismiss the building scale: while it can be relevant to study the architectural value of a single building, the nature of social value can be better comprehended inside a community. Next, the hypothesis of choosing the city scale was ruled out: on such a big scale, it is difficult to highlight the connections between design choices and their implications for the users (CABE, 2003), and considering the time limitations for this study, it was not possible to take on such a big and complex topic.

It was therefore chosen to focus on the neighbourhood scale: this allows to go beyond the narrowness of scope of a single building, and at the same time to avoid the complexity that is inherent to cities. When analysing a neighbourhood, the focus goes beyond buildings and includes the spaces in between them too: this is where social interactions happen (Gehl, 2011), and the architectural value of these spaces influences their quality as social infrastructures. The possibility of studying the implications of design choices on social behaviour and architectural quality in such a clearly delimited space was considered beneficial.

Between the two European projects that target the neighbourhood scale, ARV and syn.ikia, the latter was picked: as syn.ikia started in 2020, its demo projects are in a more advanced phase, while ARV’s, which kicked off in 2022, are still under development. Also, as highlighted in Section 4.3.4, syn.ikia’s assessment of architectural quality exclusively focused on Indoor Environmental Quality, without considering architectural value as a whole. Through the analysis of users’ perceptions it will be possible to assess whether, despite it not being directly targeted, architectural quality was still achieved.

5.1. Syn.ikia

Syn.ikia comes from the Greek word “συνοικία”, which is composed of two parts:

- Syn, which means plus
- Ikia, which means house

When put together they form Syn.ikia, which means neighbourhood, as in “more than one house”, but it also illustrates the concept of “plus energy house”. This name perfectly represents syn.ikia’s mission, which is to increase the share of sustainable neighbourhoods with surplus renewable energy in different European contexts. More specifically,

“syn.ikia aims at achieving sustainable plus energy neighbourhoods with more than 100% energy savings, 90% renewable energy generation triggered, 100% GHG emission reduction, and 10% life cycle costs reduction, compared to nZEB levels. This will be achieved while ensuring a high-quality indoor environment and well-being.”

(source: syn.ikia.eu)

Syn.ikia’s concept starts with Plus Energy Buildings, which produce more renewable energy than they use in a year, and expands the boundary to the entire neighbourhood, arriving at Sustainable Plus Energy Neighbourhoods (SPENs). Focusing on the neighbourhood scale brings several benefits: firstly, it allows to include those older or protected buildings that cannot reach the plus energy target on their own. Secondly, the neighbourhood scale brings along the idea of community: thus, the “sustainable” aspect of the neighbourhood transcends purely environmental or economic concerns, and can include matters of social value. Syn.ikia also values the architectural quality of SPENs, stating that a high-quality indoor environment must be ensured.

“Syn.ikia’s concept relies on the interplay between novel technologies at the neighbourhood scale, energy efficiency & flexibility of the buildings, good architectural & spatial qualities, housing affordability and citizen engagement.”

(source: syn.ikia.eu)

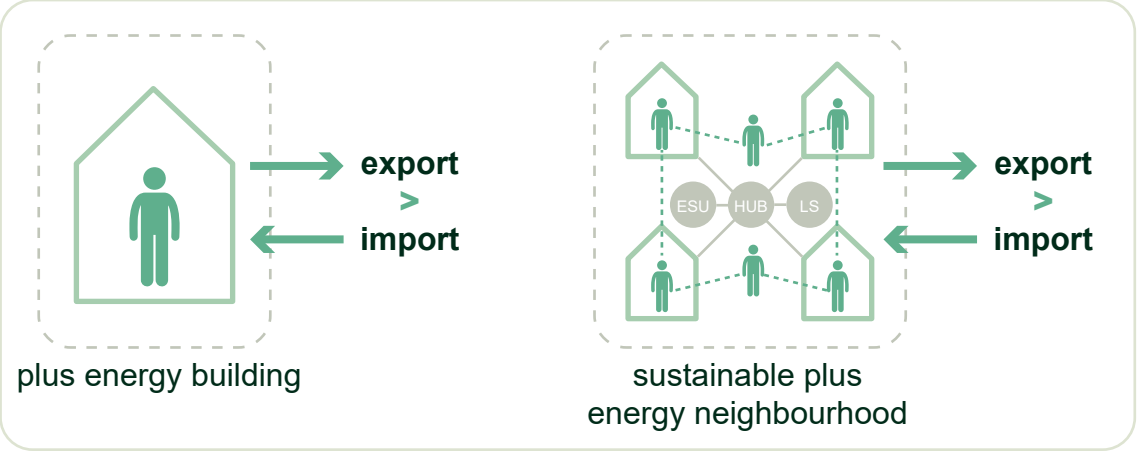


Figure 13. From plus energy building to sustainable plus energy neighbourhood (*syn.ikia*, 2020)

5.1.1. Sustainable Plus Energy Neighbourhood

A SPEN is defined as a group of interconnected buildings and their associated infrastructure, located within a confined geographical area and/or a virtual boundary. It aims to reduce its yearly energy use towards zero and to increase its use and generation of renewable energy. SPENs should also have a strong focus on greenhouse gas emissions, cost efficiency, indoor environmental quality, and occupant satisfaction.

Currently, syn.ikia is promoting the development of four demo projects to demonstrate the feasibility of its SPEN concept in different European contexts, markets, and climates. These demo projects are located in Fredrikstad (Norway), Uden (Netherlands), Salzburg (Austria), and Barcelona (Spain). Their development follows syn.ikia's 5S strategy and targets the 5D focus areas.

5.1.2. Syn.ikia's 5S strategy

 **SAVE**	Reducing the neighbourhood's net energy consumption by using solutions based on a total life cycle cost analysis.
 **SHAVE**	Facilitating peak shaving through load shifting, control, and storage thus reducing the size of energy supply installations, increasing self-consumption of renewable energy, and reducing the stress on the grid.

 **SHARE**	Sharing of resources such as energy, infrastructure, and common spaces with neighbours.
 **SHINE**	Ensuring high-quality architecture, creating good indoor and outdoor environments, and solutions that make the occupants and the community proud of their neighbourhood.
 **SCALE**	Benefitting from large-scale effects of the neighbourhood scale to replicate the solutions at the European level

Table 7. syn.ikia's 5S strategy

It is possible to look at this 5S strategy through the lenses of the 4 aspects of design value that were identified in Section 3. The "save" strategy promotes both the environmental and the economic value of the SPEN, while the "shave" strategy targets its environmental value. With the "share" strategy the focus is on the social value, but the environmental value is also influenced, and the "shine" strategy guides the development towards high-quality architectural value. The last strategy, "scale", is not related to design value, but to the overarching goal of syn.ikia to promote SPENs in the whole European context. Overall, this 5S strategy hints at the holistic understanding of design value that syn.ikia has: if the demo projects were successful in following this strategy, their architectural and social values should be appreciated by the end users.

5.1.3. Syn.ikia's 5D focus areas

 **decentralisation**	Neighbourhoods as flexibility providers that enable more renewable energy sources to enter the grid and allow for flexible management of energy demand and generation.
 **democracy**	Engaged, empowered and conscious users that have access to affordable and high-quality neighbourhoods.

 **decarbonisation**	Climate-neutral, highly energy-efficient neighbourhoods with a surplus of energy from renewable sources.
 **digitalisation**	Big data-based neighbourhoods and smart networks that provide well-managed housing for the citizens.
 **design**	Integrated energy, architectural and spatial design that improve the attractiveness of energy-efficient housing and its market uptake.

Table 8. syn.ikia's 5D focus areas

Also among the 5D focus areas, there is an understanding of the importance of social and architectural values: "democracy" highlights the desire of having engaged and conscious citizens, that can take part in the neighbourhood's life; the emphasis is also on good-quality architecture and affordability for all. The last focus area, "design", recognises once more the need to ensure qualitative architectural design, in this case with the goal of making energy-efficient housing more attractive for both the users and the market.

5.2. T' Houdthof / Maatschappelijk Mooi

Among the four demo projects developed in collaboration with syn.ikia, t' Houdthof / Maatschappelijk Mooi was the first one to be completed. This neighbourhood is located in Uden, The Netherlands, and the first tenants moved in in May 2022. T' Houdthof was developed around the concept of "socially beautiful", which is also incorporated in its name, "Maatschappelijk Mooi". For these reasons, it was chosen as the case study for this thesis: since the residents have already lived there for a year they are now familiar with the space and with each other, it will be interesting to find out if the 5S strategy and 5D focus areas declared by syn.ikia have indeed resulted in high architectural and social values for the users. The specific aim of the Dutch demo case to create a "socially beautiful" SPEN indicates that the developers have put a lot of thought into the social and architectural qualities of the space; the next sections of this thesis will investigate how

these qualities are perceived by the residents.

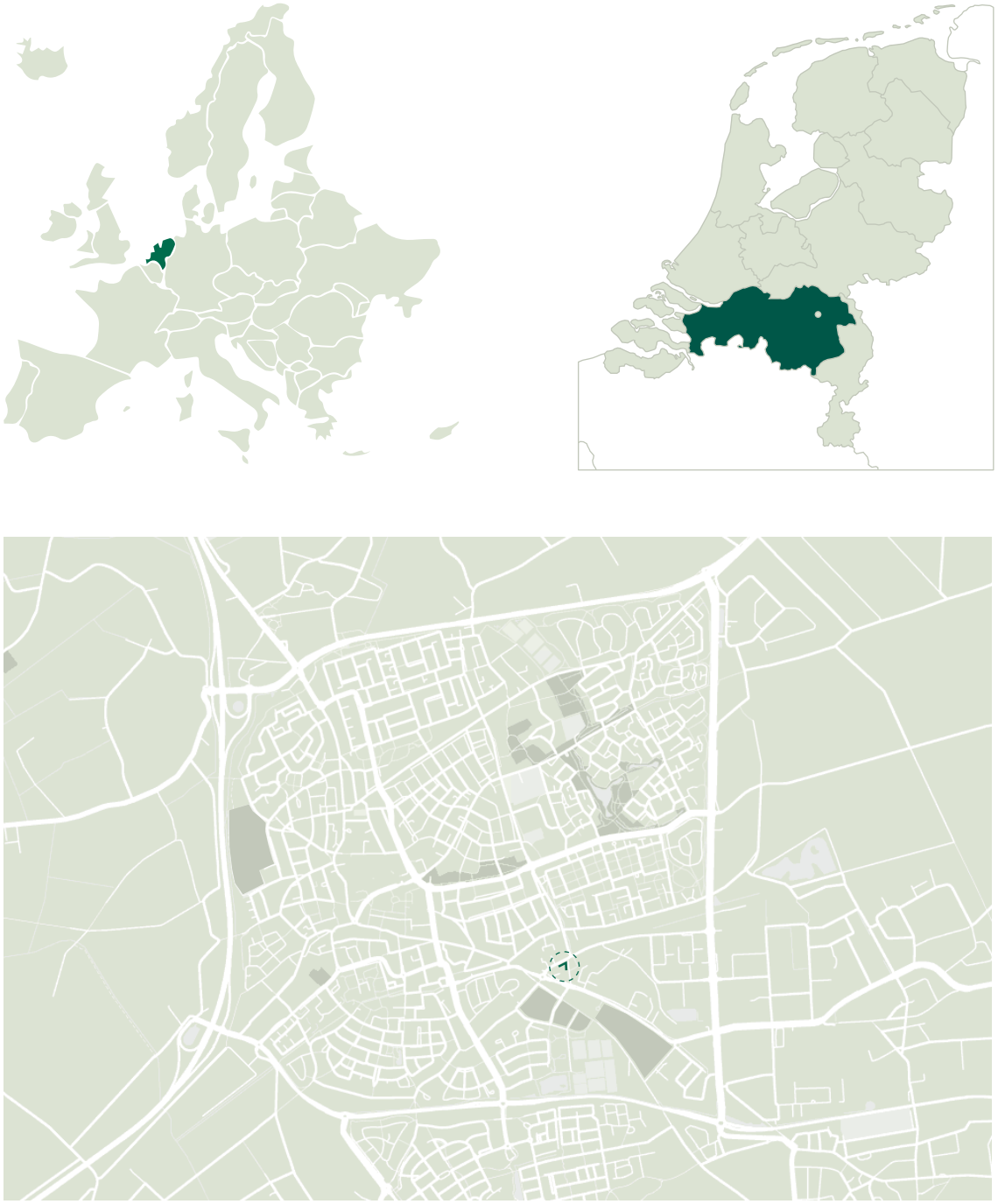


Figure 14. Location of t' Houdthof / Maatschappelijk Mooi within Europe, The Netherlands, and Uden

5.2.1. Introduction to the case study

T' Houdthof / Maatschappelijk Mooi is located in Uden, a mid-sized town of approximately 37 000 people in the southern Netherlands. According to the Köppen Geiger climate classification, Uden has a marine climate (Cfb), with mild summers and winters and abundant rain.

T' Houdthof / Maatschappelijk Mooi is a new housing complex with 39 apartments built by the developer Hendriks Coppelmans. The units are either one-bedroom (46 m2) or two-bedroom apartments (71 m2) and are organised over 3 floors. To reach the high standards set by syn.ikia with regards to energy consumption/production and GHG emissions, t' Houdthof combines a set of passive and active systems: the highly thermally insulated and airtight envelope combined with triple-glazed windows help lower the energy needs, while indoor comfort is achieved through a combination of ground source heat pumps for space heating and domestic hot water, radiant floor heating, and a mechanical exhaust ventilation system with CO2 sensors. A total of 190 PV panels located on the roof cover the remaining energy need. Each apartment is individually connected to the grid, with its own heating systems, PV solar panels, and ventilation systems. The electricity produced by the PV panels is also channelled to some charging points for electric cars in the common parking lot. In the case of t' Houdthof, the neighbourhood is not defined by hard borders; rather, the boundaries of the SPEN are expanded to include other buildings in the area which are managed by the same housing company. Moreover, seen as each apartment in t' Houdthof is individually connected to the grid and has its own set of technical systems, it could be argued that the apartment complex in itself is like a small neighbourhood.

Figure 15. Views of t' Houdthof / Maatschappelijk Mooi. External facades.
On the right, the view from the main street, Loopkanstraat. On the left, the view from the secondary street, President Kennedylaan.

Figure 16. t' Houdthof / Maatschappelijk Mooi ground floor plan.

5.2.2. The «socially beautiful» concept

The sustainability of t' Houdthof is not only about the environment, but about social inclusion too. Indeed, the second part of this building's name, "Maatschappelijk Mooi" directly translates into "socially beautiful"; this idea of combining innovative technical solutions with a socially inclusive and beautiful space became the core of the Dutch demo's mission. The attention paid to the social well-being of the residents was also dictated by the nature of the two associations managing the apartments, Area Wonen and Labyrint Zorg & Werk. The first is a social housing association that provides affordable housing in Uden and surrounding municipalities, while the latter is a care organisation that supports young adults with mental and/or intellectual disabilities to participate in society and develop their independence. Labyrint manages 16 apartments, while the remaining 23 are rented out by Area to home seekers who wish to create a strong residential community.

To help create the thriving social environment that the housing managers wished for, a project was developed: tenants with a strong wish for creating a tight community could candidate themselves, and some of them were selected to become "tenants-ambassadors". They would then help to raise awareness of what it is like to live in a SPEN, and they would help all the residents to feel included and to partake in social activities. The ambassadors, as well as the partners helping with home management skills for those who find it hard to live independently, were involved in the design of the building (syn.ikiaEU, 2022a). As explained by some ambassadors themselves, their role is "to be in contact with the residents" (syn.ikiaEU, 2022b), be available to talk with them and make sure that they feel comfortable living in the neighbourhood, and act as their spokesperson were a problem to arise. The ambassadors also organise communal activities, such as going to the nearby sports park or movie nights, and they always make sure that those residents that may be struggling living alone feel included and supported (syn.ikiaEU, 2022b).

Combining highly sustainable and beautiful homes with a closer contact between neighbours, all of this at an affordable price: this could sum up the goals of t' Houdthof / Maatschappelijk Mooi. By surveying the residents of this building this thesis investigates how the qualities of t' Houdthof are perceived by the residents, and whether this neighbourhood truly encapsulates all the aspects of design value.

5.2.3. Case study analysis: architectural and social values

Before surveying the residents, the technical drawings provided by the developers (Appendix) were analysed, to investigate the perception of the architectural and social quality of the case study from an external architect's point of view. This allows to verify whether the intentions of the developers are understood by an architect that was not involved in the design process, and to find out if and how these impressions differ from the resident's impressions.

Starting from the architectural value, the floor plan shown in Figure 17 shows a modular approach, where each typology of apartments (one-bedroom and two-bedrooms) follows a specific layout, which is repeated through the floor plan. This modularity could be beneficial in the future, in case this building had to be retrofitted to a different function. The apartments themselves are not excessively big, but they do include all the necessary spaces for a single person or a small family. Each apartment has also a small private balcony, accessible through the living room area: the access to an outdoor area definitely improves the overall worth of the apartments, and the connection of this space with the living area is also a positive aspect, as it constitutes an extension of the space that is accessible to guests, thus acting on the social quality of the apartment. The balconies face the outside of the buildings, towards the streets, thus giving the residents the opportunity to feel connected to the surroundings while being in the comfort of their homes. It also appears that accessibility was given considerable importance during the design process: all the apartments, including the main bathrooms, are accessible to wheelchairs; the apartments on the upper floors are also accessible through the central elevator that leads to a walkway.

As far as the cultural quality of t' Houdthof goes, one thing that stands out is the cladding of the building: this is mostly composed of bricks, which are the traditional cladding material of the Netherlands. While this building employs advanced technical systems to improve its environmental sustainability, its aesthetic matches the more traditional surrounding residential buildings, thus making the residents feel like their identity is connected to the rest of town. Another positive aspect is the shape of the building, which creates an enclosed courtyard: this is not a commonly seen layout in Uden, as most of the residential buildings are either single-family houses or row houses. However, there are a few other examples in town of apartment buildings arranged in a courtyard shape

Figure 17. analysis of t' Houdthof / Maatschappelijk Mooi.

(Figure 18): the resulting protected common space promotes a sense of community, and gives the residents a space where they can interact with each other and improve the social cohesion of the neighbourhood.

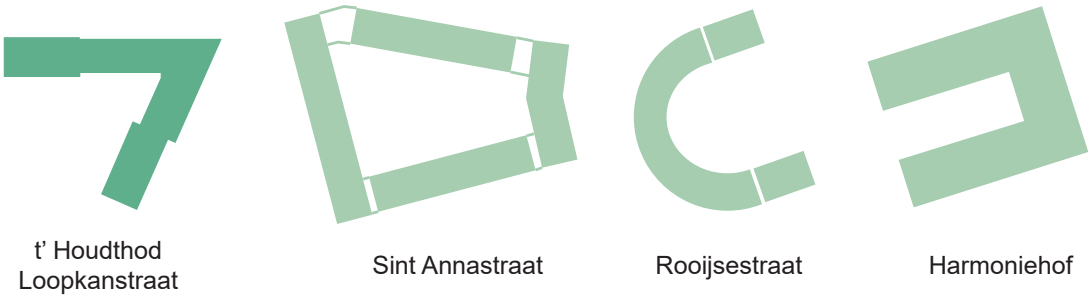


Figure 18. Some courtyard buildings in Uden.

Moreover, the side of the building facing the courtyard is lined with a walkway (Figure 19): this is clearly designed to give access to the apartments on the upper floor, but it also creates a space where the residents can meet, and where they can overlook what is happening in the courtyard without actively participating in it. Finally, the courtyard is separated from the surrounding streets, making it a safer space from which the residents can enter their homes. This is a perfect example of how an architectural characteristic of the building, its shape, not only influences its architectural value but is also deeply interconnected to its social value, as it affects the residents' opportunity to meet each other and to get together. While there are several benefits that come with the shape of

Figure 19. Views of t' Houdthof / Maatschappelijk Mooi. Internal facades with walkways.

the building, right now most of the courtyard is used as a parking lot: while this can be very practical, it means that most of this common space with a high social potential is currently occupied by cars, and people are only guests. However, as car dependency decreases in the next years, the area can be easily claimed back by people to create a more welcoming environment for the residents.

The final aspect of architectural value that should be considered is aesthetics: it was already mentioned how the traditional brick cladding creates a connection between t' Houdthof and the rest of the town, but while most of the building is covered in bricks, parts of it are cladded in timber. Wood is recognised as a sustainable material, and its use in the cladding sends a message: while this building wants to connect to the traditional Dutch identity through the use of bricks, it is also a sustainable building, and the visible timber on its facades wants to portray this. Despite this quirk in its look, this building has an overall simple look that matches the surrounding buildings, and makes it timeless: it can be assumed that locals are more prone to accept new technologies and advanced systems when the buildings that employ them have a more traditional look, that allows the town to improve its sustainability while maintaining its identity (Figure 20).

Figure 20. Cladding of t' Houdthof / Maatschappelijk Mooi and nearby buildings.

6. Survey

In Section 3 “design value” was defined as being composed of four aspects, namely economic value, environmental value, social value, and architectural value. It was also discussed how, while the economic and environmental values are easily measurable using money and carbon as their currency, social and architectural values are far more complex to evaluate, especially since they have a significant subjective component. Section 4 analysed six European projects that centre around the sustainability of the built environment, and through the comparison of their assessment frameworks it was possible to notice how not all of them had a comprehensive understanding of the value of design.

Next, one Sustainable Plus-Energy Neighbourhood from the project syn.ikia was selected, and its performance as far as architectural and social values are concerned was tested. Considering the difficulty of measuring such abstract and intangible elements, Post Occupancy Evaluation was considered the best tool to carry out this assessment. The flexibility of POE means that it is possible to develop a survey with specific targets, e.g., user satisfaction and user perception of the neighbourhood.

The analysis of the six European projects and their assessment frameworks guided the selection of the Key Performance Indicators that shaped the survey. In the next sections, the 14 chosen indicators will be described and motivated. These indicators are evaluated through several questions; in total, the survey is composed of 37 questions: 3 to gather general information, 13 about the social aspects and 21 about the architectural aspects. The questions were based on ARV’s report *D8.1 Monitoring, evaluation, and impact assessment frameworks* (Grazieschi et al., 2022).

6.1. General information

The survey starts with three questions asking the respondents to provide some general information about themselves. This is done to gather information on the demographic composition of the population answering the survey, specifically regarding their age and gender. This is considered to be valuable data, as different demographics may have different perceptions about the indicators analysed in the following sections of the survey, such as

accessibility and safety (Polko & Kimic, 2022). In this section, the respondents are also asked about how long they have lived in this housing complex.

6.1.1. Demographic information

1. How old are you? a. 18-35 b. 36-50 c. 51-65 d. Over 65
2. What is your gender? a. Male b. Female c. Other d. Prefer not to answer

Motivation: the data regarding the age and gender of the respondents is useful to put their answers into perspective.

6.1.2. Housing information

3. How long have you been living in Maatschappelijk Mooi? [open question]

Motivation: The amount of time the respondents have spent living in the neighbourhood may affect their relationships with the other residents, thus influencing the perceived social quality.

6.2. Social KPIs

The second section of the survey is composed of 13 questions aiming to evaluate 5 social KPIs. These questions are used to verify the performance of the neighbourhoods with respect to inclusivity, democracy and social engagement: considering the subjectivity

inherent to social quality, the focus of these questions is on what the residents feel and perceive. Other aspects that are assessed are safety and accessibility: the social value of architecture is deeply intertwined with its architectural value (Shirazi et al., 2022), and this is particularly relevant for the aforementioned aspects. Both the objective and the perceived safety of a space are highly related to its layout (Yu & Woo, 2022), and the design of infrastructure can promote, or hinder, accessibility and sustainable mobility (Design Council, 2017).

6.2.1. Democratic process and social engagement

4. Were you informed about the planning/design process of the building you live in? To what extent?

a. I was informed of the design proposals/decisions, but I could not express my opinion
b. I was informed of the design proposals/decisions, and I could express my opinion
c. I was informed of the design proposals/decisions, but I was not interested in expressing my opinion
d. I was not informed of the design proposals/decisions

Motivation: this question is aimed at understanding whether all individuals were offered the opportunity to participate in decision-making processes and whether they feel heard and taken into account. Enabling citizen participation results in increased community control, and in turn in citizen empowerment (Medved, 2018).

6.2.2. Demographic composition

5. Most of the inhabitants of Maatschappelijk Mooi have lived in Uden for almost their entire life.

a. Strongly disagree
b. Disagree
c. Neither agree nor disagree
d. Agree
e. Strongly agree

6. Most of the inhabitants of Maatschappelijk Mooi have a similar social background as mine (e.g. same educational level, same kind of job, similar income, etc.).

a. Strongly disagree
b. Disagree
c. Neither agree nor disagree
d. Agree
e. Strongly agree

7. I have much in common with the inhabitants of Maatschappelijk Mooi.

a. Strongly disagree
b. Disagree
c. Neither agree nor disagree
d. Agree
e. Strongly agree

Motivation: the demographic composition of the neighbourhood, and the resulting perceived sense of community, are fundamental to understanding the social quality of the area. In particular, these questions aim to understand how homogeneous or heterogeneous Maatschappelijk Mooi is. The feeling of having something in common with the other residents of the neighbourhood could result in a greater sense of belonging, but it could also result in the exclusion of new arrivals or those living outside of the neighbourhood because they are perceived as “different.”

6.2.3. Social interaction and cohesion

8. There are many people moving in and out of Maatschappelijk Mooi.

a. Strongly disagree
b. Disagree
c. Neither agree nor disagree
d. Agree
e. Strongly agree

9. Do you agree with the following statements? [strongly disagree to strongly agree]

a. I barely know the other people living in Maatschappelijk Mooi
b. I know many people living in Maatschappelijk Mooi
c. I often talk to people in Maatschappelijk Mooi
d. I often invite other people living in Maatschappelijk Mooi into my home

10. How would you rate the social interactions you have with your neighbours?

a. Very bad
b. Bad
c. Neutral
d. Good
e. Very good

Motivation: the social interaction and cohesion that characterises a neighbourhood directly affect its social capital, which is defined as connections between people (Dekker & Uslaner, 2003). These questions aim to understand to what degree the residents of Maatschappelijk Mooi know and interact with each other, and if there are any differences between the relationships among residents of the same housing complex and of different buildings. Question 8 asks about residential mobility in the neighbourhood, as that can be an indication of the perceived quality and care for the built environment. In general, assessing the social interaction and cohesion of Maatschappelijk Mooi is useful to evaluate the people's enjoyment of the space, which in turn affects their sense of pride and belonging.

6.2.4. Safety and security

11. How safe do you feel in and around Maatschappelijk Mooi?

a. Very unsafe
b. Unsafe
c. Neither safe nor unsafe
d. Safe
e. Very safe

12. Which are the main causes of unsafety in and around Maatschappelijk Mooi?

a. Robbery or theft
b. Assaults or rapes
c. Crossing the street is unsafe
d. Walking/biking in the street is dangerous
e. Lack of adequate sidewalk/bike lanes
f. Insufficient public lighting
g. Damage to public lighting/street furniture
h. I don't feel unsafe in and around Maatschappelijk Mooi

13. What makes Maatschappelijk Mooi particularly safe?

[open question]

Motivation: when a neighbourhood is perceived as safe, this supports the development of trust within the local community; on the contrary when a neighbourhood struggles with security, this can stimulate negative social behaviours and criminal activities (Zeng et al., 2022).

6.2.5. Access to sustainable mobility, services, and amenities

14. How many kilometres do you travel daily to go working and come back home? [open question]
15. What is your main mean of transportation? a. Private car b. Public transport c. Bike d. Electric scooter e. On foot
16. Do you agree with the following statements? [strongly disagree to strongly agree] a. Maatschappelijk Mooi has very good access to public transportation b. Maatschappelijk Mooi has very good access to services and amenities (e.g. supermarkets, schools, libraries, shops, etc.) c. Maatschappelijk Mooi has very good access to high-quality outdoor areas d. I live close to my place of work e. Overall, Maatschappelijk Mooi is a very high-quality neighbourhood

Motivation: access to and widespread use of sustainable mobility, e.g., public transport and bicycles, allows to significantly cut the amount of greenhouse gas emissions produced in the neighbourhood. These modes of sustainable transport are also cheaper than using a private car, thus allowing all citizens to move freely regardless of their financial status (Savvides, 2013). Equal access to services and amenities also promotes social interaction and cohesion: indeed, services and amenities can be considered a type of social infrastructure, i.e., public places that allow people to meet and socialise (Klinenberg, 2018).

6.3. Architectural KPIs

The third and last section of the survey is composed of 21 questions aiming to evaluate 9 architectural KPIs. As previously explained, the importance of architectural quality is generally agreed upon, but it is hard to measure in detail, as it is often dependent on subjective opinions (Serin et al., 2018). This is something that the architectural and social values of design have in common, but the difficulty in measuring them should not be a deterrent to keeping these values into consideration. Indeed, the aesthetic expression of a place has repercussions on its users' well-being (CABE, 2003), and this section of the survey wants to investigate how the residents of Maatschappelijk Mooi experience the architectural quality of the neighbourhood. Some of the KPIs evaluated in this section are thermal comfort, indoor air quality, acoustic comfort, and solar and daylight access. These are the components of Indoor Environmental Quality, the more "measurable" aspect of architectural value that is often included in assessment frameworks. These KPIs can be measured quantitatively through monitoring, but it is equally important to consider the subjective experiences of the residents.

6.3.1. Aesthetic and visual qualities

17. How much do you like the outside appearance of the building you live in? a. I really dislike it b. I dislike it c. Neutral d. I like it e. I really like it
18. How much do you like the inside appearance of the building you live in? a. I really dislike it b. I dislike it c. Neutral d. I like it e. I really like it

19. How much do you like the surroundings of the building you live in? a. I really dislike it b. I dislike it c. Neutral d. I like it e. I really like it
20. Is there anything in particular you like about the outside or the inside of the building you live in, or about its surroundings? [open question]

Motivation: a core element of architectural value, aesthetics and visual qualities subconsciously affect people's comfort and health (Salom et al., 2022). This KPI is also connected to the environmental value of design, as the aesthetic appreciation of a building, the belief that it is beautiful and valuable, is a prerequisite for its long life (Royal Danish Academy, 2017).

6.3.2. Flexibility and adaptability

21. Can you easily change the function of a room in your home? (e.g. changing its use from a bedroom to an office) a. Yes b. No
22. Can you easily change the floor layout of your home? (e.g. make one bigger room out of two smaller ones, or vice versa) a. Yes b. No
23. How high are the ceilings in your home? a. Low b. Normal c. High

Motivation: a flexible and adaptable building is less likely to be demolished because of functional obsolescence, as it can accommodate future changes (Murray, 2011). In this sense, flexibility and adaptability are closely linked to the environmental value of the building, as they have a strong influence on its life cycle environmental performance.

From the point of view of the users, the possibility to change the function of a room, or to create new spaces within the house, can be a very valuable way to adapt to new needs.

6.3.3. Accessibility

24. My home is accessible to people with disability in… (check what applies)

a. Walking
b. Seeing
c. Hearing
d. Not accessible

Motivation: everyone should be able to access buildings regardless of their disabilities (Salom et al., 2022); universal accessibility becomes especially important in public social infrastructures, where everyone should be able to come together and socialise

6.3.4. Sufficiency and adequacy of space

25. How would you rate your home in terms of size?

a. Too small
b. Small
c. Just right
d. Big
e. Too big

Motivation: in Europe, there is an increasing demand for indoor spaces (Salom et al., 2022), but, at the same time, reducing building construction has been identified as a crucial way to save energy and emissions in the European context (European Commission et al., 2016). From the users' perspective, living in a space of adequate dimensions can improve their satisfaction and their likelihood to live there for a longer time. Having a stable community with low mobility is linked to increased social cohesion (Dekker & Uslaner, 2003), so this KPI has an influence on both the environmental and the social quality of design.

6.3.5. Outdoor comfort

26. Is there an outdoor area associated with the building you live in, such as a garden or a park? a. yes b. no
27. Do you like spending time outdoors in your neighbourhood? a. Yes b. No
28. How often do you spend time outdoors in your neighbourhood? a. Every day b. A couple of days a week c. Once a week d. Less than once a week

Motivation: spending time outdoors is linked to numerous benefits on people's health, both physical and mental. Considering public outdoor areas as social infrastructures, with the potential to foster social integration and cohesion, reveals another important aspect of spending time outdoors.

6.3.6. Indoor air quality

29. How satisfied are you with the quality of the indoor air in your home? a. Very dissatisfied b. Dissatisfied c. Neutral d. Satisfied e. Very satisfied

Motivation: the general need for a good IEQ means that Indoor Air Quality (IAQ) should also be excellent. IAQ can be measured quantitatively by addressing the level of CO2 in the air, which is recognised as an indicator of poor ventilation (Salom et al., 2022) and can negatively affect people's health (Dorizas et al., n.d.). This question aims to investigate people's perception of IAQ in their homes.

6.3.7. Solar and daylight access

30. Are you satisfied with the quantity of sunlight in your home? a. Yes b. No
31. Do you need artificial lighting during the daylight hours to carry out your tasks? a. Yes b. No
32. Do you ever experience undesired glare effects in your home? (glare is described as an unpleasant bright or too strong light) a. Yes b. No

Motivation: access to natural light has a positive effect on human health (Jamrozik et al., 2019), specifically with regard to circadian alignment, sleep, and mental health (Nagare et al., 2021). While daylight access can be evaluated quantitatively by measuring the daylight factor inside a room and comparing the result to national or international guidelines, it is also true that individuals have different perceptions of light (Zainordin et al., 2012). These questions are aimed at assessing the residents' satisfaction with daylight and lighting conditions inside their homes.

6.3.8. Acoustic comfort

33. How loud is the noise in your home [from very loud to not loud at all] a. From outside b. From adjacent buildings/apartments c. From service equipment (e.g. fridge, washing machine, etc.)
34. How is the quality of the sound environment in your home? (Bad sound qualities are, for example, reverberation, echo, difficulty to distinguish single words/sounds) a. Very poor b. Poor c. Acceptable d. Good e. Very good

Motivation: noise levels affect indoor satisfaction and can hinder the possibility of natural

ventilation (Elnaklah et al., 2020).

6.3.9. Thermal comfort

35. Do you experience cold air drafts from windows even when they are closed? a. Yes b. No
36. Do you experience overheating problems in the summer? a. Yes b. No
37. Do you have access to and the possibility to operate shading systems? a. Yes b. No

Motivation: unpleasant temperatures can affect the building's occupant's comfort, as well as their productivity and sleep quality, overall reducing their well-being. There are guidelines for the desired air temperatures in summer and winter (Salom et al., 2022), but these questions take a qualitative approach to thermal comfort, asking the users about their experiences.

7. Survey results and discussion

7.1. Results and discussion: general information

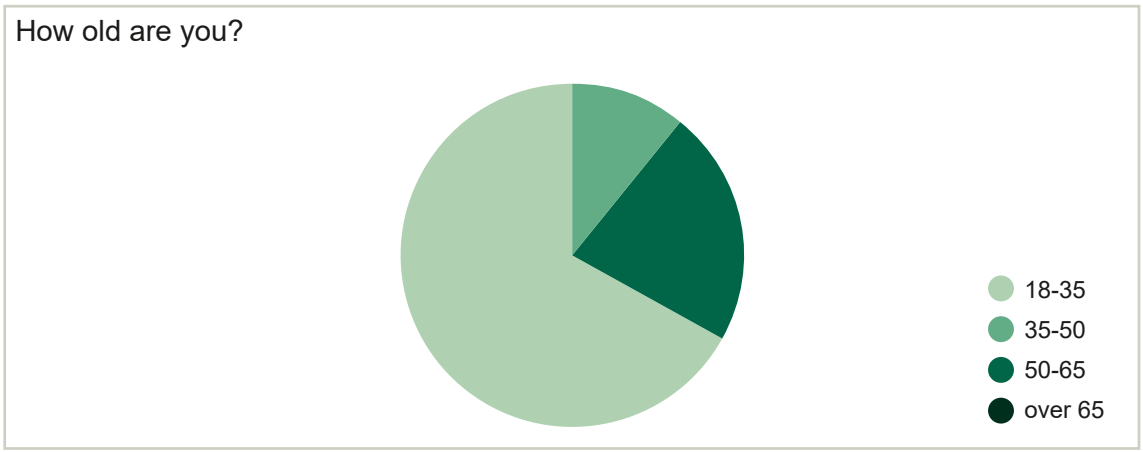


Figure 21. Demographic information 1

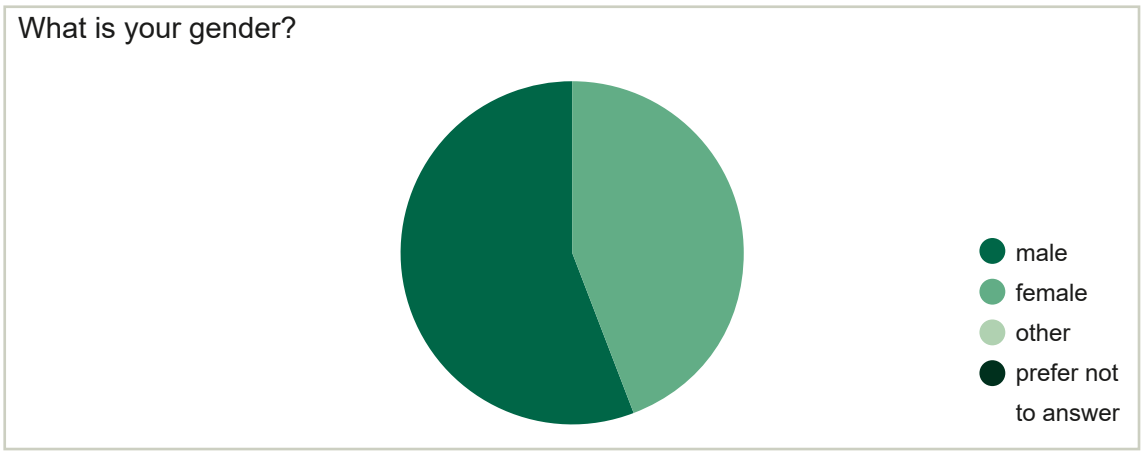


Figure 22. Demographic information 2

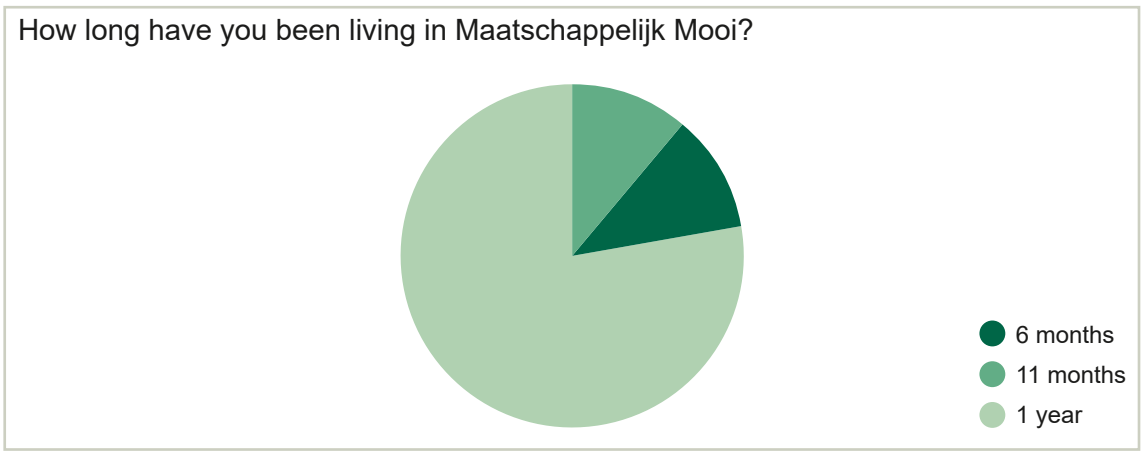


Figure 23. Housing information 1

Out of the 36 people currently living in t' Houdthof, 9 answered to the survey. The respondents are equally distributed between men and women (Figure 22), and with the majority of them being under 35 years old (Figure 21), t' Houdthof / Maatschappelijk Mooi is a young neighbourhood. The building was finalised in May 2022, and most of the respondents (88.9%) have been living there since then (Figure 23). These demographic information can be useful to put the results of the rest of the survey into perspective: for example, males and females may have different impressions of safety or thermal comfort, while age can affect the participitation in social activities or the perception of accessibility. On the other hand, the amount of time spent living in the neighbourhood can influence the feeling of community experienced by the residents.

7.2. Results and discussion: social KPIs

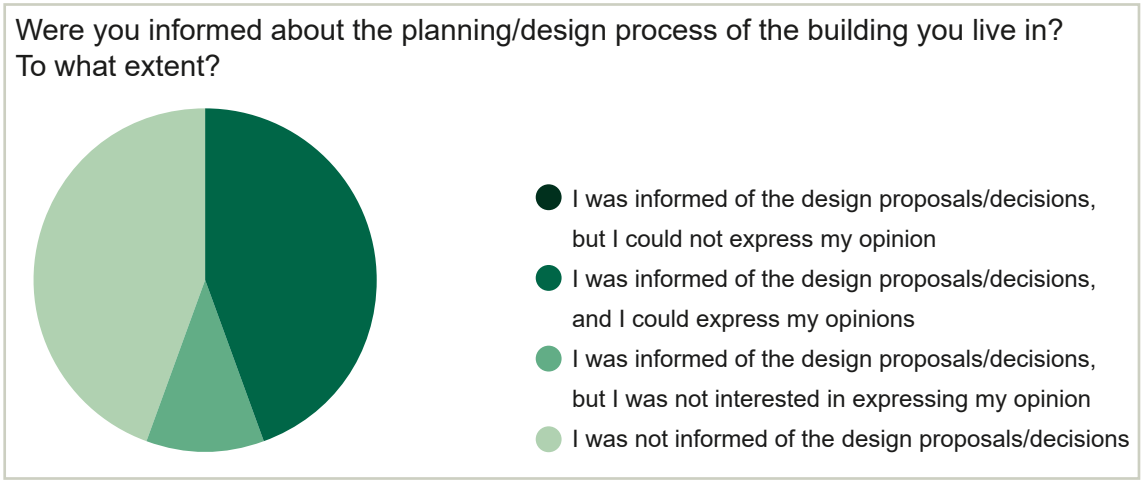


Figure 24. Democratic process and social engagement 1

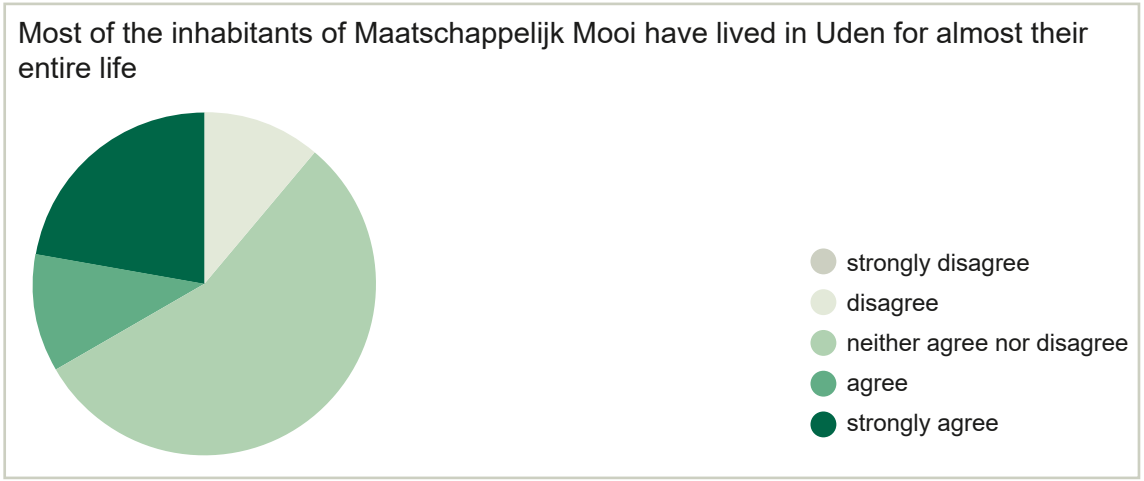


Figure 25. Demographic composition 1

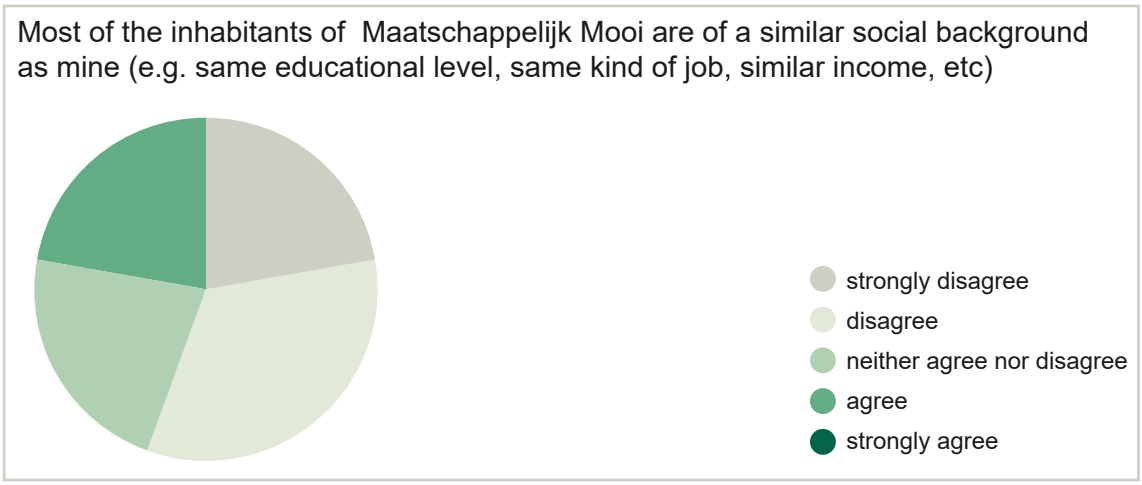


Figure 26. Demographic composition 2

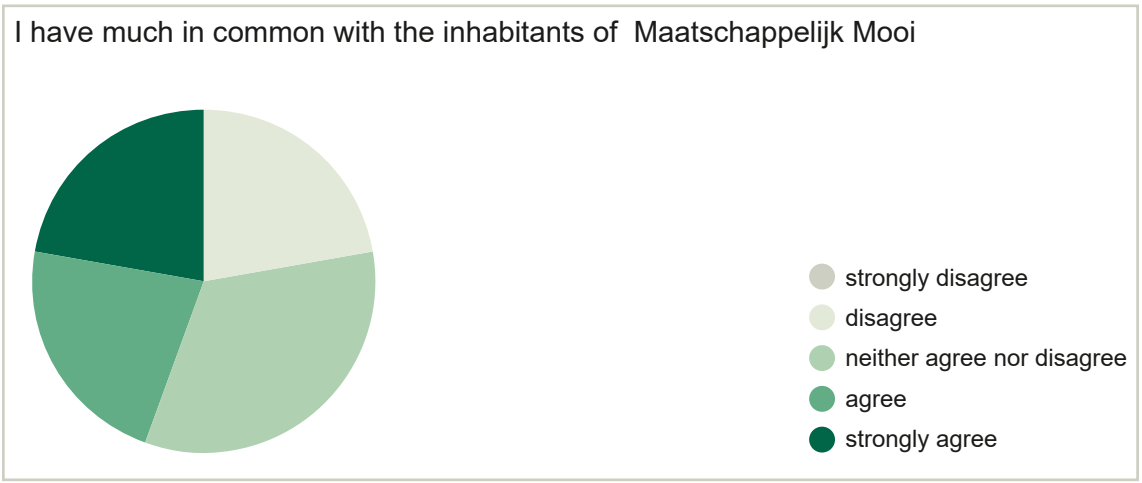


Figure 27. Demographic composition 3

Looking at the democratic process surrounding the design development of the building (Figure 24), the respondents were almost evenly split between those who were informed about the design decision and those that were not. Still, having even only a part of the future tenants share their opinions on the design proposals can lead to more satisfaction with the design outcomes. Moreover, this type of social participation results in the future residents feeling heard; promoting the engagement of the future users of the building and giving them control over the design process is also proven to result in citizen empowerment (Medved, 2018).

When asked about how similar their social backgrounds are to those of the other residents, the answers are not unanimous (Figure 26); still, 78% of the respondents do not agree,

to a varying degree, to “having a similar background” to the other residents. Despite the feeling of coming from different environments, 44.4% of the respondents state that they have much in common with the other residents, with only 22.2% claiming that they do not feel like they share much with their neighbours (Figure 27). While studies have found that when people’s characteristics do not match those of the other residents, they are more likely to want to leave the neighbourhood (He et al., 2022; Van Ham & Feijten, 2008), the differences in social background experienced by the population of t’ Houdthof do not seem to result in a desire of moving. Indeed, a more diverse socio-economic neighbourhood composition can result in better social opportunities for the individuals (Musterd & Andersson, 2005), and this could the case for t’ Houdthof.

The composition of the neighbourhood has remained stable in the last year, with an almost unanimous agreement that there are not many people moving in and out of t’ Houdthof. The low level of residential mobility can be linked to an increasing opportunity for social cohesion: improved unity and solidarity in the neighbourhood can promote greater social participation and well-being, especially for those members of society who may otherwise experience a lacking social network (Shippee, 2008), such as people suffering from mental disabilities.

The minimal residential mobility in the neighbourhood (Figure 28) combined with the limited number of apartments causes most residents to feel like they know each other, and this results in repeated interactions between the inhabitants, especially in the common outdoor areas (Figure 29). On the other hand, fewer people state that they invite their neighbours into their homes: the public space that is incorporated in the design of t’ Houdthof acts as the social infrastructure. Having a place where people can freely meet and gather is a key to strengthening the community (Klinenberg, 2018), as it provides the residents with the possibility to connect with each other, and to form relationships. Social infrastructures are the physical conditions that determine whether social capital can develop: the opportunity that the design of t’ Houdthof gives to its residents to create bonds despite their socio-economic differences results in most respondents judging the social interactions within the neighbourhood as positive, and no responders report having negative relationships with their neighbours (Figure 30).

There is complete agreement on the safety of the building, with no residents reporting feeling unsafe in t’ Houdthof / Maatschappelijk Mooi nor around it (Figures 31 and 32).

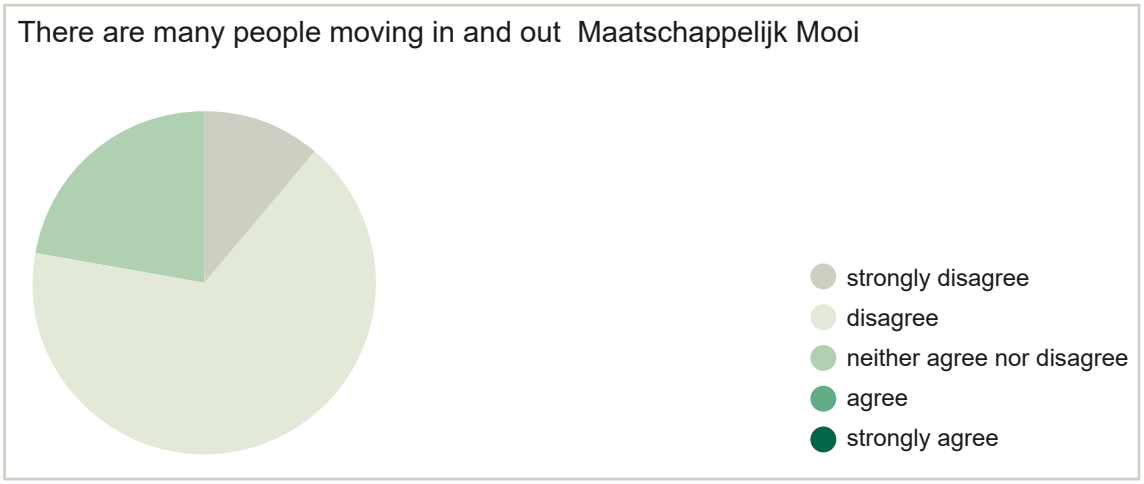


Figure 28. Social interaction and cohesion 1

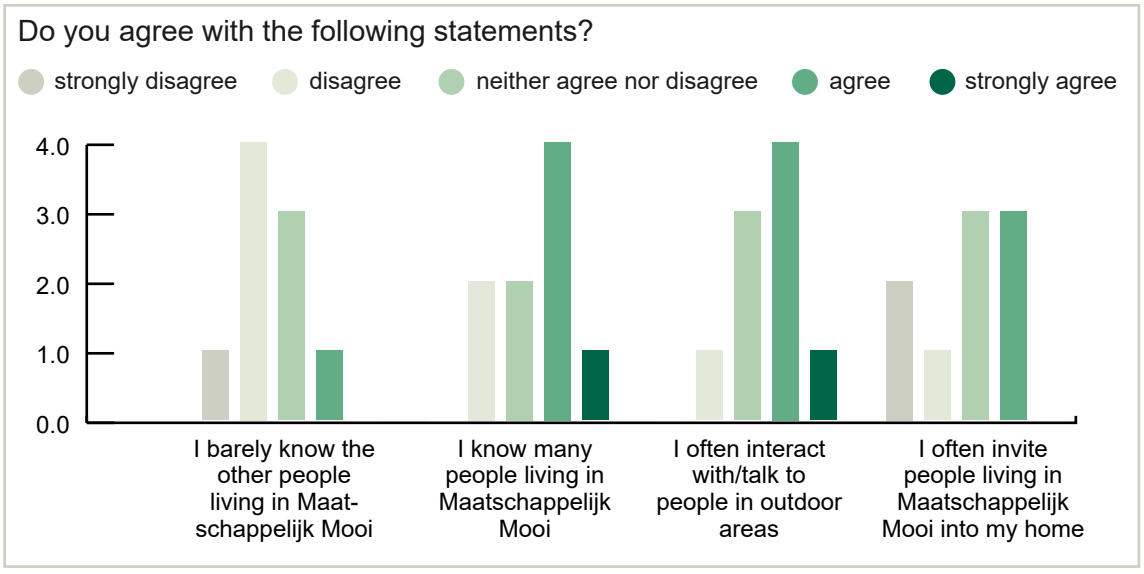


Figure 29. Social interaction and cohesion 2

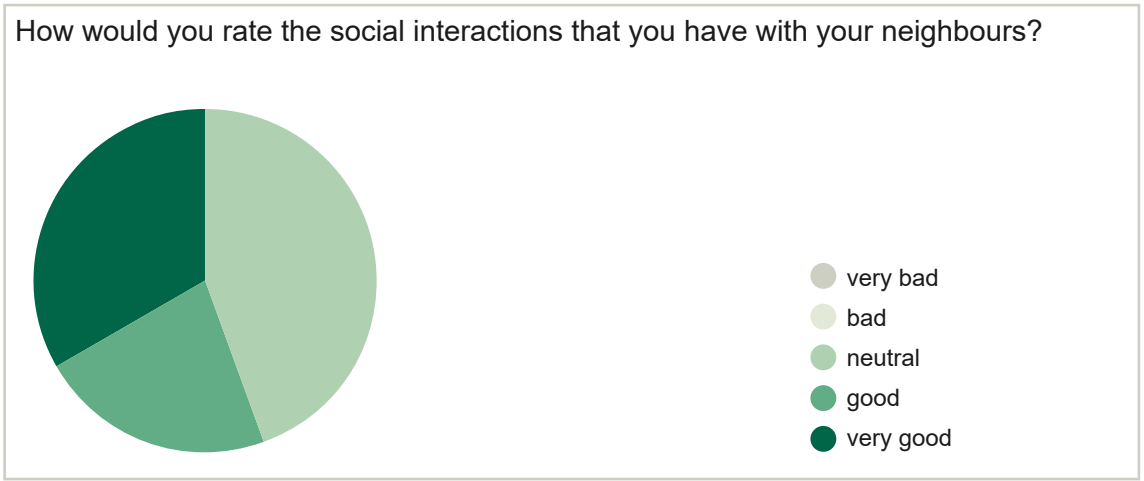


Figure 30. Social interaction and cohesion 3

When asked what the reason for this feeling of safety is, many responders point out the role of social control played by the neighbours, and the comfort resulting from knowing who lives next to you (Figure 33). Knowing that your neighbours are keeping an eye on what is happening around the building turns out to be the key to making a space feel safe: this was already claimed by Jane Jacobs in 1961. When talking about strategies for making city streets safe, she stated that “there must be eyes upon the street” (Jacobs, 1961). This network of almost unconscious voluntary controls among the people of the neighbourhood is exactly what makes t’ Houdthof such a safe environment. Other elements that are mentioned by the respondents as being a source of safety and security are having access to their apartments from a relatively secluded and private parking and

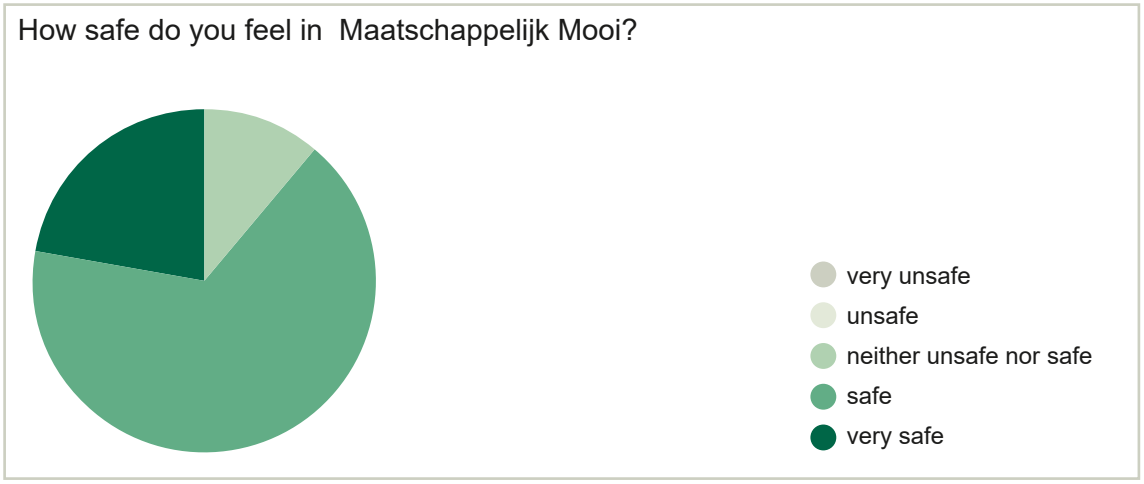


Figure 31. Safety and security 1

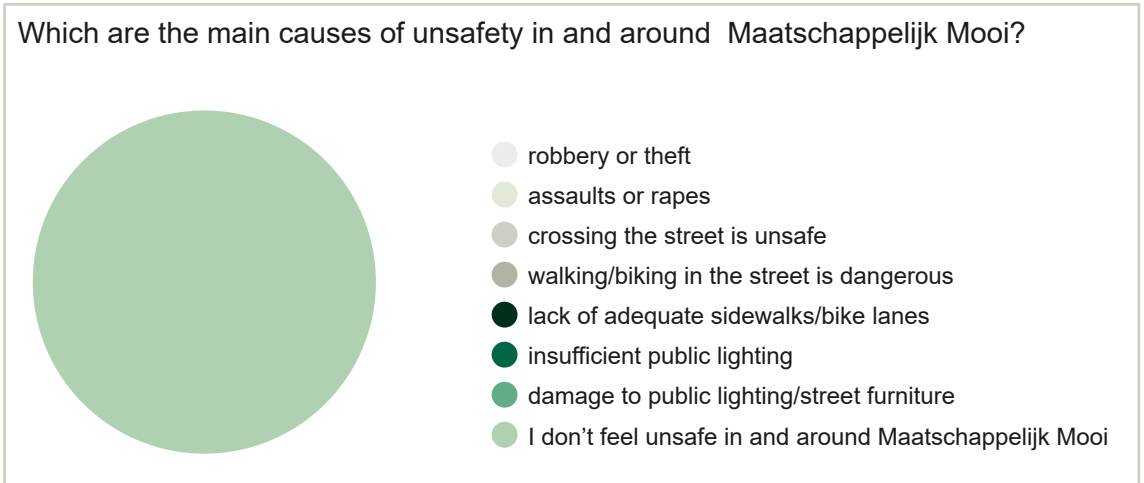


Figure 32. Safety and security 2

What makes Maatschappelijk Mooi particularly safe?

- The social control of the neighbours
- The front doors are not on the street side
- There is a lot of social oversight by the neighbours
- Knowing all your neighbours
- Closed entrance
- Social control is high, people keep an eye on what is happening and inform each other
- I feel like people here just stick to themselves, some of the people that attend meetings and certain activities (having dinner, sitting outside, going for a walk, etc.) are nice and I feel as if I could always just give them a ring or ask for advice regarding anything. Though I would say out of the 40~ people living here, that only applies to maybe 7 or so people.
- Relatively secluded parking and garden area, and good automated lighting (radar sensor that causes brightness to go up when movement is detected).

Figure 33. Safety and security 3

How many km do you travel daily to go working and come back home?

- 0 km
- 3,4 km
- 5 km
- not long
- 30-40 km
- 40 km
- 60 km
- 60 km
- 70 km

Figure 34. Access to sustainable mobility, services and amenities 1

garden area, as well as the automatic lighting that turns on when detecting movement. Indeed, public lighting provides a sense of security, making outdoor places feel more inviting and safe after the sun sets (Florian, 2023).

When it comes to accessibility to sustainable transport on a daily basis, five of the respondents report that they work between 30 and 40 km away from t' Houdthof / Maatschappelijk Mooi, and that private cars are their main means of transportation. For the other respondents, who work in Uden or from home, moving by public transport, bike or foot is the most common way of going to work (Figures 34 and 35). The use of sustainable mobility in the area is thus not widespread, and this goes against the "Sustainable and Smart Mobility Strategy" presented by the European Commission, which states that green alternatives to traditional transport modes must be widely available (European Commission, 2021). However, given the small size of Uden and its proximity to bigger cities such as Eindhoven, it is not a surprise that many residents have to commute daily to get to their places of work, and that private cars are the most efficient mean of transport. While public transport in the area is not used by several respondents to reach their workplaces, the residents of t' Houdthof agree that they live close to services and amenities and that they can easily access high-quality outdoor areas (Figure 36). Easy access to local amenities such as supermarkets and shops has been identified to increase the share of slow mobility (Elldér et al., 2022): this does not only have positive environmental repercussions, but improves the autonomy and social participation of those residents who may not have access to private cars, by promoting a more locally oriented daily life.

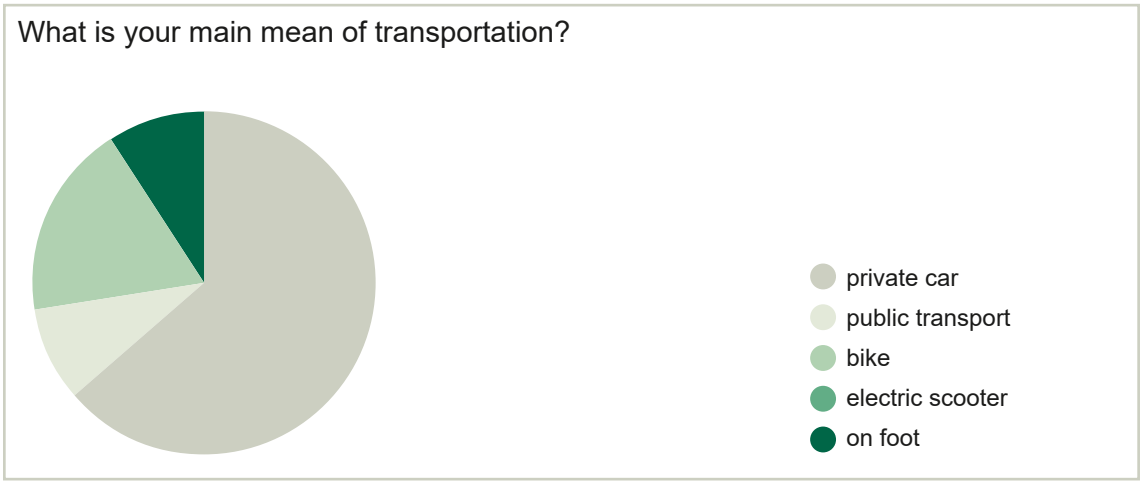


Figure 35. Access to sustainable mobility, services and amenities 2

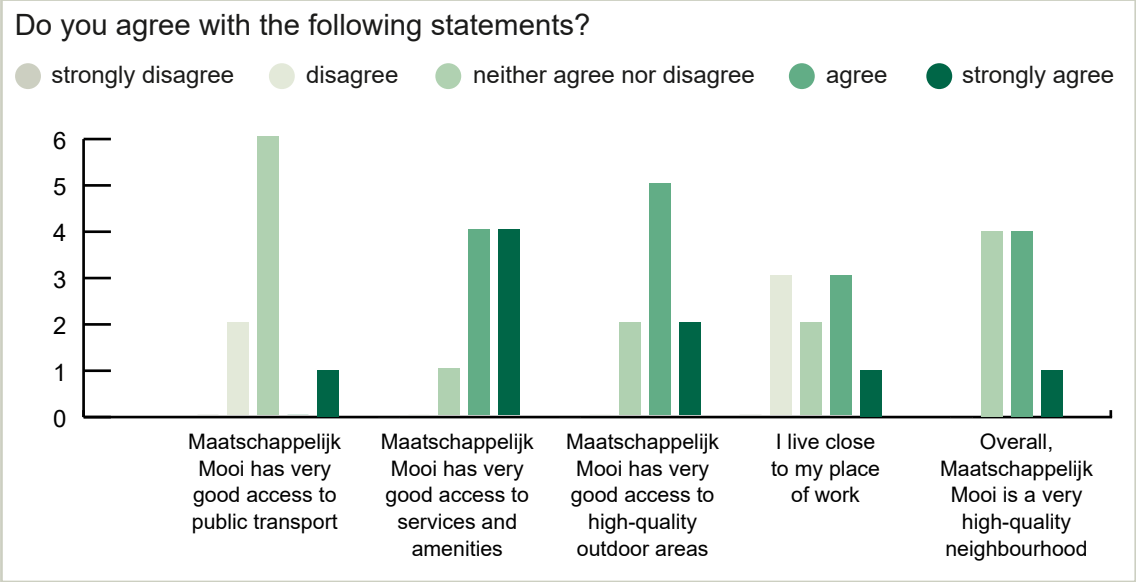


Figure 36. Survey results: question 16

7.3. Results and discussion: architectural KPIs

Moving on to the perceived architectural value of t' Houdthof / Maatschappelijk Mooi, the majority of the residents appreciates the outside appearance of the building (Figure 37), while the inside appearance of the apartments and the surrounding areas are less liked (Figures 38 and 39). As mentioned in the analysis, it can be supposed that the use of a traditional cladding material, such as bricks, is the reason why the external aesthetics of the building are appreciated. On the other hand, the housing complex is lined by a quite busy road on one side, and its courtyard is mostly taken up by parking spots, so it is understandable that fewer residents are positive about the looks of the surroundings. When asked about a specific element that they like, several respondents pointed out the easy access to the nearby park, while others appreciate the use of wood and of different colours of bricks for the façade, stating that it blends nicely with the surroundings while incorporating advanced technologies (Figures 35). The recognised quality of the space can be directly linked to the positive social experiences reported by the respondents in the first part of the survey: the influence that the physical environment has on social activities has been proven (Gehl, 2011), with outdoor areas of good quality promoting the possibility for people to meet and talk to each other. The common courtyard defined by the building volume, whose separation from the street gives a sense of privacy and containment and was highlighted as a source of safety, provides the residents with the

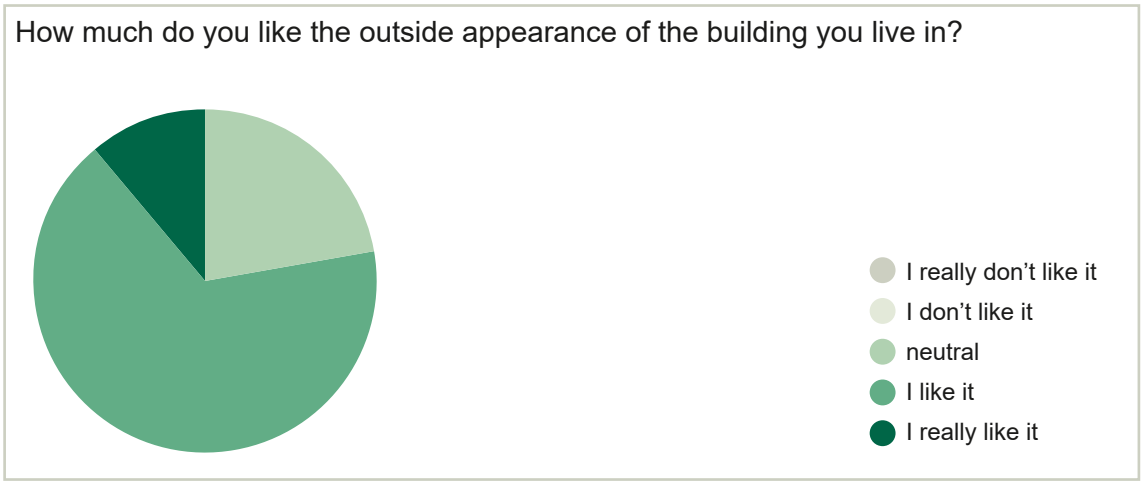


Figure 37. Aesthetics and visual qualities 1

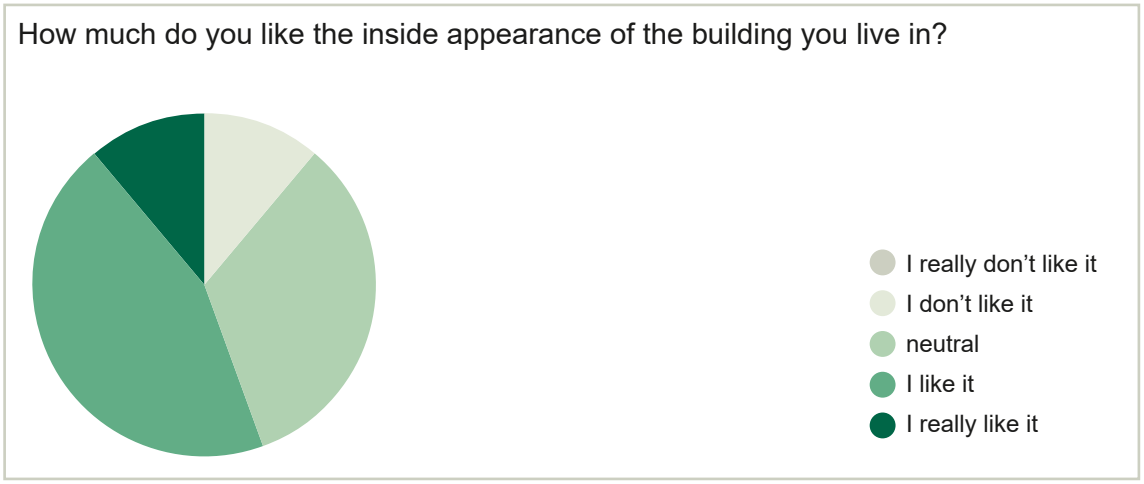


Figure 38. Aesthetics and visual qualities 2

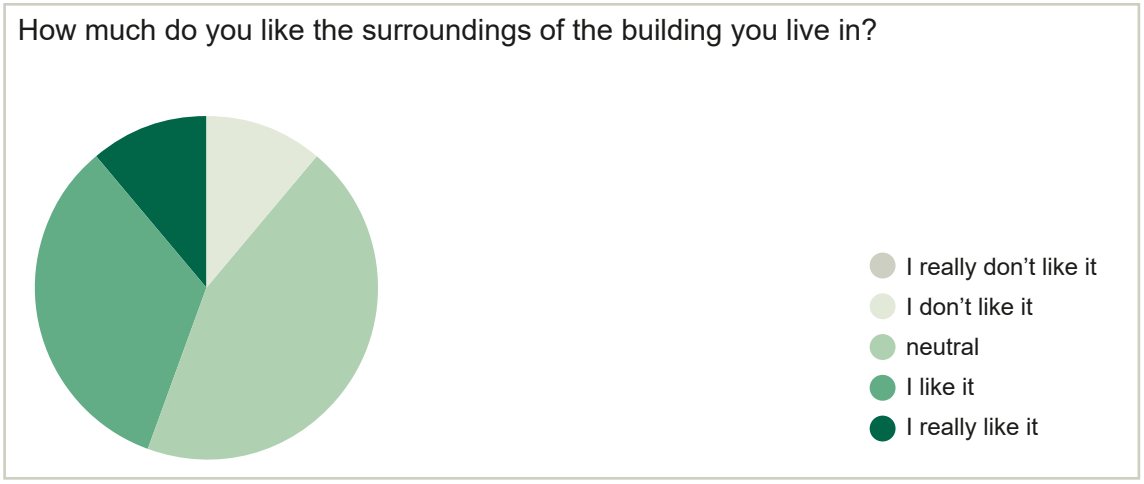


Figure 39. Aesthetics and visual qualities 3

Is there anything in particular that you like about the outside/inside appearance of the building you live in, or about its surroundings?

The picknicktable and the park on walk distance
Green!
I like living close to the city center but still having a large park at a 100m walk from the apartment
Building quality and the use of timber
It looks green, blends in well with the surroundings
I think the building looks good, modern, the inside for me (one person apartment) is small but cozy, I wish I had a little bit more storage but aside from that I cannot complain, I like the ground floor balcony as it's a great place to relax for me
The combination of wood in the loggias and the mix of brick colours

Figure 40. Aestetics and visual qualities 4

opportunity to be with others in a relaxed and undemanding way. The balconies, most of which face the courtyard, are another way in which the physical context promotes the feeling of being among others, by allowing the neighbours of seeing and hearing each other, thus participating in social activities in a modest way. Indeed, the balcony was mentioned by one of the respondents as their favourite building element. These types of low-intensity contacts promoted by such a socially-inclined built environment can be the foundations for other, deeper, forms of contacts (Gehl, 2011).

When it comes to flexibility and adaptability, most users agree that it is relatively easy to change the function of a room (Figure 41), while it is not possible to easily change the layout of the apartments (Figure 42). The adaptability of a building supports a longer life cycle and is, therefore, an important aspect of the building's architectural and environmental values. The ability of the residents to change the function of single separate rooms highlights that the apartments of t' Houdthof could be adapted in case of small changes; if bigger changes in function were to occur, a deeper study and more significant modifications in the layout would be needed. Still, the modularity highlighted

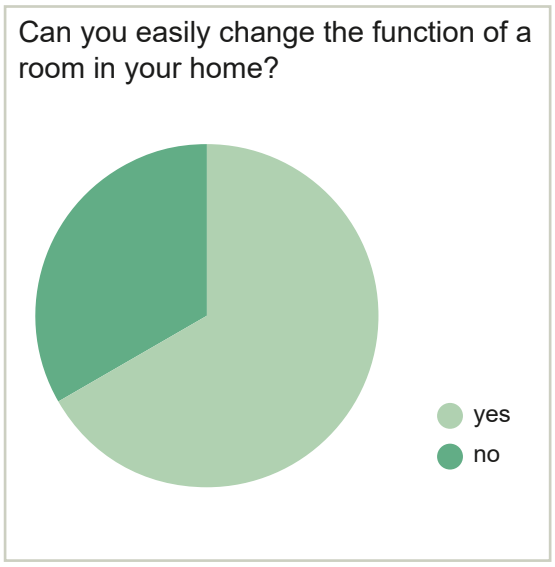


Figure 41. Flexibility and adptability 1

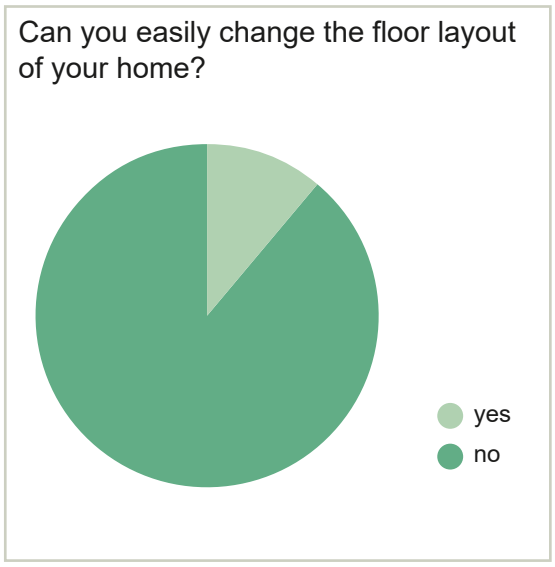


Figure 42. Flexibility and adaptability 2

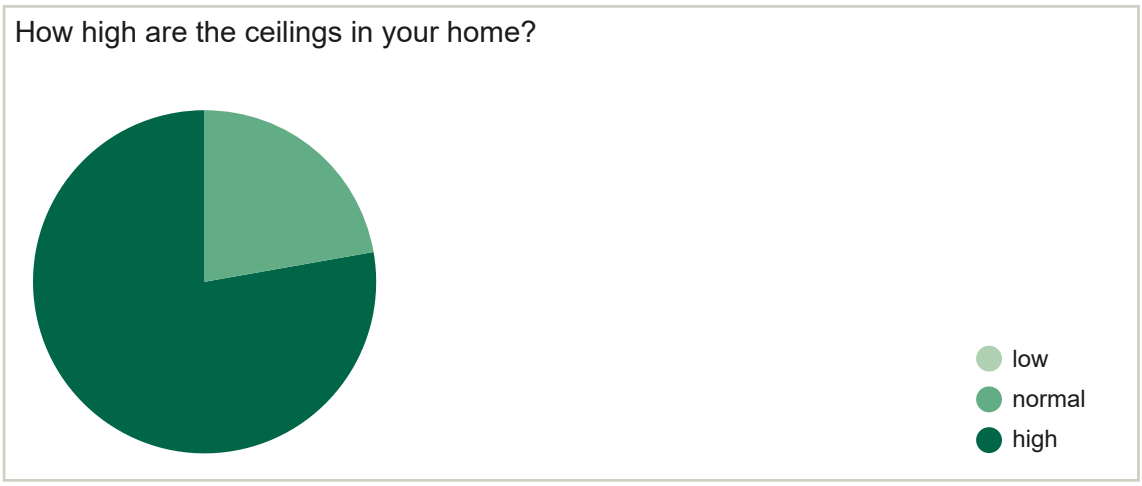


Figure 43. Flexibility and adaptability 3

in the analysis, combined with the high ceilings reported by the residents (Figure 43) indicate the attention that was given to guarantee the possibility of adapting the building for a future use.

Most respondents believe that their apartments are accessible to people with disabilities (Figure 44): indeed, ensuring accessibility for all, regardless of physical abilities, was a key parameter for the design. The apartments' sizes are considered "just right" by most respondents, but some do note that their home is small (Figure 45). This is not surprising, considering that the apartments' sizes, at 46m^2 and 71m^2, are well below

the average size for new houses in The Netherlands, which is 116m^2 (Ball, 2022). Still, most residents are satisfied with their dwelling's size, and limiting the dimension of new construction is a crucial strategy to limit energy consumption and emissions (European Commission et al., 2016). Most residents appreciate not only their apartments but also like spending time in the outdoor area connected to the building and in the nearby park, with 78.8% using these spaces at least once a week (Figures 46, 47 and 48). Spending time outdoors is recognised as a way to improve mental and physical health (Serin et al., 2018), and the aforementioned role of the public area as a social infrastructure means that spending time in the common courtyard also fosters social interactions.

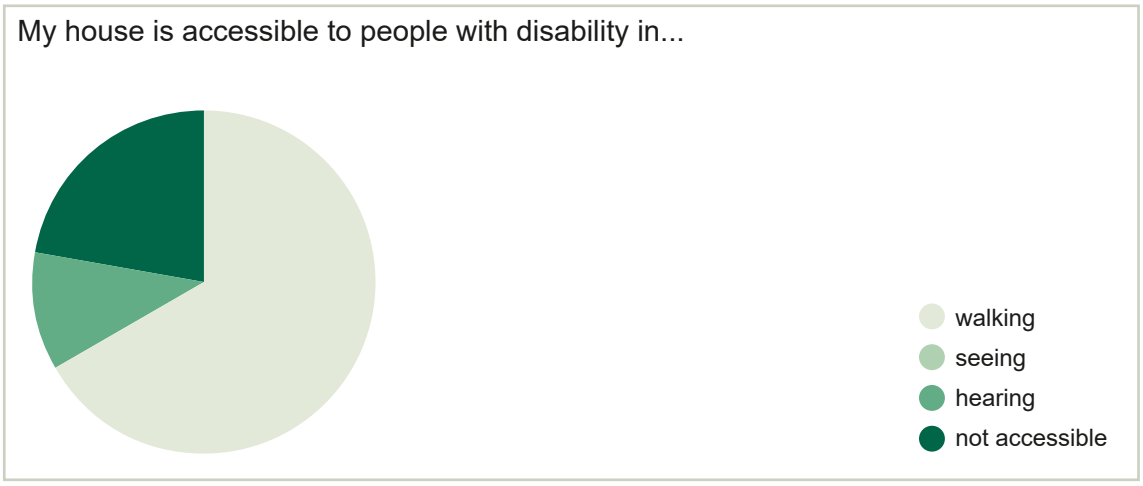


Figure 44. Accessibility 1

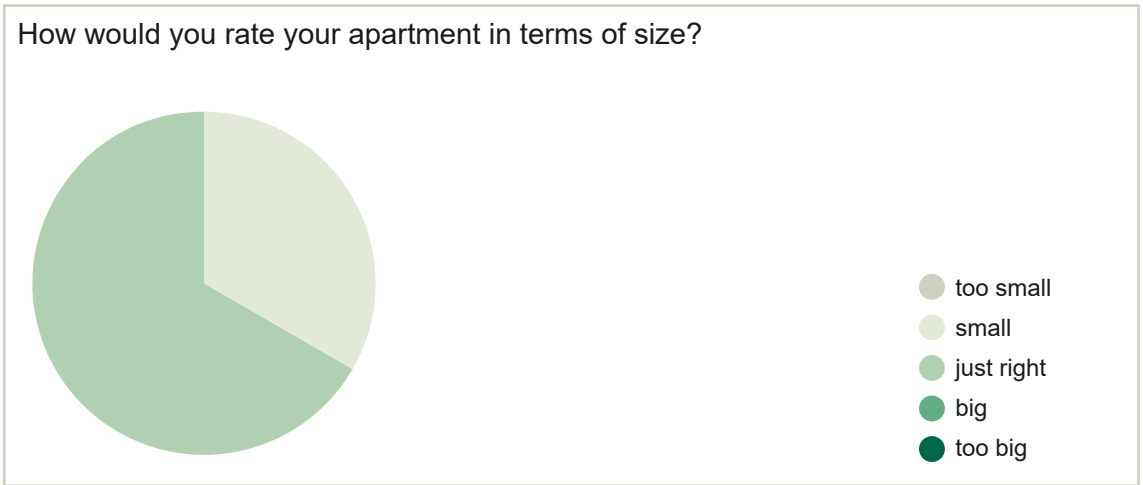


Figure 45. Sufficiency and adequacy of space 1

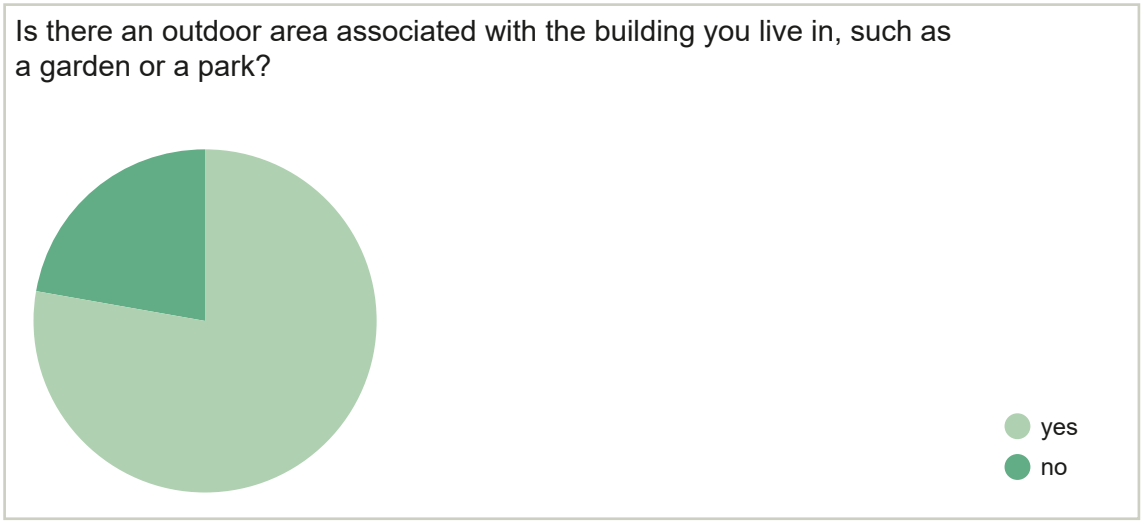


Figure 46. Outdoor comfort 1

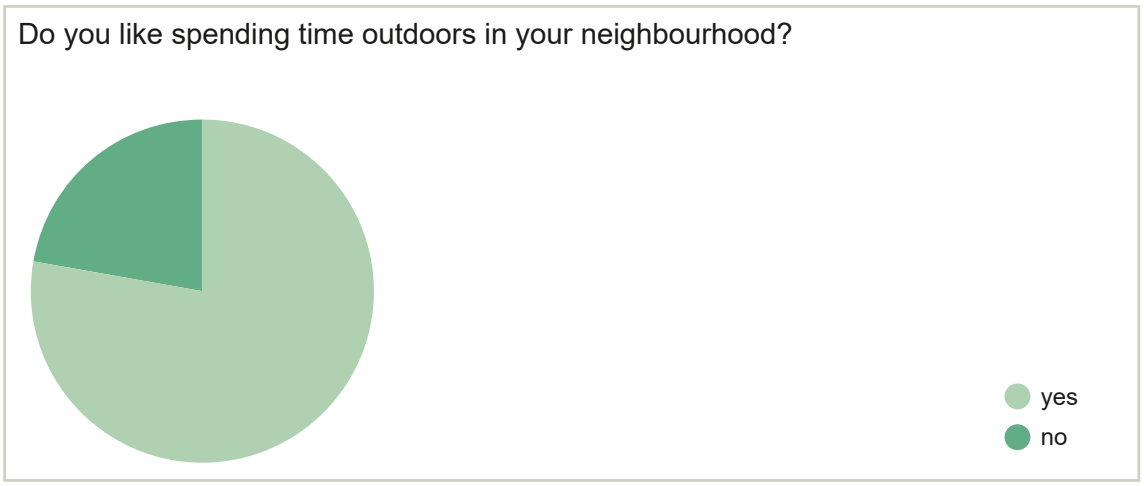


Figure 47. Outdoor comfort 2

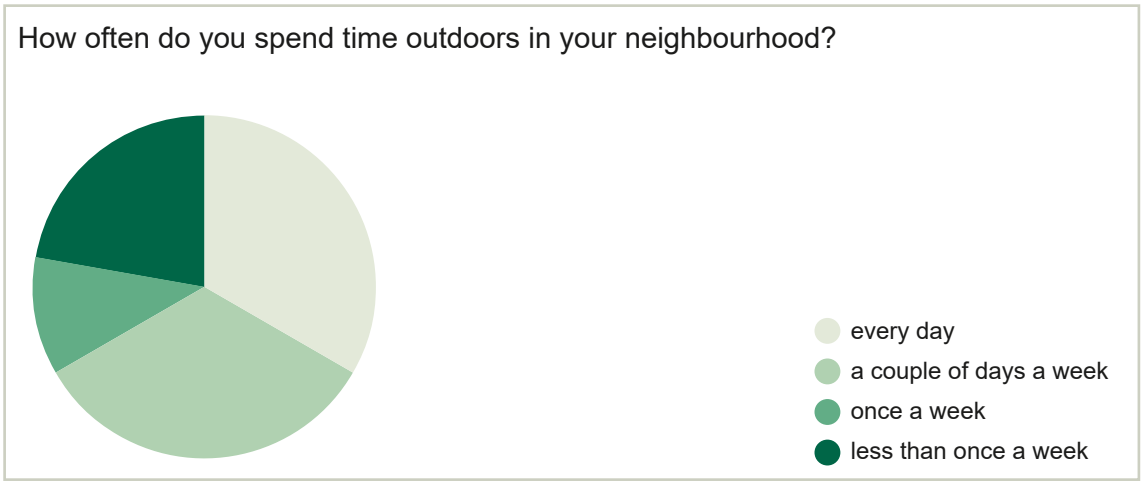


Figure 48. Outdoor comfort 3

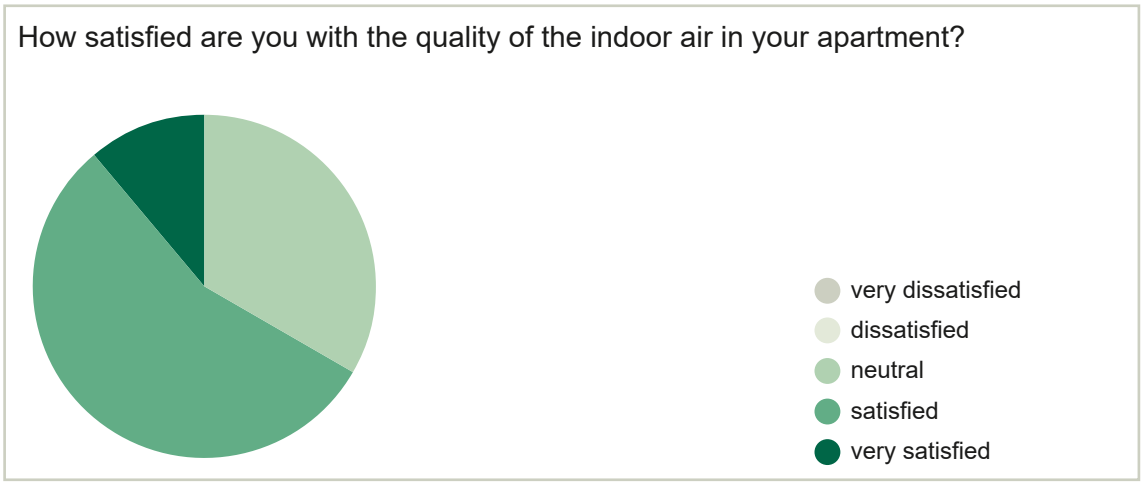


Figure 49. Indoor Air Quality 1

The IEQ of the building is generally perceived as positive: no one reports being dissatisfied with the air quality (Figure 49), and the overwhelming majority of the respondents are satisfied with the amount of light in their apartments, resulting in no need to use electric lighting during the daylight hours, and no experience of glare effects (Figures 50, 51, and 52). The acoustic performance of the apartments is also, on average, good: while some residents report moderately loud noises coming from outside, the majority are not bothered by noise coming from the street, nor from adjacent apartments or service equipment (Figure 53). The sound environment inside the apartments is also considered good to very good, with no reverberation or echo experienced (Figure 54).

Regarding thermal comfort, the results are quite divisive: about half of the respondents report experiencing cold air drafts coming from closed windows, but the other half disagrees (Figure 55). Similarly, a third of the respondents experience overheating problems in the summer, with the remaining two-thirds being satisfied with the indoor temperature even in the warmest months (Figure 56). When overlapping the results on thermal comfort with the demographic data on age and gender, it emerges that the four people reporting to experience cold air draft are two men and two women, two under the age of 35 and two above: it can be concluded that the different experiences of thermal comfort are not related to age nor gender, but are probably dictated by individual preferences. Another possible explanation for the different opinions regarding thermal comfort may be tha fact that only some apartments have access to a shading system: this is reported by the residents (Figure 57) and confirmed by the developers. Not having

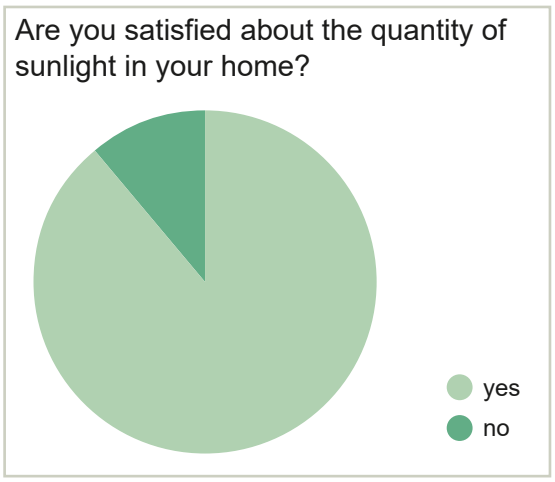


Figure 50. Solar and daylight access 1

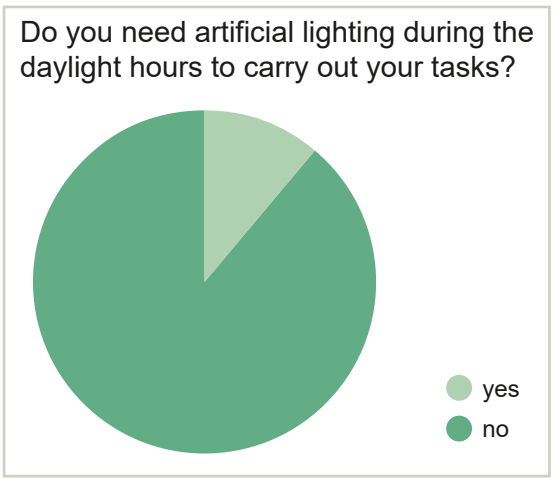


Figure 51. Solar and daylight access 2

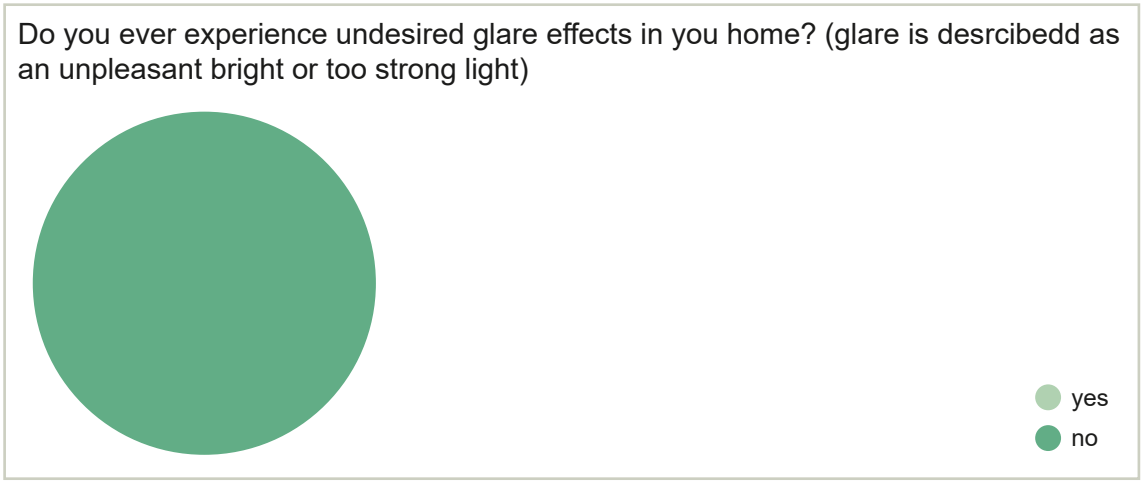


Figure 52. Solar and daylight access 3

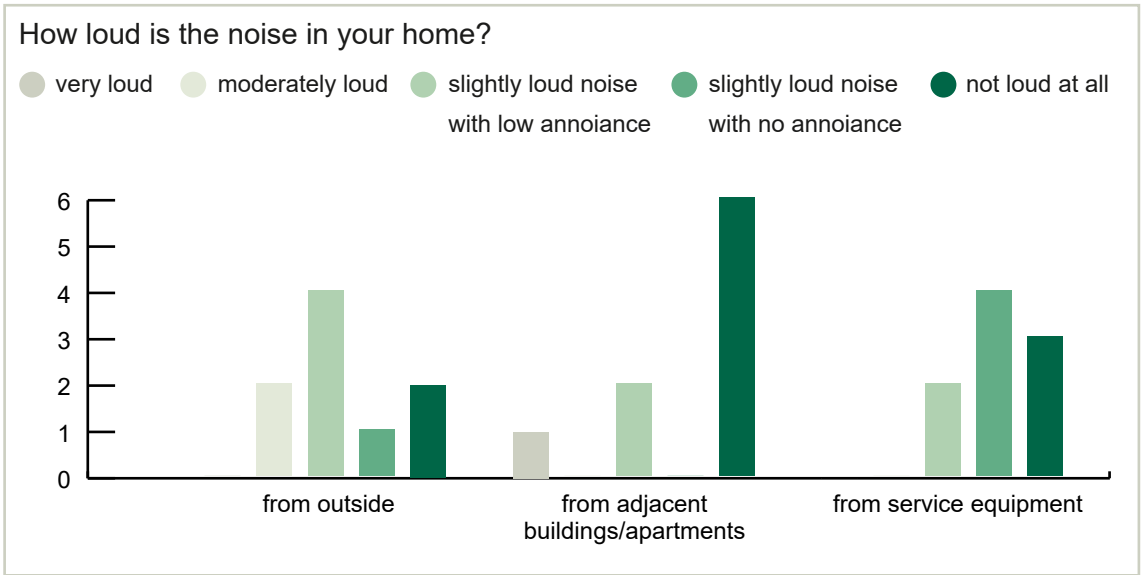


Figure 53. Acoustic comfort

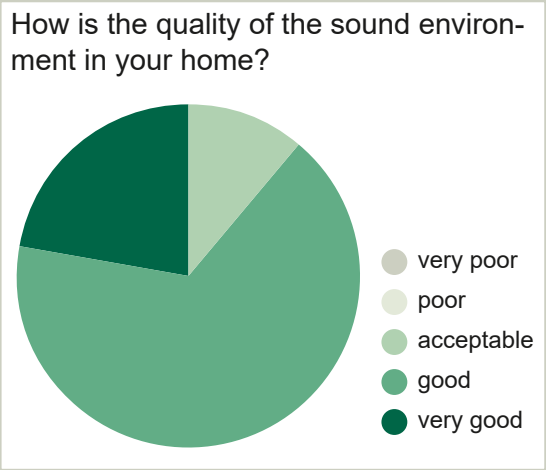


Figure 54. Acoustic comfort

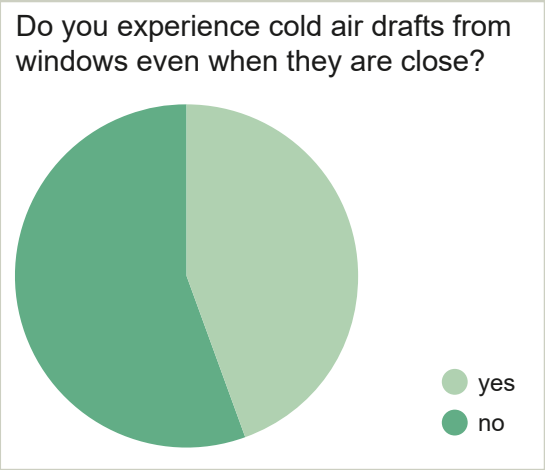


Figure 55. Thermal comfort

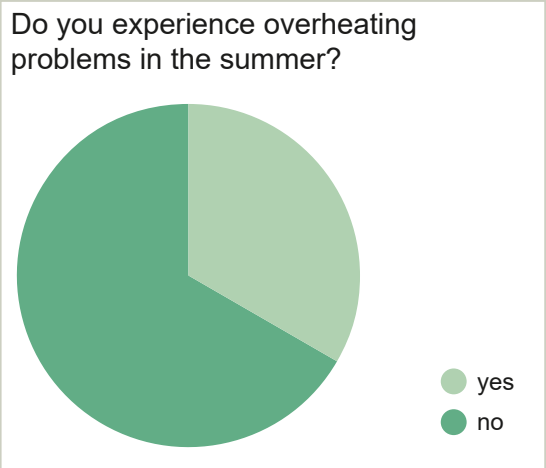


Figure 56. Thermal comfort

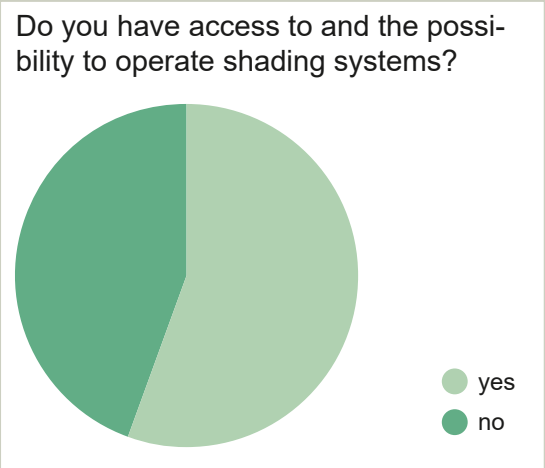


Figure 57. Thermal comfort

access to a shading system does not only influence the indoor comfort of the users, but can also have negative repercussions on energy consumption. The question of why only some apartments are equipped with shading systems arises: still, it could be possible to install these systems later, to address both the concerns of the residents and the possible energy implications.

Overall, the IEQ in t' Houdthof is rated positively by the residents: good air quality, lighting conditions, acoustic and thermal comfort are fundamental for people's health (Dorizas et al., 2018; Jamrozik et al., 2019; Nagare et al., 2021), and the considered building performs well in this department.

7.4. Limitations

The results of this survey are useful to get a first understanding of how the residents of t' Houdthof / Maatschappelijk Mooi experience their living environment with regards to its social and architectural values, but they are not free of limitations. First and foremost, the survey was answered by 9 out of 36 residents of the apartment complex: while the answers gathered can give us an idea of the overall user's satisfaction, 27 residents did not express their opinions, and assessing their point of view would be vital to have a truly comprehensive understanding of the user's perception of architectural and social values.

Another limitation lies in the tool used to assess user's perceptions, the survey itself: firstly, while a Dutch translation was provided, the survey was in English, and it is possible that the respondents might have misunderstood or misinterpreted the questions due to language barriers. Secondly, most of the questions were close-ended, meaning that the respondents were forced to choose between some provided options: this makes it easier to interpret the results, but it can inhbit the respondents from expressing their full opinions. To allow the respondents to express themselves fully it could be useful to develop this research further with the tool of interviews: having a one-on-one discussion with the residents would allow to get a better understanding of their experiences, and to ask follow-up questions if needed. A downside of this tool could be the language barrier, that may make it difficult for the respondents to clearly express their thoughts.

8. Conclusion

This thesis investigated the theme of design value and its understanding in the context of a EU-funded projects. It aimed to find a common definition of design value, that could promote a holistic comprehension of all those aspects that are necessary to create “good architecture”. Secondly, this thesis considered the case study of a sustainable plus-energy neighbourhood that supposedly embodies all the characteristics that lead to valuable design, and questioned the perception of this value, and specifically of its architectural and social components, from the user’s point of view.

It was found that the questions of what design value is, and what constitutes good architecture, are not easy to answer, and finding a definition that truly encompasses every possible aspect that influences the quality of design might be impossible. Still, the lack of an unequivocal answer does not mean that the search for a common definition of design value is vain. Indeed, several definitions of good architecture have been proposed throughout history, and this thesis considered and analysed three of them in particular. The first one, given by Vitruvius, states that buildings should have three attributes: strength, utility, and beauty. Two millennia later, Sir Alexander John Gordon claimed that good buildings must adhere to the 3L principle, and exhibit long life, loose fit, and low energy. A third and final definition of good architecture is known as the “triple bottom line of design”, which highlights the importance of considering the buildings’ economic value, environmental value, and social value.

By analysing several additional sources discussing the definition of good architecture, other important aspects emerged, such as the cultural relevance of architecture, or its aesthetic quality. Overall, it was noticed that many different definitions highlighted the importance of the economic, environmental, and social aspects of design, even though different expressions were used. These aspects are surely fundamental to ensure good architecture, and specifically sustainable architecture, as they are also commonly known as the “pillars of sustainability”. When considering the built environment, however, it has to be recognised that its value is also tightly dependent on its architectural value, which includes aspects such as durability, utility and adaptability, cultural quality and aesthetic quality, and should constitute the fourth bottom line of design.

The complexity of design value, which was defined as the sum of economic value,

environmental value, social value, and architectural value, results in the difficulty of defining it as a simple number that could be used to affect decision-making processes. Another obstacle to measuring design value is posed by the fact that, while its economic and environmental aspects can be quantified in terms of money and carbon, its social and architectural aspects are far more subjective, shaped by personal beliefs and preferences. Still, to have a holistic understanding of design value, this complexity must be embraced, and individual perspectives must be taken into account.

The difficulty in measuring good architecture is challenged by several European Projects with the tool of Key Performance Indicators, which allow to evaluate a project's performance with respect to its specific targets and goals. The analysis of six different assessment frameworks brought to the conclusion that each of them considered the economic, environmental, and social aspects of design value, if to a varying degree, while the architectural aspect was often overlooked. It was also noticed that objective elements were given priority, while not much thought was given to subjective experiences.

One sustainable plus-energy neighbourhood, t' Houdthof / Maatschappelijk Mooi, was selected for further studying its design value. This neighbourhood is recognised as being high-quality, as it incorporates advanced technology that allows it to achieve ambitious environmental goals and, being managed by a social housing association, it provides housing at an affordable cost. An interesting characteristic of this project is that it made a point of putting architectural and social values at its core, with the concept of "socially beautiful" becoming its mission. The questionnaire that was developed and submitted to the residents of t' Houdthof had the goal of finding out whether this "socially beautiful" quality was truly perceived by the users of the building, and whether this case study can be considered a good example of truly valuable design.

It was found that the residents of t' Houdthof / Maatschappelijk Mooi do recognise the quality of the space they live in: the focus of the project developers on a socially inclined design resulted in a thriving social environment. The residents report knowing each other, they appreciate spending time together in the common areas, and they feel a sense of safety and security thanks to the social control performed by their neighbours. The good results in the social area were matched by user satisfaction with regard to architectural quality: the aesthetics of the building is generally appreciated, and so is the indoor environmental quality. Living in a building with good air quality and lighting conditions

has positive repercussions on people's health and well-being, while satisfaction with the space quality can be tied back to the positive social experiences reported by the residents. T' Houdthof shows how high architectural value can positively influence the social experiences of its users.

Overall, it was found that it is possible to combine economic value, environmental value, social value and architectural value in a single project, aiming for objective and measurable goals without disregarding the experiences and perceptions of the final users. However, while t' Houdthof can be taken as a positive case, this thesis also found out that several European projects do not have a holistic understanding of design value, and that the subjective experiences of the users are often neglected. Still, the urgency of creating a more sustainable built environment is undeniable, and to achieve true sustainability all aspects of design value must be included: from environmental to economic, from social to architectural. T' Houdthof / Maatschappelijk Mooi is an example of how architecture can truly be valuable.

8.1. Further work

As previously mentioned, the research of this thesis could be continued using the tool of interviews to further inquire on the perception of social and architectural quality in t' Houdthof. It could also be interesting to submit the survey to the residents of the other demo projects promoted by syn.ikia: t'Houdthof has a declared focus on the "socially beautiful" concept, and it could be argued that this is the reason for the positive results highlighted by the survey. By surveying the other case studies it would be possible to compare how they perform in terms of architectural and social values from the standpoint of the residents, and eventually it could be possible to create some guidelines to ensure that all the projects reach the same high standards. The survey could be apply also to the other European projects considered in this thesis, to investigate user's perceptions in different contexts, and verify if those projects that, for example, did not consider architectural quality in their assessment frameworks still achieve good architectural results.

On a bigger scale, the importance of design value and all of its aspects must be understood and promoted at the European level: the European Union recognises the importance of

creating a more sustainable built environment, and created the assessment farmework Level(s) to address key sustainability aspects over the buildings' life cycles. Level(s) works on six macro-objectives, but matters of architectural quality and social value are not considered. The importance of considering greenhouse gas emissions and of promoting a circular life cycle for materials are undeniable, but the creation of a truly sustainable built environment must not overlook the reason why it was created in the first place, which is to provide people with a living place: thus, guidelines for sustainable buildings must recognise the importance of creating spaces that positively impact the life of their users, by emphasising the role played by architectural and social value.

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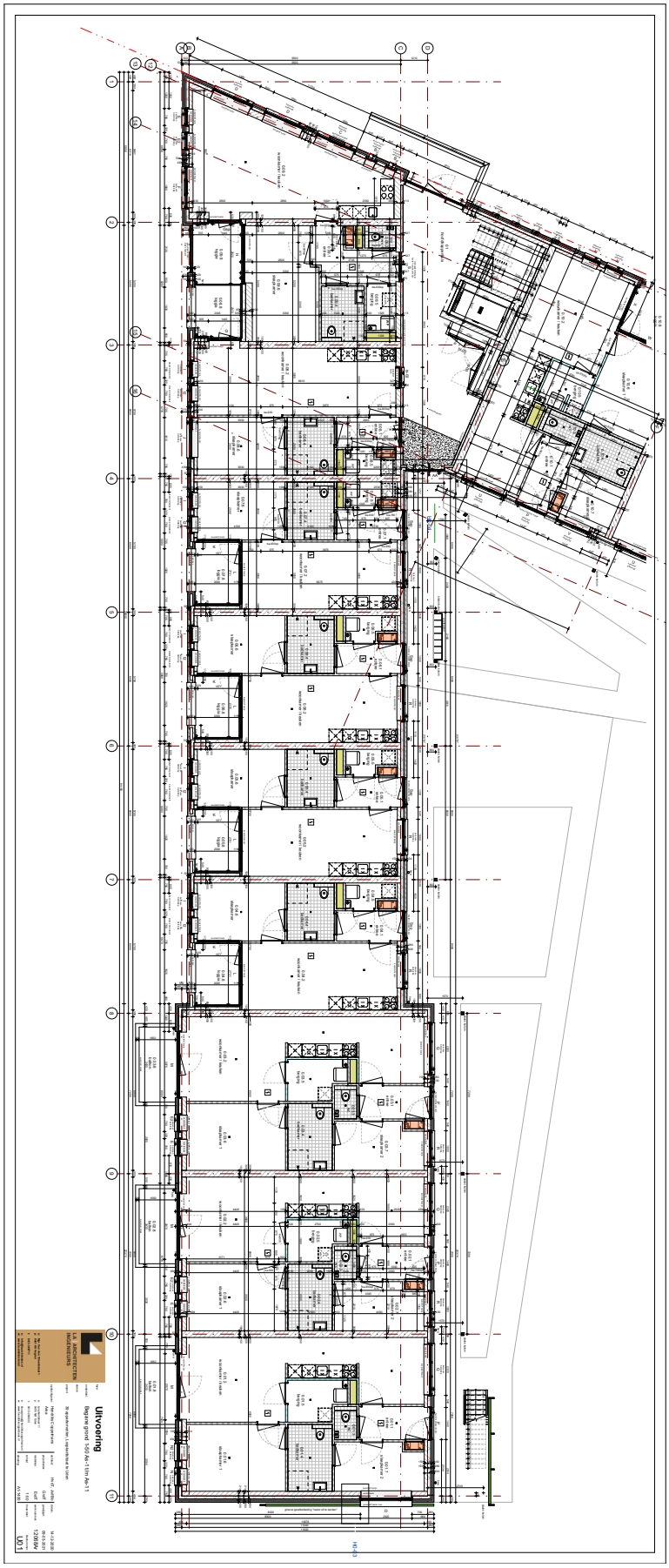
Appendix - t' Houdthof

Architectural drawings provided by the developers.

Masterplan.

Elevations.

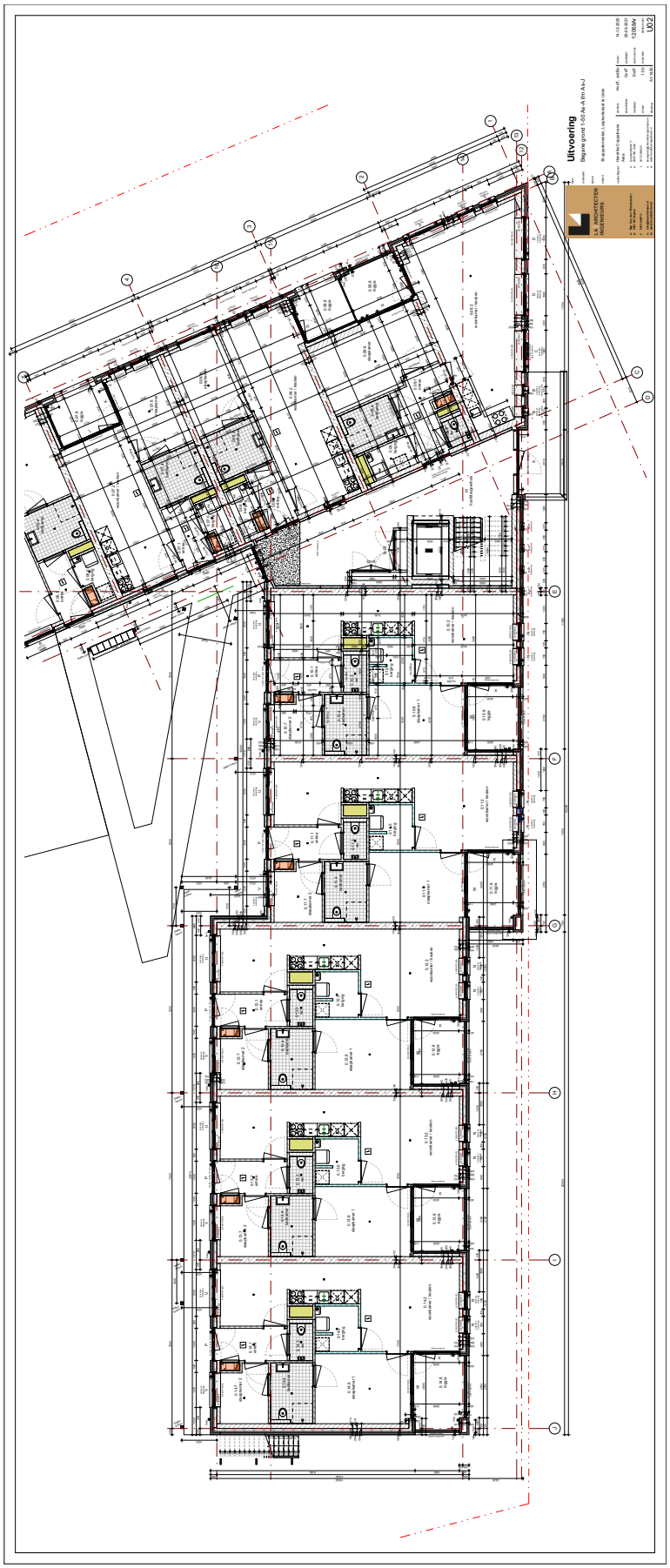
Elevations.



A

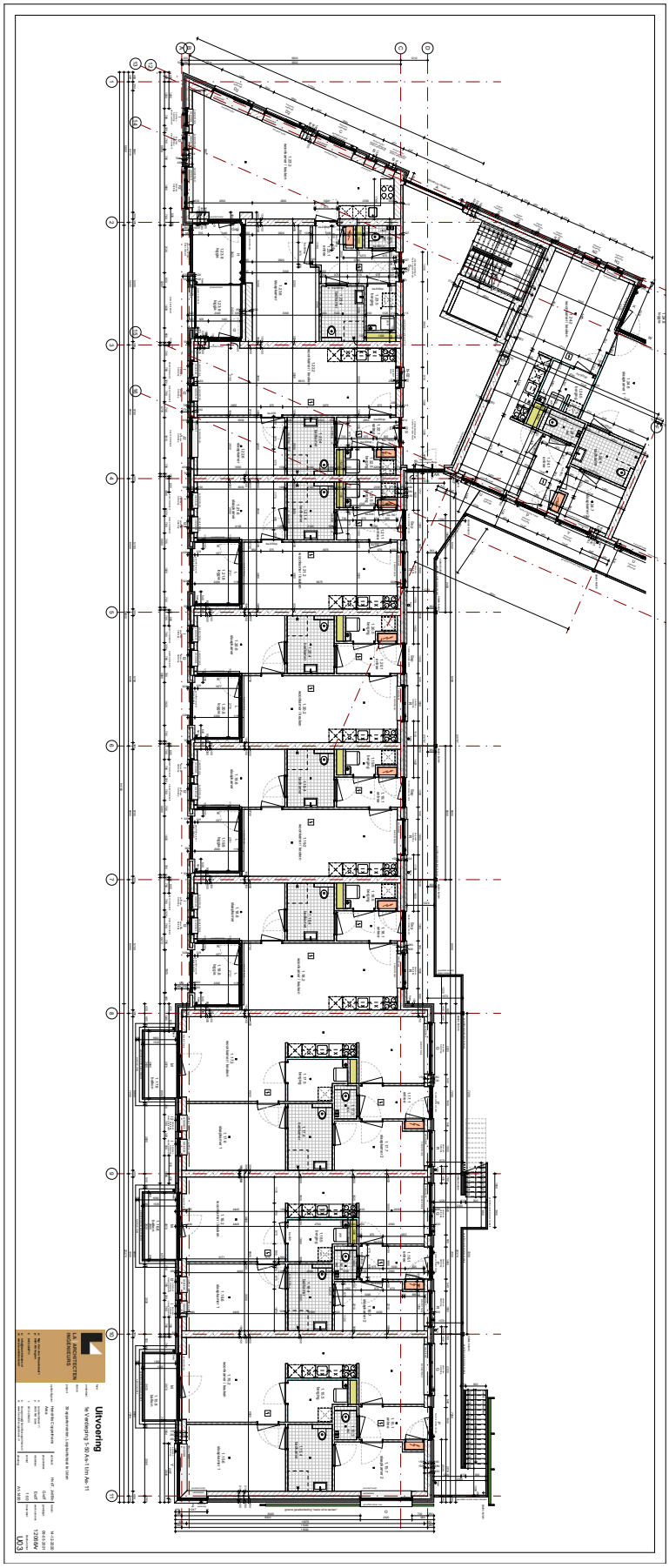
7

Ground floor plan,
part A



B

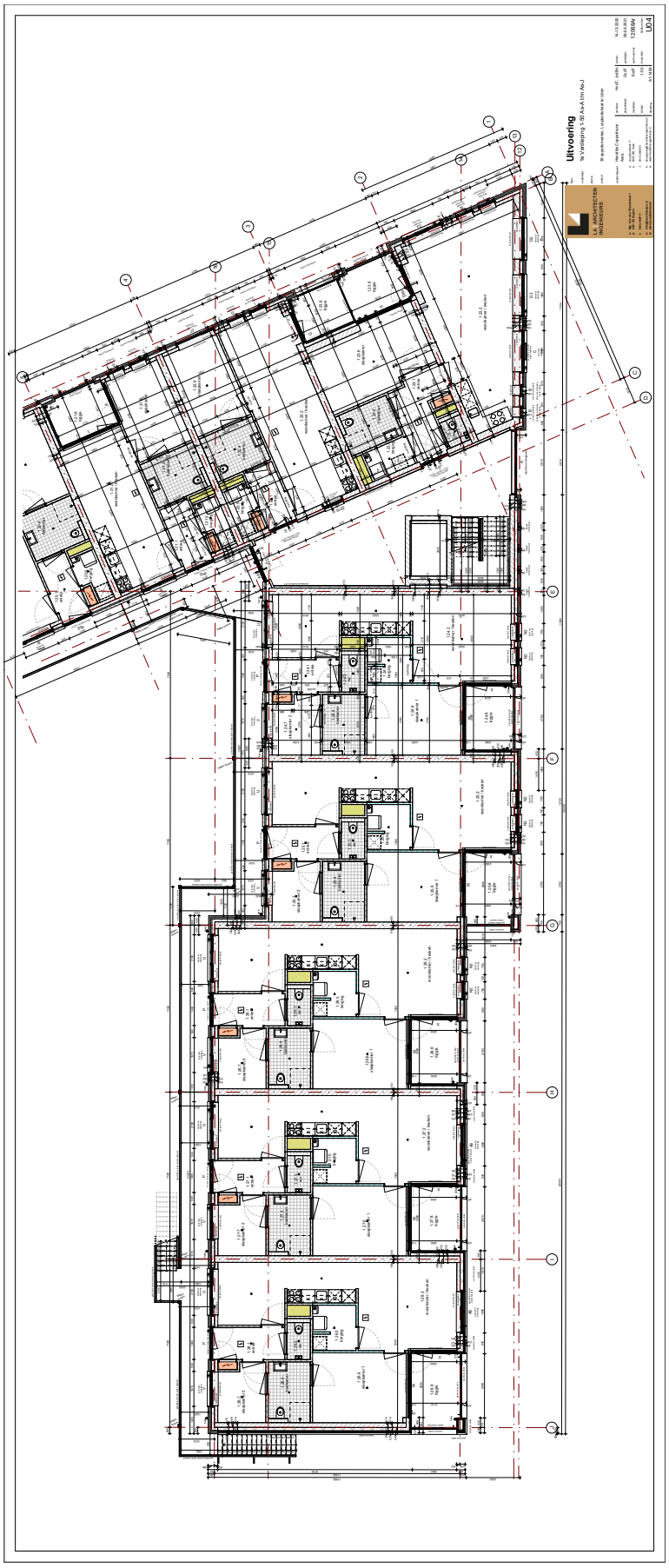
Ground floor plan, part B



A

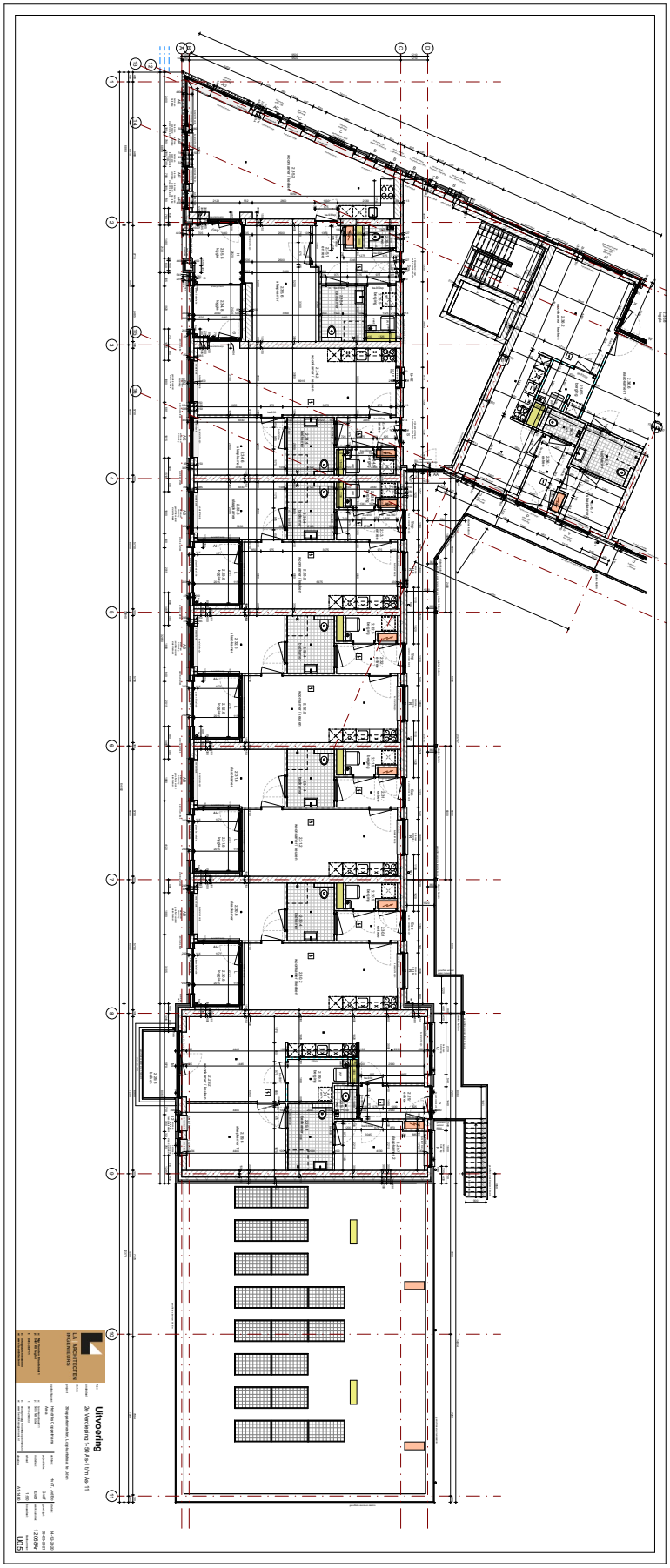
7

First floor plan,
part A



B

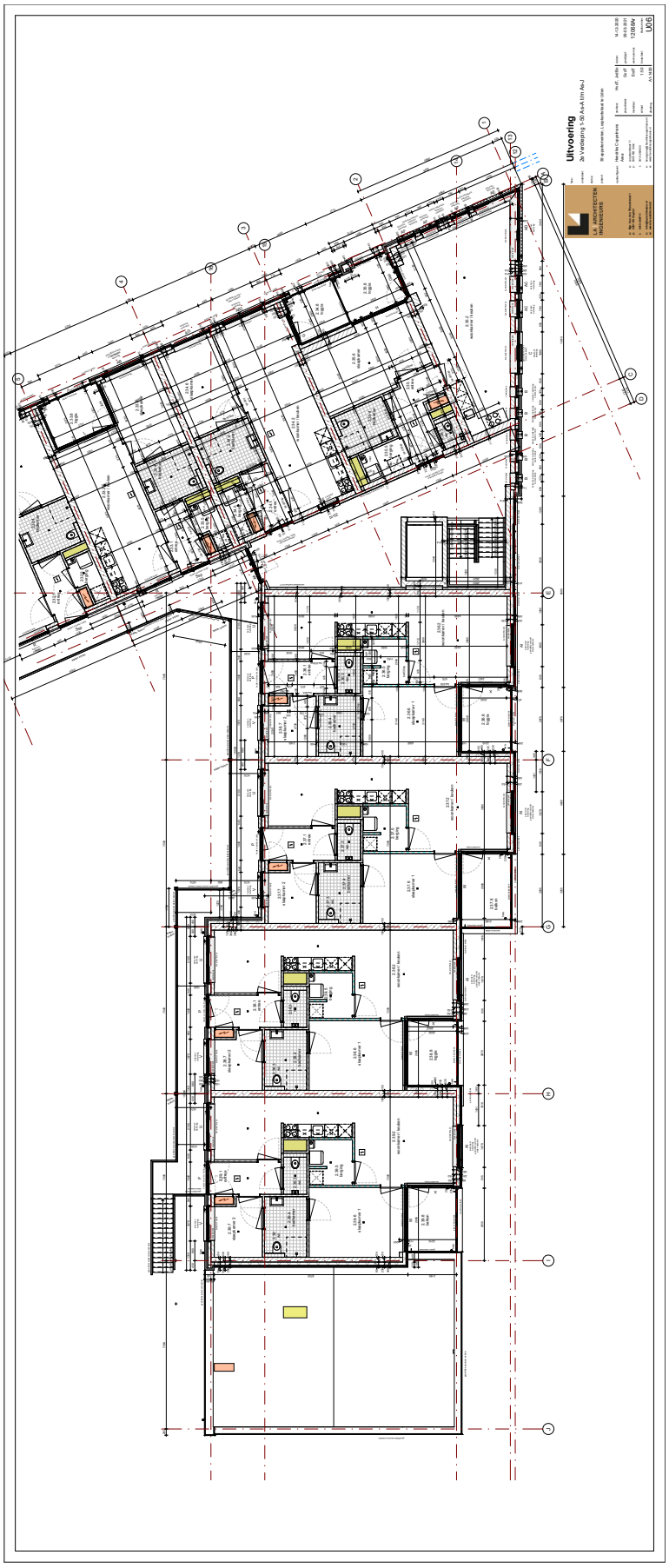
First floor plan,
part B



A

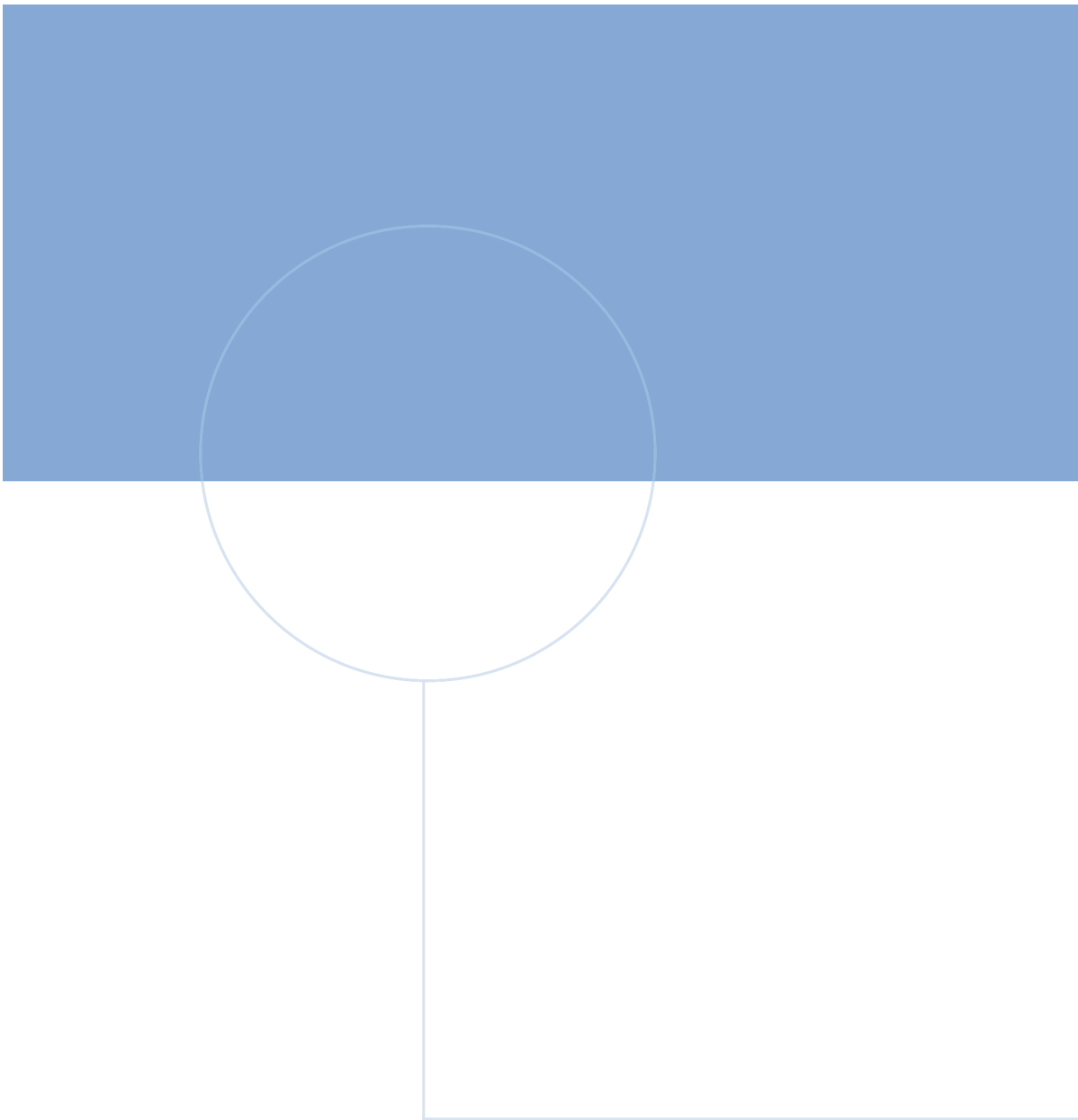
7

Second floor plan, part A



B

Second floor plan, part B



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