To what extent does commercial co-living match user preferences of young adults in The Netherlands?

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Preface

This graduation research is not only the representation of my hard work throughout the past year, but it also embodies five years of my university career. It is with great pride that I present my graduation thesis report on the topic of "*To what extent does commercial co-living match user preferences of young adults in The Netherlands?*". This topic resonates deeply with me, as I firmly believe that research should push society forward and examining the match between user demand and built supply is the key step to lay a strong foundation for further, sustainable development within the built environment. By understanding user preferences on coliving of young adults, I hope this thesis will help to provide the best guidelines for policy makers and developers to create a lasting societal value through the built environment.

Throughout this research, I have gained invaluable insights into employing diverse analytical and statistical tools to comprehend the subject of commercial coliving and analysing user preferences. It has been an enlightening experience which has shown me that with planning and dedication it is possible to achieve great results within a particular field. Moreover, I would also like to express my gratitude to my mentors, Darinka Czischke and Herman Vande Putte, whose invaluable guidance and support have helped me grow as a researcher. Their guidance and support have been invaluable throughout this thesis. I am particularly thankful for their input and discussions, which have opened my eyes to different approaches and helped me complete my work. Moreover, I deeply appreciate their understanding and assistance during challenging health situations that arose while I was writing my thesis. Their support during these difficult times means a lot to me.

On a more personal note, I want to thank all my friends who have shared incredible moments with me during my university years and I look forward to more adventures with all of you. I would also like to thank my girlfriend for always being with me, keeping me up and believing in me. To my brother, I am thankful for always pushing me to reach new heights in my journey. Lastly, I would like to thank my parents for their indisputable support in all my decisions. Your unconditional love and encouragement is invaluable to me.

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Abstract

This paper fills in the research gap about understanding to what extent does commercial co-living match user preferences of young adults in The Netherlands. The existing literature primarily focuses on analysing user choices, while this study examines the revealed preferences of young adults specifically regarding co-living arrangements. By conducting a discrete choice experiment and traditional comparison, this investigation shows which commercial co-living attributes are preferred by young adults in The Netherlands and assesses the overlap between the user demand and built supply. These findings can be widely used by governmental bodies or other public entities and private sector stakeholders such as real estate developers to study the commercial co-living market and understand how to improve housing situations by understanding people's preferences.

Keywords: co-living, user preferences, discrete choice experiment, supply-demand match

1. Introduction

1.1 The Rise of Co-Living & Housing Preferences

In recent years, there has been a surge of interest in the housing choices and living arrangements among young professionals and students in the European Union (Bergan et al., 2021; Arundel & Ronald, 2016). One of them, commercial co-living, is an intriguing combination for those who appreciate the flexibility, convenience, and social ties that these arrangements provide (Uyttebrouck et al., 2020; Jarvis, 2017). By offering a combination of on-site services and common facilities, commercial co-living goes beyond the usual leasing experience (Ronald et al. 2023).

According to numerous figures, the Dutch capital of Amsterdam is Europe's second largest commercial co-living market after London, hosting 18% of all commercial co-living complexes in the region (JLL, 2019). Next, other cities across the country are following and commercial co-living buildings are being constantly built and delivered (JLL, 2019). However, many argue that popular housing trends turn into ‘mass production’ and often forget about the end users and their preferences (Moghimi et al., 2016). According to many studies only housing solutions that are consistent with user preference can lead to better quality living environments (Sirgy et al., 2005; Kauko, 2006). Consequently, with commercial co-living buildings emerging as a major part of today's real estate (Ronald et al. 2013), the question arises whether the attributes of these commercially constructed co-living facilities align with user preferences.

Scholars have extensively explored housing preferences throughout the years (Jansen et al., 2011). Studies from across the world attempt to characterise, forecast, and explain user preferences, as well as to understand 'why people move?' and 'what does the user want?' (Jansen et al., 2011). In comparison to user choice analysis, preference analysis evaluates relative attractiveness, whereas choice refers solely to what has occurred (Molin et al., 1996) This is important to understand since choice is the result of both internal and external socioeconomic factors influencing the current situation, and preference relates to the best case scenario for providing the greatest amount of housing satisfaction through relatively unconstrained evaluation of attractiveness (Verhetsel et al., 2016). Only a few studies focus on preferences, whereas the majority of them base their knowledge on choices that, in the current (limited) market, are very unlikely to reflect real consumer preference (Kvietkute & Hauge, 2021).

1.2 Problem Statement

With rapid growth of student population and steady number of young-professionals in The Netherlands, co-living gained popularity across this target group due to its characteristics. However, with modern co-living spaces rising quickly throughout the past years in the EU, there is an explicit knowledge gap in

understanding user preference on that housing segment. The overall number of research on housing options among young adults in the Netherlands is limited, and many of them focus on tenure status rather than housing preferences. Responding to the absence of research and attention to user preferences in co-living research, this study aims to discover housing preferences among young adults in the Netherlands that represent their individual, unique preferences.

2. Research Questions

2.1 Main Research Question

Consequently, research question is formulated as follows:

To what extent does commercial co-living match user preferences of young adults in The Netherlands?

2.2 Research Subquestions

In order to answer the main research questions, several sub-questions have been established.

- *Which commercial co-living attributes are preferred by the young adults?*
- *What is the least preferred attribute that young adults have of commercial co-living?*
- *What type of amenities are typically provided in commercial co-living housing designed for young adults in The Netherlands?*

Research sub-questions are created in order to provide a deeper understanding of the main research question.

2.3 Research Design

In order to answer research questions, this paper is divided into four main chapters. Firstly, the introduction aims to develop an understanding of existing knowledge and current market conditions regarding co-living and user preferences. To do so, extensive literature review and state-of-art market research is conducted. Next, an in-depth analytical framework is presented to understand how research is going to be conducted from the methodological approach. Third part consists of collecting data. Lastly, analysis derived from the investigation of existing knowledge and combination with research findings

will be done. Afterwards, conclusions and recommendations for both private and public built environment parties will be drawn.

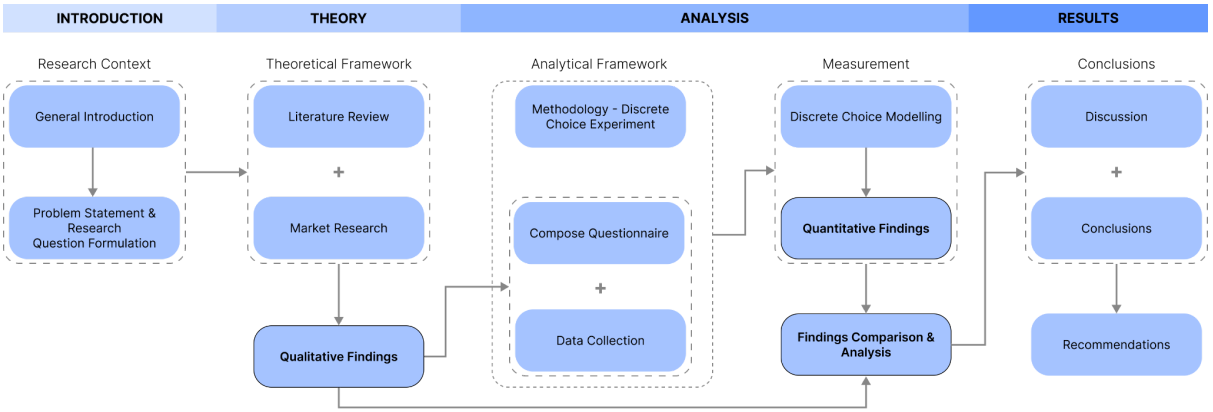


Figure 1. Research Design; own work

3. Literature Study & Market Research

Urbanisation

Rapid urbanisation can be seen all over the world. Naturally, depending on the part of the globe it happens at a different pace. According to many studies, it is predicted that by 2050 more than 70% of the world's population is going to live in cities (The World Bank, 2022), compared to e.g. North America where urban population is already estimated to be at around 82%. In other countries, such as Ethiopia, which is said to be the least urbanised country today, only 22% of the people live in the cities (The World Bank, 2018). Nevertheless, factors driving people from rural towards urban areas are relatively similar in every part of the globe. Usually people are looking to settle in the cities hoping for better quality of life, good education and salary. Employment opportunities are named to be one of the key-drivers amongst other pull factors such as better health care, living standards and social aspects (Gaffkin et al., 2019). However, this rapid and unplanned migration has led to many problems within the cities creating unsustainable environments.

Nowadays, with the average of 75% Europeans living in urbanised areas (The World Bank, 2022) many problems arose at the economical layer making people live off low-incomes, uneven distribution of welfare and mainly being unable to afford proper housing (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2022). According to a study by the European Parliament (2019), the demand for rental housing has increased in many EU countries due to factors such as population growth, urbanisation, and the financial crisis.

Demographics of Young Professionals and Students

Over the past years The Netherlands became home to many expats and international students (Statistics Netherlands, 2022). Every year there are around 329 000 students in The Netherlands. For the 2021/2022 academic year alone, more than 100 000 international students enrolled and around 40% of those are first-year students who have never lived in The Netherlands before (Statistics Netherlands, 2022). This 3.5 times rise in international students from the year 2005/2006 have significantly influenced the housing market. According to National Student Housing Monitoring, in 2021 there was a shortfall of more than 26 500 student rooms, forcing people to live far away from their universities (Kences, 2021). Housing shortages have mainly influenced first year students who at some universities were told not to come at all if no housing was found (Universiteit van Amsterdam, 2022) or were forced to sleep outside for weeks (Sawbridge, 2019).

Consequently, another enormous group on the market are the young professionals that form one of the largest population groups representing up to 30% in many cases (Nandan et al., 2019). It is important to remember that the group of starters and young professionals face similar problems as their chances to both find and finance affordable homes are declining (Rabobank, 2019). Combining it with their housing expectations and changing way of living, finding a house may seem like an impossible task for many. In order to put it into perspective, the Netherlands would have to build at least 10 000 affordable starter homes on a yearly basis (Dantuma, 2022). Yet only 38% of the young adults intending to move out of their parental homes prefer to buy, the rest are looking for various rental options on the open market laying even more pressure on that market segment.

Housing Market in the European Union

Rapid urbanisation reflects many problems the European housing market is fighting for years now. According to many studies, housing prices within the European Union have gone up by 42% over the last decade (Eurostat, 2022), whilst the rents increased by 17% on average all around Europe (Statistics Netherlands, 2022). In The Netherlands house price index of both existing owner-occupied and new buildings have seen an increase of 19.5% year-on-year (Statistics Netherlands, 2022). First-time buyers are not only limited by the lack of available supply, but also the spectre of the impending crisis that could result in either vast loss in property value or inability to pay off mortgage due to strong economic tightening (Koders, 2017). Subsequently, over the past 10 years, it became virtually impossible for home buyers to easily find a place to live and renters struggled with both affordable and mid-level rentals (Oostven, 2022). This task did not only become difficult, but also extremely expensive. Many researchers name tightening regulation, monetary constraints, population growth and overall lack of affordable housing as key elements influencing the struggle (Lalor, 2022).

Similarly to the buyer's market, identical problems can be noticed in the rental sector where many

people struggle to find proper housing within a certain price range (Savills, 2022). Demand for rental accommodation has mainly grown due to population increase, however, rental housing supply has lagged behind the demand, resulting in rising rents and housing instability for many Europeans (European Parliament, 2019). Additionally 2008 financial crisis implications that made it harder to finance home ownership negatively influenced the situation by putting more weight on that market segment only rising the housing security (Hilbers et al., 2008).

Housing Market - Overall Lack On The Supply Side

Consequently, the European housing market is facing many complex issues that also widely impact many young professionals and students. According to a European Commission study (2018), the EU is experiencing a "severe housing crisis," with rising housing costs, rental housing shortages, and an increasing number of people unable to afford quality accommodation. This situation is especially acute for young people, who are frequently priced out of the housing market, forced to live in deplorable or overcrowded circumstances (Deloitte, 2019). The current scenario is a major source of concern for young professionals and students, who frequently struggle to locate any housing alternatives within cities (Cournède & Plouin, 2022).

According to numerous studies it is said that by 2030 The Netherlands would have to build an additional million homes (Jonreneel, 2018) to meet the housing demands as the population is estimated to grow to almost 18.8 million inhabitants. Therefore, one can see that the demand-supply mismatch will only increase from current numbers of lack of around 200 000 houses (Moran, 2017) only deepening the housing crisis even further. Despite the fact that building this many houses may seem like an impossible task, The Dutch have already managed to build an impressive amount of almost million houses after World War II via Vinex agenda (Jonreneel, 2018) to tackle housing shortage problems. However, one need to remember that nowadays this task overlaps with other major issues that private and public parties try to address. Namely, sustainability is one of the major concerns as the construction industry contributes to more than 38% of CO^2 emissions and Europe is aiming to become carbon-neutral by 2050 and The Netherlands is trying to reduce 55% of its emissions by 2030 (Ministerie van Algemene Zaken, 2022). There have already been cases when around 18 000 building projects (Sante, 2022) had to be delayed as the developments did not compromise European Union laws, putting the government in a problematic situation as it had to be decided between environmental needs and housing ones.

Housing Market - Rental Sector

Limited building pace of new rental units is one important element leading to the tight rental market. According to a research published by the European Central Bank (2018), the rate of new building in the EU has been progressively dropping since the early 2000s, with notably low rates in Germany and France. This is due in part to expensive land and building costs, as well as legislative restrictions that

make it difficult for developers to establish new rental homes (European Central Bank, 2018).

Another concern is the EU's high proportion of homeownership, which has resulted in a scarcity of rental properties. According to Eurostat statistics (2021), the EU homeownership rate is over 70%, ranging from 50% in Germany to 90% in countries such as Romania and Malta. Because of the high incidence of homeownership, there is a scarcity of rental apartments, particularly in metropolitan areas where demand is high (Eurostat, 2021).

To address these issues, numerous EU member states have enacted policies to stimulate the building of additional rental units and boost the supply of affordable housing. For example, the German government has given tax breaks for developers who build new rental units, as well as rent controls to keep rents reasonable for low-income households (Federal Ministry of the Interior, Building and Community, 2021). Other nations, such as The Netherlands and Sweden, have taken similar steps to boost rental housing availability and make it more affordable (European Parliament, 2019).

Despite these measures, many Europeans are still concerned about the rental housing sector in the EU. High rents and housing instability, according to the European Parliament (2019), have a severe impact on the quality of life for many Europeans, particularly those on low incomes or in vulnerable situations. To address these difficulties, the EU and member states must continue to pursue policies that boost rental housing supply while making it more affordable for all Europeans.

Housing Market - Investment Threat

Another enormous problem that has emerged over the past years is a tendency of a richer part of the society to invest their money into real estate with an aim to profit (PWC, 2022), not only taking properties off the buyers market, but also making rents less regulated. According to a study of the Land Registry it was found that more than 20% of new properties were bought straightaway by private investors for investment companies (Tweede Kamer Der Staten-Generaal, 2022). Consequently, many Dutch cities introduced a rule that houses valued below €512 000 threshold must be owner occupied (Gal, 2022). This aims to increase the number of houses for inhabitants. Nevertheless, Dutch cities struggle with finding space and meeting housing demands all over the country. The problem is not limited to Randstad which is acting as a key economic hub of The Netherlands, but also medium and small cities stand the same challenges.

Sharing Economy

As previously mentioned, an enormous growth of the world's population was accompanied by a steady increase in consumption rate per capita (Hamari et al., 2015). Many researchers and activists argue that present capitalism and modern consumption are likely to exacerbate global issues, making it critical to

find a long-term, sustainable solution (Görög, 2018). This problem also refers to the housing market which is extremely saturated and in crisis. Consequently, many name the concept of sharing economy as the ultimate answer to many modern housing problems.

Sharing economy is a broad term describing a range of economic activities that evolve around sharing or exchange of resources or services between individuals or organisations (Hamari et al., 2015). Under that umbrella term, many find other descriptions such as “collaborative consumption” (Narasimhan et al., 2017) or “access-based consumption” (Narasimhan et al., 2017). Throughout the last century, the concept of sharing resources or services has gained popularity over the last century as it strives to decrease waste and inefficiency while producing value for both parties. (Absalyamov et al., 2021). Further, looking at the fact that in 2015 sharing-economy sectors generated revenues of nearly 4 billion euros in Europe alone (Bonciu & Bâlgar, 2016) one can clearly see the direction in which the concept is developing.

As discussed, the world has seen vast change in consumer behaviour and consumption patterns. One of the changes started to take shape in the built environment. The co-living idea combines the sharing economy and real estate. Co-living, a concept in which people and families live in a community environment, sharing numerous facilities and services, fits the shared economy model since living together allows participants to share costs of housing, utilities, housing items, and other expenditures, making it more affordable (Rutkowska-Gurak & Adamska, 2019).

Threat of the Shared Economy

On the other side, the shared economy has also had a negative influence on the European property market. Some platforms have made it simpler for people to rent out their houses or flats for a short period of time, resulting in a rise in the number of properties available for rent (Rutkowska-Gurak & Adamska, 2019). However, some experts suggest that the shared economy has contributed to the housing problem by lowering the quantity of long-term rental properties available, as more individuals choose to rent out their houses on platforms like Airbnb rather than leasing them to long-term renters (Absalyamov et al., 2021). Consequently, with rising popularity in e.g., Amsterdam as a tourist destination, many central properties have been converted into AirBnb’s which shrinked housing stock for the locals even further (Expat Housing, 2022).

Co-Housing

Many studies refer to co-housing as a social and practical way of living that encourages and makes inhabitant connection easier (Beck, 2019). By consisting of many shared spaces, common living is promoted and brings people closer. These central areas vary from estate to estate, prioritising different areas such as large kitchens, living-spaces, outdoor areas, workshops or even music rooms (Fromm, 2012).

The main idea of these developments was to achieve social interaction through community living that would support the creation and maintenance of the social networks (Fromm, 2012). Consequently, many co-housing establishments started to appear all around the world with The Netherlands, UK and North America leading the process (Ruiu, 2014). Throughout the time the purpose of bringing the people together did not change, but the ways and extent of doing it did. Today, co-housing initiatives vary in types and typologies hosting different social groups and many co-housing alternatives arise from the ones that specifically share large kitchen to interact through common eating, to those that rather focus on having private unit with private kitchen and bathroom, where interaction takes place at the co-working spaces, playrooms or in the gyms (Jakobsen et al., 2018). Marcus and Copper (2000) refer to co-housing as an art of "*balancing privacy and communality*". Nowadays, most co-housing initiatives are designed in a way to maintain personal space and privacy, without compromising the main goal of driving social interaction through spatial arrangements. Additionally, throughout the past years, co-housing has also become a way to create, not only socially as aforementioned but also environmentally, sustainable estates. Such a way of living minimises living costs and energy consumption by sharing different facilities and spaces.

Co-Living

Even though co-housing initiatives mainly emerged as the bottom-up, community driven processes (McCamant et al., 2011) with the rise of interest in this idea of living, many top-down projects started to arise. Recently, there has been a large interest in developing modern co-living housing for young professionals and students (CBRE, 2020). With the reference to the general co-living objective, these estates are being built for unrelated individuals willing to share common area amenities with preserving their privacy (CBRE, 2020). The main difference in regard to the first living communities established in Denmark, modern co-living for young professionals and students provide smaller private units to reduce costs of living and provide its users with tailor-made solutions for their way of living, such as large co-working spaces, party areas and gyms (CBRE, 2020). Nevertheless, it is crucial to remember that there are different people and thus different end-users. Consequently, it is of a great importance to understand the preferences and needs of these different target groups. This kind of knowledge could be used as a foundation to create a unique tool to understand end-user preferences and create the best living environment for the given type.

Commercial Co-Living

Commercial co-living usually consists of smaller private units, but bigger collective facilities (Rissik, 2019). When exploring shared accommodations, it is important to look at different space types that are

commonly divided into primary space, secondary space and tertiary space (Kopec, 2016). The degree of privacy and community of these spaces is presented in the table below.

Table 1. Space Division based on Kopec, 2016

Primary spaces	Secondary Spaces	Tertiary Spaces
Shared spaces where the residents communicate and socialise, such as the kitchen, living room and dining room.	Also shared spaces, but the communication and socialisation migrate - intermediate spaces such as hallway, staircase and laundry room.	Private spaces where the residents can feel safe and home.

Private rooms are typically reduced in favour of common ones to improve social footprint because co-living intends to stimulate the establishment of communities (Kadet, 2017). In commercial co-living private units are often equipped with only the bare necessities to allow users to customise and personalise the space, whereas in contrast, shared spaces that provide public amenities such as e.g. kitchens, lounges, working spaces and utility spaces are exquisitely furnished and decorated (Osborne, 2018; McAlone, 2016). On the other hand, there are also commercial co-living buildings that come with fully furnished options that aim to provide an ease of moving in and out. However, such an option may lead to an uncomfortable feeling of lack of personalisation (Shafique, 2018).

Some of the design concepts for co-living projects revolve on the premise that accessibility to tertiary spaces should be the most significant aspect and both primary and secondary spaces must be situated in a different place, e.g. complete ground floor, to establish a balance between social and private life (Palm Linden, 1992). The extent of division between these spaces is closely tied to the end group. For example, commercial co-living that are directed at the global community which desires to have simpler access to social and/or professional contacts are more often characterised by small private units with on-site restaurants, gyms, communal lounges and coworking spaces (Rugg & Quilgars, 2015).

Naturally, some argue that co-living facilities should be an open framework that can be reconfigured over the time according to the current and future needs of the tenants, but should be done with a careful attention to the private and shared boundaries (Bhatia & Steinmuller, 2018). Others notice that functional co-living can be achieved by the intelligent use of secondary spaces (Fromm, 1991).

Growing Interest in Co-Living within the EU

Looking at the data, one can notice that European stock of co-living facilities was lagging behind the American and Asian markets (Bridet et al., 2020). Consequently, in the past 5-7 years the number of co-living operators have drastically risen on the year-on-year basis (Bridet et al., 2020). While investments in the co-living projects are progressing very quickly, it is interesting to see that operators are investing in relatively sizable buildings making the overall number of beds grow exponentially. It is said that 79% of all new co-living projects will consist of at least 200 beds (JLL, 2019).

Following, it is interesting to see how fast Europe is bridging the gap compared to other regions. According to many researches, at the end 2019 around 23 150 beds in total were available in co-living facilities across Europe (JLL, 2019).

Scholars have also researched a variety of co-living formats in the Dutch context. It has been identified that there is overall a wide range of diverse types of co-living (Ronald et al., 2023).

Table 2. Space Division based on Ronald et al., 2023

	Type of provider	Type of contract	Type of resident	Avg. monthly rent (incl. service fees)
High-end colving	Large private investors	Temporary contracts in rent-liberalised segment	International young adults	€1000 - €1800
Flexible co-living	Large private investors	Short-stay	International temporary young adults	€650 - €900
Aspirational co-living	Small private investors and housing associations	Indefinite contracts either in rent-regulated segment or rent-liberalised segment	Local and international young adults and sometimes mixed with vulnerable groups	€400 - €700
Institutionalised co-living	Large private investors and housing associations	Flexible contracts	Local young adults	Varies between private and social providers

Co-Living Critics

Furthermore, co-living is on rise throughout the past years and is constantly gaining in popularity, it has also been met with criticisms and controversy. Although co-living arrangements are widely known for promoting social interaction, one also has to look on the other side. The privacy concern stems from the fact that multiple unrelated individuals share personal space such as kitchens, living rooms and limited storage for personal belongings making it challenging to have a sense of privacy at the end of the day (Anzani & Lonardo, 2022). This might be troublesome for people who value their privacy and may be uncomfortable with sharing their living environment on a daily basis. Subsequently, such facilities may become a flashpoint of conflicts as housemates have different lifestyles and expectations leading to misunderstandings (Hafström, 2021). Furthermore, co-living situations frequently have severe rules and restrictions about noise, cleaning, and guest policies, which can be invasive and restrictive for tenants (Coricelli, 2022).

Another disadvantage of co-living is the lack of stability and security (Steding, 2019). Co-living agreements are frequently short-term, and occupants may be compelled to leave at any moment with little warning. This can be a concern for people searching for a more long-term housing solution who want the stability of a permanent lease. Also co-living may be an amazing option for young, single people, however it may not be a practical or desired option for those who have families or are in long-term relationships (Steding, 2019). As a result, co-living places can have a high turnover rate, making it difficult for individuals to create long-term ties and foster a feeling of community.

Furthermore, co-living may not always be a more cost-effective housing solution as promoted (Savills, 2019). While it may be less expensive in some situations than standard flats, the cost of co-living can vary greatly and is not always a fair deal for the facilities and services given. Furthermore, co-living agreements may not provide the same amount of security as regular leases, leaving tenants exposed to eviction or price rises with few options. Co-living agreements sometimes involve a deposit or upfront payment, which can be a financial strain for some people (Savills, 2019).

Co-living - Policy & Planning Context

With the rapid growth of co-living spaces, policymakers will need to consider how to balance the interests of developers and tenants (Coricelli, 2022). Further, shared living arrangements may contribute to a range of regulatory bodies' broader environmental and social agendas (Hoekveld et al., 2022). Subsequently, there is a need to develop well controlling regulations that will meet the demands of all, or at least the majority, of stakeholders. One of the issues that occurred as a result of the absence of rules on co-living was that many informal housing complexes were profit-driven and provided relatively limited private areas with few communal utilities and spaces (Hoekveld et al., 2022). On the other hand, the risk of overregulation is that it would destroy the financial aspects, and private developers will not construct co-living real estate. Several 'best practice guides' on co-living include a metric-driven approach towards co-living policy and planning, while others argue that a 'one-size-fits-all approach' is ineffective because local difficulties differ depending on the target population, scale, or geography (ULI Europe, 2022). Consequently, many argue that local governments should provide planning assistance for co-living developers based on national or regional frameworks. These should include desirable co-living sites, physical characteristics and needs (e.g., room sizes and levels of amenity space), operational benchmarks, and contributions to affordable housing (ULI Europe, 2022). Whereas developers should identify and understand their target residents while planning, developing, and building co-living schemes in order to match consumer expectations and continue to enhance their offering (Savills, 2019).

Ultimately, the co-living sector should start project planning with a long-term perspective and involve all parties (JLL, 2019). This involves representatives from the public and corporate sectors as well as lawmakers, financiers, operators, prospective residents, and the neighbourhood (Hoekveld et al., 2022).

If conflicting requirements are balanced and many points of view are taken into account, a co-living project is more likely to succeed (Hoekveld et al., 2022).

User Preference

Next, it is critical to gain a deeper understanding of what user preference is and how it relates to the built environment. Firstly, preference and choice are frequently mistaken with each other. Preference strictly relates to the 'relative attractiveness' (Jansen et al., 2011; Heshner et al., 2005) and choice refers to 'actual behaviour' (Jansen et al., 2011; Heshner et al., 2005). Interestingly, many scholars found that this is a one-way relationship where preference influences choice (Molin et al., 1996), but choices do not always reflect preferences.

Following, user preference can be divided into two main types. Revealed preference and stated preference (Jansen et al., 2011). Revealed preference relates to consumer preference that was measured by analysing historical data of the consumers (Timmermans et al., 1994). Many researchers argue that this is the only correct way to analyse preferences as actual choices based on practical socio-economic conditions reflect real preference (Priemus, 1984; Jansen et al., 2011). However, other studies argue this is not an appropriate way as it refers more to consumer choices. Additionally, revealed preference analysis can't be conducted if historical data does not exist. Therefore, other scholars argue that stated preferences that reflect hypothetical choices is a better way to measure user preference (Jansen et al., 2011).

Studying Housing Preferences

Furthermore, there are numerous methods for measuring and analysing housing preference. According to certain studies, different life stages result in different user preferences as a result of the transition into a new life cycle with different needs and characteristics (Jansen et al., 2011). A decision-making technique is another approach that aims to analyse behaviour in relation to how people attempt to reach particular goals and values when solving difficulties, which in this case might (possibly) involve changing houses. Of course, there are also more established methods, such well-known demand research. This approach combines socio-demographic and economic elements with clear and basic questions, such as preferences for home qualities.

Survey research methods, observational research methods, and experimental research methods are some of the several approaches and procedures to assess and analyse user choice in housing. The choice of approach will rely on the particular research issue and the resources available, as each strategy has its own advantages and disadvantages.

Many reports review an interesting aspect of studying housing preferences in regard to various housing

attributes (or characteristics) and its relation to user preference (Ronald et al., 2023). Some found that attributes such as living space among the quality and design influences preferences most significantly (Rossi, 1995; Clark & Onaka, 1985). Internal space division with e.g. number of bathrooms and bedrooms also plays an important role in shaping people's preferences (Chan et al., 2008; El-Nachar, 2011). Location attributes were also heavily researched with a key finding that amenities or lower rent compensates the long distance to work (Clark & Onaka, 1985).

Subsequently, scholars have also looked into classifying methodology of those attributes when studying user preferences. Some researchers have provided a common framework of division into: housing attributes, residential environment, economic, social and location ones (Louviere & Timmerman, 1990). On the other hand, others argue that attribute types may vary vastly from the context and thus a division into internal and external housing variables brings more flexibility (Greene & Ortuzar, 2002). Intrinsic attributes include living space, design, types of functionalities or e.g., number of bedrooms and extrinsic focuses on exterior appearance or materials used for construction and therefore overall building quality (Ronald et al., 2023). Whereas, location attributes consider aspects such as access to public transport or services (Kauko, 2007).

As previously mentioned many have already looked into understanding which housing attributes are preferred by the end user. The table below presents some findings from the existing literature on preferences.

Table 3.Derived from Analysis Conducted by Mulliner & Algrans (2018)

Area	Country (and Author)	Key findings on consumer attribute preferences
Europe	Finland & The Netherlands (Kauko, 2006)	Location (accessibility and pleasantness) was more important than the housing itself (quality and spaciousness) in Finland (Helsinki). Contrastingly, functionality and spaciousness of housing was more important than location in the Netherlands (Randstad).
	Belgium, The Netherlands & Luxembourg (Molin & Timmermans, 2003)	Housing and neighbourhood attributes were more important than location accessibility attributes.
	The Netherlands (Molin, 1999)	Housing attributes were more important than location attributes
	UK (Whitbread, 1978)	Housing attributes (such as quality) were more important than environment attributes.

Housing Expectations of Young Population

Understanding that different generations have different preferences, it is crucial to constantly monitor and investigate user preferences. According to experts, young professionals and starters are trapped in a situation where they tend to earn too much for a social rental home, but earn too little to be able to keep up with rents or housing prices on the open market (Rabobank, 2019). However, it doesn't mean that this generation does not have any preferences and demands. Housing expectations are influenced by a

variety of factors, including the economy, social issues, and personal preferences. Nonetheless, there is a significant tendency among the young adults in search of economical, convenient, and accessible housing (Mackie, 2016). Many of them rank accessibility to employment or education, general public transportation, and the accessibility to shared amenities as their top priorities (Clapham et al., 2010). Others prefer housing that provides a sense of belonging and community (Yousefi et al., 2017). As a result, people's decisions are impacted by a mix of personal, economical, and societal influences (Zavisca & Gerber, 2016).

According to a survey of housing choices among university students in the United Kingdom, the top reasons for selecting co-living were the chance to meet new people, the ease of shared amenities, and the reduced cost compared to typical flats (KnightFrank, 2017). Furthermore, according to a poll of young professionals in Germany, the major reasons for selecting co-living were the reduced cost compared to typical flats and the convenient location, followed by the shared amenities and the possibility to meet new people (JLL, 2019). However, it is important to note that co-living may not be suitable for everyone, and individual preferences and values will likely play a significant role in determining whether this type of housing is a good fit.

Post Covid Implications

COVID19 pandemic had a significant influence on many areas, including real estate. Therefore, it is crucial to understand its implications on the co-living industry as it can yield the identification of possible areas for development and innovation. Research on consumer preferences and behaviour in the aftermath of the pandemic might give significant insights on the sorts of facilities and services that co-living renters seek. This might assist co-living operators in developing new goods or services that are more tailored to their tenants' demands.

According to data presented by JLL (2021) one can clearly see that the co-living and overall rental industry have seen a strong depression in the first 12 months of the pandemic as many renteers moved back to e.g. their family homes (Klein, 2020). Furthermore, in order to comply with social distancing requirements, several co-living apartment complexes were required to close or restrict access to common rooms and facilities. Consequently, many tenants started to seek larger and more private living spaces with different types of shared facilities (Regodon et al., 2021). Moreover, many people started to work or study from home increasing demand for e.g. high-speed internet or study rooms (Schetsche et al., 2020). Another negative influence of COVID on the real estate market was the fact that many lost jobs making it more difficult to afford long-term housing contracts (JLL, 2021).

Following, one of the most common strategies to limit the number of infections and hospitalizations or even deaths was social distancing. This precaution entailed avoiding close contact with people, public or private gatherings, and keeping at home as much as possible while avoiding non-essential visits away

from home (Miller, 2020). However, this has led to many undesirable side effects such as negative influence of one's mental health (Giorgi et al., 2021). According to many studies social distancing has magnified the number of people suffering from chronic stress, depression and sleep problems (Schetsche et al., 2020). Many researchers have connected lack of social gatherings with more distress across young adults (Schetsche et al., 2020). Thus, knowing that one of the characteristics of co-living is the sharing of spaces and activities to improve tenants' social dimensions (Regodon et al., 2021), such buildings may play an important role in improving society's well-being.

Case Studies: Analysing Commercial co-living Reference Projects

Case studies of reference housing projects are an important technique to analyse the supply side of the housing market as they provide valuable insights about the planning, execution, and outcomes of particular housing projects.

It can be done by using a variety of research methods, such as interviews with project developers, architects, and residents, as well as site visits and analysis of project documents (Kibert, 2016). This research will be based on analysing a variety of attributes such as: housing characteristics, design, location within the city or region, proximity to public transport and other building amenities. This will help evaluate the current supply side of co-living housing.

For this study, case studies of various commercial co-living developments located in popular student and young professional destinations across The Netherlands were studied. These cities are in high demand for housing among young adults. Additionally, in order to develop the most up-to-date overview of the current commercial co-living market in the Netherlands and gather information about what is current state-of-art facility, well-functioning, but also projects that are expected to be delivered soon are taken into account.

Figure 2. Popular Student and Young Professional Cities Across The Netherlands; Own Work Based On Openstreetmap

Figure 3. Example of Co-Living Apartment Building; Source: https://kts.org.uk/nineyards-a-co-living-co-working-proposal/

Rotterdam - OurDomain

OurDomain Rotterdam is a centrally located commercial co-living building in the heart of Rotterdam (1 minute away from Rotterdam Blaak). In the 24 story-high building there are 612 studios and apartments available. Base rent varies between €620 to €920 a month, with up to €250 in service fees. Allowance application is possible. Both fully furnished and unfurnished apartments are available. OurDomain has an enormous rooftop terrace, three community lounges, music room, cinema room and a gym. Additionally, there is a restaurant and a hairdresser located in the building. Indoor bicycle shed is present in the building, however interestingly, it is the only building in the area without parking, since the architects have persuaded the municipality that due to its central location it is unnecessary and buildable area can be used to facilitate other use cases.

Figure 4. Example of The Amenities and the Room; Source: https://www.thisisourdomain.nl/rotterdam-blaak/home

Amsterdam - Little Manhattan

Little Manhattan is a co-living building located in front of Lelylaan station in Amsterdam providing fast access to the city centre (9 minutes to Amsterdam Centraal) or the biggest airport in the country (7 minutes to Schipol Airport). It consists of 279 co-living apartments (with both furnished and unfurnished options) with an average size of 41m^2. Both studios and 1-bedroom apartments are available, ranging from €755 to €1105 a month respectively (excl. €175 service costs). Rental agreements are offered for a maximum of 5 years until the age of 27. Building has many amenities such as an indoor bicycle shed to store bicycle safety, washing rooms and two big community rooms. There is also a gym centre and a terrace for the use of residents. Complex additionally hosts a restaurant and parking spaces for electric cars upon request.

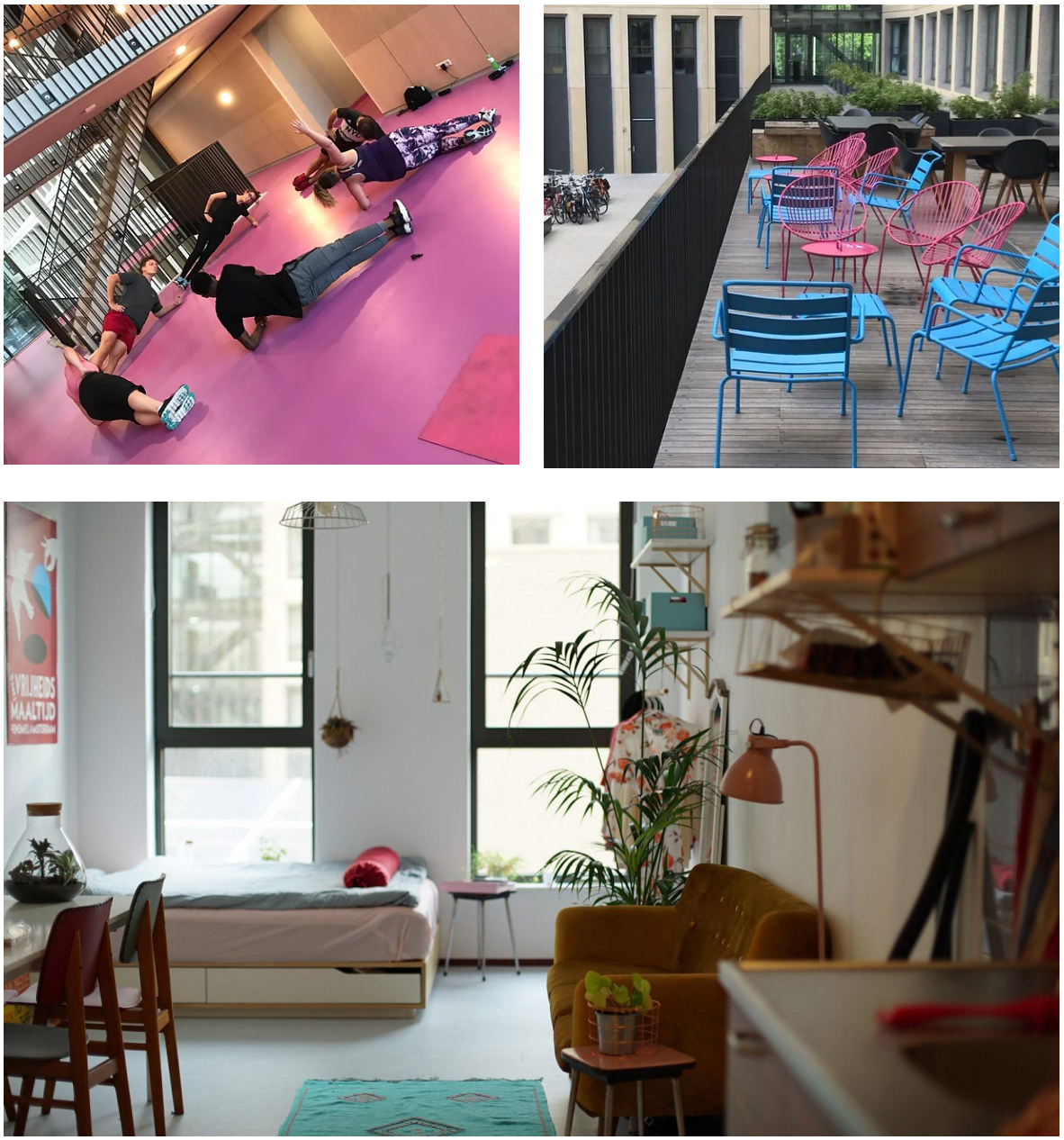


Figure 5 - Example of the Amenities and the Room; Source: https://www.littlemanhattan.nl/

Almere - High Note

High Note, has 157 apartments, is located in the city centre of Almere and is expected to be delivered towards the end 2023. Apartments will vary between three sizes: 46m2 - 54m2, 61m2 - 83m2 and 67m2 - 106m2 (rental prices are still unknown), making it an interesting example amongst other commercial co-living apartments since private units are relatively big compared to other buildings. Consequently, it comes with fewer shared amenities like accessible and open community plinth, roof garden and bicycle shed. It is also said to host a few offices, a coffee shop and a restaurant.

Figure 6. Example of the Amenities and the Room; Source: https://www.highnote.nl/woningen

Leiden - Liv

Liv is centrally located in Leiden and consists of two buildings that together host 394 residences divided into studios (24 - 35m^2) and apartments (32 - 48^{2m}). With Liv expected to be opened in the third quarter of 2023 rental prices are still unknown. The ground floor of the complex has a spacious lobby of 250m^2 that also serves as a general meeting area. Building also consists of a gym, communal living room, laundry room, enclosed patio, green courtyard and a smart parcel machine. It also has a bicycle shed and 26 available parking spaces. Liv was designed to meet various sustainability requirements to reduce e.g. electricity costs by installing solar panels.

Figure 7. Example of the Amenities and the Room; Source: https://www.kokon.nl/nl/projecten/LIV-Leiden

Eindhoven - Lux

Lux is located in one of the neighbourhoods around central Eindhoven. It has 199 apartments (studio, 1-bedroom and 2-bedroom apartments are available). Most of them come unfurnished. Prices vary between €440 and €1050 per month with up to €90 in service costs. Lux is a home to a community courtyard, study/work room and a roof terrace.

Figure 8. Example of the Amenities and the Room; Source: https://www.luxtower.nl/

Eindhoven - The Social Hub

The Social Hub (previously The Student Hotel) is an international chain that has recently transformed into a commercial co-living building for young adults. The Social Club Eindhoven is located 1 minute away from Eindhoven Centraal and 20 minutes away from Eindhoven Airport. There are two types of studios, a standard one with an average size of 18m^2, shared kitchen and a deluxe one with an average size of 24m^2 with a private kitchen. Prices vary between €710 and €1050 including all of the costs. All of The Social Hub's buildings have on-site laundry areas, gyms and coworking spaces. They also offer bicycle sheds and community rooms. There is also a restaurant located in the complex.

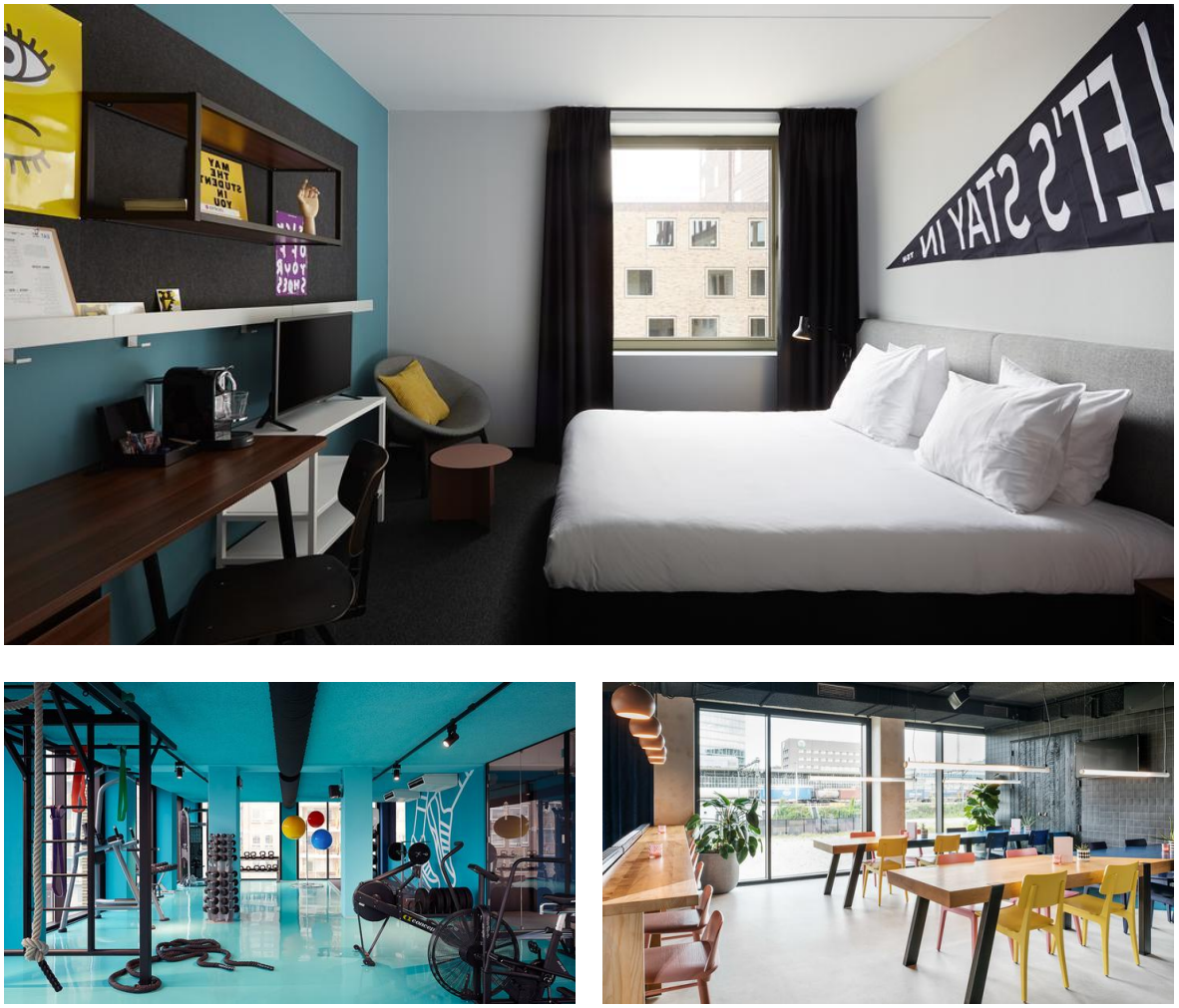


Figure 9. Example of the Amenities and the Room; Source: https://www.thesocialhub.co/eindhoven/

Utrecht - The Fizz

The Fizz is located around the city centre of Utrecht, around 3 km (20 min via public transport) to Utrecht Centraal. Being the tallest building in the neighbourhood it consists of 639 fully furnished apartments that vary in sizes. Fizz provides both single or double residencies. Base rent ranges from €442 to €763 per month with a maximum of €110 in additional service costs. Residents can also apply for a rent allowance if certain requirements are met. Fizz has a community kitchen, movie lounge, gaming area, study room, gym or a rooftop terrace amongst other community meeting rooms or laundry rooms.

Figure 10 . Example of the Amenities and the Room; Source: https://www.the-fizz.com/nl/studentenwohnheim/utrecht/

3.1 Identification of Problems That Remain To Be Solved

Almost all around the world people are facing a vast crisis in the housing market. Future and current generations have problems with finding a place to stay. According to the previous paragraphs it is clear that one of the most concerned groups are young professionals and students who are just starting their adolescent lives. As per a report by the European Commission (2020), the high cost combined with lack of housing stock in EU cities is a major obstacle for young people, particularly those who are starting their careers or pursuing higher education.

Nevertheless, a possibly promising solution to changing preferences of the young population have emerged within the European Union during past years. Understanding that user preferences are constantly changing and vary from geographical area to area, it is of a great importance to gain valuable insights into the young European user preference in co-living facilities in order to answer the needs. Seeing that the trend of modern commercial co-living facilities comes from America and Asia, it is an opportunity to analyse what are the key pulling factors towards such buildings amongst the European youth. Recognizing user demands and preferences can help improve housing situations by addressing the issues important for the current generation.

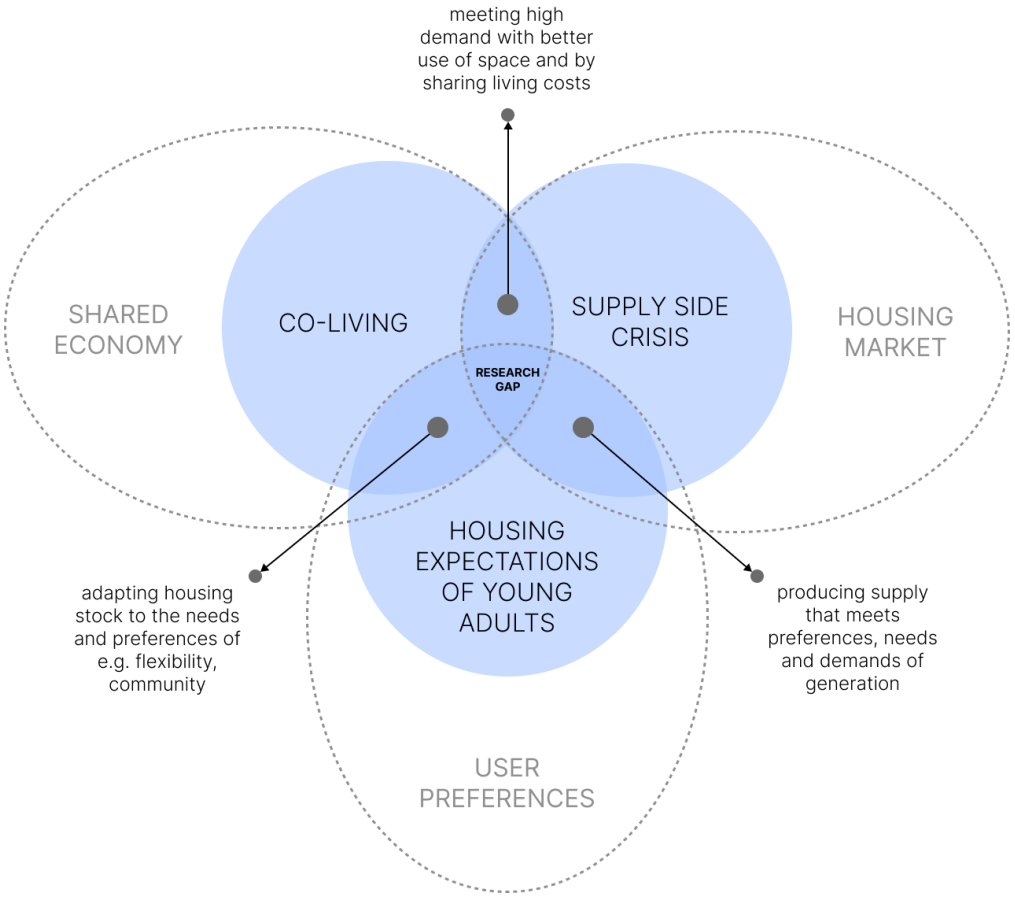


Figure 11. Representation of the Research Gap in Relation to Previously Discussed Topics; Own Work

The purpose of this study is to fill a knowledge gap and research what factors do young people in The Netherlands value the most when moving into co-living facilities. It aims to analyse and understand user preferences in relation to attributes of co-living facilities in order to understand what kind of supply will support their needs.

Goals and Objectives

Objective is to provide the best guidelines for policy makers and developers to create a housing stock that aligns with users' demands, making their lives better.

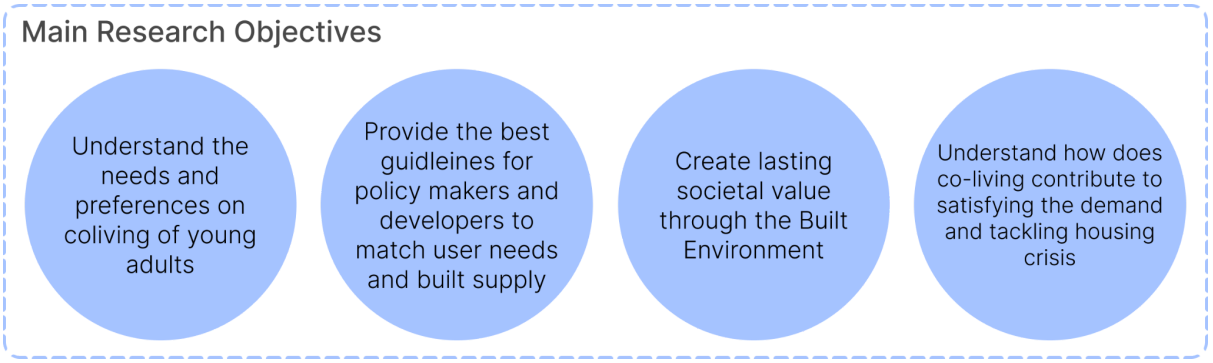


Figure 12 - Main Research Objectives; own work

Dissemination and Audiences

Key findings of the report can be found useful by various groups. They may also play a crucial role for local and national governments establishing new housing rules as such research will represent user perspective. Accordingly, it can also bring interesting insights for the developers to gain deeper understanding about the demand side of the market. All in all, the importance of this project is to have a significant impact on increasing the knowledge on a relatively new modern type of co-living, to help public and private entities, policy makers, construction companies and developers to properly address the needs of the young generation and understand their perspective on co-living.

3.2 Societal and Scientific Relevance

Understanding young adult housing preference is relevant from both societal and scientific point of view. As previously said, the housing crisis in The Netherlands is a serious problem that requires immediate attention. It is more crucial than ever to take advantage of this crisis and, by understanding the needs and desires of the current generation, maximise housing satisfaction while operating within financial constraints. Built environment can play a significant role in how people's lives change.

Societal Relevance

Looking at the housing preferences from a social standpoint, this research can assist policy makers and urban planners in building more livable and equitable communities. Understanding user preferences allows us to evaluate existing and future building supply through the eyes of end users. One of the research aims is to provide best guidelines for policy makers and developers to match user needs and build supply. Consequently, it will contribute to the decision-making process between private and public stakeholders, by providing end user input. Understanding which co-living attributes are preferred by young adults in The Netherlands, can help the society build the cities of tomorrow. It can help better understand how people behave and make decisions, including how people trade off various housing characteristics like location, size, and amenities. It can also influence the creation of housing solutions and programs meant to enhance the wellbeing of people and families.

Scientific Relevance

User preferences in the built environment have been investigated for many years now. However, in an ever changing market there is a constant need to evaluate and understand market imbalances. Currently, there is a visible mismatch between demand and supply. With co-living gaining in popularity over the past years, there is a clear lack of scientific research in The Netherlands in this field. Consequently, it is interesting to contribute to existing literature and understand whether co-living can satisfy current user demands and is a way to tackle the housing crisis.

4. Conceptual Framework

Next, it is important to visualise the research framework. Consequently, the figure below represents the conceptual framework for this study.

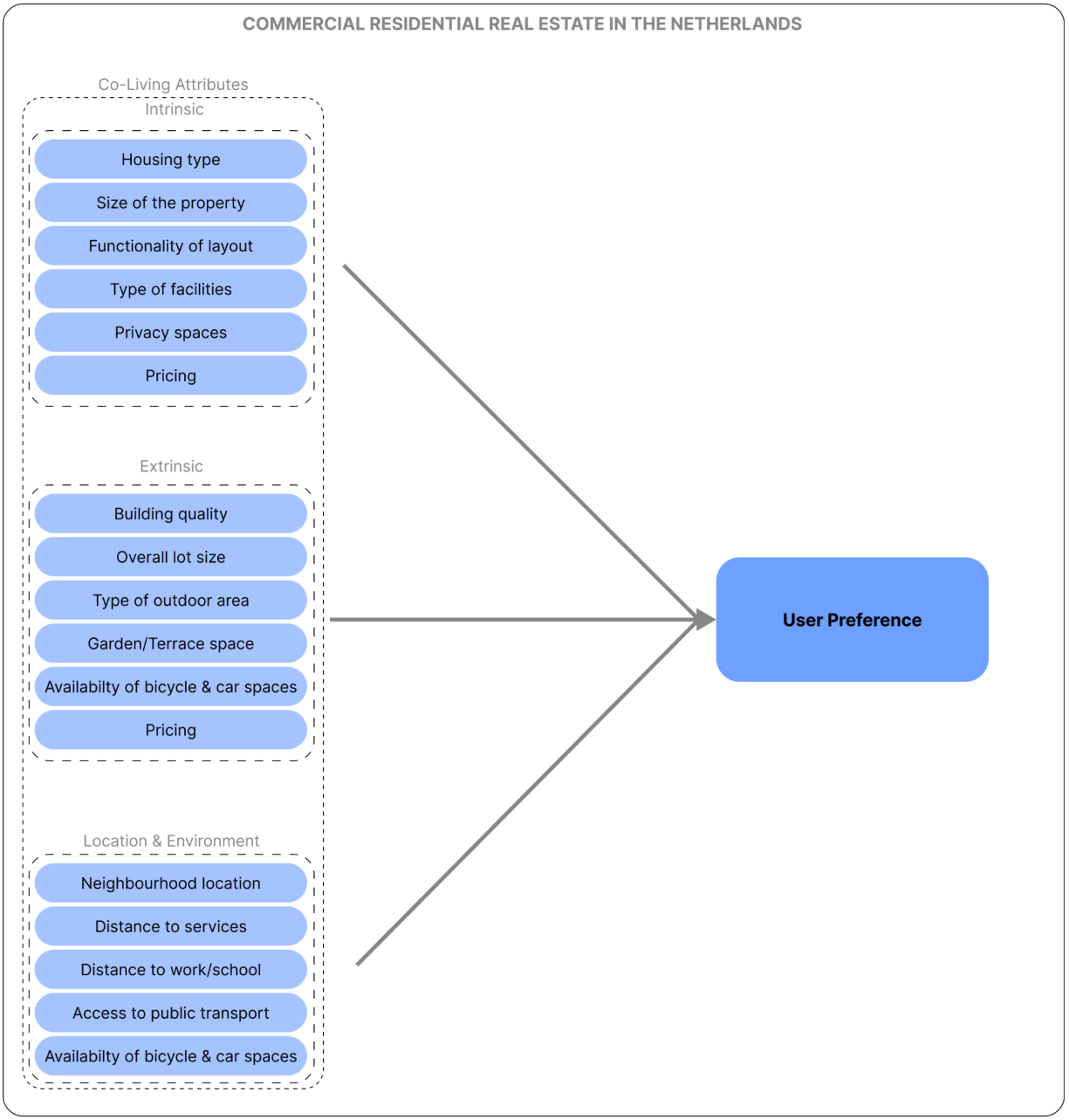


Figure 13. Attributes Derived from Previous Literature Review

In this research 'user preference' is the dependent variable and 'co-living attributes' are independent variables. Previously conducted literature review suggests that there is a casual relationship between the variables, as the change in independent variables directly influences changes in the dependent one.

5. Research Method

There is a clear knowledge gap in understanding co-living housing preference amongst young adults in The Netherlands. Measuring housing preferences is a very complicated matter. Therefore, a framework that includes both quantitative and qualitative studies is a powerful approach for understanding such complex phenomena. By triangulating data, confirming findings, and cross-checking the outcomes from both approaches, researchers may better comprehend the study topic by merging these two methodologies. When examining complicated social and behavioural concerns, this kind of research paradigm is especially helpful since it enables a more nuanced and comprehensive understanding of the phenomena under study. Furthermore, it enables the collection of several viewpoints and thoughts, leading to a more inclusive and representative knowledge of the study topic.

Consequently, this study uses two types of data: primary and secondary (Bryman, 2016). Primary data collection, usually referred to as fieldwork, entails gathering information directly from the source through methods including surveys, interviews, and observations and secondary data collection refers to gathering information that has already been gathered and documented by another party, such as from government statistics, reviews of the literature, and already published research (Kumar, 2014). Literature review together with studying reference projects will be used to create a set of scenarios for a questionnaire which will be used to collect data for discrete choice experiments. Questionnaires will be distributed amongst the target group, young adults in The Netherlands, and data will be quantified. Next, the results will be analysed using a statistical software platform IBM SPSS. It will help in conducting a quantitative analysis to draw conclusions on user preferences.

Figure 14. Relation Between Qualitative and Quantitative Methodologies; Own Work

5.1 Analytical Framework

The aim is to determine user preferences on co-living buildings attributes. Having established that The Dutch housing market is currently very tight and limited on the supply side (JLL, 2023), many people choose housing options that do not reflect their real preferences. Consequently, this study focuses on studying stated preferences as in current market this approach allows to determine user preferences in a more realistic manner (Jansen et al., 2011). In order to achieve that goal, most important co-living attributes will be derived from previously conducted literature and market study. This information will be used to conduct a quantitative study (discrete choice experiment) which will help to find real user

preferences. Additionally, as previously mentioned, to understand to what extent the built supply meets user demand in regard to their preferences, one needs to use performance measurement methods that involve comparing different scenarios. In this research, a base case scenario will be established that represents the most preferred attributes for a co-living building, which will serve as a benchmark to which other buildings can be compared. By establishing a base case scenario and comparing other buildings against it, one can identify areas for improvement and help guide future development in the co-living sector.

The process of evaluating the extent to which the built supply meets user demand can be divided into four different sections, as illustrated in the figure (15) presented below. The first section involves conducting a literature review and market research to create a questionnaire that will gather data for a discrete choice experiment. This experiment will help to identify and evaluate user preferences, which are critical to understanding how well the built supply aligns with user demands. Consequently, once user preferences have been identified, the next step is to create a best case scenario of a co-living building based on the highest scoring attributes. This base case scenario will serve as a benchmark against which other co-living buildings can be compared to evaluate how well they meet user demands. Lastly, all the findings will be gathered together and discussed to answer the main research question of to what extent the built supply meets user demand in regard to their preferences. By synthesising the results of the literature review, market research, questionnaire, discrete choice experiment, and performance measurement methods, it will be possible to provide a comprehensive answer to the research question and make recommendations for future research and development in the co-living sector.

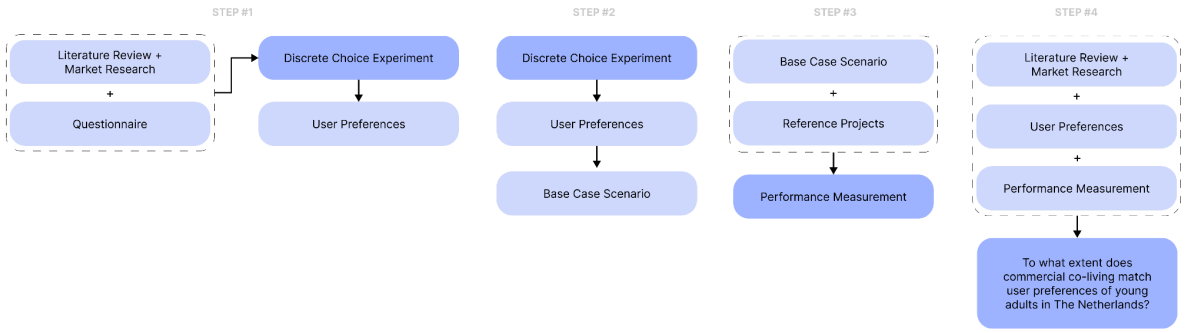


Figure 15. Analytical Framework; Own Work

Introduction to Discrete Choice Experiment

Firstly, the real user preferences need to be established. Consequently, discrete choice experiment (DCE) is a quantitative tool used to understand user preferences through decision-making (Jansen et al., 2011; Weber, 2021). Such experiments seek to establish a relative importance to people of a good or service based on different attributes (de Baekker-Grob et al., 2012). Participants are presented with

hypothetical scenarios (*choice tasks*) that describe goods or services and are asked to select a preferred one. Every scenario is described by *attributes* that consist of different *attribute levels*.

Methodology

In order to conduct a discrete choice experiment there are few common steps that have to be followed (Hensher et al., 2005; Jansen et al., 2011).

Attributes and Attribute Levels Selection

Firstly, attributes and their levels need to be selected. The most popular methodology used to determine them for the discrete choice experiment is conducting a literature study and market review to develop an understanding about the state-of-art of analysed goods or services (Weber, 2021). Having identified the overall set of attributes through qualitative research, the next step is to find relevant ones that shall be included in the choice set (Kløjgaard et al., 2012). Despite the fact that there is no specific limit on the number of attributes for the discrete choice experiment, a general rule of thumb expects the study to determine between 7 to 10 relevant ones (Henser et al., 2005; Weber, 2021). Too many attributes may later lead to achieving a cognitive burden of a participant too fast which can result in simplifying his/hers answers.

Next, the appropriate levels of the attributes need to be defined. Levels must be derived in a manner that will clearly ensure trade-offs between attributes meaning that a participant e.g. gives up some amount of attribute #1 to increase levels for an attribute #2 (Weber, 2021). Attribute levels can be expressed as words ('small', 'big', 'none') or numbers ('1km', '5km', 20km') (Henser et al., 2005). Generally, in order to create balanced designs, all attributes should have the same amount of levels and those should be two- or three-level attributes (Kemperman, 2021).

A: Choice tasks

Choice task #	Option 1					Option 2				
	A_1	A_2	A_3	A_4	A_5	A_1	A_2	A_3	A_4	A_5
1	3	1	0	2	0	1	3	2	0	3
2	2	0	1	3	3	1	3	2	0	0
3	3	0	2	1	1	1	2	0	3	2
4	2	2	2	2	3	3	3	3	3	2
5	1	0	3	2	1	2	3	0	1	0
6	1	2	0	3	1	0	3	1	2	2
7	0	1	2	3	0	3	2	1	0	1

B: Attributes and levels

A_1: Return airfare
(0 = $350, 1 = $450, 2 = $550, 3 = $650)

A_2: Total travel time, including stops
(0 = 4h, 1 = 5h, 2 = 6h, 3 = 7h)

A_3: Food/beverage
(0 = none, 1 = beverages only, 2 = beverages + cold snack, 3 = beverages + hot meal)

Figure 16. Example of Discrete Choice Experiment - Choice Tasks & Attribute and Attribute Levels, source: Street et. al., 2005

Measurement Task

There are two ways of analysing stated preferences. Compositional preference models are based on an idea where survey participants are asked to rank hypothetical alternatives from the most to the least preferred one (or the other way around). On the other hand, in the decompositional approach, participants are presented with a series of previously composed combinations of different attribute levels and are asked to decide between two or more hypothetical alternatives.

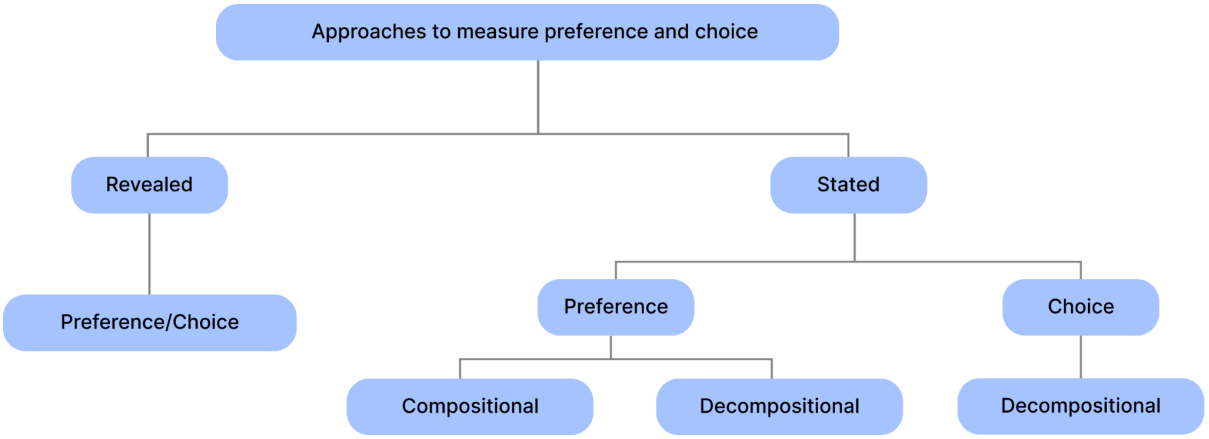


Figure 17. An Overview of Preference and Choice Measurement Approaches Derived from Kemperman, 2000

Additionally, it is important to consider a neutral option in a decompositional approach, referred to as an 'opt-out', to make choices more realistic (Watson et al., 2017).

Experimental Design and Choice Set Generation

Consequently, researchers focus on selecting an experimental design to generate hypothetical alternatives that will be presented to respondents (Kamperman, 2000). A *full factorial design* means that all of the possible combinations of attributes and their levels are going to be used to generate choice tasks. However, *full factorial designs* yield enormously large sets of possible choices (Jansen et al., 2011). To calculate the number of possible alternatives one needs to follow the equation presented below (Kamperman, 2000).

$$L^A \qquad [1]$$

L - *represents number of attribute levels*

A - *represents the number of attributes*

Subsequently, researchers can decide to use a *fractional factorial design* that reduces the number of possible choice sets by carefully deciding on a controlled set of profiles for the survey participants, making it possible to examine without overloading respondent cognitive load (Jansen et al., 2011). Hence, when conducting a study with outside participants, it is crucial to understand the trade-offs

between statistical efficiency and potential loss of respondent efficiency. Naturally, the more choice sets, the higher data reliability, but too many sets might lead to unreliable results (Hensher et al., 2005; Jansen et al., 2011). Consequently, one of the most optimal ways is orthogonal data creation that allows to reduce the number of combinations by selecting a subset of uncorrelated variables of the full design (Weber, 2021). The effects of each variable is assumed to be independent of one another and that any observed differences in the outcome are solely due to the main effects of each individual variable (Henser et al., 2005; Jansen et al., 2011). This allows efficient investigation of multiple attributes simultaneously avoiding confounding effects (Henser et al., 2005). Confounding effects occur when the investigated relationship between two variables is skewed by a presence of a third variable that relates to original variables, leading to wrong conclusions about them (Henser et al., 2005).

To achieve relevant *fractional factorial design* to reduce alternative combinations and make it realistic for respondents to give their preferences, statistical software such as SPSS, can help with flawless creation of orthogonal designs (Jansen et al., 2011). The rule of thumb for the 'simplified' design is that the (minimal) number of treatments is the construction of 27 combinations (Jansen et al., 2011).

Data Collection

Data for DCE is usually collected through a questionnaire. One of the most important things when gathering data is the sample size. According to some researchers, in order to achieve statistically significant results from a discrete choice experiment, each choice set should have 30 observations (Jansen et al., 2011). Other studies suggest that in order to generate a reliable model, sample size should be calculated using the following equation (de Baekker-Grob, 2015).

$$N > \frac{500 \times c}{(t \times a)} \quad \textbf{[2]}$$

N - suggested sample size

c - largest level of attributes

t - number of choice tasks

a - number of alternatives

Apart from efficient survey design that does not overload cognitive ability of the participants and statistically significant sample size, it is also crucial to ensure study credibility. Therefore, FAIR Data Principles are going to be used as guidelines to make this scientific research data Findable, Accessible, Interoperable and Reusable. In order to increase the transparency and reproducibility of scientific research, a group of scientists and publishers originally proposed these principles in 2016. Following these guidelines can help scientists make sure that their data and techniques are well-explained and available to other researchers, which can encourage cooperation and advance science. The table below

represents how these rules are going to be preserved.

Table 4. FAIR Principles, based on Wilkinson et al., 2016

F - Findable	The work will be findable in the TU Delft Repository, and the sources used will be findable in the last chapter called References where APA 6th Style is used to refer knowledge to the original researchers
A - Accessible	The work will be accessible via TU Delft Repository
I - Interoperable	Research is being conducted in English ensuring it can be further used. The collected data will attached at the end of the report in a known and readable to everyone format
R - Reusable	The collected data will attached at the end of the report in a raw format

Ethical Considerations

There are various ethical issues that must be taken into account while conducting a study on young people's housing choices through a literature review and survey which leads to discrete choice analysis. First and foremost, all research participants must provide their voluntary and informed permission. This implies that people must willingly consent to participate after being fully told about the study's purpose, any risks, and any benefits. In addition, participants must have the freedom to leave the research at any moment without being penalised. In order to secure participants' privacy, it is also crucial to ensure the participants' anonymity and confidentiality.

Further, study's possible negative consequences as well as the intended usage of the results must also be taken into account. For instance, it is crucial to make sure that the study's findings are not used in a way that damages vulnerable groups or exacerbates already-existing inequalities if the study's goal is to guide housing policy decisions. It is crucial to conduct entire research ethically and keep in mind that any possible harm should be minimised at any stage.

Result Analysis

After enough responses of the survey are recorded, the data can be analysed. There are few possible models to analyse an individual's selection among the alternatives in order to derive consumer preference (Hensher et al., 2005). By providing preferred alternatives in each choice task, participant answers help researchers to quantify relative strengths of preferences for improvements in certain attributes (Spinks et al, 2015; Lopez et al., 2019). Ultimately DCE allows one to estimate a utility function between certain attributes and consumer preferences, which allows one to evaluate the most ‘efficient’ way of providing a good or service (Drummond et al., 2005). This can be quantified using a multinomial logit model based on the random utility theory (Hensher et al., 2005). Total utility based upon the individual preferences of different alternatives is explained using the following formula:

$$\sum_{a}^{z} U_j = (\beta_{attribute\ a} \times X_{j\ attribute\ a}) + \ldots + (\beta_{attribute\ z} \times X_{j\ attribute\ z}) + \varepsilon \quad [3]$$

U *represents total utility derived from alternative j*

β *stands for a coefficient of* $X_{a \to z}$ *estimated in the analysis and represents part-worth utility of attribute level*

ε *is a random error of the model*

Equation 3. The Utility Function Used in DCE, Source: Szinay Et. Al., 2021

Consequently, the results of the discrete choice experiment should provide valuable and interesting insights into the housing preferences of young adults by helping to understand which housing attributes are the most and least preferred by the target group. This information will be used to answer the main research question, with a performance measurement, by analysing whether current (and foreseeable) housing supply matches the preferred demand.

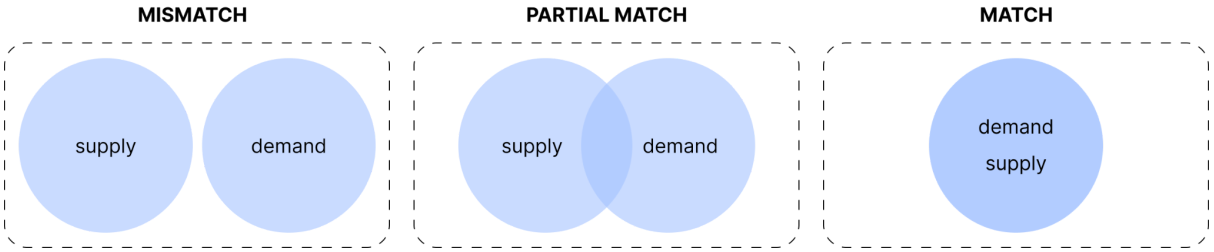


Figure 18. Potential Outcomes of Performance Measurement; Own Work

Development Process of the Discrete Choice Experiment

Following, the figure below represents the development process of the DCE in a few steps that have to be followed when setting up the experiment.

Formative Work	Attribute & Attribute Level Selection	Measurement Task	Experimental Design	Data Collection
Literature Research	Limit attribute number to <10	Compositional vs. Decompositional	Fractional vs. Full Factorial Design	Questionnaire composition
Market Research	2 - 4 levels per attribute	Decide on 'opt-out' option	Decide on number of Choice Sets	Establish required sample size
Qualitative Research	Ensure realistic attribute level ranges		Ensure realistic attribute level ranges	

Figure 20. Process for the Development of DCE. Own Work Based on Hensher Et Al., 2005; Jansen Et Al., 2011; Weber, 2010, Moor Et. Al., 2020

5.2 Discrete Choice Experiment Preparation

Formative Work

Formative Work | Attribute & Attribute Level Selection | Measurement Task | Experimental Design | Data Collection

Formative work has been extensively conducted in the previous chapters by studying both academic and market resources.

Attributes and Attribute Levels Selection

Formative Work | Attribute & Attribute Level Selection | Measurement Task | Experimental Design | Data Collection

Previously conducted formative work provides a strong background to elicit most influential attributes according to the state-of-art co-living buildings. Consequently, the first step to prepare a discrete choice experiment is to determine both intrinsic and extrinsic co-living housing attributes.

Consequently, housing attributes are determined using previously conducted literature study. An overview of key findings that helped to identify relevant attributes in the context of user preferences is presented below. Additionally, key findings from market research are also marked below, since all of the qualitative findings helped establish relevant attributes.

Table 5. Key Topics Identified Throughout the Literature Study and Market Research

Key Topic	Study													
	Clapham et. al, 201o	Palm Linden, 1992	Jakobsen, Peter & Larsen, 2018	Yousefi et. al., 2017	Fromm, 2012	Regodon et. al., 2021	Kadet, 2017	Molin & Timmermans, 2003	Rugg & Quilgars, 2015	Zavisca & Gerber, 2016	Czischke, Carriou & Lang, 2020	(Uyttebrouck et al., 2020	Reference Projects	Savillis/JLL/Rabobank/ING Research
Accessibility	X	X						X					X	X
Private Living		X	X		X	X		X					X	X
Shared Amenities	X	X	X		X	X		X					X	X
Community			X	X	X		X	X	X		X		X	X
Outdoor Areas		X			X			X					X	X
Other Services or Amenities			X						X				X	X
Social Interaction					X	X	X				X	X		X

Price													X	X
Flexibility & Convenience									X	X		X	X	X

One can clearly see that several topics have been more extensively discussed compared to the others. Next step is to translate these findings into the most relevant attributes that influence user preference, limiting the number of them for modelling to maximum 7 - 10 attributes (Henser et al., 2005). After carefully analysing both literature study and market research, it was decided that nine attributes are going to be used in this research: *accessibility, private living area, sharable living space, community space, outdoor facilities, sport facilities, leisure facilities, commercial services* and *price.*

Having done that, attribute levels were carefully developed by analysing existing (or about to be finished) co-living housing reference projects in The Netherlands. This allows for the questionnaire to be up to date and provide most valuable insights. Attributes, their levels and labels with short descriptions are presented in the table below

Table 6 . Attribute and Attribute Levels

Choice			
Attribute	**Level**	**Label**	**Short explanation**
1. Accessibility/ Location	0 1 2	Distance to city centre ≤ 500m 500m ≤ Distance to city centre ≤ 1.5km Distance to city centre ≥ 1.5km	Distance to the city centre or a city area with most important private and public services
2. Private living area	0 1 2	Area ≤ 25m2 25m2 ≤ Area ≤ 40m2 Area ≥ 40m2	Area of a private unit in a building (size of a studio or apartment)
3. Sharable living space	0 1 2	None Only kitchen Kitchen & Bathroom	The type of shared spaces within the basic, everyday living area
4. Community space	0 1 2	No space One communal space More space	Presence of community spaces where existing amenities mean one of e.g. **meeting room/communal living room** or **working/studying area** is present; more amenities mean more than one outdoor area is present within the residential complex
5. Outdoor facilities	0 1 2	No facilities One outdoor facility More outdoor facilities	Presence of outdoor areas where existing amenities mean one of e.g. **courtyard, patio, garden** or **terrace** is present; more amenities mean more than one outdoor area is present within the residential complex
6. Sport facilities	0	No facilities	Presence of sport facility where existing amenities mean one of e.g. **indoor or outdoor**

	1 2	One sport facility More sport facilities	**gyms** is present; more amenities mean more than one sport facility is present within the residential complex
7. Leisure facilities	0 1 2	No facilities One leisure facility More leisure facilities	Presence of leisure facilities where existing amenities mean one of e.g. **cinema room, music room** or **gaming room** is present; more amenities mean more than one leisure facility is present within the residential complex
8. Commercial services	0 1 2	No services One commercial service More commercial services	The presence of commercial areas where existing amenities mean one of e.g. **restaurant, bar, shop** or **hairdresser** is present; more amenities mean more than one commercial service is present within the residential complex
9. Price	0 1 2	Price ≤ €500 €500 ≤ Price ≤ €850 Price ≥ €850	The average rental price per month including service costs

Measurement Task

Subsequently, it was decided that survey participants will be presented questionnaires composed using decompositional approach as choice tasks tend to represented real behaviour to the greater extent when compared with rating or ranking tasks (Jansen et al., 2011)

Choice tasks are composed by a set of alternatives with varying levels of the attributes. Such an approach allows to investigate the trade-offs end users take. Additionally, to preserve authenticity of the research, an opt-out version will be included in the questionnaire (Hensher et al., 2005).

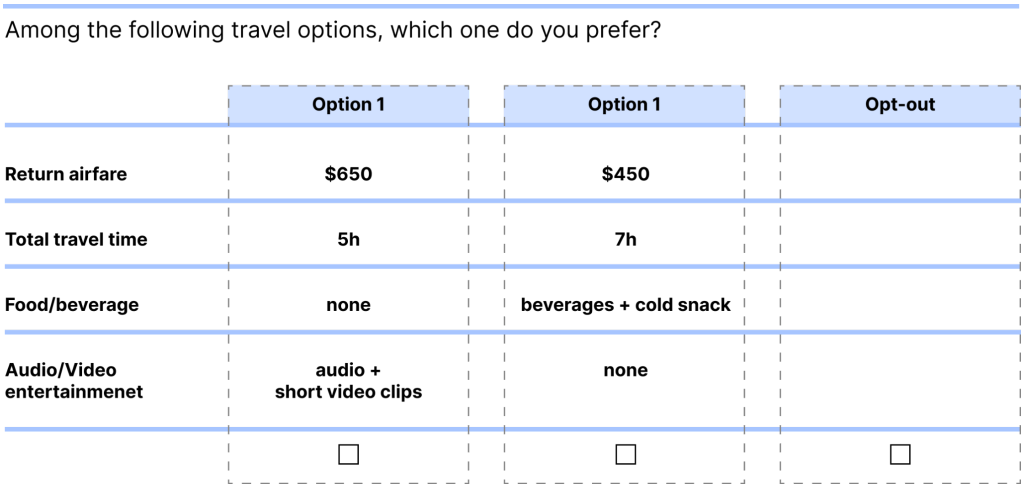


Figure 22. Example Questionnaire Choice Task. Own Work Based on Transportation Examples From Weber, 2020 Since This Report's Choice Tasks Are Still To Be Produced In The Next Steps.

Experimental Design and Choice Set Generation

After having developed a table of attributes, their relevant levels and their labels, it is now important to consider what type of an experimental design suits the needs of this research. At the beginning, it is important to investigate how many possible alternatives can the created choice set yield. To calculate the size of full fractional design one needs to follow equation [2]. Nine attributes and three levels were previously identified.

$$L^A = 3^9 = 19683$$

Subsequently, a full factorial design would result in 19 683 possible alternatives. Naturally, this would be too many questions making it unrealistic for the respondents to give their preferences. Therefore, this research will follow a fractional factorial design with a (minimal) number of three-level treatments of 27 combinations (Jansen et al., 2011). As mentioned, this requires an orthogonal data creation. In order to create such a data set, SPSS software was used (the entire process can be found in the Appendices).

Table 10. 27 Treatment Combinations Orthogonally Developed With Spss

	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
1	Distance to city centre ≤ 500m	Area ≤ 25m2	None	One communal space	One outdoor facility	No facilities	One leisure facility	One commercial service	Price ≥ €850
2	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	No space	More outdoor facilities	One sport facility	More leisure facilities	One commercial service	Price ≥ €850
3	500m ≤ Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	One communal space	More outdoor facilities	More sport facilities	No facilities	More commercial services	Price ≤ €500
4	500m ≤ Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	No space	More outdoor facilities	One sport facility	No facilities	No services	Price ≥ €850
5	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	One communal space	No facilities	One sport facility	No facilities	More commercial services	€500 ≤ Price ≤ €850
6	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	No space	One outdoor facility	More sport facilities	No facilities	No services	€500 ≤ Price ≤ €850
7	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	One communal space	More outdoor facilities	More sport facilities	More leisure facilities	No services	Price ≤ €500
8	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	One communal space	One outdoor facility	No facilities	No facilities	More commercial services	Price ≥ €850
9	500m ≤ Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	No space	No facilities	No facilities	One leisure facility	More commercial services	Price ≤ €500
10	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	More space	One outdoor facility	One sport facility	One leisure facility	No services	Price ≤ €500
11	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	More space	More outdoor facilities	No facilities	One leisure facility	No services	€500 ≤ Price ≤ €850
12	Distance to city centre ≤ 500m	Area ≤ 25m2	None	No space	No facilities	No facilities	No facilities	No services	Price ≤ €500
13	500m ≤ Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	One communal space	One outdoor facility	No facilities	More leisure facilities	No services	Price ≥ €850
14	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	No space	More outdoor facilities	One sport facility	One leisure facility	More commercial services	Price ≥ €850
15	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	No space	No facilities	No facilities	More leisure facilities	One commercial service	Price ≤ €500
16	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	More space	No facilities	More sport facilities	No facilities	One commercial service	Price ≥ €850
17	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	One communal space	More outdoor facilities	More sport facilities	One leisure facility	One commercial service	Price ≤ €500
18	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	No space	One outdoor facility	More sport facilities	One leisure facility	More commercial services	€500 ≤ Price ≤ €850
19	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	More space	No facilities	More sport facilities	More leisure facilities	More commercial services	Price ≥ €850
20	Distance to city centre ≤ 500m	Area ≤ 25m2	None	More space	More outdoor facilities	No facilities	More leisure facilities	More commercial services	€500 ≤ Price ≤ €850
21	500m ≤ Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	More space	No facilities	More sport facilities	One leisure facility	No services	Price ≥ €850
22	500m ≤ Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	No space	One outdoor facility	More sport facilities	More leisure facilities	One commercial service	€500 ≤ Price ≤ €850
23	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	More space	One outdoor facility	One sport facility	No facilities	One commercial service	Price ≤ €500
24	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	One communal space	No facilities	One sport facility	More leisure facilities	No services	€500 ≤ Price ≤ €850
25	500m ≤ Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	More space	More outdoor facilities	No facilities	No facilities	One commercial service	€500 ≤ Price ≤ €850
26	500m ≤ Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	More space	One outdoor facility	One sport facility	More leisure facilities	More commercial services	Price ≤ €500
27	500m ≤ Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	One communal space	No facilities	One sport facility	One leisure facility	One commercial service	€500 ≤ Price ≤ €850

After having orthogonally developed 27 treatment combinations, they have been randomly allocated into 9 choice sets of 3 alternatives and opt-out options. Example choice set is presented below and the rest can be found in the Appendices.

Among the following co-living alternatives, which one do you prefer?

Choice Set 1				
	Option 1	**Option 2**	**Option 3**	**Opt-out**
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≤ 25m2	Area ≤ 25m2	Area ≤ 25m2	
Sharable Living Space	Only kitchen	Only kitchen	Kitchen & Bathroom	
Community Space	No space	More space	One communal space	
Outdoor Facilities	More outdoor facilities	One outdoor facility	More outdoor facilities	
Sport Facilities	One sport facility	One sport facility	More sport facilities	
Leisure Facilities	No facilities	More leisure facilities	One leisure facility	
Commercial Services	No services	More commercial services	One commercial service	
Price	Price ≥ €850	Price ≤ €500	Price ≤ €500	

Figure 23. Generated Choice Set 1

Data Collection

Formative Work	Attribute & Attribute Level Selection	Measurement Task	Experimental Design	Data Collection

Once experimental data is created, a data collection is organised through a questionnaire. The questionnaire is going to be generated using SPSS, Excel and simple Python code to randomise choice sets composition (detailed information can be found in the Appendices). Next, the generated questionnaire will be uploaded to the Qualtrics platform which will be used to gather responses.

Questionnaire is composed of two parts: socio-demographic & economic questions and choice sets. The investigated target group are young adults (18-25) based in The Netherlands. First part of the questionnaire will gather data on gender, age, working status and education level (questions can be found in the Appendices). This will not only enrich possible results and analysis outcomes, but will also help to determine whether a questionnaire sample can statistically represent the target group. A *Pearson Chi-square Test* will be conducted by comparing observed values (gathered in the first questionnaire section) with expected values (based on the data from CBS). Goddess of fit is assessed by the following equation.

$$\chi_c^2 = \Sigma \frac{(O_i - E_i)^2}{E_i} \quad [4]$$

χ^2 - *measure of the difference between the observed and expected variables*

c - *degrees of freedom*

O - *observed value(s)*

E - *expected value(s)*

Next, there are different suggestions about the sample sizes. One of them assumes 30 observations as the bare minimum, others suggest to follow equation [3]. In this report, 3 is the largest level of attribute, there are 9 choice tasks and 3 alternatives.

$$N > \frac{500 \times c}{(t \times a)}$$

$$N > \frac{500 \times 3}{(9 \times 3)}$$

$$N > 55.(5)$$

$$N > 56$$

According to this equation, the minimum number of respondents to produce a reliable model is 56. Consequently, in order to achieve the best results, aim for the questionnaire to gather at least 56 responses. After, the second part of the survey will focus on gathering information about the preferences. Entire questionnaire can be found in the Appendices.

5.3 Performance Measurement Experiment

As mentioned earlier, a performance measurement will be conducted to evaluate the effectiveness of the research. In addition to the baseline scenario determined through a discrete choice analysis, it is crucial to quantitatively assess the findings of the reference projects based on the predetermined attributes. Furthermore, by understanding the relative importance of these attributes, it will be possible to calculate points per co-living project at the results section, providing a comprehensive evaluation. However, first, it is essential to outline the attributes that are present within the reference project. Table below provides an overview of these attributes where 1 means level is present and 0 means it is not.

Attribute	Level	OurDomain	Little Manahttan	High Note	Liv	Lux	The Social Hub	The Fizz
Accessibility/Location	Distance to city centre ≥ 1.5km	0	1	0	0	1	0	1
	500m ≤ Distance to city centre ≤ 1.5km	0	0	1	1	0	0	0
	Distance to city centre ≤ 500m	1	0	0	0	0	1	0
Private Living Area	Area≤ 25m2	1	0	0	1	1	1	1
	25m2≤ Area ≤ 40m2	1	1	0	1	1	0	1
	Area≥ 40m2	0	1	1	0	1	0	0
Sharable living space	None	1	1	1	1	1	1	1
	Only Kitchen	0	0	0	0	0	1	1
	Kitchen & Bathroom	0	0	0	0	1	0	0
Community Space	No space	0	0	0	0	0	0	0
	One communal space	0	1	1	0	1	0	0
	More space	1	0	0	1	0	1	1
Outdoor Facilities	No facilities	0	0	0	0	0	0	0
	One outdoor facility	1	0	1	0	0	0	1
	More outdoor facilities	0	1	0	1	1	0	0
Sport Facilities	No facilities	0	0	0	0	0	0	0
	One sport facility	1	1	0	0	0	1	1
	More sport facilities	0	0	0	1	0	0	0
Leisure Facilities	No facilities	0	0	0	0	0	0	0
	One leisure facility	0	0	1	0	1	0	0
	More leisure facilities	1	1	0	1	0	1	1
Commercial Services	No services	0	0	0	0	0	0	0
	One commercial service	0	0	0	0	0	1	1
	More commercial services	1	1	1	1	0	0	0
Price	Price≥ €850	1	1	1	1	1	1	1
	€500≤ Price ≤ €850	1	1	0	1	1	1	1
	Price ≤ €500	0	0	0	0	1	0	1

Figure 24. Reference Projects Present Attributes

6. Results

This chapter aims to present and analyse the key findings of the previously described experiment. Goal of the data collection is to identify the most preferred co-living building attributes to further understand user preferences.

Data Collection

Data was collected through a questionnaire that was distributed among the target group in The Netherlands. An online survey tool, Qualtrics platform, was used to gather the responses over the course of 30 days. The questionnaire was promoted through various communication platforms and to people all over The Netherlands with the support of colleagues and friends. As a result, participation rate could reach the levels needed to conduct a statistical analysis.

In total, 172 people opened the survey and 119 filled it in. However, due to the definition of the target group (young adults), some of the responses turned out to not be suitable for later research as the age of the respondents was above the threshold of 25 years. Consequently, this has resulted in 88 full responses that fit into the target group and ultimately can be taken into account when conducting the analysis. As previously established in the methodology section, the goal was to gather at least 56 responses, therefore one can say that the desired amount has been gathered and the total number of responses is satisfactory. Subsequently, discrete choice experiments can be conducted.

Descriptive Statistics

The first section of the questionnaire (can be found in the Appendices) featured a series of background questions designed to provide extra context to the survey participants' responses. Age, gender, education level, occupation, place of residence, and income were among the general subjects covered in these inquiries. Such questions allow one to gain a more complete picture of the sample characteristics and determine the extent to which the survey results were representative of the entire population by gathering this information. This step also helps to evaluate the reliability and validity of the latter findings.

Next, distribution of responses was compared to the demographic questions with relevant data from CBS (Central Bureau of Statistics), which gives information on the distribution of the total Dutch population, to check the representativeness of the survey results. This enables performance of a Chi-Square test to see if there were any significant differences between the survey sample and the overall population.

Table 7. Overall Questions

		Questionnare Respondents	Young Adults in The Netherlands (CBS, 2022)
Gender	Male	51%	51%
	Female	49%	49%
Age	18	0%	12%
	19	6%	13%
	20	3%	13%
	21	16%	13%
	22	23%	13%
	23	22%	13%
	24	23%	12%
	25	8%	12%
Income	less than €19.999	36%	44%
	between €20.000 - €24.999	10%	15%
	between €25.000 - €29.999	20%	6%
	between €30.000 - €34.999	10%	8%
	between €35.000 - €39.999	5%	6%
	more than €40.000	9%	21%
	Prefer not to say	9%	//
Education	HBO/WO	92%	29%
	HAVO/VWO/MBO	2%	31%
	PhD	6%	0.60%
Occupation	Employed	55%	74%
	Student	43%	22%
	Unemployed or other	2%	4%

Subsequently, Table 7 represents distributions among the questionnaire respondents and also informs about the distributions in the general Dutch population. Looking at the gender category, one can see that there is almost an equal number of responses from men and women (51% vs. 49% respectively), making it a well balanced study proving that the survey was conducted in an inclusive and equitable manner. Next, comparing the distributions with the CBS data using Chi-Square test (full results can be found in the Appendices), results suggest that the findings may be applicable to the Dutch population since the survey sample is not significantly different.

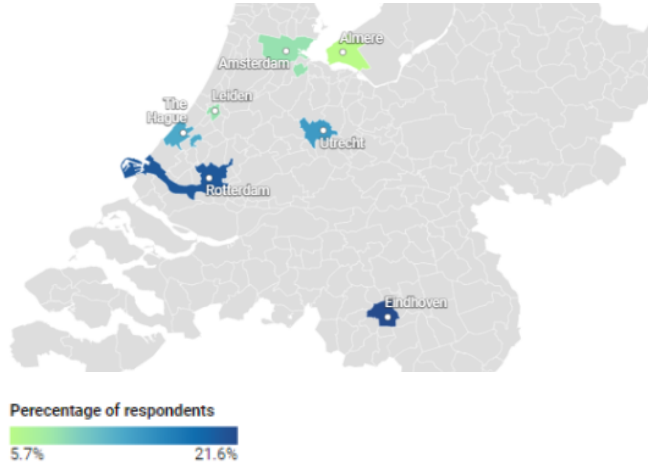
Following, one can notice that in the age category the survey did not only gather information about the 18 year olds, whereas the majority of answers came from individuals between the ages of 22 and 24. When compared to the data from CBS. it becomes clear that the survey does not represent the Dutch population well, in which age groups are spread more evenly. The uneven age distribution of survey respondents could be due to several factors, such as greater interest or motivation among older young adults, or a survey distribution strategy. Additionally, it's possible that the age bias reflects the demographics of the population with whom me and my colleagues interact regularly.

When considering the income category, both the survey and CBS data show that the majority of people earn less than €19 999. However, there are some significant disparities between the survey results and the general population data. In particular, the second greatest income group among survey respondents is €25 000 to €29 999, although this group earns more than €40 000 in the general population. It is worth noting that the survey contained an option for respondents to indicate that they chose not to

reveal their salary, whereas CBS does not. This could explain some of the observed discrepancies in income distribution reported between survey and general population data. Despite these differences, statistical analysis shows that the income distributions are not statistically significant, implying that the survey sample is broadly representative of the Dutch population.

In the education category, it becomes clear that the majority of survey respondents had a higher education level, which is not indicative of the broader Dutch population, which has a lower percentage of higher education holders. It is crucial to note that the survey sample's age distribution may have influenced these results, as the questionnaire did not equally cover all young adult age groups, whereas CBS provides more extensive data. As a result, the survey's distribution of education levels may not fully reflect the broader Dutch population, and comparisons should be made with caution.

Finally, the occupation category provides useful information about the survey results. The distribution of occupations differs significantly between the survey sample and the general Dutch population, as it does for schooling. According to the survey, fewer respondents are employed and more are still studying, although the broader population has a higher share of employed individuals. This gap could be influenced by the survey sample's age distribution, as younger respondents are more likely to be studying rather than working. However, it is worth noting that the survey has a similar number of respondents from both employed and student categories, which is beneficial for the research as co-living buildings aim to host both groups. This indicates that the survey responses are unlikely to be biased towards one group or the other, allowing for a more balanced analysis of the data.



City		
	Almere	5.70%
	Amsterdam	9.10%
	Eindhoven	21.60%
	Leiden	9.10%
	Rotterdam	20.50%
	The Hague	13.60%
	Utrecht	14.80%
	Other	5.70%

Figure 25. Overall Respondents Distribution

In terms of city distribution, the survey results suggest a concentration of respondents in Rotterdam and Eindhoven, which is in line with expectations. Places such as Utrecht, Leiden, and Amsterdam also have a significant number of responses, whereas other cities such as Almere have a lower percentage of participation. These statistics indicate that respondents are predominantly concentrated in larger, more international locations, which corresponds to the target demographic of many co-living developers.

When looking at the sample's descriptive statistics, it's crucial to remember that while certain distributions are corresponding with the overall Dutch population, others indicate potential biases that could influence the DCE study results. Nonetheless, the data appears to be valid and reliable in general, indicating that the respondents are largely representative of the target population for co-living companies. However, it is also worthwhile to examine potential enhancements for future research. Alternative sampling procedures should be investigated to boost the sample's representativeness, particularly among younger age groups. Furthermore, additional research could be undertaken to better understand the potential biases presented by particular categories, such as occupation and education levels.

Data Preparation and Analysis

Subsequently, the multinomial logistic regression (MNL) model in SPSS Statistics was used to analyse the data. Such a model allows individuals to elicit preferences for different attributes and/or levels of a co-living building. It assumes that the choice probabilities are proportional to the exponentiated utility of each alternative, where the utility is a function of the attributes and their levels (Hensher et al., 2005). Thus, it is feasible to determine the relative relevance of each characteristic by carefully evaluating the coefficients of each attribute level.

However, gathered data cannot be directly imported to SPSS to make the use of multinomial logistic regression models, but needs to be carefully prepared. The most common approach revolves around the creation of dummy variables for categorical attributes as a way of including them in the regression (Jansen et al., 2011). Another possibility is to use effect coding, yet no real advantage of that has been found by the scholars (Hu et al., 2018) and dummy encoding is a more common approach with more insightful explanations (Jansen et al., 2011). Therefore, dummy encoding was used for the purpose of this research (Table 8).

Table 8. Dummy Encoding Example

	Dummy Encoding		
Level	**β1**	**β2**	**β3**
1	1	0	0
2	0	1	0
3	0	0	1
4	0	0	0

Next, data can be imported into the SPSS and a multinomial logistic regression model can be run. Then, the consequent step is to analyse whether the estimated model is good enough for further analyses and if goodness of fit check yields positive results, analysis shall be continued. Coefficients will be examined to determine the strength of the effect and the direction of it. Positive coefficients indicate that a certain

attribute is more likely to be chosen, whereas negative ones mean that the probability of that attribute to be chosen is lower.

Consequently, estimated coefficients will be used to estimate a so-called part-worth utility values for each attribute. This will help evaluate which of the attributes is most and least preferred. Part-worth utilities are used to establish desirability levels of each attribute. The higher the part-worth utility, the higher user preference for that attribute. Comparing part-worth utilities allows us to assess the relative importance of each attribute level. Additionally, this information can be used to calculate total utility of the previously generated choice sets from the questionnaire and establish which housing option is the preferred one. Apart from analysing that, willingness-to-pay (WTP) can be indicated to check the maximum price a customer is willing to pay for a product or service.

Experiment Results

The data gathered through the second part of the questionnaire have been imported in SPSS. As previously mentioned, dummy encoding was used to create MNL. The coefficients measure the impact of different attributes on the utility as the MNL model assumes that people choose the option with the maximum utility. Inclusion of the "no preference" option is thought to make the choice decision more realistic. Consequently, as one of the first steps it is important to evaluate the estimated MNL model goodness of fit (R-Square). If the value of R-Square falls between 0.2 and 0.4, they are considered highly satisfactory, whereas if the value falls below 0.1, they are considered weak. Therefore, looking at all of the Pseudo R-Square tests yielded by SPSS during the MNL analysis, one can say that the model is satisfactory and the goodness of fit is high.

Table 9. Pseudo R-Square

	Pseudo R-Square
Cox and Snell	0.218
Nagelkerke	0.322
McFadden	0.218

Now, it is important to take a look at the coefficients (B0). As previously mentioned, if an attribute has a positive coefficient, it implies that the survey participants are more likely to prefer the attribute, whereas if it is negative, one can assume that the survey participants are less likely to prefer it. It is also important to evaluate significance levels. Looking at the table below 'Distance to city centre > 1.5km' and all of the attributes related to Commercial Services are found insignificant with the model using 95% confidence interval (p-value is above the 0.05 significance threshold). Consequently, it can be assumed that these attributes do not affect decision-making when choosing a preferred housing option by a participant and therefore shall be excluded from the further analysis.

Table 10. Attribute Utilities And Their Significances

Attribute	Level	B0	Significance
Accessibility/Location	Distance to city centre ≥ 1.5km	-0.062	0.496
	500m ≤ Distance to city centre ≤ 1.5km	0.318	0.004
	Distance to city centre ≤ 500m	0.063	0.001
Private Living Area	Area≤ 25m2	-0.16	0.0176
	25m2≤ Area ≤ 40m2	0.376	0.001
	Area≥ 40m2	0.144	0.036
Sharable living space	None	0.711	0.001
	Only Kitchen	0.676	0.001
	Kitchen & Bathroom	0.692	0.001
Community Space	No space	-0.714	0.001
	One communal space	-0.343	0.002
	More space	0.55	0.001
Outdoor Facilities	No facilities	-0.472	0.001
	One outdoor facility	-0.132	0.024
	More outdoor facilities	0.311	0.001
Sport Facilities	No facilities	0.046	0.0494
	One sport facility	0.435	0.001
	More sport facilities	0.218	0.025
Leisure Facilities	No facilities	-0.306	0.008
	One leisure facility	-0.355	0.002
	More leisure facilities	0.368	0.001
Commercial Services	No services	-0.084	0.46
	One commercial service	-0.203	0.076
	More commercial services	0.117	0.227
Price	Price≥ €850	-0.769	0.001
	€500≤ Price ≤ €850	-0.149	0.0177
	Price ≤ €500	0.478	0.001

Accessibility/Location

It can be seen that overall locations closer to the city centres are preferred. Interestingly, young adults preferred the '*500m ≤ Distance to city centre ≤ 1.5km*' option. This might stem from the fact that relatively to other attributes they would prefer to 'sacrifice' absolutely central location over other desired attributes.

Private Living Area

Areas below 25m^2 are negatively perceived by young adults, whereas a living area of 25m^2 to 40m^2 is the most preferred option. Larger than 40m^2 units are still positively desired by them, however there is no significant preference for such big areas.

Sharable Living Space

According to these results, young adults prefer to not share anything with others. Utility of this attribute is also the highest among the others. Interestingly, young adults still positively perceive sharing the kitchen or kitchen & bathroom, indicating that these options should not be omitted at the later stages of analysis.

Community space

The results clearly show that the target group strongly prefers having more communal spaces than one or no space at all. The two least preferred options are also classified among the attributes with most negative utility scores across the board.

Outdoor Facilities

Results of the importance of outdoor facilities suggests that access to outdoor spaces and recreational activities is a significant factor for younger adults when choosing a place to live.

Sport Facilities

One sport facility is the most preferred option by the target group. There is no significant preference for having no sports facilities or more of them. However, all of the attributes regarding sport facilities have positive utilities.

Leisure Facilities

Having more leisure facilities such as cinema rooms, etc. are most preferred, whereas other options are least preferred and even have negative utilities.

Price

When it comes to the prices, lower prices are strongly preferred with the highest preference of prices less than or equal to €500. Interestingly, attributes of price above €850 have the highest negative utility among other attributes.

Having analysed utility scores of the introduced attributes, data from the discrete choice analysis indicates that location and accessibility are important criteria for young adults, with a high preference for living near city centres. This is most likely due to a desire to be close to the vibrant metropolitan as well as the convenience of having easy access to public transportation and facilities. Another significant conclusion is that younger adults appreciate their personal living space and choose a living area of 25-40m^2. This suggests that, while shared living options may appeal to some, many young adults still value their own personal space. It is worth noting that larger living areas are not always preferred, as having a room that is too large may not be feasible or affordable for many people in this age range (18-25). Next, in terms of shared living areas, the findings indicate that younger adults prefer not to share anything with others, but are willing to share the kitchen or kitchen and bathroom. This suggests that, while communal living arrangements may not be appealing to many young people, they may be willing to share some aspects of their living space, particularly those that are more practical or required for everyday life. Consequently, the results also emphasise the importance of social and outdoor areas for younger adults, with a significant preference for additional options. This implies that socialisation and outdoor activities are vital parts of their way of life. Furthermore, having only one sport facility is the preferable alternative, demonstrating that access to exercise and fitness activities is important.

Finally, the study results show that younger adults prefer cheaper prices, with a preference for prices less than or equal to €500. This shows that affordability is important for this demographic, owing to the high cost of living and low discretionary money that many young adults confront. Interestingly, among other features, prices above €850 have the biggest negative utility, indicating that high prices may be a key disincentive for this group.

Relative Importance

Consequently, after having analysed part-worth utilities of each attribute, it is possible to derive another interesting metric for the discrete choice analysis, called relative importance. Policymakers, developers, and operators may build co-living spaces that fulfil the needs and expectations of young adults by knowing which features are most essential to consumers. It enables to determine which features have the biggest influence on user preferences and can assist us in better understanding the primary decision-making drivers. Figure 26 below represents the relative importance of the attributes in this discrete choice experiment. According to the findings of the co-living investigation, communal space is the most essential quality, with a relative relevance of 24%. This research implies that access to shared spaces such as conference rooms, living rooms, or other public places is highly valued by young adults. This is most likely due to the fact that these places allow for socialisation and collaboration, both of which are crucial parts of the co-living experience.

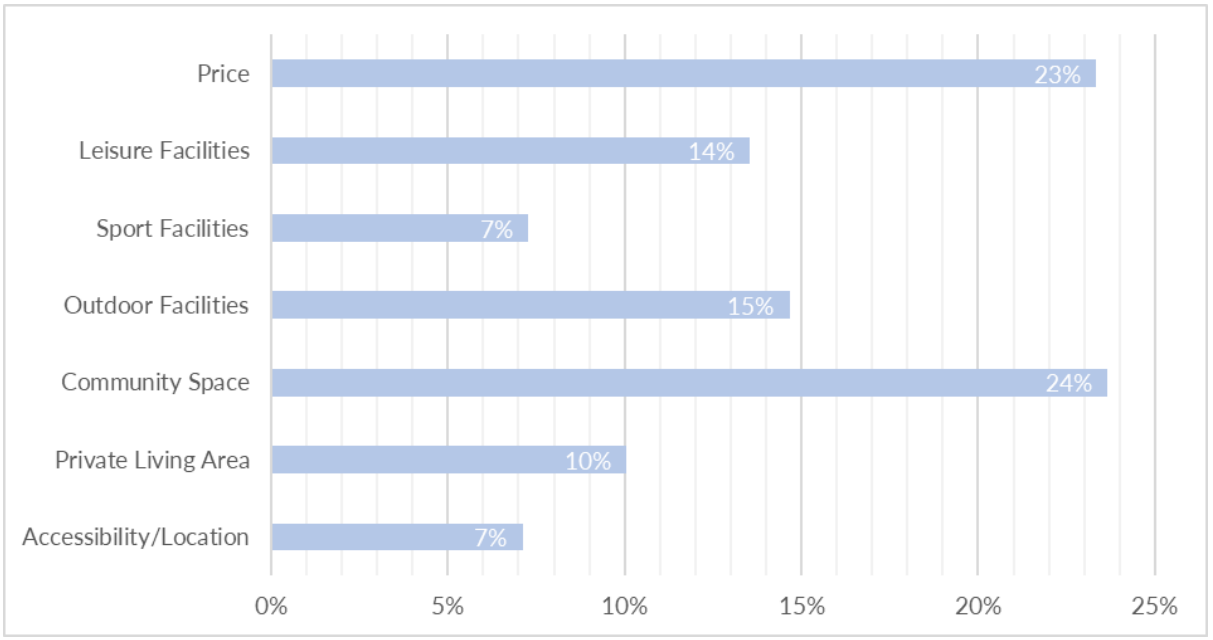


Figure 26. Relative Importance

With a relative value of 23%, price is also an important element in deciding user preferences. This finding is in line with earlier research on the significance of affordability in the housing market. Price is especially relevant in the case of co-living because the target market is frequently young individuals with low financial resources.

Outdoor space and leisure facilities, in addition to communal space and affordability, are important features that impact user preferences. These features have relative relevance scores of 15% and 14% respectively, indicating that access to outdoor areas and amenities such as a gym or pool are important to young adults. These facilities can offer chances for physical activities and relaxation, both of which are critical for preserving mental and physical health.

Although it has a lower relative relevance score of 10%, living area is still a significant characteristic. This shows that communal rooms and amenities are more appealing to young adults than having a huge private living area. However, many people consider having adequate space to live comfortably while choosing a co-living place. Interestingly, shared living spaces (shared bathroom & kitchen vs. shared kitchen vs. none) in the apartment scored less than 0.5% in the relative importance analysis and therefore was omitted in it, since it showed that users do not have a strong preference for any of the offered forms for that attribute, and all utilities are the same. This means that when making a decision, people do not consider shared apartment space to be a significant concern. Lastly, both location and sports facilities have the lowest relative significance scores of 7%. This conclusion implies that young adults are more concerned with other factors such as communal space and affordability than they are with the location of their co-living space or availability to sports facilities.

Willingness-to-pay (WTP)

Consequently, it is interesting to understand the willingness-to-pay for the preferred co-living attributes. A least favourite price category (price>850€) was utilised as a reference point to judge willingness to pay. This offers a solid foundation for a realistic understanding of how young adults prioritise various features in co-living structures. To avoid unfavourable influences on the outcomes of other qualities, shared living areas were eliminated from the willingness-to-pay analysis.

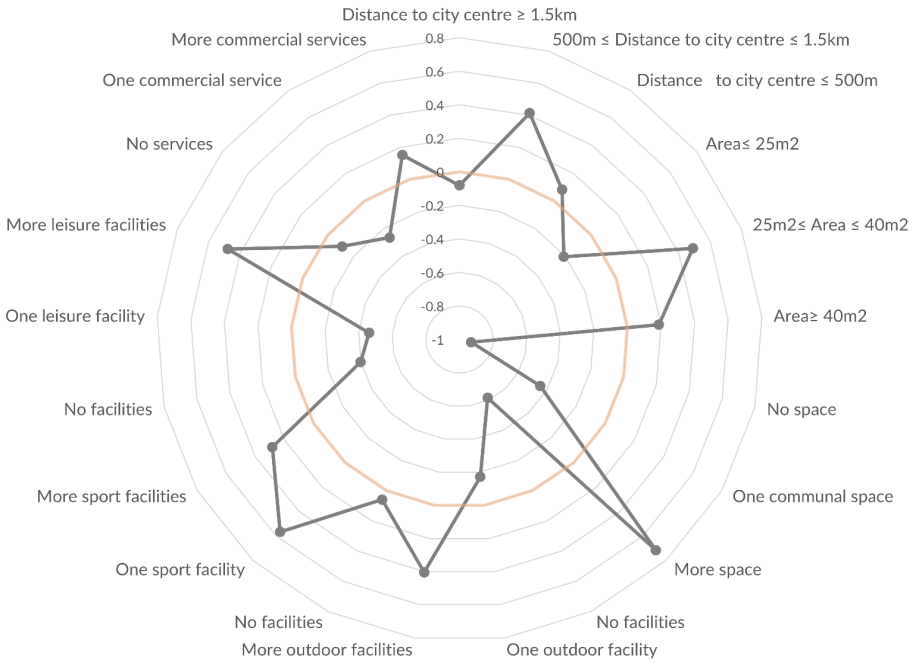


Figure 27 - Willingness to pay per Attribute

As shown in Figure 27 above, qualities outside the orange circle at 0 are those for which consumers are ready to pay, whilst those inside the circle are those for which users may want some sort of remittance. According to these findings, young individuals are prepared to spend the most for social spaces, sport and leisure amenities, and dwelling areas ranging from 25m2 to 40m2. This suggests that these services and characteristics are highly desired and may be required for co-living spaces aimed at this demographic.

Young individuals are also prepared to pay extra for outside facilities, implying that developers should consider including outdoor spaces where inhabitants can get some fresh air and exercise. Surprisingly, proximity to the city centre or commercial services had no effect on young adults' willingness to pay. This could imply that young adults are willing to live further away from city centres if they can access amenities via public transit or ridesharing services.

Young adults, on the other hand, are willing to pay the least for larger living rooms (those larger than $40m^2$) and may seek compensation or a lower price if a home lacks community facilities. This suggests that developers and operators of co-living spaces should prioritise communal spaces over larger living quarters in order to appeal to the tastes and willingness to pay of young adults. Attributes with low WTP values, such as large areas and lack of facilities, should be compensated for or offered at a reduced price.

In conclusion, understanding young adults' willingness to pay for co-living amenities and features can provide valuable insights into their preferences. Developers, regulators and operators in the field of co-living spaces may want to prioritise communal spaces, smaller living areas, and outdoor facilities while considering the importance of transportation access and compensation for larger living areas and lack of communal facilities.

Total Utilities of Choice Sets

Following, the results of the discrete choice experiment provide useful insights into respondents' preferences for various co-living space features. With each respondent given 27 options, the total usefulness of these options may now be calculated. It is worth noting that only seven choice sets had a negative total utility, showing that the majority of the choice sets were well welcomed by the respondents.

Looking at the table provided below, the top three choice sets in the table all have a few features in common. To begin with, they are all priced at €500 or less, demonstrating that pricing is a crucial element in assessing the appeal of a co-living option for the respondents. Furthermore, each of the three top choice sets has at least one outdoor facility, with two of them featuring several sport and leisure facilities. This shows that having access to outdoor amenities and activities is important to young adults. In terms of geography, two of the top choice sets are 500m or less from the city centre, while the third is 1.5km or more distant. This suggests that, while proximity to the city centre is crucial, it is not always a

deal breaker for respondents. Interestingly, the size of the living space does not appear to be as crucial as other amenities.

Table 11. Total Utility of the Choice Sets

Choice Set		Tot Utility	Rank				
Choice Set 1 (Q1) profile 2		**2.533**	**1**				
500m ≤ Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	More space	One outdoor facility	One sport facility	More leisure facilities	Price ≤ €500
Choice Set 3 (Q3) profile 2		**2.146**	**2**				
Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	One communal space	More outdoor facilities	More sport facilities	More leisure facilities	Price ≤ €500
Choice Set 9 (Q9) profile 2		**2.05**	**3**				
Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	More space	One outdoor facility	One sport facility	No facilities	Price ≤ €500
...		...	...	...	...	...	...
Choice Set 2 (Q2) profile 3		**-0.613**	**26**				
Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	No space	One outdoor facility	More sport facilities	No facilities	€500 ≤ Price ≤ €850
Choice Set 8 (Q8) profile 3		**-0.746**	**25**				
Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	One communal space	One outdoor facility	No facilities	No facilities	Price ≥ €850
Choice Set 7 (Q7) profile 1		**-0.94**	**27**				
Distance to city centre ≤ 500m	Area ≤ 25m2	None	One communal space	One outdoor facility	No facilities	One leisure facility	Price ≥ €850

The most popular sets have living rooms of 25m^2 or more, with one even offering the option of having extra space. This implies that, while respondents prioritise enough living space, other criteria such as outside facilities and price range may take precedence.

The worst choice sets, on the other hand, include characteristics such as a greater area size, no social spaces or leisure facilities, and a higher price range. Respondents were especially put off by option sets larger than 40m^2 with no community rooms or leisure facilities. These findings imply that young adults value the availability of communal spaces and desirable amenities over a bigger living space.

Comparison with the Reference Projects

Lastly, in the first part of this study, reference projects throughout The Netherlands have been introduced. These real case scenarios are now going to be used for a performance measurement to find, whereas at all and/or which of these co-living apartment buildings answer to the user preferences.

In order to do so, previously derived utility levels have been translated into a score system (0 - least preferred attribute, 0.5 - semi preferred attribute, 1 - most preferred attribute) and each category was subsequently assigned these scores as presented in the figure below. The base case scenario serves as a benchmark for comparison, representing the most preferred options for each attribute. This method allows for a consistent and standardised evaluation of all co-living apartment complexes in the study, making it easy to compare and evaluate them based on their performance. By comparing each building to the base case scenario, the study can identify which buildings are meeting user preferences and which ones require improvements.

Attribute	Level	Score	Base Case	OurDomain	Little Manahttan	High Note	Liv	Lux	The Social Hub	The Fizz
Accessibility/Locati	Distance to city centre ≥ 1.5km	0	0	0	0	0	0	0	0	0
on	500m ≤ Distance to city centre ≤ 1.5km	1	1	0	0	1	1	0	0	0
	Distance to city centre ≤ 500m	0.5	0	0.5	0	0	0	0	0.5	0
Private Living Area	Area≤ 25m2	0	0	0	0	0	0	0	0	0
	25m2≤ Area ≤ 40m2	1	1	1	1	0	1	1	0	1
	Area≥ 40m2	0.5	0	0	0.5	0.5	0	0.5	0	0
Sharable living	None	1	1	1	1	1	1	1	1	1
	Only Kitchen	0	0	0	0	0	0	0	0	0
	Kitchen & Bathroom	0.5	0	0	0	0	0	0.5	0	0
Community Space	No space	0	0	0	0	0	0	0	0	0
	One communal space	0.5	0	0	0.5	0.5	0	0.5	0	0
	More space	1	1	1	0	0	1	0	1	1
Outdoor Facilities	No facilities	0	0	0	0	0	0	0	0	0
	One outdoor facility	0.5	0	0.5	0	0.5	0	0	0	0.5
	More outdoor facilities	1	1	0	1	0	1	1	0	0
Sport Facilities	No facilities	0	0	0	0	0	0	0	0	0
	One sport facility	1	1	1	1	0	0	0	1	1
	More sport facilities	0.5	0	0	0	0	0.5	0	0	0
Leisure Facilities	No facilities	0.5	0	0	0	0	0	0	0	0
	One leisure facility	0	0	0	0	0	0	0	0	0
	More leisure facilities	1	1	1	1	0	1	0	1	1
Commercial	No services	0.5	0	0	0	0	0	0	0	0
	One commercial service	0	0	0	0	0	0	0	0	0
	More commercial services	1	1	1	1	1	1	0	0	0
Price	Price≥ €850	0	0	0	0	0	0	0	0	0
	€500≤ Price ≤ €850	1	1	1	1	0	1	1	1	1
	Price ≤ €500	0.5	0	0	0	0	0	0.5	0	0.5
Sum			**9**	**8**	**8**	**4.5**	**8.5**	**6**	**5.5**	**7**

Figure 28. Points Per Reference Project

Looking at the Figure 29 presented below the benchmark of the base case scenario is set at the maximum of 9 points. Liv, located in Leiden, scored the second-highest with 8.5 points, followed by Little Manhattan in Amsterdam and OurDomain Rotterdam, both scoring 8 points. The lowest score was awarded to High Note, located in Alemere, with a score of 4.5 points.

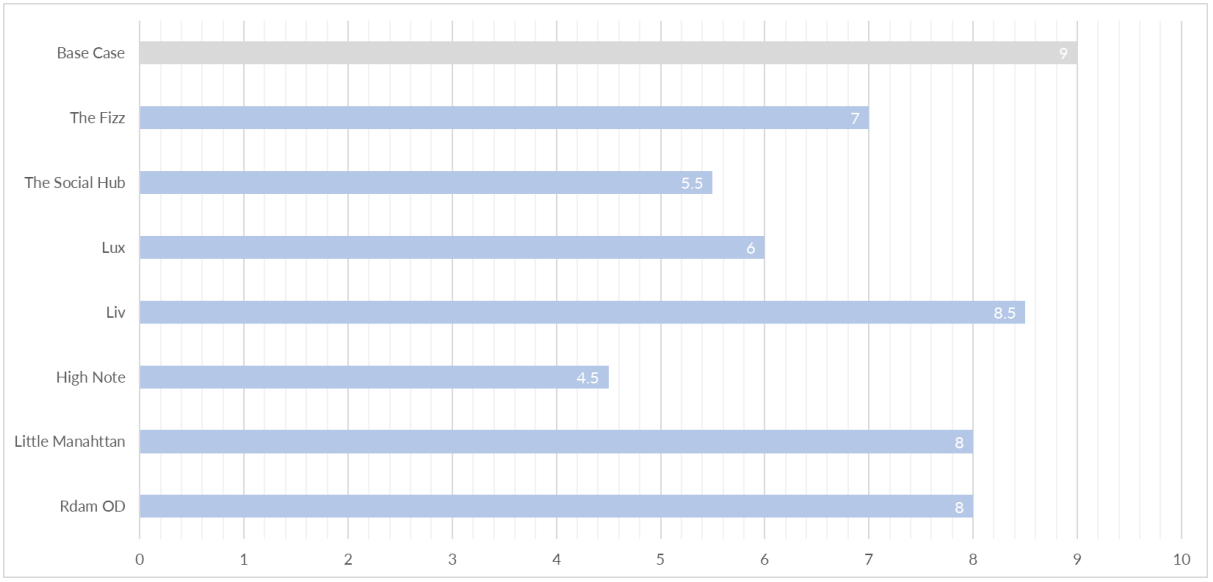


Figure 29. Comparison With The Reference Projects

Subsequently, it is important to dive deeper into the comparison and understand which of the attributes preferred by the users are present in these co-living developments. In the Figure 30 below, the first row represents the most preferred level in each attribute. Next rows show which co-living housing developments have these preferred attributes across the developments compared to the base case

scenario. This allows for a detailed analysis of what types of amenities are missed by the developers and in which areas it makes the most sense to improve.

Figure 30. Comparison with the Reference Projects

Many developments, for example, still lack outside facilities, which respondents strongly liked. The lack of outdoor facilities can have a significant impact on renters' living experiences, particularly in highly crowded urban regions. To meet the needs of their target demographic, developers can consider including outdoor amenities in their co-living complexes. The category of distance/accessibility should also be carefully considered. While the intended location was between 500m and 1.5km from the city centre, some of the reference projects are located less than 500m from the city centre and so do not compare well to the base case scenario. However, this does not necessarily imply that being closer to the city centre is a negative characteristic, as certain tenants who value access to urban facilities may prefer it. As a result, developers should consider the different interests of their target audience when deciding where to locate their co-living complexes. Another factor to consider is affordability, as just two of the reference designs offer housing alternatives for less than €500. Surprisingly, pricing and location match to some amount, implying that most of the reference projects are less than 500m from the city centre and hence cannot provide cheaper lodging. This gives potential for additional research to uncover cost-effective solutions to accommodate tenants' interests while keeping rent reasonable.

Nonetheless, the findings suggest that High Note in Almere has the fewest parallels to the base case scenario, whereas Liv in Leiden has the greatest. This suggests that High Note's developers should consider making considerable enhancements to their co-living projects in order to appeal to the tastes of their target audience. Developers of Liv, on the other hand, can grow on their success by enhancing and adding features that are highly valued by their residents.

As a result, the study's findings indicate that there is a significant degree of match between the supply of co-living flats and the demands (preferences) of potential users. In terms of meeting user preferences,

Liv in Leiden looks to be the most successful, with a high level (94%) of overlap with the base case scenario. High Note in Almere, on the other hand, appears to be the least successful, with only a 50% overlap with the base case scenario. These findings imply that there is still potential for development in certain co-living programs in terms of achieving user expectations.

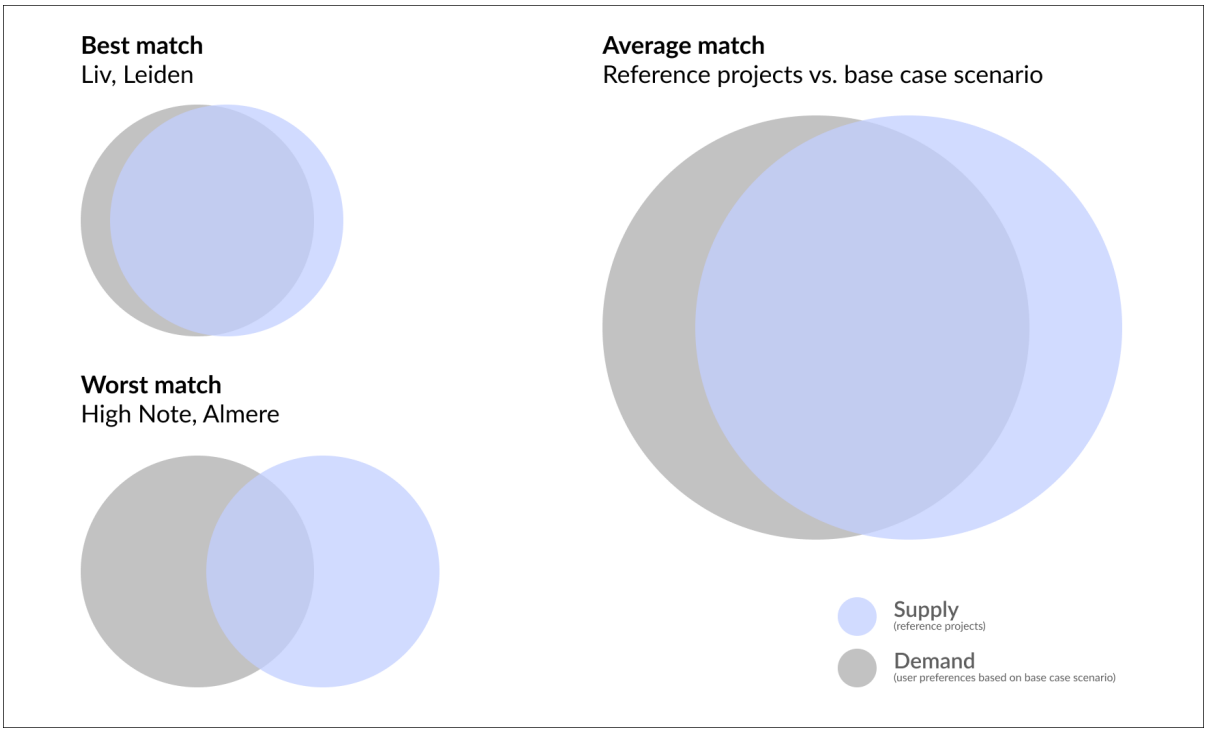


Figure 31. Comparison with the Reference Projects

It is worth noting, however, that the reference projects, on average, overlap with the base case scenario by over 75%. This suggests that co-living apartment developers are fulfilling user preferences and delivering amenities and services that are relevant to potential residents in a variety of ways. While there is obviously space for improvement in some areas, the Dutch co-living apartment market looks to be pretty well-aligned with user preferences.

While previous comparisons provided insights into how the projects compare against best-case scenarios, it is important to recognize that aiming for the best case isn't always feasible due to various factors such as building location and regulations. Therefore, it is essential to conduct additional analysis of the total utilities of the reference projects. In the figure below, one can observe the total utility scores per reference project, including and excluding pricing. It is crucial to consider both a realistic perspective, where monetary constraints are taken into account, and pure user preferences, where the price attribute is excluded due to its negative impact on utility scores.

When comparing the total utility including the price attribute, The Fizz in Utrecht performs the best, with Liv in Leiden coming in second. Interestingly, High Note in Almere scores a negative utility score,

indicating that existing amenities do not outweigh the price paid for them. Overall, the reference projects scored substantially below the base case when considering the price attribute.

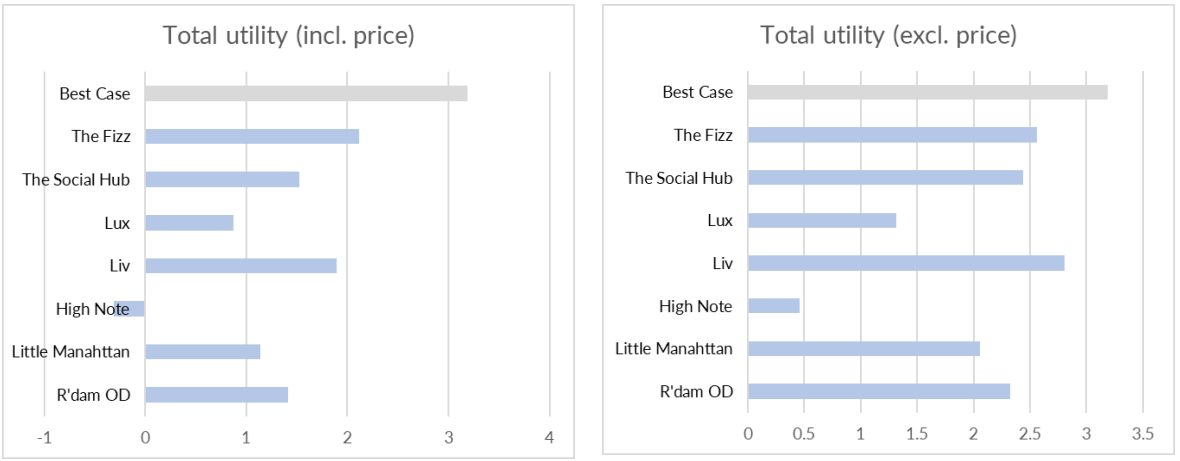


Figure 32 - Comparison with the Reference Projects

Next, looking at the total utility of co-living projects excluding the price, it can be seen that without monetary constraints, more projects score high utility scores. The Liv in Leiden emerges as the most preferred option by users, followed closely by The Fizz in Utrecht, The Social Hub in Eindhoven, and OurDomain in Rotterdam. Once again, High Note in Almere and Lux in Eindhoven scored the lowest.

Overall, the results suggest that while some reference projects align closely with user preferences, there is still room for improvement in terms of amenities and pricing in co-living developments.

7. Discussion

Based on the previously conducted literature review, market research and discrete choice experiment it is now possible to develop a comprehensive understanding of the extent to which commercial co-living matches user preferences of young adults in The Netherlands. In this chapter, further findings and implications of the analysis will be explored.

The conducted questionnaire managed to reach a wide and varied audience, thereby providing valuable insights into the co-living preferences of young adults. The survey received a significant number of responses, indicating a high level of interest in the topic among the target demographic. As previously highlighted in the literature study, this reflects the fact that many highly educated young professionals and students are entering the housing market (Nandan et al., 2019; Rabobank, 2019) and are keen to share their experiences and opinions on what they seek in a living space.

Consequently, discrete choice experiments have clearly provided valuable insights into user preferences that can be used to increase knowledge on existing and future building supply through the eyes of the end users. It also allowed me to answer research questions:
Which commercial co-living attributes are preferred by the young adults?

After conducting this study, it became apparent that this research question should be reformulated to focus on the extent to which co-living attributes are preferred by young adults. Nevertheless, as previously discussed by many researchers, communal spaces such as lounges, working spaces, and other utility areas have consistently been among the most preferred attributes in co-living buildings for young adults (Osborne, 2018; McAlone, 2016). The importance of these shared spaces is further supported by the results of the discrete choice analysis, where communal spaces ranked the highest in the relative importance index compared to other facilities. This finding emphasises the significance of communal areas in co-living buildings as young adults value social interaction and collaboration in their living spaces (Marcus & Copper, 2000). Consequently, it the fact that shared amenities are top priorities of young adults shouldn't surprise anyone (Clapham et al., 2010)

Moreover, outdoor areas, which have been relatively neglected in previous research, were found to be highly valued by the sample group, indicating that this could be an interesting point for future reference. However, from an economical perspective, it may not always be financially sustainable for developers to sacrifice room space for outdoor areas. Nevertheless, the reference projects, such as centrally located OurDomain in Rotterdam, demonstrates that it is possible to utilise areas such as rooftops to incorporate outdoor spaces and meet user preferences. This could also increase the value of the developments in the eyes of end-users, as the willingness-to-pay (WTP) analysis showed that users are willing to pay more for such attributes. In light of these findings, it would be worthwhile for developers to explore innovative ways to incorporate outdoor areas into co-living buildings while maintaining financial feasibility. This could potentially increase the appeal of these developments to young adults' preferences and contribute to their overall satisfaction in choosing to live in such places.

Interestingly, leisure facilities, such as music or gaming rooms, were found to be highly preferred attributes in co-living buildings by the study participants. Although these facilities may add monetary value to the building, it may not be the best idea to prioritise them since affordable quality accommodation has been a pressing issue for many years (European Commission, 2018). Therefore, it may be beneficial for regulatory bodies to implement rules to prevent developers from artificially inflating prices by adding such features without providing affordable options. Moreover, the study revealed a strong preference towards low prices and a dislike for high prices, which emphasises the need to provide affordable housing options. However, it is important to note that these are only initial thoughts and further research is required to examine the feasibility of implementing such regulations and to explore the potential impacts of such policies on the housing market.

Next, study participants did not express a strong preference for private kitchens or bathrooms. This is noteworthy, as most reference projects featured private bathrooms and kitchens. It is possible that the preferences of the sample group in the study differ from those of other populations or demographic segments. However, it may also indicate a gap in the market that developers could address by placing less emphasis on private living areas and focusing more on developing better communal spaces. This approach would align with the general idea behind co-living, which emphasises the importance of shared spaces and community living (Beck, 2019). Moreover, the fact that young adults demonstrate a willingness to share facilities like kitchens and bathrooms with their fellow housemates at this stage of their lives, aligns with the notion presented by Görög (2018) that seeking solutions within the sharing economy can lead to sustainable outcomes for global challenges. In exploring various possibilities for creating both ecologically and financially sustainable housing, sharing spaces emerges as a promising idea to solve numerous housing problems. By reducing private living space, developers could provide more amenities for communal areas, thus appealing to the preferences of young adults who value community living and social interaction, but also provide more affordable units since cost per square metre should vastly reduce. However, further research is needed to confirm this hypothesis and determine the optimal balance between private and communal spaces in co-living developments.

When it comes to sport facilities, it is interesting to note that despite the popularity of fitness and wellness trends among young adults, only one sport facility was found to be most preferred by the users in the co-living buildings. This could be attributed to the fact that many young adults prefer to engage in sports activities outside of their living spaces, such as in local gyms or parks. However, it is worth noting that nearly all of the reference projects examined (OurDomain, Liv, The Social Hub, The Fizz, Little Manhattan) have a small sports unit as a means of encouraging residents to adopt a healthy and active lifestyle. Additionally, these projects often organise various social events (OurDomain, Liv, The Fizz) to promote the use of these facilities and foster a sense of well-being and social ties. Consequently, it is crucial to consider the role of these amenities in not only promoting physical fitness but also in facilitating social interactions and community building. Perhaps this emphasis on smaller sports facilities, rather than large gyms, is intended to create a starting point for individuals to embark on their personal fitness journeys while simultaneously providing a space for social engagement. Coming back to the user preferences, it may also be possible that many co-living residents prioritise communal spaces over sport facilities, and would rather have a larger space to socialise and interact with their fellow residents. It is also possible that users are aware of the higher costs associated with sports facilities, and therefore prioritise having access to one sport facility over having a wider range of options available.

Next, accessibility and location of the building had the smallest impact on user preferences for co-living spaces. However, the study did find that there was a stronger preference for living closer to the city centre, which is likely due to the fact that young adults tend to utilise city centres more frequently for social and professional purposes. Additionally, living closer to universities and other amenities was also important for the study participants, as they want to be able to easily access these resources.

Interestingly, Kauko (2006) noted that in certain countries, accessibility holds greater importance than housing qualities like spaciousness. However, the results of this analysis align with previous research findings (Mackie, 2016; Molin & Timmermans, 2003) by indicating that accessibility has a relatively weak influence on the housing preferences of young adults. These findings highlight the importance of considering the specific needs and preferences of young adults when developing co-living spaces, as they are the primary demographic for these types of housing options.

Subsequently, one can also answer another research sub-question, which is as follows:
What is the least preferred attribute that young adults have of commercial co-living?

As introduced in the paragraphs above, both sport facilities and location categories scored the lowest in the relative importance analysis. However, looking more in depth, it was found that the least preferred attribute that young adults have of commercial co-living is the lack of community space and high prices above €850, followed closely by a shortage of leisure facilities and small living areas below 25m^2. It is worth noting that sport facilities and location categories scored slightly higher in the analysis but still ranked among the least preferred attributes.

The findings are consistent with previous literature studies that show that young adults are looking for affordable, convenient, and accessible housing options (Mackie, 2016). The lack of community space and shortage of leisure facilities can negatively impact social interactions and the overall experience of co-living. On the other hand, high prices above €850 can create financial barriers and limit the accessibility of co-living to a wider audience.

Consequently, previously conducted analysis have also helped to answer the question:
What type of amenities are typically provided in commercial co-living housing designed for young adults in The Netherlands?

Based on the analysis of the reference projects, it is evident that developers in the Dutch co-living market are placing a strong emphasis on providing more communal space and leisure facilities to their residents. This trend aligns with the findings from previous studies that suggest that communal spaces are critical to the success of a co-living community. These spaces provide opportunities for socialising and building a sense of community among the residents. In addition, the amenities provided in these spaces, such as meeting rooms and working spaces, also serve practical purposes, which can enhance the residents' overall living experience.

From a developer's perspective, providing a wide range of amenities can be costly, and striking a balance between meeting the residents' needs and maximising profitability can be challenging. However, developers who prioritise providing high-quality amenities that align with the preferences of their target market are likely to reap the benefits of increased resident satisfaction and retention.

All of the previous answers lead to the main research question which aims to find out:
To what extent does commercial co-living match user preferences of young adults in The Netherlands?

Consequently, the previous analysis conducted in this study has led to answering the main research question, which is to determine whether the provided housing supply matches the preferences of young adults in commercial co-living. The definition of commercial co-living, as stated by many researchers, highlights the importance of on-site services, common facilities, and social ties (Uyttebrouck et al., 2020; Jarvis, 2017). It is interesting to note that this definition aligns with the user preferences derived from the discrete choice experiment. This finding suggests that the young adults in the Netherlands have a clear understanding of what commercial co-living entails and what they are looking for in this type of housing.

Further analysis revealed that some projects have a better match with user preferences than others. For instance, the Liv in Leiden project had a better match than the High Note Almere project. This finding raises questions about whether the developers had good research on user preferences that allowed them to match them or whether the supply shaped the demand over the time. This is an important aspect to consider for future research, as it could help in understanding the dynamics between supply and demand in the commercial co-living market. Furthermore, there is still much room for further research in this area, as the best scoring reference project, Liv in Leiden, is yet to be delivered this year and will be the newest project. This will be an interesting project to observe, as it can provide insights into the latest trends and developments in the commercial co-living market. Comparing this project with The Social Hub in Eindhoven, which is one of the oldest projects of this kind, clearly demonstrates the improvement over the years in understanding and fitting user preferences.

Next, looking at the attributes and their utilities, one finding emerges regarding the "sharable living spaces" attribute. The study reveals that individuals do not place a significant preference on whether they share a kitchen or bathroom with others. This discovery holds particular interest due to the fact that most co-living buildings in The Netherlands currently offer accommodations with private kitchens and bathrooms. By opting for a shareable kitchen, several advantages can be observed. Firstly, it aligns well with the fundamental principles of co-living and the desire for a sense of community. Sharing a kitchen fosters interaction and facilitates social connections among residents, enhancing the overall living experience (Kadet, 2017). This communal aspect can contribute to a more vibrant and inclusive environment. Additionally, the adoption of shareable living spaces has the potential to reduce unit costs. Private kitchens and bathrooms often require more space per unit, which increases construction and maintenance expenses. In contrast, incorporating shared facilities allows for more efficient use of available space and may lead to cost savings. Consequently, this cost reduction could translate into more affordable housing options for users, a crucial consideration given the growing demand for affordable living solutions. Moreover, embracing shareable living spaces enables developers to optimise the

utilisation of existing spaces. By reducing the footprint of individual units through shared kitchens and bathrooms, developers can accommodate more units within the same building or floor area. This optimization not only maximises the potential revenue for developers but also addresses the ever-increasing demand for housing in densely populated urban areas. Naturally, it is important to balance developers and tenants needs (Coricelli, 2022). While the study indicates that people are open to sharing these spaces, it is essential to consider certain factors to ensure a successful implementation. For instance, providing adequate storage and maintaining cleanliness and hygiene standards become crucial when communal spaces are involved (McAlone, 2016). Proper design and layout considerations can help mitigate potential issues and ensure residents' comfort and satisfaction (Bhatia & Steinmuller, 2018).

In addition to the questions raised about whether the supply of co-living units shaped the demand or vice versa, there are other factors that may have influenced the match between user preferences and building supply. One factor could be the regulatory environment. In The Netherlands, there are certain rules and regulations that developers must follow when building co-living units, such as the requirement for a certain amount of communal space per resident. These regulations may have helped shape the building supply to better match the preferences of young adults. On the other hand, it is possible that the preferences of young adults have influenced the regulatory environment, as policymakers seek to encourage the development of housing that meets the needs of this demographic.

Another factor to consider is the impact of the COVID-19 pandemic on co-living preferences. The pandemic has forced many people to spend more time at home, which may have also increased the demand for social connections and communal spaces, as people seek out opportunities for socialising and networking. It will be interesting to see how these trends play out in the coming years and how they will impact the development of new co-living units.

Overall, based on the analysis conducted in the research, it can be concluded that the commercial co-living supply in The Netherlands matches the preferences of young adults to a significant extent. The study used a discrete choice experiment to identify the most important attributes of co-living for young adults and the results were compared to the amenities provided in reference co-living projects across the country. The findings showed that the most commonly provided amenities in the reference projects, such as communal spaces and leisure facilities, aligned with the preferences of young adults. Additionally, the study found that the newer co-living projects tend to have a better match with user preferences compared to the older ones, indicating an improvement in understanding and fitting user preferences over time. This suggests that co-living developers in The Netherlands have been successful in providing amenities and services that cater to the needs and preferences of young adults. However, there is still room for further research to explore how the demand for co-living in the country has been shaped by the supply of amenities and services provided by developers. Additionally, it is important to

continue monitoring the evolving preferences of young adults in The Netherlands to ensure that co-living developments remain relevant and attractive to this demographic.

8. Limitations and Further Research

It is critical to recognize and account for the numerous limitations that can naturally develop while conducting research, as they have the potential to substantially affect the final results. By identifying and addressing these constraints, research' validity and reliability can be improved, ensuring that conclusions are built on accurate and solid evidence. Furthermore, identifying a study's limitations can provide significant insight into areas for future research as well as new pathways for refining methodology and approaches.

As mentioned previously, statistical constraints can have an impact on research results. One such constraint is that samples can only estimate characteristics of a population, as they are not a one-to-one representation of the entire group being studied. To improve the accuracy and significance of research findings, it may be necessary to increase the sample size in future research. Although the current study received a satisfactory number of survey responses given the time frame, collecting more data would significantly enhance the results. However, it is important to note that increasing the sample size may also increase the cost and time required to conduct the research.

Following that, it is critical to recognize that the number of attributes included in the study was limited due to statistical constraints. This is because the more attributes included in a survey, the more respondents are required to assure the findings' reliability and validity. As previously stated, expanding the sample size would not only increase the significance of the results, but would also allow for the addition of other factors that could provide more insight into user preferences for living in The Netherlands. By incorporating other attributes into the study, it is possible to acquire a more comprehensive understanding of the elements that influence user preferences. As a result, useful insights into topics on both developer and regulatory end could be gained.

Another potential limitation of the study is that it was performed in English, which may have made it less accessible to those who do not speak the language fluently. While many Dutch people speak English very well, some people may have found it difficult to participate in the poll, limiting the representativeness of the results. To address this constraint, future research should consider delivering multilingual versions of the poll, not also only in Dutch, but also in languages often spoken by immigrant communities in The Netherlands, such as Turkish, Arabic, or Polish. This would make the survey more accessible to a wider variety of respondents, capturing a more diverse spectrum of experiences and viewpoints on user preferences.

9. Conclusions and Recommendations

After conducting a thorough analysis of the co-living market and user preferences among young adults in the Netherlands, it is clear that commercial co-living is largely meeting the demands of its target demographic. The provided housing supply closely aligns with the researchers' understanding of commercial co-living as a combination of on-site services, common facilities, and social ties, as well as with the user preferences derived from the discrete choice experiment.

It is worth noting that some projects have a better match than others, but overall, the young adults' preferences in The Netherlands seems to align with the available co-living options. This finding raises interesting questions about whether the developers had a good understanding of user preferences and tailored their offerings accordingly, or whether the supply shaped the demand. Research provides valuable insights into the co-living market in The Netherlands and highlights the importance of understanding user preferences when creating new co-living spaces. As co-living continues to grow in popularity, it will be essential for developers to stay attuned to the evolving needs and wants of their target demographic.

From a developer's point of view, the findings highlight the importance of providing quality communal areas and affordable living spaces that cater to the needs of young adults. Additionally, developers need to find ways to balance the demand for private living spaces with the need for larger communal areas that promote social interactions and community building. These findings can help guide developers in their decision-making process and lead to the creation of more successful co-living projects.

From a regulatory point of view, these findings suggest the need for policies that encourage the development of affordable co-living spaces with adequate communal areas and leisure facilities. There is also a need to regulate the prices of co-living spaces to prevent the artificial inflation of prices due to the potential addition of unnecessary amenities. Policies that focus on creating more affordable and accessible housing options can address the needs of young adults and ensure that they have access to quality housing options.

In recent years, several co-living projects have emerged in many Dutch cities such as Rotterdam, Utrecht, and Leiden. For example, the Liv project in Leiden was mentioned earlier as one of the best scoring reference projects in terms of matching user preferences. This shows that developers are recognizing the potential for co-living in other regions outside of Amsterdam and are starting to invest around the whole Netherlands. Moreover, the COVID-19 pandemic has accelerated the trend towards remote work and flexible living arrangements, making co-living more attractive to young adults who want to live in affordable, convenient and socially connected spaces. This has led to an increase in demand for co-living across the country, including in smaller cities and towns.

Overall, it is clear that co-living is becoming a popular housing option among young adults in The Netherlands. As more and more co-living projects emerge in other regions of the country, it will be interesting to see how the market develops and whether the supply will continue to meet the demand.

Glossary

Whilst conducting an in-depth investigation, it is crucial to quickly introduce the glossary terms of this research.

Commercial co-living: residential community living model that accommodates unrelated individuals willing to share common area amenities with preserving their privacy; modern commercial co-living spaces run by private companies (top-down approach)

Young Adults: generally a person in the years following adolescence; a person who is in his or her late teenage years or early twenties. For this research, young adults are understood as people between 18 to 25 years old including such groups as young professionals or students

Match: the extent to which commercial co-living market supply matches (aligns with) the user preferences (market demand); can either be a complete mismatch, part match or full match

User Preference: preference analysis evaluates relative attractiveness; this study focuses on analysing stated preferences that reflect hypothetical choices/user willingness

Appendix

Data Design SPSS

In order to create an orthogonal design, SPSS is used. Firstly, **Data > Orthogonal Design > Generate** was accessed where factor names and labels have been filled.

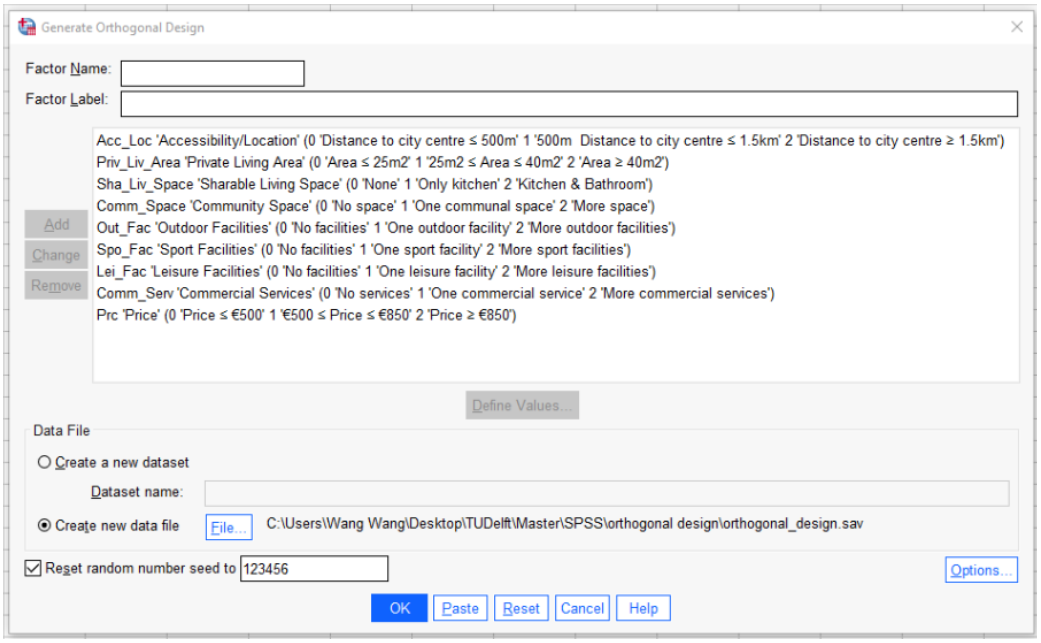


Figure 33. Generate Orthogonal Design

Afterwards, attribute levels have been added.

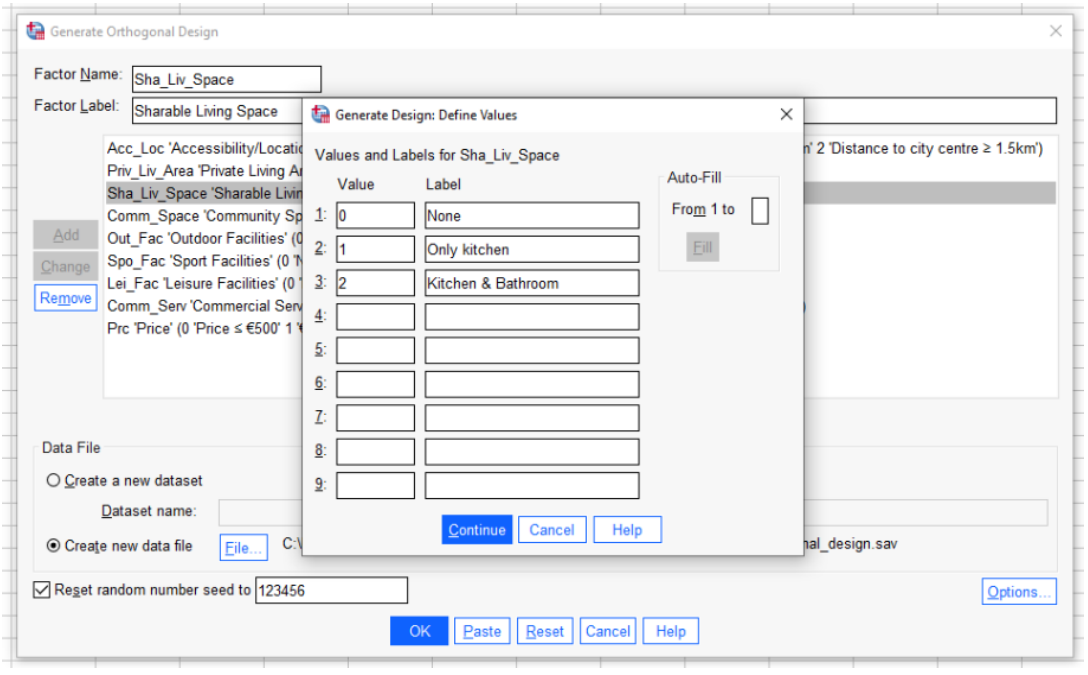


Figure 34. Generate Orthogonal Design

Next, since 27 treatment combinations are needed, a 'number of cases to generate' have been set at 27. Additionally, one can see that the 'reset random number seed to' is at 123456, this means that if the experiment were to be generated once again, SPSS will set the same assumptions to generate an orthogonal design instead of random ones. This is important to set in case the file would be lost.

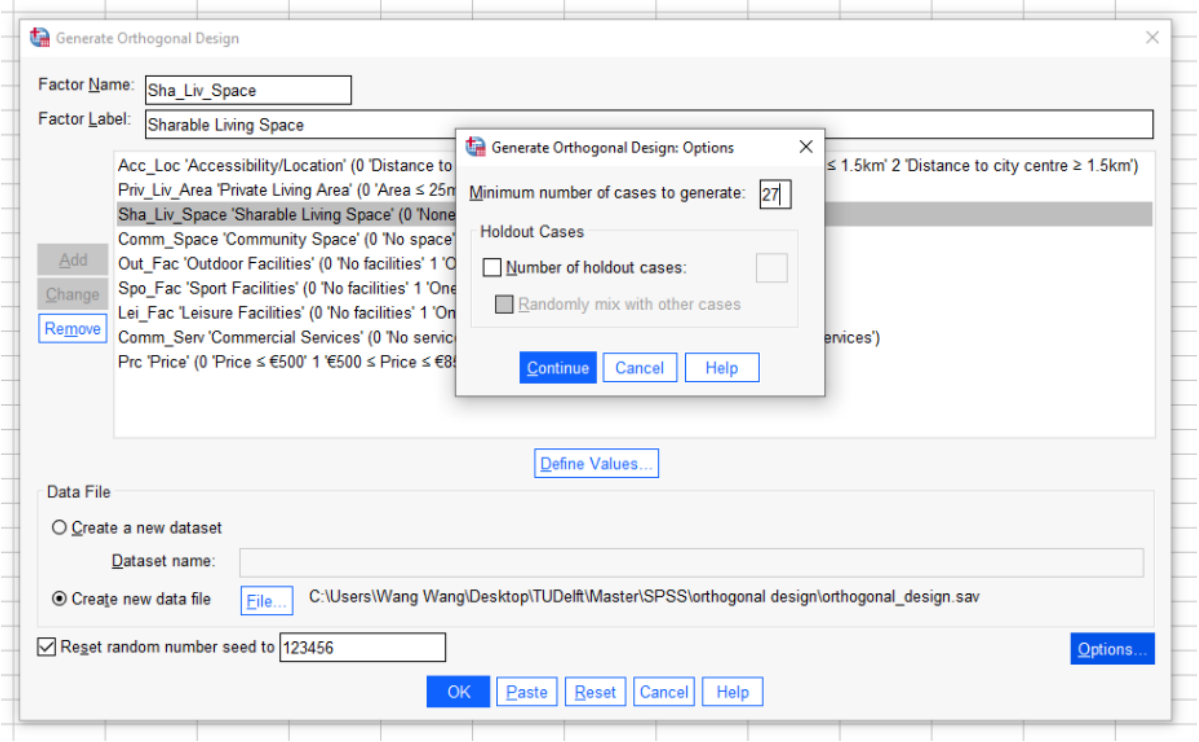


Figure 35. Generate Orthogonal Design

Generated results can be seen below. Afterwards, they have been displayed by accessing **Data > Orthogonal Design > Display** in SPSS.

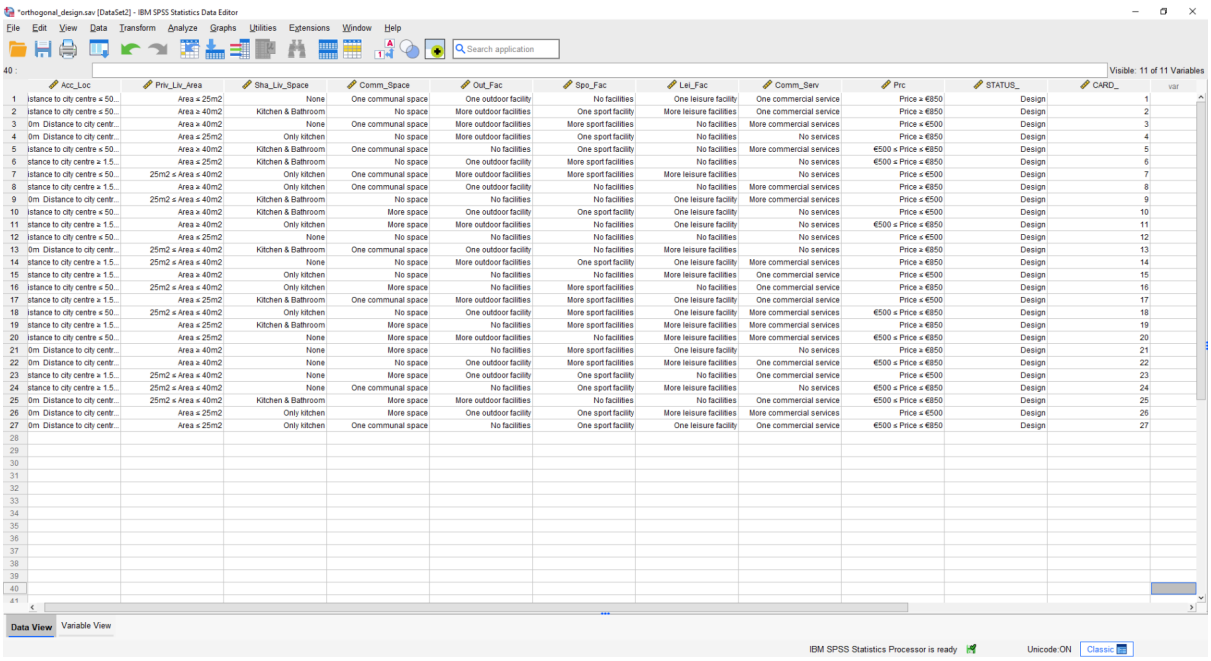


Figure 36. Generate Orthogonal Design

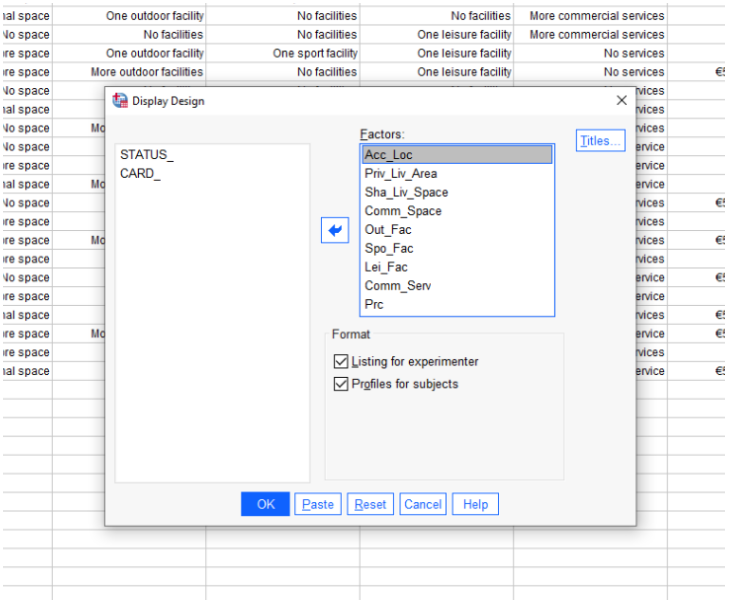


Figure 37. Generate Orthogonal Design

Displayed design is presented below.

Profile Number 1

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
1	Distance to city centre ≤ 500m	Area ≤ 25m2	None	One communal space	One outdoor facility	No facilities	One leisure facility	One commercial service	Price ≥ €850

Profile Number 2

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
2	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	No space	More outdoor facilities	One sport facility	More leisure facilities	One commercial service	Price ≥ €850

Profile Number 3

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
3	500m Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	One communal space	More outdoor facilities	More sport facilities	No facilities	More commercial services	Price ≤ €500

Profile Number 4

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
4	500m Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	No space	More outdoor facilities	One sport facility	No facilities	No services	Price ≥ €850

Profile Number 5

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
5	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	One communal space	No facilities	One sport facility	No facilities	More commercial services	€500 ≤ Price ≤ €850

Profile Number 6

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
6	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	No space	One outdoor facility	More sport facilities	No facilities	No services	€500 ≤ Price ≤ €850

Profile Number 7

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
7	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	One communal space	More outdoor facilities	More sport facilities	More leisure facilities	No services	Price ≤ €500

Profile Number 8

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
8	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	One communal space	One outdoor facility	No facilities	No facilities	More commercial services	Price ≥ €850

Profile Number 9

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
9	500m Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	No space	No facilities	No facilities	One leisure facility	More commercial services	Price ≤ €500

Profile Number 10

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
10	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	More space	One outdoor facility	One sport facility	One leisure facility	No services	Price ≤ €500

Profile Number 11

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
11	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	More space	More outdoor facilities	No facilities	One leisure facility	No services	€500 ≤ Price ≤ €850

Profile Number 12

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
12	Distance to city centre ≤ 500m	Area ≤ 25m2	None	No space	No facilities	No facilities	No facilities	No services	Price ≤ €500

Profile Number 13

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
13	500m Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	One communal space	One outdoor facility	No facilities	More leisure facilities	No services	Price ≥ €850

Profile Number 14

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
14	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	No space	More outdoor facilities	One sport facility	One leisure facility	More commercial services	Price ≥ €850

Profile Number 15

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
15	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	No space	No facilities	No facilities	More leisure facilities	One commercial service	Price ≤ €500

Profile Number 16

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
16	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	More space	No facilities	More sport facilities	No facilities	One commercial service	Price ≥ €850

Profile Number 17

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
17	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	One communal space	More outdoor facilities	More sport facilities	One leisure facility	One commercial service	Price ≤ €500

Profile Number 18

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
18	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	No space	One outdoor facility	More sport facilities	One leisure facility	More commercial services	€500 ≤ Price ≤ €850

Profile Number 19

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
19	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	More space	No facilities	More sport facilities	More leisure facilities	More commercial services	Price ≥ €850

Profile Number 20

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
20	Distance to city centre ≤ 500m	Area ≤ 25m2	None	More space	More outdoor facilities	No facilities	More leisure facilities	More commercial services	€500 ≤ Price ≤ €850

Profile Number 21

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
21	500m Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	More space	No facilities	More sport facilities	One leisure facility	No services	Price ≥ €850

Profile Number 22

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
22	500m Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	No space	One outdoor facility	More sport facilities	More leisure facilities	One commercial service	€500 ≤ Price ≤ €850

Profile Number 23

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
23	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	More space	One outdoor facility	One sport facility	No facilities	One commercial service	Price ≤ €500

Profile Number 24

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
24	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	One communal space	No facilities	One sport facility	More leisure facilities	No services	€500 ≤ Price ≤ €850

Profile Number 25

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
25	500m Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	More space	More outdoor facilities	No facilities	No facilities	One commercial service	€500 ≤ Price ≤ €850

Profile Number 26

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
26	500m Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	More space	One outdoor facility	One sport facility	More leisure facilities	More commercial services	Price ≤ €500

Profile Number 27

Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
27	500m Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	One communal space	No facilities	One sport facility	One leisure facility	One commercial service	€500 ≤ Price ≤ €850

Figure 38. Profile Numbers

Card List

	Card ID	Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
1	1	Distance to city centre ≤ 500m	Area ≤ 25m2	None	One communal space	One outdoor facility	No facilities	One leisure facility	One commercial service	Price ≥ €850
2	2	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	No space	More outdoor facilities	One sport facility	More leisure facilities	One commercial service	Price ≥ €850
3	3	500m Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	One communal space	More outdoor facilities	More sport facilities	No facilities	More commercial services	Price ≤ €500
4	4	500m Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	No space	More outdoor facilities	One sport facility	No facilities	No services	Price ≥ €850
5	5	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	One communal space	No facilities	One sport facility	No facilities	More commercial services	€500 ≤ Price ≤ €850
6	6	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	No space	One outdoor facility	More sport facilities	No facilities	No services	€500 ≤ Price ≤ €850
7	7	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	One communal space	More outdoor facilities	More sport facilities	More leisure facilities	No services	Price ≤ €500
8	8	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	One communal space	One outdoor facility	No facilities	No facilities	More commercial services	Price ≥ €850
9	9	500m Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	No space	No facilities	No facilities	One leisure facility	More commercial services	Price ≤ €500
10	10	Distance to city centre ≤ 500m	Area ≥ 40m2	Kitchen & Bathroom	More space	One outdoor facility	One sport facility	One leisure facility	No services	Price ≤ €500
11	11	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	More space	More outdoor facilities	No facilities	One leisure facility	No services	€500 ≤ Price ≤ €850
12	12	Distance to city centre ≤ 500m	Area ≤ 25m2	None	No space	No facilities	No facilities	No facilities	No services	Price ≤ €500
13	13	500m Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	One communal space	One outdoor facility	No facilities	More leisure facilities	No services	Price ≥ €850
14	14	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	No space	More outdoor facilities	One sport facility	One leisure facility	More commercial services	Price ≥ €850
15	15	Distance to city centre ≥ 1.5km	Area ≥ 40m2	Only kitchen	No space	No facilities	No facilities	More leisure facilities	One commercial service	Price ≤ €500
16	16	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	More space	No facilities	More sport facilities	No facilities	One commercial service	Price ≥ €850
17	17	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	One communal space	More outdoor facilities	More sport facilities	One leisure facility	One commercial service	Price ≤ €500
18	18	Distance to city centre ≤ 500m	25m2 ≤ Area ≤ 40m2	Only kitchen	No space	One outdoor facility	More sport facilities	One leisure facility	More commercial services	€500 ≤ Price ≤ €850
19	19	Distance to city centre ≥ 1.5km	Area ≤ 25m2	Kitchen & Bathroom	More space	No facilities	More sport facilities	More leisure facilities	More commercial services	Price ≥ €850
20	20	Distance to city centre ≤ 500m	Area ≤ 25m2	None	More space	More outdoor facilities	No facilities	More leisure facilities	More commercial services	€500 ≤ Price ≤ €850
21	21	500m Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	More space	No facilities	More sport facilities	One leisure facility	No services	Price ≥ €850
22	22	500m Distance to city centre ≤ 1.5km	Area ≥ 40m2	None	No space	One outdoor facility	More sport facilities	More leisure facilities	One commercial service	€500 ≤ Price ≤ €850
23	23	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	More space	One outdoor facility	One sport facility	No facilities	One commercial service	Price ≤ €500
24	24	Distance to city centre ≥ 1.5km	25m2 ≤ Area ≤ 40m2	None	One communal space	No facilities	One sport facility	More leisure facilities	No services	€500 ≤ Price ≤ €850
25	25	500m Distance to city centre ≤ 1.5km	25m2 ≤ Area ≤ 40m2	Kitchen & Bathroom	More space	More outdoor facilities	No facilities	No facilities	One commercial service	€500 ≤ Price ≤ €850
26	26	500m Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	More space	One outdoor facility	One sport facility	More leisure facilities	More commercial services	Price ≤ €500
27	27	500m Distance to city centre ≤ 1.5km	Area ≤ 25m2	Only kitchen	One communal space	No facilities	One sport facility	One leisure facility	One commercial service	€500 ≤ Price ≤ €850

Figure 39. Generate Orthogonal Design

Consequently, a bivariate correlation test in SPSS has been conducted to ensure that the orthogonal design is correct. Pearson correlation coefficient was used to check it as it assumes the linearity in the

relationship between the variables. Since the goal of orthogonal design is to minimise the correlation between independent variables, it is performed correctly if low or non-significant correlations are found.

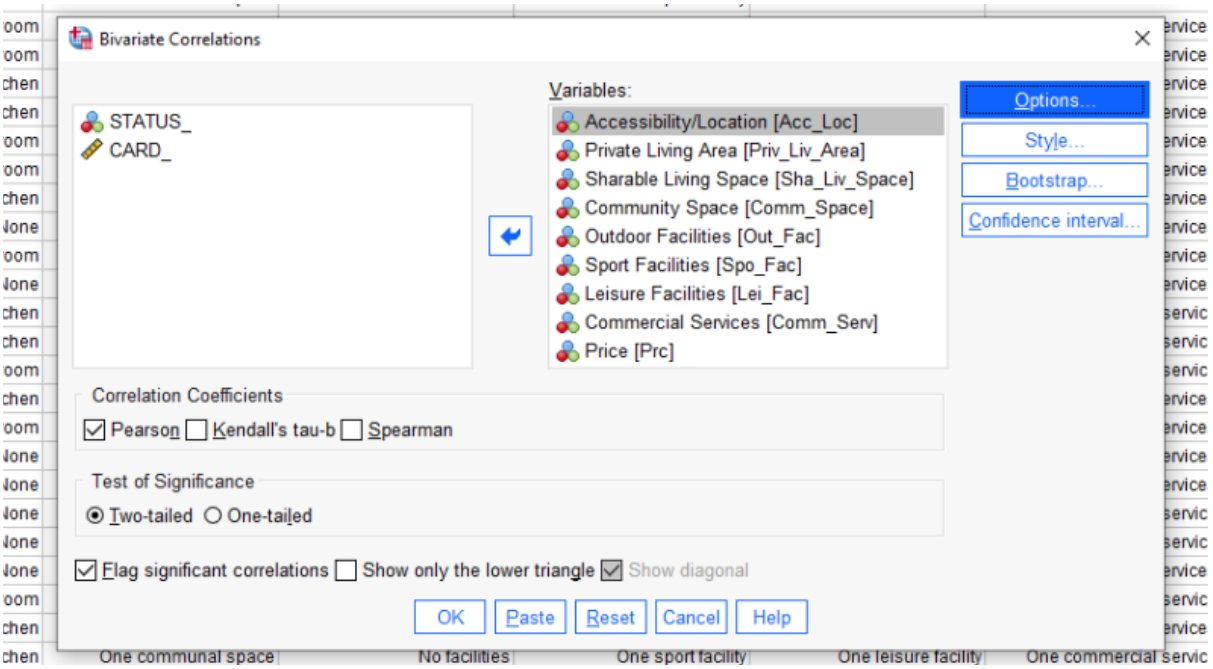


Figure 40. Generate Orthogonal Design

Additionally, a two-tailed test of significance was chosen as this tests the effect in both ways - testing whether it is positive or negative. Consequently, looking at the table presenting the correlations, one can see that all of the independent variables do not correlate with each other meaning that the orthogonal design developed by SPSS can be used for further analysis.

Correlations

		Accessibility/Location	Private Living Area	Sharable Living Space	Community Space	Outdoor Facilities	Sport Facilities	Leisure Facilities	Commercial Services	Price
Accessibility/Location	Pearson Correlation	1	.000	.000	.000	.000	.000	.000	.000	.000
	Sig. (2-tailed)		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Private Living Area	Pearson Correlation	.000	1	.000	.000	.000	.000	.000	.000	.000
	Sig. (2-tailed)	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Sharable Living Space	Pearson Correlation	.000	.000	1	.000	.000	.000	.000	.000	.000
	Sig. (2-tailed)	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Community Space	Pearson Correlation	.000	.000	.000	1	.000	.000	.000	.000	.000
	Sig. (2-tailed)	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Outdoor Facilities	Pearson Correlation	.000	.000	.000	.000	1	.000	.000	.000	.000
	Sig. (2-tailed)	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Sport Facilities	Pearson Correlation	.000	.000	.000	.000	.000	1	.000	.000	.000
	Sig. (2-tailed)	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Leisure Facilities	Pearson Correlation	.000	.000	.000	.000	.000	.000	1	.000	.000
	Sig. (2-tailed)	1.000	1.000	1.000	1.000	1.000	1.000		1.000	1.000
	N	27	27	27	27	27	27	27	27	27
Commercial Services	Pearson Correlation	.000	.000	.000	.000	.000	.000	.000	1	.000
	Sig. (2-tailed)	1.000	1.000	1.000	1.000	1.000	1.000	1.000		1.000
	N	27	27	27	27	27	27	27	27	27
Price	Pearson Correlation	.000	.000	.000	.000	.000	.000	.000	.000	1
	Sig. (2-tailed)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
	N	27	27	27	27	27	27	27	27	27

Figure 41. Correlations

Having established 27 treatment combinations in an orthogonal manner, it is now crucial to translate it into 9 choice sets with 3 alternatives each. In order to generate it randomly, a short Python script was written. Random generation ensures that choice modelling data is unbiased and efficient improving the validity and reliability of the analysis.

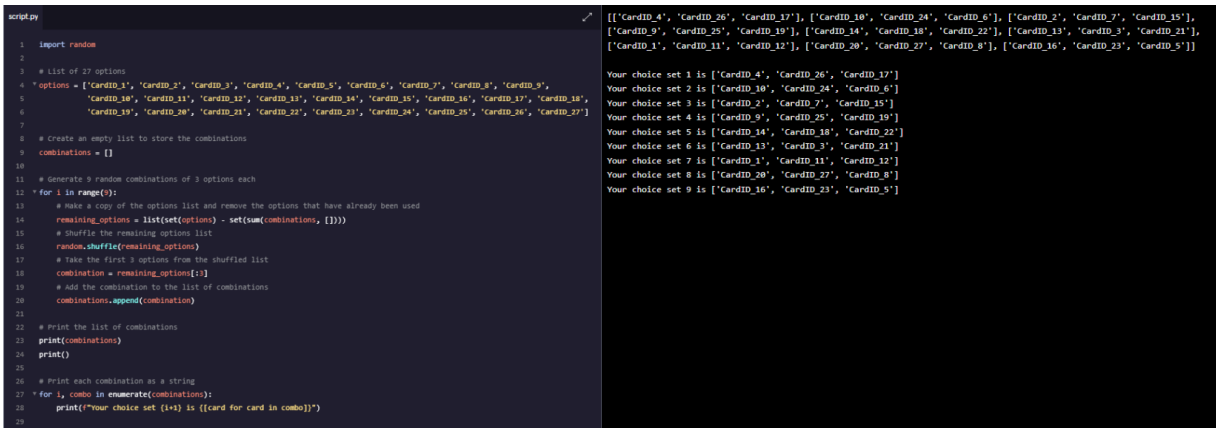


Figure 42. Python Code

```
import random

# List of 27 options
options = ['CardID_1', 'CardID_2', 'CardID_3', 'CardID_4', 'CardID_5', 'CardID_6', 'CardID_7','CardID_8',
'CardID_9','CardID_10','CardID_11','CardID_12','CardID_13','CardID_14','CardID_15','CardID_16','CardID_17',
'CardID_18','CardID_19', 'CardID_20', 'CardID_21', 'CardID_22', 'CardID_23','CardID_24','CardID_25', 'CardID_26', 'CardID_27']

# Create an empty list to store the combinations
combinations = []

# Generate 9 random combinations of 3 options each
for i in range(9):
  # Make a copy of the options list and remove the options that have already been used
  remaining_options = list(set(options) - set(sum(combinations, [])))
  # Shuffle the remaining options list
  random.shuffle(remaining_options)
  # Take the first 3 options from the shuffled list
  combination = remaining_options[:3]
  # Add the combination to the list of combinations
  combinations.append(combination)
# Print the list of combinations
print(combinations)
print()

# Print each combination as a string
for i, combo in enumerate(combinations):
  print(f"Your choice set {i+1} is {[card for card in combo]}")
```

Figure 43. script.py

```
[['CardID_4', 'CardID_26', 'CardID_17'], ['CardID_10', 'CardID_24', 'CardID_6'], ['CardID_2', 'CardID_7', 'CardID_15'], ['CardID_9', 'CardID_25',
'CardID_19'], ['CardID_14', 'CardID_18', 'CardID_22'], ['CardID_13', 'CardID_3', 'CardID_21'], ['CardID_1', 'CardID_11', 'CardID_12'], ['CardID_20',
'CardID_27', 'CardID_8'], ['CardID_16', 'CardID_23', 'CardID_5']]

Your choice set 1 is ['CardID_4', 'CardID_26', 'CardID_17']
```

```
Your choice set 2 is ['CardID_10', 'CardID_24', 'CardID_6']
Your choice set 3 is ['CardID_2', 'CardID_7', 'CardID_15']
Your choice set 4 is ['CardID_9', 'CardID_25', 'CardID_19']
Your choice set 5 is ['CardID_14', 'CardID_18', 'CardID_22']
Your choice set 6 is ['CardID_13', 'CardID_3', 'CardID_21']
Your choice set 7 is ['CardID_1', 'CardID_11', 'CardID_12']
Your choice set 8 is ['CardID_20', 'CardID_27', 'CardID_8']
Your choice set 9 is ['CardID_16', 'CardID_23', 'CardID_5']
```

Figure 44. Console

Questionnaire

As mentioned in the report, the questionnaire will consist of two parts: socio-demographic & economic questions and preference choice sets.

2.1 Part One

This part will include more gene

What is your gender?

○ Woman

○ Man

○ Rather not say

How old are you?

What is your highest finished education level?

○ None

○ Primary education (elementary)

○ Secondary education (havo, vwo, mbo)

○ Higher professional education (hbo, wo; university education)

○ Post academic (post-teritary, doctor; PhD)

What is your current work status?

○ Student

○ Employed

○ Unemployed

○ Other

What is the name of the city in which you currently reside?

○ Amsterdam

○ Eindhoven

○ Leiden

○ Rotterdam

○ The Hague

○ Utrecht

What is your current gross annual income?

○ less than €19.999

○ between €20.000 - €24.999

○ between €25.000 - €29.999

○ between €30.000 - €34.999

○ between €35.000 - €39.999

○ more than €40.000

○ rather not say

2.2 Part Two

Among the following co-living options, which one do you prefer?

Choice Set 1				
	Option 1	**Option 2**	**Option 3**	**Opt-out**
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≤ 25m2	Area ≤ 25m2	Area ≤ 25m2	
Sharable Living Space	Only kitchen	Only kitchen	Kitchen & Bathroom	
Community Space	No space	More space	One communal space	
Outdoor Facilities	More outdoor facilities	One outdoor facility	More outdoor facilities	
Sport Facilities	One sport facility	One sport facility	More sport facilities	
Leisure Facilities	No facilities	More leisure facilities	One leisure facility	
Commercial Services	No services	More commercial services	One commercial service	
Price	Price ≥ €850	Price ≤ €500	Price ≤ €500	

Accessibility/Location - Distance to the city centre or a city area with most important private and public services

Private living area - Area of a private unit in a building (size of a studio or apartment)

Sharable living space - The type of shared spaces within the basic, everyday living area

Community space - Presence of community spaces where existing amenities mean one of e.g. meeting room/communal living room or working/studying area is present; more amenities mean more than one outdoor area is present within the residential complex

Outdoor facilities - Presence of outdoor areas where existing amenities mean one of e.g. courtyard, patio, garden or terrace is present; more amenities mean more than one outdoor area is present within the residential complex

Sport facilities - Presence of sport facility where existing amenities mean one of e.g. indoor or outdoor gyms is present; more amenities mean more than one sport facility is present within the residential complex

Leisure facilities - Presence of leisure facilities where existing amenities mean one of e.g. cinema room, music room or gaming room is present; more amenities mean more than one leisure facility is present within the residential complex

Commercial services - The presence of commercial areas where existing amenities mean one of e.g. restaurant, bar, shop or hairdresser is present; more amenities mean more than one commercial service is present within the residential complex

Price - The average rental price per month including service costs

Choice Set 2

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≥ 40m2	25m2 ≤ Area ≤ 40m2	Area ≤ 25m2	
Sharable Living Space	Kitchen & Bathroom	None	Kitchen & Bathroom	
Community Space	More space	One communal space	No space	
Outdoor Facilities	One outdoor facility	No facilities	One outdoor facility	
Sport Facilities	One sport facility	One sport facility	More sport facilities	
Leisure Facilities	One leisure facility	More leisure facilities	No facilities	
Commercial Services	No services	No services	No services	
Price	Price ≤ €500	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	

Choice Set 3

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≥ 40m2	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	
Sharable Living Space	Kitchen & Bathroom	Only kitchen	Only kitchen	
Community Space	No space	One communal space	No space	
Outdoor Facilities	More outdoor facilities	More outdoor facilities	No facilities	
Sport Facilities	One sport facility	More sport facilities	No facilities	
Leisure Facilities	More leisure facilities	More leisure facilities	More leisure facilities	
Commercial Services	One commercial service	No services	One commercial service	
Price	Price ≥ €850	Price ≤ €500	Price ≤ €500	

Choice Set 4

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	25m2 ≤ Area ≤ 40m2	25m2 ≤ Area ≤ 40m2	Area ≤ 25m2	
Sharable Living Space	Kitchen & Bathroom	Kitchen & Bathroom	Kitchen & Bathroom	
Community Space	No space	More space	More space	
Outdoor Facilities	No facilities	More outdoor facilities	No facilities	
Sport Facilities	No facilities	No facilities	More sport facilities	
Leisure Facilities	One leisure facility	No facilities	More leisure facilities	
Commercial Services	More commercial services	One commercial service	More commercial services	
Price	Price ≤ €500	€500 ≤ Price ≤ €850	Price ≥ €850	

Choice Set 5

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≥ 1.5km	Distance to city centre ≤ 500m	500m ≤ Distance to city centre ≤ 1.5km	
Private Living Area	25m2 ≤ Area ≤ 40m2	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	
Sharable Living Space	None	Only kitchen	None	
Community Space	No space	No space	No space	
Outdoor Facilities	More outdoor facilities	One outdoor facility	One outdoor facility	
Sport Facilities	One sport facility	More sport facilities	More sport facilities	
Leisure Facilities	One leisure facility	One leisure facility	More leisure facilities	
Commercial Services	More commercial services	More commercial services	One commercial service	
Price	Price ≥ €850	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	

Choice Set 6				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	
Private Living Area	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	Area ≥ 40m2	
Sharable Living Space	Kitchen & Bathroom	None	None	
Community Space	One communal space	One communal space	More space	
Outdoor Facilities	One outdoor facility	More outdoor facilities	No facilities	
Sport Facilities	No facilities	More sport facilities	More sport facilities	
Leisure Facilities	More leisure facilities	No facilities	One leisure facility	
Commercial Services	No services	More commercial services	No services	
Price	Price ≥ €850	Price ≤ €500	Price ≥ €850	

Choice Set 7				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≤ 500m	
Private Living Area	Area ≤ 25m2	Area ≥ 40m2	Area ≤ 25m2	
Sharable Living Space	None	Only kitchen	None	
Community Space	One communal space	More space	No space	
Outdoor Facilities	One outdoor facility	More outdoor facilities	No facilities	
Sport Facilities	No facilities	No facilities	No facilities	
Leisure Facilities	One leisure facility	One leisure facility	No facilities	
Commercial Services	One commercial service	No services	No services	
Price	Price ≥ €850	€500 ≤ Price ≤ €850	Price ≤ €500	

Choice Set 8				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≤ 25m2	Area ≤ 25m2	Area ≥ 40m2	
Sharable Living Space	None	Only kitchen	Only kitchen	
Community Space	More space	One communal space	One communal space	
Outdoor Facilities	More outdoor facilities	No facilities	One outdoor facility	
Sport Facilities	No facilities	One sport facility	No facilities	
Leisure Facilities	More leisure facilities	One leisure facility	No facilities	
Commercial Services	More commercial services	One commercial service	More commercial services	
Price	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	Price ≥ €850	

Choice Set 9				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≤ 500m	
Private Living Area	25m2 ≤ Area ≤ 40m2	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	
Sharable Living Space	Only kitchen	None	Kitchen & Bathroom	
Community Space	More space	More space	One communal space	
Outdoor Facilities	No facilities	One outdoor facility	No facilities	
Sport Facilities	More sport facilities	One sport facility	One sport facility	
Leisure Facilities	No facilities	No facilities	No facilities	
Commercial Services	One commercial service	One commercial service	More commercial services	
Price	Price ≥ €850	Price ≤ €500	€500 ≤ Price ≤ €850	

Qualtrics Questionnaire design

Dear Participants,

I am a master's student at TU Delft, and I am conducting a survey to understand user preferences regarding coliving housing attributes.

The survey will take approximately 10 minutes to complete and is divided into two sections. The first section contains general information questions, while the second section consists of nine choice sets about housing preferences. The purpose of this survey is to collect data to help me analyze and understand the housing attributes that influence user preferences for coliving housing.

Your participation in this survey is greatly appreciated and will help me achieve my academic goals. All responses are anonymous and will be kept confidential. Thank you for your participation.

- (●) I will answer each question/statement as honestly as possible

What is your gender?

- ( ) Male
- ( ) Female
- ( ) Non-binary / third gender
- ( ) Prefer not to say

How old are you?

What is your highest finished education level?

- ( ) Primary education (elementary)
- ( ) Secondary education (HAVO, VWO, MBO)
- ( ) Higher professional education (HBO, WO; university education)
- ( ) Post academic (post-teritray, doctor; PhD)
- ( ) None

What is your current work status?

- ( ) Student
- ( ) Employed
- ( ) Unemployed
- ( ) Other

What is your current gross annual income?

- ( ) less than €19.999
- ( ) between €20.000 - €24.999
- ( ) between €25.000 - €29.999
- ( ) between €30.000 - €34.999
- ( ) between €35.000 - €39.999
- ( ) more than €40.000
- ( ) Prefer not to say

What is the city in which you currently live?

- ( ) Amsterdam
- ( ) Almere
- ( ) Eindhoven
- ( ) Leiden
- ( ) Rotterdam
- ( ) The Hague
- ( ) Utrecht
- ( ) Other

In the next section of this survey, you will be presented with 9 choice sets, each containing 3 different options that represent different coliving housing attributes.

For each choice set, you will be asked to choose your preferred alternative based on your housing preferences. If none of the alternatives are suitable, you may also choose the opt-out option, indicating that you do not prefer any of the presented alternatives.

Below you can find an example of a choice set:

Example Choice Set				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≤ 25m2	Area ≤ 25m2	Area ≥ 40m2	
Sharable Living Space	None	Only kitchen	Only kitchen	
Community Space	More space	One communal space	One communal space	
Outdoor Facilities	More outdoor facilities	No facilities	One outdoor facility	
Sport Facilities	No facilities	One sport facility	No facilities	
Leisure Facilities	More leisure facilities	One leisure facility	No facilities	
Commercial Services	More commercial services	One commercial service	More commercial services	
Price	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	Price ≥ €850	

Characteristics description:

Accessibility/Location - Distance to the city centre or a city area with most important private and public services

Private living area - Area of a private unit in a building (size of a studio or apartment)

Sharable living space - The type of shared spaces within the basic, everyday living area

Community space - Presence of community spaces where existing amenities mean one of e.g. meeting room/communal living room or working/studying area is present; more amenities mean more than one outdoor area is present within the residential complex

Outdoor facilities - Presence of outdoor areas where existing amenities mean one of e.g. courtyard, patio, garden or terrace is present; more amenities mean more than one outdoor area is present within the residential complex

Sport facilities - Presence of sport facility where existing amenities mean one of e.g. indoor or outdoor gyms is present; more amenities mean more than one sport facility is present within the residential complex

Leisure facilities - Presence of leisure facilities where existing amenities mean one of e.g. cinema room, music room or gaming room is present; more amenities mean more than one leisure facility is present within the residential complex

Commercial services - The presence of commercial areas where existing amenities mean one of e.g. restaurant, bar, shop or hairdresser is present; more amenities mean more than one commercial service is present within the residential complex

Price - The average rental price per month including service costs

Please take your time to carefully consider each choice set and select the option that best represents your preferences. Your responses are anonymous and will be kept confidential. Thank you for your participation in this survey.

◯ I understand the exercise

→

Among the following co-living options, which one do you prefer?

Choice Set 2

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≥ 40m2	25m2 ≤ Area ≤ 40m2	Area ≤ 25m2	
Sharable Living Space	Kitchen & Bathroom	None	Kitchen & Bathroom	
Community Space	More space	One communal space	No space	
Outdoor Facilities	One outdoor facility	No facilities	One outdoor facility	
Sport Facilities	One sport facility	One sport facility	More sport facilities	
Leisure Facilities	One leisure facility	More leisure facilities	No facilities	
Commercial Services	No services	No services	No services	
Price	Price ≤ €500	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	

◯ Option 1

◯ Option 2

◯ Option 3

◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 1

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≤ 25m2	Area ≤ 25m2	Area ≤ 25m2	
Sharable Living Space	Only kitchen	Only kitchen	Kitchen & Bathroom	
Community Space	No space	More space	One communal space	
Outdoor Facilities	More outdoor facilities	One outdoor facility	More outdoor facilities	
Sport Facilities	One sport facility	One sport facility	More sport facilities	
Leisure Facilities	No facilities	More leisure facilities	One leisure facility	
Commercial Services	No services	More commercial services	One commercial service	
Price	Price ≥ €850	Price ≤ €500	Price ≤ €500	

◯ Option 1

◯ Option 2

◯ Option 3

◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 2				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≥ 40m2	25m2 ≤ Area ≤ 40m2	Area ≤ 25m2	
Sharable Living Space	Kitchen & Bathroom	None	Kitchen & Bathroom	
Community Space	More space	One communal space	No space	
Outdoor Facilities	One outdoor facility	No facilities	One outdoor facility	
Sport Facilities	One sport facility	One sport facility	More sport facilities	
Leisure Facilities	One leisure facility	More leisure facilities	No facilities	
Commercial Services	No services	No services	No services	
Price	Price ≤ €500	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	

- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 3				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≥ 40m2	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	
Sharable Living Space	Kitchen & Bathroom	Only kitchen	Only kitchen	
Community Space	No space	One communal space	No space	
Outdoor Facilities	More outdoor facilities	More outdoor facilities	No facilities	
Sport Facilities	One sport facility	More sport facilities	No facilities	
Leisure Facilities	More leisure facilities	More leisure facilities	More leisure facilities	
Commercial Services	One commercial service	No services	One commercial service	
Price	Price ≥ €850	Price ≤ €500	Price ≤ €500	

- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 4				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	25m2 ≤ Area ≤ 40m2	25m2 ≤ Area ≤ 40m2	Area ≤ 25m2	
Sharable Living Space	Kitchen & Bathroom	Kitchen & Bathroom	Kitchen & Bathroom	
Community Space	No space	More space	More space	
Outdoor Facilities	No facilities	More outdoor facilities	No facilities	
Sport Facilities	No facilities	No facilities	More sport facilities	
Leisure Facilities	One leisure facility	No facilities	More leisure facilities	
Commercial Services	More commercial services	One commercial service	More commercial services	
Price	Price ≤ €500	€500 ≤ Price ≤ €850	Price ≥ €850	

- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 5				
	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≥ 1.5km	Distance to city centre ≤ 500m	500m ≤ Distance to city centre ≤ 1.5km	
Private Living Area	25m2 ≤ Area ≤ 40m2	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	
Sharable Living Space	None	Only kitchen	None	
Community Space	No space	No space	No space	
Outdoor Facilities	More outdoor facilities	One outdoor facility	One outdoor facility	
Sport Facilities	One sport facility	More sport facilities	More sport facilities	
Leisure Facilities	One leisure facility	One leisure facility	More leisure facilities	
Commercial Services	More commercial services	More commercial services	One commercial service	
Price	Price ≥ €850	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	

- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 6

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	500m ≤ Distance to city centre ≤ 1.5km	
Private Living Area	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	Area ≥ 40m2	
Sharable Living Space	Kitchen & Bathroom	None	None	
Community Space	One communal space	One communal space	More space	
Outdoor Facilities	One outdoor facility	More outdoor facilities	No facilities	
Sport Facilities	No facilities	More sport facilities	More sport facilities	
Leisure Facilities	More leisure facilities	No facilities	One leisure facility	
Commercial Services	No services	More commercial services	No services	
Price	Price ≥ €850	Price ≤ €500	Price ≥ €850	

- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 7

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≤ 500m	
Private Living Area	Area ≤ 25m2	Area ≥ 40m2	Area ≤ 25m2	
Sharable Living Space	None	Only kitchen	None	
Community Space	One communal space	More space	No space	
Outdoor Facilities	One outdoor facility	More outdoor facilities	No facilities	
Sport Facilities	No facilities	No facilities	No facilities	
Leisure Facilities	One leisure facility	One leisure facility	No facilities	
Commercial Services	One commercial service	No services	No services	
Price	Price ≥ €850	€500 ≤ Price ≤ €850	Price ≤ €500	

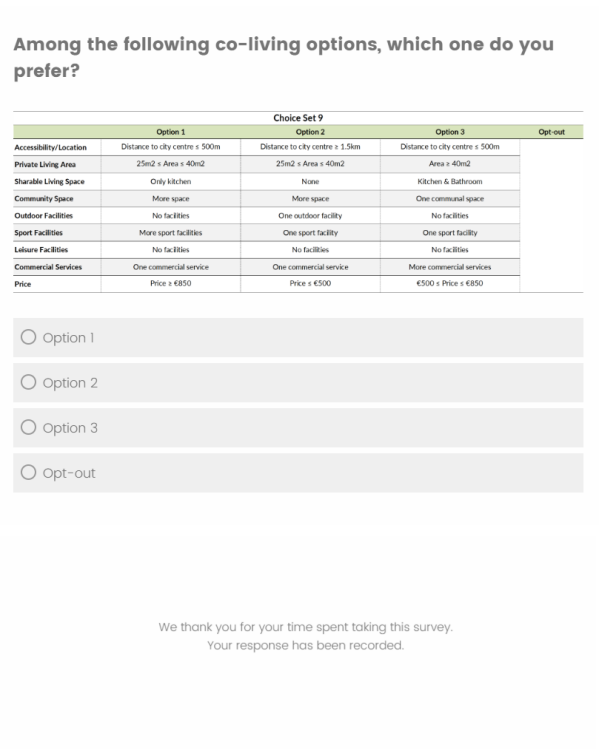
- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out

Among the following co-living options, which one do you prefer?

Choice Set 8

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	500m ≤ Distance to city centre ≤ 1.5km	Distance to city centre ≥ 1.5km	
Private Living Area	Area ≤ 25m2	Area ≤ 25m2	Area ≥ 40m2	
Sharable Living Space	None	Only kitchen	Only kitchen	
Community Space	More space	One communal space	One communal space	
Outdoor Facilities	More outdoor facilities	No facilities	One outdoor facility	
Sport Facilities	No facilities	One sport facility	No facilities	
Leisure Facilities	More leisure facilities	One leisure facility	No facilities	
Commercial Services	More commercial services	One commercial service	More commercial services	
Price	€500 ≤ Price ≤ €850	€500 ≤ Price ≤ €850	Price ≥ €850	

- ◯ Option 1
- ◯ Option 2
- ◯ Option 3
- ◯ Opt-out



Among the following co-living options, which one do you prefer?

Choice Set 9

	Option 1	Option 2	Option 3	Opt-out
Accessibility/Location	Distance to city centre ≤ 500m	Distance to city centre ≥ 1.5km	Distance to city centre ≤ 500m	
Private Living Area	25m2 ≤ Area ≤ 40m2	25m2 ≤ Area ≤ 40m2	Area ≥ 40m2	
Sharable Living Space	Only kitchen	None	Kitchen & Bathroom	
Community Space	More space	More space	One communal space	
Outdoor Facilities	No facilities	One outdoor facility	No facilities	
Sport Facilities	More sport facilities	One sport facility	One sport facility	
Leisure Facilities	No facilities	No facilities	No facilities	
Commercial Services	One commercial service	One commercial service	More commercial services	
Price	Price ≥ €850	Price ≤ €500	€500 ≤ Price ≤ €850	

○ Option 1

○ Option 2

○ Option 3

○ Opt-out

We thank you for your time spent taking this survey.
Your response has been recorded.

Data From the Questionnaire

First part of the questionnaire consisted of background questions in order to further understand the context of the given answers. General questions about age, gender, education level, occupation, place of residence and income have been asked. This information can be used to derive more in-depth results regarding the sample and conclude how well the survey represents the general population.

CBS data about the distributions of the entire Dutch population is used to compare survey results distribution which ultimately allows the Chi-Square test.

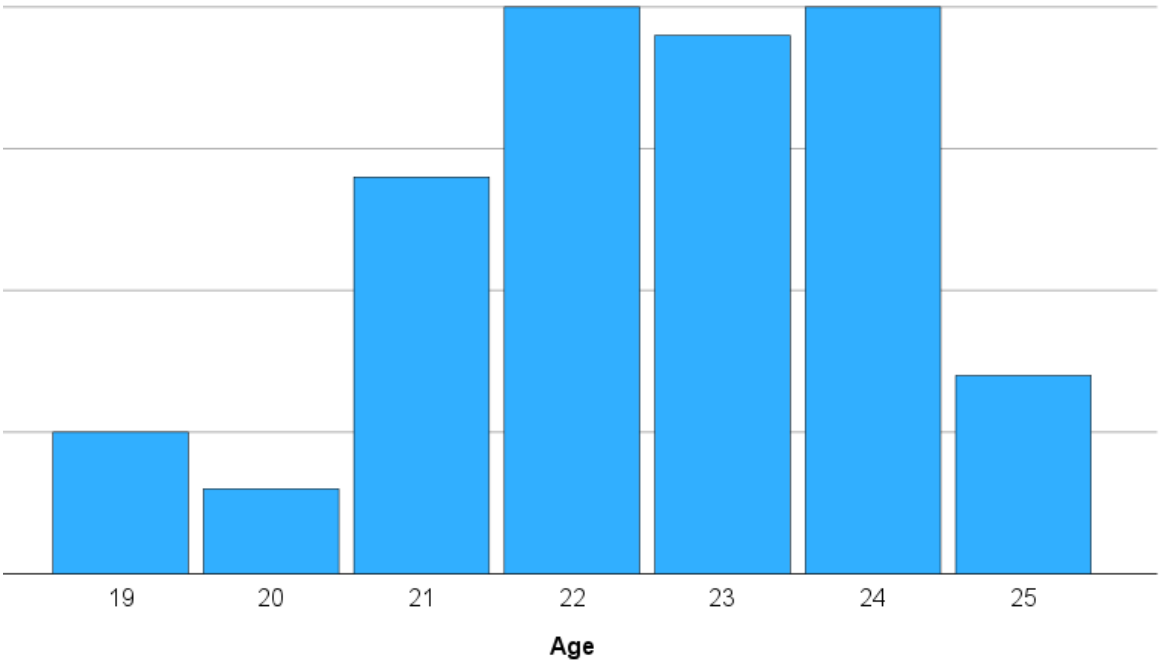


Table 7. Questionnaire age distribution

Age		
	Frequency	**Percent**
19	5	5.7%
20	3	3.4%
21	14	15.9%
22	20	22.7%
23	19	21.6%
24	20	22.7%
25	7	8%
Total	**88**	**100%**

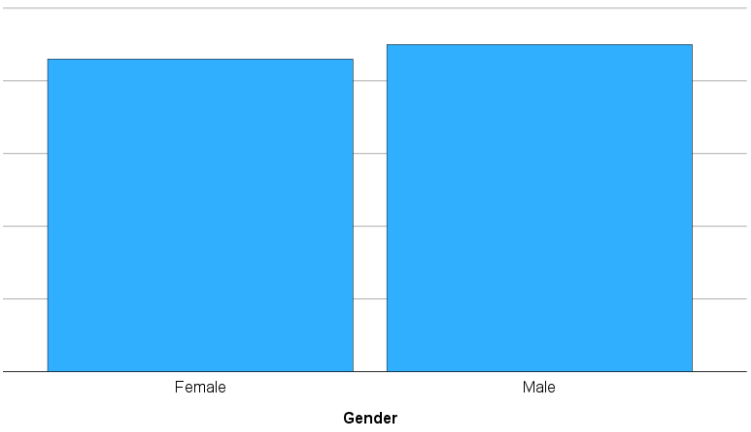


Table 8. Gender Distribution

Gender		
	Frequency	**Percent**
Male	43	48.9%
Female	45	51.1%
Total	**88**	**100%**

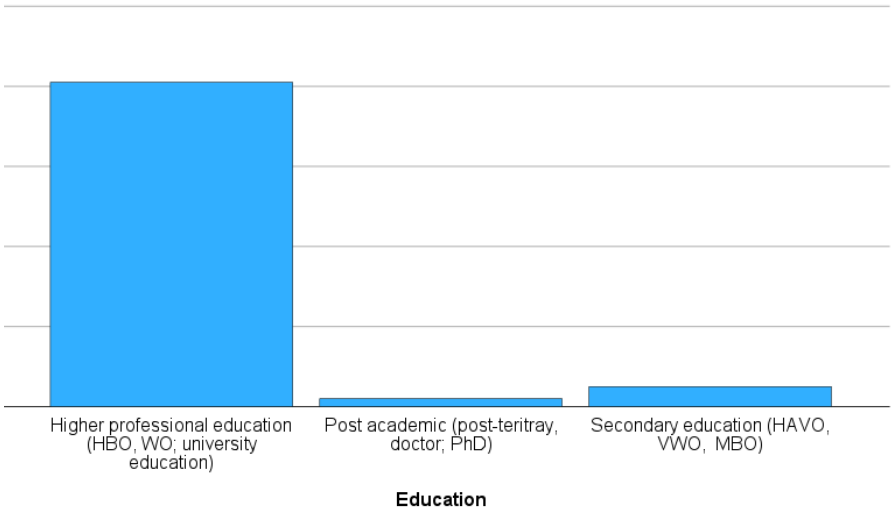


Table 9. Education Distribution

Education		
	Frequency	**Percent**
Higher professional education (HBO, WO; university education)	81	92%
Secondary education (HAVO, VWO, MBO)	2	2.3%
Post academic (post-teritray, doctor; PhD)	5	5.7%
Total	**88**	**100%**

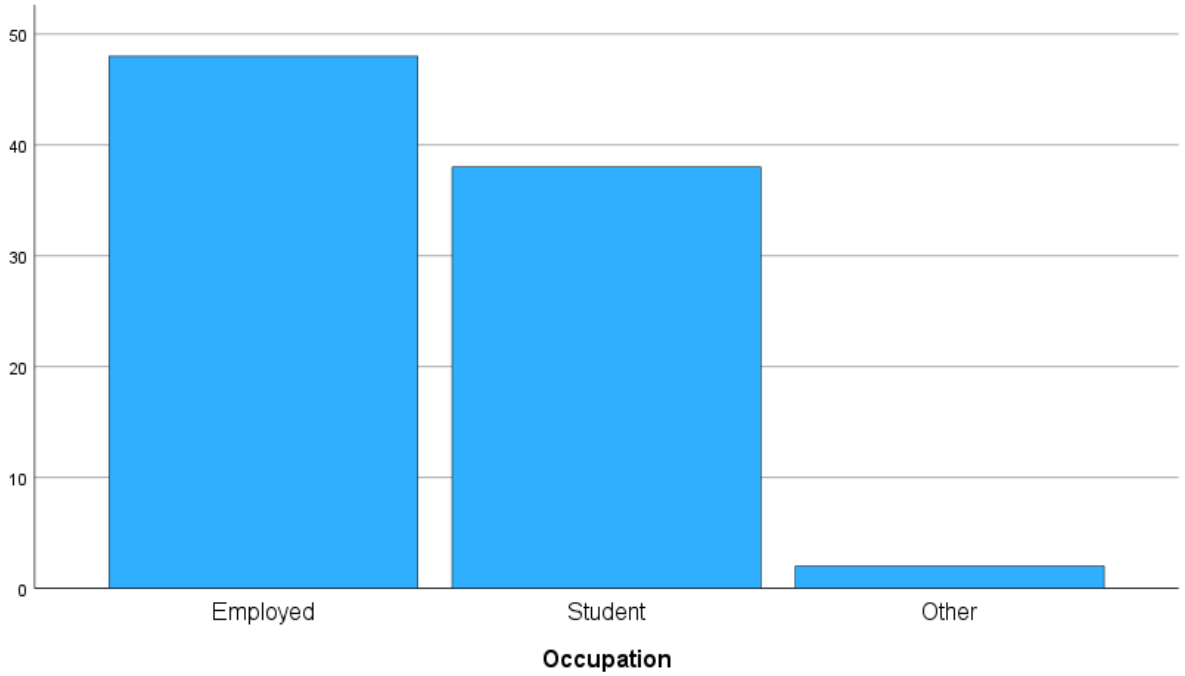


Table 10. Occupation Distribution

Occupation		
	Frequency	**Percent**
Employed	48	54.5%
Student	38	43.2%
Unemployed or other	2	2.2%
Total	**88**	**100%**

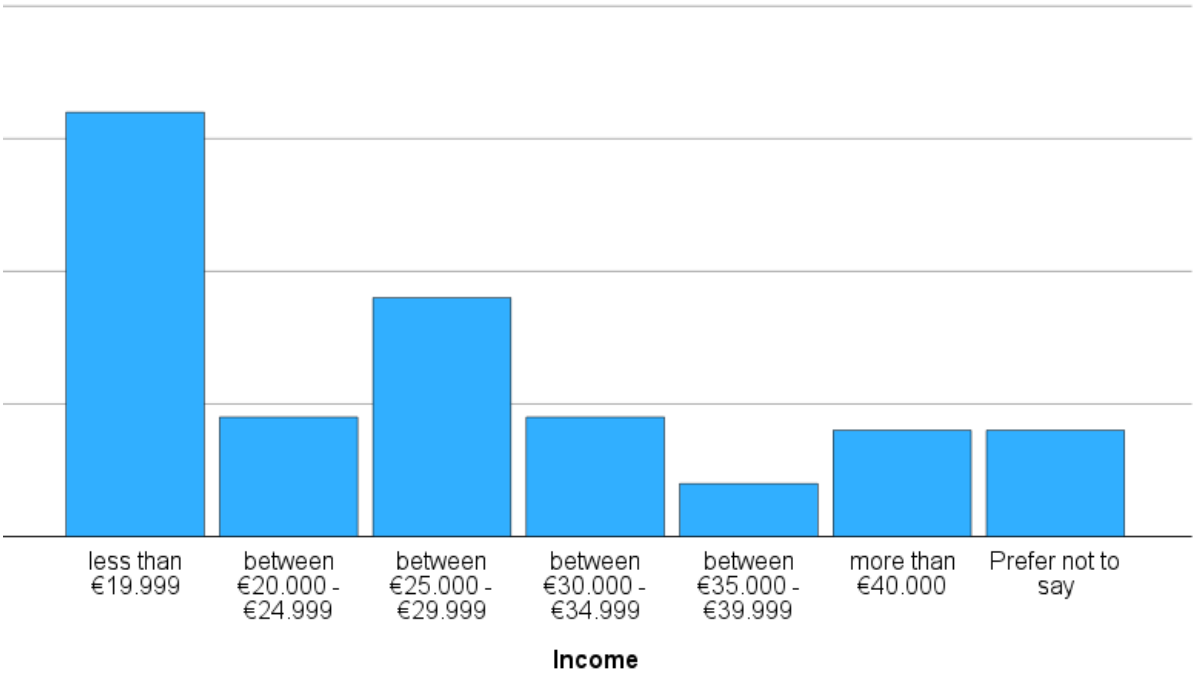


Table 11. Income age distribution

Income		
	Frequency	**Percent**
less than €19.999	32	36.4%
between €20.000 - €24.999	9	10.2%
between €25.000 - €29.999	18	20.5%
between €30.000 - €34.999	9	10.2%
between €35.000 - €39.999	4	4.5%
more than €40.000	8	9.1%
Prefer not to say	8	9.1%
Total	**88**	**100%**

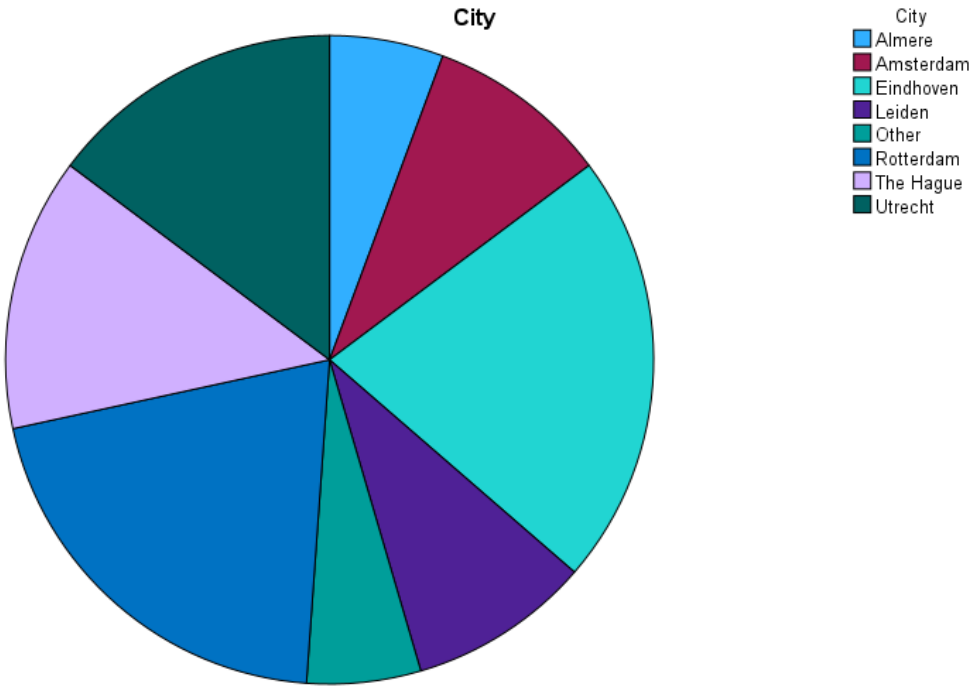


Table 12. Questionnaire city distribution

City		
	Frequency	**Percent**
Almere	5	5.7%
Amsterdam	8	9.1%
Eindhoven	19	21.6%
Leiden	8	9.1%
Rotterdam	18	20.5%
The Hague	12	13.6%
Utrecht	13	14.8%
Other	5	5.7%
Total	**88**	**100%**

Chi-Square Test

Consequently, in order to determine whether the gathered data sample is a good representative of the general Dutch population, a chi-square test that evaluates observed and expected values was conducted. The following equation describes the test.

$$\chi_c^2 = \Sigma \frac{(O_i - E_i)^2}{E_i} \quad [4]$$

Chi-square test was conducted using excel function (CHISQ.TEST) and all of the necessary information was derived. Table below presents the results with the significance of p>0.05.

Table 13. Occupation Distribution

Chi-Square Test Results					
	Gender	**Age**	**Income**	**Education**	**Occupation**
Chi-square statistics	0	55.964	10.046	54.53	12.667
Degrees of freedom	1	6	6	2	2
p-value	1	1.092e-10	0.121	1.5e-12	0.00176
Significance (p>0.05)	**no**	**yes**	**no**	**yes**	**yes**

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