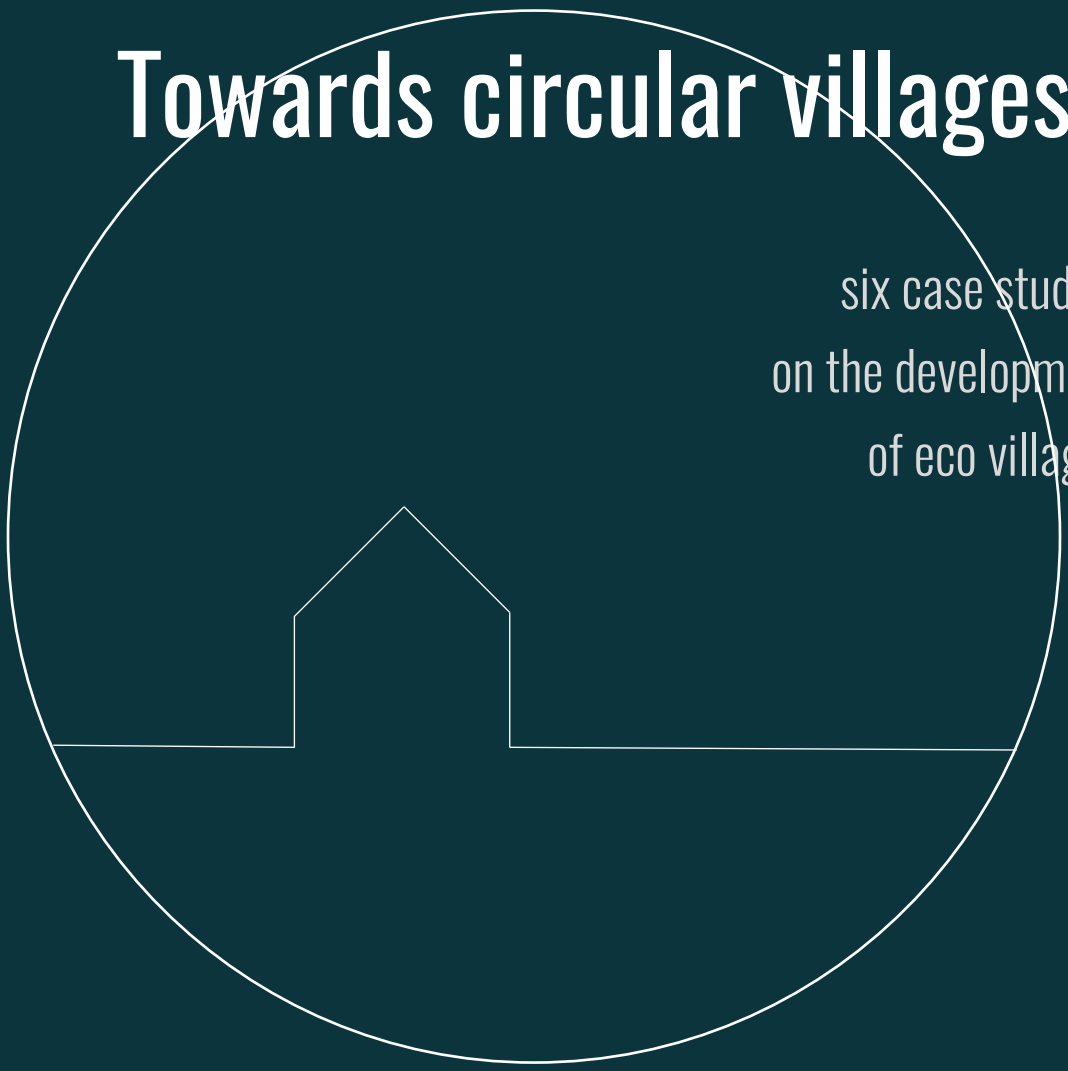
Towards circular villages?

six case studies
on the development
of eco villages



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Children playing in Het Groene Dak, Utrecht

A birds eye view of EVA-Lanxmeer, Culemborg

Children playing in De Bongerd, Zwolle

Building a community pizza oven in Meanderhof, Zwolle

A wooden frame house in Buitenkans, Almere

Abstract

Circular villages are the latest evolution of eco villages and are being built throughout the Netherlands. Circular housing projects present themselves as pilot projects, and keep reinventing the wheel. There seems to be a lack of knowledge on how to conduct the process of creating an eco village, and how to sustain them. To support the development of eco villages, and in particular the project of Diamondiaal (an eco village to be built in Almere during this year), this research explores how eco villages develop over time through six case studies. This research looks at four dimensions that characterise a successful eco village: planet, people, organisation and innovation. Data is gathered through a triangular method of personal interviews with eco village pioneers and residents, research of (online) documents and reports and observations in the villages. This research has found that over the years, successful eco village communities rely on solid organisational structures and show some fluctuations but overall remain quite socially cohesive. The ecological dimension however over time becomes less pronounced. Eco villages start as innovative projects with ambitious visions, but get locked in to decisions made in the planning phase. The initially high ecological ambitions decline, mainstream technologies catch up with the village's level of innovation and there are few incentives to keep innovating. Important lessons for future eco villages are, among others, that attracting a supportive group of residents and complementary external network contributes to achieving (ecological) ambitions. Creating and documenting a vision helps in attracting these supportive residents and network and an effective application procedure ensures that projects keep attracting the right people and. A horizontal structure with consensual decision making procedures makes residents feel involved and remain supportive of and decisions made. This is one of the determinants of social cohesion, a condition for a village to successfully function.

***Key words**: eco villages, circular economy, collective private commissioning, collectief particulier opdrachtgeverschap, institutional sustainability, strategic niche management*

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List of abbreviations

CE	Circular Economy
CPO	Collective private commissioning (in Dutch "*collectief particulier opdrachtgeverschap*")
IPO	Individual private commissioning (in Dutch "*individueel particulier opdrachtgeverschap*")
NSA	Neighbourhood Sustainability Assessment tool
SNM	Strategic Niche Management

PART ONE | FOUNDATION

1 | Introduction

1.1 Problem description

In 2017 Inspiratie Inc., a social enterprise that strives for the inclusion and empowerment of (vulnerable) people and communities, will start building Diamondiaal: an intercultural, circular neighborhood in Almere Oosterwold that will host around eighty people and a community center (Inspiratie Inc., 2016). Inspiratie Inc. has called upon Wageningen University & Research Centre Science Shop to help establish this project, as there is no blueprint for building and organising an eco village and there is still much to learn about the practical applications of circular economy. At present there is a proliferation of circular housing pilot projects, confirming that circularity is a new concept and every circular project has an explorative and pioneering nature. The following statements are excerpts from news articles and websites about circular projects:

- Buiksloterham in Amsterdam is presented as a "pioneer project" and a "living lab" for the circular city of the future (Amsterdam Woont, 2016; Amsterdam Economic Board, 2015).

- Parkkade Rotterdam, is introduced as "the first circular neighborhood in the Netherlands" (Sus Ateliers, 2015).

- Ecodorp Boekel, is a "unique example" and a "testing ground for future living" (Ecodorp Boekel, n.d.; Genugten, 2016).

Although the concept of circular neighbourhoods is fairly new, ecological living and building has been around for several decades. The term eco villages came into common usage in the beginning of the nineties (Van Schyndel Kasper, 2008). Around that same time, sustainable building was integrated into Dutch governmental policy (Van Hal et al., 2000). Despite the fact that eco villages have been around for a while, the pilot-oriented approach of new initiatives gives the impression that there's a lack of knowledge on how to develop a (circular) eco village. Perhaps these new initiatives suffer from a "not invented here" syndrome: the rejection of knowledge that is generated elsewhere (Agrawal et al., 2010; Grosse Kathoefer & Leker, 2010; Burcharth & Fosfuri, 2014). Or they're simply unaware of lessons that can be learned from other initiatives. In any case: too little is known about how circular neighbourhoods can successfully develop over time. Several authors share this notion, stating that existing good practices are insufficiently analysed and there is a need to assess different approaches (Medved, 2016; McCormick et al., 2013). Circular neighbourhoods can be seen as the latest trend in the field of ecological living and building, and there is still much to explore about this concept, as well as eco villages in general.

Why is a circular system desirable? According to the Global Footprint Network humanity consumes and wastes more resources than the Earth can handle. In fact, it would require 1.6 Earths to sustainably handle the current pattern of production and consumption (Global Footprint Network, n.d.). Bearing in mind that the world's population is expected to continue to grow, the depletion of resources will not decline any time soon (UN DESA, 2015). This leads to a range of environmental problems such as climate change (Stott et al., 2010). Scholars, governments and knowledge institutions argue that the problem lies in the current linear mode of production. In a linear "take-make-dispose" system resources are extracted, transformed into products and end as waste (Ellen MacArthur Foundation, 2015 C). In a circular system however, materials are reentered into the system at the highest possible quality and processes rely on renewable energy, thereby vastly reducing waste, resource depletion and corresponding environmental problems

1.2 Research objective

The main focus of this research is to gain insight into how eco villages develop over time. The previous section showed that there is a lack of knowledge concerning eco villages. By analysing the long term development of eco villages, this

research will contribute to the general body of knowledge around eco villages. A second objective of this examination is to establish recommendations for Diamondiaal specifically. As a third objective, this research adds to the efforts of the Amsterdam Institute for Advanced Metropolitan Solutions (AMS), for which this thesis is also written. The AMS Institute aims to develop sustainable solutions for urban settings with regard to water, energy, waste, food, data and mobility. Circular economy is one of the main topics.

1.3 Research questions

To guide the analysis of eco villages, a main research question and three sub questions have been formulated. This thesis explores the following questions:

What lessons can be learned from the long term development of existing eco villages in the Netherlands, in order to benefit future initiatives?

- What defines a successful eco village, in terms of environmental, social and organisational dimensions?
- How do eco villages in the Netherlands develop over time?
- What pitfalls and success factors characterise eco villages, which can benefit future (circular) villages such as Diamondiaal?

The first sub question is intended to define when an ecovillage is considered a success and what features characterise a successful eco village, according to literature. The environmental, social and organisational dimensions are derived from the three pillars of sustainability - people, planet, profit. It has been argued that an integrated, holistic approach is needed for an eco village to succeed, as this will lead to a long-term balanced system (Medved, 2016). Current models are predominantly focused on technical aspects and ecological parameters (Georgiadou & Hacking, 2011). A holistic approach offers the best chance of seizing opportunities presented by rapid urbanization and avoiding its potential pitfalls" (Sustainable Development Solution Network, 2013). This research therefore uses an integrated approach for the theoretical and practical exploration of eco villages, that combines environmental, social and organisational dimensions. The first sub question is aimed at creating a definition and characteristics of a successful eco village. Based on this, a framework is created that will guide an exploration of existing eco villages, to provide an answer the second sub question. To answer the third sub question, this research analyses the data gathered, to see which factors contributed to the success of the projects and what pitfalls they encountered.

The methods and data used to answer the main and sub questions of this research are discussed in the next section.

1.4 Methodology

This research uses a comparative, qualitative case study design to gain insight into how eco villages develop over time. In a case study design, the cases are subject to a holistic exploration of different features (Kumar, 2011). A holistic approach is essential to subjects like sustainability (Medved, 2016). Kumar (2011) states that a case study design is specifically relevant if the aim of a study is an in depth exploration and understanding of a certain phenomenon. As this research tries to understand the process of the long term development of eco villages and explores different dimensions, a case study is the appropriate design for this research. The selection of the cases, as well as the methods used to gather data, is now discussed.

1.4.1 Data collection

A case study design is characterised by a flexible application of data collection methods, though it is important that different methods are used simultaneously (Kumar, 2011). The collection of primary and secondary data is done through three different methods:

- **Literature study** of documents containing relevant information, such as websites, policy documents and evaluations / reports.

- **Semi-structured interviews**, with pioneers and active (current and former) residents, sixteen in total. The list of interviewees is featured in appendix A. The interviews are recorded and transcribed. The eco villages were contacted either through an email to a general eco village email address or with a phone call or email to a specific contact person. In this first contact, it was made clear to that this research searched for a mixture of interviews with people that were actively involved in the early stages, as well as residents that were active during later stages, in order to recruit the right people. The first contact either led to a rejection or a reference to potentially relevant interviewees. Respondents were thus recruited via snowball sampling, a method in which networks are used to gather respondents (Kumar, 2011). In total, sixteen interviews were conducted.

- **General and participative observation**. In four out of six cases (all but De Bongerd and Boddegat) observations took place, by walking in and around the village and taking descriptive notes of the scenery. In two specific cases participative observation occurred, by attending a neighbourhood council meeting at EVA Lanxmeer and a "Groendag" at Meanderhof. During participative observation descriptive notes were made and informal interviews and group discussions took place.

1.4.2 Analysis

The three methods of data collection provide this research with qualitative data, that is processed through content analysis. This method is used to identify central themes from large bodies of text in a systematic way (Haapanen & Tipio, 2016; Graneheim and Lundman, 2004; Kumar, 2011). Content analysis is done as follows: the text is read a few times in order to grasp the meanings that are communicated. While reading, headers, notes and highlights are added to the text that help identify the main topics. Once the different topics are made out, they are grouped together and main dimensions and characteristics are formed which forms the foundation of a framework that is used to analyse the eco villages with (Kumar, 2011). The framework and content analysis interacted with one another: the framework provided certain dimensions and characteristics for the content analysis, and the content analysis further fine tuned the framework (e.g. by identifying more, or more detailed categories or topics). This interplay is inherent to qualitative studies, as research design often overlaps with methods of data collection (Kumar, 2011).

The information gathered per eco village is categorised and placed in the framework. This framework is used to assess the development on each dimension per eco village, as well as to systematically compare the results of different eco villages.

1.5 Outline

This thesis is divided into three parts: part one - foundation, part two - results and part three - conclusions. The foundation (part one) consists of chapter 1 and 2 and introduces the fundamentals of this research. Chapter 1 gives a general introduction and describes the research objective, research questions and methods of data collection. Chapter 2 dives into a theoretical exploration of the concepts that are essential to this research (which are sustainable living and building, eco villages and circular economy) and uses this theoretical input to establish a framework that guides data collection and analysis. Results (part two) includes chapter 3, presenting case studies of each eco village, and chapter 4, analyzing and comparing each case. The concluding part with chapter 5 and 6 make up the third and final part of this research. Chapter 5 starts with a discussion of the findings in this research and ends with an overall conclusion as to how eco villages develop over time. From this research, recommendations for future initiatives, research institutions and policy makers are derived and presented in chapter 6. An overview of literature is found in chapter 7 and the appendices are featured in chapter 8.

2 | Theoretical exploration

Before going into an empirical analysis of eco villages, this chapter dives into a theoretical exploration of the concepts essential to this research. First, a brief history of sustainable living and building is discussed in section 2.1. These developments shape the context from which the cases in this research emerged, and will thus help to better understand them. This historic account ends in recent years, which show a trend towards circular economy (CE). This leads section 2.2 to continue with an exploration of the concept of CE, and its implications for villages and neighbourhoods. Section 2.3 addresses the concept of eco villages itself, and is divided into two sections. It first explores the definition of the concept, and secondly addresses the dimensions eco villages can be analysed on. After a theoretical exploration of eco villages and circular economy, this theoretical input is used to create a framework that guides the empirical analysis of this research. The framework is developed in section 2.4.

2.1 A brief history of ecological living and building

To gain insight into the context from which eco villages emerged, historic developments concerning ecological living and building are discussed in this section.

> 1960s - 1970s

In 1973, E.F. Schumacher published his book *Small is Beautiful*, stating that the industrial economy, with its emphasis on economic growth and increased production, spoils the environment, exploits non renewable resources, devalues quality of life, and increases inequality (Strange, 1974). This notion resonated with certain people in society that felt decentralised, small scale systems that rely on alternative technologies are needed to deal with environmental problems (Van Koppen & Spaargaren, 2015). Around this same time, several initiatives sparked in The Netherlands. In 1973, *De Kleine Aarde* started to experiment with organic agriculture and alternative sources of energy (Andere Tijden, n.d.). *De Twaalf Ambachten* was founded in 1978 as a center for ecological technology development (De Twaalf Ambachten, n.d.). These organisations aimed to advance the development and application of environmentally friendly technological solutions. Besides these rather technical initiatives, there was a development of communal initiatives. The Netherlands saw the rise of about eighty *Centraal Wonen* projects during the 1970s. *Centraal Wonen* is a cooperative way of living, that combines private dwellings with shared facilities and spaces (Woonvorm van de Toekomst, n.d.; Van Hal et al., 2000). The idea behind it is that cooperative living offers the possibility of achieving societal goals, such as social justice and environmentally conscious behaviour, that can not be achieved when people live isolated from one another (LVCW, n.d. A).

The rise of these communal and environmental initiatives must be seen in relation to other developments. In 1972 a group of scientists, united in the Club of Rome, link environmental degradation to economic development in their Limits to Growth (Meadows et al., 1972). During this time, environmental awareness experiences a boost and reaches the political agenda (Van Koppen & Spaargaren, 2015). The Dutch government responded with *Urgentienota Milieuhygiene*, addressing polluted air, water and soil. With regard to living and building, the policy was focused on energy efficiency (Van Hal et al., 2000). To this end, the government launched a subsidy programme to promote building insulation in 1978.

> 1980s - 1990s

So, during the sixties and seventies environmental awareness and small scale ecological and communal projects experienced a boost. As for ecological and cooperative living in the eighties, additional Centraal Wonen projects were initiated, but significant other developments in ecological or cooperative living did not occur during this decade. The publication of the Brundtland report in 1987 however further increased environmental awareness and in the following years this led to governmental and societal responses (Van Koppen & Spaargaren, 2015). During the beginning of the nineties, both the Dutch government, as well as grassroots communities started to experiment with ecological living projects (W/E adviseurs, 2010). Ecolonia in Alphen aan de Rijn, developed in 1990, is an example of a government initiative. The project was designed as a testing ground of 101 houses, intended to give sustainable building a boost.

Besides top down initiatives like Ecolonia, many bottom up ecological living and building projects popped up in the Netherlands during the nineties, of which at least twenty still exist today. To gather and spread knowledge, and ultimately advance the development of alternative living and building projects, organisations such as the Global Ecovillage Network and the Dutch *SEV Programme* were established, both intended at aggregating and spreading knowledge on ecological living and building.

The 1986 Chernobyl disaster and the 1987 Brundtland report, putting forward the famous definition of sustainable development, again sparked environmental awareness among society (Van Koppen & Spaargaren, 2015). Environmental issues became institutionalised and sustainability was incorporated into fields like urban planning (Bayulken & Huisingh, 2015 A). The Dutch National Environmental Policy Plan was created, and elaborated with a Sustainable Building Appendix in 1990 (Van Hal et al., 2000). From here on, the body of building standards and regulations kept on growing. 1996 was the year of the *Nationaal Pakket Duurzaam Bouwen*, intended to aggregate knowledge on sustainable building on a large scale (Van Hal, 2000). The first phase was centered around newly built houses, engagement of the building sector through interactive methods. The second phase accentuated existing buildings. The third phase was about upscaling and making sustainable building a market issue and eventually getting citizen-consumers to incorporate innovation in their living practice (Beckers et al., 2000). The institutionalisation of sustainability is paralleled with communities autonomously creating grassroot projects such as *Centraal Wonen* projects and eco villages. Through these projects the idea of "small is beautiful" is continued in this decade. The Dutch government however still commissioned large scale, mainstream projects such as Vinex, with a mass production of over 600.000 houses (RIGO, 2007).

> 2000s - 2010s

In the first decade of the 21st century, about five to ten *Centraal Wonen* projects and eco villages were established, compared to thirty in the eighties and ten to fifteen in the nineties (LVCW, n.d. B). During the nineties sustainable building was formalised in policy. This continued in the beginning of the 21st century with additional policy measures and higher technical standards. A specific measure from this decade is the introduction of an EU wide energy label for houses and appliances (Rijksoverheid, 2008). This is related to the nature of environmental awareness of this time, which focuses on the global character of environmental problems, with climate change gaining special attention (Van Koppen & Spaargaren, 2015). In Dutch policy this led to the *energietransitie*, by gradually shifting to renewable energy, thereby reducing carbon output.

With regard to living and building, two streams can be distinguished. On the one hand the energy transition has sparked large scale technical systems and top down solutions, giving rise to smart meters, zero energy houses and circular neighbourhoods initiated by municipalities (Roskam, 2015; Naus et al., 2015; Zhou & Brown, 2017; Energie Sprong, n.d.). On the other hand, the "small is beautiful" notion is still vivid. It can be found in the "tiny house movement", with people consciously choosing to downsize their living environment by living in a tiny house. Reasons for doing so are environmental are financial concerns, and obtaining a lifestyle with more time and freedom (Treehugger, 2008; Tiny Life, n.d.). The recent trend of minimalism can also be seen within the scope of "small is beautiful". It involves discarding a vast amount of possessions, leaving only minimal necessities, and consciously taking a stance against consumerism (The Minimalists, n.d.; Weinswig, 2016). Another related development is the popularity of urban agriculture, making people less dependent on large scale food systems and allowing people in dense areas to cultivate their own vegetables (Van der Schans, 2011). And lastly, the "small is beautiful" notion is still expressed through grass roots eco village projects that continue to be established.

From this short review of ecological living and building developments, a number of things can be concluded. Due to several publications and events, environmental awareness experienced a boost since the 1970s. In the building sector, this has led to attention for sustainable building. Society saw the rise of grassroots movements, in line with the small is beautiful movement, that seek alternative, conscious and sustainable ways of living and building. In recent years, the number of eco villages is increasing, with the creation of circular neighbourhoods as the latest trend in sustainable living and building. In the next section eco villages, one of the central concepts of this research, is explored further.

2.2 Theoretical perspectives on eco villages

The previous section gave an overview of historic developments in sustainable living and building, which have become more widespread over the years. The rise of eco villages is one of these developments. To gain an understanding of eco villages, this section gives a theoretical account of the definition and characteristics of eco villages. It first gives a theoretical perspective on the definitions and functions of eco villages. The second part of this section looks at why eco villages are a suitable unit of analysis and how they can be analysed.

2.2.1 What is an eco village?

Scholars argue that the term eco village has come into common usage since the beginning of the 1990s (Van Schyndel Kasper, 2008). An eco village is an intentional community that integrates ecological principles into everyday life and its direct environment. Robert Gilman (1991) put forward a definition of eco villages that is widely used. He proposes that an ecovillage is "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". This definition gives a general idea of what an eco village is, but is very general and anthropocentric. The definition proposed by the Global Ecovillage Network (GEN) gives a better idea of what an eco village is in practice and focuses on both social and natural environments. According to GEN, an eco village is "an intentional or traditional community using local participatory processes to holistically integrate ecological, economic, social and cultural dimensions of sustainability, in order to generate social and natural environments" (Global Ecovillage Network, n.d.). It is this definition that is be used in this research.

It is important to emphasise that this definition is an ideal type, which describes ambitions more accurately than reality (Van Schyndel Kasper, 2008). In practice, eco villages come in many shapes and sizes, varying in setting (urban versus rural), size (50-500 residents), degree of sustainability, self sufficiency and isolation from society (Van Schyndel Kasper, 2008).

Setting up an eco village goes hand in hand with difficulties, such as effort, high costs, risks and institutional boundaries (Van Vliet et al., 2005). Despite these potential barriers, people have different motives to start or join an eco village, either of personal or societal nature. In general they can be divided into a few main categories, which are environmental concerns, political reasons, a feeling of autonomy, a craving towards more social or cooperative ways of living, and spiritual values (Van Schyndel Kasper, 2008). Bayulken and Huisingh (2015 B) have examined the perceived quality of life and found that eco village inhabitants score higher on this dimension than do residents of conventional neighbourhoods. Increased quality of life is also identified as a reason for moving into an eco village. People thus have personal as well as societal considerations for starting an eco village. Eco villages can also be seen as grassroots innovation movements. Grassroots innovation emerges from local communities, in response to unsatisfying results brought forward by conventional systems. They challenge the status quo by experimenting with novel solutions for sustainable development (Smith et al., 2014; Feola & Nunes, 2014).

2.2.2 Analysing eco villages on sustainability

Eco villages can be instruments of change, as they are a type of grassroots innovation movement. Newman and Dale (2005) emphasise that: "although international and national governments have a significant role to play in the implementation of sustainable development, much of the practical movement towards sustainable development is occurring at the community level". Eco villages are an example of this community level, and are therefore an appropriate unit of analysis. Another reason is that villages allow for the analysis of not only the technical performance of buildings, but also the "spaces between them, services that are provided, humans and other organisms that are living there and the synergies between this broad range of elements and activities" (Sharifi & Murayama, 2013). The benefits of analysing eco villages and neighbourhoods, as opposed to cities or districts, is articulated by Sharifi & Murayama (2013): "a neighbourhood is likely to be the minimum level where economies of scale can be exploited [...]. It is also the level at which community-based interventions can be organised and residents can be involved in the decision making process". On a smaller scale there is less efficiency and little to no economies of scale, on a larger scale manageability is at stake. So analysing a city would be rather complex, whereas analysing a single house would lack certain dimensions.

Although eco villages are a suitable unit of analysis, Siracusa et al. (2008) warn that the evaluation of eco villages is not an easy task due to the wide range of parameters that must be taken into account. To structure the evaluation, the analysis is divided into different dimensions, related to the pillars of sustainability. The traditional definition of sustainability refers to the pillars people, planet and profit. Although some degree of economic activity could influence the way a village functions, and some financial liquidity is necessary for a village's survival, profit is not a core objective of an eco village, and will therefore not be treated as a separate category in this research. Several authors propose that an institutional pillar should be added to the traditional definition of sustainability, because this supports the other dimensions and is essential to a sustainable system (Sharifi & Murayama, 2013; Valentin & Spangenberg, 2000; Parris & Kates, 2003). The profit dimension is therefore replaced by an institutional pillar. Additionally, as eco villages can be seen as grassroots innovation movements, innovation will be the final dimension that is taken into account. The dimensions planet, people, organisation and innovation are discussed separately in the following sections.

Planet

The planet pillar refers to the ecological character of eco villages. Eco villages strive to reduce environmental impact and regenerate natural environments, but there is no norm or precise definition of the ecological aspect of eco villages. The degree to which environmental impact is reduced, and the way this is done, differs greatly per village. As there is a trend towards circular villages, this research considers a circular system as the environmental norm. The cases in this research will thus be assessed on the extent to which they approach a circular system. The concept of circular economy is discussed in section 2.3.

People

Social sustainability is important to the functioning of a village, because an eco village is created by and for people. The social system around an eco village should be designed in such a way, that it contributes to the vitality of the whole (Missimier et al., 2017). In literature, there is no consensus on the precise definition and characteristics of social sustainability, but there are common denominators. Social capital (or cohesion) is indicated as an important characteristic by most scholars (Missimier et al., 2017; Woodcraft, 2012; Marsal-Llacuna, 2016). Social capital is necessary for a proper functioning system, as it allows for collective action (Dragolov et al., 2016; Rydin & Pennington, 2000; Missimier et al., 2017). Overcoming collective action problems is especially relevant for circular neighbourhoods, as CE implies a shift in the role of consumers. Social cohesion is regarded as the quality and quantity of connections among residents (Alcalá et al., 2016; Veen et al., 2016; Dargolov et al., 2016). A cohesive society is characterised by "resilient social relations, a positive emotional connectedness between members, and a pronounced focus on the common good" (Dragolov et al., 2016). The criterion social relations regards how and how often people engage with one another, for example through meetings or group activities. Connectedness is portrayed by trust, identification and perception of fairness (Dragolov, 2016). Focus on the common good is translated into solidarity or helpfulness and participation in common activities. Social cohesion

Diversity is seen as an important aspect as well, as diversity is a good strategy to be resilient in the long run (Missimier, 2017). Following this theory, diversity could potentially be important for the long term development of eco villages. Firstly, it is important to Diamondiaal, as they aim to create a diverse and intercultural village. It is also related to social justice and equality; is the higher quality of life, associated with eco villages, attainable for different groups in society? Some authors claim that (ethnic) heterogeneity is at odds with social cohesion, especially within neighbourhoods (Van der Meer & Tolsma, 2014). Perhaps the results of this research can bring some insights into this relationship.

Organisation

The institutional topic refers to the system of rules that governs the interactions of members of a society (Spangenberg et al., 2002; Sharifi & Murayama, 2013). These rules, norms, regulations and procedures include both social values as well as formalised rules. In case of an eco village, this could refer to an application procedure that manages the entry of new residents or the maintenance of a communal garden. The institutional dimension is also concerned with the role of actors, stakeholders and organisations, such as a resident's organisation (Spangenberg et al., 2002). It furthermore includes decision making procedures, such as decisions are made, who is involved in decisionmaking and what topics are

addressed. Also: who can put a topic on the agenda and how often are there meetings. Sustainable development is concerned with deliberate decision making, aimed at creating environmentally sound development.

In terms of organisation, Seyfang et al. (2013) have defined key success factors for community energy projects. These key factors are applicable to the cases in this research, as eco villages and community energy projects have similar characteristics. They share a high degree of autonomy, a focus on technology and ecology, and a base in civil society. These success factors are applicable to the planning phase of eco villages than can be used to assess its success. The success factors defined by Seyfang et al. (2013) are community, network, policy and project. 'Community' means the extent to which the project is designed to meet the community's needs, and the community's involvement in the process. Forming supportive partnerships and information sharing networks, is also seen as a key success factor. A supportive policy context is essential to the project's success. 'Project' encompasses sufficient time, information, skills, money and material resources to carry out the project.

Innovation

Eco villages are a type of grassroots innovation, in essence eco villages feature alternative methods of organising, cooperating and providing. To assess the innovative nature of eco villages, this research turns to strategic niche management (SNM) to analyse the extent to which eco villages form an environment in which innovations can grow. Although SNM was intended as a policy tool, it is mostly used as an analytical tool, and is used as such in this research.

Kemp et al. (1998) define strategic niche management as "the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about desirability of the new technology and (2) enhancing the further development and the rate of application of the new technology". Through strategic niche management, disruptive innovations that clash with existing structures and established regime technologies, serve long-term goals (such as sustainability) and would otherwise remain "hopeful monstrosities", have a chance to evolve and invoke societal change (Kemp et al., 1998). A niche thus allows testing the design of a technology and supports the coevolution of technology, user practices and regulatory structures. Furthermore, technology and societal issues can be aligned. The notion of experimentation in technological niches is based on the principle that there is no such thing as a radical innovation that serves as a simple technological fix. Instead, technology and social change are interrelated, as (sustainable) technology is embedded in a societal context. They can not be seen separately and therefore technologies must evolve in a societal setting.

Socio-technical niches must be seen from a multi-level perspective (Schot & Geels, 2008). Niches form the micro level at which innovations occur. The meso level is formed by socio-technical regimes. At the macro level there is the socio-technical landscape which is an exogenous environment that is beyond the influence of niches end regimes, such as cultural patterns and political developments. Figure 1 shows the multi-level dynamics and the potential journey of an innovation.

Schot and Geels (2008) have identified determinants of the successful emergence of niches:

- Articulation of expectations and visions
- *Building of social networks* - create a constituency behind new technology, facilitate interactions between relevant stakeholders, and provide necessary resources. Important is: broad networks (multiple kinds of stakeholders), deep networks (people who represent organisations should be able to mobilise commitment and resources within their own organisation and networks).
- *Learning processes at multiple dimensions* - first order learning (facts and data) and second order learning (changes in cognitive frames and assumptions).

Articulation of expectations and visions is crucial for niche development because they provide direction to learning processes, attract attention and legitimate protection and nurturing. The expectations have to be specific, of high quality and robust (i.e. shared by multiple actors). Eco village pioneers have a certain vision of how they perceive an ideal world and want to create a distilled, small scale version of this ideal type within the eco village project. This provides them

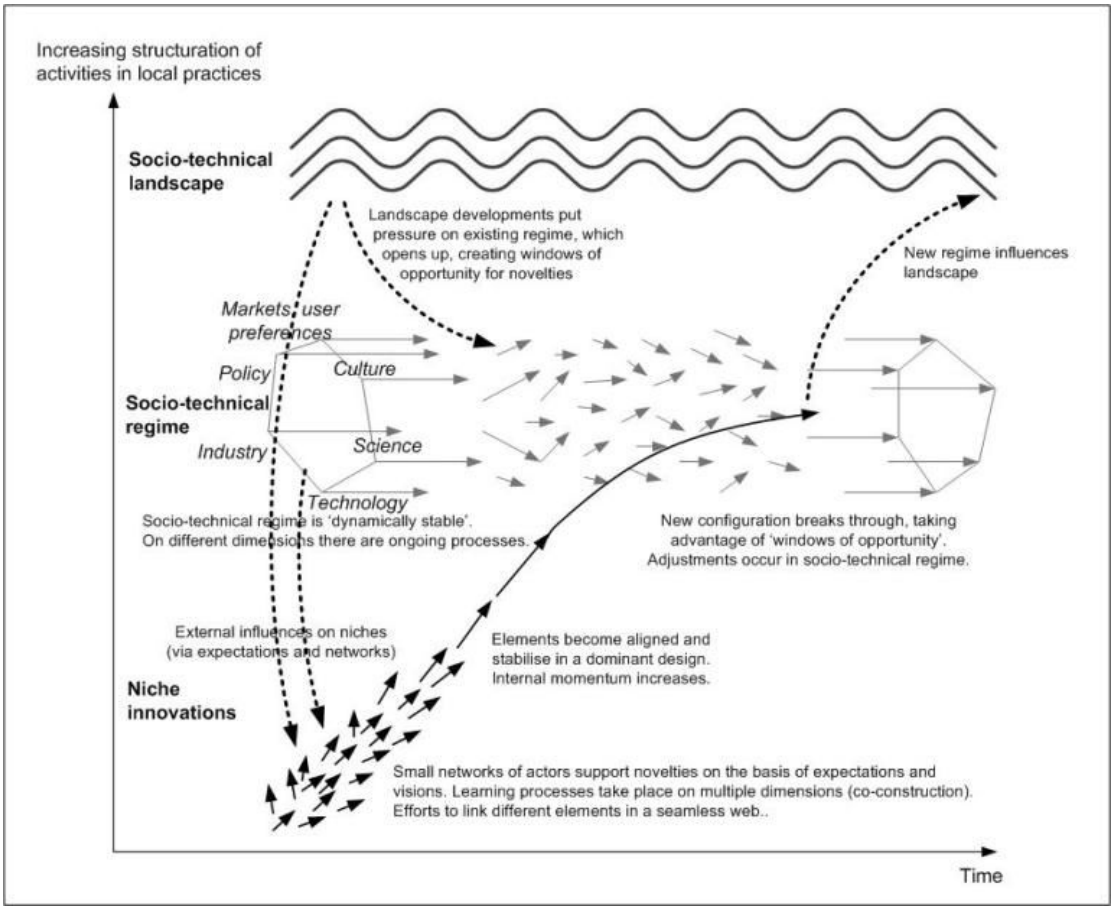


***Figure 1**: From niche innovations to socio-technical regimes. Source: Schot & Geels (2008).*

with the opportunity to experiment with alternative, environmentally friendly technologies that are in line with their vision. But new technologies are often imperfect and user experiences are initially suboptimal. Applying new and unproven technologies requires commitment from end users. Commitment is likely to be higher when users are presented with a clear vision on the ultimate goal of the project the technology serves and justifies a compromise in user experience or comfort.

Building of social networks is essential to create a constituency behind new technology, facilitate interactions between relevant stakeholders, and provide necessary resources (Schot & Geels, 2008). It is important that these networks are broad (multiple kinds of stakeholders) and deep (people who represent organisations should be able to mobilise commitment and resources within their own organisation and networks). To create a supportive network, eco villages can address both the internal network of residents, as well as an external network of supporting actors. This research distinguishes an internal network, or the village's residents, and an external network, i.e. supportive partners from outside the village. This determinant is quite similar to the success factor "network" derived from the work of Seyfang et al. (2013), but in this section network specifically targets external networks around innovation. It also has similarities with the successfactor "group" with regard to the internal network.

Learning processes at multiple dimensions are important for the technology to evolve. Learning can happen on two dimensions: first order learning is concerned with facts and data about the technology. Second order learning deals with changes in cognitive frames and assumptions. An example of solar energy illustrates the difference between first and second order learning. Data and feedback on how much energy is generated through solar panels and how people value their experiences with solar panels are examples of first order learning. Second order learning takes a step back and questions for example what is deemed as environmentally friendly and if solar energy is an appropriate technology to meet this goal.

This chapter has explored the theoretical side of eco villages. The term eco villages has been around for twentyfive years. Eco villages manifest themselves in many different ways, but what they have in common is that eco village pioneers try to do things differently and create pathways that diverge from conventional systems. An eco village has the potential to serve as a technological niche in which ecological socio-technical innovations can evolve. The definition of eco villages leaves the interpretation of the ecological aspect open for interpretation. As there is a trend towards circular villages, this research regards a circular system as the latest standard in eco villages. In the next section, the concept of circular economy, and what is means for living and building, is explored further.

2.3 From circular economy to circular living

Cities all over the world are transforming into "circular cities" or are creating circular neighbourhoods (Yuan et al., 2006; Geng et al., 2013; Li & Yang, 2016; Cities in Transition, n.d.). This research regards a circular system as the ecological standard for eco villages. In order to gain an understanding of the concept, his section explores the general concept of circular economy (section 2.2.1), and its implications for living and building (section 2.2.2).

2.3.1 Circular economy - the concept

The currently dominant economic model can be described as a linear model: raw materials are taken from nature, these materials are used to create end products, which are then consumed and finally disposed of (Ellen MacArthur Foundation, 2015 A). This take-make-dispose model inherently leads to resource depletion and high levels of waste, generating a wide range of environmental problems. It also creates a dependency between economic development and material input. As most resources are finite, both environmental and economic problems lie ahead if the linear model is continued. A circular economic model in contrast, focuses on the flow of materials. CE is based on re-entering materials into the system and using regenerative components. The Ellen MacArthur Foundation, regarded as an authority in the field of CE, established the following definition:

> *"A circular economy is a global economic model that decouples economic growth and development from the consumption of finite resources. It is restorative by design, and aims to keep products, components and materials at their highest utility and value, at all times"* (Ellen MacArthur Foundation, 2015 B).

In a circular economy, environmental capacity and ecological laws are taken into account. Environmental impact is minimised through cleaner production methods and extensive recycling (Li & Yang, 2015). Products and materials are recycled at highest possible quality, eliminating waste as much as possible.

The Ellen MacArthur Foundation (n.d.) has defined three guiding principles for circular economy:

1. *Preserve and enhance natural capital*, by controlling finite stocks and balancing renewable resource flows. This is done by first dematerialising utility, and second by applying technologies and processes that use renewable and better performing resources.
2. *Optimise resource yields*, by circulating products, components and materials at the highest utility at all times in both technical and biological cycles. In practice, this means that products have to be designed for remanufacture, refurbishment and recycling to keep materials circulating, at highest possible quality.
3. *Foster system effectiveness*, by revealing and designing out negative externalities. Damage to human utility and management of negative externalities have to be taken into account.

With regard to material flows, circular economy distinguishes two types of cycles, a biological and a technical cycle (figure 2). The Earth has many cycles of biological nutrients such as water, carbon dioxide and phosphorus (Murray et al., 2015). Nearly all biogeochemical cycles have been altered due to human activity, which has resulted in excessive extraction of nutrients on the one hand, and excessive addition of nutrients on the other, with unbalanced systems as a consequence. Biological cycles can deal with some degree of change, but it is the rate of change that is important. Circular models are aimed at managing this flux, so nutrients can be restored to their natural levels.

The technical cycle deals with all other materials that are used in production processes, such as the wood and metal screws that make up a table. These materials are supposed to stay out of the biological cycle (Murray et al., 2015). This means that products, and the components and materials they are made of, are restored and re-entered into the market at the highest possible quality (Ellen MacArthur Foundation, 2015 B). There are two ways to create and maintain high (or highest possible) quality of products and materials. This starts with designing a product in such a way that it can be easily reused or reassembled. After the production phase the quality and use of a product can be improved by repair, reuse, refurbishment, remanufacture, recycling and recovery.

A shift towards circular economy requires a change of the current production and consumption model. Circular economy is being applied in many countries, with China as a frontrunner adopting circular economy as the basis of its economic development (Yuan et al., 2006; Murray et al., 2015). The restorative and regenerative nature of circular models makes concepts of waste and resource depletion obsolete, decreasing environmental problems and reducing resource dependency (Ellen MacArthur Foundation, 2015 B; Murray et al., 2015). The potential environmental benefits of circular economy are promising, but literature also poses criticism on the subject. Some authors claim that circular economy focuses only economy and environment, and is lacking a social dimension (Murray et al., 2015). The third principle of CE (designing out negative externalities) could imply social factors. Scholars and research institutions are figuring out how embed this social dimension more explicitly. One example comes from Metabolic (2017). In their "seven pillars of circular economy" social dimensions such as "the health and wellbeing of humans and other species are structurally supported" are incorporated into CE. Murray et al. (2015) propose an alternative definition: "An economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximise ecosystem functioning and human well-being".

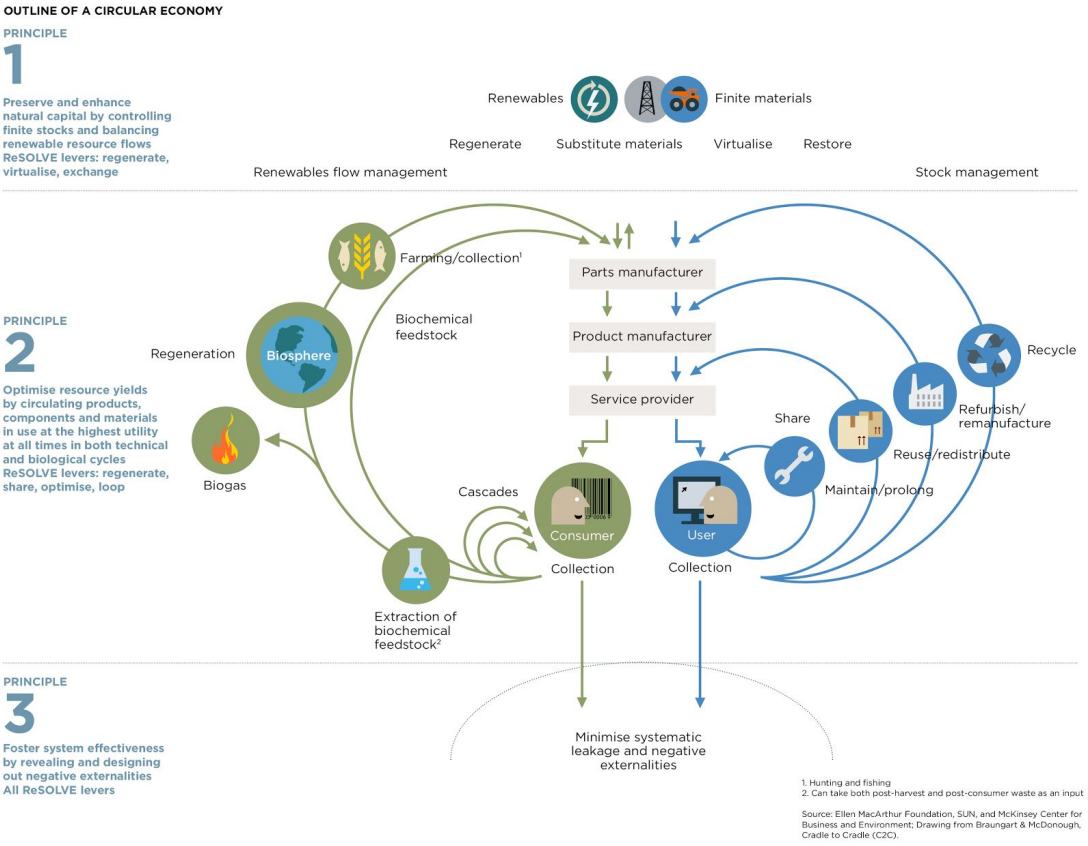


***Figure 2**: The biological cycle (left) and technical cycle (right) of a circular model. Source: Ellen MacArthur Foundation (2015 A).*

A second criticism is that research has shown that even though circular economy focuses on environment and economy, the environmental dimension sometimes suffers and that circular economy appears to be mostly an economic strategy (Yuan et al., 2006; Schneider, 2015; Junior, 2014). A final criticism is the notion that circular economy leads to unintended consequences and oversimplification. Unintended consequences can be explained with the example of biofuel. Biofuel is presented as a renewable source of energy but the quest for biofuel has led to the loss of millions of acres of tropical forest that has been replaced with soy fields (Farigone et al., 2008). So initially biofuel seemed a sensible source of energy, but instead its cultivation led to new issues. Oversimplification is apparent in the quest for longevity, one of the implications of CE. Longevity seems sensible, but this is not necessarily a desirable feature. Longevity could lead to ecological inefficiency: plastic cups have a long life span than for example bamboo cups, but bamboo also breaks down more quickly, uses only natural nutrients and the production process requires less energy (Murray et al., 2015). These examples show that there is still a lot to unravel about the practical implications of circular economy. This makes it rather difficult to precisely define what (optimal) circular solutions are, and what not. The next section explores principles and characteristics of circular economy and makes an effort to make them applicable to living and building.

2.3.2 Translating circularity to living and building

Circular economy is a fairly new concept and started out as an economic and industrial concept. There is no blueprint for creating a circular economy, let alone for circular neighbourhoods. The practical implications of circular economy for villages and neighbourhoods are explored through pilot projects, such as Living Lab Buiksloterham in Amsterdam, Ecodorp Boekel and Circulaire Parkkade in Rotterdam. organisations such as the Ellen MacArthur Foundation and Metabolic are working on practical applications to bridge the gap between theory and practice. The Ellen MacArthur Foundation has established the ReSOLVE framework that guides the transition to a circular economy and can be applied to the built environment (Lemmens & Luebkeman, 2016). The general principles are summarised in figure 3 and the ReSOLVE framework is shown in figure 4.

Principles	Preserve and enhance natural capital
	Optimize resource yields
	Foster system effectiveness
Characteristics	Design out waste
	Build resilience through diversity
	Work towards energy from renewable sources
	Think in systems
	Think in cascades

Figure 3 *Principles and characteristics of circular economy*

***Figure 4**: The ReSOLVE framework by the Ellen MacArthur Foundation. Source: Lemmens & Luebkeman (2016).*

So what would it mean in practice to apply the principles of circular economy to living and building? To examine this, it is necessary to first define the dimensions these principles can be applied to. For this, inspiration is drawn from neighbourhood sustainability assessment tools (NSAs) and articles that reviewed NSAs (Reith & Orova, 2015; Haapio, 2012). NSAs are certification schemes such as LEED-ND, BREEAM and HQE2R that assess neighbourhoods on their environmental performance. On the intersection of building, living and circularity, the following dimensions are relevant:

- Buildings and materials
- Energy
- Water & sewage
- Waste
- Transport
- Food

The building and materials category includes the design of the houses and the materials used. From the ReSOLVE framework, prolonging an assets life (Optimise) and using alternative materials (Exchange) can be applied to this dimension. Building houses with wooden frames (made from wood that is durable and can be reused once the house is demolished). The energy category is fairly straightforward: the framework proposes energy from renewable sources. Circular options for water and sewage are rainwater harvesting and plain reuse or filtering of greywater for non potable purposes (IWA, 2016). This relates to the options reusing assets, decreasing resource usage and restoring natural capital. Waste should be diminished as much as possible, and waste that can not be prevented should be reused. Organic waste could become compost, and for remaining waste streams the eco village could set up partnerships with organisations that can use this waste as a resource. In relation to transport, the option of "dematerializing utility" (see the first principle of CE as defined by the Ellen MacArthur Foundation) could be applied. An example could be that people do not own a car individually, but buy it collectively or rent one when they need it. Transport that runs on renewable fuels is another option. With regard to food provision, eco villages could produce vegetables or fruits according to the principles of permaculture design to create self regulating systems (Holmgren, 2002). Another option is that an eco village could become part of the regional food chain, e.g. by getting their food from a local farmer and supplying the farmer with organic waste that can be composted (Medved, 2016).

In an ideal circular economy, different technologies are used, waste is decreased as much as possible, and waste that can not be prevented becomes a resource. This shift is not merely technical, but also involves a change in the role of consumers and a reconfiguration of social and institutional practices (Van Vliet et al., 2005). Circular economy requires a more active and conscious role of consumers. Instead of the serving as an end station for consumer products, consumers become part of the cycle. It calls for a change in behavior, such as separating waste, repairing damaged goods and minimising consumption (Iles, 2013; Edie, 2015). The consumer's role, or in the case of eco villages the role of pioneers and residents, shifts from end user to provider. The role of "consumer provider" demands that eco village residents also become suppliers, service technicians or financiers within their autonomous network (Van Vliet et al., 2005). It is important to keep this in mind when aiming to create a circular project.

This previous sections gave an overview of historic developments in the field of sustainable living and building and explored the concept of eco villages. The current section has shown what a circular economy means in theory, and what it implies for eco villages in practice. The first three sections of this chapter have provided input on the main concepts of this research. In the fourth and final section of this research a framework is created by which eco villages can be analysed on their ecological, social, organisational and innovative sustainability.

2.4 Towards a framework for analysing eco villages on sustainability

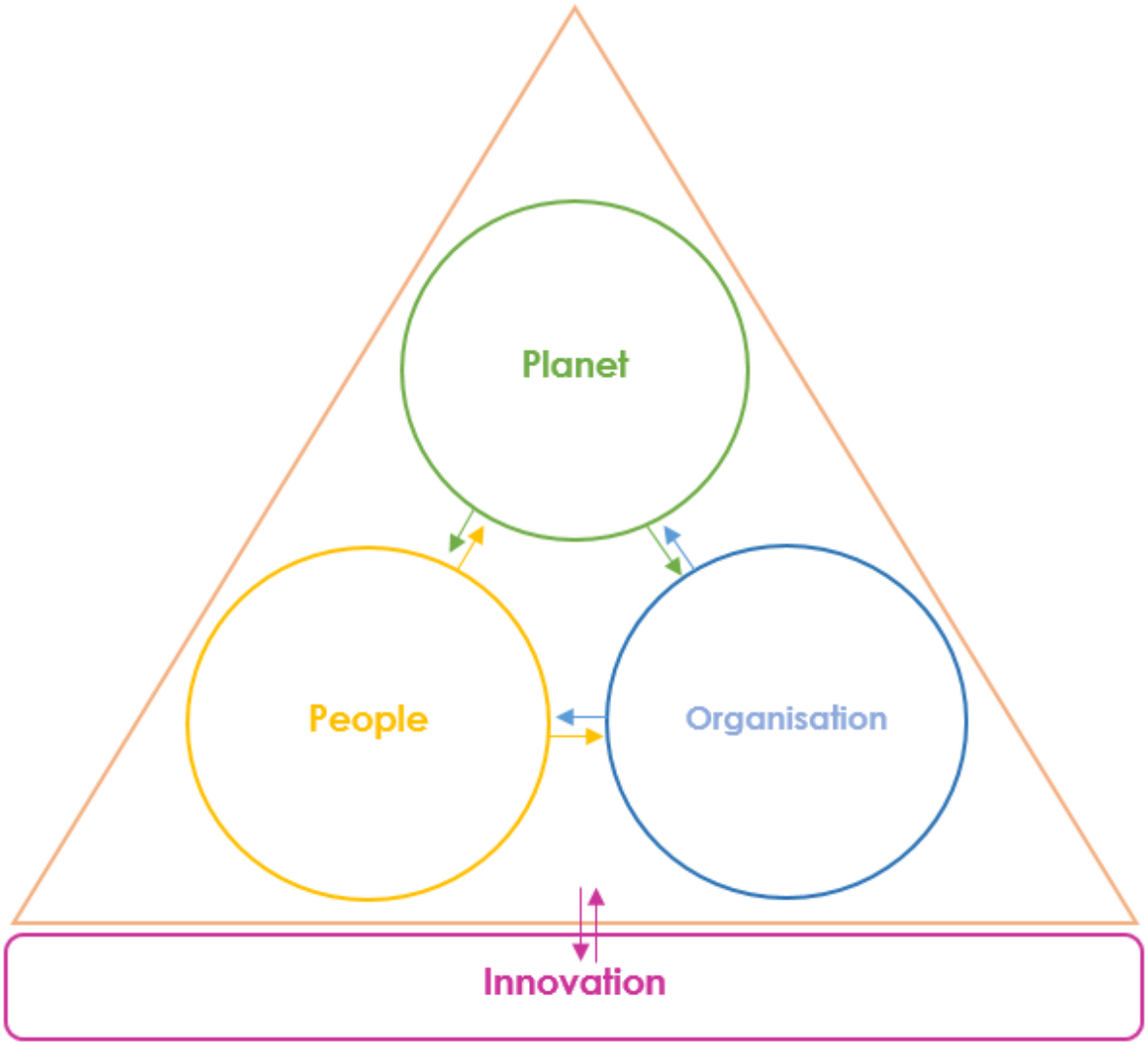
The previous sections presented a history of sustainable living and building in the Netherlands and explored the concepts of eco villages and circular economy. This theoretical exploration serves as a basis to set up a framework that is used to analyse how eco villages develop on different dimensions of sustainability which are translated into the categories planet, people, organisation and innovation. An integrated approach of various aspects is chosen because scholars argue that setting up a sustainable village requires a holistic approach (Medved, 2016). Existing projects often focus on one aspect, typically the technical or ecological dimension (Georgiadou & Hacking, 2011). Social and institutional elements are often overlooked (Haapio, 2012). An integrated framework facilitates a systematic collection of an extensive and consistent body of knowledge per case. The full framework is featured in figure 5 and is now discussed per dimension.

The planet dimension deals with ecological sustainability. This research regards a circular system as the benchmark for ecological sustainability. In order to assess the level of circularity, it is necessary to collect data on which technologies are applied. This is done through six aspects that are relevant for circular villages: buildings & materials, energy, water & sewage, waste, mobility, and food. The principles of circular economy are applied to the data gained on each dimension, to assess the extent to which the technologies and solutions applied are in fact circular. The principles of CE are found in section 2.3.2, figure 3 and 4.

The people dimension incorporates social sustainability and is essential to an analysis of eco villages. Eco villages are created by and for people and social dynamics influence the functioning of a village. This is especially relevant for circular projects, as they are characterised by a shifting role of end users. In order for a circular eco village to function, demands of a circular system and the needs and preferences of residents should be balanced. The people dimension distinguishes three relevant characteristics: group, social cohesion and diversity. Before going into an elaboration of these characteristics, a distinction has to be made between a planning phase, from the moment the first idea is born to the point the houses and village are completed, and a living phase, the moment the first group of residents moves in. The "group capacity" characteristic applies to the planning phase and is borrowed from the success factors defined by Seyfang et al. (2013) for community energy projects. It deals specifically with social dimensions during the planning phase. 'Group capacity' denotes the presence of key committed individuals and / or an effective organising group, capable of maintaining momentum, overcoming setbacks, and having clear direction. Social cohesion and diversification apply to the living phase. Social cohesion is assessed through the concepts of social relations, connectedness and focus on the common good (Dragolov, et al. 2016). The third characteristic is diversification and examines the degree of diversity of the residents in the eco village and the extent to which the village caters to needs and preferences of different people. Indicative for this diversification could be the presence of specified facilities for vulnerable or marginalised groups, such as mixed housing types, social housing or housing for people with special needs. Social cohesion and diversity are applicable in the living phase.

The organisational dimension deals with institutional sustainability and is also divided in a planning phase and living phase. The assessment of the planning phase is based on the key success factors defined by Seyfang et al. (2013), which are slightly adjusted to fit this research better. The success factors are community involvement, partnerships, policy and resources. The living phase is assessed based on two categories. The first category looks into the organisational structure and decision making. The second category is concerned with rules, regulations and procedures. In circular system there are no end users, as they become part of a cycle. This different role has to fit with the residents of a community. The extent to which a community is part of the planning process and the degree to which the eco village matches the needs and preferences of its residents determine the success of an eco village. Circular systems are new and use alternative technologies and solutions, which requires both financial investment and knowledge on how to create such a system. It is therefore useful to establish partnerships. In this sense, the organisational dimension can be supportive of the planet dimension.

The innovation dimension examines if innovative technologies are applied and to what extent the cases provide a niche environment in which technologies can evolve. This examination is based on the three determinants of successful



Planet
- Buildings & materials
- Energy
- Water
- Waste
- Food
- Transport

Circular economy principles

People
Planning phase: Group capacity
Living phase: Social cohesion
Overall: Diversity

Organisation
Planning phase
- Community involvement
- Partnerships
- Policy
- Resources

Living phase
- Organisational structures
- Rules and procedures

Innovation
- Technologies
- Vision
- Network building
- Learning

Figure 5: Research framework for analysing circular eco villages

socio-technical niches from Strategic Niche Management, which are articulation of expectations and visions, building of social networks and learning processes. Circularity is a novel concept, that uses innovative ideas and technologies. There is still a lot to learn about the practical implementation of the concept. It could thus benefit from experiments with innovative solutions and technologies.

The framework in figure 5 shows the four dimensions that make up an integrated framework that is used to analyse eco villages. The dimensions in this framework are interrelated. The planet dimension is placed on top, as ecology is the most defining feature of an eco village. It is supported by the people and organisation dimensions. The arrows show that all dimensions are interrelated. The planet dimension, for example the way ecology is defined and what technologies are used, affects what people are attracted to the village and what rules and regulations are defined in order to maintain the ecological character. The people dimension, and social cohesion in particular, influences to what extent people participate in ecological experiments or in community meetings. The organisational dimension assesses for example the resources and partnerships available which influenced the extent to which ecological goals, or the rules and regulations that affect people's behavior. These are examples of the different ways in which the dimensions influence each other. Innovation is the fourth dimension through which eco villages are analyzed. It is placed in a different position than the other dimensions, because innovation slightly differs from the other dimensions. Innovation is a way of looking at the other three dimensions, therefore it is part of the model, but is separated from the other three dimensions. Eco villages have the potential to innovate on all three dimensions, not only different ways of sustainable building but also social and organisational innovations.

One could think of other themes that could be included in an analysis of eco villages, such as design or environmental impact. This research however looks at process rather than output. This is particularly relevant for the "planet" theme. it means that this research does not look at for example the amount of CO_2 that has been saved, but rather what measures have been taken to reduce the amount of CO_2. For the sake of time, this research particularly looks at ecological innovation.

This chapter explored the history of sustainable living and building, the concepts of eco villages and circular economy and finally established a framework through which the cases in this research can be analysed. The next chapter first features the selection of cases and second gives a detailed account per case.

PART TWO | RESULTS

3 | Case selection & description

The previous chapter provided theoretical perspectives on circular economy, eco villages and the context in which both emerged and featured a framework that is used to gather and analyse data on the cases that are selected for this research. This chapter first explains how the cases for this research are selected. Secondly, this chapter gives an account of the data gathered per case.

For this research, an inventory that was made of all eco villages in the Netherlands that can be found online, and have been created over the last 25 years to this day. It includes projects that are currently still in their planning phase. The inventory is shown in appendix B. Most of these projects can be found in the online database of *Omslag - Servicepunt Anders Wonen Anders Leven*, a Dutch organisation that bundles knowledge on alternative ways of living (Omslag, n.d.) The inventory could be incomplete, due to the fact that not all eco villages can be found online. Also, there might be projects that match the definition of eco villages as used in this research, but do not regard or market themselves as such. Similar to what has been concluded by scholars, the inventory shows a great deal of variety between eco villages (Van Schyndel Kasper, 2008). This variety can be explained by diverging local circumstances and the fact that eco villages are products of community processes. The inventory shows that, since in 1989, at least twenty eco villages have been built, two failed projects were identified and at least thirteen projects are currently in their planning or construction phase. A majority of the projects is born in the nineties. What is striking is that projects from the nineties use terms along the lines of "ecological living projects". It is only since recent projects that the term eco village is used by the projects themselves. Recent initiatives show a slight trend towards circular projects.

Most projects are the result of bottom up processes and *Collectief Particulier Opdrachtgeverschap* (CPO) or collective private commissioning. In collective private commissioning projects a group of citizens is organised through a legal entity, such as an association (Agentschap NL, 2012). They are the principal commissioner and developer, with full control and responsibility, of a housing project. Advantages of CPO include that organised groups are seen as worthy partners, since there's a lot of freedom of choice, CPO often leads to innovative projects with added value for residents and their environment, and in CPO it is possible to create more affordable housing. Agentschap NL describes a group of twenty to forty houses as an ideal amount. A too small number of households compromises financial benefits, too many households increase the time and effort it takes to organise the project.

From this broad inventory, the selection of cases is narrowed down, based on the following criteria:

- *Size*: the village should contain more than twenty houses. In order to fulfill the functions of a village, as defined in the previous chapter, the project should not just be a collection of individual sustainable houses but has to be big enough to demonstrate the different features and dimensions associated with eco villages.

- *Time*: the village has to exist for at least five years. Exist means the moment the first group of residents moved in. This criterion relates to the main aim of this research, because in order to assess long term development, the village should have surpassed the start up phase.

- *Availability of secondary resources*: in order to gather a broad range of information it is important that multiple sources are available. The long term development of eco villages deals with a vast period of time and many dimensions, therefore it is likely that interviewees are not aware of the full story or have forgotten parts of it. To fill this gap, secondary resources are used. This criterion also follows from the research design. The thorough nature of a case study design requires information from all available sources to understand the case in its totality. Gathering data from a multitude of sources is an important aspect of a case study design (Kumar, 2011).

The remaining cases are classified on two dimensions: top down or bottom up and time of existence. Bottom up projects are grass roots projects, initiated by future residents. Top down projects are initiatives that originate from a

governmental organisation or project developer and is not created by future residents. Based on these dimensions, a selection was composed to ensure a versatile mix of cases is represented in this research. In total, eleven cases are contacted, of which ten replied: four rejected the request or responded too late to participate in this research, and six were willing to participate. All cases that responded positively and in time to this request are taken up in this research. In addition to these projects, this research also examines an eco village that never made it to completion. This is to not only focus on success factors, but to also examine the pitfalls. These criteria have led to the following selection of cases:

1. Het Groene Dak
2. De Bongerd
3. EVA Lanxmeer
4. Meanderhof
5. De Buitenkans
6. Boddegat

In the following subchapters, the results gathered per case are discussed in detail. Each case is discussed in a specific order. The cases start with a general introduction and an account of the planning phase. The cases are then discussed according to the dimensions of planet, people and organisation.

3.1 Het Groene Dak

Het Groene Dak is an ecovillage located in Voordorp, a suburb of the city of Utrecht, enclosed by highway A27 and several railways. The idea for Het Groene Dak arose in 1989, when Marijke van Zoelen wanted to create an environmentally friendly village (M. Post, personal communication, 14 February 2017; W. Reinboud, personal communication, 14 February 2017). Environmental considerations were the most important reason for starting an eco village, but not the only one. Van Zoelen also wanted to create a project that facilitated alternative ways of living, and not just traditional family homes. In total, 66 houses are built around a communal garden with a garden house (Groene Dak, n.d. B). The garden has a playground for children and a vegetable garden that is operated according through a crop rotation scheme (Het Groene Dak, 2013). Additionally there is an organic grocery store "Citroenvlinder" that is opened two days a week and sells non perishable goods to residents (Groene Dak, n.d. A; W. Reinboud, personal communication, 14 February 2017). Their aim to create a diverse neighbourhood, resulted in all kinds of housing situations (Groene Dak, n.d. B).

Planning phase

In 1989, Marijke van Zoelen hosted an informative meeting to share her ideas on an ecological and communal living project to attract like minded people (M. Post, personal communication, 14 February 2017 150 attendees heard her speak about her vision, of creating a project that shows the possibilities with regard to ecological living and building, and in terms of social housing (W. Reinboud, personal communication, 14 February 2017). About one hundred people were drawn to the idea of starting a collective private commissioning project together, thirty of which formed an active core that explored different options and ideas. For a period of three years the group met every monday, to discuss and decide on the course of the project (M. Post, personal communication, 14 February 2017). After six month the group was formalised in an association. The group explicitly did not want to be organised hierarchically, so the many decisions taken during this phase were all based on consensus (W. Reinboud, personal communication, 14 February 2017). There was no voting, and everyone's opinion was heard. Some of the people came from a background in anarchistic and squatter communities, so the group was familiar with alternative ways of living (W. Reinboud, personal communication, 14 February 2017). This also influenced the horizontal way the group is organised.

The association was structured through working groups based on content, such as green, waste, water and finances. A coordinating group structured meetings, which meant that they made sure that everyone got a say (W. Reinboud, personal communication, 14 February 2017). There was a lot of knowledge present in the first group, giving access to both technical knowledge as well a political contacts (M. Post, personal communication, 14 February 2017). The municipality saw Het Groene Dak as a testing ground for the area of Leidsche Rijn that was going to be built around

that same time. Because of this, The city of Utrecht financed a feasibility study to determine the basic principles and the costs of the project (W. Reinboud, personal communication, 14 February 2017). The group did not have an ideal amount of houses in mind, the final amount followed from the piece of land they got appointed combined with municipal guidelines on the amount of houses per square meter (M. Post, personal communication, 14 February 2017). This topic created resistance with the municipality, as Utrecht had a 1:1 house to car policy, whereas Het Groene Dak wanted 1:0,5. The municipality was willing to give in, under the condition that if this caused parking problems, Het Groene Dak should give some of their land back to the municipality so parking spots could be created after all (W. Reinboud, personal communication, 14 February 2017).

The group worked together with BEAR Architects, a sustainable agency, with contractor Ceelen Bouw and a small, local housing corporation Prinses Juliana to include social housing (Het Groene Dak, 2013). The costs of the project were estimated at ten million guilders (W. Reinboud, personal communication, 14 February 2017). Through a combination of different funds (by the housing corporation, contractor and project developer) and all kinds of subsidies, the group did not have to pre-finance the entire project themselves. All in all, the process went rather quick. This was partially due to the fact that the Voordorp area was already in development, and Het Groene Dak jumped on this "moving train", adding pressure to the project M. Post, personal communication; 14 February 2017, W. Reinboud, personal communication, 14 February 2017). In 1994, only five years after the idea rose, residents moved into Het Groene Dak.

The planning phase was marked by a range of decisions. The outcomes of the decision on ecology and technology are discussed in the next section.

Planet

Ecology was the main driver for starting Het Groene Dak. The pioneering group decided that the project should have a specific angle. Around that time several other projects were centered around energy or green roofs so to be innovative, Het Groene Dak chose water as their main topic (M. Post, personal communication, 14 February 2017; W. Reinboud, personal communication, 14 February 2017). This paved the way for all kinds of (mostly water related) technological experiments (Het Groene Dak, 2013; Isjaisja, n.d.; W. Reinboud, personal communication, 14 February 2017). These experiments and the experiences gained are discussed in this section.

Ecological and technological solutions

Het Groene Dak is built around a communal garden with a pond which is used for rainwater collection by directing rainwater from the houses to the pond. In cluster homes, rainwater which is collected and used to replace tap water for purposes that do not require potable water, such as flushing the toilet. There were experiments with a flow greenhouse that uses waste water for watering crops. Greywater and helophyte filters are applied to enhance the quality of waste water. All houses were equipped with compost toilets. These do not require water for flushing and produce manure, creating a resource instead of polluting water.

Het Groene Dak made sure that waste from the building and construction process was separated and recycled (W. Reinboud, personal communication, 14 February 2017). Other waste measures include a waste separation system. One of the sheds was equipped with different bins and containers to facilitate waste separation. Different parties were then supplied with these resources. Today, this autonomous waste separation system is not really applied anymore, as these waste streams are currently picked up by the municipality. Nowadays, the waste streams are handed over to the municipality and Het Groene Dak has no control over how the waste is handled. The municipality of Utrecht has an elaborate waste separating system, and has just launched a policy that could be the start of a transition into a circular waste system (Gemeente Utrecht, n.d.). Het Groene Dak though a lot about material use, resulting in materials that are recyclable and / or have a reduced impact on the environment . Walls are made from sand lime bricks, drainpipes from non chlorine containing PPC and the woodwork, from European production forests, was painted with eco paint. (Isjaisja, n.d;W. Reinboud, personal communication, 14 February 2017). This paint required too frequent repainting, therefor they now use High Solid paint (Het Groene Dak, 2013). The community building was made from straw clay / loam and had a green roof (Isjaisja, n.d.). Energywise, solar boilers were applied to preheat tap and cv water and they

strived for a high degree of insulation . In 2001 the neighbourhood was equipped with solar panels: three out of four cluster houses and one third of the other houses are provided with energy from solar panels since then (W. Reinboud, personal communication, 14 February 2017). At this time, solar power was still very expensive. Het Groene Dak received subsidies and made an arrangement with the supplier of the solar cells to be able to add solar power. Today, in some households solar energy provides up to 83% of their consumption (W. Reinboud, personal communication, 14 February 2017).

Technological experiences

Het Groene Dak created an extensive and ambitious set of ecological and technological measures, but as some of them were experiments, not every solution turned out to function properly. The optimistic residents of Het Groene Dak still think of these experiments as a success, because despite some experiments failed, they contributed to knowledge around the application of these technologies (Groene Dak, F). A major issue was caused by compost toilets that were placed in every house, which did not actually compost the excrements (Het Groene Dak, 2013). Residents tried to shovel their excrements, hoping this would add air into the vessel. This was a dirty job, and very inconvenient because the vessel was hard to reach. The compost toilets attracted all kinds of flies. A likely reason for the compost failing to happen is the low temperature in the basements were the vessel were installed. After seven or eight years, residents wanted to remove the compost toilets, when they found out that there was an accumulation of ammonia in the vessels. The fire department thought the risk of explosion was too big, therefore the entire neighbourhood had to be evacuated before the toilets could be removed. Het Groene Dak chose to install Gustavsbergsysteem toilets as a replacement. This again caused trouble: over a period of five years they had thirty fallouts of the sewage system (Het Groene Dak, 2013). In the cluster houses greywater filters were applied, to filter shower and kitchen water, before discarded into the sewage. In these cluster houses, toilets are flushed with rainwater that is collected in large underground tanks. During the first years this water was also used for washing machines, but this led to problems with the washing machines. There was an experiment with a flow greenhouse ("vloeikas") in which water was discarded, but this became too boggy and it was impossible to grow crops (Het Groene Dak, 2013). The flow greenhouse was replaced with a helophyte filter which to date has not caused any problems. As a crown to the project, Het Groene Dak created a community house. The building is a wooden frame house with a green roof, its walls were isolated with loam and straw. Seven years after the community house was built, the wooden floor and wall construction were corroded by fungus caused by the loam (Isjaisja, n.d.). The floors and parts of the wall had to be removed and reconstructed. The new floor is made from polystyrene concrete and the walls are closed off with a wooden frame building technique. Portaal used to be a small, local organisation, but has been taken over by a national organisation. This has lead to a less involved and responsive partner (W. Reinboud, personal communication, 14 February 2017). One example is that a solar boiler in the cluster houses has been broken for 1,5 years and so far it is been impossible to get this fixed.

Het Groene Dak partially monitors its environmental performance and keeps track of its energy production and consumption per housing block, because a few residents are interested in these amounts and also to potentially motivate people to consume less energy (W. Reinboud, personal communication, 23 April 2017). Besides the addition of solar panels, they have not updated their ecological or technological performance in other areas. Weia Reinboud says the level of insulation is outdated, as current standards are more ambitious than the level that is achieved in Het Groene Dak, which is energy label B., but she emphasises that a study on the use of materials showed that Het Groene Dak is still a frontrunner. Recently there was a group that addressed Het Groene Dak's performance in a general meeting and proposed that it is time for a sprint. Some people were up for it, other people think it's too expensive or too much of a hassle (W. Reinboud, personal communication, 23 April 2017).

Het Groene Dak thus conducted many technological experiments, with different levels of success. The next section looks at the social dimensions of Het Groene Dak.

People

Creating a social community that caters to the needs of different people, and not just to traditional households, was a second important reason for starting Het Groene Dak. This section looks at the social dimension of Het Groene Dak by exploring the community life and its diversity.

Social cohesion

When people moved in, there immediately was a sense of community, due to the process of planning and building a project together (M. Post, personal communication, 14 February 2017). It is crucial that people are familiar with the history, the effort and considerations that went into the project (W. Reinboud, personal communication, 14 February 2017; M. Post, personal communication, 14 February 2017). This, and the fact that they saw each other every week for three years, made the group grow close.

The garden, garden house and various social activities created many opportunities to engage with each other, further reinforcing this sense of community. The garden is maintained on a monthly basis and the garden house serves as a meeting spot, where meetings are held, activities such as yoga and tango lessons take place and every friday there is a café (Groene dak, n.d. C; Groene Dak, n.d. E). It is also the setting of spontaneous potluck dinners and many parties. In the beginning there were many children, who remember their childhood as constantly being outside and playing with other children (Groene Dak, 2013). A clear sign of this sense of community was shown when the community house was infested with fungus, and had to be either torn down or rebuilt, at a cost of 100.000 guilders. Despite these high costs, people chose to rebuild the community house and invested their personal savings. The garden house was seen as a pivotal aspect of the village. The garden house is a source of cohesion, and was saved by the cohesion it produced.

Today, people still get along well and engage with each other. Attendance at the friday night bar has decreased, but overall people are still active and involved residents. They still meet at garden days, meetings and parties and people that work on a freelance basis work together in the garden house (W. Reinboud, personal communication, 14 February 2017). Most residents are active members of the community and do their part. A few people are less active or not active at all. With regard to social activities, about 50% of the residents participate. Meetings and garden maintenance are generally attended by 20% of residents (Weia Reinboud, personal communication, 23 April 2017).

On average, two to three households per year move and half of the original residents still lives in Het Groene Dak after almost twentyfive years (Het Groene Dak, n.d. D; W. Reinboud, personal communication, 14 February 2017). People don't like to move, but if they do this is mainly because of work. Not all purchased houses were sold immediately during the planning phase. People that bought houses later on in this early period turned out to be less involved with the community. In the current situation, old and new residents are involved and active residents (W. Reinboud, personal communication, 14 February 2017). This has remained stable over the years.

Diversification

One of the goals was to build different types of housing, suitable for alternative ways of living. This is visible in both the group of residents that lives in De Bongerd, as well as in the housing facilities. Residents of Het Groene Dak can be characterised as non traditional, with former anarchists, vegans and people with different sexual orientations (Het Groene Dak, 2013). The aim to create a diverse neighbourhood, resulted in all kinds of housing situations: 22 cluster homes (with shared bathrooms, toilets, bicycle shed, garden and a common room), 18 rental apartments and houses (with shared laundry room and bicycle shed), and 26 purchased houses, varying in size and number of bedrooms (Groene Dak, B). There's currently a property for sale for €320.000 (Funda, n.d. A).

Organisation

During the planning phase, Het Groene Dak was organised horizontally and made decisions based on consensus. This section explores the organisational dimensions further.

Organisational structure and decision making

Het Groene Dak has two main bodies. One is the foundation Stichting Het Groene Dak which legally owns the garden house and garden. The other is the residents' association Vereniging Het Groene Dak. The residents' association meets four times per years and its main aim is to advance ecological living (Het Groene Dak, 2007). The residents association decides about budget, a small issues such as nuisance caused by cats or from what material pathways should be made and collects contribution.

The group thought a lot about how they should be organised, once they would actually live in the village. They wanted a horizontal community, making sure everyone is heard, no single group has a mandate or authority. This has not changed over the years, decisions are still made through consensus. The association is supported by different working groups, each addressing a different theme (Groene Dak, n.d. C). An overview of the working groups and their tasks is shown in figure 6.

Board	Chair, secretary and treasurer. New board every four years
Coordinating group	Prepares meetings
Introduction group	Visits new residents
Garden group	Organises monthly garden maintenance
"Tuinhuis" group	Manages the gardenhouse
Bar group	Organizes cafe on fridays, take bar shifts and buy organic snacks and drinks
Care group	In case of acute or chronic aid residents can address the care group for groceries, transportation or just a chat)
Paper group "t Groeiend Dak"	Puts together the village's paper
Rental group	Discusses with Portaal about rent, complaints and ecological upgrades
Working group A27 Voordorp	Task force that fights nuisance caused by highway A27

***Figure 6**: Working groups in Het Groene Dak.*

Rules and procedures

Het Groene Dak has formalised some essential aspects of the the village through a perpetual clause. An important procedure is the application process for new residents. Another important procedure is that residents maintain the garden together. What this all entails is discussed in the following paragraph.

The garden is maintained during monthly garden days. These are arranged by the working group "*Garden group*" and occurs under supervision of an ecological gardener. The garden days are not mandatory. Aspiring residents have to become a member of the residents' association by filling in an application form and paying a €16 registration fee, and €7 for each following year (Het Groene Dak, n.d. D). While waitlisted, people receive the village's paper. The website addresses that people are encouraged to enrol if the goals and character appeal to them. So they emphasise the importance of having the same ideas. Vacant houses are first offered to members. For rental houses, people additionally have to be a member of Woningnet Utrecht. If this doesn't lead to an offer, a buyer is sought outside of Groene Dak, and they too have to become a member of Vereniging Het Groene Dak. In case the seller has to lower the price, the house first has to be offered to members again (Groene Dak, 2007). Other rules are that every house should have a minimum amount of residents (e.g. 4 room house should be lived in by at least 2 people) and that group and cluster houses get to choose their new housemates. There is currently a property for sale and realtor advertisement mentions that the house is situated in an ecological project (Funda, n.d. A). So in case a property is sold to new residents that come from outside Het Groene Dak's network, people are informed on the particular character of the village. Once a house is sold, the formal contracts include a perpetual clause. This perpetual clause demands that people become a member of the resident's association, that they do not built a fence around the garden and in case of remodelling this should be done according to ecological principles. When moving to Het Groene Dak, there's in introduction committee that has a chat

with new inhabitants. They used to receive a brochure with a code of conduct, but it's unclear if this is still done today (W. Reinboud, personal communication, 23 April 2017).

3.2 De Bongerd

In 1993 Syb Tjepkema, who was involved with ecological magazine De Twaalf Ambachten, and his wife had the idea to create a project that would combine ecological building and social living (S. Tjepkema, personal communication, 27 January 2017). Eco village De Bongerd, with 36 houses, is located in a suburb of the city of Zwolle. Central to the village is a communal garden which serves as a meeting spot, and includes a playground, jeu de boules course and a shared bicycle shed (MMWZ De Bongerd, n.d. A) People work together in maintaining the garden. De Bongerd used to have a organic grocery store and a day care centre (because Tjepkema wanted to create a vibrant neighbourhood), but both have ceased to exist. De Bongerd did not opt for a separate community building, because they feared this would cause too much trouble with regard to construction costs and maintenance responsibilities. Instead they made an arrangement with the day care centre, allowing De Bongerd to use the space in evenings and weekends for meetings and other community affairs (S. Tjepkema, personal communication, 27 January 2017).

Planning phase

Tjepkema and his wife started the pursuit of their dream of creating an ecovillage by placing an advertisement in a newspaper, hoping to attract like minded people (S. Tjepkema, personal communication, 27 January 2017). Their idea was to create a green, environmentally friendly village in which people could live with each other, as opposed to next to each other. This village would have to cater to a diverse group of inhabitants and would combine different functions, such as living, working and recreation. Tjepkema reasoned that this would create social benefits and increase the feasibility of the neighbourhood (S. Tjepkema, personal communication, 27 January 2017). In response to the advertisement a group of ten enthusiasts joined forces and set the first steps towards the creation of an ecovillage. The group created a mission statement, so that it was clear for the group as well as for outsiders, what vision they were pursuing.

The group was formalised in an association called Mens en Milieuvriendelijk Wonen (MMWZ) De Bongerd and held informative meetings to attract more members (S. Tjepkema, personal communication, 27 January 2017). Members paid a contribution to finance excursions, hold meetings but also to organise parties to keep the spirits up. To include social housing in the project, the association formed a partnership with housing corporation Delta Wonen, which at the time had sustainable development high on the agenda. The project gained the municipality as a partner, because a city council woman was especially drawn to the social character of the project. De Bongerd looked for links and similarities in potential partner, emphasising their common ground and making them a stakeholder. Delta Wonen financed the first part, members of De Bongerd did not have to put in much money in the first stage, which was an advantage says Tjepkema because it difficult to demand money from people without concrete plans and results (S. Tjepkema, personal communication, 27 January 2017). The municipality had an advising role, especially on urban planning, and financed some parts of the process, such as a feasibility study. The municipality also provided benefits to De Bongerd, such as asking a low price for the plot De Bongerd was going to be built on. The communal areas formally belong to the municipality, but in return for management and maintenance of these areas, De Bongerd's residents use these areas as if they were their own. The municipality and Delta Wonen were important partners, but MMWZ De Bongerd was the principal commissioning party within this collective private commissioning project, and could make most decisions independently.

The association was divided into expert groups (building, communication, finances etc.), one member per expert group was also a member of the coordinating group. Expert groups prepared content, whole association decided on issues during meetings. This was done by consensus, making sure everyone's on the same page, not necessarily by majority rule (S. Tjepkema, personal communication, 27 January, 2017). Tjepkema addressed people's individual roles/input and expertise, by asking people about their passion and what they could contribute to the process. He was convinced that doing what people are good at or passionate about gives them energy. Through this strategy people kept engaged and enthused throughout the process, even in the face of setbacks. During the planning and building phase, the

association grew gradually. New people were attracted people through hosting informative meetings, attending construction fairs and Delta Wonen provided new inhabitants. Only when it was necessary to add new people to the mix they did so. The group feared becoming too big would hamper the process, as it would invite more opinions and threaten the manageability of the process. Tjepkema advises to keep projects like this compact. When the final location was found an agency conducted a feasibility study, to determine the level of ecological ambition, create a financial picture and gain insights on the characteristics of the urban plan and architecture (such as allotment, the height of houses and development plans) (S. Tjepkema, personal communication, 27 January, 2017).

After this study the architects were chosen. They attracted ORTA Atelier, as an architectural agency that had experience with this type of project. This feasibility study served as point of departure, but in the end only a fraction of the initial dream was realised (S. Tjepkema, personal communication, 27 January, 2017). Many ideological concessions had to be made. Tjepkema says that people are content with the way De Bongerd turned out, but the pioneers know how beautiful the project could have been. Obstacles during the preparation phase were finding a proper location (five or six locations fell through, before they were appointed their current spot) and they had fierce discussions on necessary budget cuts. But all in all, the process from placing the advertisement until the completion of the construction, lasted less than 5 years. In 1997 residents could finally move in (S. Tjepkema, personal communication, 27 January, 2017).

Planet

The idea from which De Bongerd originates was a mixture of quality of life, creating a social community and realizing a sustainable village, in that order. Ecology was not the main reason for starting De Bongerd, but it was still an important one. This section looks at the ecological and technological nature of De Bongerd.

Ecological and technological solutions

In terms of ecology, De Bongerd chose wooden frame houses, made from pinewood from Canadian and Scandinavian production forests (MMWZ De Bongerd, n.d. C). Recyclable and environmentally friendly materials such as clay stucco ("leemstuc") were used. With regard to energy De Bongerd chose to apply wall heating and solar boilers (for tapwater and central heating systems). Wall heating runs on water that is heated to a maximum of 55 degrees Celsius, whereas radiators use water up to 80 degrees. Wall heating diminishes gas use and produces healthier air, because there is less circulation of particles (Milieu Centraal, n.d.). Solar power was part of the project since the beginning (MMWZ De Bongerd, n.d. C). Furthermore, the village is car free and De Bongerd conducted a rainwater collection pilot project (H. Hamstra, personal communication, 16 May 2017). The rainwater was collected and used for non potable purposes (such as toilet flushing), but this did not work properly in all houses. Today, only half of the people use this technology. Gustavsberg toilets were installed, that use only 4 liters of water. To be able to realise a certain ecological level, De Bongerd sought after potential partners that that could contribute to achieving this goal. The solar boilers were leased from an energy company, that took care of the maintenance and the rain water pilot arose in cooperation with an external party.

Technological experiences

In general, the technologies worked well. The rainwater pilot was not successful for every household. In some cases the rainwater system was not installed properly. Due to this today, half of the residents still use rainwater for nonpotable purposes (Harrie Hamsta, personal communication, 16 May 2017). Every now and then, a devoted inhabitant measures the ecological performance (L. Olthof, personal communication, 3 May 2017). This occurs randomly, there is no structural monitoring or evaluation. The last measurement was done a few years ago. De Bongerd's ecological performance was still good, although technology has caught up with the initially innovative neighbourhood. Residents are unsure as to why they do not update technologies. During meetings, they mostly discuss things like adding a new bicycle shed or garden management. Tjepkema thinks that one of the reasons for ecology is not being updated could be that most people were attracted to the social character and the design of the village, and that ecology came second or third. Olthof (personal communication, 27 January 2017) says that once they started living in De Bongerd, they were not constantly aware of the fact that they lived in an eco village, after a while it just became living, as you would in any other house or street. So in that sense the awareness has worn out.

People

Creating a social community was another important reason for starting De Bongerd. The social dimensions is explored further in this section.

Social cohesion

It was exciting to finally live in De Bongerd, says Tjepkema. People did not end up in De Bongerd out of the blue, they had shared a dream, a history, successes and failures. This was key for the sense of community in the village. The foundations for the community were laid before people had even moved in. During the first years, most residents were families with young children, which was an important source of connection. Adding to this sense of community is taking care of the green areas together and sharing a responsibility of the common areas. There is a no fence policy, which adds to the open character and facilities social engagement. Everyone respects each other's privacy, as it was not their intention to become a Centraal Wonen project, but there is a close knit community (L. Olthof, personal communication, 27 January, 2017). This is especially visible in times of need, people take care of each other.

The sense of community was felt by the vast majority of inhabitants, though there have been a few exceptions. During the construction phase, all but two households were involved from the very beginning. These last two parcels were sold in the final half year of the construction phase. In hindsight Tjepkema says that they became too lenient, because the people that bought the last two parcels just wanted cheap houses (S. Tjepkema, personal communication, 27 January 2017). They were not interested in partaking in the social and ecological events that represent the core of the village. A few years after completion, these people moved out and sold their houses with a huge profit, despite an anti speculation clause. These former residents filed a lawsuit against De Bongerd because they did not agree with the clause. During the 20 years De Bongerd has existed, the aforementioned mismatch is the only instance in which inhabitants refused to contribute. L. Olthof (personal communication, 31 January 2017) says that it is quite natural to have a division of very active people, non active people, and people that are somewhere in the middle. As long as there is a general sense of responsibility, it works. Forcing people to participate is undesirable. In general (new) residents consciously choose to live in De Bongerd, they are enthusiastic and bring in new ideas (L. Olthof, personal communication, 27 January 2017).

Diversification

To create social diversity, De Bongerd made sure that houses are suited for different types of households and incomes. It was important to the pioneers that it would be possible for everyone to live in De Bongerd, out of social responsibility and to create a lively neighbourhood. There are two types of purchased houses and several types of rental houses and apartments, that are available through social housing (MMWZ De Bongerd, n.d. B). Some houses include office space, so people can work from home. A few apartments are part of a sheltered housing project, leaving room for vulnerable groups to live in De Bongerd (L. Olthof, personal communication, 27 January 2017).

Organisation

During the planning phase, De Bongerd was structured in a horizontal fashion and decisions were made through consensus. This section explores how the organisational dimensions developed in further stages.

Organisational structure and decision making

Residents' association MMWZ De Bongerd, led by a board of five members, holds meetings 4 times per year (L. Olthof, personal communication, 3 May 2017). There are several supporting groups, each with their own subject, such as a garden & building group, a party committee and a magazine committee. Topics discussed in meetings are the yearly budget, lay out of the garden, building a new bicycle shed. Members pay twenty euros per year and there is a yearly savings arrangement of €25 euros for large expenses (L. Olthof, personal communication, 3 May 2017). Main expenses are garden and terrain maintenance, which make up for about half of the budget. The other half goes to activities.

Decision making still occurs in the same way as during the planning phase which is through consensus. "Half-plus-one" is considered as insufficient support, (almost) everyone has to be in agreement (S. Tjepkema, personal communication, 27 January 217). In case of difficult or controversial topics, in which after long discussion there is still no consensus, the topic is decided through voting. For example in the case where two inhabitants wanted to make clear that they did not

agree with a decision, therefore there was in vote (L. Olthof, personal communication, 27 January 2017). Inhabitants are allowed to bring anything to the table during meetings. In case of complex topics the board would like to be notified up front, though this is not necessary. The board changes when board members feel like it's time for someone new or when someone new applies. There is no specific amount of years per term and residents can apply if they feel up for the task. New members are proposed during a meeting, there is no procedure around it. The performance of the board is not evaluated, this is not deemed necessary. Olthof, chairman for ten years now, says there is an open atmosphere so if people feel that the board should have handled a situation differently, they express this during meetings and board members then take this into account.

Rules and procedures

De Bongerd has two main procedures, which are the "*Groendagen*" and the application procedure. In terms of formalised rules, in the beginning there was an anti speculation clause, but this is no longer in force. These rules and procedures are explained further in this section.

De Bongerd maintains the garden during has monthly "*Groendagen*". Participation is on a voluntary basis, monitoring does not fit with De Bongerd's character (Syb Tjepkema, personal communication, 27 January 2017; L. Olthof, personal communication 3 May 2017; H. Hamstra, personal communication, 16 May 2017). This has always worked well, with one exception. Two to three years ago, there was a period in which attendance was low. There was no particular reason for the decrease and it required one residents' meeting to point out people's responsibilities. After this meeting people took this task serious again.

De Bongerd has an application procedure. This procedure was not very strict in the beginning, but because of instances like the lawsuit, De Bongerd has become more punctual and wants to make sure that everyone is properly informed and no misunderstandings can arise (S. Tjepkema, personal communication, 27 January 2017). The way it currently works is that people have to register for a waiting list. Before getting put on this list, people are invited for an introductory chat and are provided with a document in which the principles and responsibilities that come with living in De Bongerd are explained. This is to assure people are aware of the ecological and social nature of the neighbourhood. De Bongerd has never rejected people, but it has happened that potential new inhabitants withdrew after this interview because they felt the neighbourhood did not match their preferences. Vacant houses are first offered to current residents and waitlisters. If within two weeks no potential buyer is found, the selling party will ask around in their own network. If there is still no response, the property is offered to the private market. When selling a house, sellers are expected to educate potential buyers on the ecological nature of the village. People are expected to become a member of De Bongerd. Formally, it is not possible to obligate people to become and remain a member of the association (L. Olthof, personal communication, 27 January 2017). De Bongerd has found a loophole, in the sense that if people want to use the shared facilities people simply can't expect to have access to these facilities without becoming a member. In practice a lack of formalisation of these rules has not been an issue, as people have always registered to the association.

Six to seven years ago there was a discussion around the sheltered living apartments: people that started out in these assisted living apartments, sometimes moved on to regular housing, but De Bongerd noticed that these residents are less involved in activities and maintenance (L. Olthof, personal communication, 27 January 2017). This was a difficult situation because these people are welcome in the neighbourhood, but to maintain a livable situation, this also requires input and effort from residents. In the end, the community decided that there would a cap on how many people can progress from these sheltered houses to a regular house. This caused a stir within the community and this was one of the rare occasions in which the community took a vote. Currently, there is another a reflective process going on about the entry procedure, debating whether or not families with (young) children should be favored over others (L. Olthof, personal communication, 3 May 2017). At the start De Bongerd had about 45 children, this number has dropped to six or seven at present. Some community members have put forth the opinion that this is unfavourable for the village, and that more diversity would create a better dynamic.

Tjepkema thinks the strength of De Bongerd is the mixture of people, that take care of each other and their surroundings. Olthof agrees, they have successfully maintained the village because people make a conscious decision to

live in De Bongerd and feel that it belongs to the community and is worth maintaining. De Bongerd has served as an inspiration and advising body to other initiatives. Still, every year between two to five groups visit De Bongerd for inspiration and information. De Bongerd's pioneers participate in lectures and other informative events to share their experiences with CPO, to prevent other initiatives from reinventing the wheel. Two initiatives, Meanderhof and De Nooten, are projects that directly stem from De Bongerd.

3.3 EVA-Lanxmeer

In the beginning of the nineties, in the years after the Brundtland report was published, and the Dutch government decided on building "Vinex-wijken", Marleen Kaptein felt that it was time to present an environmentally friendly alternative urban plan (M. Kaptein, personal communication 31 January 2017). This led to the creation of EVA-Lanxmeer, which is home to 300 households and is located next to the train station in Culemborg (EVA-Lanxmeer, n.d. A). Some important elements are that the village is car free, houses are built around twelve open courtyards, so people can engage with each other in shared spaces and compact building to increase efficiency. Kaptein wanted to realise a wide diversity of functions, like living, recreation, employment, education, and facilities, such as offices, schools, a farm, so people would have to travel less, decreasing environmental impact and enabling people to spend more time at home (M. Kaptein, personal communication 31 January 2017).

Planning phase

EVA-Lanxmeer's origins are quite different from the other cases in this research. EVA Lanxmeer did not start as a collective private commissioning project, with future inhabitants creating their own dream village (EVA-Lanxmeer, n.d. B). Its roots lie with Marleen Kaptein, who felt a need to create an environmentally friendly alternative urban plan. The Dutch government was educating citizens on their responsibilities with regard to the environment ("Een beter milieu begint bij jezelf"). Kaptein completely disagreed, agriculture, fossil fuels and energy are significant causes for environmental degradation. She wanted to create an urban plan that takes quality of life, social cohesion, the environment, food production, employment and the landscape into account. Kaptein took a permaculture design course and wanted to translate these principles to living. She felt that neighbourhoods like Vinex could be seen as monocultures, when they should be ecosystems. It should be a large scale project, because environmental gains are created through infrastructure, not through individual houses. Because of this large scale, the project became an expert-led process. Kaptein was able to create a large network of experts and professionals from different fields (urban planning to permaculture), that supported the project and supplied knowledge, relevant contacts and finances (M. Kaptein, personal communication 31 January 2017). The team was divided into five disciplines: water, energy, green, living & working and residents & consumers. In 1993 Kaptein, and the team, finalised a proposal and in 1994 the foundation EVA Stichting (Ecologisch Centrum voor Educatie, Voorlichting en Advies) was established (EVA-Lanxmeer, B). The vision of the foundation was threefold:

- Creating a living environment in which people engage with their direct environment
- Create solutions for environmental problems and develop healthy ecosystems
- Facilitate conscious lifestyles

This vision translated into the following principles:

- Incorporating the genius loci (loca spirit): existing qualities should be preserved and enhanced
- Closing material and energy cycles
- Bring local and organic food production back into people's everyday lives
- Connect architecture to elements of the landscape
- Embed sustainable water and energy systems into the urban plan

Another function of the foundation was managing contacts with the constituency (M. Kaptein, personal communication, 31 January 2017). The foundation served as a link between the top down and bottom up elements of the project. Since the beginning there was a solid base of supporters. In 1995 Kaptein made a brochure to attract

potential residents and stakeholders, which she spread through her own network. Even when the project did not have a location, there were 80 applicants that wanted to live in the EVA project (M. Kaptein, personal communication, 31 January 2017). A location was finally found in Culemborg. This led to media attention and attracted more interested people. The municipality funded the explorative phase of the project. They also sold the land used for communal courtyards at a low price.

It was not until 1996, when the foundations of the urban plan were laid, that residents were involved in the process (M. Kaptein, personal communication, 31 January 2017). And even then, they were merely informed, they could not contribute to the process. Residents had no say in the urban plan. They did participate in the design of the courtyards. Participation of residents was mostly done via workshops. Ministry of VROM financed these workshops. The building process was divided over four phases, with the aim of taking learnings from each phase and applying them to the next one (M. Kaptein, personal communication, 31 January 2017; EVA-Lanxmeer, n.d. B). In 1999 the first construction phase started. The municipality was the principal commissioner in the first and second phase of the development. In the third and fourth phase there were also individual and collective private commissioning projects. Phase five was done by a project developer. The first 55 houses were finished in 2000.

Planet

Creating sustainable solutions was the main purpose of the urban plan behind EVA-Lanxmeer. This section explores the ecological and technological aspects of the village.

Ecological and technological solutions

EVA-Lanxmeer is built according to an urban plan. Compact building, as opposed to detached houses, was an important element to increase efficiency (e.g. better insulation) and leave more space for green and natural areas, (M. Kaptein, personal communication, 31 January 2017). Most houses are placed in such a way that the main windows and rooms face the south side, which allows optimal use of sunlight. In principle, EVA-Lanxmeer is a car free neighbourhood, with parking spots on the border of the village. In case of physical disabilities, emergencies or moving, all houses can be reached by car. Within the village there are mostly small streets, and many walking and bicycle paths, often made from soft undergrounds (EVA-Laxnmeer, n.d. B). EVA-Lanxmeer is car free, with the exception of one section. Towards last phase, the role of the municipality got smaller, leaving room for other parties (EVA-Lanxmeer, n.d. B). A project developer took the responsibility of developing a section of Lanxmeer and created parking spaces in the area, which did not sit well with inhabitants. EVA-Lanxmeer is located next to a train station. A sustainable building agency designed an integral water concept for EVA-Lanxmeer (M. Kaptein, personal communication, 31 January 2017; EVA-Lanxmeer, n.d. B). Rainwater from rooftops is directed to retention ponds, from which drinking water is created. Street water is collected in underground wadis and directed away from the retention ponds. Greywater, from washing machines, showers and kitchens passes a helophyte filter, to lower harmful substances and decrease the environmental impact of wastewater. This water is also directed away from the retention pool. Black water is connected to the municipal system. EVA-Lanxmeer thus collects rainwater for potable use, instead of letting it run off into sewage system it used for a purpose, and restores water quality before it is discarded.

Because of its scale, EVA Lanxmeer has been able to establish infrastructures that are unique compared to the other cases in this research. The water concept allows for the use of rainwater as a source for potable water. Waste water is filtered before it runs off into nature. This water concept makes efficient use of natural resources and lets water circulate at a higher quality. EVA-Lanxmeer created its own heating system, operated by the village's own Thermo Bello foundation. In this low temperature heating system (maximum of 50 degrees Celsius), water runs through the village and is heated through a central heat pump (Thermo Bello, n.d.). For tap water, the houses are equipped with solar boilers, that pre heat the water. Most houses are equipped with PV cells that provide the energy. Houses that are insufficiently equipped with PV cells get their energy from a local energy company that generates energy from renewable sources (Vrijstad Energie, n.d.). Waste is separated (paper, plastic, organics and rest) and taken care of bij Avri, a local company that calls itself a sustainable waste processor. The urban farm Caetshage not only produces food that can be bought in the farm shop, but is also provides day time activities for people with a mental impairment (Caetshage, n.d.). These are general, neighbourhood wide infrastructures and facilities. Some houses are built in

individual and collective private commissioning and apply additional and a more extensive set of technologies (EVA-Lanxmeer, n.d. C).

Technological experiences

From the interviews, EVA-Lanxmeer does not appear to have had issues with technology. The technologies and infrastructures are still running. Different aspects of EVA-Lanxmeer's ecological performance are measured, such as a count of species to examine biodiversity or an evaluation of the infrastructures (Marleen Kaptein, personal communication, 20 May 2017). This is not a task that is done by residents but by external parties such as students or nature organisations. In some courtyards though, energy use is monitored and shared to create awareness (EVA-Lanxmeer, n.d. C). In terms of technology, every now and then there are active groups or individual residents that make a case for a specific topic, such as the replacement of the old PV cells. But this is not done structurally or on neighbourhood level. Kaptein feels that there were hardly any concessions with regard to their initial ambitions.

People

EVA-Lanxmeer can be seen as a type of grass roots initiative, yet it is however not created by future residents. This section explores the social dimension further, to see if EVA-Lanxmeer was still able to create a community.

Social cohesion

Despite its size, there seems to be a general sense of community. During a neighbourhood council meeting the passing away of a young resident was addressed, which appeared to affect the entire community greatly. Most of the social dimensions occur at courtyard level. This is where people meet and socialize. People maintain courtyards together and organise parties. Some courtyards have additional meetings, or created a courtyard music band. The social character differs per courtyard. Although EVA-Lanxmeer initially was not a bottom up project in the sense that it was created by future residents, the courtyards is where residents got the freedom to design something themselves. They maintain the courtyards with their neighbours, children play here and it is the decor for parties. Social cohesion differs per courtyard, a few examples of the twelve courtyards are highlighted (EVA-Lanxmeer, n.d. C). Most courtyards seem to have high social cohesion. They have many parties and other spontaneous activities, have frequent garden days and meetings, some people are friends or very good neighbours and there are a few examples of courtyards music bands. In a few courtyards, people have a friendly chat and occasionally maintain the garden, but are not as engaged with each other. One of the courtyards was built in two stages. Residents of the first stage had already designed and created their courtyard, when the second stage was being built. This lead to friction within the courtyard that caused a divide and the courtyard was maintained less. When some new people moved in, the courtyard made a new start and designed a new garden with input by all residents. This has worked well, the courtyard now has a good atmosphere again. Other issues that occur in several courtyards are the use of the courtyards for personal purposes and nuisance caused by children and renovations. Residents state that because the general atmosphere is good, people can also discuss these issues.

Diversification

EVA-Lanxmeer has diverse housing types, divided over social housing (30%), middle class private sector (20%) and higher segment private sector (50%) (EVA-Lanxmeer, n.d. B). Some courtyards have housing that is suited for elderly, or mentally disabled people that live in sheltered housing (EVA-Lanxmeer, n.d. C). EVA-Lanxmeer is big and has a variety of inhabitants.

Organisation

This section explores how a large neighbourhood like EVA-Lanxmeer is managed and organised.

Organisational structure and decision making

A meeting on January 23, 2017 showed that EVA-Lanxmeer is discussing its current structure. EVA-Lanxmeer is supported by three main pillars, which are resident's association BEL, a neighbourhood council and the courtyards. The first one is resident's association Bewoners EVA-Lanxmeer (BEL), originated in 1997 or 1998 as a way to manage the waiting list for aspiring inhabitants. BEL meets two times per year and discusses matters such as donating money to local causes. Members pay a fee of €25. From BEL, many working groups and foundations originated (see figure 7 for a

full list) (EVA-Lanxmeer, n.d. D). Its main tasks are collecting members' contributions, which is mainly used for the neighbourhood magazine (C. Mesters, personal communication, 6 February 2017). Other expenses are more ad hoc, such as contribution for new play equipment for the primary school that is located in the village or lending money to the farm. Participation is generally low, only thirty to forty people show up, which is less than 10% (Carleen Mesters personal communication, 16 May 2017).

Besides the roles of the three different bodies, BEL 2.0 also explores other issues such as new innovations with regard to climate change (Carleen Mesters, personal communication, 23 January 2017). Or because new inhabitants do not all become members of BEL, or unsubscribe when they don't agree with issues. This could cause a divide within the community and poses potential threats to maintenance but also social atmosphere. Residents present at the meeting explain that the neighbourhood council was established as an organ that could informatively and exploratively discuss topics, without immediately leading to a decision. Theoretically, the council exists of heads of the working groups and courtyards, but in practice this is not strictly adhered to. The council arose in 2012, as turnout to BEL meetings was very high and there was little time for discussion (Carleen Mesters, personal communication, 23 January 2017s. In the neighbourhood council people can discuss these topics, before they're addressed in the meetings. The council functioned well in its first years, but a few board members quit and there was no replacement. As mentioned earlier, EVA Lanxmeer is divided over twelve courtyards. Courtyards form the environment that is closest to all residents and are an important source of social sustainability. This is where people engage with each other and spend their everyday lives. The courtyard areas are in legal joint ownership of the people that live around them and are maintained by these residents. Every courtyard has a different organisation and social atmosphere. In short, BEL is the decision making body, the neighbourhood council an informal body that discusses content and the courtyards fulfill an important social function. Over the last few years, residents got confused about what role each body has. Therefore they have started the project "Bel 2.0" that explores what elements are important and contribute to living in EVA-Lanxmeer (Carleen Mesters, personal communication, 23 January 2017).

Rules and procedures

There are several, formal and informal, procedures in EVA-Lanxmeer. Every house owner has a share in the courtyard there house is located at (EVA-Lanxmeer, n.d. C). They can't individually claim a specific piece, it is jointly owned. In all courtyards people pay a small amount of monthly contribution (around five euros) to buy new plants or tools. Maintenance is organised organically and based on trust. It is not mandatory and that has worked so far. People do their part. The maintenance of courtyards is not necessarily very ecological, in the sense that there is no ecological principle on which maintenance is based. Mesters (personal communication, 6 February 2017),chair of residents association, says that she think maintenance of the green is more important for social ecology than for traditional, natural ecology.

In the earliest stage of EVA-Lanxmeer there was no screening, everyone could join. Kaptein (personal communication, 31 January 2017) says that these were mostly motivated people from different backgrounds, but what they had in common is they were predominantly higher educated. The fact that people were into the project, even when there was no location yet, shows that people were very dedicated and believed in the vision of the EVA foundation. Everyone can still apply, but there is an application procedure. Aspiring residents should first become a member of BEL in order to be able to rent or buy a property in EVA-Lanxmeer. If someone wants to move, they first have to offer the house to members of BEL for two weeks. This is included in a perpetual clause and could be penalized with a fine if people do not adhere to this. If it is not sold to a BEL member, the house is sold through a realtor. The realtor is supposed to inform potential buyers on the ecological and social character of the project the house is situated in, but Mesters (personal communication, February 6) says that realtors hardly do this anymore. In a few cases realtors have sold houses "with parking space" but EVA-Lanxmeer is car free, so that caused issues. Housing corporation Kleurrijk is responsible for new renters, and a while a go let people in that were not a member of BEL. These two developments have led to a situation in which some residents do not specifically want to live in a project like this, these people did not become a member of BEL and are not active in social or gardening activities. The board of BEL discussed this with Kleurrijk, and they now only let people in that are members of BEL. But once people move in, it's impossible to prevent them from cancelling their membership, says Mesters. It is unclear if this influences the character of EVA-Lanxmeer.

BEL Bestuur	Board of the residents' association with five members
Redactie BEL Nieuws	Responsible for creating the newsletter four times per year
Werkgroep Lanxzij	Provides social services by helping people in times of need
Energiebedrijf Thermo Bello	Technicians and residents cooperate in advancing the energy facilities
Werkgroep Energie en Installaties	Supporting residents with installing and maintaining energy systems
Werkgroep Watertoren Culemborg	Finding a purpose for the unused water tower
TOPLA Toetsing Planontwikkeling	Supervises the further development of EVA-Lanxmeer
Stichting Terra Bella	Coordinates the public green spaces
Stichting Caetshage	Ownership of the urban farm
Stadsboerderij Caetshage	Practical side of the urban farm
Droge Voeten	Prevention and solutions to water nuisance
Amfibieën	Responsible for saving amphibians from wells

***Figure 7**: Working groups n EVA-Lanxmeer.*

3.4 Meanderhof

Meanderhof is located in a suburb of Zwolle and hosts 53 houses. Meanderhof is designed around three courtyards, with a string of houses meandering around them (Meanderhof, n.d. A). There are three communal gardens, a pizza oven, a wasteland that is filled with vegetable garden bins and shared bicycle sheds and tools. Meanderhof has a common room called "De Hofkamer", that is used for meetings, parties, yoga and piano lessons, childrens' study groups, and has a fireplace that people can gather around (Meanderhof, n.d. B). There are a few people that have an office at home, but in general work is not inherent to the setup of the village. There are many options to recreate, e.g. by sitting in the meditative spot in one of the gardens, or playing piano in the common room. There are some fruit trees, herbs and vegetable garden patches and is a shared bicycle shed for all residents. The idea behind these common facilities is that it would improve contacts between residents and create social cohesion.

Planning phase

During the realization of ecovillage De Bongerd in Zwolle, it was clear that more people were interested than could be housed in De Bongerd. In 1998 a small group of people gathered and started a process of creating a ecovillage through collective private commissioning (Meanderhof, n.d. C). They placed advertisements in newspapers to attract more people and gathered a group of over forty people that would start an eco village together. The pioneers wanted to create a village in which people could live in harmony with nature, be socially connected and ultimately inspire the world (K. Schoe, personal communication, 12 February 2017). In 2001 they established Vereniging MMWZ Stadshagen (Meanderhof, n.d. C). The association debated about urban plans, designs of houses and communal gardens, sustainability ambitions, which architects to go with, etcetera. The group joined forces with DeltaWonen, which had a stake in the project as the provider of the social housing. The process took years longer than they had anticipated. This was due to several reasons. A major issue was finding a proper location. They went through several locations, before they finally were appointed their own spot. This was bad for moral, the group was faced with many setbacks each time a location fell through (L. Gussenhoven, personal communication, 12 February 2017; Meanderhof, n.d. C). On a few occasions budget cuts had to be made, which put pressure on their ideological ambitions. Concessions, such as not including a greywater system, were made. Some people could not deal with this and stepped out of the project (Meanderhof, n.d. C). Meanderhof had to work together with the municipality, but they ran into some issues. Meanderhof did not want to create straight rows of houses, which was the standard in this particular area of Zwolle.

Instead, they wanted courtyards and houses placed in organic forms. It was difficult to convince the municipality of this (K. Schoe, personal communication, 12 February 2017). Meanderhof did not want the village to become too big, keeping the built surface to a minimum, but the municipality wanted a minimum amount of houses, as selling land is a source of income. Another difficulty the group faced had to do with matters of feeling, such as the colors of the houses or who would live in which house (K. Schoe, personal communication, 12 February 2017). The group overcame these obstacles and the first group of inhabitants moved in in August 2007, the last residents came in february 2008 (Meanderhof, n.d. C).

Planet

Many ecological concessions had to be made at Meanderhof. This section examines the technologies that remained.

Ecological and technological solutions

As the environment was one of the main reasons for starting Meanderhof, several ecological measures can be found throughout the village. When entering the village, one comes across a Greenwheels car and a charging pole for electric cars. The village itself is car free, as it is centered around three courtyards. The houses are wooden frame houses, hve ouses have a high level of insulation, wall heating systems and are equipped with solar boilers (K. Schoe, personal communication, 12 February 2017; Meanderhof, n.d. D). Since 2012 the village has solar power, which was partially financed by a prize Meanderhof won. Solar energy was still very expensive at that time (Meanderhof, n.d. D). Energy from the solar panels is not only used for household energy supply, but also provides the charging pole with power (K. Schoe, personal communication, 12 February 2017). A high level of insulation is very important to use energy more efficiently.Meanderhof strives to create a varied green area, thereby enhancing biodiversity. There are some fruit trees and herb gardens, but the actual onsite production of food is negligible. A few residents are members of a food cooperative that delivers an organic food box to the common room, for residents that are also a member of this coop (Anonymous, personal communication, 12 February 2017).

Ecological experiences

Meanderhof monitors the energy production from the solar panels, because one of the residents is interested in this (K. Schoe, personal communication, 12 February 2017). Meanderhof does not monitor its overall ecological performance. On an individual level, there are people that look into new options, but this does not occur on a collective scale. Interviewees say that although it's not monitored, they expects that Meanderhof's ecological performance will still be quite ok. There is no structural evaluation or update but every now and then there are new ideas. These are initiated by individuals that take up personal a project and take the "burden" for everyone else.

People

The group went through some difficulties during the planning phase, but they still managed to create a village together. What this meant for the sense of community and the how the community developed is explored in this section.

Social cohesion

Right from the beginning, residents experienced a good atmosphere and a strong sense of community (K Schoe, personal communication, 12 February 2017; L. Gussenhoven, personal communication 12 February 2017). Residents feel this is because people went through an intense process together, marked by many setbacks, so people had already gone through ups and downs before even living in Meanderhof. The sense of community is continued by and expressed through joint maintenance of the courtyards ("Groendagen"), movie nights, baking pizzas in summer new year's evening and easter celebrations and watching big sports events together. Furthermore, there is a handyman club, a cooking club, a weight loss club "Happy Hippos" and there are weekly yoga lessons. Every now and then, the community organises workshops and lectures. Recently there was a lecture series about respectful communication (Meanderhof, n.d. B; S. van Nisperen, personal communication, 12 February 2012). The sense of community is also reinforced through shared facilities, such as the gardens, tools and the bicycle shed, and the no fence policy - gardens should gradually flow into the communal gardens. Another connecting factor is the presence of children. Children play with each other, inspire all sorts of activities and people watch each other's children. In the event of people becoming sick, residents take care of each other, by helping out by cooking for them or just having a chat (S. van Nisperen,

personal communication, 12 February 2017). This sense of community is visible when visiting the Groendag: people are active all over the village or having a chat, in the courtyard or in the common room. Everyone is making an effort, children are playing together, adults are building a new shed and preparing the land for new plants. Around noon a lunch is prepared for everyone.

When creating Meanderhof, people had different reasons for starting an eco village. For some, ecological aspects were the main reason, others wanted to live in a social community (K. Schoe, personal communication, 12 February 2017). This diversity is continued into the present, current reasons for living in Meanderhof are the environment, living in a social community, the increased quality of life and also a sense of autonomy that comes with managing and maintaining a village and a community.

Diversification

As mentioned, Meanderhof exists of 53 households, divided over 21 social houses (ten family homes, nine apartments and two torenwoningen and 31 purchase houses (mainly family homes and a few apartments) (Meanderhof, n.d. A. One of the houses is tailored to needs of elderly and disabled people. The setup of Meanderhof facilitates non-traditional ways of living. There is an example of a couple that have a "birds nest" parenting arrangement, meaning that the children still live in the same house they grew up in, and the parents alternate this house and an apartment in Meanderhof they rent (M. Nugteren, personal communication, 12 February 2017)..

Meanderhof also has "adopted" a Syrian family, in the sense that they live just outside Meanderhof, but participate in the village's activities (S. van Nisperen, personal communication, 12 February 2017). Interviewees feel that eco villlages are perfect for vulnerable inhabitants, as people with mental issues or physical disabilities are part of a community, and the community cares for them. Whereas in a regular, more individual, neighbourhood these people would be less visible and more on their own (M. Nugteren, personal communication, 12 February 2017). Inhabitants describe the group of inhabitants as predominantly higher educated, 86% has a university degree, caucasian and a left political orientation (Hanze, 2009; S. van Nisperen, personal communication, 12 February 2012).

Organisation

The ecological and social dimensions of Meanderhof have been explored. It is now time to look into the organisational side of the village.

Organisational structure and decision making

Meanderhof has an active residents' association, MMWZ Meanderhof. All residents are a member, there were never cases in which people did not become a member or leave the association (S. van Nisperen, personal communication, 12 February 2017). MMWZ Meanderhof is lead by a board, and also has a greengroup, a common room group and many ad hoc groups, for instance when there's a celebratory event that needs to be set up. The board changes every three years and is appointed through an election. There are bimonthly meetings to discuss the annual budget, financial reports and issues at hand such as cats causing trouble, adding more green patches to increase biodiversity or adding an electric car charging pole. Inhabitants pay a monthly membership contribution of €12,70 for a household with one or €17,50 with 2 adults (Meanderhof, n.d. E). Other earnings include renting the common room.

Meanderhof has a website with an agenda, an archive and a members only section (Meanderhof, n.d. E). For more informal purposes there is a Whatsapp-group. Meanderhof has an (online) newsletter, called Hofmail (S. van Nisperen, personal communication, 12 February 2017).

Rules and procedures

The village is managed and maintained by its residents. Communal courtyards are maintained during the monthly "*Groendag*" (Meanderhof, n.d. F). Every inhabitant is part owner of these common areas, through a "*mandeligheidsregister*", which is part of a perpetual clause (S. van Nisperen, personal communication, 12 February 2017). De Hofkamer is cleaned according to a schedule, every household is responsible for a certain week of the year (Meanderhof, n.d. E). In practice, not everyone is equally involved. Residents explain that there are non active to super

active people, when it comes to *Groendagen*. Initially, *Groendagen* were on a voluntary basis which fitted more with the character of the village. But as years progressed, *Groendag* participation was marked by ups and downs. Over the last year, the green committee noticed that turnout was too low to keep up with the maintenance. This was discussed during a residents' association meeting and it was decided that everyone is obliged to attend at least three *Groendagen* a year. There's no penalty if people do not conform, but merely monitoring attendance has already boosted turnout (E. de Kruif, personal communication, 12 February 2012). There was also an issue around using *De Hofkamer*, Meanderhof's common room. It used to be the case that resident's had to pick up a key before they could use the room, but this made people feel pressure and control. It felt like the common room wasn't theirs. This was also discussed during a meeting and now there's a system in which everyone can enter at all times (Anonymous, personal communication, 12 February 2017).

There is an entry procedure for aspiring inhabitants (Meanderhof, n.d. F). Aspiring residents should join two events (for example a resident's association meeting and a *Groendag*). This is followed by an introductory interview, to inform people about life in Meanderhof. In case a rental house is vacant, there is a waiting list. Based on the date of subscription, people are offered the possibility to rent a house. Purchased houses are first offered to members of Meanderhof, then to the other two MMWZ projects in Zwolle (De Bongerd and De Nooten), and finally they are sold in the private sector. The waiting list for rental houses is long, it could take a few years before aspiring residents get offered a house. Although the flow of people is low, the community is not ageing. Young families with children keep coming in. On average two households a year change of inhabitants (S. van Nisperen, personal communication, 12 February 2017). There are different reasons for people moving out. In a few occasions people did not really fit in the community. These were mostly people that joined the preparation phase last, and did not go through the intensive planning and preparation process. De Bongerd was perhaps a bit too lenient in the entry procedure, in hindsight these people probably just wanted a cheap house. Their current policy, as explained earlier, should prevent this.

3.5 De Buitenkans

Buitenkans is an initiative in Stripheldenbuurt, Almere, and houses 55 dwellings. It is a car free village, centered around a green area with a large pond, overlooked by the community centre (Buitenkans, n.d. A). The idea for Buitenkans originated in 1999, when a group of friends wanted to create an eco village (W. Janssen, personal communication, 26 January, 2017). Their vision was to create a village, in which people know their neighbours, are in touch with nature, and live in a healthy environment. They dreamed of having an autarkic farm and adding helophyte filters, but not all of their dreams became a reality (F. Steekelenburg, personal communication, 26 January, 2017).

Planning phase

The process started in 1999 with the recruitment of potential residents through personal networks and hiring a professional project manager, who was experienced with ecological living projects (Buitenkans, n.d. C; W. Janssen, personal communication, 26 January, 2017). He made budgets, negotiated with the municipality and contractor and created cohesion within the group. In hindsight, Chris Postma was an essential factor and he was missed a lot, especially because he had a knack for uniting people (F. Steekelenburg, personal communication, 26 January, 2017). The project was formalised through the establishment of Vereniging De Buitenkans in 2001.

Buitenkans gathered a group of partners that could help with different parts of the process (Buitenkans, n.d. C). A team of architects, a landscape architect and contractors was hired, most of which had experience with ecological building. The municipality was an important partner during this first phase. The project was unconventional at that time, and the municipality was new to projects in collective private commissioning. This required a lot of convincing. Their efforts paved the way for other bottom up initiatives. (W. Janssen, personal communication, 26 January, 2017). To be able to include social housing in the project, housing corporation Alliantie Flevoland was included in the project (Buitenkans, n.d. C). Social housing was deemed important because the pioneers wanted to achieve a diverse neighbourhood that had room for people with different budgets. As an added bonus, Alliantie Flevoland was able to buy parcels that remained unsold, and because of this the building process could start. These remaining parcels were sold later on. During this time, an inventory was made of aspects that were important aspects of the village that would

have to be passed on to future residents and could be formalised in perpetual clauses, to assure the survival of important qualities (Buitenkans, 2005). This includes a "*planvisie*" (describes ecological living and building) and a "*mandeligheidsregelement*" (formalises the joint ownership of certain green areas).

The building process was divided into two phases. During the first phase, Vereniging De Buitenkans held public meetings to attract potential buyers for the unsold properties. Residents thought the houses would sell themselves, but it turned out that people were not into the ecological and social character of the project (W. Janssen, personal communication, 26 January, 2017). Buitenkans had to put a lot of effort in to sell the remaining houses, and they succeeded. After the first 48 houses were built, a second phase started, with seven houses in individual private commissioning (IPO). Again, a few parcels were not sold. The municipality sold the remaining parcels to people that were not involved in the project, so both Buitenkans as well as these new residents were unaware of each other's vision (W. Janssen, personal communication, 26 January, 2017).

Some of these new residents did not agree with the idea of ecological building or with living in a community, but because the parcels had to be sold, Buitenkans was faced with residents with different ideas (F. Steekelenburg, personal communication, 26 January, 2017; W. Janssen, personal communication, 26 January, 2017). Because these remaining houses were built in individual private commissioning, Buitenkans had little to say about the buildings and materials used, which is why some of these houses differ greatly from the other buildings in the project. Janssen adds that these people were not part of the collective process, these people were more individualistic and this left Buitenkans in an unwanted and unforeseen situation. Steekelenburg thinks the project should have been smaller, so all houses would have been sold to people with similar ideas and expectations.

Planet

Some concessions had to be made during the planning process. This section explores the technological solutions that are applied in Buitenkans.

Ecological and technological solutions

During the planning and building stages, many decisions had to be made with regard to ecological measures that would be taken. Although concessions were made and not all dreams could be realised (such as the autarkic farm and helophyte filters), residents did feel they created a solid ecological project (F. Steekelenburg, personal communication, 26 January 2017; W. Janssen, personal communication, 26 January 2017). For the collectively commissioned houses, residents of Buitenkans chose timber frame houses, sedum roofs and opted for the use of natural paint (Buitenkans, n.d. D). The houses are equipped with solar water heaters. The common areas are car free, cars must be parked in a parking lot on one side of the plot. The houses are centered around a large pond and can be reached through paths made of lava stone, which enhance permeability of rainwater into the soil. The borders of the village are marked by a small strip of forest, which attracts different kinds of birds. The area has an open feel, and there are only green boundaries. The use of fences is not allowed. Rainwater is directed to the pond, instead of running of into the sewage. Residents agreed that the municipality of Almere had good waste separation facilities, and therefore Buitenkans did not create their own solution for this dimension (F. Steekelenburg, personal communication 26 January 2017). There are a few fruit trees and at a certain point residents tried to cultivate vegetables, but because of an excessive amount of snails in Almere, this turned out to be impossible. There are some small scale food related initiatives, Buitenkans has become a delivery point for a local organic farmer and every now and then people buy and share a cow (F. Steekelenburg, personal communication 26 January 2017). But these are very particular initiatives, which are not shared collectively.

Technological experiences

The previously discussed measures were all decided and applied before and during construction of the village. Slowly but surely, mainstream technology has caught up with Buitenkans (W. Janssen, personal communication 26 January 2017). After completion of the village, residents have not updated the ecological performance the village, with the exception that some houses now run on solar power. This was a personal project by one of the residents who was interested in solar power, which made it easy for other people to join in (F. Steekelenburg, personal communication 26 January 2017). But other than this individual project, residents do not collectively evaluate or enhance the ecological

performance. Perhaps this is because Buitenkans lacks an ecological vision. Buitenkans has not defined ecology, and has a different meaning for each resident (F. Steekelenburg, personal communication 26 January 2017).

People

During the planning phase, Buitenkans was led by a project manager who created a good atmosphere. This section looks into the social dimensions in later stages.

Social cohesion

In 2013 a community centre was added to the project. This was funded in large part by residents, who saved money for the construction of the building. Additionally, Oranjefonds donated €10.000 and Rabobank Almere donated €2500, with the specific purpose of building an ecological building (Buitenkans, n.d. B). The idea behind the community centre is that it would facilitate the cohesion within the community. The addition of the community building was marked by opposition (W. Janssen, personal communication, 26 January 2017). Although it was specified in the documents all buyers signed, two or three plot owners did not agree with the construction of this building. Because they did not agree with this, they started boycotting unrelated issues or nag about procedural details instead of content. Their protests gathered a small group of bystanders and even lead to a court case in which this group protested the community building. Although the protesters lost the case, the affair has had quite the consequences for Buitenkans, as it was left with legal costs of 20.000 euros, a divide within the community and important decisions were put on the back burner until Buitenkans was again in calm waters, such as creating a storage room or updating the green policy (F. Steekelenburg, personal communication, 26 January 2017; W. Janssen, personal communication, 26 January 2017). Before this court case, there were rarely any problems and people felt they were part of a community. This particular situation changed the dimensions and atmosphere in de Buitenkans. The community is recovering from this impasse. People decided it is time to move on and not let this get in the way of social activities or decisions that need to be made (F. Steekelenburg, personal communication 2017).

Even though the creation of the community building was accompanied by difficulties, it did lead to the positive attribution residents had hoped for (F. Steekelenburg, personal communication, 26 January 2017; W. Janssen, personal communication, 26 January 2017). The community center has become a pivotal factor in the village. The community building houses many activities, including a foodclub, tai chi and yoga lessons, meditation evenings, neighbourhood quire theater for kids, weekly tutoring sessions, "klaverjassen", thursday morning meetings with pensioners and freelancers, new years drinks, a summer party and so on (Buitenkans, n.d. B). At the start of the eco village there were many activities, in a backlash to the court case the activities decreased, and now they are getting back to the old levels again. Besides these social activities, people also meet during so called "green days" in which residents maintain the common green areas. Participation in social activities and maintenance varies, which is natural according to F. Steekelenburg (personal communication, 26 January 2017). There is always a small group that is very active, a small group that is not, and a large group in the middle. There will always be natural fluctuations: people get older, their interests change or they get a different job, and this influences their participation in the community. Steekelenburg feels that this works, as long as the pressure on the active group doesn't get too big. Bu there are opposing voices within Buitenkans: the board has investigated the costs of outsourcing maintenance, which would total to additional costs of €10.000 per year (W. Janssen, personal communication, 26 January 2017). To prevent people from not fulfilling their duty, this group is looking into an arrangement in which people either participate or buy off their share. This investigation is a response to the disobedience portrayed during the difficulties surrounding the building of the community centre.

Despite these tensions people are glad to live in Buitenkans. One of the inhabitants describes living in Buitenkans as being on a permanent holiday. This is also expressed through the rate of moving. Since the first group of residents started living in the village, only 5 houses have been sold. From the rental houses no one has moved so far. Reasons for moving are mostly of personal nature, such as work or family related matters.

Diversification

Buitenkans includes social rent and purchased houses. There is currently a house for sale for €350.000 (Funda, n.d. B). The realtor ad mentions that the property is situated in an ecological project. Buitenkans residents feel that this combination of social housing and purchased houses has lead to a diverse crowd, with families and singles, young and old. Buitenkans is also in touch with neighbouring areas, that use the community house for meetings, parties etc.

Organisation

The social situation had consequences for other dimensions. This section looks into the organisational nature of the village, and to how it is affects and is affected by other dimensions.

Organisational structure and decision making

There are two important governing bodies in Buitenkans, which are Vereniging De Buitenkans, and an owner's association (F. Steekelenburg, personal communication, 16 April 2017; W. Janssen, personal communication, 26 January 2017). Both bodies include all residents, from rental and privately owned properties. The difference is that the owner's association decides about the collectively owned areas, Vereniging De Buitenkans decides on all other topics. Vereniging De Buitenkans is lead by a board, comprised of a president, secretary and treasurer, and is concerned with matters like the amount of monthly contribution, the annual budget, management plan for the green areas ("*Groenplan*") and the community building, new play facilities for children (Buitenkans, n.d. E). Meetings are held monthly, and in the event that a resident calls for a meeting about a specific subject. Attendance is high, residents are very involved (W. Janssen, personal communication, 26 January, 2017). In case of decisions, residents get one vote per household. Practical matters are executed through different groups, such as a social group ("Buurtleven"), a "green group", and a community center group. Member of Vereniging De Buitenkans pay a monthly amount of €17,50 per household (F. Steekelenburg, personal communication, 26 January 2017). With this amount all costs are covered, such as a license for a accountancy software programme, lunch during green days, tools, parties and a "bestuursverzekering". Besides these costs, Vereniging De Buitenkans has been able to save money which was used in the event of the court case. Besides the membership contribution, financial resources are acquired through guided tours and the rental of the community building.

During the planning phase, decisions were made through consensus, making sure everyone was heard and could live with the outcome of the decision. This changed when people started living in De Buitenkans and people moved in that were not part of the pre-living phase. Decision making became formal: a sufficient amount of residents has to be present and decision are based on majority rule. Steekelenburg (personal communication, 16 April 2017) feels that this is not the best solution, because it is possible that a large share of the residents don't support the decision. Membership of De Buitenkans is not mandatory, there's no way to obligate this, according to interviewees.

Rules and procedures

Although there are documents such as the "*Groenplan*" and "*mandeligheidsregister*", not everything can be set in stone. People still have individual freedom and if they want to for example use a harmful type of paint, they can (W. Janssen, personal communication, 26 January 2017). People feel awkward pointing out certain behavior of fellow residents, so this does not occur (F. Steekelenburg, personal communication, 26 January 2017). The only way this occurs is during meetings, where people sometimes make general comments such as the paint types that can be used or emphasising that car use could be decreased. Theoretically, people have a lot of individual freedom but in general people adhere to the rules that are set, the ecological character of the village is not threatened, Steekelenburg feels. She also points out that it is very difficult to pinpoint ecological behaviour. Perhaps someone uses the proper paint and uses solar energy, but uses a car for every tiny errand.

3.6 Boddegat

Not all ecological living and building projects have a successful ending, an interview with Johan Feenstra shows (personal communication, 20 April 2017). He was involved with three aspiring eco village projects that, for different reasons, ended in the planning phase.

The first project Feenstra was engaged in was De Dreijen, a terrain that belonged to the Wageningen University. In 2010 the university organised a design contest for future possibilities for the area (J. Feenstra, personal communication, 20 April 2017). Different people brainstormed, designed and presented ideas but there was no follow up. Feenstra thought this was a pity and felt that he had to take initiative. He contacted the people that were involved with the contest to see who was interested to start an eco village, they united in Initiatief Duurzame Ecowijk Wageningen (J. Feenstra, personal communication, 20 April 2017). The group, with forty to fifty members, came up with plans to develop an eco village, along with the university and a former municipal official, but the plan got turned down by the city council. The municipality felt that the project was not socially diverse enough and the density of houses was too high. After this setback, the group wanted to continue, but the province of Gelderland concluded that, bearing in mind the 2008 housing crisis, Wageningen already had too many projects and did not approve this project (J. Feenstra, personal communication, 20 April 2017).

The group decided they wanted to continue the project and looked for another location, which they found in Kortenoord in Wageningen. The group wanted to achieve a mixed neighbourhood, combining social housing with purchased houses, so they included housing corporation Woningstichting. An additional bonus was that the corporation could take care of the financial side of the projects. The group also worked together with project developers from Bouwfonds, but it turned out that Bouwfonds had a conflict with Woningstichting and they ended the cooperation, which ended this second project at the beginning of 2012 (J. Feenstra, personal communication, 20 April 2017).

In 2013 Johan Feenstra came across a collective private commissioning project that was already in preparation for a few years and had a visions similar to that of Feenstra's previous projects. Feenstra was reassured by the fact that the municipality signed a declaration of intent for this project, intended to be built at a military base (J. Feenstra, personal communication, 20 April 2017). Feenstra visited an information meeting, joined the project and became an active member taking up the function of secretary. The provincial department had assigned subsidies to the project. The initial vision was threefold. They wanted to achieve technical sustainability (e.g. energy neutral houses), social sustainability (creating a community) and ecological sustainability (extending the ecosystem of the neighbouring forest into the village).

During the process, the group had to cut down on their dream because of financial reasons (J. Feenstra, personal communication, 20 April 2017). This caused some tensions, because this revealed that people had different preferences. Some people were in it for technological innovation, other people were more attracted to the social character. They could not include social housing because the price of the parcel was too high. The municipality was not willing to negotiate a lower price that would allow social housing in the neighbourhood. Another setback was that wooden frame houses were too expensive and they had to use a design with bricks instead. During different stages of the process, the group hired a process manager. The first one was very helpful in maintaining contacts with the municipality, functioning as a more or less independent party, the second one contributed to the group process (achieving consensus). Feenstra says that there was a sense of community. Mostly there was a good atmosphere during meetings, and apart from they gathered for social and educational trips. The group was organised through different working groups, such as an energy group, a building group, a social group and an ecological group.

After a few years of preparation, the final drawings were in, an owner was found for 25 out of 26 houses and each household had invested around five to six thousand euros. In this stage, a realtor valued the houses based on the drawings and estimated that the value of the houses would be less that it cost to build the houses (J. Feenstra, personal communication, 20 April 2017). People felt that the realtor valued the houses as regular houses, and did not quantify the specific characteristics (such as the social character, communal garden and ecological character). Despite this,

confidence within the group had dropped significantly, and ten households decided to withdraw because they did not want to take a risk in building a house that could be worth less than it cost (J. Feenstra, personal communication, 20 April 2017). A second opinion, from three different realtors, could not redeem trust. In an arrangement with the housing corporation and the municipality it said that if they were short of 5 houses, the project would continue. But now they were ten houses short of 25 and that's when the municipality pulled the plug. A small group still continued their plans in a different way. They built individual technically sustainable houses, but without the social an ecological ambitions that they had intended in their village.

The first project failed because the municipality and the housing corporation could not agree, and because the housing crisis had just taken place. The second project fell through because there was a conflict between the contractor and housing corporation. the final project fell through because of lack of trust in the project, from within the group as well as the municipality. Although Feenstra's efforts did not lead to the creation of an eco village, he did built his own energy neutral house.

This chapter has explored six case, five of which succeeded in developing and sustaining and eco village and one case that did not make it to completion. This chapter has given an overview of the data gathered on each case, through the dimensions of planet, people, organisation and innovation. The data gathered in this chapter provides the input for the analysis of the development of eco villages in the next chapter.

4 | Analysis of six eco village case studies

The previous chapter discussed each of the six eco villages in depth and has provided input for the current chapter, in which the results from the six case studies are analysed with regard to their long term development (did the eco villages change over the years?) and the cases are compared to one another. This chapter is structured according to the research framework figure 5, and is divided into the sections planet, people, organisation and innovation. Each section comes with an appendix that features a table that summarizes the results per case.

4.1 Planet

Perhaps the most distinctive character of an eco village is its ecological values and ambitions. This section first looks into the ecological solutions and technologies that have been applied in eco villages over the last twenty five years. These solutions and technologies are divided into the dimensions buildings & materials, energy, water & sewage, waste, transport and food. This section then continues with an assessment of the degree to which the cases studied in this research approach a circular system. This research regards a circular system as the latest evolution of the ecological standard, in terms of living and building and they cases are thus tested on the extent to which they incorporated circular principles. The circular economy principles are presented in section 2.3.2., in figure 3 and 4. Appendix C gives an overview of all ecological measures taken in each case.

Buildings & materials

This research has found that all cases include wooden frames houses from non-tropical hardwood, which are often finished with clay stucco or sand lime bricks. Houses are usually painted with specific types of paint made from less harmful or only natural substances. Another common feature is that all villages achieved a, relative to that specific time, high level of insulation, to enhance energy efficiency. But all interviewees point out that technology and energy efficiency standards have caught up with them. Besides these common features, some cases applied individual measures and solutions. Het Groene Dak and Buitenkans lava stone for garden paths to enhance the permeability of the surface. Instead of tiled roofs, Buitenkans applied sedum roofs on all houses. Het Groene Dak additionally applied drainpipes from non chlorine containing PPC. The idea behind these materials is that they are recyclable and made from less environmentally harmful materials than conventional materials. Or, in case of sedum roofs and permeable surface coverage, enhance natural processes. Natural and recyclable materials fit with the notion of circular economy, provided they are indeed recycled when the village is one day torn down.

Energy

In all cases the application of solar boilers and solar energy was found. The villages differ in the degree to which solar energy is applied. In none of the villages the energy is fully generated by domestic pv cells. As most villages have been around for quite some time, solar energy was fairly new and quite expensive at the time the villages were built. In some casess solar energy was added or expanded later on, often because they were granted subsidies, such as in Meanderhof. To make up for the fact that solar energy does not provide enough energy, EVA-Lanxmeer gets its energy from a local energy company that generates energy from renewable source.. Solar energy is a renewable source, so this fits well with circular economy. The coverage could be enhanced in most eco villages.Another frequently applied solution is wall heating, which is a low temperature heating system. EVA-Lanxmeer created its own heating system, operated by the village's own Thermo Bello foundation. In this low temperature heating system (maximum of 50 degrees Celsius), water runs through the village and is heated through a central heat pump (Thermo Bello, n.d.). This measure can be seen as a step towards a circular system, provided that the heat pump efficiently heats the water without too much loss of energy and the energy source is renewable.

Water & sewage

When it comes to water, there's quite some variety between the cases in this research. EVA-Lanxmeer has created an integral water concept that allows for the use of rainwater as a source for potable water. Waste water is filtered before it

runs off into nature. This water concept efficiently uses of natural resources and lets water circulate at a higher quality, so the water concept approaches a circular system. The only improvement could be that waste water from toilets is connected to the municipal sewage system. Het Groene Dak's main theme is water, so the village conducted many experiments related to water, which are all in line with circular economy. Greywater and helophyte filters enhance the quality of water, which is in accordance with the principle that materials should circulate at highest possible quality. Het Groene Dak also experiments with rainwater, which is collected and used to replace tap water for purposes that do not require potable water, such as flushing the toilet. Compost toilets do not use water and, when functioning properly, they produce a resource (manure) instead of polluting water with excrements. The compost toilets have been replaced with water saving toilets, making Het Groene Dak slightly less circular, but with regard to water it is still approaches a circular system. Both Het Groene Dak and De Bongerd use Gustavsbergsystem toilets, which is a water saving toilet. Andere eco villages ook? Het Groene Dak and Buitenkans are centered around ponds, to which rainwater is directed. This way it is saved, instead of run off into the sewage. De Bongerd experimented with rainwater collection, to replace toilet and washing machine water. Currently only used by half of the residents.

So EVA-Lanxmeer and Het Groene Dak both have water systems that fit well with the notion of circularity. De Bongerd's experiment with rainwater collection can be seen as a circular measure, but it is only used in half of the houses and furthermore this is the only water related solution applied in the village.

Waste

Waste is an important element in circular economy. Most eco villages have not created autonomous solutions for waste, they all lean on municipal policy for waste services. So in that sense, the level of circularity depends on the municipal waste policy. Het Groene Dak made sure that during the construction and building of the neighbourhood, waste was separated properly. In the beginning Het Groene Dak did create a system that is similar to that of a circular economy. Residents of Het Groene Dak used to separate all kinds of waste and for each waste stream sought partners that could use this waste as a resource. Currently Het Groene Dak has shifted to the municipal system, because they felt the city of Utrecht had a good waste policy. The municipality of Utrecht has an elaborate waste separating system, and has just launched a policy that could be the start of a transition into a circular waste system. In some cases, like EVA-Lanxmeer and Meanderhof, organic waste is composted, which is an example of a circular measure, but other than that there are no waste related measure. When asked about why there is no waste policy within the eco village, interviewees reply that their municipalities have good waste policies and that they feel the villages are too small to create a circular waste system. All villages rely on municipal waste facilities and currently have not designed their own waste solutions. Examining municipal waste systems falls out of the scope of this research and and analysis of the level of circularity of the waste facilities is therefore not possible.

Transport

All villages emphasise that they are car free, in the sense that cars are parked on the border of the villages and can only enter the village in case of emergencies or when people move. In practice this does not mean that car use is decreased, so rather than a reduction of environmental impact this aspect is more related to the livability of the neighbourhood. Meanderhof has a Greenwheels car located in the village to facilitate car sharing which is is a form of dematerializing utility. Furthermore there is an electric car charging pole on the parking spot which is powered by solar energy. Both of these features are essentially circular but they are just two small examples, they do not apply to the whole village. EVA-Lanxmeer is located next to a train station, which could potentially decrease car use. In all cases, there are no village wide transportation solutions, so the level of circularity in this respect is at a minimum.

Food

In all villages there are fruit trees and / or vegetable and herb gardens. Besides producing a small amount of food, an important purpose of these gardens is their recreational and educational value. Additional to this domestic food production, Meanderhof and Buitenkans are part of the local food system (Meanderhof, Buitenkans). The common room in Meanderhof and community house in Buitenkans serve as a pick up point for food boxes from local suppliers some residents have subscribed to. In Buitenkans it sometimes occurs that people buy a cow together from a local supplier. EVA-Lanxmeer is the only village that provides for large scale local food production. The villages has an

organic farm and the food that is produced there is sold in the farm store. Following circular economy, buying local products from suppliers that produce environmentally friendly is to be encouraged.

Overall circular performance

Figure 8 shows the overall performance of each case on the six aspects of circular living and building. It is clear that Het Groene Dak and EVA-Lanxmeer approach a circular system most. Coincidentally, these are the two largest cases in this research, although Het Groene Dak is close to the average amount of houses. Striking is that Het Groene Dak is the oldest case, whereas circular economy is a fairly new concept. The youngest cases are only circular with regard to the application of renewable energy but other than that, their circular performance is low. Perhaps it is easier to design a circular system in larger neighbourhoods because CE is a system and deals more with infrastructures rather than individual, separate technologies. Another factor could be a lack of resources, as most villages, except for Het Groene Dak and EVA-Lanxmeer, explain that many concessions were made with regard to the original dream.

The cases examined in this research show few developments over the years with regard to ecological solutions and technologies. The set of measures and technologies chosen at the beginning of the project remain stable, with some occasional changes. Some eco villages have added or expanded solar energy, as this became more affordable as technology progressed. There are a few examples of small scale additions, such as a car charging pole, but there are no village-wide upgrades or expansions that take the village's environmental or innovative performance to a higher level. Furthermore, it is more likely that technologies and solutions disappear, rather than being expanded, as in practice they do not function as expected. Interviewees from all cases mention that they feel that technology and regulations have caught up with them, and that they are hardly innovative anymore, with the exception of material use. Residents are unsure as to why they do not update technologies. During meetings, they mostly discuss garden maintenance or new facilities such as a bicycle shed. Tjepkema from De Bongerd reasons that one of the reasons for ecology is not being updated could be that most people were attracted to the social character and the design of the village, and that ecology came second or third. Olthof says that once they started living in De Bongerd, they were not constantly thinking: "We live in an eco village, after a while it just became living as you would in any other house or street. But every once in a while we think about the future, what do we want". So they are not constantly aware of the vision or ecological character. Reinboud from Het Groene Dak thinks that the restraints are mostly of financial nature, and the fact that for rental houses the housing corporation has to be willing to participate.

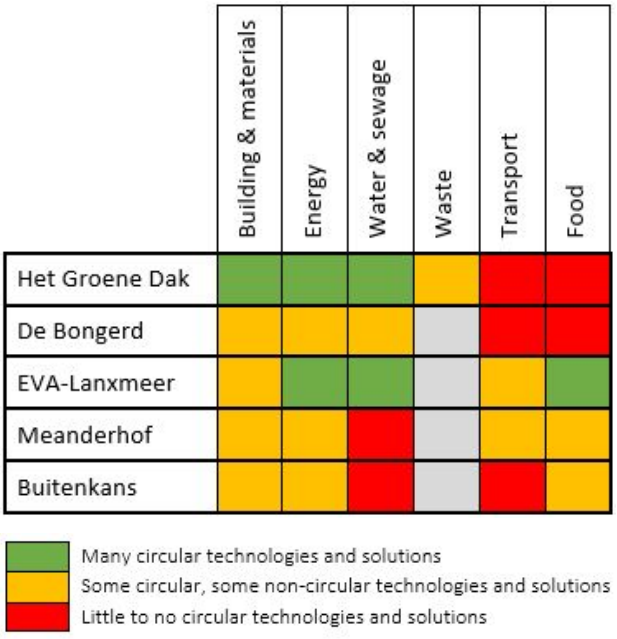


***Figure 8**: Overview of circular solutions applied by each eco village.*

4.2 People

Social dynamics are an important part of eco villages, as they are created by and for people. An important reason to start or join an eco village is the fact that living in an eco village means living in a community, in which people engage and cooperate more than in regular neighbourhoods. Pivotal aspects of eco villages are based on (or work better because of) a supportive community. That is why this chapter addresses the social aspects of eco villages. It first looks into extent to which group dynamics positively contribute to the realisation of a project during tte planning phase. This topic is derived from the work of Seyfang et al. (2013) and specifically looks at the group dimensions during the planning and preparation phase, and is in this research seen as a precursor of social cohesion. This chapter then continues with social cohesion within eco village communities, from the moment the first group of residents moved in. Lastly, this chapter looks at diversification in two ways. First, by establishing a characterisation of the inhabitants and second, by assessing whether the eco village caters to the needs of different groups in society. An overview of the results per case on the people dimension is found in appendix D.

Group capacity

The success factor 'group capacity' denotes the presence of key committed individuals and / or an effective organising group, capable of maintaining momentum, overcoming setbacks, and having clear direction. Most cases (Het Groene Dak, De Bongerd, Meanderhof and Buitenkans) have a dedicated group. These cases all started out with one or more pioneers that attracted enthusiastic people, generating a group to start the process with. In all of these cases, group members dedicated their time and (financial) resources to the project. Interviewees from Het Groene Dak state that for three years, the group met every monday and on top of this they spent personal time on researching the best options for this village. What all of these projects furthermore have in common is that they are structured in a horizontal fashion, with thematic groups exploring different topics. Decisions are made by all members and they strive for consensus, ensuring everyone is heard and can agree with the final outcome. This makes people feel involved and generates support for the final result. All of the aforementioned cases experienced setbacks, such as budget cuts or difficulties in finding a location. Despite setbacks, the groups remained supportive of the project. Interviewees from all projects state that they had a few people leaving the group, mainly because these people had found another project or house they could move into, but this was not disruptive to the group atmosphere.

EVA-Lanxmeer, Buitenkans and Boddegat had different experiences with group dynamics. EVA-Lanxmeer differs from other cases, as it exists because of the vision and effort of one single person. Marleen Kaptein had a vision and created a brochure to spread her ideas. This gained a lot of support with aspiring residents. Although residents were not involved in the design of the urban plan of EVA-Lanxmeer, the project did have a solid and extensive base of supporters from the beginning, with people that believed in the project and wanted to live there.

The project of Buitenkans also had a committed group of people that supported the project, but on top of this they hired a project manager that was essential to the project's success (F. Steekelenburg, personal communication, 26 January 2017; W. Janssen, personal communication, 26 January 2017). The project manager had the ability to create unity within the group. Interviewees designate him as a key figure in the planning phase, that contributed greatly to the success of the planning and building phase. When the planning phase was finished, the project manager's job was done and he left the project. Interviewees state that this created a void, Buitenkans was missing a key figure or different individuals from within the group that was capable of taking up his tasks and role. Although this key figure contributed to the success of the project, it also creates a risk in the event that the key figure is no longer involved with the project.

Boddegat appeared to have a solid group, that was able to create a good atmosphere and had a lot of knowledge about sustainable building (J. Feenstra, personal communication, 20 April 2017). But when the houses were valued below the costs, a large part of the group lost their faith in the project. The faith could not be restored and the group was not capable of overcoming this setback.

Seyfang et al. (2013) have defined 'group' as a successfactor. From this analysis it is clear that 'group' indeed contributes to the success of a project, as it generates knowledge and ideas, (financial) resources, patience and time to let the project

grow. Trust within a group is an important element for a project to succeed. Furthermore, strength is in numbers because a solid and large group generates trust for external parties as well. Most cases show similarities in group dimensions in the planning and preparation phase:

- Successful projects are characterised by a supportive group of people, that remain supportive even when facing (multiple) setbacks
- Having a clear vision (articulated in a (public) document such as brochure or mission statement) helps in attracting the right people and creates direction within the group
- The explorative phase is structured through thematic groups, to efficiently gather knowledge
- Decisions are made based on consensus

A dedicated and well organised group contributes to the success of an eco village. An alternative possibility to a dedicated group is leaning on a key figure that carries the project. This can be risky, because if the key figure recedes this creates a void, whereas a dedicated group seems more resilient to changes.

Social cohesion

The previously discussed dimension 'group' can be seen as the social cohesion of the startup phase. Both are essential to the succeeding of the project. Interviewees state that the planning phase was very important for social cohesion (Bongerd, Michel Post, Franka Steekelenburg, Meanderhof). Social cohesion is determined by three variables: social relations, connectedness and focus on the common good. Living in an eco village has the potential to create all three variables: people engage with each other in an extensive process (social relations), they strive towards the same goal and sometimes have to make concessions (focus on the common good) and creating such a process requires and generates trust (connectedness). Overall, social cohesion is achieved in all villages, but the cases differ in the ratio between social relations, focus on the common good and connectedness.

The variable social relations regards how and how often people engage with one another. Social relations are created in different ways, and in general residents frequently meet each other. In all villages, residents are joint owners of the garden areas, and together they are responsible for managing and maintaining these areas at regular garden days. They furthermore all have a residents' association with frequent meetings, attended by most resident. The communities also engage in social activities, in De Bongerd for example these occur more ad hoc or randomly, arising for example through spontaneous initiatives communicated via a WhatsApp group. In other villages (Het Groene Dak, Buitenkans, Meanderhof) there are many structural events. Meanderhof for example has movie nights, baking pizzas in summer, new year's evening and easter celebrations and watching big sports events together. Furthermore, there is a handyman club, a cooking club, a weight loss club "Happy Hippos" and there are weekly yoga lessons. Every now and then, the community organises workshops and lectures. In some villages, social relations are stimulated by shared facilities, such as a communal bicycle shed, and a no fence policy that is applied in all cases. This means that gardens should gradually flow into the communal gardens, without disruptive or unnatural partitions. Another connecting factor is the presence of children. Children play with each other, inspire all sorts of activities and people watch each other's children. Most eco villages experience a decrease in social relations, compared to the beginning, but interviewees state that there are still many activities going on (Meanderhof, Buitenkans, Groene Dak). The presence of a community centre leads to additional contacts and activities, but it does not seem essential. The source of contacts and engagement seems to lie in maintaining and managing the neighbourhood together, and from this social activities arise as well.

Connectedness is characterised by trust, identification and perception of fairness. Most villages appear to have no issues with connectedness, people seem to trust each other and identify with the village's character and people. Interviewees state they feel that in general, (new) residents support the village's vision. There are three examples of issues with connectedness. Both Buitenkans and De Bongerd were faced with a lack of trust and residents that felt mistreated, which lead to court cases. In Buitenkans, two people did not agree with the plans to build a community centre, gathered a group of bystanders and eventually this created a divide within the community. This also affected social relations (people engaged less with each other) and focus on the common good (there was more attention for procedural details instead of important issues, and for a while Buitenkans did not make any major decisions). Buitenkans is recovering

from this, and social cohesion is recovering. De Bongerd was also faced with a few residents that did not agree with the village's principles and this too led to a court case, but unlike Buitenkans, it did not create a social divide. In De Bongerd, these residents withdrew and did not participate, whereas the troublemakers in Buitenkans were active members and drew a crowd (Syb Tjepkema, Wim Janssen). In one of the courtyards in EVA-Lanxmeer, houses were built in two phases which poorly affected connectedness. New residents did not feel that the courtyard was theirs. This caused friction among residents and garden maintenance also suffered from this. In the end, they designed a new garden with input from all residents and the atmosphere has picked up.

Focus on the common good is translated into solidarity or helpfulness and participation in common activities. In general, residents experience a sense of solidarity. They feel people are there for each other, also in time of need. In most villages this occurs informally (in case of sickness people voluntarily take care of each other), in some villages there are specific working groups around this theme (EVA-Lanxmeer has Lanxzij, Het Groene Dak has a care group). With regard to focus on the common good, Het Groene Dak especially showed signs of this variable. When the garden house had to be replaced, people donated personal savings towards this goal. They also agreed with many technological experiments, sometimes at the expense of their personal convenience, but supported it because it was part of their vision. Other cases sometimes experienced temporary decreases in participation in garden maintenance. There were no particular reasons for this. In De Bongerd people merely had to be reminded that they had a certain responsibility. Meanderhof created a policy to ensure that everyone contributes their share. Another issue with residents not being focused on the common good, was common in several cases. Het Groene Dak, De Bongerd and Buitenkans had not sold all of their houses before the building started. Because houses needed to be sold, they were less strict in who they sold the houses to. This led to people joining the villages, that did not go through the explorative phase in which many decisions were made, or did not care that much for the ecological and social character of the village. Some interviewees suspect these people just wanted an affordable house (Syb Tjepkema, Wim Janssen). Thus in some cases people entered the community that were not in line with the village's vision. In some cases, this caused issues such as the court cases. But overall, participation in meetings and maintenance is still (or again) good, and people act in accordance with what is expected of them.

Overall, the eco villages show a high level of social cohesion. The planning and preparation phase is an important precursor for social cohesions. Dreaming, discussing and deciding is very important, for several reasons:

- Get to know each other
- Understand each other, and why certain decisions are made
- Create a feeling that the project belongs to everyone
- Go through struggles, celebrate successes

Social relations arise quite naturally in eco villages as they are inherent to the concept, by taking care of the jointly owned gardens and uniting in residents' associations. Social activities occur as well. Some cases have had issues with connectedness, which has even led to court cases and friction within the community. This shows that trust and perception of fairness are essential, and that they affect other dimensions of social cohesion. With regard to focus on the common good, this is generally present, but it is important to be careful that new residents support the goals and characteristics of the village. EVA-Lanxmeer, despite its large scale and a lower level of residents' involvement during the planning phase, managed to create social cohesion.

Connectedness seems especially important for all other dimensions (if people don't trust each other or feel mistreated, they engage less (even withdraw) and do not support the common goal (e.g. do not take care of gardens).

Diversity

Interviewees from all villages feel that the community is diverse, as there are young and old people, people with different levels of income, and in some villages people from vulnerable societal groups reside, such as elderly and / or mentally or physically disabled people. But there are also many similarities within and between the different cases. According to the interviewees, residents mostly have a left political orientation and are often higher educated. In Meanderhof for example 86% of the residents is high educated (Hanze, 2009). And generally speaking, there is low

ethnic diversity in eco villages. Unfortunately it is not possible to draw strong conclusions on this point, as the eco villages do not keep a (public) list with resident demographics.
In any case, all eco villages have provided for social housing, making the villages fit for people with different kinds of income. De Bongerd had also included sheltered housing, and Meanderhof and EVA-Lanxmeer have houses which are equipped for elderly and physically disabled people. All villages have different types and sizes of houses. Het Groene Dak specifically wanted to provide housing for non-traditional households. Het Groene Dak has therefore created large family homes, single person apartments and cluster homes with shared facilities. Most cases specifically wanted to create diversity, because it is a matter of principle (the eco village should be accessible for everyone) and because they feel it is good to get in touch with different people (S. Tjepkema, personal communication, 13 February 2017; C. Mesters, personal communication, 16 May 2017). Chapter 2 has shown that there are two sides to diversity. On the one hand diversity is a source of resilience, on the other hand diversity is at odds with social cohesion. The cases in this research show that social diversity does not threaten social cohesion. What is important is that people agree with the ambitions and character of the village, in that they support the ecological and / or social character of the village. It appears that not all residents have to support both dimensions, as long as in general there is enough support to keep both characteristics alive. Interviewees explain that people sometimes move into the village without having a specific interest in the environment, but learn from their neighbours and grow into the character.

Missimier (2017) concluded that diversity can contribute to resilient neighbourhood, while Van der Meer and Tolsma (2014) state that diversity can also be a threat to neighbourhood. This research encountered examples of both. In some cases, a diverse crowd has led to less participating residents. De Bongerd for example has a diverse neighbourhood, which is highly valued by its residents but at the same time residents from sheltered housing turned out to be less participative. Opposed to this, all cases have also experienced an opposite effect. It has happened that new residents moved in who only partially fit the profile of the village. They for example did not care for ecology, but highly valued the social and cooperative nature of the village. Once they moved in, they got in touch with different views on ecology and got inspired by other residents, learned about ecology and started to support this characteristic of the village as well. This question whether or not diversity has a positive or negative effect thus remains unsettled, but in any case it can be argued that diversity is not seen as a threat and residents highly value a high degree of diversity.

4.3 Organisation

Creating an eco village does not happen coincidentally, it requires thorough preparation. And even after the village is built, eco villages require certain (formal or informal) rules and practices in order to maintain it's character and purpose. An organisational dimension can safeguard a village's character and support it's main functions. That is why this chapter looks at the organisational dimensions of eco villages. Eco villages are products of a long process, characterised by many decisions and stakeholders. This section explores the planning process, in which the foundations for the village are laid. It first looks at the top down versus bottom up processes from which the cases originated. This section then continues with an assessment of the planning phase through the success factors community, network, policy and project, as defined by Seyfang et al. (2013). It is expected that overall, the cases in this research perform well on these dimensions, as the were able to create and sustain a village. After this exploration of the organisational dimensions during the planning phase, this section then moves onto the "living" phase of the project by addressing the organisational structures and the, formal and informal, rules and regulations that are present in each case. Appendix E gives an overview of the organisational dimension per case.

Analysis of organisational dimensions in the planning phase

Community involvement

The successfactor 'community' deals with the community's involvement in the planning process, i.e. if the process what top down or bottom up initiated, and examines the extent to which the project is designed to meet the community's needs. All projects, except for EVA-Lanxmeer, are bottom up, grassroots projects, initiated by their future inhabitants through collective private commissioning. EVA-Lanxmeer differs from the traditional top down versus bottom up divide, and can be characterised as a hybrid form. EVA-Lanxmeer de facto started as an urban plan, created by a team

of professionals, that laid the foundations for sustainable design and infrastructure. Residents were only included in later stages of the development, by designing their own courtyards. Similar to the other cases in this research, few parts of EVA-Lanxmeer are developed through collective private commissioning. So EVA-Lanxmeer is characterised as a mixture of top down and bottom up efforts, and all other projects are typical bottom up projects.

As most projects are bottom up initiatives, conducting collective private commissioning, future residents are very much involved with the final results, as to be expected. In all projects but EVA-Lanxmeer, future residents initiated the projects and were involved from the start, which means that future residents decided on and contributed to every aspect of the project. Most cases are organised through thematic working groups that operate horizontally. When decisions had to be made, in all cases they tried to strive for consensus, making sure that everyone is heard and can agree with the final decision. The collective private commissioning and the horizontal and consensual nature of the planning process, adds to the extent to which the project meets the communities needs. This was different in EVA-Lanxmeer as during the first years EVA-Lanxmeer did not include its future residents in the process, with the exception of a few informative meetings. Aspiring residents could not provide input in the urban plan and design of the village. On the level of the courtyards however, residents had the freedom to design, so in the final stages of the planning phase residents got involved.

Partnerships

Forming supportive partnerships and information sharing networks, is seen as a key success factor. All cases cooperated with at least the following partners:

- Housing corporation - to include social housing in the project but in some cases also to bear (part of) the costs or serve as guarantee.
- Municipality - advise on urban planning, sell land at a reduced rate, finance part of the process (often a feasibility study to determine the costs and setup the basic principles of the village)
- Architect - often with experience ecological or sustainable building and / or CPO
- Contractor

Tjepkema (personal communication, 27 January 2017) from De Bongerd said that they looked for links and similarities in a potential partner, emphasising their common ground and make them see that they are a stakeholder that benefits from the project.

With its large scale and ambitions, EVA-Lanxmeer succeeded in creating a vast team of partners from a professional background, like housing corporation Kleurrijk Wonen, the municipality of Culemborg, the province of Gelderland, Dutch ministry of infrastructure and environment, and many experts, scientist and professionals from all sorts of disciplines. These partners were dedicated to the project and wanted to contribute because it was new and different. Buitenkans joined forces with the common actors, and in later stages got in touch with other projects to find out how they cope with legal issues (W. Janssen, personal communication, 26 January 2017).

The cases in this research are quite successful in collecting supportive partners. In some cases eco villages draw inspiration from each other, by excursions in the planning phase. Later on they return the favour, by giving tours and information to new initiatives. De Bongerd in particular has created an agency that advises other projects and has created "offspring" (Meanderhof and De Nooten) and participates in lectures on CPO. But there does not seem to be large scale information sharing or formal networks, such as the Global Ecovillage Network. Some initiatives visited other projects, but every project still has to find its own way. Tjepkema (personal communication, 27 January 2017) feels that eco villages could and should learn more from each other, but the should also create their own formula, as each project, location and community is different.

Policy

A supportive political context is seen as essential for a project to succeed. All projects partnered up with the local municipality, which indicates that governmental structures and regulations are a key factor in these kinds of projects.

Especially in the case of EVA-Lanxmeer, the municipality, province and national government were very supportive to the project, despite the innovative nature (providing land, resources). Also in Het Groene Dak, the municipality was keen to cooperate because they saw it as a testing ground for Utrecht Leidsche Rijn, a large district that was going to be built. Because of this, the municipality was interested in this ecological project and funded a feasibility study that would determine the costs and general principles of the village. In other initiatives, this innovative nature stumbled upon some issues. De Bongerd, Meanderhof and Buitenkans worked together with the municipality as well, but the municipality created some opposition because they weren't used to collective private commissioning or because the design of the village didn't fit common practice. This usually worked out after some debate, but the last three initiatives say this wasn't easy. Some projects felt they paved the way for future collective private commissioning projects. Contrary to this barrier the municipality could sometimes be, municipalities did sometimes bend the rules or made financial arrangements such as selling parcels at a minimum. In case of Boddegat, the municipality played an important role in the failure of the aspiring village. When part of the group wanted to get out of the project because of the disappointing valuation, there was still a big group left that wanted to continue and find new residents. But the municipality pulled the plug and did not prolong the declaration of intent.

Resources

The successfactor 'project' encompasses resources such as sufficient time, information, skills, money and material resources to carry out the project. As these projects have existed for ten to twentyfive years it is safe to say that there were sufficient resources to carry out the project. Also in the case of Boddegat, which did not make it to the building phase, there were sufficient financial resources as well as access to knowledge, as the pioneers of the project worked in the sustainable building sector. All projects differ in the degree to which concessions had to be made in respect to their initial vision, and this can be linked to the availability of resources. In De Bongerd, Meanderhof, Buitenkans and Boddegat however, financial issues led to ideological concessions such as adding a helophyte filters, a limited number of solar panels, or not being able to create an autarkic farm. In case of Boddegat, time was also an issue. The municipality pulled the plug from the project because they felt that they were given plenty of time to create the project, despite the fact that the remaining group wanted to continue. Interviewees from the two largest cases in this research, Het Groene Dak and EVA Lanxmeer, feel that there were little concessions made and that they stayed close to their initial dream. According to interviewees from both projects, they had access to a lot of expertise and / or financial resources which resulted in projects with little concessions made (M. Kaptein, personal communication, 31 January 2027; W. Reinboud, personal communication, 14 February 2017). It seems likely that these larger projects were able to acquire more resources and had to compromise less.

Taking into account the success factors community, network, policy and project, the planning phase took some initiatives longer than others. Het Groene Dak and De Bongerd both only needed four years to plan build their project. Interviewees from Het Groene Dak say that they jumped on a moving train, because the project was being built in a neighbourhood that was already being developed. De Bongerd had an efficient process with motivated people, say interviewees. Buitenkans, EVA-Lanxmeer and Meanderhof needed seven, eight and nines years respectively, to go from dream to reality. For Meanderhof, which is an average size project, this seems quite long. Interviewees explain that they had great difficulties in getting a location. They went through many locations before they were formally appointed a site, which was bad for group moral.

Analysis of organisational dimensions in the living phase

Organisational structure, meetings and decision making

All initiatives have a resident's association. This is is inherent to the process of CPO projects, as shown in chapter 2. In some cases there is an additional owner's association that legally owns properties, but has no practical relevance. All villages work with working groups, in some cases they are ad hoc (Meanderhof), while other village have many structural working groups (Het Groene Dak). Most villages either have bimonthly or quarterly meetings. In all cases, residents are free to bring topics to the table. In some villages the board of the association changes frequently, while in others this is not as formal and people can remain in their position for four years.

Decision making remains quite stable over the years, and in most cases this occurs through consensus. One example is De Bongerd. Half plus one is considered as insufficient support, (almost) everyone has to be in agreement. In case of difficult or controversial topics, in which after long discussion there is still no consensus, the topic is decided through voting. For example in the case where two inhabitants wanted to make clear that they did not agree with a decision, therefore there was in vote. Inhabitants are allowed to bring anything to the table during meetings. Buitenkans is the only initiative that changed its decision making procedure. During the planning phase, decisions were made through consensus, making sure everyone was heard and could live with the outcome of the decision. This changed when people started living in De Buitenkans and people moved in that were not part of the pre-living phase. Decision making became formal: a sufficient amount of residents has to be present and decision are based on majority rule.

Rules and procedures

With regard to rules and policies, it is very common to have

- an application procedure
- a "*mandeligheidsregelement*", in which the shared ownership of common areas is arranged
- joint maintenance of communal areas
- a perpetual clause that is included in the deed of purchase to ensure the survival of certain principles

An application procedure is important to ensure that people are fully informed when moving into the village. Most villages have elaborate procedures, but the basics are quite similar. Common features are:

- Become a member of the residents association (by filling in form, paying entrance fee or membership fee - adjusted amount). After application, people are put on a waiting list.
- Hand aspiring residents a document, with for example guidelines to living in an eco village.
- Receive communication while waitlisted, such as the village newspaper.
- In some villages it is common to have some interaction, either by having an introductory chat or interview with aspiring residents, or oblige them to visit meetings, social event, or both.
- In case there is a vacant property, the house is first offered to members of the association (this includes people that are waitlisted, but do not yet live in the village). If the property is not sold within the community, only then it is offered to the private market.

Some villages have fine tuned their application procedure in response to having residents that do not fit with the character of the village, and possibly threaten the atmosphere or the basic principles.

Another common feature is the joint maintenance of garden areas, and ownership of a community building. most interviewees agree that is normal to have a Grauss curve with regard to participation: a small group of highly active people, a small group of less or none active people and a large group in the middle. Most villages feel it is unfavourable to formalise this procedure. In one case, participation is monitored (although lack of participation is not penalized, still indicating an informal character. In another case, a village has looked into quantifying garden maintenance and obliging people to either participate or pay for their lack of maintenance. In this case, a lack of trust has lead to an increase in formalisation.

A final common feature is a perpetual clause, that formalises certain principles of the village. In Het Groene Dak the clause includes membership to the residents' association, no fences allowed and in case of renovations this should be done according to ecological standards. In general, it is unclear what can be formalised. Some say membership can't be obliged, or they feel obligations do not fit the social character, others say that they have embedded membership in the perpetual clause.

In general, eco villages have comparable policies and the principal arrangements remain unchanged over the time they exist. In some cases, there are changes in application procedures or decision making, but overall this is quite stable. In the case of Buitenkans it is apparent that a lack of trust and a disruption of social cohesion has led to an increase in formalisation. In Meanderhof there used to be a formal procedure around entering the common room - the key had to be picked up and this made people feel restricted and watched. In general the villages try to stay away from formalisation because this does not fit with the character of the village. Social cohesion and formalization seem to be ad odds with

each other, functioning in both ways: if there are many rules then people tend to feel mistrusted, and if there is a lack of trust there is a tendency to turn to (more) formalization.

4.4 Innovation

Eco villages can be seen as grassroots innovation movements. They are intentional communities that look for environmentally friendly solutions that offer an alternative to current mainstream environmentally harmful socio-technical systems. Eco villages and their supportive communities have the potential to form a nurturing environment, in which an (eco friendly) socio-technical innovation can be experimented with and is provided feedback to further develop the technology, in order for it to be able to compete with existing socio-technical regimes. The notion of socio-technical niches is the essence of Strategic Niche Management. The core idea is that certain environments, like eco villages, can serve as technological niches that provide a supportive environment in which technologies can coevolve with their context, such as user preferences, expectations, regulations and complementary technologies (Schot & Geels, 2008).

This section assesses to what extent the cases in this research fulfill the role of socio-technical niche, to see if eco villages do provide an environment in which technologies can grow and if experiments with innovative technologies actually took place. This assessment is done based on three determinants (Schot & Geels, 2008). The first determinant is the articulation of expectations and visions, the second determinant is building social networks and the third determinant is the presence of first and second order learning processes. Section 2.2.2 gives an elaborate explanation of SNM and its determinants. The extent to which the cases fulfill these descriptions are now discussed per determinant. These results are summarized in appendix F.

Articulation of expectations and visions

The articulation of expectations and visions is crucial for niche development because it provides direction to learning processes, attracts (media) attention and legitimates the protection and nurturing of a certain technology (Schot & Geels, 2008). Furthermore, a strong and clear vision manages expectations, gives guidance and attracts like minded people that support the project's goal.

The articulation of expectations and visions differs greatly per village. In the villages of Het Groene Dak and EVA-Lanxmeer there was a clear and elaborate vision, driven by innovative and ecological motives. Het Groene Dak had a vision of creating a project that shows the possibilities with regard to ecological living and building as a main reason. Showcasing alternatives in terms of social housing and nontraditional ways of living came second. In 1993 they created a brochure to attract like minded people, and this brochure was updated again in 2007 (Groene Dak, n.d. H). The original brochure introduces the project as an ecological building project and a large part of the document is dedicated to explaining the ecological nature of the village. The brochure from 2007 deals less with ecology and innovation, and explains the practical side of living in Het Groene Dak.

The fundamental vision of EVA-Lanxmeer was threefold: a) create a living environment in which people engage with their direct environment, b) create solutions for environmental problems and develop healthy ecosystems, c) facilitate conscious lifestyles. In 1995 Kaptein made a brochure to attract potential residents and stakeholders, which she spread through her own network (M. Kaptein, personal communication, 31 January 2017; EVA-Lanxmeer, n.d. E). This brochure explains the ecological vision and basic principles of the EVA foundation and was geared towards creating an innovative and sustainable urban plan.

Het Groene Dak and EVA-Lanxmeer had a clear and well documented vision with ecology at the heart of the vision. The other villages however were less explicit about their (ecological) vision. Ecology was part of the vision but was not necessarily the most important feature. Rather, it was equal to or deemed less important than social dimensions and achieving a certain quality of life. The ecological dimension was not specifically defined or translated into practical principles. Despite wanting to create "something different", De Bongerd did not specifically target innovation. The idea of De Bongerd was to create a green, environmentally friendly village in which people could live with each other,

as opposed to next to each other. This village would have to cater to a diverse group of inhabitants and would combine different functions, such as living, working and recreation. The idea from which De Bongerd originates is a mixture of quality of life, creating a social community and realizing a sustainable village, in that particular order (Syb Tjepkema, personal communication, 13 February 2017). Ecology was not the most important feature of the village. From the interviews with residents of Meanderhof, it is clear that they took some ecological measures but there was no mentioning of a specific ecological vision or innovative ambitions. The vision of Buitenkans vision to create a village, in which people know their neighbours, are in touch with nature, and live in a healthy environment (W. Janssen, personal communication, 26 January, 2017; F. Steekelenburg, personal communication, 26 January, 2017). There were ambitious ecological ideas, but these did not survive due to insufficient resources. Interviewees additionally state that it was too difficult to define ecology because the interpretation of the concept differs per person (F. Steekelenburg, personal communication, 26 January 2017). Thus, Het Groene Dak and EVA-Lanxmeer had an elaborate, clear and practical vision whereas De Bongerd, Meanderhof and Buitenkans did not define a particular ecological or innovative vision.

Network building

Building networks around new technologies is important to their development. Networks create a constituency that supports the technology and provides necessary resources to further develop the technology (Schot & Geels, 2008). This section distinguishes an internal network, which are the village's residents, and an external network, i.e. supportive partners from outside the village. To determine the strength of the internal network, this section borrows from the results on "group capacity" and "social cohesion" from the people dimension (4.2). For the external network, results on "resources" and "partnerships" from the organisational dimension (4.3) are used. The results are slightly different as this section specifically targets results on internal and external networks around innovation.

With regard to building an network building, Het Groene Dak and EVA-Lanxmeer were very successful. Het Groene Dak had a constituency that dedicated its personal time and resources to the development of the project. Furthermore, residents decided on many experimental technologies, sometimes at the expense of their personal comfort (e.g. malfunctioning compost toilets requiring them to dig into their own excrements). When the community building was affected by fungus it had to be rebuilt, and residents were willing to give a vast amount of financial support. These are all signs of a supportive (internal) network. Currently, residents are still active and supportive in other dimensions, but are not engaging or initiating new experiments. Het Groene Dak was also capable of creating support from external parties. The municipality funded a feasibility study, the housing corporation gave in to experiments with unconventional technologies in the social housing units and subsidies from governmental bodies were arranged. In later stages, the role of this external network has diminished.

During the explorative phase of creating EVA-Lanxmeer, many professionals of different disciplines were involved in the process, providing their knowledge because they believed in the project. (Financial) support was also gained from governmental bodies, on municipal, provincial and national level. Together with these experts and governments, innovative technologies were created for EVA-Lanxmeer. Although residents were not involved from the start in terms of input and decisions, the project did have a large group of aspiring inhabitants from an early stage. They too believed in the project, and supported the decisions that were made by the group of professionals. In recent years there have been no additional innovations, and the networks do not seem to play a role anymore.

With regard to De Bongerd, it is worth mentioning that they attracted a partner to engage in a rainwater collection experiment. During the planning phase De Bongerd got in touch with Wavin, a company that produces pipes, that wanted to test rainwater collection at household level (Wavin, n.d.; H. Hamstra, personal communication, 16 May 2017). Wavin and the province of Overijssel funded the extra costs of adding a rainwater collection system to the project. So De Bongerd succeeded in creating a (small) supportive external network. With regard to the internal network, residents at first were supportive of the pilot project, but when the system had to be adjusted due to some malfunctions, half of the people decided to discontinue their participation.

Het Groene Dak and EVA-Lanxmeer thus were able to create supportive internal and external networks, which both diminished over time. De Bongerd was also capable of creating a supportive network, but to a lesser extent. The other cases in this research did not have explicit internal or external networks concerning innovation.

Learning processes

In order to let a technology grow, feedback is an important element that allows a technology to further evolve. As explained in section 2.2.2 learning can occur through first and second order learning processes. This section explores how learning occurred in the cases in this research. Het Groene Dak, EVA-Lanxmeer and De Bongerd engaged in innovative pilot projects or created their own innovative technologies. Meanderhof and Buitenkans are not discussed in this section, as these cases did not apply innovative technologies that can be learned from.

Het Groene Dak had many experimental projects, such as compost toilets and flow greenhouses. An interviewee stated that the projects have been researched extensively (W. Reinboud, personal communication, 14 February 2017). The University of Amsterdam monitored the water systems for a long time and wrote reports about it, so the results have become accessible to a wide audience. The results of the rainwater system have been studied extensively to assess it's applicability for other areas in the city. Not every technology was studied. The case of the compost toilets was not researched, but was featured on national television and newspapers making the end result of the pilot project known to the public. So results on lessons and learnings were applied in Het Groene Dak, but was also available to a wider audience. M. Post (personal communication, 14 February 2017) mentions that in hindsight, an energy theme would have been a better way to go with regard to environmental gains. But at that time, water seemed to be a bigger theme. So there was second order learning as well in Het Groene Dak.

EVA-Lanxmeer designed their own unique integral water concept and heating system. EVA-Lanxmeer was built in different stages, which allowed for systematic learning and evaluation. Each stage provided input and lessons for the next stage. Lessons on the water concept include that there has to flow enough water through the system, otherwise weeds will grow in it. The heating system ran smoothly according to Marleen Kaptein (personal communication, 20 May 2017). EVA-Lanxmeer not only applied the lessons learned to the project itself, but also shared the results via lectures. Additionally, EVA-Lanxmeer is regularly visited by researchers or students that investigate the systems and technologies. EVA-Lanxmeer is thus very much engaged in first order learning. Second order learning not so much, although during a neighbourhood meeting the topic of updating to a circular economy (thus adjusting the frame) was addressed but it is unclear if this is going to be followed up in the future. .

De Bongerd engaged in a rainwater experiment, with a pipe producing company that provided the materials and the province of Overijssel that financed the project (Harrie Hamstra, personal communication, 16 May 2017). After a short period of time, the rainwater collection system turned out to have disappointing water revenue. The filters that were applied in the system were too small, so they were replaced with more appropriate filters that lead to satisfying results. Another issue was the fact that the pipework between the storage tank and the waterpump was poorly done. In the first few years, the pipes were repaired at the expense of the pipe company, but after five years the company withdrew and residents had to pay for their repairs. Some of the residents were willing to pay these costs, others were not. That is why approximately half of the houses in De Bongerd does not use rain water. When asked, residents are unclear about what the pipe company has done with the results of the pilot project and in what way the project contributed to the general development of rainwater collection systems (Harrie Hamstra, personal communication, 16 May 2017). One of the residents occasionally measures performance, but this does not lead to village wide second order learning as to how their environmental performance has developed. It appears that only first order learning was conducted in De Bongerd. There have been no discussions of adding different technologies or reflecting on their ecological level and the way technologies fit this purpose.

It is clear that first learning occurred in all three cases, and second order learning only occurred in Het Groene Dak. What is unclear is how feedback and lessons learned contributed to the general development of these technologies.

Are eco villages socio-technological niches?

The three determinants of technological niches have now been discussed. Both Het Groene Dak and EVA-Lanxmeer fulfill all three determinants. They both created an elaborate and well documented vision on the goals and principles of each project. They succeeded in attracting supportive external partners and residents. Lastly, they engaged with external parties to evaluate the technologies, draw lessons and spread the knowledge gained on these technologies. Het Groene Dak and EVA-Lanxmeer (and De Bongerd to a certain degree) are the only villages that actually experimented with novel technologies. How can this difference be explained? The cases that did not experiment with technologies, were not successful in network building and could not engage in learning processes. Furthermore, these cases are lacking a clear vision around ecology and innovation. It seems that vision is decisive for the outcome on the other two determinants. Because if there is no vision, how do eco village pioneers know what to look for in a network? And what is there to learn from?

This chapter so far regarded actual technologies as the innovations. But what about eco villages themselves? Can they too be considered an innovation? Especially in light of new developments towards a circular economy. In any case, eco villages try to create something novel and different. Even the cases that did not apply experimental technologies or pilot projects, they did have their own vision (albeit not necessarily an ecological one) and realised projects through a process of collective private commissioning, which was also new at the time. All cases attracted partners that supported the project and aided in their realisation. The projects set up websites so new projects can learn from their experiences, they give tours and lectures and in one case a professional advising agency on eco villages originated from their experiences. It can thus be concluded that eco villages form socio-technical niches, on the one hand because of the environmentally friendly and innovative technologies they apply and on the other hand because the concept of eco villages is inherently innovative.

This chapter assessed and compared the long term development of eco villages along four dimensions, planet, people, organisation and innovation. As the results have been examined, it is now time to move on to the third and final part of this research. The next chapter will continue with a discussion of the design and results of this research and the theories used, and will then come to the final conclusions of this research.

PART THREE | CONCLUSIONS

5 | Discussion and conclusion

Six case studies have been conducted to understand the long term development of eco villages and the lessons that can be learned from these cases. The background to this research is the lack of knowledge on how to set up (circular) eco village, by new initiatives such as Diamondiaal. Before formulating the final conclusions, this chapter first features a discussion of the results and methods. This chapter then continues with answering the research questions that guide this thesis, at the purpose of answering the main question: "What lessons can be learned from the long term development of existing eco villages, in order to benefit future initiatives?"

5.1 Discussion

Before discussing the contributions and limitations of this research, this section first addresses some reflections on Strategich Niche Management. This research used SNM as a way of looking at eco villages as protected spaces that can contribute to the evolution of (ecological) innovations. During this research it was at times hard to define the boundaries of an innovation, as SNM does not provide a clear definition of the concept of innovation. Is an innovation brand new and high tech, or can an innovation also be a low tech solution that has been stuck on niche level for a while but has not yet had a breakthrough into the realm of socio-technical regimes? Can an innovation also be a social or organisational innovation? And if so, do the same rules or determinants apply to non-technical variants? If the aim of Strategic Niche Management is to support the development of technologies, the theory could be elaborated further and clarify these points. Another point with regard to SNM is that in some cases in this research all three determinants of a technological niche were fulfilled, but it was still unclear how the pilot projects and technological experiments actually contributed to the evolution of the technologies. If the aim of SNM is to further evolve technologies, or analyze the evolution of technologies, this research suggests that there should be a fourth determinant that deals with putting the learnings and networks into action. Because in the current setup of SNM there is no guarantee that the networks and learnings are acted upon. Several authors have made contributions to SNM that further elaborate the theory into the field of social innovations, with regard to both a broadening of the concepts into different kinds of technology, as well as deepening the subject by exploring ways in which the evolution of technologies can be further stimulated. Hegger et al. (2007) have made valuable contributions to the debate by introducing Conceptual Niche Management. It incorporates a wider understanding of innovation and includes a suggestion for advancing technologies. Hegger et al. (207) propose that pilot projects should be designed in such a way that they do not merely test a technology but also account for the entire concept of creating a new sustainable socio-technical regime. Furthermore, pilot projects should think a few steps ahead about how a concept can be socially embedded and what actors can play a role in this.

After these theoretical reflections, this section now turns to the limitations and contributions of this research. The first remark in this respect is that this research, as does Strategic Niche Management, relies on the American eco modernist assumption that environmental progress is achieved through technological innovations (Bussink, 2016). This research did not look at low or no tech ecological solutions that steer away from technology, which too can be an appropriate strategy in reducing environmental impact.

As there is little research on the development of eco villages, and there is no single blueprint for the creation of an eco village, this research has contributed to the exploration of the concept of eco village. It has provided an overview of Dutch eco villages that have been developed over the last twentyfive years. It furthermore conducted an integrated assessment of different dimensions that characterise the development of eco villages. It has provided insight into how eco villages develop over time, and what factors contribute to or challenge the success of an eco village. There are however limitations to this research.

A larger sample of eco villages could have provided more insights into the development of eco villages, but due to time restraints it was not possible to add more eco villages to this research. Moreover, this research highly depends on the willingness of eco villages pioneers to contribute, very few people were however willing to participate. This leaves room

for further research into eco villages with a larger and different sample. Furthermore, it would have been interesting to conduct more interviews per case. Due to time constraints and the specific aim of this research, the most practical solution was to specifically request interviews with eco village pioneers and / or long time residents, because it is to be expected that these people have the most knowledge about the entire process. These people have been gathered through snowball sampling. If there was more time, it would have been interesting to gather people in different ways and add interviewees with a wider range of residents, such as people that are not active or have left an eco village due to conflict.

With additional time and resources, it would have been possible to explore the social dimension deeper. The results in this research are based on interviews. With regard to the social dimension, it would have been valuable to conduct surveys as this would provide insights into social cohesion and residents' demographics, which were now rather subjective and speculative.

One of the findings of this research is that eco village communities initially have ambitious goals with regard to ecology. As the years progress, these ambitions decline and people become more indifferent or passive about these initial goals. Even though all interviewees explain that technology has caught up with their once innovative project, they do not feel the need to update their innovativeness. More research is needed into this process of declining ambitions and the barriers eco village communities experience that prevent them from maintaining their ecological ambitions so they can remain vibrant and do not lose their ecological character.

5.2 Conclusion

The previous chapters have provided input to come to a final conclusion to the main research question: "What lessons can be learned from the long term development of existing eco villages in the Netherlands, in order to benefit future initiatives?". This chapter first addresses the sub questions, before coming to a final conclusion.

The first question is "What defines a successful eco village and neighbourhood, in terms of environmental, social and organisational dimensions?". A literature review shows that an eco village is an intentional or traditional community using local participatory processes to holistically integrate different features, in order to regenerate social and natural environments. Defining features of a succesfull eco village are planet, people, organisation and innovation. The people dimension is relevant because an eco village is created by and for people, and can only function if there is a certain level of social cohesion. Following latest developments in the field of sustainability, this research regards a circular system as the norm for the planet dimension. An organisational dimension, which implies having structures and institutions that support the other dimensions and overall ambitions, is deemed essential to the success of an eco village. And finally, in order to become a grassroots innovation movement and contribute to the evolution of sustainable solutions and technologies, an eco village can fulfill a role as a technological niche and its community can engage in knowledge sharing networks.

The second question is"How do eco villages and neighbourhoods in the Netherlands develop over time?". The long term development of eco villages overall is quite stable. The foundations of an eco village, such as its vision, design, technologies and character of the community, are established during the planning phase. The outcomes of the many decisions made during the planning phase can still be found years later. Residents experience a high level of social cohesion. This feeling is especially high during the planning phase, but is still felt in later stages. There are some fluctuations with regard to social cohesion, as most eco villages have known peaks and dips in participation and social activities. Overall, the level of social cohesion is high and fairly stable. In case of disturbances or disappointments, such as court cases or malfunctioning technologies, communities show resilience. The level of ecological ambitions and performance is at its peak in the planning phase, and then decreases as the years progress. The ecological solutions and technologies that are chosen during the planning phase remain present throughout the years. On rare occasions new technologies are added, such as more solar panels or an electric car charging pole, or disappear because they do not function properly. But there are no large changes in terms of technologies, materials or infrastructures. Eco villages get somewhat locked in in the technologies they once decided on. The high ambitions that characterize the planning phase

decrease over the years. Bearing in mind that technology develops fast, the once innovative nature of eco villages is quickly caught up with. Thus, one could conclude that although the ecological technologies of an eco village remain quite stable, the constant rate of technological improvement and decreasing ambitions result in a decrease in the level of ecology. Residents lack incentives to invest time and resources to evolve the ecological dimension. After a while, some villages start approximating a social community that is focused on living together, rather than an eco village that wants to achieve ecological goals.

What is striking is that, although technology continues to improve, similar technologies and materials have been applied in different eco villages, over different periods in time. The inventory of current and future initiatives showed that there is a trend towards circular projects. A development towards circular neighbourhoods was not found in this research. Surprisingly, the oldest cases in this research showed most similarities with circular systems. These are also the cases that had a clear and ambitious vision and succeeded most in creating a supportive network and gathering sufficient resources. The level of innovation and the extent to which a village fulfills the conditions of socio-technical niches seems to be an important determinant of the degree of circularity. The organisational structure is solid, but there are changes in eco village policies in response to experiences gained, such as refining an application procedure after noticing that new residents are insufficiently informed. Preservation of the identity of the village has to be kept in check when new residents move in. During the planning phase, eco villages form partnerships with external actors, providing different kinds of benefits. Later on, these partnerships disappear. Generally speaking, eco villages do not change a lot. The people dimension remains quite stable, the organisational dimension is adjusted in response to events and the planet and innovation dimensions decline.

The third question is "What pitfalls and success factors do eco villages and neighborhoods face, that are relevant for future circular villages or neighbourhoods such as Diamondiaal?". The main pitfalls during the planning phase are the absence of a supportive and resourceful group, regulatory barriers, insufficient resources (money, knowledge, time), and the inability to gather a network of supportive partners. Social cohesion is crucial for the success of an eco village, both during the planning phase as well as when living in the village. People that trust and engage with each other are more likely to make an effort for the village. Not every character of an eco village can be set in stone. Basic principles, such as a no fence policy, membership to a residents association and ecological rules for renovating a house can be put in a perpetual clause. But is not possible to force people to participate in community activities or to guarantee that the right people move into the village, despite a proper application procedure. An important part of the success of a village lies with the willingness of people to participate in the community and support the bigger picture. Social cohesion contributes to this.

After analysing six eco villages, it is clear that much of the character and dynamics of an eco village are determined in the planning phase of the village. When living in an eco village, small developments take place but no large changes occur. The organisational and social dimensions are quite stable, yet the ecological dimension, which is perhaps the most defining feature of an eco village, becomes less pronounced. With regard to the pitfalls and success factors, there is a lot to learn from existing eco villages. Important lessons for future eco villages are, among others, that attracting a supportive group of residents and complementary external network contributes to achieving (ecological) ambitions. Creating and documenting a vision helps in attracting these supportive residents and network and an effective application procedure ensures that projects keep attracting the right people and. A horizontal structure with consensual decision making procedures makes residents feel involved and remain supportive of and decisions made. This is one of the determinants of social cohesion, a condition for a village to successfully function. Chapter 6 includes a further elaboration of these pitfalls and success factors, which are converted into recommendations for future eco village initiatives, for policy makers and for researchers.

6 | Recommendations

This chapter is dedicated to the lessons learned from the six case studies conducted in this research. From the analysis of eco villages it is possible to derive recommendations for future pioneers (such as Diamondiaal), for policy makers and for researchers.

6.1 Recommendations for future initiatives

At the start of the project, it is important to **establish a vision** and document it, creating a clear picture of the goals and ambitions of the project. Decide what the goal of the project is, what the character of the village and its community will be and what ecology means in this project. This gives guidance and focus to the process, and helps in attracting like minded potential residents. It also helps in engaging supportive external partners, that can contribute knowledge and (financial) resources to the project or remove policy barriers. The initial vision serves as a starting point and is decisive for further developments.

Planning phase

Once a group is gathered to start the process of collective private commissioning with, it is recommended to

- **create structure** by dividing the group into thematic working groups (e.g. water, energy, design, finances, etc.) to enhance efficiency
- **address people's strengths, expertise or passion**, because it keeps people motivated
- have a **horizontal structure and decision making based on consensus**. This contributes to the notion that the project really is a collective project. In order to gain full support and generate trust, everyone has to feel part of the project. Consensual decision making is also essential to create a match between residents' needs and preferences and the final result. The design, the technologies used and the social character should be in line with residents' needs.

The process of planning and designing an eco village is highly defined by the amount of resources available. Resources determine the extent to which a dream can become reality. In order to gain sufficient resources, it is recommended to **find supportive partners**, that can provide advice, financial support or remove policy barriers. In addressing potential partners, look for a common denominator, emphasise this common ground and make the potential partner feel that they have a stake in the project and that the realisation of the project is in their benefit too. There following partnerships are most common and recommended:

- A municipality can give advice, financial support, remove policy barriers and help with purchasing land (at a reduced price).
- A housing corporation can take up (part of) the financial burden and add social housing to the project. It is often a large party with helpful contacts.
- Partner up with architects and contractors that are experienced with CPO and sustainable building.
- Connect with innovative companies that can provide technologies and materials that have not yet entered the mainstream systems.
- If creating a circular system is an intention, create a network of partners to set up a circular system. A circular system does not necessarily have to be achieved within the village, the village can also become a part of a system.

It is important to emphasise that **concessions and setbacks are part of the planning process**, and that **the process requires patience**.

Social dimensions

Social cohesion is key for the success of a project. The planning phase is an important first step towards creating social cohesion, as people get to know and learn to trust each other, and create a bond through overcoming obstacles and celebrating successes.

- Social cohesion is created through **frequent social contact**. This can be of social nature, or merely functional, such as maintaining a garden together.
- People have to **trust** each other, and feel they are treated fairly. Consensual decision making contributes to this.
- **Focus on the common good** can be created by making people collectively responsible for something, such as a communal garden.

These dimensions determine social cohesion and are key for the general atmosphere and participation. If people do not trust or care for each other, they will not make an effort for the community. To create social cohesion and a supportive group, it is important to attract people that **share similar ideas** about ecological and cooperative living and make sure new residents **receive full information** on what is expected of them when living in the eco village. This is one of the reasons why establishing and documenting a vision is very important in creating a clear picture of what the characteristics and responsibilities of living in an eco village are. Additionally, an application procedure can help in attracting and informing aspiring residents. Recommendations for creating an application procedure are:

- Ensure a **mutual exchange of information**. Make sure that new residents are are informed on the character of the village, and the responsibilities that come with living in an eco village, so they can decide if they want to live in the village. The village in return can see if there's a match with the village and its residents. An example is to set up an interview or informal chat to meet the aspiring residents.
- Create a **document with essential principles and responsibilities** and have new residents sign it. This prevents a situation in which residents can claim that they are insufficiently informed.
- Create some form of **commitment**, such as signing up for a waiting list, asking a registration fee or obligate aspiring residents to visit a village meeting, maintenance day or social activity. This allows both parties to see if there is a match.
- Make aspiring residents **feel part of the community**, for example by allowing them to attend meetings or sending them the village paper or newsletter as long as they're waitlisted.

Organisation

There are many ways to organise. It is important to **find an organisational structure and procedures that work for the specific group of residents**. For some this means that there is a high degree of structure and formalisation, for others it works better to have an informal setting without to many rules and procedures. In any case, it is important that it is clear what is expected from residents and to **document the essential principles and procedures**. Define what is expected of people and if a certain principle should be warranted (such as rules for ecological building or becoming a member of the residents' association), this can be ensured through a perpetual clause.

Innovation

If contributing to technological and ecological innovation is an essential aspect of the eco village, it is important to actively pursue it, as ecological ambitions tend to fade away. To make sure the village does not lose its innovative character, the following principles apply:

- **Embed this innovation nature and ambition in the vision of the village**. Make sure this vision stays on top of mind with all residents.
- Make sure to have enough **resources** to maintain this innovative character, or have partners that can support this innovative nature.
- **Share information and create networks** that facilitate learning.

With regard to circular innovations and experiments, it is important to be aware of the fact that circular economy goes hand in hand with **a shift in the role of consumers**, and this fact should be kept in mind when creating a circular eco village. Residents have to cope with the solutions and technologies chosen, which could require a different and more intense treatment or compromise convenience. A clear vision that justifies these technologies, agreement from residents on these technologies and proper instructions are advisable.

6.2 Recommendations for governments and policy makers

If (national) governments want to advance sustainable living and the creation of technological niches, there are several options to stimulate the creation of (circular) eco villages:

- Make sure that policy and regulations do not form an obstacle for unconventional projects, such as CPO.
- Stimulate eco villages through subsidies or knowledge and advice.

In case (local) governments intend to create urban plans or top down circular neighbourhoods, but still want to achieve with a sense of cohesion and cooperation this is possible through:

- Involving citizens in some part of the process. Incorporate their needs and wishes into the project. Make sure the end result works for future residents.
- Give them ownership and responsibility, e.g. by giving them a communal garden,

6.3 Recommendations for research institutions

There is still a lot to unravel about the practical implications of a circular system are. More research is needed to find out which circular options are environmentally sound, affordable and work for citizens. Research institutions could partner up with eco villages to explore different options and exchange information, to ultimately advance the concept of circular economy.

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8 | Appendices

A. List of interviewees
B. Inventory of eco villages
C. Results per case on the planet dimension
D. Results per case on the people dimension
E. Results per case on the organisation dimension
F. Results per case on the innovation dimension

A. List of interviewees

Het Groene Dak	W. Reinboud - Pioneer, former chair of residents' association, current resident	Interview February 14, 2017 E-Mail April 23, 2017
	M. Post - Pioneer, technical specialist, moved out	Interview February 14, 2017
De Bongerd	S. Tjepkema - Principal pioneer, moved out and set up second and third initiative	Interview January 27, 2017 E-Mail February 13, 2017
	L. Olthof - Current chair residents' association since ten years, current resident	Interview January 27, 2017 E-Mail May 3, 2017
	H. Hamstra - Pioneer, technical specialist, current resident	E-Mail May 16, 2017
EVA-Lanxmeer	M. Kaptein - Principal pioneer, current resident	Interview January 31, 2017 E-Mail May 20, 2017
	C. Mesters - Moved in later, current chair of residents' association	Interview February 6, 2017 E-Mail May 16, 2017
Meanderhof	K. Schoe - Pioneer, technical specialist	Interview February 12, 2017
	S. van Nisperen - Moved in later, current chair of residents' association	Interview February 12, 2017
	E. de Kruif - Ecological specialist, current resident	Interview February 12, 2017
	L. Gussenhoven - Board member, current resident	Interview February 12, 2017
	M. Nugteren - New resident	Interview February 12, 2017
	Anonymous	Interview February 12, 2017
Buitenkans	F. Steekelenburg - Pioneer, board member, current resident	Interview January 26, 2017 E-Mail April 16, 2017
	W. Janssen - Pioneer, current chair of residents' association, will move out	Interview January 26, 2017
Boddegat	J. Feenstra - Pioneer in three (unfinished) projects	Interview April 20, 2017

B. Inventory of eco villages

	Project	Location	Planning phase	Living	Size (*houses*)	Participant?	Website
1	*Het Groene Dak*	Utrecht	1989	1993	66	Participant	https://www.groenedak.nl/
2	*GWL terrein*	Amsterdam	1989	1998	600	Not selected - eco & social character doubtful	
3	*Ecolonia*	Alphen a/d Rijn	1989			Not selected - no social dimension	http://www.except.nl/overig/yale/sem5/sustainabledesign/Ecolonia.pdf
4	*Waterland*	Groningen	1989	1995	166	Responded, too late	http://www.drielanden.nl/index.php/duurzaam-wonen
5	*'T Heem* (MW2 project)	Den Bosch	<1990	1990		Not selected, too little info online + GD represents this period.	http://www.bwwb.nu/inspiratie/t-heem/
6	*Romolenpolder* (MW2)	Haarlem	<1990	1990		Not selected, GD represents this period. Centraal Wonen	
7	*De Groene Marke*	Zutphen	<1991	1991		Not selected, too little info online + GD represents this period.	http://www.omslag.nl/wonen/ecodorpen.html#groenemarke
8	*Waterspin*	Den Haag	1992	1998		Responded, too late + no one was interested in being interviewed	http://www.omslag.nl/wonen/ecodorpen.html#Waterspin
9	*EVA Lanxmeer*	Culemborg	1993	2008	240	Participant	http://www.eva-lanxmeer.nl/
10	*De Goedemeent*	Purmerend	1993	1998	33	Not selected, around same time as Bongerd, not very well documented?	http://www.ruudenmieke.nl/DE%20wijk%20entree.htm
11	*De Bongerd*	Zwolle	1993	1997	36	Participant	https://sites.google.com/site/mmwzdebongerd/
12	*De Vuurplaats*	Heerhugowaard	<1994	1994		Not selected, too little info online + GD represents this period.	http://www.de-vuurplaats.nl/
13	*Kersentuin*	Utrecht	1995	2003	94	Did not respond	http://www.kersentuin.nl/index.php
14	*Woonderij EOS*	Zutphen	1997	2006	30	Not selected - poorly documented, eco character unclear	http://www.woonderijeos.nl/home
15	*De Meanderhof*	Zwolle	1998	2008	51	Participant	
16	*Zonnespreng*	Driebergen	1999	2010	20	Did not want to participate (busy with similar requests)	http://www.zonnespreng.nl/index.php

17	*Buitenkans*	Almere	1999	2007	55	Participant	
18	*Het Carré*	Delfgauw	2000	2003	49	Did not respond	http://www.hetcarre.nl/historie.html
19	*Eco-Tribe*	Teuge	2001	2001		Did not want to participate	
20	*Pentakel*	Zeewolde	2006	2010	8	Not selected - to small	http://www.pentakel.nl/
21	*Ecowijk De Dreijen*	Wageningen	2009	NVT?			
22	*Kernhem*	Ede	2010	NVT?			
23	*Ecodorp Bergen*	Bergen		-		Not selected - new	
24	*Ecodorp Zwolle*	Zwolle		-		Not selected - new	http://www.ecodorpzwolle.nl/docs/EcodorpZwolle.pdf
25	*Ecodorp Boekel*	Boekel		-		Not selected - new	
26	*Ecowijk Houten*	Houten		-		Not selected - new	http://www.ecowijkhouten.nl/
27	*Iewan*	Nijmegen		-		Not selected - new	http://www.iewan.nl/
28	*De Kiem*	Arnhem		-		Not selected - new	http://www.ecowijkdekiem.nl/co-creatie
29	*ReGen Village*	Almere		-		Not selected - new	
30	*Buiksloterham*	Amsterdam		-		Not selected - new	
31	*Aardehuis*	Olst				Not selected - new	http://www.aardehuis.nl/en/
32	*De Groene Hoek*	Arnhem		-		Not selected - new	http://www.degroenehoek.nl/en-us/home.aspx
33	*Vereniging Duurzaam Wonen Overbetuwe*	Hemmen		-		Not selected - new	
34	*Boddegat*	Ede		-		Not selected - new	http://www.boddegat.nl/
35	*Ecodorp Groeningen*	Groningen		-		Not selected - new	http://www.ecodorpgroeningen.nl/
36	*Ecohof Texel*	Texel		-		Not selected - new	http://www.ecohoftexel.nl/

C. Results per case on the planet dimension

Planet	Groene Dak	Bongerd	EVA Lanxmeer	Meanderhof	Buitenkans
Buildings & materials	▸ Wooden frame houses ▸ Non-tropical hardwood ▸ Walls from sand lime bricks ▸ Drainpipes from non chlorine containing PPC ▸ Eco paint → High Solid paint ▸ Community house from loam and straw ▸ Polystyrene concrete	▸ Wooden frame houses ▸ Pinewood from Scandinavian production forests ▸ Clay stucco	▸ South facing windows ▸ Compact building to increase efficiency	▸ Wooden frame	▸ Wooden frame
Energy	▸ Solar boiler ▸ Solar panels	▸ Wall heating ▸ Solar boilers ▸ Solar power	▸ Solar boilers ▸ Solar power	▸ Wall heating ▸ Solar boilers ▸ Solar power	▸ Wall heating ▸ Solar boilers ▸ Solar power
Water & sewage	▸ Greywater filters ▸ Rainwater collection ▸ Compost toilets → Gustavsberg system toilets ▸ Flow greenhouse → Helophyte filter ▸ Reed pond for rainwater collection	▸ Rainwater collection pilot ▸ Gustavsberg toilet	▸ Independently functioning water system, with only wastewater from toilets being part of the municipal network		▸ Rainwater directed to pond
Waste	▸ Compost toilets ▸ Domestic waste separation → municipal waste separation	-			
Transport	▸ Less than average parking space. ▸ Bus stops nearby	▸ Car free. ▸ 10 min walk to bus	▸ Car free ▸ Electric car charging poles and ▸ car sharing ▸ Located next to train station	▸ Greenwheels ▸ Electric car charging pole ▸ 10 min walk to bus stop	▸ Car free. ▸ 15 minute walk to train,
Food	▸ Vegetable garden ▸ Fruit trees ▸ Organic food and drinks in café		▸ Urban farm Catshaege. ▸ Fruit, vegetable and herb gardens	▸ Fruit trees, herbal garden ▸ Food coop delivery point	▸ Delivery point for a local organic farmer ▸ Every now and then people buy and share a cow

D. Results per case on the people dimension

People	Het Groene Dak	De Bongerd	EVA-Lanxmeer	Meanderhof	Buitenkans	Boddegat
Group	Supportive group, dedicating time, effort and knowledge to the project	Dedicated group. Group remained supportive, despite setbacks.	Big supportive group that showed faith in the project, despite lack of residents' involvement	Dedicated group. Group remained supportive, despite setbacks.	Dedicated group, with a key individual that lead the group, kept spirits up and overcame setbacks.	Group lost faith in the project, which was detrimental to project's success
Social cohesion	▸ Many structural social activities ▸ Feeling of connectedness is present ▸ Focus on common good = high, Care group + community building + people feel they can count on their neighbours	▸ Ad hoc social activities, not structural ▸ Feeling of connectedness is present, although small issue during the first year ▸ Focus on common good is quite good, one occasion where participation decreased	▸ Social activities differ greatly per courtyard. ▸ Feeling of connectedness is present, with the exception of one courtyard ▸ Focus on the common good not so high on aggregate level (low participation), high on courtyard level Overall: social cohesion is especially high within courtyards, also present within entire village.	▸ Many structural social activities ▸ Feeling of connectedness is present. ▸ Focus on common good is high, with one instance in which participation garden maintenance was low Overall: High, also visible when visiting groendag.	▸ Many structural social activities, despite crisis. Participation slightly less ▸ Crisis in connectedness, also influenced ▸ Focus on common good low, due to issues with connectedness	-
Diversity	Social housing. Non traditional households.	Social + sheltered housing	Social + sheltered + elderly + disabled housing	Social housing + one house fit for elderly / physically disabled	Social housing	-

E. Results per case on the organisation dimension

Organisation	Het Groene Dak	De Bongerd	EVA-Lanxmeer	Meanderhof	Buitenkans
Top down / bottom up	Bottom up	Bottom up	Hybrid	Bottom up	Bottom up
Community	Community involvement throughout entire process	Community involvement throughout entire process	Community involvement in final stage, on limited dimensions.	Community involvement throughout entire process	Community involvement throughout entire process
Network	Partnerships with common actors + partnerships around various water related pilot projects	Partnerships with common actors + partnership around rainwater pilot	Extensive network of professional partners contributing money, time and expertise to the project.	Partnerships with common actors	Partnerships with common actors
Policy	Supportive policy context (municipality saw project as a testing ground for city expansion)	Supportive policy context (municipality provided finances, advice and asked low price for soil)	Supportive policy context (from municipal, provincial and national governmental levels)	Both supportive and unsupportive policy framework (i.e. municipality opposed to unconventional shapes)	Both supportive and unsupportive policy framework (i.e. municipality was new to CPO)
Project	Access to sufficient resources to carry out project without many concessions	Lack of financial resources lead to ideological concessions	Access to sufficient resources to carry out project without many concessions	Lack of financial resources lead to ideological concessions	Lack of financial resources lead to ideological concessions
Structure and working groups	Foundation (legal) Stichting Het Groene Dak Residents' Association Vereniging Het Groene Dak(practice) Decisions about budget and small issues (nuisance caused by cats, materials walking paths should be made from). Working groups: ▸ Coordination group ▸ Garden group ▸ Garden house group ▸ Introduction group ▸ Rental group ▸ Care group ▸ Paper group ▸ Werkgroep A27	Residents'assocation MMWZ De Bongerd Topics discussed in meetings are the yearly budget, lay out of the garden, building a new bicycle shed. Working groups: ▸ Garden & building ▸ Party committee ▸ Magazine committee	Residents' association BEL Neighbourhood council Courtyards Working groups: ▸ BEL bestuur ▸ Werkgroep Lanxzij ▸ Droge voeten ▸ Stadsboerderij Caetshage ▸ Stichting Terra Bella ▸ Stichting Caetshage ▸ TOPLA Toetsing ▸ Planontwikkeling ▸ Werkgroep Energie en Installaties ▸ Werkgroep Watertoren ▸ Energiebedrijf Thermo Bello ▸ Redactie BEL ▸ Amfibieën Nieuws	Residents' association MMWZ Meanderhof Working groups: ▸ Board ▸ Greengroup ▸ Common room group ▸ Ad hoc groups	Owners association Residents' association Vereniging De Buitenkans Working groups: ▸ Buurtleven ▸ Green group ▸ Community center group

Meetings & decision making	Meetings 4x / year. Decision making occurs through consensus, this has remained stable throughout it's existence.	Meetings 4x / year. Decision making still occurs in the same way as during the planning phase: consensus. Half plus one is considered as insufficient support, (almost) everyone has to be in agreement. In case of difficult or controversial topics, in which after long discussion there is still no consensus, the topic is decided through voting.	Meetings 4x / year. In general via consensus, seldom via voting.	Meetings 6x / year. There are bimonthly meetings to discuss the annual budget, financial reports and issues at hand such as cats causing trouble, adding more green patches to increase biodiversity or adding an electric car charging pole.	Meetings 1x / month. Buitenkans shifted from consensus to majority rule. One vote per household. One meeting per month. the annual budget, management plan for the green areas ("*groenplan*") and the community building, new play facilities for children.
Contribution	€7,50-22,50 / month	€50 per year	-Unknown	€12,50 for a household with one or €17,50 with 2 adults, on a monthly basis	€17,50 per household per month.
RULES, REGULATIONS, PROCEDURES	▸ Garden maintenance ▸ Application procedure ▸ Perpetual clause	▸ Garden maintenance ▸ Application procedure ▸ Perpetual clause	▸ Application procedure ▸ "*Mandeligheidsregelement*" ▸ Perpetual clause ▸ Differing regulations per courtyard	▸ Garden maintenance ▸ "*Mandeligheidsregelement*"	▸ Garden maintenance ▸ Application procedure ▸ "*Mandeligheidsregelement*" ▸ Perpetual clause

F. Results per case on the innovation dimension

Innovation	Het Groene Dak	De Bongerd	EVA-Lanxmeer	Meanderhof	Buitenkans
Vision	Vision of creating a project that shows the possibilities with regard to ecological living and building, and in terms of social housing. Env & non traditional ways of living.	The idea was to create a green, environmentally friendly village in which people live with each as opposed to next to each other. The village would cater to a diverse group of inhabitants and combine different functions (living, working and recreation). The idea from which De Bongerd originates was a mixture of quality of life, creating a social community and realizing a sustainable village, in that order.	The vision of the foundation was threefold: ▸ Creating a living environment in which people engage with their direct environment ▸ Create solutions for environmental problems and develop healthy ecosystems ▸ Facilitate conscious lifestyles	No clear vision, but in line with the idea of De Bongerd.	Vision was to create a village, in which people know their neighbours, are in touch with nature, and live in a healthy environment.
Network	▸ Internal: dedicated constituency, supportive of experimental ecological measures, even when they did not always function properly ▸ External: partnerships with common actors + partnerships around various water related pilot projects	▸ Internal: supportive group of residents ▸ External: partnerships with common actors + one partnership around rainwater pilot	▸ Internal: supportive constituency, even in absence of residents' involvement ▸ External: Extensive network of professional partners contributing money, time and expertise to the project.	-	-
Learning	▸ First order learning about technologies in cooperation with University of Amsterdam, the municipality of Utrecht who applied the results to other projects. ▸ Second order learning occurred after a few years when residents realised that energy could have been a more promising theme with regard to environmental benefits as opposed to water.	With regard to the rain water pilot, there was first order learning on the (mal) functioning of the system, but it is unclear as to what happened with the results of the pilot project.	EVA-Lanxmeer was built in phases, so lessons from each phase could be applied to the next. Besides internal learning, EVA-Lanxmeer gave lectures on its experiences and knowledge and was frequently researched by external parties and institutions. Knowledge shared through lectures. There is mostly first order learning in this case.	-	-