Ecovillages in a Dutch context:

Different Clusters of Ecovillages from a Geographical Perspective

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Abstract

Nowadays, climate change is becoming an ever more pressing problem. Temperatures are rising, resources are running out and the single-use consumption economy is thriving. Simultaneously, urbanisation is an accelerating trend globally. Cities are becoming fuller of people and concrete, whilst urban green is becoming scarcer and nature less accessible to citizens. Ecovillage initiatives are part of a movement trying to counteract both of these trends for their inhabitants. Their housing initiatives consist of sustainable, bio-based building with reduced energy demands, autonomous food production and closed water systems. Moreover, ecovillages practice an extended community lifestyle in which they take care of each other, the shared garden and the rest of the neighbourhood amenities together. Ecovillages could be a blueprint for more ecologically and socially sustainable society. Unfortunately, the realisation of ecovillages is often unsuccessful due to planning policies and reluctant municipalities. Therefore, it is highly interesting to research these initiatives into more depth.

This research attempts to add to the academic debate and increase the knowledge on different types of ecovillages present in the Netherlands. To achieve this the Dutch context of ecovillages was researched and a hierarchical cluster analysis was executed. By conducting interviews with ecovillage representatives, more qualitative, integrated descriptions of different types of ecovillages were formulated, as well as additional general insights concerning the ecovillage movement.

Concludingly, three clusters were found. The first cluster is a rural village cluster with a focus on slow consumption, caring for each other and closed energy systems. The second cluster is a small city cluster with an emphasis on community and aiding those in need. The third cluster is a metropolitan cluster located in the west of the Netherlands in which citizens want to live less individualistic and more sustainable. In general, it became clear that all clusters aimed for ecology and community, yet less for spirituality. These objectives and other principles are best executed when an ecovillage is realised bottom-up. The process is easiest in a smaller municipality, as these are not bound by bureaucracy.

Keywords: Ecovillage – Hierarchical Cluster Analysis – the Netherlands – Sustainability – Resilient Communities – Collective living – Municipal relations

Preface

Dear Reader,

Today, I have finally finished my thesis report. It has been a long journey and I have learned a lot along the way. It was not always easy or fun, but I am proud of my accomplishments.

I would like to thank my supervisor, Dr. Martha Bakker, for supporting me with help and guidance along the way. Also, I would like to thank my interviewees for their time, knowledge and inspiration. I would like to thank my friends and family for being there when times were hard. Lastly, I would like to thank my fellow students for struggling with me in the thesis room in Gaia and eating lunch together every day.

I hope you enjoy reading,
Esther Peters
Voorhout, 25th of April 2025

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1. Introduction

1.1. Context

One of the seventeen Sustainable Development Goals formulated by the United Nations in 2015 is to *"Make cities and human settlements inclusive, safe, resilient and sustainable"* (United Nations, 2024, September 23). The Sustainable Development Goals are meant to realise the accomplishment of the 2030 Agenda for Sustainable Development. The 2030 Agenda aims to decrease inequality and poverty, and to improve health, education and economic growth worldwide, whilst battling climate change and increasing preservation of nature (United Nations, 2024, September 23). Currently, in 2025, the 2030 Agenda is becoming more and more pressing. The challenge of improving sustainability in the world's most heavily populated areas, should be tackled in a multitude of ways. One practice with a focus on both battling climate change and realising resilient settlements are *ecovillages*, which have been becoming increasingly popular since the 1990's (GEN, 2024, September 23).

The concept of ecovillages was coined in 1991 in a sustainability magazine (Mare, 2000). It was presented as the ultimate synthesis for a sustainable movement which included all emerging sustainability concepts into one. Several years later, in 1994, the Global Ecovillage Network (GEN) was founded, which organised meetings, communicated with sustainable communities globally and united them into a network of ecovillages that could learn from each other (Mare, 2000). The real take-off moment for the concept was a conference organised in the ecovillage of Findhorn, under the title of 'Eco-villages and Sustainable Communities Conference 1995'. The conference unexpectedly drew a large amount of attention and interested more than 800 people from all over the globe (Shaw, 2024). This enthusiasm symbolised the widespread concern of climate change and eagerness for action. Nowadays, about 70 ecovillages have been identified in the Netherlands and around a 1,000 worldwide (GEN-NL, 2021; GEN, 2023).

Although ecovillages used to be regarded as social experiments that explored alternative lifestyles and as social structures that minimise the exhaustion of nature, they have transformed themselves into an alternative lifestyle in which people reduce their ecological footprint and protect nature (Singh et al., 2019). Because of their counter-hegemonic narratives and efforts, ecovillages can be seen as a transformative actor regarding climate change (Hausmann, 2019; Avelino & Kunze, 2009). They have the potential to serve as a viable model for a truly sustainable future (Jackson, 2004; Van Eck dos Santos, 2017; Sevier et al., 2008). If ecovillages can be part of a solution to battle climate change, it is important to increase knowledge on their functioning to optimise the implementation of ecovillage initiatives.

1.2. Societal Relevance

However, the implementation of ecovillages has been problematic in the Netherlands. Oftentimes, there is uncertainty and hesitation regarding ecovillages within the policy field (Martens, 2023). Policymakers are unfamiliar with ecovillage practices and are therefore reluctant to make decisions. For instance, ecovillages are not granted permits for their initial construction, their ideas for sustainable infrastructure or other green initiatives (Van Dorst, 2015). Spectres of trailer parks, squatters and other informal practices discourage municipalities to support alternative lifestyle initiatives (Van Gemert, 2014). Furthermore, according to GEN-NL the problems are also caused by outdated laws, written prior to the awareness of climate change, the existence of holistic communities like ecovillages, and certain technological innovations (GEN-NL, 2021).

Considering the aforementioned pressure of climate change in combination with an ecovillage's transformative potential, municipalities could be missing opportunities to inspire change by neglecting their legislative power to make exceptions and create precedence (Schaatsbergen, 2019). Providing policymakers with more information about ecovillages, potential different types and characteristics can potentially improve the current situation. By increasing knowledge on ecovillages, the uncertainty and hesitation can be decreased or even annulled. Policy officers would then be able to make confident decisions based on relevant and contemporary knowledge, enabling more ecological initiatives through policy changes. The results of this research are therefore relevant to society.

1.3. Scientific Relevance

Many scholars have already researched the phenomenon of ecovillages and published articles on the matter. Various perspectives and topics have therefore been covered, as will be summarised in the next section.

1.3.1. Literary Background

First and foremost, there has been a lot of research into the sustainability efforts of ecovillages. Several scholars have calculated whether the ecological lifestyles and practices actually result in lower climate impacts. Research concludes that the ecological footprint per capita in an ecovillage is lower than for conventional households (Giratalla, 2010; Daly, 2017). Expressed in numbers, comparing the Irish averages to the averages of an Irish ecovillage, an ecovillage resident's ecological footprint for food is 2.3 times smaller, for transport is 9% lower and for water is 6 times smaller than the mainstream ecological footprint (Carragher & Peters, 2018). Ecovillages implement these savings via different experimental sustainable technological innovations, like wastewater management via photobioreactors (Smits & Ibáñez Martín, 2019), Sustainable Implants, helophyte filters and Combined Heat Power (Van Timmeren et al., 2007). Based on this, it is said ecovillages possess a high transition potential (Avelino & Kunze, 2009).

Other literature focusses more on sociopolitical and philosophical aspects of ecovillages. Ecovillages are referred to as utopian communities where sustainable societies can be imagined and practised (Casey et al., 2020). Residents of ecovillages are continuously constructing their environment and hence, develop social and ecological relations (Kirby, 2003). Moreover, people living in an ecovillage community are said to be constantly socially learning, as well as building and sustaining a cooperative culture (Mychaljuk, 2017). Thus, a collective identity is created through the community ethics (Ergas, 2010) resulting in an alternative paradigm that rejects the dominant Western worldview. This is visible in their recognition of human-ecosystem interdependence, their critique of the society/nature divide and their expanded notion of community (Van Schyndel Kasper, 2008). These postmaterialist values drive an increased social movement participation amongst inhabitants of ecovillages (Ergas, 2010). The values can also be of a more spiritual nature. Litfin (2009), for example, explains how the foundations of the ecovillage movement partly lie in holistic beliefs and the commitment to radical interdependence of human and natural systems. The practiced lifestyle can furthermore be based on Gaian theory, in which Earth is regarded as a living organism (Jackson, 2004). This holistic worldview is expressed through a low-impact way of life with initiatives such as permaculture (Litfin, 2009).

Lastly, there is some literature into geographical and spatial topics. Relevant to mention is a study by Saadi et al. (2022), into the locational preferences of ecovillage residents. It appears different variables were deemed important when comparing urban and rural ecovillages. In both, however, social and individual components appear most relevant. Urban ecovillages additionally value agricultural and economic components (Saadi et al., 2022). Another relevant study is the research by Escribano et al.

(2020). This study has attempted to formulate a typology of Ecological Intentional Communities based on the expected viability of the communities. The research was based on variables important to the material reproduction and thus survival of these communities. Mainly, ecovillages can be differentiated into transformative and instrumental ecovillages, in which transformative ecovillages can be subdivided into self-provisioning, production and training ecovillages (Escribano et al., 2020).

1.3.2. Knowledge Gap

As exemplified above, plenty of knowledge has previously been established about the technological, sustainable, sociopolitical, philosophical and other aspects of ecovillages. Geographical and spatial planning research, however, has only been regarded minimally. Besides, only one single research has been carried out to determine different typologies of ecovillages, regarding a specific niche topic, whilst it is known that the ecovillage movement is and has been very diverse in many regards (Magnusson, 2018).

Several scholars hence urge for further research on the practices of ecovillages. Barani et al. (2018), for instance, expresses a need to research more than just a one-dimensional view of ecovillages, but to rather take an integral perspective. Furthermore, according to Waerther (2014), a clarification of the positioning of ecovillages in dominant culture and their intent can aid ecovillages to become a relevant inspiring alternative to the mainstream lifestyle. Lastly, Xue (2014) calls for more research on the spatiality of degrowth developments, under which ecovillages fall. It can therefore be concluded that there is a knowledge gap in the academic knowledge on ecovillages and an urge for more research into them. Considering scientific purposes, it is hence relevant to research this into more depth.

1.4. Objective

1.4.1. Research Objective

The general objective of this research is to gain better understanding of ecovillages within the Netherlands, specifically regarding different typologies in order to better inform the spatial planning sector. A first intention is hence to explore whether ecovillages can be divided into clusters based on a number of geographical attributes. A second aim is to explore what variables define different ecovillages and what characterises possible different clusters. If successful, new knowledge will consist of a cluster division of ecovillages based on a set of geographical variables. The cluster division will include both quantitative and qualitative in-depth descriptions of the cases in each cluster. New knowledge can also include typology, derived from the cluster descriptions. Moreover, the results will contain general insights into ecovillages present in the Netherlands. Themes that will be touched upon will include objectives, ecological aspects, community aspects and the relationship with the municipality. As a result, the range of Dutch ecovillages and the amount of heterogeneity between them will become more clear and comprehensible.

1.4.2. Research Questions

Two general research questions have been formulated to guide the research towards this objective. These two questions help to divide the research into comprehensible parts. Besides, the binary research objective is best suited with two general research questions.

The first general research question is: “What types of ecovillages can be distinguished within the Netherlands from a geographical perspective?” This descriptive research question will be answered using a quantitative approach. The second research question is: “How can the types of ecovillages found in the Netherlands be described?” This explanatory question will be answered using qualitative

methods. Combined, these two research questions should provide extra knowledge to enable policymakers to adequately handle ecological initiatives, as well as address the academic knowledge gap regarding geographical cluster research into ecovillages.

1.4.3. Research Strategy

This research takes a sequential mixed methods approach. The first part consists of quantitative research, based on data gathering using ArcGIS Pro and analysis via SPSS. The outcome of the quantitative part provides analytical results about a list of ecovillages. In doing so, the quantitative part ensures an objective basis for the continuation of the research and therewith provides a level of certainty and objectivity within the results. The second part of the research consists of a qualitative approach, carried out through in-depth interviews. This qualitative research intends to provide more context and explanations to the results of the quantitative part. The report is then able to present a completer image of the findings combined with contextual explanations, which increases the practical use of the conclusions.

1.5. Reading Guide

The rest of the report will assume the following structure. After the introduction, a theoretical framework will be provided in which ecovillages will be further defined. The hypothetical framework used throughout the report will be disclosed. Next, the methods will be described. Considering the sequential mixed methods approach of the research, the methods will be split into a quantitative and a qualitative section. Each section will first discuss the data gathering methods, followed by the analysis methods. The methods will include a section on ethical considerations. Then, the results will be presented, again divided into a quantitative and a qualitative part. The discussion chapter will include further analysis of the results by placing them into contemporary academic context, along with limitations of the research and recommendations for further research. Finally, the report will close off with a bibliography and an appendix section.

2. Theoretical Framework

2.1. Theory

Definition

Many scholars have defined ecovillages in their works. As can be expected, definitions are generally similar although they differ on some details. Actually, Brombin (2018) even argues that the ecovillage movement is too heterogeneous to be defined in a single definition, so this section will attempt to provide an as complete representation as possible. The first published definition of ecovillages, by Gillman (1991) in his magazine 'In Context', described the phenomenon as a *"human-scale, full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development and can be successfully continued into the indefinite future."* (Gillman, 1991, 10). Other aspects were added over the years, resulting in the commonly accepted definition by the Global Ecovillage Network of an ecovillage as *"an intentional, traditional or urban community that is consciously designed through locally owned, participatory processes in all four dimensions of sustainability (social, culture, ecology and economy) to regenerate their social and natural environments."* (GEN, 2024, September 23).

What concretely sets ecovillages apart from intentional, traditional or urban communities, is the explicit focus on ecology, the extended notion of community, and the accompanying ecovillage ethic (Dawson, 2015; Van Schyndel-Kasper, 2008). Firstly, the focus on ecology is often executed by integration of ecological design and building, green ways of producing energy and heat, community gardens and permaculture, degrowth, and other alternative ways of protecting the ecology whilst living in it (Siracusa et al., 2008; Del Romero Renau, 2018). In practice, ecovillages might have organic food production, extensive recycling systems and closed water cycles as well (Bissolotti et al., 2006; Del Romero Renau, 2018). Secondly, the extended notion of community refers to the bottom-up nature of the initiatives, their conviviality values, commons thinking and a sharing economy (Schwab & Roysen, 2022; Hong & Vicdan, 2016; Koziol, 2020). Often, this is executed by communal actions, such as eating together, cooperating on garden maintenance, buying each other groceries when necessary, and sharing tools and cars. Thirdly, the ecovillage ethic refers to the mindset of the community which everyone shares and fulfils to succeed. Examples are conflict resolution, limited hierarchy, self-development practices, and the spirituality of interconnectedness as an ultimate objective (LeVasseur, 2013; Hall, 2015; Papenfuss & Merritt, 2019). Ecovillages used to be considered social experiments, yet now they are increasingly recognised as an example of grass roots level sustainability (Singh et al., 2019) as well as guides to action and role models (Jane, 2020 as cited in Voltz, 2022).

Summarised, ecovillages are intentional communities focussing on a sustainable lifestyle that ensures stewardship of nature through local, participatory initiatives and projects, often operating on ecological, spiritual and social levels. This is also the definition that will be handled throughout this research.

Discrepancies

In theory, ecovillages are thus a perfect practice towards an ecologically integrated, self-sufficient, locally led, convivial society. Some academics, however, have expressed concerns and inconsistencies. Dawson (2006), for instance, argues how ecovillages - in spite of their efforts - are inextricably linked to the dominant destructive global economy. An example is when ecovillages organise workshops and tours against a fee, showing their dependence on the culture of consumerism. Another problem for

ecovillages, are the financial risks that can lead to decrease of the ecovillage ethos. Ecovillages are namely often prone to financial problems, as residents regularly do parttime work within the community, yet simultaneously suffer higher expenses for habitually purchasing biological and local products (Zimmermann, 2023). As Temesgen (2020) observes, ecovillages under financial stress can unintentionally weaken their values, which results in decreased sustainable practices and less application of the ecovillage ideology. This means that ecovillages might start off with strong ecological practices, but might minimise their efforts after existing for a while (Temesgen, 2020). Worse reportedly occurs in Spain, where a distinction between actual social transformation ecovillages and green capitalist projects without ecovillage ethos can be made (Del Romero Renau, 2018). Aware of the financial pitfalls, Litfin (2014, as cited in Goell, 2015) states that ecovillages should not overstep the size of a village in order to remain an autarkic society. Final pitfalls, according to Marckmann et al. (2012), include the overlooking of sustainable potential in ecovillages. Residents tend to emphasise visible and pioneering technologies whilst forgetting the low-hanging fruit. Furthermore, ecovillages still lose on energy efficiency compared to traditional blocks of flats, due to their preference for semi-detached, spacious housing style (Marckmann et al., 2012). Lastly, ecovillages have not yet addressed the mainstream growth in consumption patterns, thus far failing the promise of transition potential.

Context & Perceptions

It is interesting to consider how locals and other non-ecovillage parties perceive ecovillage initiatives. Oftentimes, mainstream society negatively regards ecovillages as mythical islands with objectives of self-reliance and private community building (Andreas, 2013). Stereotypically, the ecovillages are thus seen as an isolated community with little added value to the mainstream civilisation. Following this, a case study on Ecovillage Woldwijk in Ten Boer, Groningen, has concluded that locals are sceptical at first, seeing the initiative as different and alternative. However, when time passed and interaction occurred, locals began to participate in events and started to positively adjust their perceptions (Siebert, 2023). This change of heart, nonetheless, does not apply everywhere. Neighbours of Ecodorp Bergen, Ecodorp Allemansland and Ecowijk Het Groene Spoor have repeatedly protested against the location, behaviours and perceived illegality of initiatives, sometimes even successfully (Hensbergen, 2021; Boudewijns, 2025; Willems, 2024). Other outsider understandings of ecovillages involve the eco-building approach. Houses in ecovillages can be considered uncomfortable as they are designed in a very basic way, surrendering on luxury. Besides, the architecture is sometimes seen as quirky and culturally out-of-place. These characteristics make eco-housing less appealing and less accepted amongst mainstream society (Pickerill, 2012).

Municipalities and other authorities do not commonly share one opinion regarding alternative housing initiatives. Some municipalities have strongly supported ecovillage initiatives whilst others have disregarded or actively rejected them. In Boekel, for instance, the local ecovillage initiative fit well within the hedonist-realist planning culture and was thus personally supported by an alderman (Van Rooy, 2018). Contrarily, in Wijbosch, initiative Ecobosch was denied support by both the municipality and the province after determining the plans simply did not fit within current regulation (Van Schijndel, 2025). Rejection and reluctance, or acceptance and support by a government will be dependent on the political environment in which an ecovillage exists (Ergas, 2010). Since ecovillages often operate in a non-mainstream, anti-hegemonic type of way regarding politics, an Othering discourse following us/them thinking is regularly performed between initiatives and municipalities (Lennon & Berg, 2022). Semi-governmental organisations have nonetheless recently started calling on local authorities to acknowledge the advantages of alternative living forms and take more actions accordingly (Goossens & Van der Zanden, 2024).

Little has been documented about the ecovillage movement in a Dutch context. What is known, is that an ecovillage movement is certainly present. It is, however, less self-evident that ecovillages can realise themselves due to complicated national policies (Van Dorst, 2012). Oftentimes, they are therefore realised in cooperation with a local government. Moreover, from a global perspective, the Netherlands hardly have any rural areas that are not in close proximity to a large city. Dutch ecovillages can therefore not exist in the same autarkic way that applies to non-Dutch ecovillages (Siebert, 2023; Van Dorst, 2012).

2.2. Operationalisation

2.2.1. Geographical Variables

Considering this research is executed from a spatial planning perspective, spatial and geographical variables can be considered relevant to the analysis. The research objective, as aforementioned, is to increase knowledge and insights on ecovillages regarding typologies in order to improve informed decision-making in the policy field. Therefore, the focus will be on geographical variables.

A first reason to include geographical variables, is because they are able to describe a neighbourhood based on unbiased facts. The neighbourhood around an ecovillage can thus be described objectively during the research. Moreover, geographical variables are often of importance in the planning practice as they describe processes within public spaces, meaning that they might reveal unexpected effects and relations between variables and ecovillages. Lastly, geographical variables are crucial to anchoring broader, abstract social processes to physical locations (Ballinger, 2011). In this research specifically, using geographical variables will also help to demarcate a clear framework. It provides a focus during the analysis and hence helps to contextualise the results.

2.2.2. Dimensions, Indicators & Variables

Within the scope of geographical variables, different dimensions were examined during the research. Namely, demography, economy, education, ecology, politics and facilities. Each of these dimensions was considered relevant to the analysis, because of their expected effect on the settling location of an ecovillage. The dimensions have been operationalised into indicators and corresponding variables as presented in table 1. The relevance of each dimension and indicator will be discussed hereafter.

Operationalisation of Quantitative Variables

	Concept	Dimension	Variable
Geographic Variables	**Demography**	Population Density	Rate of urbanity
			Population Density
			Liveability
		Accessibility	Distance to train station
			Distance to bus stop
			Distance to Big City
	Economy	Housing	Average Property Value
			Average agricultural land price
			Private-owned housing
			Rental housing
		Employment	Job Availability
			Number of companies
			Labour participation
			Inhabitants with social benefit
	Education	Educational Facilities	Number of primary schools within 5 km
			Distance to University of Applied Science
			Distance to University
	Ecology	Climate	Climate Health Risk
			Flood risk
		Nature	Distance to body of water
			Distance to Dutch nature network
			Distance to Natura2000
	Politics	Political colour of municipality	Largest Party in Municipal Council
	Facilities	Density of Amenities	Number of GPs within 5 km
			Number of grocery stores within 5 km
			Number of kindergarten within 5 km
			Distance to picking garden

Table 1: Operationalisation of Concepts into Quantitative Variables

Firstly, the dimension of demography will be analysed by variables concerning population density and accessibility. The variables concerning population density will clarify in what kind of surrounding an ecovillage is located. For instance, a dense urban area or an accessible rural area. According to research in Spain, ecovillages often exist in rural areas in close proximity of a central city (Del Romero Renau, 2018), making it interesting to see whether that applies to the Netherlands as well. The type of area is expected to be relevant for an ecovillage community looking for a site to realise their alternative lifestyle.

Secondly, the dimension of economy has been subdivided into housing and employment. Housing has been operationalised by variables considering housing and land prices, as well as types of housing. The state of the housing market is very relevant to municipalities, considering they are a large

contester in buying and allocating land. This can be a strong determinant when supporting or rejecting an ecovillage initiative, also considering ecovillages are often able to provide relatively cheap purchasable housing to their residents (Adalilar et al., 2015). Nevertheless, they also take up a lot of space because of the extended amount of green and low level housing. Employment, represented by the number of jobs and companies, labour participation and inhabitants with a social benefit, can be interesting as ecovillage communities are known to work less employment hours and can offer onsite job opportunities (Hall, 2015; Adalilar et al., 2015). Besides, a municipality might consider an ecovillage a positive addition to a neighbourhood that is underperforming, because ecovillages aim to positively activate a community.

Thirdly, the geography of education is researched by analysing the locations of primary schools, universities and universities of applied science in relation to the locations of ecovillages. The distance to primary schools is considered interesting as ecovillagers purposefully choose to live in a community aiming to consist of all generations, thus including children, teenagers and adolescents (McGlaughlin, 2016). The distances to universities and universities of applied science are considered interesting, because ecovillage initiatives are expected to emerge more often in a location with a concentration of high-educated residents (Meltzer, 2005; Williams, 2005). Education is even referred to as "the single most promising catalyst for widespread participation in the sustainability transition" by Wahl (2018).

A fourth, very important dimension is ecology. Ecology, as a dimension, has been operationalised by variables concerning climate risks and the nearby presence of nature. The importance of nature and ecology to an ecovillage community has previously been explained and does not need to be emphasised further. It is therefore considered evident that an ecovillage is expected to be located near nature, a body of water and in an area with little noise and air pollution (which are included in the variable of climate health risk). In addition, a municipality with nature preservation goals might encourage ecovillages to settle near protected areas, because ecovillages have the potential to preserve nature for two reasons. One, ecovillages will not harm the ecology unnecessarily as their goal is to improve its condition. Two, when executed in the right way, local authorities can use the presence of the local community to enforce policies protecting nature (Gurney et al., 2021).

Fifth, the dimension of politics has been operationalised by only one variable, namely the largest political party in the municipal council. Considering the political environment will influence ecovillage initiatives by facilitating or inhibiting actions (Ergas, 2010), it is very relevant to analyse what political party is most present in the municipal council. It is expected the political colour, e.g. left, right, progressive, conservative or green, of a municipality has effect on the settling of an ecovillage.

A last dimension is the density of amenities near an ecovillage. Ecovillages are often portrayed as isolated, yet it has been proven impossible for ecovillages to survive cut off from global society (Mare, 2000; Singh et al., 2019). Therefore, it is interesting to research where ecovillages position themselves in relation to amenities providing primary and secondary human needs.

In total, the research will quantitatively asses 27 variables. The concepts, dimensions and variables have been chosen carefully, in order to research all relevant aspects of the ecovillages. However, the research was obliged to limit the number of variables for accuracy of the cluster analysis, time limits and availability of data.

3. Methodology

3.1. Research Design & Approach

The research took a sequential mixed methods approach, meaning quantitative methods were applied first, followed by a qualitative phase. This approach was deemed suitable for several reasons. Firstly, a sequential mixed methods approach fits well with an exploratory research objective. As there are two phases in the research, which are designed sequentially, there is room to adjust the second research phase according to the results of the first. The first phase can be designed to explore many different aspects of a phenomenon, whilst the second phase then focuses on a selection in more depth. Secondly, this research design is able to handle a large level of complexity as the strengths of both quantitative and qualitative methods will be applied instead of just one. Thirdly, a mixed methods approach will generate more deepened insights, due to the double nature of the results.

The research started with a quantitative phase. For this part, a cross-sectional research design was chosen. As the research objective is exploratory and inductive research will be used aiming to support planning policymakers, a cross-sectional research design was deemed suitable. The research obtained a large number of cases without using sampling criteria, besides fulfilling the ecovillage description. Consequently, the research featured a sample of cases with high heterogeneity that is large enough to generalise conclusions. The data gathering and analysis took place within a delimited amount of time, all consistent with a cross-sectional research design (Bryman, 2012).

The qualitative research was executed according to a general qualitative approach. The goal was to seek explanation and context for the results of the quantitative research. Any patterns or explanations found, could be translated into the basis for new theory, according to the induction approach. In this research, the expected result was a typology of ecovillages present in the Netherlands. Basing itself on the quantitative part of this research, the qualitative part studied several ecovillages in-depth and looked for patterns whilst enjoying the support of the quantitative results.

3.2. Sample

During the research, a sample of Dutch ecovillages was used throughout the data gathering and analysis. An attempt was done to draft a large database of ecovillages, containing the majority of Dutch ecovillages. To this end, multiple sources with enumerations of ecovillages were contemplated. For each found ecovillage, it was carefully considered whether the case or cases meet the definition of an ecovillage as determined in this research. An example of a source used, is the GEN-NL: the Dutch network of ecovillages.

The data gathering did not aim to make a complete list of all locations of Dutch ecovillages for two reasons. Firstly, it is likely impossible to successfully find all ecovillages. For one, there will always be ecovillages that do not publicly present themselves as ecovillages or ones that would rather not be found. Besides, one can never be certain to have found all ecovillages and can therefore never truthfully claim to have composed a complete list. Secondly, considering the research objective, it is not relevant to have a complete set. As long as the sample is cross-sectional and is reasonably representative of the population, the results should not be effected negatively. Therefore, the aim was to compose a list of at least 40 ecovillages, as this would be roughly 50% of the estimated total of 70 (GEN-NL, 2021).

3.3. Quantitative data

3.3.1. Data gathering

The quantitative data gathering started by making a list of locations of Dutch ecovillages, as they were the dependent variable. Using the Google search engine, ecovillages were found and collected in a Microsoft Excel file. Websites used were the website of GEN-NL (2024), PuurPermacultuur (Ballemans, 2022) and Omslag (Resink, 2024). For each found ecovillage, its name, its address, postal code, city and province were entered into an Excel file. As aforementioned, no attempt was made to compose a complete representation of all currently existing ecovillages. Rather a sample of the majority, because they are expected to deliver the same results. When a certain level of saturation was reached, it was assumed the majority of ecovillages had been found. This occurred when no new ecovillages were found in several searches and the same cases kept appearing. The data gathering resulted in a total of 67 ecovillages. Then, the Excel table was considered finished and transferred to ArcGIS Pro. The ArcGIS World Geocoding Service, part of the Geocoding tool, was used to create a point file of the addresses. Using the street names, postal codes, cities and provinces, all ecovillages were geocoded and presented on a map layer as visible in figure 1.

Figure 1: Map of Ecovillages in the Netherlands (GEN-NL, 2024; Ballemans, 2022; Resink, 2024)

After the dependent variable, the data gathering continued searching for data on the independent variables. The independent variables, as explained in the Theoretical Framework, focused on geographical variables that are expected to have an effect on ecovillages. This can be either because a municipality specifically does or does not want an ecovillage in a certain location, or because an ecovillage does or does not prefer a location itself. The data gathering started out by searching for the predetermined variables via online databases. Many combinations of search terms were used, mainly consisting of different ways to describe an independent variable with the addition of a search term for spatial data. For example, when looking for data on job availability, the following search terms were used in different combinations: ‘jobs’, ‘work’, ‘job availability’, ‘economy’, ‘socioeconomic statistics’, ‘data’, ‘map’, ‘spatialised’, ‘per area’, ‘planning’ and ‘the Netherlands’. Often used sources were CBS, PDOK, Nationaal Georegister and data from governmental departments.

Of course, the data gathering was dependent on the availability of data and subject to a limited time frame. Therefore, new relevant variables were added during the data gathering and some old variables had to be deleted from the prearranged list. This occurred when data were not available, too old, when other occurring variables were considered more accurate than the original variable, or when a variable had not previously been listed yet was considered relevant. The final list of variables is presented in table 2 along with their unit and source. The level of measurement is ratio for most of the variables.

Three variables are of an ordinal scale and one variable is nominal. None of the variables have missing values. More information about the data is summarised in appendix 8.1.

Data Information		
Variable	**Unit**	**Source**
Population Density	km2	PDOK, 2024
Distance to Big City	m	CBS, 2024; via PDOK
Rate of urbanity	5 through 1	CBS, 2024; via PDOK
Private-owned housing	%	CBS, 2024; via PDOK. KadastraleKaart.com
Rental housing	%	CBS, 2024; via PDOK. KadastraleKaart.com
Average Property Value	€	CBS, 2024; via PDOK
Average agricultural land price	€/ha	Kadaster, 2024; via Boerderij.nl
Job Availability	#	LISA, 2023
Number of companies	#	LISA, 2023
Labour participation	%	CBS Statline, 2023; via Pzinfo
Inhabitants with social benefit	%	CBS, 2024; via PDOK
Number of GPs within 5 km	#	CBS, 2024; via PDOK. PZH, 2024; via NGR
Number of grocery stores within 5 km	#	CBS, 2024; via PDOK
Number of kindergarten within 5 km	#	CBS, 2024; via PDOK
Number of primary schools within 5 km	#	CBS, 2024; via PDOK
Distance to University of Applied Science	m	Vereniging Hogescholen, 2024; edited
Distance to University	m	Allecijfers.nl, 2024; edited
Distance to train station	m	NGR, 2023
Distance to bus stop	m	RUG, 2021; via ArcGIS HUB
Climate Health Risk	%	RIVM, 2020; via Atlas Leefomgeving
Flood risk	0 through 4	LIWO, 2021
Distance to body of water	m	Kadaster, 2023; via PDOK
Distance to picking garden	m	Pluktuinen.nl, 2024; edited
Distance to Dutch nature network	m	Bij12, 2024; via PDOK
Distance to Natura2000	m	CBS, 2024; via PDOK
Liveability	0 through 5	Ministerie van BiZa en Koninkrijkrelaties, 2020
Largest Party in Municipal Council	1, 2, 3, 4, 5	Kiesraad, 2023; via Overheid.nl

Table 2: Information regarding Quantitative Variables (n=67 for all)

Most datafiles were complete upon discovery, yet some lacked values. These thus had to be completed by hand with elsewhere retrieved data to complete the data set. When all were complete, variables were added to ArcGIS Pro one by one to generate values per case. Some data were already offered in a spatial format and were therefore immediately added to the map in ArcGIS Pro. Other data consisted of tables with statistics per municipality or other administrative region, and therefore had to be spatialised before being able to add them as a map layer. This was done via the Spatial Join tool and a CBS-file with maps of administrative areas. An example was the agrarian land prices, which were listed per agricultural region. These were joined to a map of agricultural regions via the regional names in the attribute table. A last group of data consisted of points with addresses. These were geocoded via the ArcGIS World Geocoding Service. A complete list of the actions executed per variable can be found in appendix 8.2.

In ArcGIS Pro, the obtained data layers were added to four different maps. The maps, named ‘Attribute Join’, ‘Spatial Join’, ‘Near’ and ‘Extract Values’, contained different datafiles organised based on the tool needed to determine their value per ecovillage. By means of these four spatial extraction methods, attribute tables with values were generated for each variable.

In the Attribute Join map, layers were joined via the action 'Add Join' based on an attribute in the Attribute Table. An example is the variable 'Largest Party in Municipal Council', which was joined via the municipality's name. In the Spatial Join map, data were joined via spatial attributes. For example, the average housing value was joined via 'Add Spatial Join', based on the location of an ecovillage within the target feature. For some datafiles, namely the density variables, an extra action was needed prior to the Spatial Join. Such as the number of primary schools within 5 kilometres. To generate this value, a 5 kilometre buffer was generated for each ecovillage via the 'Pairwise Buffer' function. Then, a Spatial Join was carried out to collect all primary schools within the buffer, after which the sum of primary schools was interpreted via the 'Join_Count' attribute in the attribute table. In the Near map, the distances between ecovillages and another feature was calculated via the 'Generate Near Table' function. This was carried out for, for instance, the distance to train stations. During this action, the 'Find only closest feature' box was checked, the Planar method was used and metres were used as the distance unit. In the Extract Values map, data were extracted from a raster file to an ecovillage location. For example, the values for the Environmental Health Risk were extracted via the 'Extract Values to Points' function.

All explained methods provided values for each case per variable in a table within the ArcGIS maps. These tables were exported as .csv files into Excel. Thereafter, the tables were reduced and organised to contain only the names of the ecovillages and the relevant values. Some variables had to be converted from absolute numbers to percentages. All attribute tables were then combined into one Excel masterfile containing all values.

Before continuation, the file was properly checked on missing values and errors. Foremost, this was done by looking for obvious outliers, for example percentages higher than 100% or values below zero. To do so, the Excel function 'Sort by Ascending' was used, as the values could then be easily regulated. When a value was missing, the case and variable were revised in ArcGIS Pro and added by hand. An extra check was performed by double-checking whether the values in the Masterfile and the values in the original Excel spreadsheets matched for two of the cases. Any mistakes found were corrected by returning to the individual Excel table for the original values or by using other data. When the check eventually turned up without mistakes, the dataset was considered reliable. Hereafter, variables were put in a similar format and unit as much as possible to minimise the differences in scale of the variables. This ensures more accurate results during the data analysis.

As a last step of the data gathering, the Masterfile was transferred into SPSS, where the data were checked once more for accuracy. First, the automatically assigned level of measurement was checked and changed if necessary. Second, the number of decimals was adjusted to a suitable number. For instance, persons, amounts of money and companies were rounded to whole numbers, percentages were rounded to two decimals, and distances to one decimal. Third, string variables were transformed into numerical variables, because a cluster analysis cannot function with values expressed in text. After this action, the dataset contained mainly scale variables, three ordinal variables and one nominal variable.

3.3.2. Data analysis

To start the analysis, descriptive statistics and frequencies were calculated for all variables. In SPSS, the minimum, range, median and interquartile range were generated via 'Analyse', 'Descriptive Statistics', and 'Descriptives' or 'Frequencies'. These descriptive statistics are useful to get more familiar with the obtained data, making it easier to understand and interpret results. It can also uncover any discrepancies in the data, making the eventual results more reliable. The minimum and range will shed light on the dispersion of the values per variable. The median will reveal more about the central

tendency of a variable. The median was preferred above other measures of central tendency, like the mean, as it is both suitable for ordinal variables and negligent of outliers. The interquartile range is a measure of statistical dispersion. Combined with the median, being the 50th percentile, the interquartile range (IQR) shows the range between the 1st and 3rd quartile, telling more about the spread of the values.

Next, the cluster analysis was carried out. A hierarchical cluster analysis (HCA) was considered most suitable for this research, because of several reasons. Firstly, multiple levels of measurement were present in the data, namely, nominal, ordinal and ratio variables. A HCA can handle these different levels of measurement. Secondly, the scales of the data were quite varied. Values differed from percentages between 0% and 100%, to average housing values like €521,000. When carrying out a HCA, SPSS provides the option to standardise the values, allowing irregular scales of data to be entered. Thirdly, the research uses a relatively small dataset. These are three characteristics of the dataset that a HCA can handle well, as opposed to K-means cluster (which is meant for very big datasets) and Two-Step cluster analyses (which cannot comprehend nominal data). Other advantages of the hierarchical cluster analysis are that it does not require a predetermined number of clusters and that it provides transparency into the results. Furthermore, as a HCA produces a hierarchy of clusters and presents this in a dendrogram, which is highly useful for understanding data and the relationships between cases. Hence, a hierarchical cluster analysis suits the research, with its exploratory objective, well.

The HCA was executed in SPSS via ‘Analyse’, ‘Classify’ and ‘Hierarchical Cluster’. The HCA in SPSS takes an agglomerative approach as opposed to a divisive one, meaning that it starts with each case as an individual cluster, before linking cases together to start forming clusters. Before the real analysis, a cluster method of ‘Single-Linkage’ was used, as this can uncover outliers threatening to disturb the results. If this analysis shows any obvious outliers, the cases can be excluded from the research. Then, for the actual clustering, Ward’s Linkage was used. This method maximises the significance of the distances between clusters whilst continuously starting from the central point of the sample. Hence, it is expected that Ward’s Linkage will provide the most balanced result with the most clearly removed clusters. Additionally, the variables were standardised using Z-scores to balance out the different scales of the variables. Moreover, squared Euclidean distance was used to maximise large differences between values. Finally, a dendrogram, agglomeration schedule and icicle plot were produced.

The dendrogram and the agglomeration schedule were used to determine the most suitable number of clusters. The dendrogram presents the agglomeration of clusters in a tree-like shape. The distances between the embranchments symbolise the distances between different cluster centres. Meaning the larger the distance between embranchments, the larger the heterogeneity between the clusters. Then, the agglomeration schedule was used to plot the heterogeneity coefficient in a line graph. Interpreting the line graph was done using the elbow method, which simply looks for a sharp curve in the line, representing the most logical cluster division. The research has combined these two analysis methods to determine the appropriate number of clusters. Then, the HCA was run again, this time with a predetermined numbers of clusters as ‘Single Solution’ whilst utilising the ‘Save’ function to create a new variable containing the cluster membership.

To analyse the fitness of the results, a silhouette analysis was carried out via ‘Analyse’, ‘Classify’ and ‘Cluster Silhouettes’. All variables were entered as cluster variables with the assigned cluster membership as cluster number. This analysis produces a new variable with a score ranging from -1 to 1 per case, measuring how well they fit within the assigned cluster. It thus quantifies the quality of a

cluster. A score of -1 embodies poor clustering and a score of 1 embodies perfect clustering. A histogram can be drafted to visually represent the distribution of the cases per cluster based on their silhouette score. Moreover, a table is produced that calculates the mean silhouette score per cluster. Both these products were used to critically reflect on the quality of the cluster analysis. The analysis additionally creates a new variable called ‘Next Best Cluster’. As the name suggests, the Next Best Cluster suggests what cluster a case is best assigned to, after the current cluster membership. Considering that a hierarchical cluster is not an iterative method, causing some cases to be assigned a less suitable cluster, cases with a very bad silhouette score (lower than -0.5) were assigned to another cluster by hand. Afterwards, the silhouette analysis was rerun. The researcher then checked whether this indeed improved the robustness of the clusters according to the silhouette analysis.

After the clusters had been finalised and their quality was approved, an ANOVA was run. The SPSS commands used were ‘Analyse’, ‘Compare Means and Proportions’ and ‘One-Way ANOVA’. All independent variables were entered to check whether the variance of the variables between the three clusters was significant. A significance of 99% was applied, translating to a p-value smaller than 0.01, which was determined from the ANOVA table. Additionally, the ANOVA effect sizes were calculated. These show how much of the variance in the clustered ecovillages can be explained by one of the independent variables with a score between -1 and 1. For this research, the Omega-squared fixed effect was most suitable as eta-squared is considered too biased. Based on the ANOVA and the ANOVA effect sizes, a smaller selection of variables was made with a significance of 99% and an effect size of above 0.4. These variables were considered most influential on the cluster analysis, and thus most relevant for the qualitative analysis.

Further, a Tukey HSD test was performed for all variables. This test produced a Multiple Comparisons table, showing exactly which clusters significantly differ from each other per variable. Based on this, a table was produced in combination with the medians per clusters. The table only shows variables with a significance of 99%, as insignificant variables will not show any interesting patterns. It shows what clusters are significantly different and which are not per variable using superscripts above the median. Significantly different clusters receive a differentiated superscript whilst clusters with an insignificant difference receive the same superscript. The results from the Tukey test can be used to gain more insight into what distinguishes the clusters.

In order to present the results in a more visual way, boxplots were generated for significant variables with an effect size higher than 0.4. By generating boxplots for these variables per cluster, differences between the clusters become visibly clear. The boxplots can then be used to formulate a more insightful quantitative description of the found clusters, as boxplots very clearly show the range between the cases.

3.4. Qualitative data

3.4.1. Data gathering

The qualitative data gathering aimed to describe the quantitatively found clusters with more elaborate insights and explanations. Therefore, structured interviews were executed with representatives of ecovillages. Representatives of ecovillages could be impersonated by seasoned inhabitants, initiators, or members of the board. For every found cluster, a minimum of three interviews were planned. With three found cluster, a total of ten interviews were conducted. To set up the interviews, a total of 18 ecovillages were approached via e-mail or their website. These were randomly picked from the cluster membership table. The only criteria were that the ecovillage had clear contact information on their website and that the initiative was fully realised for a few years already. In the sent message, the research objective was explained and information about the interview was given. Also, interviewees with extended knowledge of their ecovillage were requested. Out of 18, about 12 ecovillages responded to the message and 10 were willing and able to participate in the research. The interviews were held either physically in the ecovillage or via Teams and lasted one and a half hour on average. A list of the interviews with details on duration and location can be found in appendix 8.3.

The interview item list was based on the results of the quantitative research. Namely, on the significant variables with a high effect size, which were thus most relevant to the cluster division. These included the number of jobs and companies in the area, the percentages of rental and private housing, and the density of GP's, grocery stores and primary schools. Several other topics were included to the interviews, as they were considered interesting for general knowledge on Dutch ecovillages. For instance questions concerning the realisation of the ecovillage and the relationship with the municipality. All questions were asked to be able to provide more qualitative descriptions of the clusters. Per item, several example questions were formulated, which were used during the interviews. Which questions were asked exactly, was based on the context of the ecovillage and the course of conversation during the interview. The general interview item list can be found in appendix 8.4.

Every interview was preceded by signing a consent form, the format of which can be found in appendix 8.5. Through this consent form, an interviewee acknowledged their voluntary participation and informed consent to being interviewed, recorded and the data being used in a research. Consent forms were mailed to the interviewee in advance, so that they were able to read the form carefully, prepare any questions and sign it at their own convenience. After having signed the form, interviewees were always asked whether they still had questions, whether they wanted to receive a transcript of the interview, and whether they wanted to receive the final product. The interview was then recorded via either Microsoft Teams or a phone recorder app, depending on the setting. Afterwards, the recordings were transcribed, by hand or via Teams, depending on the quality of the recording and the recording method. When transcribed via Teams, the transcript was thoroughly checked on errors. When requested, transcripts were then mailed to the interviewees for a read-through.

3.4.2. Data analysis

For the qualitative data analysis, the transcripts were transferred to Atlas.ti as separate documents. First, a preliminary coding list was made, based on the interview items and thus indirectly, the results of the quantitative analysis. Per item, several expected codings were formulated. For instance, regarding questions on housing types 'Only rental housing' and 'Only private housing' were added to the code book. Then, the interviews were coded in alphabetical order. Alphabetical order was used because Atlas.ti automatically organises interviews like so and because it randomises the cluster

division, avoiding unconscious subjectiveness of the researcher. During coding, many new codes were added if no existing code was fit, to assure completeness of the coding list. When all interviews were coded, the old and new codes were organised via the coding manager in Atlas.ti. Codes were merged, renamed and grouped based on the findings during the coding process. After doing so, interviews were reviewed to add, delete and change codes based on the new coding list. The coding was then considered finished. The complete code book can be found in appendix 8.6.

Analysis of the codes occurred via Code-Document Tables. In these, grouped codes were presented against ecovillages per cluster to create themed tables. A table is able to visualise patterns spread over the clusters within a theme. The values in the cells, originally presenting the number of mentions of a code, were translated to a dot system, using blanks, single dots and double dots. Blank spaces mean zero presence or mention of a certain phenomenon or code, single dots mean some presence, and double dots mean a lot of presence of a code. The assigning of dots was based on the answers of interviewees, mentions of a code and the applicability of a phenomenon, judged by the researcher. This way, the lengths of conversations on a certain theme – which directly influences the number of codes created – do not influence the table, as this does often not present reality well.

3.5. Ethics & data management

During the research, many efforts have been made to implement an ethical treatment of the participants, the data and the readers. The participants of the qualitative research have partaken voluntarily. Their participation was preceded by a formal invitation to participate, the signing of informed consent and a full explanation of the research process and their rights as a participant. These include the right to withdraw participation at any moment and to review interview transcripts afterwards. Also, agreements could be made to use the data anonymously, meaning that no use of individual names or other retraceable references will be made. Interviewees could choose the location of their interview, to ensure their comfort. All interviewees were strangers to the researcher and far-removed from the researcher's personal and professional circle, eliminating any risk on a conflict of interest. Additionally, as the researcher is a young, female student, thus no conflict of autonomy was expected. Furthermore, the researcher made the best efforts not to manipulate or ask leading question with regards to the integrity of the answers.

The research did not gather any sensitive or private data from individuals, only general information about larger entities. The raw data gathered, i.e. recordings and notes, are stored on the researcher's encrypted personal laptop. The data might be shared with the researcher's supervisor, but otherwise, no other parties will have access to the information. Sharing of the data will be done via a university email account, which is secured with two-step verification via Microsoft Authenticator. The raw data will be saved for the duration of the research and for an extra period of one month after the deadline. Then, the recordings and other primary data will be removed from the researcher's laptop and USB-drive. The processed data, i.e. the interview transcripts and final quantitative datafile, will be transferred to the WUR database. There it will be stored for a total of five years, as a resource for other researchers, after which it will be discarded. The final product, being a research report, will be shared with second and third parties and will thus be available to others after finishing the research.

Other non-empirical data used in this research, are fully and correctly cited to ensure credits are present where they are due.

4. Results

4.1. Quantitative

4.1.1. Descriptive Statistics

First, the results of the descriptive statistics and frequencies are presented. For all variables, the sample size is 67 cases. In table 3, the minimum and range can be found. From this, it becomes clear that many variables show a large range with a large difference between minimum and maximum. An example is the range of the average housing price, which is a difference of 330,000€ between the lowest average and the highest average. Another is the number of kindergartens within a 5 kilometre radius. The lowest value is 1, whilst the highest is 786, meaning that the range is 785 kindergartens. For only two variables, the range is small. This goes for the distance to a body of water and to the Dutch Nature Network. These are 2513.4 and 4110.4 meters, respectively, which comes down to only 2.5 and 4.1 kilometres in difference between 67 ecovillages. Nonetheless, because most variables have a large range, it can be stated that there is a high level of variability between the cases.

Descriptive Statistics & Frequencies

Variable	Minimum	Range	Median	IQR
Population Density	6	15384	774	3533
Distance to Big City	0.00	62.22	4.39	13.21
Rate of urbanity	1	4	3	3
Private-owned housing	13	77	60	20
Rental housing	10	77	40	20
Average Property Value	181000	330000	286000	88000
Average agricultural land price	56391	135934	82086	16496
Job Availability	4030	740760	36020	98650
Number of companies	1300	189370	7230	23140
Labour participation	66	12	73	3
Inhabitants with social benefit	0	16	8.42	3.62
Number of GPs within 5 km	0	212.0	23.0	47.0
Number of grocery stores within 5 km	0.4	429.6	42.0	58.2
Number of kindergartens within 5 km	1.0	785.0	106.0	207.0
Number of primary schools within 5 km	0.3	137.7	24.1	26.0
Distance to university of applied science	1046.0	67199.0	10598.0	12264.0
Distance to university	1285.0	75490.0	15680.0	22059.0
Distance to train station	252.0	13641.7	3225.1	4280.5
Distance to bus stop	15.0	2929.0	376.0	408.0
Climate Health Risk	0.00	9.06	4.017	1.260
Flood risk	0	4	2	3
Distance to body of water	0.0	2513.4	575.3	617.2
Distance to picking garden	543.0	34262.0	9063.0	8566.0
Distance to Dutch Nature Network	6.7	4110.4	555.3	888.6
Distance to Natura2000	30.0	15084.0	2969.0	6134.0
Liveability	3.93	0.41	4.178	0.114

excluded: Largest Party in Municipal Council, because its nominal scale of measurement

Table 3: Descriptive Statistics & Frequencies of Ratio and Interval Variables

Next, the median is presented as the measure of centrality, and the interquartile range as the measure of spread. The median presents the central point per variable. When assessing the median, in relation to the range, it becomes clear some variables have outliers amongst their cases. For instance, the

distance to a big city, for which the range is 62.22 km whilst the median is only 4.39 km. Another is the percentage of private housing, for which the minimum is 13%, whilst the median is 60%. A last example is the number of grocery stores within a 5 kilometre radius. The median is 42, whilst the maximum is 430, which is a tenfold. In combination with the median, the interquartile range can clarify the spread of the cases. For many of the variables, quite a large spread can be observed. For instance for the distance to a big city, average property value, number of kindergartens. With a median of 106 kindergartens within 5 km, an interquartile range of 207 is a large spread. This reaffirms that the variability is high and the cases are widespread.

4.1.2. Hierarchical Cluster Analysis

A single linkage cluster analysis did not identify any cases as outliers. The dendrogram of this analysis can be found in appendix 8.7. Thus, the constructed sample can be considered suitable for a hierarchical cluster analysis (HCA).

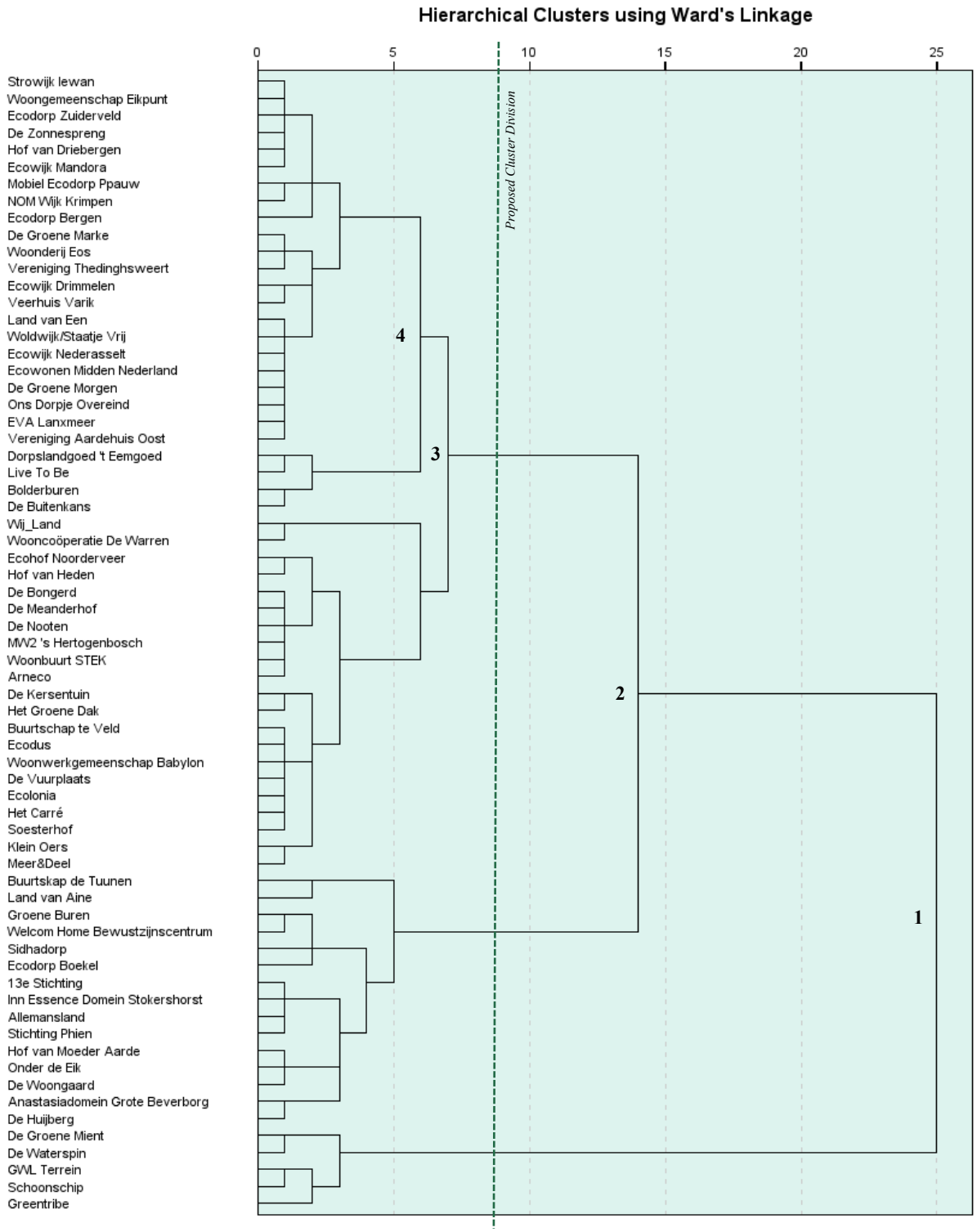

Figure 2: Dendrogram of ecovillages using Hierarchical Clustering according to Ward's Method

The HCA has generated several results. A dendrogram (figure 2), an icicle plot (appendix 8.8) and an agglomeration graph (figure17, appendix 8.9). When interpreting the dendrogram graph, several clusters can be distinguished. Starting from the right at embranchment number 1, the tree immediately branches into two clusters. One of them very large, and one very small. Then, at embranchment number 2, it branches into three clusters. Between these embranchments (1&2 as well as 2&3), the branches are quite long. The distance between these embranchments represent the heterogeneity between the cases and thus the robustness of the clusters. As the distance between bifurcation number 3 and 4 is very small, the difference between the 3rd and 4th cluster can be assumed to be small and negligible. Three clusters is therefore considered the most appropriate cluster solution. In the dendrogram, the proposed cluster division has been presented by a green dotted line.

To support the three-cluster solution, the elbow method was applied to the agglomeration graph. The graph and a full explanation can be found in appendix 8.9 and figure 17. From this analysis, it becomes obvious that the three clusters present a large heterogeneity, whilst cluster solutions with four or more clusters present a smaller heterogeneity, implicating that the clusters then become less distinguished. Afterwards, the robustness of the cluster division has been improved by applying a silhouette analysis. An elaborate description hereof is reported in appendix 8.10.

Figure 3: Map of the Netherlands with ecovillages according to cluster division

Based on the three cluster solution and the improvements based on the silhouette analysis, a cluster membership table has been produced, visible in table 4. What immediately catches the eye, is the uneven division of cases of the cluster. Cluster 1 has 38 cases, cluster 2 has 21 cases, and cluster 3 features eight cases. A visual impression of the cluster division, i.e. a map of the ecovillages according to their clusters has been presented in figure 3 Visually, it is noticeable that the ecovillages of cluster 3 are only located in the West of the Netherlands, or rather only in Holland. Furthermore, the ecovillages of cluster 2 often seem to occur in groups, rather than alone. The ecovillages of cluster 1 appear to be spread out equally.

Cluster Membership		
Cluster 1	**Cluster 2**	**Cluster 3**
13de Stichting	Arneco	Groene Mient
Allemansland	Bolderburen	De Waterspin
Anastasiadomein Grote Beverborg	Buurtschap te Veld	Greentribe
Buurtskap de Tuunen	De Bongerd	GWL Terrein
De Groene Marke	De Buitenkans	Hof van Heden
De Groene Morgen	De Kersentuin	Schoonschip
De Huijberg	De Meanderhof	Wij_Land
De Vuurplaats	De Nooten	Wooncoöperatie De Warren
De Woongaard	Dorpslandgoed 't Eemgoed	
De Zonnespreng	Ecodorp Bergen	
Ecodorp Boekel	Ecodorp Zuiderveld	
Ecodus	Het Groene Dak	
Ecohof Noorderveer	Hof van Driebergen	
Ecolonia	Live To Be	
Ecowijk Drimmelen	Meer&Deel	
Ecowijk Mandora	MW2 's Hertogenbosch	
Ecowijk Nederasselt	Soesterhof	
Ecowonen Midden Nederland	Strowijk Iewan	
EVA Lanxmeer	Woldwijk/Staatje Vrij	
Groene Buren	Woonbuurt STEK	
Het Carré	Woongemeenschap Eikpunt	
Hof van Moeder Aarde		
Inn Essence Domein Stokershorst		
Klein Oers		
Land van Aine		
Land van Een		
Mobiel Ecodorp Ppauw		
NOM Wijk Krimpen		
Onder de Eik		
Ons Dorpje Overeind		
Sidhadorp		
Stichting Phien		
Veerhuis Varik		
Vereniging Aardehuis Oost		
Vereniging Thedinghsweert		
Welcom Home Bewustzijnscentrum		
Woonderij Eos		
Woonwerkgemeenschap Babylon		

Table 4: Cluster Membership division based on three-cluster solution

4.1.3. Further Analyses on HCA

The results of the ANOVA analysis can be found in table 5. In the second column, the p-value has been presented for each variable. It can be noted that quite a lot of variables have a p-value below 0.01, meaning a significance of above 99%. This goes for the variables population density, distance to big city, rate of urbanity, private housing, rental housing, average property value, job availability, number of companies, the variables concerning density of facilities, the distance to a university of applied sciences, inhabitants with a social benefit and flood risk. Some variables show a p-value between 0.01 and 0.05, which translates to a significance of 95%. This goes for the average agricultural land price, labour participation, distance to university and distance to train station. These variables thus explain the variance between the clusters. The remainder of the variables, which have proven insignificant, do not differ significantly between the clusters.

ANOVA Effect Sizes

Independent Variable	Sig.	ω^2
Population Density	<0.001	0.250
Distance to Big City	<0.001	0.268
Rate of urbanity	<0.001	0.241
Private housing	<0.001	0.525
Rental housing	<0.001	0.520
Average Property Value	<0.001	0.223
Average agricultural land price	0.036	0.070
Job Availability	<0.001	0.834
Number of companies	<0.001	0.821
Labour participation	0.030	0.074
Inhabitants with social benefit	0.004	0.133
Number of GPs within 5 km	<0.001	0.529
Number of grocery stores within 5 km	<0.001	0.539
Number of kindergartens within 5 km	<0.001	0.492
Number of primary schools within 5 km	<0.001	0.526
Distance to university of applied science	<0.001	0.202
Distance to university	0.024	0.082
Distance to train station	0.040	0.066
Distance to bus stop	0.106	0.038
Climate Health Risk	0.025	0.080
Flood risk	0.004	0.128
Distance to body of water	0.272	0.010
Distance to picking garden	0.180	0.022
Distance to Dutch Nature Network	0.562	-0.013
Distance to Natura2000	0.408	-0.003
Liveability	0.071	0.050
Largest Party in Municipal Council	0.797	-0.024

Table 5: ANOVA significance & Omega-Squared Fixed-effect size

Besides the p-values, table 5 also presents the ANOVA omega-squared fixed-effect sizes. This shows that of the significant variables, some variables have a stronger effect on the cluster division than others. As the omega-squared fixed-effect size is a range between -1 and 1, variables with an effect

size above positive 0.4 are considered to explain a lot of the variance between the clusters. Variables with a lower positive effect size still explain some of the variance, but in a much smaller degree. In descending order of effect size, the most relevant variables are job availability ($\omega^2 = 0.834$), number of companies ($\omega^2 = 0.821$), number of grocery stores within 5 km ($\omega^2 = 0.539$), number of GPs within 5 km ($\omega^2 = 0.529$), number of primary schools within 5 km ($\omega^2 = 0.526$), private housing ($\omega^2 = 0.525$), rental housing ($\omega^2 = 0.520$) and flood risk ($\omega^2 = 0.492$). Other variables show a relatively much lower effect size and therefore do not explain the cluster division.

In table 6, the medians of the variables with a significance of above 99% have been presented per cluster. The superscripts present which clusters are significantly different from one another according to the Tukey test. When looking at these statistics, the differences between the three clusters become more clear. For instance, cluster 1 is distinct from cluster 2 and 3 based on its larger distance to a big city and the long distance to a university of applied science. Cluster 3 can be distinguished based on a high population density, little private housing, a large share of rental housing and a high density of facilities (GP's, grocery stores, kindergartens and primary schools). All three clusters are distinct from one another when regarding job availability and the number of companies. Another observation is that the values for cluster 2 appear to be positioned in between cluster 1 and 3 for the large majority of the variables, except the flood risk. In the last column, the median of all cases is written, which can provide some more context to the numbers.

Median per Cluster				
Variable	**1**	**2**	**3**	**Total**
Population Density	469[a]	1266[a]	3534[b]	774
Distance to Big City	10.95[a]	0.00[b]	0.00[b]	4.39
Rate of urbanity	4[a]	2[ab]	1[b]	3
Private-owned housing	70.0[a]	60.0[a]	29.5[b]	60.0
Rental housing	30.0[a]	40.0[a]	70.5[b]	40.0
Average Property Value	273500[a]	328000[ab]	401000[b]	286000
Job Availability	20615[a]	113950[b]	744790[c]	36020
Number of companies	4055[a]	21020[b]	190670[c]	7230
Inhabitants with social benefit	7.5[a]	9.1[ab]	10.7[b]	8.4
Number of GPs within 5 km	10[a]	39[a]	165[b]	23
Number of grocery stores within 5 km	23.6[a]	69.0[a]	336.0[b]	42.0
Number of kindergartens within 5 km	70.5[a]	177.0[a]	576.0[b]	106.0
Number of primary schools within 5 km	14.5[a]	28.7[a]	105.0[b]	24.1
Distance to university of applied science	15500.0[a]	6814.0[b]	3460.5[b]	10598.0
Flood risk	1[a]	3[b]	1[ab]	2

Table 6: A Variable's Median per cluster and Significance between the Clusters in Superscript

Finally, the generated boxplots will be presented on the next page in figure 4 through 14.

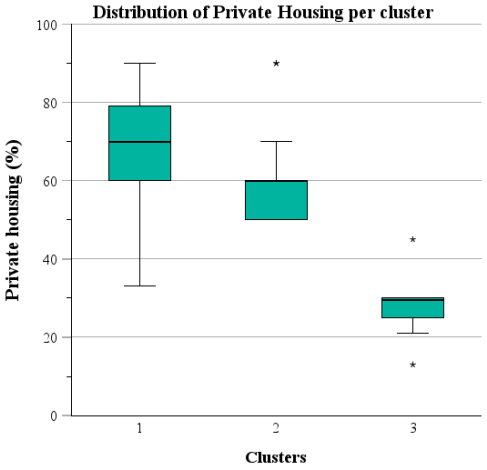

Figure 4: Boxplot of Private Housing

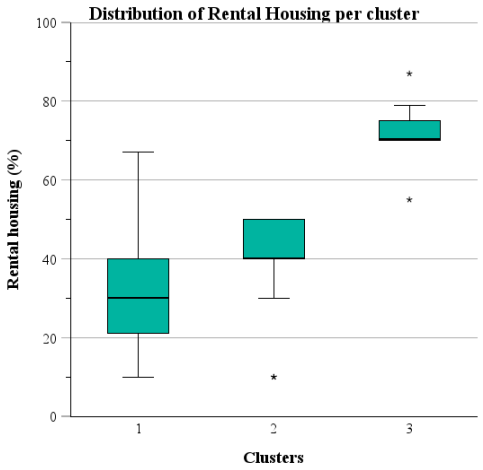

Figure 5: Boxplot of Rental Housing

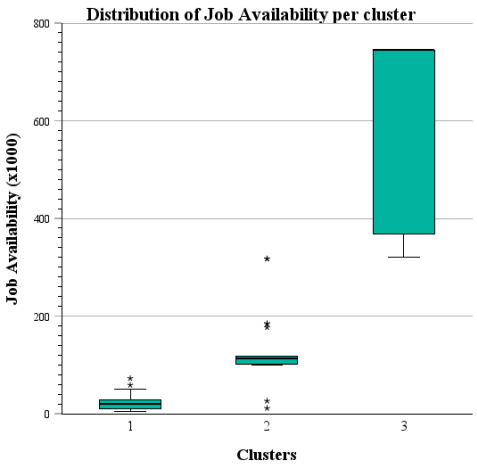

Figure 6: Boxplot of Job Availability

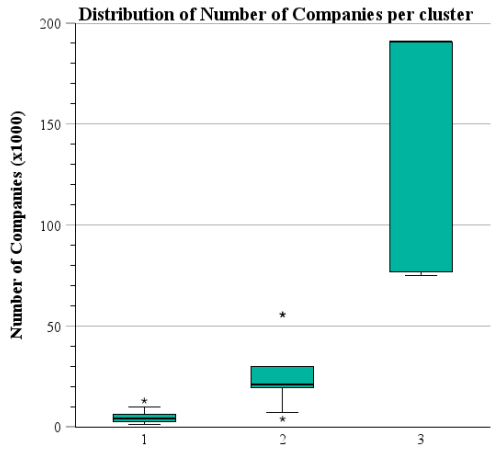

Figure 7: Boxplot of Number of Companies

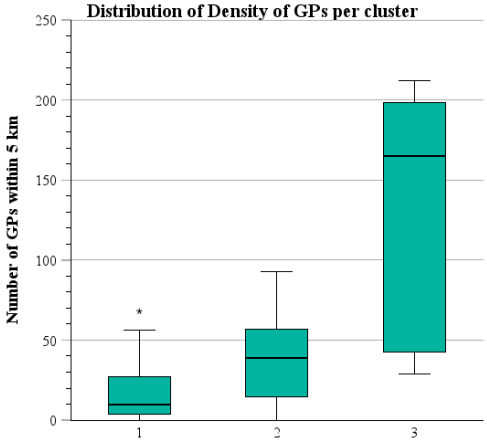

Figure 8: Boxplot of GP's

Figure 9: Boxplot of Grocery Stores

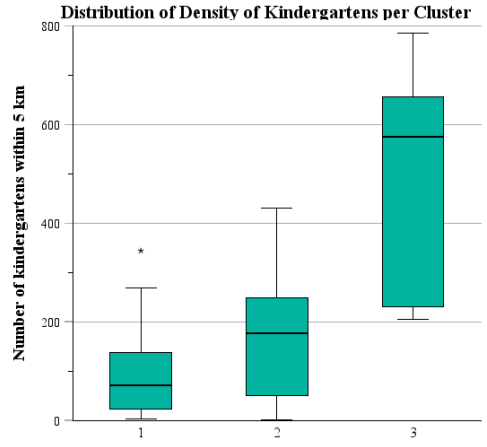

Figure 10: Boxplot of Kindergartens

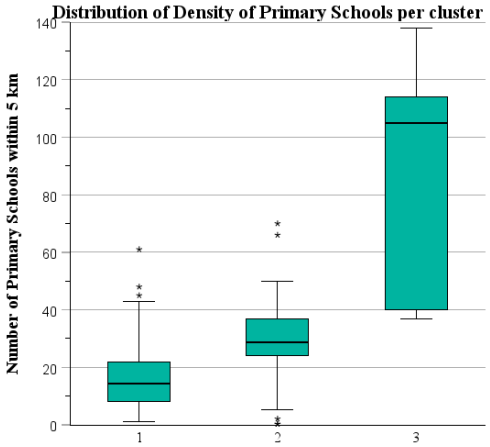

Figure 11: Boxplot of Primary Schools

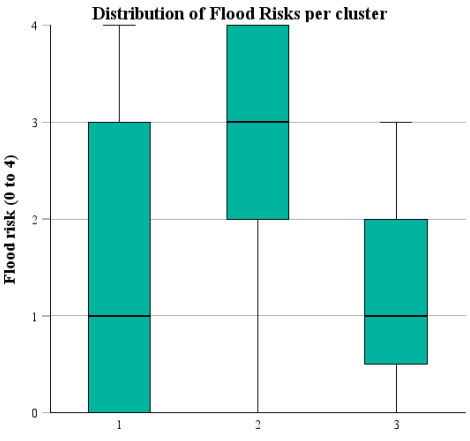

Figure 12: Boxplot of Flood Risks

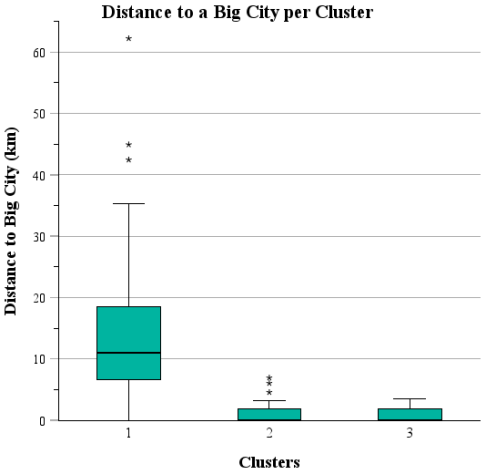

Figure 13: Boxplot of Distance to Big Cities

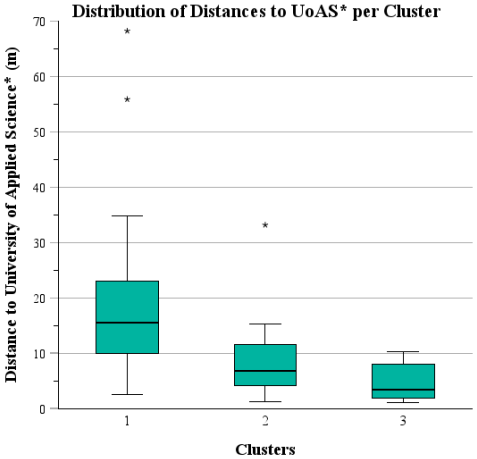

Figure 14: Boxplot of Distance to University of Applied Science

Using the boxplots, each cluster can be described. The first cluster is characterised by a relatively extremely high percentage of private housing. Most values lie between 60% and 78%, although the range between the minimum and maximum is quite large for this variable (fig. 4). Moreover, the cluster has a low job availability of about 20,000 jobs in the region (fig. 6). The same goes for the number of companies, which is about 5,000 (fig. 7). Both these variables show a small interquartile range for the cases, meaning this is very descriptive of the ecovillages in this cluster. There are relatively little general practitioners in the surrounding area of these clusters, between 5 and 30 in a radius of 5 kilometres (fig. 8). The same goes for the density of grocery stores, kindergartens and primary schools, (fig. 9, 10 & 11) meaning the cluster is characterised by a low amount of amenities close by. Some outliers can be spotted with higher densities of amenities. The flood risk shows a long interquartile range for the cases in this cluster; ranging from 0 to 3 (out of 4 classes) in figure 12. The distance to a big city is also a good descriptive variable of this cluster. Half of the cases display distances from 7 to 18 kilometres, which is a lot more than cluster 2 and 3 show (fig. 13). A similar effect is visible in the distance to universities of applied science, where the distance is again clearly larger than for cluster 2 and 3 (fig. 14).

Contrastingly, the third cluster is characterised by a low percentage of private housing, namely only 25% to 30% (fig. 4). The boxplot shows a very low range from the minimum to maximum and no overlap from other clusters, so this is a very descriptive variable for this cluster. The job availability for this cluster is very high, ranging from 160,000 to 720,000 jobs (fig. 6). This is a very large interquartile range, which makes it seem less descriptive of the cases. However, there is no overlap with other clusters, making it a good predictor. The same goes for the number of companies, which mostly lies between 75,000 and 190,000 (fig. 7). For the variables concerning density of amenities, namely the number of general practitioners, grocery stores, kindergartens and primary schools within 5 kilometres (fig. 8, 9, 10 &11), the numbers are relatively high compared to cluster 1 and 2. The ranges are large and there are several overlaps with other clusters. The cases in this cluster are located very close to a big city, generally no further than two kilometres away (fig. 13). The distance to a university of applied science is also relatively small, between 2 and 8 kilometres (fig. 14).

The second cluster can mostly be described as the cluster in between cluster 1 and 3. This is applicable to the shares of private and rental housing, the jobs and companies, the density of amenities and the distance to a university of applied science (fig. 4-11, 14). For each of these variables, the range of values lies in between the values of the first and the third cluster. An exception can be found in the distribution of flood risks. For this variable, the second cluster clearly shows a higher range of values than cluster 1 and 3 do, namely 2 through 4. This suggests that the cases in the second cluster might be located closer to riverine and delta areas. For the distance to a big city, the cases in the second cluster are similar to the cases of cluster 3, namely, very close to or in big cities.

4.2. Qualitative

4.2.1. General Insights

Several general remarks can be made about the data gathering during the interviews. First of all, all interviewed ecovillages seem to share two main objectives for their initiative. Namely, to live in a community and to live ecologically, as can be seen in table 7. Both of these are common themes in the interviewed ecovillages, although the execution can occur in different ways. Living in a community can vary from voluntary game nights and a shared garden for meaningful encounters like in MMWZ De Bongerd, to mandatory community days and a shared business like in Ons Dorpje Overeind. An ecological lifestyle can manifest itself in choosing sustainable building materialsn (e.g. Groene Mient), filtering one's own wastewater (Aardehuizen Olst) and sharing cars within the community (Strowijk Iewan). Whatsoever, all ecovillages interviewed aimed to achieve collective living and protection of ecology and climate.

Initiatives' Objectives per Ecovillage

	Aardehuizen Olst	Ons Dorpje Overeind	EVA Lanxmeer	De Bongerd	Ecodorp Zuiderveld	Strowijk Iewan	Woongemeen-schap Eikpunt	Groene Mient	De Waterspin	GWL terrein
Objectives	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Attractive Urbanism & Architecture			•	••						
Bridging Government and Inhabitants			••							
Community	•	••	•	•	••	••	••	••	••	•
Ecology	••	••	•	••	••	••	•	•	••	•
Equal Accessibility regarding Housing Market	••			••	••	••	•	•	••	
Giving back to Society	•	••	•	••	•	••	•			
More generations of inhabitants	••	••		••			•		•	
Serving as an Inspiration/Example to Others	••	••	••	••		••		•		•
Spirituality	••				•		••			

[blank] no presence of theme, • lower presence of theme, •• high presence of theme

Table 7: Objectives per Ecovillage and per Cluster

Besides ecology and community, some other objectives play a role for the majority of ecovillages. One is to increase equal accessibility to the housing market. As stated by interviewee 4 from MMWZ De Bongerd: *"One's income situation should not dictate whether you can or cannot live in such a neighbourhood."* Another important goal is provide back services to society. Examples are the city farm in EVA Lanxmeer, elderly care in Ons Dorpje Overeind, running a biological grocery store in Woongemeenschap Eikpunt and providing sleeping places for refugees and undocumented people in Strowijk Iewan. A last common objective is to serve as an example or inspiration to others. For interviewee 9 from EVA Lanxmeer, this was the main reason: *"The most important goal is of course to simply be an example, where people can allow their senses to really experience what sustainability is about, instead of only hearing about it [on television]."*

Continuing on the final of these three objectives, several ecovillages expressed disappointment concerning, in their opinion, too little recognition and follow-up on their initiatives. Many interviewees want to call on municipalities and researchers to take more interest in their initiatives, as they are in many ways pioneers. Not only in their ideas, but also because they are often deployed as a pilot for new sustainable, technological systems. In that sense, they feel as though large opportunities for knowledge gathering are being missed.

Previous to the analysis, a spiritual aspect was expected to play a large role in the ecovillages as well. However, this was not reflected in the interviews as much. Only one ecovillage clearly stated it as a pillar of the community, calling it "*silence and reflection*" (Woongemeenschap Eikpunt). Two interviewees indirectly referenced to it. The first by mentioning their shared meditation space Eldin (Ecodorp Zuiderveld). The second, in the following quote: *"We are building as inspiration to the world and in connectivity to the people and nature."* (Aardehuizen Olst).

Multiple remarks have been made about the role of municipalities throughout the interviews. For every ecovillage, the relationship with the local authority is different. For one, two interviewees have described the municipality as *"a many-headed monster"* (Interview 1, GWL terrein & Interview 4, MMWZ De Bongerd), consisting of many different departments and contact points that should support each other but rather counteract each other. If lucky, an alderman was invested in the project and personally saw to success. In other cases, the municipality was described as opportunistic, like in this quote about the municipality by interviewee 6: *"Oh, now is a good time for us, let's make good cheer by saying 'Look, what a nice project we have, so good for the neighbourhood […] with participation and blablabla.' […] But we know they were not so forthcoming with other projects in other moments."* (Interviewee 6, Strowijk Iewan). So apparently, municipalities are enthusiastic about ecovillage initiatives when the economy is at a low, when other projects are too expensive.

When a municipality initiates a project, they sometimes unite in a cooperation with an ecovillage. The two interviewed ecovillages with this particularity, however, both do not identify themselves as real ecovillages since their values and norms have diminished during the development (Interview 1, GWL terrein & interview 9, EVA Lanxmeer). Initiatives sometimes also unite with social housing corporations, for example Ecodorp Zuiderveld, Strowijk Iewan, GWL terrein, MMWZ De Bongerd and Woongemeenschap Eikpunt. These cooperations appear to develop smoothly, as the corporations can assure capital and the initiatives can assure maintenance. Like Interviewee 5 from Ecodorp Zuiderveld says: *"The real estate is property of Talis and we maintain it."* Corporation Talis even adopted co-living as a segment within their business. Though sometimes, these cooperations cease to exist when a housing corporation considers the partnership too complex.

4.2.2. Cluster Division

The interviews have also shed more light on the found cluster division. In the next few paragraphs, the clusters will be described according to the interview data, supported by themed tables. All qualitative data have been assembled into one large table for better overview, which can be found in appendix 8.11.

Cluster 1
The ecovillages in the first cluster consider themselves to be distant from large cities. They enjoy being located there, as they are happy to be close to nature, visible in table 10. As states Ons Dorpje Overeind: *"Everything is too much in the city",* EVA Lanxmeer: *"God, those enormous apartment buildings… I can't even bear the thought. I'm glad this is a quiet area."* and Aardehuizen Olst: *"I wouldn't want to live in the city anymore, I fled the Randstad."* Moreover, the community feeling in the surrounding settlement is appreciated: *"Schalkwijk is still really a village, where they care about each other and know about one another… Everybody knows each other, they say 'hello' on the cycling path."* (Interview 7, Ons Dorpje Overeind).

The fact that there are not as many amenities close by, hardly bothers them: "*We live in a village, the centre is 5 minutes of cycling away, so that's really easy"* (Interview 8, Aardehuizen Olst). And to Ons Dorpje Overeind applies: *"Just one supermarket, one bar and one restaurant. But everything is close by. Houten is close by."* Besides, all three of them do serious attempts to be self-sustaining in certain ways, decreasing the continuous need for amenities. For instance, Aardehuizen Olst is not connected to gas, drinking water or sewage systems. They have organised all these infrastructure systems themselves within the community. Ons Dorpje Overeind has a food forest, an allotment garden and chickens to provide them with a basic level of fruits, vegetables, nuts, eggs and meat for themselves and interested neighbours. EVA Lanxmeer, comparatively, has an urban farm, serving the same purpose, as well as a local heating network, helophyte filters and solar panels for hot water.

Types of Housing per Ecovillage

	Aardehuizen Olst	Ons Dorpje Overeind	EVA Lanxmeer	De Bongerd	Ecodorp Zuiderveld	Strowijk Iewan	Woongemeen-schap Eikpunt	Groene Mient	De Waterspin	GWL terrein
Types of Housing	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Only Social Rent					••	••				
Partly Social Rent	•		•	••			••		••	•
Only Rental Housing										
Mostly Rent, Some Private Housing							•			
Equal part Rental and Private Housing				••					••	
Mostly Private, Some Rental Housing			••							••
Only Private Housing	••	••						••		

[blank] no presence of theme, • lower presence of theme, •• high presence of theme

Table 8: Types of Housing per Ecovillage per Cluster

A last distinctive feature is the large share of private housing in these ecovillages, as visible in table 8. In two out of three ecovillages, there are only private houses, and in the third, more than 70% is private. According to Ons Dorpje Overeind, this is a necessity for equivalent relations, because *"if you want equivalence, one cannot be owner whilst another is renter, that is not equivalence."* Remarkably, only Aardehuizen Olst stated a concern for the housing market, whilst the other two interviewees did not mention equal accessibility to the housing market as a problem.

Cluster 2:

Contrary to the first cluster, the four ecovillages interviewed from the second cluster are all located within a city (table 10). The cities, e.g. Zwolle and Nijmegen, are considered relatively large but lay outside the Randstad area. As interviewee 3 from Woongemeenschap Eikpunt says: *"It's a choice, if you feel good [in a big city], then it's fine. If you want some nature around you, Nijmegen is relatively positive with lots of nature everywhere."* Interviewee 6, from Strowijk Iewan, argues: *"We wanted to be close to the city, so that we were connected to public transport networks and needed less cars."* Interviewee 5 from Ecodorp Zuiderveld, adds: *"I do appreciate city life because of the many possibilities and everything that happens."* Summarised, the ecovillages in cluster 2 consider it the perfect balance between urban facilities and nature.

Remarkably, the interviewees from cluster 2 emphasise the importance of their community more than others. As aforementioned, all ecovillages interviewed share the objectives of community and ecology. However, in practice it seems the ecovillages in cluster 2 extend extra meaning to their community lifestyle. The difference is even visible in table 9, in which the ecovillages in cluster 2 score high on all aspects of collective living. Besides the data, it was also eminent during the interviews as interviewees would emphasise the community aspects more than ecological parts of the ecovillage. A quote to exemplify this comes from the interview regarding Strowijk Iewan: *"We very much want people to just have time to be home and have time to commit to the community."* Interviewee 4 from MMWZ De Bongerd similarly states: *"There are things you don't do, because you take into account the context we are in. And the part for which you cannot do your own thing, you get a lot in return."*

Community Aspects per Ecovillage

	Aardehuizen Olst	Ons Dorpje Overeind	EVA Lanxmeer	De Bongerd	Ecodorp Zuiderveld	Strowijk Iewan	Woongemeen-schap Eikpunt	Groene Mient	De Waterspin	GWL terrein
Community Aspects	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Citizen initiatives	••	••	•	••	••	••	••	••	•	•
Living Together	•	••	•	••	••	••	••	••	•	•
Prioritising the Collective	••	••		••	••	••	••	•	•	
Sharing Amenities	••	••	•	••	••	••	••	•	••	
Social Support System	•	••	•	••	••	••	••	•	•	•
Consensus decision making	••	••		••	••	••	••	••		

[blank] no presence of theme, • lower presence of theme, •• high presence of theme

Table 9: Community Aspects per Ecovillage per Cluster

On a similar note, ecovillages in cluster 2 seem somewhat more involved with society outside of their own community. As aforementioned, many of the ecovillages aim to give services or products back to society. Ecovillages in cluster 2 are overrepresented in this trend. Also, the interviewees explain these services have a selfless objective, whilst ecovillages from other clusters provide services in return for payment. In Strowijk Iewan, for example, the interviewee explains: *"We want to show solidarity to groups like undocumented and refugees […] So people without documents can stay here for free. Our shared space is also freely available to groups we sympathise with, they don't need to pay."* Likewise, De Bongerd provided some apartments to a mental health institution for people in need of guided living. On top of that, they hosted a kindergarten, after-school care and a natural grocery store. As the interviewee from De Bongerd says: *"These were functions that stimulated a relationship with the neighbourhood around our community."*

Possibly related to this, the ecovillages in the second cluster have a larger share of social rent housing, visible in table 8. Two ecovillages in this cluster fully consist of social rent, in Woongemeenschap Eikpunt the vast majority is social rent, and in De Bongerd half of the houses are social rent. As is stated by the representee from Strowijk Iewan: *"They [other ecovillage] just have private housing in individual property and I think that is a very different approach than ours."* For De Bongerd is similarly mentioned: *"From our philosophy regarding humanfriendliness, we want to retain ground-floor social rent housing."* This is remarkable, considering other villages expressed preference for social rent as well, but were quick to cede once context made it difficult to retain. This large share of social housing thus sets the second cluster apart from the others.

Cluster 3:

The ecovillages of the third cluster are not only located in cities, they are located in big cities in the Randstad. As is visible in table 10, they enjoy being in big cities and identify as city people. For Groene Mient it is said: "*These are all city people that live here."* and the interviewee from GWL terrein refers to the neighbourhood and people as *"highly urban"*. Several interviewees mention that this might result in a different mindset, like in GWL terrein: "*We do have a different relation with nature, we are still city people."* and according to the interviewee from De Waterspin: *"I do have to say that everyone keeps their privacy, no mandatory group dinners and such. Because in the city, you do want to do your own thing."*

Relations to Cities per Ecovillage

	Aardehuizen Olst	Ons Dorpje Overeind	EVA Lanxmeer	De Bongerd	Ecodorp Zuiderveld	Strowijk Iewan	Woongemeen-schap Eikpunt	Groene Mient	De Waterspin	GWL terrein
Relations to Big City	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Far from a Big City	•	••	••							
In a Big City				••	••	•	•	••	••	••
Like being outside the Big City	••	••	•				••			
Neutral about Big Cities			•	••						
Like being in the Big City					••	•		••	••	••
Village people	••	••								
Village and City people	•		••							
City people							••	••	••	••

[blank] no presence of theme, • lower presence of theme, •• high presence of theme

Table 10: Relations to Cities per Ecovillage per Cluster

This mindset is somewhat reflected in table 11. For instance, all ecovillages in cluster 1 and 2 have some self-sustaining systems, whilst none in the third cluster do. Like interviewee 6 from GWL terrein states: *"We have some allotment gardens in the neighbourhood, but it is very individual. […] We [the board] want a shared fruit garden or food forest, but people remain a little conservative: 'I want my own rosemary'. You would say people are progressive here, but no."* This means, the ecovillages might still have a close community, but they are less reliant on one another for their energy, food or car. Besides, only one of the three cases in cluster three uses a consensus decision making method, whilst all other ecovillages do. In De waterspin they say: *"If the majority thinks it is a good plan, then we just do it. Then, you have to execute it. […] If not, some people can hijack the entire group, you know?"* Moreover, the majority of housing in this cluster is private, with some social housing in De Waterspin and GWL. All of these remarks combined, suggest these ecovillages have a different perspective on how a community should function, namely, in a somewhat less collective way.

Ecological Efforts per Ecovillage										
	Aardehuizen Olst	Ons Dorpje Overeind	EVA Lanxmeer	De Bongerd	Ecodorp Zuiderveld	Strowijk Iewan	Woongemeen-schap Eikpunt	Groene Mient	De Waterspin	GWL terrein
Ecological Efforts	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Composting	••							••	••	•
Ecological Lifestyle Choices	••	••	•	••	••	••	••	••	••	•
Ecological or bio-based Building Materials	••	••	••	••	•	••	••	••		
Green Energy Systems	••	••	••	••	••	••		•	•	
Self-sustaining Efforts	••	••	•	•	•	••	•			
Sharing possessions for degrowth purposes	••	••	•	•	••	••	••	••	••	•
Watersystems	••	••	•	••		••			••	
Zero waste	••	••								

[blank] no presence of theme, • lower presence of theme, •• high presence of theme

Table 11: Ecological Efforts per Ecovillage per Cluster

All respondents in this cluster have, nonetheless, expressed their wish to renew aspects of their ecovillage. The GWL terrein board is discussing how to make the neighbourhood greener. During the interview in De Waterspin, the interviewee explains he is planning on suggesting a new level of housing on top of the current construction, to help the housing market. Inhabitants from Groene Mient have indicated they aimed to implement many more social and ecological ideas in the neighbourhood, but time restrictions made it impossible during their realisation.

5. Discussion

5.1. Significance & relevance of results

5.1.1. Interpretations & implications

Quantitative Research
The quantitative research has attempted to answer the following research question: What types of ecovillages can be distinguished within the Netherlands from a geographical perspective?

The results have definitely proven that several clusters of ecovillages can be distinguished based on geographical variables. The most distinguishing variables during the cluster analysis have been identified as job availability, number of companies, density of grocery stores, density of general practitioners, density of primary schools, share of private housing, share of rental housing and flood risk. Based on these, three clusters were found. Of these three, the first and third are very different from one another. One could say they are opposites based on the aforementioned variables. The second cluster, however, seems more like the cluster in between the other two. The only variable on which the second cluster does not appear to be the intermediate, is flood risk, although this effect was not significant. The cluster division seems to be strongly related to the urbanity of the environment, with the density of amenities and jobs as important variables.

Qualitative Research
The qualitative research has focused on answering the question: How can the types of ecovillages found in the Netherlands be described?

During the qualitative research, not only descriptions of the clusters have been found, other interesting results have also emerged. For instance, it appears all Dutch ecovillages are mainly focused on living in a community and improving the ecology around them. Although previous literature raised expectations of spiritual aspects in contemporary ecovillages, a spiritual objective was only encountered in three out of ten interviewed ecovillages. This could be because ecovillages want to present themselves as legitimate movements with a potential to save the earth from climate change, instead of a squatter or hippie type of movement. In addition, several other objectives seemed more relevant to the ecovillages. Amongst these, the most widely shared were the enhancement of equal accessibility to the housing market, providing care services and biological, local products to mainstream society, and being a pioneer and example to others to inspire social change. This adds to the suggestion that ecovillages aim to prompt real change in contemporary society.

Additionally, more insight has been gained on the relationship between municipalities and ecovillages. Several ecovillages have described bureaucratic stubbornness of a municipality, which required a high level of perseverance from initiatives. Moreover, some initiatives have witnessed opportunism from municipalities, who were eager to realise an ecovillage in times of economic demise, yet continued with capitalist contractors as soon as the housing market was back on its feet. In case of a successful ecovillage initiative, several times one particular politician was very involved and passionate, and made it their personal goal to realise an ecovillage. Overall, these observations suggest that municipalities are often less flexible with alternative housing initiatives. As these troubles only appeared in ecovillages in cluster 2 and 3, this suggests that the bureaucracy and the size of larger municipalities hinder their openminded reception of alternative housing plans.

Two initiatives were realised as a co-operation between a municipality and the private initiative. Both have resulted in much larger scale neighbourhoods, with more than 1,000 inhabitants. Moreover, both

interviewees were hesitant to call themselves an ecovillage, because they personally did not feel they met the criteria. Apparently, ecovillages realised partly by a public party gradually have to let go of their values during the process due to compromises. Moreover, once realised, the maintenance and management is shared between the community and the municipality, dwindling their ideological program even more. This implies ecovillages will hold on to and progress according to their objectives much more when their movement is bottom-up and the municipality is on the other side of the negotiating table.

Cluster descriptions
As both the quantitative and qualitative research have resulted in insights about the characters of the three clusters, the results of both approaches will be integrally discussed in the following paragraphs.

Cluster 1
The first cluster can be described as the rural village cluster. Ecovillages are located far from big cities, especially considering the Dutch densely populated context. The inhabitants have consciously chosen to live outside the more urban areas. They feel cities are too full and asphalted to live in anymore. Rather, they want to live in close connection to nature and a more peaceful and quiet life. They prefer a slow life with less luxury products over a rushing life with higher expenses for social status. The fact that they are somewhat more focused on ecology than other ecovillages is thus no surprise.

Related to this, there is usually a low density of amenities in the vicinity. Ecovillagers do not seem to mind that there are less amenities close by, everything they really need (like groceries and schools) is at a walking or cycling distance within the centre of a village. In case they need more, they will occasionally shop at a town nearby or they will organise something within their community. They enjoy the village life amongst village people within a village community. Jobs and companies are even more scarce than amenities, especially compared to the supplies in other clusters. Inhabitants either commute to areas with more companies, work in the companies close by or work less in a paid job.

Often, ecovillagers buy their house to privately own it and do not see any advantage in social rent. In order to care more for their environment as a community, they feel privately owning the house instead of renting will add to feelings of responsibility about the neighbourhood and more steadiness amongst inhabitants. The inhabitants are interested in serving as an inspiration to others. Being an example to municipalities, neighbours and other initiators is something they definitely want to achieve by organising tours, appearing in magazines, and generally showing others how they live. In that sense, they also do not want to be an isolated island within society. They want to connect to neighbours and others around them to improve the world together.

The ecovillages of the first cluster can, concludingly, be described as rural ecovillages with a village community, a self-sustaining and slow consumption lifestyle that want to provide food, energy and education for themselves as well as the community around them.

Cluster 3
The ecovillages of the third cluster can be characterised as highly urban, metropolitan ecovillages. Their locations are amidst large Dutch cities that lie within the Western, more densely populated region of the Netherlands. Large amounts of amenities, jobs and companies are located very close by. The inhabitants like to see themselves as highly urban citizens that are rooted in the city. Therefore, they are not looking to move to other, less densely populated areas with more close-knit village communities. However, they are tired of the very individualistic lifestyles in large cities and are looking for somewhat more connection to the people around them. Also, they are highly aware of the contemporary scarcity of space. Therefore they have been looking for ways to have a larger garden at

their disposition, whilst not using up more untouched nature. Their ecovillages thus commonly have a communal courtyard in which they share lounging spaces and green areas. To them, this lifestyle has many advantages, namely a more sustainable lifestyle, less individualism whilst living in a large city, and obtaining more garden space as an individual whilst not claiming more space as a group.

On the one hand, the community lifestyle is a little less present in this cluster compared to the others. The collective is prioritised less, decisions are not always made using a consent method, and overall, interviewees indicate that they want to maintain their autonomy and privacy regardless of the ecovillage. Additionally, the ecological living efforts consist mainly of individual choices and not of larger collective systems that require responsibility and collective effort. It can be interpreted that these initiatives lean more towards sustainable neighbourhood communities, than hardcore ecovillages. One interviewee also expressed this notion himself during an interview.

On the other hand, all three interviewees have strongly expressed that they are still looking to renew aspects of their initiatives. Whether it is renewing their goals or implementing new buildings, their ecovillage is still developing and might therefore still change in the future.

Thus, the ecovillages of the third cluster can be described as metropolitan ecovillages, located in the Randstad area. Inhabitants are rooted citizens with a desire to live less individualistic and more sustainable, whilst retaining privacy and freedom.

Cluster 2

The ecovillages of the second cluster are also located in cities, but these cities are notably smaller and not located in the Western Randstad area of the Netherlands, but for instance in Nijmegen and Zwolle. In many senses, the cluster appears to be positioned in between the first and third cluster. They, for instance, enjoy a larger density of amenities than the rural cluster, but not nearly as much as the urban cluster. Likewise, considering the types of housing as well as the presence of jobs and companies, the cluster falls in between the low values of cluster 1 and high values of cluster 3. Nonetheless, the ecovillages have proven to be distinct in several ways.

The inhabitants describe their settlements as spacious and being close to nature, whilst also being close to public transport and amenities. This way, they can enjoy an ecological lifestyle as well as being connected to agglomerative advantages like proximity to public transport. When asked, they state they do not dislike large cities, yet are very glad to live in areas with more space and nature around. Another characteristic setting cluster 2 apart, is their higher associated flood risk. This might mean ecovillages in cluster 2 are more often located closer to rivers or located in outside-the-dike areas, although this has not been investigated further.

Furthermore, cluster 2 is very much characterised by their explicit focus on community living. Inhabitants really choose to live in a community where the collective is prioritised, where they share supplies and spaces, where decisions are only made based on consensus and where people take care of each other. Inhabitants rather work less hours a week to spend more time at home with their fellow ecovillagers, which is often also agreed upon as a general rule. Moreover, the vast majority of housing in this cluster is social rent. In order to make this type of housing available to everyone, social housing is a spearpoint of these clusters. In addition, they also provide housing for those in need of assisted living and with less options in society.

So, the ecovillages in cluster 2 are urban, yet located in the more spacious outskirts of smaller cities closer to nature. They enjoy the sustainable advantages of living in a larger agglomeration, focus on collective living, desire a more equitable housing market and are more inclusive than ecovillagers in other clusters by aiding those in need.

5.1.2. Expectations & insights

Expectations

Before this research was carried out, there was already quite some literature available on ecovillages. Many touched upon their social structures, technological solutions and activities. Less research took a planning perspective nor researched geographic variables. One cluster analysis had previously been done, yet with a very different focus regarding variables. This current research therefore adds new literature to the debate and helps to answer part of a knowledge gap. The research was expected to result in a cluster division of ecovillages which may lead to the formulation of a typology. Although the cluster analysis was successful and cluster descriptions were formulated, a typology was not formed. As said, different clusters can definitely be distinguished, but I have come to realise that this research alone is not enough to formulate a complete typology. Because the explorative nature of this research, some variables included were less relevant to the research and some relevant variables were overlooked. This makes the current cluster division a good start, but not a comprehensive framework yet.

Other expectations, based on literature, were that ecovillages would have ecological, spiritual and community sides to it (Jackson, 2004). Although these aspects were recognised within the Dutch ecovillage movement, the focus within the qualitative sample was definitely on ecology and community, and less on spirituality. Moreover, some of the characteristics specified in literature were hardly found in Dutch ecovillages. For example, many inhabitants eagerly admit that their initiative is not a utopia at all, refuting Casey et al. (2020). Also, several residents have stated they do not reject the dominant Western worldview. Some even actively explain they need a capitalist business approach to be able to exist at all. Considering the previously executed cluster analysis (Escribano et al., 2020), the current cluster analysis does not concur with their findings. Escribano et al. (2020) differentiated ecovillages into self-provisioning, production, training and instrumental ecovillages. Regarding these, it is certain no ecovillage in the Netherlands is self-provisioning or an actual training ecovillage. Notwithstanding the cluster division, all investigated Dutch ecovillages would actually suit within the transformative-production type, meaning that their cluster analysis is likely not applicable to the Dutch context.

Academic Debate

The research can be placed in the academic debate alongside other articles with a mainly practical aim, rather than articles focussing more on expanding academic niche knowledge regarding ecovillages. Articles by scholars such as Dias et al. (2017) and Barani et al. (2018) have recently attempted to add more useful and practical research to the existing array. Their research, focusing on building a framework to identify and support developing ecovillages, and formulating the meaning and relevance of ecovillages to construct sustainable societal alternatives, both want to increase knowledge on ecovillages to improve their implementation into contemporary societies. This research has had a similar aim and can thus be placed within this academic trend.

The results, consisting of raw data, elaborate descriptions of three clusters within the Dutch ecovillage movement and new general insights on ecovillages, are relevant in multiple ways. The first is that this research generally adds to the identified knowledge gap present in literature about ecovillages. As aforementioned, a geographical cluster analysis has not been done before, making it an addition to the academic debate. Mainly, the research has shed more light on the positioning of ecovillages towards larger cities. Some are an actual part of a metropolis, some find a balance in the outskirts and some actively distance themselves from it. The results explain more about different objectives of ecovillages too, providing interesting insights into the cluster characteristics. Also, elaborate research into the

Dutch ecovillage movement is scarce, which is addressed in this research. The results also indirectly indicate this void, because much of the expectations based on foreign literature do not seem to apply to the Dutch context. The results of this research might, nonetheless, be applicable to other countries. The preference of being inside or outside the city does not limit itself to the Dutch people, meaning this same pattern of rural, semi-urban and urban ecovillages could be present elsewhere. Especially considering Dutch cities are relatively small, and the distances between rural and urban areas short. In contexts where cities are much larger and busier, and rural areas far more spacious and distant, this trend could present itself more intensively. Lastly, the results can be a basis for new research. Because this research was mainly explorative, many variables were examined, providing information on whether these are relevant to ecovillages or not. The research process has shown variables like job availability, density of amenities and housing types are very relevant to ecovillages, whilst variables like distances to public transport and nature are not. New research can thus be specified more, based on the results of this report.

Overall, it thus seems that the results are very relevant as a basis of knowledge on Dutch ecovillages. The expectations, explanations and descriptions based on other research formulated previously, barely made sense in the current research and context. Probably, the Dutch context of planning policy, building practice and socioeconomics, have shaped the Dutch ecovillage movement to be very different from those described in other research.

Reflection
Reflecting on my research, I have learned a lot about ecovillages. Although I knew ecovillages were diverse, the diversity is much larger than I anticipated. The people, the lay-outs, their efforts and opinions were very varied. Overall, I was positively surprised by their welcoming attitude, pride of their initiative and enthusiasm to keep improving. On the other hand, I do think some ecovillages do not fully live up to the ecological potential, and could better be described as sustainable or green neighbourhoods. Considering this, the claim that ecovillages have a transition potential is only applicable to some of the cases.

Whether ecovillages really can be the future of housing and living practices, is hard to say. At this point, I think ecovillages are too particular for the majority of mainstream society. Some aspects and rules will not be scalable to larger societies, like the spirituality aspects, but also the prohibition of cats (because they hunt birds and mice). Also, the inhabitants are all socially involved, whilst many Dutch people enjoy privacy and alone time. In the end, we are probably too dependent on the dominant culture and existing systems to be able to realise large scale ecovillages at all.

5.2. Limitations & Recommendations

5.2.1. Limitations

Multiple remarks can be made about the strengths and limitations of this research. This section will elaborate on the most relevant of them.

First of all, some doubts have occurred about the list of quantitative variables entered into the HCA. Several variables have been included which, in hindsight, might have clouded the analysis. I am referring to the variables of private housing and rental housing, as well as job availability and number of companies. It is obvious that the first two and the latter two are related to one another. When looking at one case, the percentage of private housing should match the percentage of rental housing to total at 100%. Similarly, the job availability and number of companies in one area are likely to be

highly correlated. Therefore, these two sets of variables might have reinforced their effect on the analysis and played an unjust part in the analysis above other variables.

Another limitation of the research, is the research strategy determined beforehand, namely a sequential mixed-methods approach. As has been the structure throughout this entire report, I have first executed a quantitative research, followed by a qualitative research. At the beginning, this seemed a logical strategy, however, some disadvantages occurred, foremostly during the interviews in the qualitative part. It became clear that several themes were very important to the ecovillages that had not come to mind whilst choosing the variables for the quantitative part. Thus, some of the variables included in the HCA appeared to be of very little importance to the ecovillages, whilst other variables were not included yet were relevant. Although starting with quantitative research has advantages as well, starting with a qualitative approach could have increased the quality of the cluster analysis.

Besides, the sequential mixed-methods approach has some general disadvantages. One is that proposing a research in which the second part is reliant on the other, causes confusion in the proposal phase. Because the second part should be well connected to the first, you can only construct a proposal for the second part after the first is finished, leaving the research proposal incomplete. Another disadvantage might occur during writing the final report. A final report should naturally adhere to a chronological structure. But in the case of a sequential research report, this means that the results of the first part have been processed into the methods of the second part. Therefore, the final report can hardly follow the usual chronological structure in the methods chapter, hence making it harder to compose an understandable report.

Furthermore, the quality of the research can be considered limited because of the choice to use only existing data. As may be known to academic readers, gathering empirical data from scratch by means of a survey, is not often recommended. The response rate is often low, missing values are almost a guarantee and a researcher can never be certain that answers have been given sincerely. Thus, I have refrained from setting out a survey. However, in hindsight, some data that would have had to be gathered by means of a survey, would have been very valuable to the cluster analysis. For instance, simple demographic variables like population size of the ecovillage, household size, ages, gender shares and some questions into their initiation and objectives. Arguably, the HCA would likely result in a different cluster division.

5.2.2. Scientific recommendations

Based on these limitations, several recommendations can be made for further research. For one, I would recommend a research to be carried out based on empirically gathered data. Data could entail demographic details of the population, social structure of the society, technological implications and ecological aspects of the village. Seeing as a general cluster analysis has never been done and the results of the current research do implicate different types of ecovillages within the Netherlands, such a research is likely to yield results. It would then be helpful to approach the research very iteratively, so that findings along the way about relevance of variables can be included into the results. The results could include an actual typology of Dutch ecovillages, which would be both academically and socially relevant.

Another interesting research could focus on the chronological development of Dutch ecovillages. During the current research, it appeared there were large age differences between the clusters, which also seemed to express themselves in the contents of an ecovillage. One perspective could be to research different ecovillages in relation to the sociohistorical context to uncover more about different waves or streams within the ecovillage movement. Such a research would mean a lot to the

understanding of ecovillages and could serve as a basis for much more research. Another perspective could be to zoom in on several ecovillages and research their development as a case in detail. During the interviews, many stories were told about the processes before arriving where they are at now. It could be very interesting to understand what ecovillages face during the phases of conceptualisation, realisation, inauguration and developing, until they arrive at the state of a balanced neighbourhood. This could help new ecovillage initiatives by understanding what barriers could occur and how to deal with them.

6. Conclusion

6.1. Summary of findings

Considering the urgency of battling climate change and the accelerating rate of urbanisation, it is of importance that cities and settlements become more resilient and sustainable, following the Sustainable Development Goals by the United Nations. Ecovillages hold the potential to transform urban housing practices and be a model for ecological living. Nonetheless, the implementation of ecovillages in the Netherlands often does not proceed smoothly due to outdated policies, ignorance and reluctance by policymakers. This research can therefore help to increase knowledge on the ecovillage movement and improve the handling of ecovillage initiatives in policy.

Hence, the overall aim of this thesis was to gain better understanding of ecovillages in the Netherlands. This was specifically executed by researching what possible typologies and geographical clusters exist amongst the ecovillage movement, and what might characterise and describe each one of them. To achieve this, both quantitative and qualitative research were sequentially conducted. The quantitative part, conducted first, involved gathering geographical data on a set of ecovillages, executing a hierarchical cluster analysis, and analysing the results in SPSS. The qualitative part, then, consisted of interviews with ecovillages to qualitatively describe the found clusters.

In conclusion, three geographical clusters have been identified based on geographical variables. The first can be described as the rural, ecological, degrowth cluster. The ecovillages are located far from big cities, enjoy nature, want to improve the ecology around them by living a simpler life and taking responsibility for ecology. The second cluster can be illustrated as an urban, community-focused cluster. In these ecovillages, people live together, take care of their fellow humans, and live in proximity to both nature and urban facilities. The third cluster can be characterised as a highly urban, metropolitan cluster. These ecovillages are home to real city people that want a little less individualism than is usual in cities, as well as more sustainability and natural lifestyles.

Besides the cluster descriptions, it can be concluded that Dutch ecovillages generally tend to focus on community and ecology, rather than spirituality. Moreover, they are not as anti-capitalist and closed-off as some literature portrays them to be. They actually want to improve equal accessibility to the housing market, provide services and products to society, and be an example to inspire social change. The role of the municipality has been different in each case, however, overall it seems municipalities as organisations make the process of realising ecovillages more difficult, whilst individual representatives of municipalities support ecovillages and help them to succeed.

6.2. Societal recommendations

The knowledge gained by this research, will likely be helpful to Dutch policymakers. They will be better informed on the objectives, shapes and organisations of ecovillages, making the handling of new ecovillage initiatives more understandable and easy. Using the results of this research, a policymaker can make better judgments regarding ecovillages and whether they would be suitable within a certain location. What benefits and disadvantages are applicable to Dutch ecovillages have also been clarified, which policymakers can use to improve their judgments of initiatives. It may also have become easier to communicate with ecovillages, as their language has become more clear.

Additionally, the results can be helpful to ecovillage initiatives. A simple advantage is that many ecovillages are mentioned in this research, initiatives that can be used as inspiration or contact to share knowledge. Another benefit is that now more information is available on the relationship between

ecovillages and municipalities, initiatives can improve their preparation for the realisation process. Ecovillages could also use the cluster descriptions to better identify themselves and play into their strengths more. It can be a push to set an initiative thinking about their exact goals and structure, initiating improvements to their ecovillage.

To constitute more improvements regarding the handling of ecovillages, several societal recommendations for further research can be made, adding to the scientific recommendations made earlier. For instance, a comparative case study of successful and failed ecovillage initiatives could be very interesting. This could shed light on what factors will constitute a successful ecovillage and which might break it. Initiatives can use this information to improve their ideas and structures accordingly. A policymaker could be able to infer what initiatives can become a success and which ones will not, so that a municipality can put its efforts into the promising initiatives. Also, a policymaker can support an initiative in the right ways if it seems they need it. Besides, it might improve communications between ecovillages and municipalities, so they can come to a compromise if their desires are too divergent.

Another research could focus more on municipalities. It has become clear from this research that certain municipalities are very open to ecovillage initiatives, and some are not. It would be interesting to investigate what makes a municipality positive regarding ecovillages and what might condition them to be more pessimistic. Factors like political colour, size of municipality, work atmosphere and culture could be included. The results would be interesting to ecovillages, as they would know what municipality suits them. Besides, municipalities can learn from the results if their attitude is not deemed suitable.

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8. Appendices

List of appendices:

8.1. List of Variables: Extensive Information

Details about the variables are listed below.

Data Information

Variable	Unit	Scale of Measure	Source
Population Density	km2	Ratio	PDOK, 2024
Distance to Big City	m	Ratio	CBS, 2024; via PDOK
Rate of urbanity	5 through 1	Ordinal	CBS, 2024; via PDOK
Private-owned housing	%	Ratio	CBS, 2024; via PDOK. KadastraleKaart.com
Rental housing	%	Ratio	CBS, 2024; via PDOK. KadastraleKaart.com
Average Property Value	€	Ratio	CBS, 2024; via PDOK
Average agricultural land price	€/ha	Ratio	Kadaster, 2024; via Boerderij.nl
Job Availability	#	Ratio	LISA, 2023
Number of companies	#	Ratio	LISA, 2023
Labour participation	%	Ratio	CBS Statline, 2023; via Pzinfo
Inhabitants with social benefit	%	Ratio	CBS, 2024; via PDOK
Number of GPs within 5 km	#	Ratio	CBS, 2024; via PDOK. PZH, 2024; via NGR
Number of grocery stores within 5 km	#	Ratio	CBS, 2024; via PDOK
Number of kindergarten within 5 km	#	Ratio	CBS, 2024; via PDOK
Number of primary schools within 5 km	#	Ratio	CBS, 2024; via PDOK
Distance to University of Applied Science	m	Ratio	Vereniging Hogescholen, 2024; edited
Distance to University	m	Ratio	Allecijfers.nl, 2024; edited
Distance to train station	m	Ratio	NGR, 2023
Distance to bus stop	m	Ratio	RUG, 2021; via ArcGIS HUB
Climate Health Risk	%	Ratio	RIVM, 2020; via Atlas Leefomgeving
Flood risk	0 through 4	Ordinal	LIWO, 2021
Distance to body of water	m	Ratio	Kadaster, 2023; via PDOK
Distance to picking garden	m	Ratio	Pluktuinen.nl, 2024; edited
Distance to Dutch nature network	m	Ratio	Bij12, 2024; via PDOK
Distance to Natura2000	m	Ratio	CBS, 2024; via PDOK
Liveability	0 through 5	Ordinal	Ministerie van BiZa en Koninkrijkrelaties, 2020
Largest Party in Municipal Council	1, 2, 3, 4, 5	Nominal	Kiesraad, 2023; via Overheid.nl

Table 12: All Information on Quantitative Variables (n=67 for all)

8.2. List of Variables: Actions Executed for Data Gathering

For each variable, different actions were undertaken to assign values to each case. As they are spatial and geographic variables, most were executed via ArcGIS Pro. Below, it is visible what actions were exactly carried out for what variable in ArcGIS Pro.

Actions Executed per Variable	
Variables	**ArcGIS Pro Tool**
Population Density	Extract Values to Points
Distance to Big City	Select by Attributes, Extract selected feature to Layer, Generate Near Table, Add Join
Rate of urbanity	Spatial Join
Private-owned housing	Spatial Join
Rental housing	Spatial Join
Average Property Value	Spatial Join
Average agricultural land price	Spatial Join
Job Availability	Add Join
Number of companies	Add Join
Labour participation	Add Join
Inhabitants with social benefit	Spatial Join
Number of GPs within 5 km	Pairwise Buffer, Spatial Join
Number of grocery stores within 5 km	Pairwise Buffer, Spatial Join
Number of kindergarten within 5 km	Pairwise Buffer, Spatial Join
Number of primary schools within 5 km	Pairwise Buffer, Spatial Join
Distance to University of Applied Science	Generate Near Table; 2x Add Join
Distance to University	Generate Near Table; 2x Add Join
Distance to train station	Spatial Join
Distance to bus stop	Generate Near Table; 2x Add Join
Climate Health Risk	Extract Values to Points
Flood risk	Edited properties; Spatial Join
Distance to body of water	Generate Near Table; Select by Attributes (name =/= <null>)
Distance to picking garden	Generate Near Table; 2x Add Join
Distance to Dutch nature network	Generate Near Table, Add Join
Distance to Natura2000	Generate Near Table; 2x Add Join
Liveability	Select by Attributes, Spatial Join
Largest Party in Municipal Council	Add Join

Table 13: Data processing tools used in ArcGIS Pro per variable

8.3. List of Interviews

Ten interviews were conducted during the qualitative phase of this research. The answers to where, when and how long can be found in table 14.

List of Interviews

#	Ecovillage	Cluster	Role	Date*	Time	City	Length
1	GWL terrein	3	Treasurer	7th of February	11:00	Amsterdam	1:09:05
2	Groene Mient	3	Initiator	16th of February	10:45	Den Haag	0:56:46
3	Woongemeenschap Eikpunt	2	Secretary	17th of February	11:00	Lent	0:38:23
4	MMWZ De Bongerd	2	Initiator	21st of February	15:00	Zwolle	1:04:30
5	Ecodorp Zuiderveld	2	Inhabitant	25th of February	11:00	Nijmegen**	0:52:10
6	Strowijk Iewan	2	Initiator	27th of February	18:00	Lent**	0:56:09
7	Ons Dorpje Overeind	1	Initiator	3rd of March	11:00	Schalkwijk	1:14:30
8	Aardehuizen Olst	1	Inhabitant	7th of March	10:00	Olst**	0:56:32
9	EVA Lanxmeer	1	Initiator	7th of March	14:00	Culemborg	2:35:05
10	De Waterspin	3	Inhabitant	8th of March	10:00	Den Haag	1:08:16

Table 14: List of Executed Interviews ** all in 2025, ** executed online*

8.4. Interview Item List

Vragenlijst voor Ecodorpen

Inleiding:
Allereerst, kunt u nogmaals bevestigen dat u toestemming geeft voor de opname en vrijwillig deelneemt aan dit interview?

Fijn! Ik zal nog even kort wat meer vertellen over mijn onderzoek. Ik probeer meer informatie te verzamelen over ecodorpen en de redenen waarom zij op bepaalde locaties gevestigd zijn. Daarbij kijk ik naar wat de initiatiefnemers van ecodorpen willen en waar zij naar zoeken, maar ook of er bepaalde drijfveren vanuit gemeenten bestaan om ecodorpen wel of niet 'toe te laten'. Het is een exploratief, breed ontdekkend, onderzoek, dus ik zal over allerlei verschillende onderwerpen vragen stellen om te kijken wat er allemaal van belang zou kunnen zijn bij dit onderzoek.

Q: Voordat we beginnen, heeft u nog vragen over uw deelname, het onderzoek of iets anders?

Q: Kunt u beginnen met kort iets over uw ecodorp en uw rol daarbinnen te vertellen?

Deel 1
Doel: kwalitatieve omschrijving van clusters met betrekking tot vestigingsfactoren en gemeentebeleid.

Q: Kunt u mij vertellen over het ontstaan van ecodorp X, hoe het proces van idee tot realisatie verliep?
- Wat was zo ongeveer de tijdlijn?
- Ervaringen tijdens proces.

Q: Wat zijn de belangrijkste waarden en doelen van ecodorp X? Wat willen jullie bereiken?
- m.b.t. samenleving, ecologie, spiritualiteit, woningmarkt, gemeenschap etc.

Q: Welke factoren hebben meegespeeld in de zoektocht naar een geschikte locatie voor jullie ecodorp?
- Was er keuze of waren er maar beperkte opties?
- Kwamen de eerste bewoners uit de buurt of kwamen mensen vanuit verschillende kanten van het land?

Deel 2
Afstand tot grote steden, bevolkingsdichtheid, stedelijkheid
Q: Wat vindt u (en uw medebewoners) van 'de grote stad'? Van de mensen, de levensstijlen, de bevolkingsdichtheid, de faciliteiten etc.
Grote stad = meer dan 100,000 inwoners, eerste 25 steden van NL, van Amsterdam tot Alkmaar.

Percentage huur- versus koopwoningen, WOZ-waarde
Q: Binnen jullie ecodorp, hoeveel huur versus koop hebben jullie en waarom hebben jullie voor een dergelijke verdeling gekozen? Is er nog sprake (geweest) van sociale huur?
- Zou u de verdeling graag anders zien? Hier en in de rest van NL?
Q: Wat zijn de prijsklassen binnen het huizenaanbod en om welke redenen hebben jullie daarvoor gekozen? Socio-economische klasse?

Aanwezigheid van banen, bedrijven en mensen met een uitkering
Q: Werken mensen in het ecodorp meer fulltime of parttime?
Q: Hoeveel onbetaald werk doet men nog voor de gemeenschap?
Q: Om welke redenen werken de bewoners van het ecodorp? Werken mensen om te leven of leven mensen om te werken? Carrière?

Afstand naar huisarts, supermarkten en basisscholen
Q: Hebben de meeste mensen in het dorp een auto?
Q: In hoeverre vinden bewoners het belangrijk om een faciliteit met de fiets te kunnen bereiken?
Q: Streven jullie in bepaalde opzichten naar zelfvoorzienendheid? Bijv. voedselproductie met moestuintjes en kippen, zelf klussen, eigen houtvoorraad, thuisscholing, waterzuivering.

Afstand tot universiteit, HBO
Q: Zijn er veel van jullie op een manier betrokken bij de universiteit of een HBO (geweest)?
- Alumni, docenten, onderzoekers, andere invloeden.

Deel 3:
Doel: kwalitatief omschrijven van cluster m.b.t. de verstandshouding met de gemeente.

Q: Hoe is jullie verhouding met de gemeente (geweest)?
Q: Hebben jullie veel communicatie en overleg gehad over de plannen en de realisatie?
Q: Hoe hebben jullie het proces van vergunningen aanvragen ervaren?
Q: Heeft de gemeente op enige manier jullie plannen willen aanpassen, verplaatsen of verbieden?
Q: Hoe is de houding van de gemeente tegenover jullie plannen (geweest)?
Q: Zijn er veranderingen geweest in hun ideeën ten opzichte van jullie als ecodorp?

Q: Hebben jullie sinds de realisatie evenementen georganiseerd, bijgedragen aan de gemeenschap buiten het ecodorp, (iets positiefs toegevoegd waar de gemeente baat bij had)?
Q: Zijn er sinds de realisatie incidenten geweest op of in de buurt van het terrein waardoor jullie negatief in beeld kwamen?

Deel 4:
Doel: kijken of zij het 'eens' zijn met de resultaten van het kwantitatief deel, mogelijk relevant voor discussie.

Voordat ik aan deze interviews begon, heb ik al een ander deel van mijn onderzoek uitgevoerd. Daarbij werden ecodorpen ingedeeld in een aantal clusters/groepen gebaseerd op verschillende variabelen.

De voorlopige omschrijving wordt uitgelegd.

Q: Denkt u dat deze omschrijving goed bij uw ecodorp past?

Andere ecodorpen in uw cluster zijn X, Y en Z. Deze zijn bij jullie ingedeeld op basis van mogelijke vestigingsfactoren.

Q: Kent u deze ecodorpen en ziet u overeenkomsten tussen jullie ecodorpen?
Q: Kent u nog andere ecodorpen waar jullie het ecodorp mee zouden vergelijken?
Q: Zijn er nog andere dorpen waar jullie inspiratie vandaan gehaald hebben of die als voorbeeld gediend hebben?

8.5. Consent Form Interviews

Toestemmingsformulier Deelname Interview

Door het invullen van dit formulier geeft u toestemming voor deelname aan een interview. Het interview zal gaan over het ecodorp/ecowijk/eco-initiatief (vanaf hier: ecodorp) waar u onderdeel van bent. De vragen zullen gaan over het ontstaan, de realisatie en huidige gemeenschap binnen het ecodorp, en niet over u als individu. Het doel van het onderzoek is om de kennis over verschillende soorten ecodorpen te vergroten met betrekking tot hun locaties en vestigingsprocessen.

Uw antwoorden worden opgenomen, uitgeschreven en daarna verwerkt in de analyse. De opname en transcripties zullen niet worden gedeeld of gepubliceerd en zullen worden verwijderd zodra ze verwerkt zijn (ten laatste 1 mei). Het eindverslag wordt wel gedeeld met derden.

U kunt op ieder moment uw medewerking aan het onderzoek stopzetten zonder opgave van reden.

Deelname (beiden vinken)
O Ik verklaar vrijwillig deel te nemen aan dit interview.*
O De uitkomsten van dit interview mogen verwerkt worden in het onderzoeksverslag en (potentieel) een wetenschappelijke publicatie.*

Opname
Het interview zal worden opgenomen op de telefoon of laptop van de onderzoeker. De antwoorden zullen via de opname uitgewerkt worden, waarna de opname verwijderd wordt. U kunt de uitwerking dan inzien (niet verplicht).
O Ik geef toestemming om het interview op te nemen.*
O Ik wil de transcriptie graag inzien na uitwerking en ontvang deze graag op (mail/tel):
[ ]

Anonimiteit
U kunt, indien gewenst, uw deelname laten anonimiseren. Geef hieronder aan welke mate van anonimiteit u graag toe wilt laten passen, u kunt kiezen uit de volgende drie opties:

O Geen anonimiteit; mijn naam, functie, leeftijd en ecodorp mogen genoemd worden.
O Deels anoniem; mijn geslacht, leeftijd en ecodorp mogen genoemd worden (bijv.: man , 35).
O Volledig anoniem; alleen het ecodorp wat ik representeer mag genoemd worden.

O Ik verklaar hierbij te zijn ingelicht over de aard, methode en doel van het onderzoek en het is mij duidelijk waar ik aan meewerk. Ik heb vragen over het onderzoek kunnen stellen en die zijn naar tevredenheid beantwoord.*

Handtekening*: ……

Naam: ……

Naam Ecodorp*: …….. Datum: …….……..……

Onderzoeker

Ik heb mondeling toelichting verstrekt over de aard, methode en doel van het onderzoek en naar vermogen uitleg gegeven over waar de geïnterviewde mee instemt.

Handtekening: ……

Naam: …….. Datum: ……

* Antwoorden met ster zijn een vereiste voor het onderzoek, zonder deze kan het interview helaas niet gebruikt worden.

8.6. Final Code Book

Table 15 below shows the codes used throughout the qualitative analysis. They have been organised by code group, which are based on themes occurring during the interviews and themes important to the quantitative analysis. Not all codes could be assigned to a group, but were still considered interesting. They have been gathered under 'undetermined'.

Codes per Code Group		
Community	**Municipalities**	**Rate of Urbanity**
Citizen Initiatives	Bureaucracy	High rate of urbanity
Equality	Co-op with Housing Cooperation	Low Rate of Urbanity
Living Together	Communication with Authorities	Population Density
Prioritising the Collective	Cooperation with Municipality	**Presence of jobs and companies**
Sharing Amenities	Enthusiasm from Authorities	Forensen location
Social Support System	Fitting in landscape, culture, laws	High presence of jobs in vicinity
Sociocratic Decision-making	Independent from municipality	Little people fulltime
Distance to amenities	Municipality change of ideas	Low presence of jobs in vicinity
Good public transport connection	Municipality initiative	Mandatory unpaid labour
Larger distance to amenities	Municipality took distance	No mandatory jobs, presence
Limited public transport	Neutral authorities	No one fulltime
Short distance to amenities	Opportunism from municipality	Normal job relations
Distance to Big City	Resistance by authorities	Not aiming for self sustainance
Close to a Big City	Time pressure	Not self sustaining
Far from a Big City	Uncertainty authorities	Paid labour
In a Big City	**Objectives**	Political positions in neighbourhood
Like (being in) the Big City	Attractive Urbanism & Architecture	Some unpaid work, next to job
Like being outside the Big City	Bridging Government and Inhabitants	Unpaid Labour
Neutral about Big Cities	Community	**Ecology**
Real city people	Ecology	Composting
Some city people	Equal Accessibility to Housing Market	Ecological Lifestyle Choices
Village Atmosphere	Giving back to Society	Ecological/Bio-Based Building Materials
Distance to higher education	More generations of inhabitants	Environmentally and Nature Friendly
Close to HBO	Serving as an Inspiration/Example	Green Energy Systems
Close to Uni	Social Visions and Sustainability	Self-sustaining
Connections to HBO	Spirituality	Sharing Possessions for Degrowth Goals
Connections to Uni	**People with social benefit**	Zero waste
Housing	Diverse house sizes	Watersystems
Cheap Land Prices	Diverse inhabitants	**Undetermined**
Cheap materials	Diversity of houses	Lots of families
Diversity in Housing Prices	Do not filter inhabitants	Missing follow-up on initiative
Equal part Rental and Private Housing	Filter inhabitants	Pioneering
Fitted Housing Situations	Having a company	Practical, not spiritual
Mostly Private, Some Rental Housing	People with social benefits	Private maintenance
Mostly Rent, Some Private Housing	Postcapitalism	Public maintenance
Only Private Housing	Very high-educated residents	Public vs. Private space
Only Rental Housing	Some high-educated inhabitants	Left-winged
Only Social Rent		Squatter Movement
Partly Social Rent		Stacked building

Table 15: Code Book of Qualitative Analysis via Atlas.ti

8.7. Single Linkage Cluster Analysis: Dendrogram

The single linkage cluster analysis resulted in the dendrogram in figure 15. As the dendrogram does not show clear clusters, but only a large group of cases, it can be concluded that there are no outliers amongst the cases. The data are thus suitable for a Hierarchical Cluster Analysis.

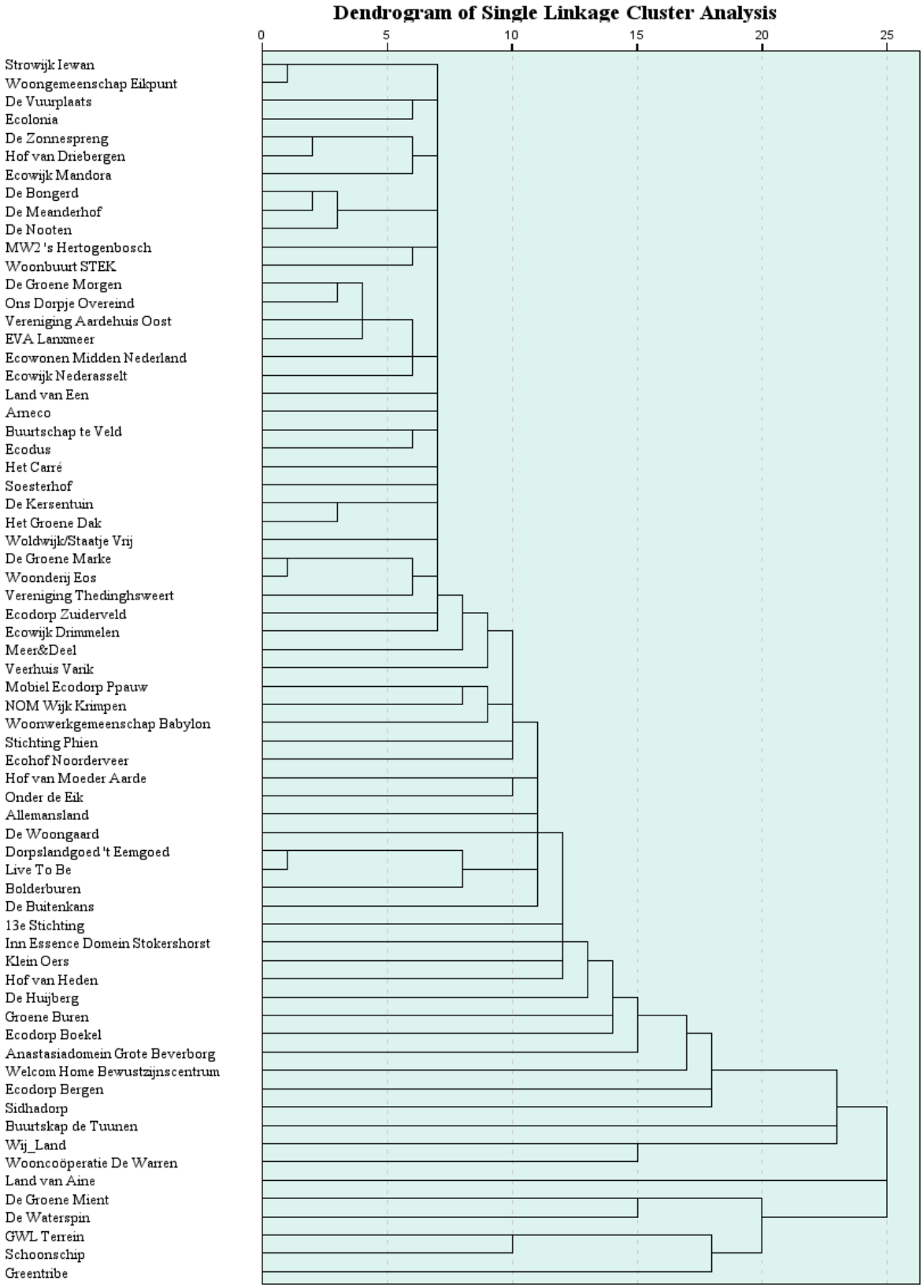

Figure 15: Dendrogram of Single Linkage Cluster Analysis

8.8. Hierarchical Cluster Analysis: Icicle Plot

The chronological order of the clustering during the HCA can be analysed from the icicle plot below. Every bar represents an iteration of the analysis and the clusters combined.

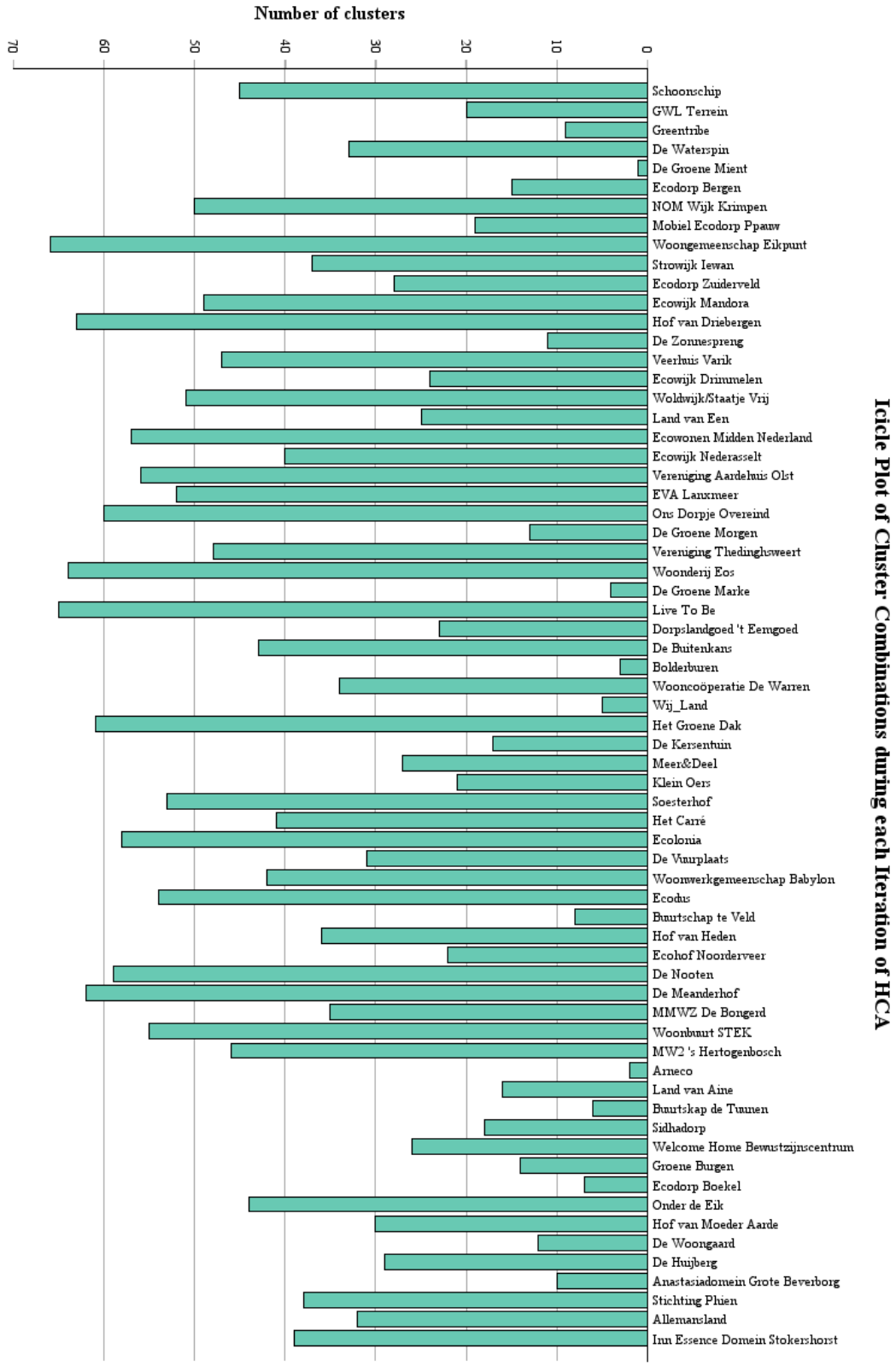

Figure 16: Icicle Plot of Cluster Iterations

8.9. Hierarchical Cluster Analysis: Agglomeration Graph & Elbow Method

Another product from the HCA is the agglomeration graph, in figure 17. This graph presents data originating from the agglomeration schedule. The heterogeneity coefficient of different cluster solutions is plotted in the final ten clustering stages. Otherwise formulated: the graph show how heterogeneous clusters are from one another for ten different cluster solutions, ranging from two clusters to ten. These data can help when deciding the appropriate number of clusters. To do so, the elbow method can be applied. Simply put, this method looks at the interpolation line drawn between the cluster stages. The steeper the line is, the larger the difference between the cluster in the different cluster solutions. From the graph, it can be seen that the first three bifurcations have a steep line, meaning they enjoy a large heterogeneity. From the four-cluster-solution onwards, the line becomes more flat, indicating smaller differences between the clusters in the cluster solution. Thus, from interpreting the agglomeration graph, a three cluster solution seems suitable.

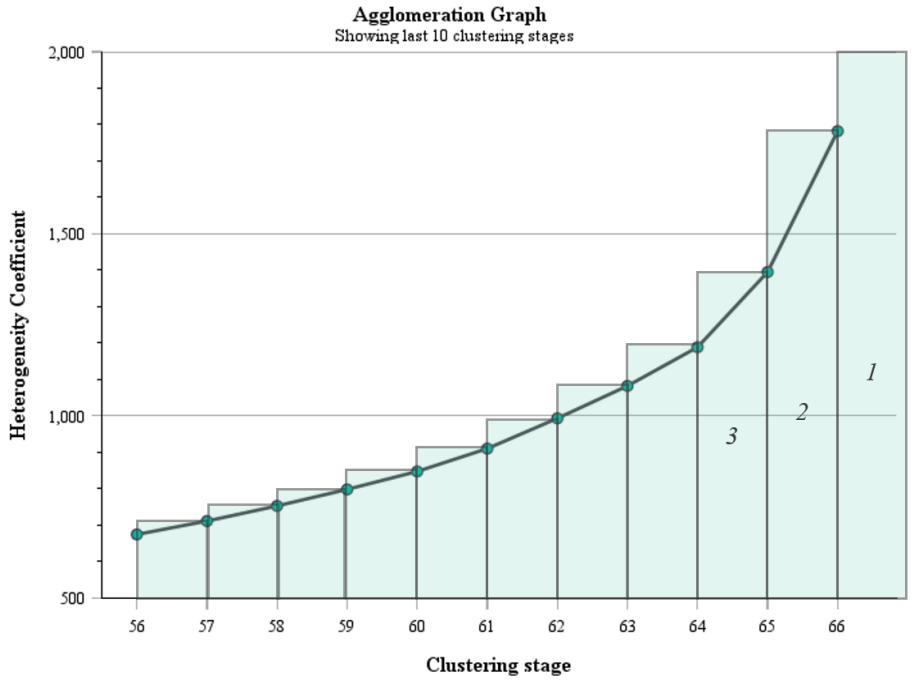

Figure 17: Agglomeration Graph plotting the Heterogeneity Coefficient for last clustering stages

8.10. Silhouette Analysis

A silhouette analysis tests the quality of a cluster division, providing insight into the robustness of the clusters. The verdict is expressed in a silhouette coefficient between -1 and 1, ranging from poor to perfect clustering. For the three clusters in this research, every case has been analysed individually. After which the mean, minimum and maximum have been presented in table 16 (A), as well as a visual representation as histograms in figure 18 (A). The mean silhouette coefficient of cluster 2 is negative, with a minimum of -0.619, and at least 25% of cases below -0.5, meaning that the cluster is actually of bad quality.

Silhouette Statistics A

Cluster	Count	Mean	Min.	Max.
1	15	0.558	0.337	0.646
2	47	-0.267	-0.619	0.122
3	5	0.431	-0.008	0.725
Total	67	-0.030	-0.619	0.725
		Dissimilarity measure = Euclid		

Silhouette Statistics B

Cluster	Count	Mean	Min.	Max.
1	38	0.550	0.202	0.669
2	21	0.136	-0.200	0.348
3	8	0.368	-0.294	0.702
Total	67	0.399	-0.294	0.702
		Dissimilarity measure = Euclid		

Table 16: Silhouette Statistics for original cluster division A and improved cluster division B

After adjustment of the poorest cases via the Next Best Cluster variable, a new silhouette analysis was conducted. New silhouette statistics (table 16 B) and histograms (figure 18 B) were created. Now, all three mean silhouette scores are positive, with only moderately negative minimums. The total mean has improved to 0.399 instead of -0.030. The cluster division can therefore now be considered of good quality.

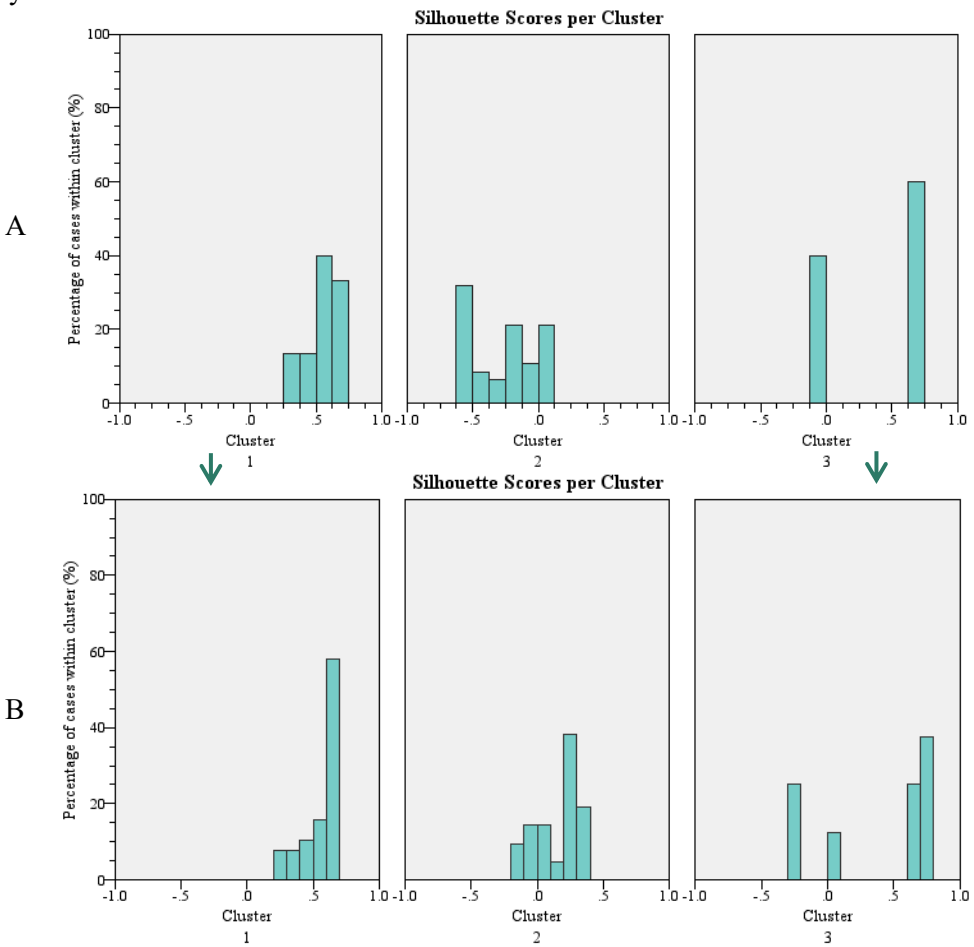

Figure 18: Histograms visualising the Silhouette Scores per Cluster for original cluster division A and improved cluster division B

8.11. Interview Results Table

Qualitative Results Combined

	Aardehuizen Olst	Ons Dorpje Overeind	EVA Lanxmeer	De Bongerd	Ecodorp Zuiderveld	Strowijk Iewan	Woongemeen-schap Eikpunt	Groene Mient	De Waterspin	GWL terrein
Objectives	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Attractive Urbanism & Architecture			•	••						
Bridging Government and Inhabitants			••							
Community	•	••	•	•	••	••	••	••	••	•
Ecology	••	••	•	••	••	••	•	•	••	•
Equal Accessibility to Housing Market	••			••	••	••	•	•	••	
Giving back to Society	•	••	•	••	•	••	•			
More generations of inhabitants	••	••		••			•		•	
Serving as an Inspiration/Example	••	••	••	••		••		•		•
Spirituality	••				•		••			
Ecological Efforts	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Composting	••							••	••	•
Ecological Lifestyle Choices	••	••	•	••	••	••	••	••	••	•
Ecological/Bio-based Building Materials	••	••	••	••	•	••	••	••		
Green Energy Systems	••	••	••	••	••	••		•	•	
Self-sustaining Efforts	••	••	•	•	•	••	•			
Sharing Possessions for Degrowth goals	••	••	•	•	••	••	••	••	••	•
Watersystems	••	••	•	••		••			••	
Zero waste	••	••								
Community Aspects	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Citizen initiatives	••	••	•	••	••	••	••	••	•	•
Living Together	•	••	•	••	••	••	••	••	•	•
Prioritising the Collective	••	••		••	••	••	••	•	•	
Sharing Amenities	••	••	•	••	••	••	••	•	••	
Social Support System	•	••	•	••	••	••	••	•	•	•
Consensus decision making	••	••		••	••	••	••	••		
Relations to Big City	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Far from a Big City	•	••	••							
In a Big City				••	••	•	•	••	••	••
Like being outside the Big City	••	••	•				••			
Neutral about Big Cities			•	••						
Like being in the Big City					••	•		••	••	••
Village people	••	••								
Village and City people	•		••							
City people							••	••	••	••
Types of Housing	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Only Social Rent					••	••				
Partly Social Rent	•		•	••			••		••	•
Only Rental Housing										
Mostly Rent, Some Private Housing							•			
Equal part Rental and Private Housing				••					••	
Mostly Private, Some Rental Housing			••							••
Only Private Housing	••	••						••		
Distance to Amenities	**Cluster 1**			**Cluster 2**				**Cluster 3**		
Limited public transport		••		•	•					
Good public transport connection	••		••		•	•	•	•	••	••
Short distance to amenities	•		•	•	••	••	••	••	••	••
Larger distance to amenities	•	••	•	•						

[blank] no presence of theme, • lower presence of theme, •• high presence of theme

Table 17: All Qualitative Results presented together