Sustainable and circular development of business parks:

A cross-case analysis on the current practices and developments in sustainable and circular business parks in Zuid-Holland, the Netherlands in their contribution to the national, regional and local circular and energy transitions

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by

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ABSTRACT

The Dutch government has set ambitious targets of a completely circular economy and a nearly completely sustainable and carbon neutral energy system by 2050. Business parks are key in achieving these objectives, and marked as essential areas in sustainable transitions, including the energy transition and circular transition. Literature on the sustainable and circular development of Dutch business parks, and their contribution to the energy and circular transitions, is limited. And there is a need for more knowledge, information and practical examples. Accordingly, this research aims to answer the question: *"What are the current practices and developments in sustainable and circular business parks in Zuid-Holland, the Netherlands in their contribution to local, regional and national circular and energy transitions?".*

To answer this question, the current practices and developments of four sustainable and circular business parks in the Province of Zuid-Holland were evaluated. In this evaluation various themes were investigated, including: the organizational structure and development approach at the park; the explored and implemented sustainable and circular initiatives at the parks; policy and strategies by government actors and those at the park; the social and physical park characteristics; the regional and local characteristics; and the financial and economic context.

A cross case analysis of the four cases shows that the business parks contribute to local, regional and national circular and energy transitions in several ways. The parks and businesses at the park implement a variety of sustainable and circular initiatives, mostly focussed on individual company scale or business parks scale. Initiatives include energy efficient and/or circular construction, renewable energy generation and storage, collective firm facilities and joint provision of services, collaborative models for appliances, tools and services, and waste material synergies. Initiatives at regional scale are of limited presence, and those that are present are often aimed at sharing of knowledge and business-to-business.

Furthermore, the parks function as key sources of information to facilitate collective learning and government planning. Park managements of the parks actively facilitate sharing of knowledge and experiences with relevant actors such as the province, municipalities, other parks and entrepreneurs and businesses which to ultimately result in development of new initiatives. Moreover, government actors utilize the experiences and developments at the park as input in development of policy and strategies on sustainable energy and circular development.

Lastly, a remark on the practices and developments at the parks in relation to the long term objectives of a completely circular economy and a nearly completely sustainable and carbon neutral energy system by 2050. The targets of the desirable future are set, but the outcome of what this future will look like, and the role of business parks in this future, is undetermined. Current practices and developments at the parks determine the path, or potential paths, the business parks can follow in further transitioning to a sustainable energy and circular future at the national, regional and local scale.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Human activity has been a profound influence on the global environment and is the most dominant cause of the contemporary environmental change and related problems, including climate change, resource depletion, eutrophication, proliferation of solid waste, dispersion of toxic material and loss of biodiversity (Lewis and Maslin, 2015; Barles, 2010). Many of these problems can be attributed to energy and material exchanges between society and the environment, i.e., extraction of resources from or discharging of waste materials into the environment, which have an impact on ecosystems and the biosphere (Barles, 2010). Preventing, or rather limiting, these negative environmental changes is a task designated to humanity and critical for achieving sustainable development. Sustainable development entails "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Neshovski, 2023).

In December 2015, *The Paris Agreement* was adopted by 196 Parties in a collective effort against climate change. The objective of this "legally binding international treaty on climate change" is to limit the increase of the global average temperature to below 2°C above pre-industrial levels and take aim at limiting the temperature increase to 1.5°C above pre-industrial levels (UNFCCC, n.d.).

The Dutch government has converted these international goals into national climate goals of "reducing greenhouse gas emissions by 49% by 2030, compared to 1990 levels, and a 95% reduction by 2050", as laid down in the Climate Act (May 2019). Among key strategies to achieve the national climate goals are transitioning towards a circular economy and a renewable energy system. Accordingly, the Dutch government has set ambitious targets of a completely circular economy by 2050 (Ministry of Infrastructure and Water Management, 2023c) and a nearly completely sustainable and carbon neutral energy system by 2050 (Netherlands Enterprise Agency, n.d.)

1.1 PROBLEM STATEMENT

The Netherlands is transitioning to a sustainable future, but the tempo of this transition is too slow to achieve both national and international sustainability objectives. At present the majority of business lags behind on the sustainable objectives and targets by the Dutch government (Rli, 2023).

Business parks (BP's) are marked as key areas in sustainable transitions, including the energy transition and circular transition, and in achieving the national and international climate objectives. Potential ways BP's can contribute to the energy transition include generating renewable energy, developing heating networks, sustainable development of transport and mobility, implementing energy efficiency measures to reduce energy demand and carbon emissions and by helping overcome grid congestion issues through functioning as energy hubs. In the transition towards a circular economy, business parks are key areas for locating circular activities such as collecting, disassembling and processing of 'waste' materials (Province of Zuid-Holland, 2020; Rli, 2023). Moreover, business in business parks can implement circular concepts such as industrial symbiosis (IS), which entails engaging traditionally separate industries in the exchange of resources such as energy, water, materials and by-products and the collective management and organization of park services and infrastructure (Butturi et al., 2019; Fraccascia et al., 2019).

Overall, a wide variety of collective and individual initiatives van be implemented in business parks to contribute to the energy and circular transition. Existing literature on the implementation of these initiatives largely focusses on industrial complexes with materials and energy intensive production processes that can be coupled. Business parks that are home to mainly Small and Medium Sized

Enterprises (SME's) [1], with 'lighter' industrial activities achieve sustainable and circular development through the implementation of other initiatives (Le Tellier et al., 2019).

These types of business parks are underrepresented in literature. This lack of knowledge and lack of access to information and advice forms a barrier in the implementation of sustainable and circular initiatives such as industrial symbiosis by SME's. And there is a need for practical examples (Eilering and Vermeulen, 2004; Patricio et al, 2018).

Moreover, the implementation of industrial symbiosis, circular initiatives at business parks level, and eco-industrial park development in European countries needs to be investigated further (Ghisellini et al., 2016). The research that is focussed on sustainable business park in the Netherlands, is mostly dated and often focus on the same pool of parks.

1.2 SCOPE OF THE STUDY AND RESEARCH OBJECTIVES

This study focusses on the sustainable and circular development and initiatives in business parks in the Province of Zuid-Holland, the Netherlands.

The research is concentrated on business parks with mainly SME's, with 'lighter' industrial activities and limited potential for the coupling of production processes.

The geographical boundary for the study is set to the Province of Zuid-Holland. In the Netherlands, policy on sustainable development is developed at all government levels including national, provincial and municipal level. To enable a more in-depth evaluation of these policies, it was decided to focus on one province. The selection of the Province of Zuid-Holland resulted from a variety of reasons. Zuid-Holland is the province that is home to the most SME's in the country (Bos, 2023), as well as home to circa 600 business parks and industrial parks that have been identified by the province as key areas in the regional circular and energy transition (Ecorys, 2022; Province of Zuid-Holland, 2020). Furthermore, first supervisor Dr. ir. Quist has a contact at the province which enables the first contact with an actors related to development of circular business parks in the province. And lastly, previous research by colleague students van der Bent et al. (2022) provides a basis of knowledge on circularity in business parks in the province of Zuid-Holland.

The main objective of the study is to contribute to the knowledge and information on sustainable and circular developments and initiatives at business parks and their contribution to the energy and circular transition, as well as to provide practical examples and advice for future development. In doing so, the study aims to: explore the sustainable and circular initiatives business parks can implement to contribute to the transitions; establish the initiatives are actually implemented in practice at the business parks; evaluate national, provincial and municipal policy on sustainable and circular development of business parks and how these policies relate to the development of the parks in practice; and lastly, determine key lessons that can be learned from current practice and developments in sustainable and circular business parks, to enable further development of business parks.

[1] SME's are enterprises that consist of at least 1 and at most 250 employees, that have a maximum of 40 million euro revenue depending on the size of the company, and total assets of maximum 20 million euro's also depending on the size of the company (Bos, 2023).

1.3 RESEARCH QUESTION AND SUB-RESEARCH QUESTIONS

Based on the problem statement and research objectives, the following main research question and sub research questions have been established:

What are the current practices and developments in sustainable and circular business parks in Zuid-Holland, the Netherlands in their contribution to local, regional and national circular and energy transitions?

1) *What options for sustainable and circular initiatives can business parks implement in sustainable and circular development?*
2) What are the current policies and strategies on sustainable and circular development of business parks by the national, provincial and municipal governments?
3) What are the current practices, initiatives and developments in sustainable and circular business parks in Zuid-Holland, the Netherlands?
4) What lessons can be learned from the developments and practices at sustainable and circular business parks in Zuid-Holland, the Netherlands, for future sustainable and circular development of business parks?

1.4 RELEVANCE OF THE RESEARCH IN THE FIELD OF INDUSTRIAL ECOLOGY

The concept of Industrial Ecology draws an analogy between industrial systems and natural ecosystems, to suggest that industrial systems should be restructured in order to make them compatible with the way natural ecosystems function (Graedel and Allenby, 1995; McManus, 2009). The concept is closely related to concepts such as the circular economy, industrial symbiosis and eco-industrial parks. Figure 1.1 provides a visualisation of how the concepts relate to each other.

Industrial ecology (IE) can be identified as one of the pillars of a circular economy (Belaud et al., 2018). The concept promotes optimization of material cycles and energy flows within an industrial cluster, to minimize environmental impact and simultaneously create competitive advantages (Belaud et al., 2018). This optimization of material cycles and energy flows occurs through the concept of industrial symbiosis (IS). The implementation of industrial symbiosis in a business park at the local scale, or meso scale, occurs in eco-industrial parks.

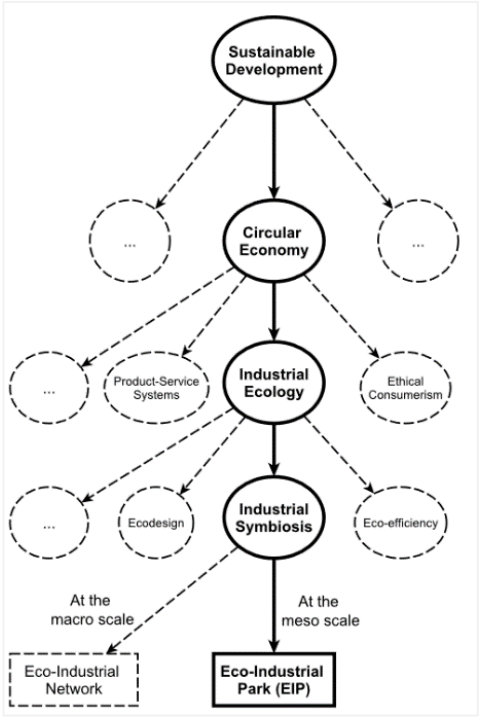

Figure 1.1 Position of EIP concepts by Le Tellier et al. 2019

1.5 OUTLINE OF THE RESEARCH

This chapter has introduced the problem statement, research objectives and research questions.

Chapter 2 consist of a literature review that provides an understanding of relevant concepts and the basis for the rest of the research. The chapter encompasses two sections: First, the concepts related to sustainable and circular development of business parks and archetypes of business parks are further explored. Second, the initiatives business parks can implement in circular and sustainable development that are identified in literature are discussed to answer sub-research question 1.

Chapter 3 discusses the methodology of the empirical part of the study. The chapter covers the multi-case research design and explains the individual steps in the research process.

Chapter 4 encompasses the case studies. In this chapter, an inventory of international, national and provincial policies on sustainable and circular development of business parks is provided to answer sub-research question 2. The chapter furthermore includes the individual case study reports with detailed evaluation of the current practices, initiatives and developments of the four parks to answer sub-research question 3.

Chapter 5 compares the four individual case studies in a cross case analysis, to establish the main similarities and differences between the business parks.

Chapter 6 discusses the key findings and lessons learned based on the cross case analysis, to answer sub-research question 4. Implications and limitations of the research are also discussed in this chapter.

Lastly, Chapter 7 encompasses the conclusion of the research. In this chapter the answer of the main research question and sub research questions is found, as well as the recommendations for future research and recommendations for actors in development of business parks.

2 LITERATURE REVIEW

This chapter presents a literature review that is performed in twofold. First, concepts related to sustainable and circular development of business parks such as the circular economy, business park archetypes, industrial symbiosis and eco-industrial parks are explored. And second, an overview of the initiatives business parks can implement for sustainable and circular development is presented to answer sub-research question 1.

2.1 LITERATURE SELECTION

Literature sources have been extracted using two methods. First, a search of relevant key words in the database Scopus provided a number of papers. The following key words, and combinations thereof, have been used in the search: “sustainable”, “circular”, “business”, ”park”, “energy”, “material”, “eco”, “industrial” and “symbiosis”. Titles and abstracts of papers were reviewed, to make a selection of papers that cover the principles of circular economy and/or industrial symbiosis, cover sustainable energy initiatives for business parks and businesses; cover on eco-industrial parks and/or sustainable business parks. Second, sources in the selected papers that proved relevant are searched and added to the papers in the literature review.

2.2 INTRODUCTION TO THE CIRCULAR ECONOMY

The circular economy (CE) is an umbrella term with diverging definitions in literature. One definition based on extensive evaluation of literature by Homrich et al. (2018) reads: “CE is a strategy that emerges to oppose the traditional open-ended system, aiming to face the challenge of resource scarcity and waste disposal in a win-win approach with economic and value perspective” (Homrich et al., 2018, p. 534). To supplement, “The ultimate goal of promoting CE is the decoupling of environmental pressure from economic growth” (Ghisselini et al., 2016, p. 11).

2.2.1 Material cycles in the Circular economy

In a circular economy a distinction should be made between the biological materials cycle and the technical materials cycle. The Ellen MacArthur foundation (2019) has developed a systems diagram to illustrate the two cycles, as is presented in Figure 2.1.

On the left the biological, nutrient based cycle is shown, which encompasses a cycle of biodegradable, renewable raw materials that can be returned to the biosphere to regenerate nature. And on the right the technical cycle that encompasses materials humanity has created from made of non-renewable, finite resources that cannot be returned to the biosphere and should be kept in circulation (Cramer, 2020; Ellen MacArthur Foundation, 2019). Use of renewable energy sources is key in a circular economy (Ghisellini et al., 2016).

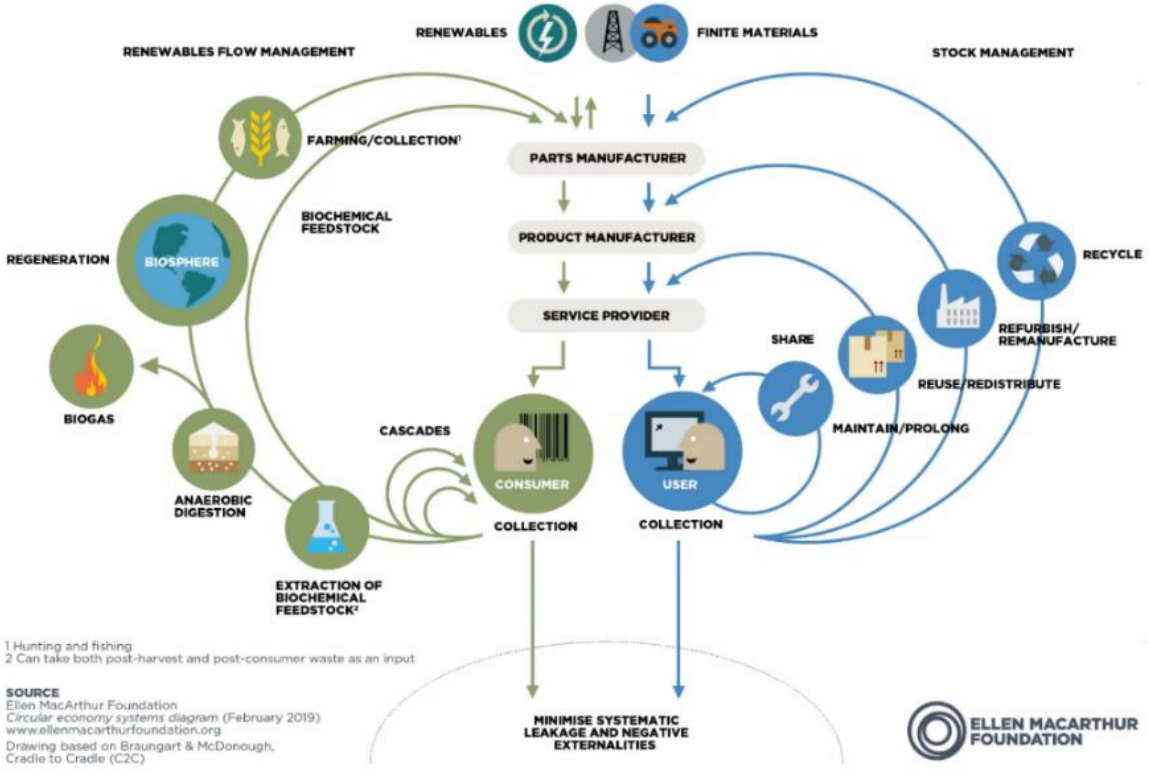

Figure 2.1 Circular economy systems diagram (Ellen MacArthur Foundation, 2019)

2.2.2 Strategies to navigate the Circular Economy

To navigate the circular economy various models and tools have been developed. The circularity ladder of 10 R's is one of these tools, that is recognized in the Dutch government's approach to a circular economy by 2050. The so called 'R-ladder', that is illustrated in Figure 2.2, consists of a hierarchical representation of circular strategies that reflects their level of ambition and order of priority. The strategies higher on the ladder generally have a lower environmental impact (Cramer, 2020). The strategies in the ladder are sequentially: refuse, reduce, redesign, reuse, repair, refurbish, remanufacture, re-purpose, recycle and recover.

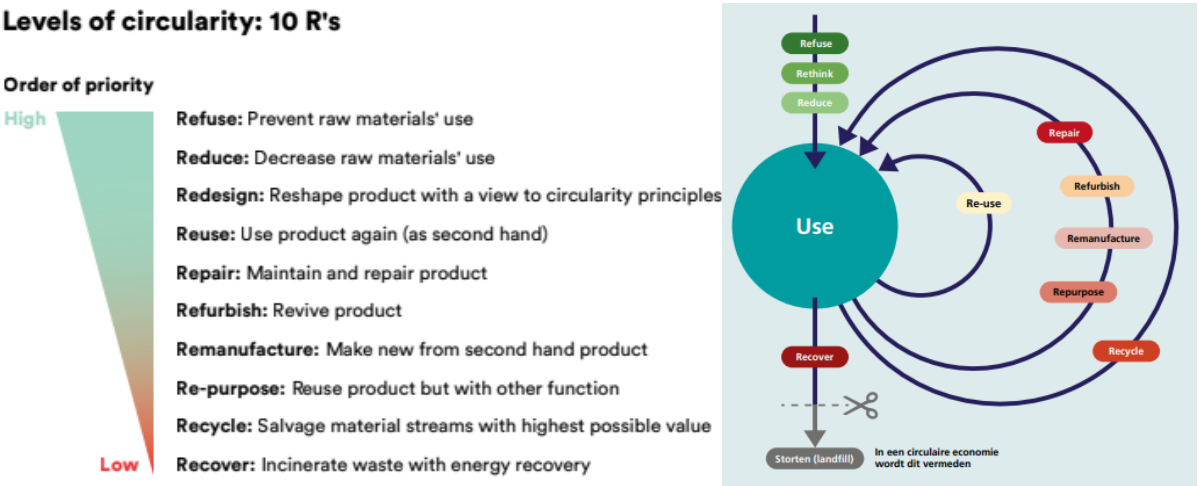

Figure 2.2 Illustrations of the R ladder (Left: Cramer, 2017; right: Province of Zuid-Holland, 2019).

2.2.3 The circular economy at different scales

Circular principles can be implemented at different scales, namely macro, meso and micro, according to Ghisellini et al. (2016).

CE at macro level encompasses circular development in local, regional and national economies. This involves the integration and the redesign of four systems: (1) the industrial system, for example by changing the size of companies from small to large or the phase-out of the heavy polluting enterprises in favour of light economic activities as related to high-tech industries, tourism or culture; (2) the infrastructure system delivering services, so adapting transportation and communication systems, water-recycling systems, clean energy and electrical power lines, etc.; (3) The cultural framework; (4) and the social system (Ghisellini et al., 2016).

The meso level entail the implementation of circular principles at business park level, through the introduction of eco-industrial park initiatives. This level is discussed in more detail in Section 2.3.

Lastly at micro level CE targets individual companies and consumers. Strategies at this level are aimed at improving circularity in production systems and supply chains of companies; promoting consumer responsibility on the purchase and use of more sustainable products and services through labelling and informing; and waste management as resource recovery and prevention of environmental impacts (Ghisellini et al., 2016).

2.3 BUSINESS PARK DEFINITIONS AND ARCHETYPES

Business parks are the result of a process called 'zoning', which is an urban planning concept used to set planning guidelines for urban development. It ensures that certain business activities aren't merged with environmentally sensitive functions, such as residential areas (Le Tellier et al., 2019; van den Berghe, 2023). An exact definition of the word 'business park' is hard to define, as the interpretation of the word varies in literature, regulation, between countries, and in different languages and translations. This section navigates the wide variety of business park typologies, elaborating on the relevant definitions and archetypes found in literature and Dutch policy.

2.3.1 Definitions and archetypes of business parks in literature

In literature, the definition of business parks is wide-ranging, covering "areas designated by local, regional and in some cases national governments to accommodate multiple companies that produce, transfer or store goods or provide services" (Snep et al., 2009, p.26). The characteristics such as functional qualities, spatial-visual qualities, economic requirements and flexibility of business parks' differ, and determine the business park archetype. (Snep et al., 2009). Four relevant archetypes from literature are further discussed in this section: eco-industrial parks, mixed-industrial parks, industrial complexes, and mixed-use ecoparks.

2.3.1.1 Eco-industrial parks

An eco-industrial park (EIP) is a business park that participates in industrial symbiosis synergies. Industrial Symbiosis (IS) is defined as engaging "traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and by-products. The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity" (Chertow, 2008, p. 12). Resource exchanges in IS generally occur through three approaches:

1) "By-product reuse - the exchange of firm-specific materials between two or more parties for use as substitutes for commercial products or raw materials.

2) Utility/infrastructure sharing - the pooled use and management of commonly used resources such as energy, water, and wastewater.
3) Joint provision of services - meeting common needs across firms for ancillary activities such as fire suppression, transportation, and food provision." (Chertow, 2008, p. 12)

The term eco-industrial park is first recognized by Boons and Lambert (2002), who acknowledge two definitions for eco-industrial parks: (1) "Industrial systems of planned materials and energy exchanges that seek to minimise energy and raw materials use, minimise waste, and build sustainable economic, ecological and social relationships", which focusses on industrial complexes that house mainly heavy industries with materials and energy intensive production processes; and (2) "a community of businesses that collaborate with each other and with the local community to efficiently share resources (information, materials, water, energy, infrastructure and natural habitat), leading to economic gains, gains in environmental quality, and equitable enhancement of human resources for the business and local community".

Greenfield vs. brownfield EIP projects

In EIP literature, a distinction is made between greenfield and brownfield eco-industrial park projects. A greenfield project is a new business park that addresses ecological issues and sustainability objectives in different development stages. Brownfield projects are existing parks that are transformed into EIP's and revitalised with the goal of reducing its environmental impact and becoming more sustainable (Boons and Lambert, 2002; Susur et al, 2019).

Self-organising, planned or facilitated symbiosis model for EIP development

In EIP literature, three development models are recognized. First, the self-organizing symbiosis model, also called the bottom up model. In this process the EIP forms as a result from spontaneous actions and decisions of private actors that are motivated to increase efficiency, reduce costs, enhance revenues or expand business by exchanging resources with other organizations (Bellantuono et.al., 2017; Chertow, 2008; Susur et al., 2019). Next is the planned eco-industrial park model, or build and recruit top down model. In this model synergies result from conscious efforts by an exogenous promoter or 'initiator' that identifies potential synergies between companies, and locates them together so they can share resources and utilities. Examples of initiators are local of regional governments, associations of companies or entrepreneurs, or other players (Bellantuono et al., 2017; Chertow, 2008; Susur et al., 2019). Lastly, a mixture of the two models is called the facilitated symbiosis model (Susur et al., 2019).

Succes and constraining factors for IS and utility sharing in EIP's

There is a wide variety of factors that influence the implementation of industrial symbiosis and utility sharing in business parks, or eco-industrial parks. Valladolid (2021) has established a list of 64 factors that either contribute to the success or constrain the implementation in the parks. The list of factors is provided in Appendix B.

2.3.1.2 Mixed-industrial parks and industrial complexes

Following the definitions of eco-industrial parks by Boons and Lambert (2002), a distinction is made between mixed-industrial parks and industrial complexes.

This study focusses on business parks that are recognized in literature as 'mixed industrial parks'. Mixed industrial parks are characterised by the occupation of mainly small and medium enterprises (SME's) with diverse core businesses and little to no coupling of production processes. These parks emerged when economic activities such as local services and retail moved from residential areas to industrial parks. Companies located in mixed-industrial parks often gain minimal advantage from each

other's vicinity, have minimal dependency on the specific characteristics of the plot and mostly have a local importance, sometimes regional at most. The occupancy of mixed industrial parks changes quickly and several similar companies can be located in the same park (Boons and Lambert, 2002). Following their taxonomy, the types of IS synergies mixed-industrial parks are mostly interested in include "collective purchasing of utilities such as energy, the collective recollection and processing of packaging materials and solid waste, and, possibly, the collective generation of energy" and "the need for the exchange of residual products is considered of minor importance" (Boons and Lambert, 2002, p. 478).

Contrastingly, industrial complexes comprise of geographically concentrated (heavy) industrial activities, most of which are process activities. In these types of parks, a tight coupling of energy and material intensive production processes can be found (Boons and Lambert, 2002)

2.3.1.3 Mixed-use ecoparks

Le Tellier et al. (2019) state there is a significant difference between the (potential) types of IS synergies in business parks or mixed-industrial parks, and those in industrial complexes. Accordingly, they introduce a new business park archetype: the 'mixed-use ecopark'. The mixed-use eco parks is a sustainable business park that improves its sustainability through collaborations such as "shared services for the employees and companies, collective logistics or joint research and development. Moreover, reflections could also be orientated towards the park's design and infrastructure planning" (Le Tellier et al., 2019, p. 1).

2.3.2 Definition of business parks in Dutch policy and regulation

The most close definition of the word 'business park' in Dutch is the word 'bedrijventerrein', which is regularly used in policy and regulation. The definition of '*bedrijventerrein*', is anchored in the currently active Environmental Management Activities Decree (NL: Activiteitenbesluit milieubeheer). This definition reads: *"Cluster of contiguous plots with predominantly business destinations, within an area designated as an business park in the 'Physical Environment Plan', not including a 'zoned industrial park' or an 'industrial park' for which noise production ceilings have been established as environmental values"*[2] (Bruidsschat, n.d.).

The types of business activities that are allowed at a business park is determined by the maximum environmental category a park allows, as part of the Environmental Management Activities Decree. Business activities are evaluated on the smell, dust, noise and danger they emit, to specify the required distance between environmentally challenging functions and environmentally sensitive functions, such as quiet residential areas or rural areas or mixed areas, to protect or increase quality of life. Based on these characteristics, the environmental category of the business activity is determined. The categories range from '1: light activities' to '6: heavy industry', as illustrated in Table 2.3 on the next page (Ministry of Infrastructure and Water Management, n.d.)

[2] NL: "Activiteitenbesluit-bedrijventerrein: Cluster aaneengesloten percelen met overwegend bedrijfsbestemmingen, binnen een in het Omgevingsplan als bedrijventerrein aangewezen gebied, daaronder niet begrepen een gezoneerd industrieterrein of een industrieterrein waarvoor geluidproductieplafonds als omgevingswaarden zijn vastgesteld".

Table 2.3 Environmental categories and target distance to sensitive functions

Environmental category	Target distance to ... in metres		Example of business operation
	quiet residential area / quiet rural area	'mixed area'	
1	10	0	Telecommunication companies
2	30	10	Datacentre
3.1	50	30	Waste collection company / municipal yards (waste collection depots)
3.2	100	50	Car junkyards > 1000 m²
4.1	200	100	Electric motor and generator factories incl. repair
4.2	300	200	Landfill
5.1	500	300	-
5.2	700	500	-
5.3	1.000	700	-
6	1.500	1.000	Petroleum refineries/ nuclear power plants with cooling towers

From: (Ministry of Infrastructure and Water Management, n.d.)

2.4 OPTIONS FOR SUSTAINABLE AND CIRCULAR INITIATIVES IN BUSINESS PARKS

In literature a variety of options are recognized for sustainability and circularity in business parks. Parks can implement collective measures for streams and production processes and architectural and for site arrangement (Pellenbarg, 2002). Moreover, at the individual business level improving the efficiency and circularity of energy and building designs and construction, as well as closing and improving efficiency of production and consumption chains are recognized as options for sustainability and circularity at business parks (Van Bueren et al. 2023). As this thesis is focussed on circularity and sustainability of business parks, and not the demand and supply chains of businesses individually, the production and consumption chains are excluded from the scope of this research.

Based on above introduced divisions of measures, this chapter reviews the possibilities for sustainable and circular initiatives in business parks, following four categories:

1. Collective initiatives aimed at streams and production processes;
2. Collective initiatives aimed at site arrangement, architecture and park organization;
3. Individual initiatives aimed at streams and production processes;
4. Individual measures aimed at architecture and building design and construction

2.4.1 Collective initiatives aimed at streams and production processes

This section includes the following initiatives:

- Exchange of energy, materials and water
- Collective use of utilities, infrastructure and firm functions
- Collective waste management
- Shared mobility and collective transport of goods and people
- Collaborative models for appliances, tools etc.

2.4.1.1 Exchange of energy, materials and water

Interfirm exchanges of resources such as energy, raw materials, by-products, waste materials, and water are one of the three approaches in industrial symbiosis (Chertow, 2008). The potential synergies businesses at BP's can establish are very diverse and the available resources depend on the types of

businesses that are present at the park. The most frequently exchanged resources in EIP's include: plastics and rubber, wood, metallic, non-metallic e.g. glass, waste from construction and demolition, lime based waste, waste heat and steam, ash, water and wastewater, chemicals, sludge, paper and organic materials such food and food processing wastes, biomass, livestock and fisheries wastes (Neves et al., 2019).

Motivations for enterprises to participate in resource exchanges vary. Businesses that supply the resource can experience reductions of avoidance of waste disposal costs and/or financial gains that result from selling materials or energy. Enterprises on receiving end can reduce their costs and better their environmental performance by not buying (primary) raw materials and resources. Moreover, new business opportunities and marketing are also among motivations for companies to participate in energy, materials and water (Patricio et al., 2018).

As earlier discussed in Section 2.3, business parks in the scope of this study are occupied by SME's with limited production processes that are rarely compatible. For this reason, coupling of production processes and material substitution synergies are rarely desired at these types of business parks (Le Tellier et al., 2019). Other barriers for implementing material symbiosis are difficulties of finding receivers, a negative business case for participating in the symbiosis, lack of knowledge, practical issues regarding for example storage and transportation and investing in installing new equipment (Patricio et al. 2018).

2.4.1.2 Collective utilities and infrastructure

Collective management and use of utilities and sharing of infrastructure is one of the approaches in industrial symbiosis (Chertow, 2008). This initiative can focus on the energy system of the parks, the grey water system or (waste) water system.

Collective organization of the energy system at the park can take a variety of forms. The renewable energy technologies most often integrated in business parks include ground-source heat pumps, waste and/or biomass treatment plants, wind turbines, and solar panels. Furthermore, combined heat and power (CHP) systems are recognized as an effective method of integrating renewable energy technologies at park level (Butturi et al., 2019).

A variety of factors determine the optimal configuration of energy technologies in a business park. Factors include the uncontrollable, intermittent and non-dispatchable characteristics of renewable sources such as the sun and wind. The thermal demand of business at the park are also an important factor, as well as the temperature levels of thermal energy sources. The temperature of energy supplied through burning of biomass is for example much higher than the temperature of energy that is supplied by a datacentre. Moreover, the objective for the implementation of a collective energy system is of influence in the configuration. The design of a system that has targets related to minimisation or limitation thresholds, e.g. total carbon emissions, might differ from the design with targets related to maximization or minimum thresholds, e.g. the share of renewable energy production (Timmerman et al., 2014).

Challenges for a collective energy system include the intermittent nature of renewables, which can pose an obstacle in the stability and reliability of the energy supply. A second challenge is load balancing, the systems needs to be able to cover peak loads and some renewable sources as non-dispatchable. Energy storage can help overcome these difficulties and provide time varying energy management, reduce the intermittence of renewable source power generation and help meet peak load demands (Luo et al., 2015). Alternatively, energy surpluses can also be supplied to the external electricity grid or, if present, a district heating network for residual thermal energy.

A smart-multi energy system can help business parks in the organization of the energy system. In these systems, presented in Figure 2.3, multiple (renewable) energy sources, storage systems and energy distribution networks are integrated into one system which allows for smart control and management of the energy grid, and optimal use of the energy sources (Butturi et al., 2019)

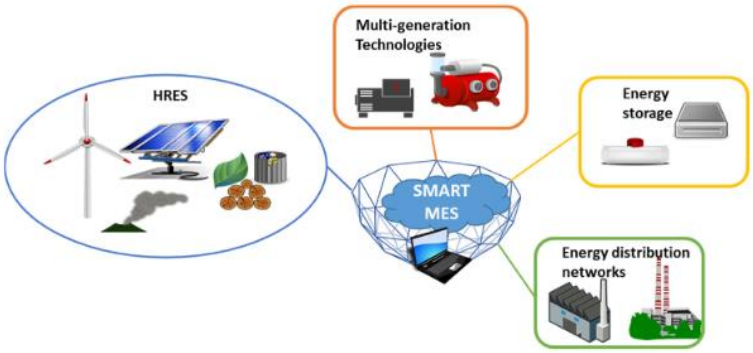

Figure 2.3 Smart multi-energy system concept (Butturi et al., 2019)

Business parks can also connect to a district heating network, in which thermal energy is generated at an external centralized location and distributed to connected area's. Energy sources used in district heating networks vary from fossil fuels to sustainable alternatives such as energy from waste processing companies or residual energy from for example data centres. Whether pursuing connection to the network is desirable thus depends on the source of the energy, as well as other factors such as the distance to the source and heat demand at the park (IEA, n.d.).

Collective purchase of energy is another initiative parks can implement in their energy strategy, and one of high interest in mixed-industrial parks (Boons and Lambert, 2002; Butturi et al., 2019). The initiative can be used to overcome challenges in the balance of supply and demand of at the parks. In case of a mismatch, a supply of renewable energy from the grid can complement the energy generated at the park (Timmerman et al., 2014).

2.4.1.3 Collective waste management

Collective collection and processing of waste is recognized as a form of joint provision of services, one of the approaches in industrial symbiosis. This initiative can take several forms, depending on the types of waste that are generated at the park. Companies in the Netherlands are obligated to separate their municipal waste into: paper and carton, organic waste, glass, foils, EPS packaging, wood, biomass waste and textiles. Depending in the business, other types of waste might also have to be separated (Netherlands Chamber of Commerce KVK & Ministry of Infrastructure and Water Management, n.d.). Business parks can provide collective waste removal contracts to companies, that result economic advantages to the companies, as well as environmental advantages as a result of efficiency in the frequency of waste collection at the park. Instead of transport occurring for each company, all waste can be collected at once. Furthermore, Jaczkó et al. (2019) state collective park-wide recycling and composting at the park could reduce social and economic barriers for companies to separate their waste, possibly resulting in an increase in waste separation. This initiative could also provide additional jobs for (new) employees at the park, that can collect the waste. In their research, they also explore the potential of pressing the paper and carton waste at the park, reducing the frequency of pickups and thus reducing emissions from transportation emissions. Lastly, organic waste could be composted and utilised withing the park. This initiative would save on waste collection costs, provide natural fertilizer to nature in the park and provide environmental benefits by eliminating waste transport (Jaczkó et al., 2019).

2.4.1.4 Shared mobility and collective transport of goods and people

Providing shared mobility such as (electric) vehicles, electric or regular bikes etc. is a form of shared services and facilities at a business park. These facilities can be made available to businesses at the park, but the park can also function as a storage and charging location for publicly available share cars. Generally, the benefits of electric carsharing include a reduction in fuel consumption and greenhouse gas emissions, greater environmental awareness and reduced vehicle kilometres travelled. However, these results are based on business-to-consumer, business-to-business and peer-to-peer carsharing (Shaheen et al., 2019). Other initiatives could include collective bus services for employees at the park or collective coordination of car-pooling (Pellenbarg, 2000). Lastly, fright transport from and to the business park could potentially be combined among companies. This could result in a reduction in transport movements, and the environmental and financial effects accompanies by these movements.

2.4.1.5 Collaborative models for appliances, tools etc.

Collaborative models for appliances, tools and other products can be implemented at a business park. Among these models can be sharing, lending and renting of these products, and are recognised as "one of the best available options on consumer side to shift from the present business-as-usual model to CE" (Ghisellini et al., 2016, p. 23). Examples of appliances and tools can hand held equipment such as hammers, screw drivers etc., but also bigger products such as fork lifts. Implementing this initiative results a decrease in consumptions of these products, possibly a higher number of use in the lifetime of a product.

2.4.2 Collective initiatives aimed at site arrangement and park management

This section reviews collective initiatives regarding design, development and management of the business park, including the firm's premises, the infrastructure, and the various facilities at the site. This section includes the following initiatives:

- Effective and strategic use of space
- Joint commercial firm facilities and provision of services
- Multimodal transport and high quality public transport
- Sustainable and circular

2.4.2.1 Effective and strategic use of space

Effective and strategic use of space at business parks is required for sustainable and circular development of the park. Pellenbarg (2000) emphasizes "Intensifying the activities aiming at the sustainability and continuity of existence of business locations in urban environments is of utmost importance to control this undesirable growth of mobility and thus contributes to one of the most important targets of spatial planning". Initiatives to facilitate effective and strategic use of space include "collective buildings for small firms, collective storage of goods and materials, strategic land reserves, collective land reserves" (Pellenbarg, 2000, p.22).

2.4.2.2 Joint commercial firm facilities and provision of services

Joint commercial firm facilities and provision of services is one of the approaches in IS (Chertow, 2008). The basics at the park must be organized well for sustainable functioning of the parks. Examples of collective facilities and services include security and safety system, maintenance of public area and buildings, telematics, fire protecting, signposting, traffic control etc. (Boons and Lambert, 2002; Pellenbarg, 2000)

2.4.2.3 Multimodal transport and high quality public transport

To enable sustainable transport movements, multimodal transport and high quality public transport can be implemented at the parks. These can be facilitated via: nearby public transport options such as

bus, train or tram routes; site transport systems such as share cars, cabs and bicycles; parking options (Pellenbarg, 2000).

2.4.3 Individual initiatives aimed at streams and production processes

This section includes the following initiatives:

- Individual renewable energy generation and energy storage
- Reuse of energy from waste streams
- Individual waste management

2.4.3.1 Individual renewable energy generation and energy storage

Enterprises can generate renewable energy and store it at the individual level. Technologies they can implement include solar panels on rooftops of in façades, both thermal collectors and photovoltaic panels, heat pumps combined with low-temperature energy sources such as ground, water or air, and small-scale wind energy (Netherlands Enterprise Agency, 2013). Enterprises can be self-sufficient in their energy demand, or in some cases even generate energy surpluses they can sell to the grid. Combined heat and power installations are also among techniques that can be implemented.

Companies can implement initiatives for individual energy storage at the individual level, for example in electric batteries or thermal energy in e.g. Aquifer thermal energy storage (Netherlands Enterprise Agency, 2013).

2.4.3.2 Reuse of energy from waste streams

Reuse of residual energy in streams within the company aims to reduce the demand for thermal energy. Measured they can implement are for implementation of heat recovery installations in ventilation or water (Gennitsaris et al., 2023; Netherlands Enterprise Agency, 2013)

2.4.3.3 Individual waste management

If a park does not offer collective approached to waste management, businesses have to establish individual contracts with waste management companies. As introduced in Section 2.4.1.3, the waste a company generates is dependent on the type or business activities and businesses are obligated to separate certain types of municipal waste. In addition to the legal requirements, business can set their own ambitions for waste separation.

2.4.4 Individual initiatives aimed at architecture and building design and construction

This section includes the following initiatives:

- Energy efficient building construction, installations and appliances
- Circular construction
- Individual waste management

2.4.4.1 Energy efficient building construction, installations and appliances

Business parks and companies located in business parks can implement a number of initiatives and measures related to energy sustainability. The energy demands of a business encompass energy related building use and occupancy, such as lighting, heating and cooling, ventilation, electrical appliances and transportation systems (Butturi et al., 2019; Timmerman et al., 2014). Furthermore, depending on the types of businesses located at the park, production related energy services can be present. Examples of these services include process heating and cooling, process steam, refrigeration, technical tools, and more (Timmerman et al., 2014).

Reducing the energy demand of businesses can be achieved by via construction measures or implementation of energy efficient appliances and installations. Examples of measures include

implementing energy efficient installations and appliances such as LED-lighting, optimal control and management of installations and appliances to prevent unnecessary use, limiting energy and/or thermal losses e.g. improving building envelope insulation or internal building components such as pipes or implement heat recovery technologies (Gennitsaris et al., 2023; Netherlands Enterprise Agency, 2013).

Strategic planning is relevant when implementing these types of measures, and making use of 'natural moments' can provide benefits. Natural moments include scheduled maintenance or renovations, or unplanned defects of installations. Furthermore, in the planning of these interventions it's highly important to consider the types of renewable energy sources and conversion technologies are implemented, or will be implemented in the future.

2.4.4.2 Circular construction and design

The definition of circular construction reads: "developing, using and reusing buildings, areas and infrastructure, without unnecessarily depleting natural resources, the pollute the environment and damage ecosystems. Building in a manner that is economically responsible and contributes to the well-being of people and animals. Here and there, now and later" (Verberne et al., 2021). In circular construction eight principles are recognized, these principles are briefly explained in Table 2.1.

These principles can also be applied in development of the public area at the business parks by park management or the project developer.

Table 2.1 The principles of circular construction, from Verberne et al. (2021)

Design principle	**Elaboration**
Design with minimal materials	Design with as little material as possible, to avoid unnecessary prevent consumption of raw materials.
Design for maximal functional lifespan	Design for maximum functional life, whereby elements in a building are adaptive and can be adjusted based on changing needs
Design for optimal management and maintenance	Design for optimal use and maintenance, whereby the functionality of the building throughout its lifespan is preserved as best as possible with as little as possible use of materials (minimizing waste) for maintenance.
Design for multiple lifespans	Design for future life cycles, where elements and products are detachable at the end can be reused throughout its lifespan
Maximise quantity of reused materials	Maximize the amount of recycled material, whereby the value of released products and materials is retained.
Maximise the quantity of sustainable and biobased materials	Maximize the amount of (sustainable) biobased materials, preventing the use of 'technical' materials such as concrete, steel and plastic.
Minimise amount of new, virgin materials	Minimize the amount of 'primary' (new) material, where it is still necessary to fulfil functions.
Maximise potential for high-value reuse	Maximize the potential for high-quality reuse, where materials are suitable for reuse due to, for example, high quality or the absence of toxic substances.
Minimise embedded energy (CO_2 emissions) and avoid use of (humane) toxic materials	Minimise total embedded environmental impact of materials, and avoid the use of (human) toxic substances. These are substances that are toxic to humans during their lifespan.

2.4.5 Conclusion

This section answers sub-research question 1 "*What options for sustainable and circular initiatives can business parks implement in sustainable and circular development?".* Business parks can implement a variety of collective initiatives that are aimed at production processes and streams, and at site arrangement and park organization. Moreover, enterprises can implement individual initiatives focussed on energy efficiency or circular construction. An overview of sustainable and circular initiatives in business parks is provided in Table 2.2.

Table 2.2 Overview of sustainable and circular initiatives in business parks

	Collective initiatives	**Individual initiatives**
Streams and production processes	• Exchange of energy, materials and water • Collective use of utilities, infrastructure and firm functions • Collective waste management • Shared mobility and collective transport of goods and people • Collaborative models for appliances, tools etc. • Circular design principles in public space	• Renewable energy generation and energy storage • Reuse of energy from waste streams • Individual waste management
Site arrangement, park organization and architecture/ construction	• Effective and strategic use of space • Joint commercial firm facilities / provision of services • Multimodal transport and high quality public transport	• Energy efficient building construction, installations and appliances • Circular construction and design

3 METHODOLOGY

This chapter discusses the methodology used for the empirical research in this thesis. The chapter starts with the design of multi-case research, followed by the theoretical framework that was used for analysis of cases, the case study selection, data collection protocol, and lastly the data analysis approach.

3.1 MULTI-CASE RESEARCH DESIGN

The aim of the research is to investigate the current practices and developments in business parks in Zuid-Holland. Multi-case research was chosen as the suitable research design, as this is used for "in-depth investigation of a problem (or phenomenon) in one or more real-life settings", and has increased generalizability in comparison to a single case study (Bhattacherjee, 2012). The multi-case research design adapted from Yin (2002) is presented in Figure 3.1. Upcoming sections explain the steps in further detail.

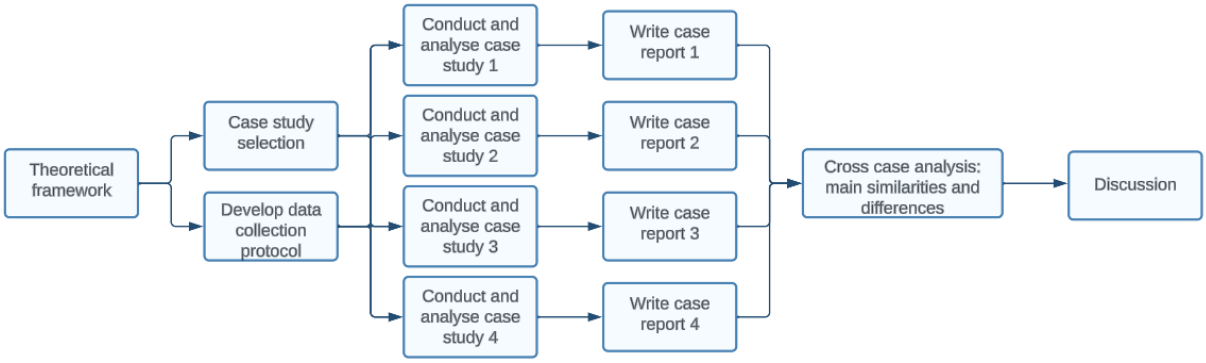

Figure 3.1 Multi-case research design, adapted from Yin (2002)

3.2 THEORETICAL FRAMEWORK

The first step in the multi-case research design is establishing the conceptual framework used in the analysis of the cases. The aim of the multi-case research is to evaluate the current practices and developments of what is recognized in literature as eco-industrial parks.

3.2.1 Existing frameworks on eco-industrial parks in literature

Eilering and Vermeulen (2004) developed a framework to analyse the establishment process of eco-industrial parks, displayed in Figure 3.2. The framework covers the establishment process from ambition to performance, and includes five factors that influence process: (1) the vision of sustainability; (2 & 3) location and business specific physical and social features; (4) the organisation of the decision-making process; (5) policy instruments (Eilering and Vermeulen, 2004).

Valladolid (2021) used this framework to evaluate the implementation of industrial symbiosis and utility sharing in EIP's. He has expanded the initial framework by Eilering and Vermeulen (2004) with two new influential factors: the project economic features and the external context. His framework is presented in Figure 3.3. Moreover, he determined 64 sub-factors within the nine main factors. A complete list of all factors and their subfactors is found in Appendix B.

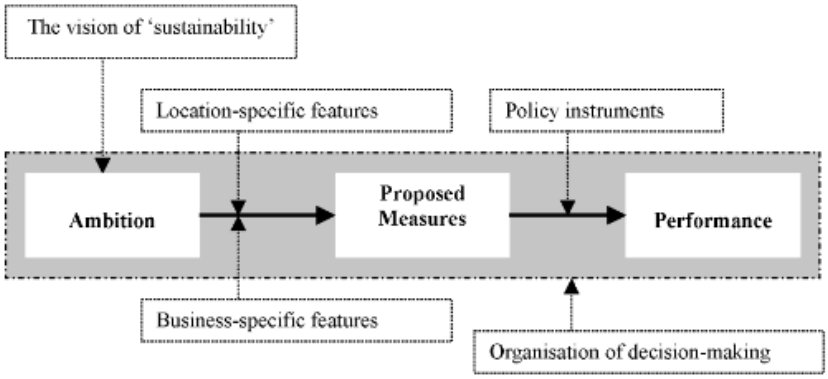

Figure 3.2 Eco-industrial park framework (Eilering and Vermeulen, 2004)

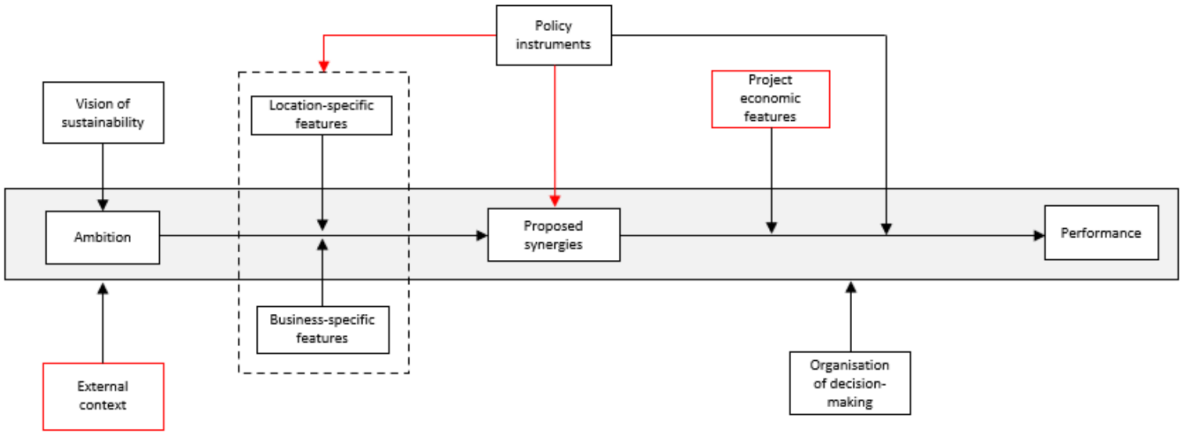

Figure 3.3 Eco-industrial park framework (Valladolid, 2021)

Table 3.1 elaborates on the three process steps and eight main factors for establishing EIP's and implementing IS and utility sharing.

Table 3.1 Variables influential in development of EIP's and implementing IS and utility sharing initiatives

Variable	Explanation
Ambition	The ambition at the business park comprehend the initial ideas for the development of the park and the goals the developers aim to achieve (Eilering and Vermeulen, 2004).
Proposed synergies	The synergies that are proposed to implement at the park. These measures and initiatives are influences by a number of factors including location and business specific features and policy instruments.
Performance	Performance indicates the level of success of the park, measured indirectly via a binary score of 'none of the proposed measures were carried out' or 'all or most of the proposed measures were carried out'. The actual economic and ecological effects are not measured and included in the variable 'performance' (Eilering and Vermeulen, 2004).
Vision of sustainability	The vision of sustainability guides the whole project" (Valladolid, 2021, p. 4).
Location specific physical features	"Refers to the park's physical characteristics where industrial symbiosis and utility sharing activities occur. Physical characteristics are defined by the type of companies, layout, and resources available at the park" (Valladolid, 2021, p. 4).

Location specific social features	"Refers to the social context of the park. A favourable social context includes awareness of neighbour activities, a sharing culture, easy communication, trust and knowledge sharing between companies" (Valladolid, 2021, p. 4).
Business specific features	"The characteristics of the companies inside the park. Companies should be entrepreneurial, with financial capacity, willing to commit and innovate, disposed to make long-term investments, big-sized and with a lot of residues" (Valladolid, 2021, p. 4).
Policy instruments	"Tools used to support the implementation of synergies such as regulations, subsidies, promotion, a facilitator and park policies" (Valladolid, 2021, p. 4).
Economic features	"Economic impact of the project on the company. A proposed synergy project must have beneficial economic features to move forward" (Valladolid, 2021, p. 5).
Organization of decision making	"The way in which the process to make decisions is organised" (Valladolid, 2021, p. 4).
External context	"Play an indirect effect on synergy implementation. External context includes the sustainability importance given by society, market conditions, public opinion and human capital" (Valladolid, 2021, p. 4).

3.2.2 Additional proposed variables for analysis

The sustainable and circular development is potentially influenced by regional and local characteristics, strategies and policy potentially. Moreover, there might be a strategic role that was determined for the business parks in the regional and local sustainable transitions.

These features are not reflected in the existing frameworks on business park (EIP) development by Eilering and Vermeulen (2004) and Valladolid (2021). This research has incorporated these features through the two new variables:

1. Regional and local characteristics: to evaluate the regional and local developments and characteristics that potentially influence the sustainable and circular development of the business parks
2. Regional spatial-economic strategies and environment policy: to evaluate the regional spatial economic strategies, as well as local and regional environment policy, that potentially affect the sustainable and circular development of the parks.

3.3 CASE SELECTION

The selection of business parks for the case studies was a multistep process, that started with the circa 600 business parks in teh province of Zuid-Holland and ultimately resulted in the selection of four case studies. The process is illustrated in Figure 3.4 and further detailed in the next sections.

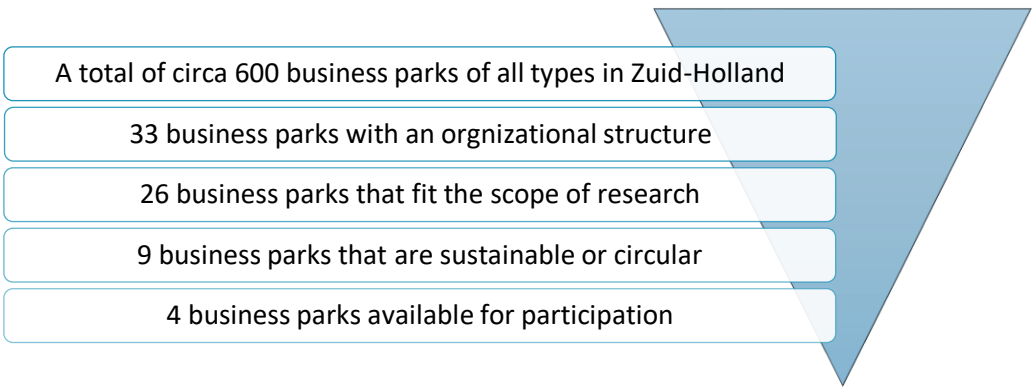

Figure 3.4 Case selection process

3.3.1 Selection of business parks with an organizational structure

The province of Zuid-Holland accommodates a total of circa 600 business parks, which includes all types of business parks except for sea ports (Province of Zuid-Holland, 2020). The first round of filtering the parks is based on whether the parks have some form organizational structure or not. Reasoning for this is that these it is more easy to get in contact with these parks, and that an organizational structure facilitates collaboration between businesses at the parks and achieving circular goals, though it is not a guarantee for circularity (van der Bent et al., 2022).

In 2022, colleague students of the Industrial Ecology master's programme from Leiden University and TU Delft conducted research on circular business parks, commissioned by the province of Zuid-Holland. The Province supplied a list of 33 business parks (of all types) that have some form of organizational structure. The list is provided in the first column of the table in Appendix C.

The next step is to filter this list and exclude all parks that do not fit the scope of business park as intended in this thesis (explained in section 2.3). This filtering is based on park categorisation by the province of Zuid-Holland, who distinguish between: industrial parks, mixed parks, distriparks, agribusiness, high tech parks and high end park (Province of Zuid-Holland, 2022). The categorization of the parks is provided in the third column of Appendix C. After eliminating the parks categorized as industrial park, agribusiness or distripark, a total of 26 business parks remain for further evaluation in the next section.

3.3.2 Initial evaluation of potential business parks

The second step entails a first exploration of sustainable and circular development at the remaining 26 business parks. In Table 3.2, four characteristics of are documented for the parks: Does the park has clear circular/sustainable ambitions, are there resource exchanges at the park, does the park have shared utilities or infrastructure, is there joint provision of services at the park and is the park a greenfield or brownfield project. For the evaluation secondary data was used from webpages of the parks, webpages of the business associations of the park, news articles, etc. In some instances, no information was found.

Table 3.2 Initial evaluation of potential case sites

	Circular ambitions	Resource exchanges	Shared utilities	Joint provision services
1) Ambachtsezoom	Yes	Yes	yes	Yes
2) Antoniapolder	Unclear	No info	No info	No info
3) Avelingen Oost en West	No	No info	No info	No info
4) Groote Haar	Yes	Not found	Yes	Yes
5) De Boezem	Yes	Yes	Not found	Yes
6) Coenecoop	No	No info	No info	No info
7) Gelkenes	No	Not found	Not found	Yes
8) Gouwe Park	Unclear	Yes	Not found	Yes
9) Halfweg-molenwatering	Yes	Yes	Yes	Yes
10) Heron	Yes	Yes	Yes	Yes
11) Kickersbloem 1 and 2	No	Yes	Yes	Not found
12) Kickersbloem 3	Yes	Yes	yes	Yes
13) M4H	Yes	Yes	Yes	Yes
14) De Nieuwe Wetering	No	No info	No info	No info
15) Noordoost Kwadrant	No	No info	No info	No info
16) Oosteind	Yes	Yes	Yes	Yes
17) OV de Bosschen	No	Maybe	Not found	Yes

18) Oostambacht	No	No info	No info	No info
19) Sandlelingen	No	No info	No info	No info
20) Seggelant	No	No info	No info	No info
21) Spaanse polder	No	No info	No info	No info
22) Stellendam	No	No info	No info	No info
23) Vinkenwaard	No	No info	No info	No info
24) VSB	Mostly energy	Not found	Yes	Yes
25) Westvlietweg III	Yes	Unclear	Yes	Yes
26) ZKD	Yes	Not found	Not found	Not found

A selection of parks was made based on whether the park has circular and sustainable ambitions, an whether they have implemented at least two of the three types of industrial symbiosis initiatives; and where the focus of the park is, and stays, regular business operations. The selection resulted in a list of nine potential business parks for the case studies, highlighted in Table 3.2, that are described in the upcoming sections and indicated in Figure 3.5.

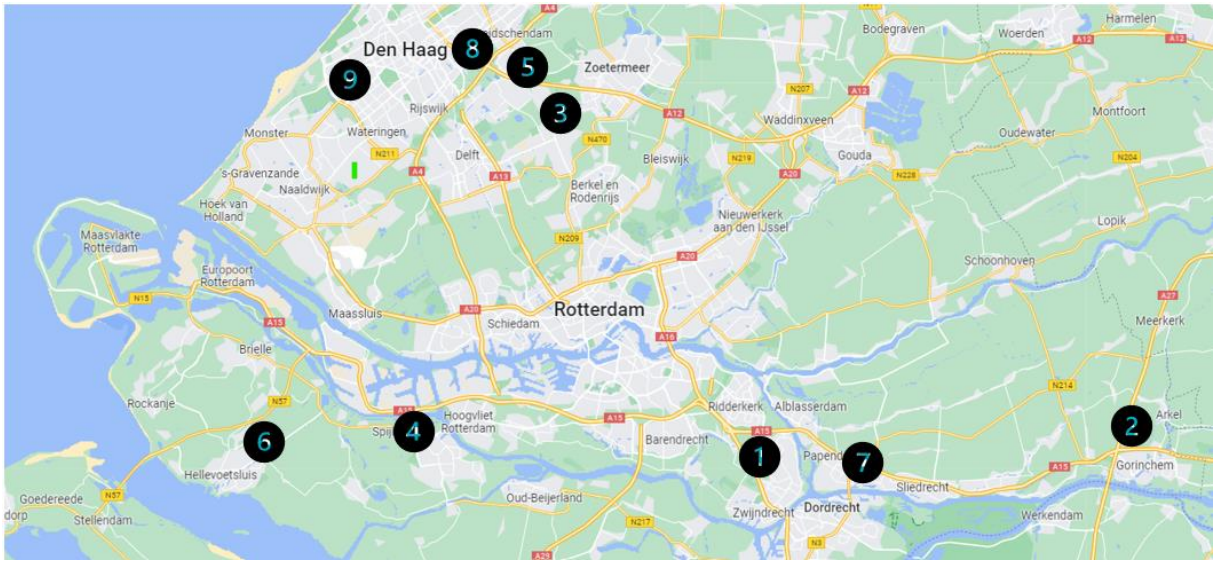

Figure 3.5 Map of the nine selected potential case sites in the Province of Zuid-Holland

1. Ambachtsezoom, Hendrik-Ido-Ambacht

Business park Ambachtsezoom in the municipality of Hendrik-Ido-Ambacht is the first circular business park of the Netherlands. The park is newly developed greenfield project by the municipality of Hendrik-Ido-Ambacht. The small-scale park is energy-neutral and natural gas free, and circular and sustainable initiatives at the park include use of circular materials and cradle-to-cradle principles of buildings and public space, renewable energy generation, resource exchanges, and collective services such as park security (Ambachtsezoom, 2020).

2. Groote Haar, Gorinchem

Business park Groote Haar is a sustainable business park that will be developed in the municipality of Gorinchem in the nearby future. The land-use plan (*NL: bestemmingsplan*) for the location specify the municipality aims to cover eight pillars of sustainability in the development of the park for maximum sustainability. The pillars are energy, water, raw and waste materials and building sustainably, ground, liveability and safety, spatial planning, landscape and ecology and lastly, traffic and mobility. Examples of efforts on these topics are installation of two wind turbines to cover the energy demand of the park, collective waste management and security, optimal use of residual and waste water, and more (SAB, 2017).

3. De Boezem, Pijnacker-Nootdorp

Business park de Boezem in the municipality of Pijnacker-Nootdorp, consists of two sections: Boezem-Oost and Boezem-West. One of the parks is a brownfield project, that will be revitalised, the other a greenfield project that expands the first park. The park has a working group 'Maatschappelijk Verantwoord Ondernemen' that focusses on the research and implementation of initiatives of collective sustainability (De Boezem, n.d.). The business park's project manager at the municipality of Pijnacker-Nootdorp mentioned collective waste management at the park, and the website communicates effort on renewable energy initiatives by individual companies.

4. Halfweg-Molenwatering, Spijkenisse

Halfweg-Molenwatering is an existing business park in the municipality of Spijkenisse, developed in sections between 1960 until 1995 and onwards. At present, the park has an organizational structure in the form of a 'Business Investing Zone'/BIZ (*NL: Bedrijven investerings zone*), where the businesses and municipality collectively work toward the ambition of an energy neutral, circular and climate resistant business park. Examples of initiatives at the park include exploring opportunities for collective sustainable waste management, businesses can opt for help in circularity for raw and residual materials, installation of solar PV panels, shared electric bicycles, a shared carport with solar panels and electric vehicle charging station, as well as collective efforts on biodiversity and climate adaptation at the park. The park has an online Parksharing platform, where businesses can rent, sell or share materials, appliances and personnel. Lastly, there are efforts at the park for a circular craft centre (Stimular, 2020; BIZ Halfweg-Molenwatering, n.d.).

5. Heron, Pijnacker-Nootdorp

Heron is a green field business park located in the municipality of Pijnacker-Nootdorp. They aim to be an example of a sustainable business park by aiming for an energy and carbon neutral business park. At present, sustainable energy initiatives such as solar panels and a smart-grid energy system are implemented at the park. The business park also has a platform where sustainable and circular initiatives are discussed named House of Heron. This platform is also used to exchange knowledge and experiences with entrepreneurs, students, start-ups and so on (Business park Heron, n.d.).

6. Kickersbloem 3 (1 and 2), Hellevoetsluis

Kickersbloem 3 is a park that is being newly developed by the municipality of Hellevoetsluis. To fulfil the parks sustainability ambitions, targets and ideas are developed for sustainable mobility, sustainable spatial planning, renewable energy, and more (Stimular, 2023).

7. Oosteind, Papendrecht

Business park Oosteind in Papendrecht is a brownfield project of revitalising the existing park, in the road towards an energy-neutral park in 2050. At present, not much information can be found online regarding the developments and planning of the park (Crossing Borders Development, n.d.).

8. Westvlietweg III, The Hague

Westvlietweg is an existing business park in the Hague. The park is a BIZ, and aims to research and implement sustainable initiatives. Examples mentioned on the website include collective efforts in an energy transition, solar PV panels, waste management and distribution (Westvlietweg, n.d.)

9. Zichtenburg Kerketuinen Dekkershoek, The Hague

Business park Zichtenburg Kerketuinen Dekkershoek (ZKD) in the Hague is an existing park that is implementing a number of sustainable initiatives as a result of becoming a BIZ. Examples of initiatives at the park include use of reused materials, LED and separate rainwater drains after revitalisation of

the park. As well as, support for businesses to become more energy sustainable and manage their waste (ZKD, 2019).

3.3.3 Case study selection

Efforts were made to contact all nine parks. The following four business parks were willing to participate in the study:

1. Ambachtsezoom in Hendrik-Ido-Ambacht,
2. De Boezem in Pijnacker-Nootdorp
3. Heron in Pijnacker-Nootdorp
4. Groote Haar in Gorinchem

Business parks ZDK responded the park management would not to be able to contribute to research because of limited available time. From Kickersbloem, Halfweg-Molenwatering and Westvlietweg III no response was received. For park Oosteind, no contact details found thus this park was not contacted.

3.4 DATA COLLECTION PROTOCOL

The multi-case study follows a qualitative research approach that uses interviews as the primary form of data collection. The chosen interview method is semi-structured interviews, as this method "creates opening for a narrative to unfold, while also including questions informed by theory" (Galletta, 2013, p.2). The aim of interviews is to obtain the perspectives and experiences of actors with different positions and roles at the business parks. For each position or role, a list of open-ended questions was developed to guide the interview, but the order and exact formulation of the questions were not followed strictly.

Interview data is supplemented by additional sources of data such as internal documents provided by the interviewees, direct personal observations, government documents, business park websites, etc.

3.4.1 Selection of participants

The aim of the interviews was to obtain knowledge, views and experiences of actors with different positions and roles in the development of business parks in the province.

To investigate the perspective from the province of Zuid-Holland, a policy officer on circularity in business parks was interviewed. The policy officer shared his expertise and knowledge on sustainable and circular development of business parks, and elaborated on the provincial policy and strategies for circular development of business parks. For business parks actors with roles as park manager, members of park management / the board, actor at the municipality that is involved in development of the park, and an entrepreneur or representative of a business at the park have been interviewed. Contact details of the actors were searched on the websites of the business parks, which contained contact details of the park managers and/or project managers of the parks that are employed at their respective municipality. These actors functioned as contact persons for other actors at the parks, by either providing their contact details of inviting them to join the interview.

With each participant that was not invited to the interview by another actor, initial contact was made via an email that contained an introductory explanation of the research and the request for participation. After confirmation of willingness to participate, the date, time and location for the interview were scheduled and the list with guiding questions (Appendix D), as well as a consent form (Appendix E), were provided.

In total 10 interviews were conducted with project managers at municipalities, policy officers or advisors, park managers, entrepreneurs or business representatives that are also a member of the park management / board, and a consultant. Additionally, one participant provided a written response to the questions via email. An overview of the actor roles of the participants at each park is provided in Table 3.3

Table 3.3 Overview interview participants per case

	Ambachtsezoom	De Boezem	Heron	Groote Haar
Project manager	●	●	●	●
Park manager	●	●	●	
Policy advisor				●
Park management member/ entrepreneur	●	●	●	
Consultant		●	●	

3.4.2 Data collection

To evaluate the current practices, initiatives and developments at the business parks the variables in the theoretical framework are evaluated through interviews and analysis of secondary data. A set of questions that cover the variables from the theoretical framework was developed for the interviewees (Appendix D. All interviews have been recorded with consent of the interviewees. Online interviews were conducted and recorded via Microsoft Teams, in person interviews with a 'Dictaphone' mobile application. Transcripts of the interviews were made using the automatic transcript function Microsoft Teams, then reviewed and adapted manually in case the transcript was incorrect. During the interviews, no additional notes were made on e.g. body language or intonation as these aspects are irrelevant in the purpose of the interviews. For privacy reasons the transcripts are not included in the research document. Before finalization of the research, participants have received the chapter on their respective business park and to opportunity to provide feedback and comments.

3.5 DATA ANALYSIS

The data analysis is performed in two stages: the within-case data analysis and the cross-case analysis.

3.5.1 Individual case analysis

In the within-case analysis, for each business park the interview responses were coded using the software ATLAS.ti. Coding is a process that helps to filter out the relevant quotes interviewees have made in an interview, and structures them into categories or assigns them to specific topics (Elliott, 2018). This process follows a deductive approach that is subjective to the interpretation of the researcher. In the primary round of coding, categories were defined using the variables in the theoretical framework as introduced in section 3.2:

1. Ambition and vision of sustainability
2. Proposed synergies
3. Performance
4. Location specific physical features
5. Location specific social features
6. Business specific features
7. Policy instruments
8. Project economic features
9. Organization of decision making
10. External context
11. Regional and local characteristics
12. Regional spatial-economic strategies and environment policy

Reviewing the interviews and secondary data was an iterative process that consisted of several rounds of revising the assigned codes and adapting categories. Some of the categories from the first round were relabelled, to more clearly indicate the contents of the variable. An example of a change is the variable 'sustainable and circular measures and initiatives at the park' that replaces the variables 'proposed synergies' and 'performance'. Reason for this change is that business parks are in the middle of developing, exploring and implementing all kinds of sustainable and circular initiatives. The polarity of assigning them to either 'proposed' or 'performance (read: implemented measures)' does not accurately represent practice. The new variable provides a more comprehensive approach to the sustainable and circular development process of the park. Another example is the variable 'Organisation and actors' roles' that replaces 'Organization of decision making'. During the interviews, it was emphasised the roles of various actors are important in the development of the parks, not just in decision making but e.g. also in organising the collective initiatives. Ultimately the following ten main variables were used to evaluate the business parks.

Ultimately, individual case study reports were written structured in ten categories that allow for comprehensive and in-depth analysis of the current practices, initiatives and developments at the business parks:

1. Initiation, vision and ambition
2. Organization and actors' roles
3. Sustainable and circular initiatives at the park
4. Physical location specific and business specific features
5. Social location specific and business specific features
6. Regional and local characteristics
7. Regional spatial-economic strategies and environment policy
8. Policy instruments
9. Economic context
10. External context

Within each variable/category, information is further aggregated into sub-sections, with the objective of easier navigation of the large amounts of information in the sections. The sub-sections and titles were defined through various methods: by using information in the literature review, e.g. for the sustainable and circular initiatives; using the sub-factors from Valladolid (2021), e.g. for Policy instruments; or by identification of reoccurring theme's and topics in the interviews and secondary data, e.g. in Economic context.

It is important to acknowledge that all information and any quotes used in these chapters have been obtained through personal communication, and are thus subjective to explanations and interpretations of interviewees and the researcher. Also, to ensure readability of the chapters the term 'personal communication' is left out of the APA-referencing in the text when using information provided through the interviews. Instead, the interviewee as source is indicated with: '(*interviewee function, 2023)'.* In some instances, citations from the interviews are added to illustrate or substantiate the information in the sections.

3.5.2 Cross-case analysis

In the cross-case analysis, the four individual cases are compared to determine the main similarities and differences between the business parks. Instead of providing an evaluation of each variable from the framework, the results are aggregated into six theme's to cover the main similarities and differences. Theme's used in the cross case analysis are: (1) Organizational structure and development approach; (2) The explored and implemented sustainable and circular initiatives at the parks; (3) Policy and strategies; (4) Social and physical park characteristics; (5) Regional and local characteristics; (6) Financial and economic context.

4 CASE STUDIES

This chapter presents the individual case analyses of the business parks and provides and answer on sub-research questions 2 and 3, that read "*What are the current policies and strategies on sustainable and circular development of business parks by the national, provincial and municipal governments?"* and *"What are the current practices, initiatives and developments at sustainable and circular business parks in Zuid-Holland?".*

The first section of this chapter investigates the (inter)national and provincial policy and strategies that relate to sustainable and circular development of business parks. Followed by the four individual case reports.

4.1 EUROPEAN, NATIONAL AND PROVINCIAL POLICY AND STRATEGIES

The central government prepares policy on national and international issues, and forms the basis for legislation ratified by the Dutch Parliament. Provinces are responsible for translating national policy into the regional context. Environmental management policy is related to spatial planning, for which the province is (partially) responsible by e.g. developing regional plans setting out zoning guidelines for the location and expansion of residential, industrial and commercial areas such as business parks, as well as regulating emissions from road transport, industry and other sources. Provincial authorities 'play a key role in stimulating the use of sustainable energy and in meeting targets for the production of renewable energy and for provision of adequate space for the construction of wind energy parks'. Moreover, they are 'responsible for granting environmental permits stipulating the limits' and 'enforcement of environmental regulations by large companies' (Ministry of Infrastructure and Water Management, 2012). The Municipalities are largely responsible for the implementation of national policy on environmental management. Municipal authorities 'prepare local regulations and have both the legal and financial means to implement and enforce decisions and regulations' (Ministry of Infrastructure and Water Management, 2012).

Per January 2024, laws for spatial planning, housing, infrastructure, the environment, nature and water changes from the current situation in the new 'Environment and Planning Act of the Netherlands'. For this reason, the current spatial planning and environmental management approach is not explained in further detail. This section presents current national and provincial policy and strategies related to sustainable and circular development of business parks. Municipal policy is discussed per case.

4.1.1 International and national environmental policy and strategies

The Dutch government is responsible for national regulation that can support or force business parks into sustainable and circular development. An important remark both Valladolid (2021) and van der Bent et. al. (2022) have made, is that regulation sometimes forms a barrier for the implementation of synergies, collaborations and innovation. Table 4.1 provides an overview of current policy, a more detailed explanation is provided in Appendix F.

Table 4.1 Overview international and national policy

Level	Theme	Policy title
International	Climate (Informatiepunt Leefomgeving, n.d.-c)	The Paris Agreement *(NL: VN-klimaatakkoord van Parijs)*
		EU Green deal
National		The Climate Act *(NL: Klimaatwet)*
		Climate Plan (*NL: Klimaatplan)*
		National Climate Agreement *(NL: Klimaatakkoord)*
		The Environment and Planning Act *(NL: Omgevingswet)*

	Energy transition (Informatiepunt Leefomgeving, n.d.-b)	The National Strategy on Spatial Planning and the Environment *(NL: Nationale Omgevingsvisie)*
		Regional Energy strategies *(NL: Regionale Energiestrategieën (RESsen))*
		The Environmental Quality Decree of the Netherlands *(NL: Besluit kwaliteit leefomgeving (Bkl))*
		Municipal programs for energy transitions *(NL: Gemeentelijke Programma's voor energietransities)*
		Vision on Heat Transition. *(NL: Transitievisie warmte)*
EU	Energy efficiency (Informatiepunt Leefomgeving, n.d.-a)	Energy efficiency directive
National		Energy saving obligation from Environmental Management Activities Decree *(NL: Energiebesparingsplicht uit Activiteitenbesluit Milieubeheer)*
		Energy label C obligation for offices (NL: Energielabel C-verplichting kantoren)
	Circular economy (Ministry of Infrastructure and Water Management., 2023b)	Government-wide programme for a Circular Dutch Economy by 2050 *(NL: Rijksbrede programma Nederland circulair in 2050)*
		Raw Materials Agreement (NL: Grondsoffenakkoord)
		Transition agendas: zooming in on five sectors (NL: Transitieagenda's: inzoomen op 5 sectoren)
		Circular economy implementation plan 2019-2023, 2020-2023, 2021-2023. (NL: Uitvoeringsprogramma Circulaire Economie 2019-2023, 2020-2023 & 2021-2023)
		National Circular Economy Programme 2023-2030, (NL: Uitvoeringsprogramma Circulaire Economie 2023-2030)
		Government-wide programme for a Circular Dutch Economy by 2050 (NL: Rijksbrede programma Nederland circulair in 2050)
		Raw Materials Agreement (NL: Grondsoffenakkoord)

4.1.2 Provincial policy and strategies

The province of Zuid-Holland is the link between the national government and the municipalities in the province, as well as with other actors at business parks. To evaluate current provincial policy and strategies in Zuid-Holland, a policy officer on circularity in business parks at the province of Zuid-Holland was interviewed. Moreover, secondary data used in the chapter includes government documents, including provincial programs and strategies, and research by van der Bent et al. (2022).

The policy officer at the Province of Zuid-Holland explains there are three strategies the province of Zuid-Holland has that touch sustainable development and circularity at business parks:

1. The strategy 'Circular Zuid-Holland: Accelerate together' *(NL: Strategie Circular Zuid-Holland: Samen versnellen)* of which business parks are a small section. "This is actually more are going to focus on it, an entry point" he explains.
2. The 'Business park strategy Zuid-Holland' *(NL: Bedrijventerreinenstrategie Zuid-Holland)*, that includes sustainability at business parks.
3. The Circular Zuid-Holland Spatial Strategy *(NL: Ruimtelijke strategie circulair Zuid-Holland)*, that highlights the spatial side of circularity more. Business parks have a significant role in the circular economy, especially as they often have a high environmental category and are water-bound, which are the hot-spots for circularity" (Policy officer province of Zuid-Holland, 2023).

4.1.2.1 Circular Zuid Holland: Accelerate together (2019)

The strategy Circular Zuid-Holland: Accelerate together encompasses the regional strategy to achieve the national objective of circular economy by 2050. The policy officer explains business parks are a small section of the strategy.

The strategy focusses on four out of five transition themes the national government has established in the national raw materials agreement: the construction sector, plastics, biomass and food, and the manufacturing industry. The strategy describes five lines of action for the Province: (1) Boosting networks & chain collaboration; (2) Develop and share knowledge & innovation; (3) Update policy & regulations; (4) Designing the physical living environment; and (5) Purchasing and tendering" (Province of Zuid-Holland, 2019).

Business parks are part of the theme 'construction sector'. The strategy describes circular initiatives in business parks must be stimulated in development, construction and maintenance of the parks. This translated objectives such as: flexible and modular construction which enables businesses to expand with growth of the company and expedites moving new residents into existing buildings; the reuse of residual flows at the parks for waste reduction; the identification of future steps towards circular business parks; and developing practical tools and support for the business parks in Zuid-Holland. The latter will be part of an integral sustainability approach in coordination with for example the 'MRDH's Next Economy Business Parks program' (Province of Zuid-Holland, 2019).

4.1.2.2 Business park strategy Zuid-Holland (2020)

The Business park strategy Zuid-Holland contains three policy lines for future proof business parks: (1) Sustainable development of the business parks; (2) a qualitative and quantitative balance in the supply and demand of business parks; and (3) better use and functioning of existing business parks (Province of Zuid-Holland, 2020).

The province states business parks are sustainable and future proof when they are considerate of "'their surroundings and the available space, buildings, raw materials, waste, water and energy, biodiversity, mobility and people" (Province of Zuid-Holland, 2020). Some of the highlights of the strategy include:

- The basics at the park have to be in order. This indicates that the parks are clean, whole and safe.
- Some degree of organization is required to progress sustainability at the parks. This can take different forms, including an association of entrepreneurs or a BIZ.
- For sustainable energy the parks need to focus on energy efficiency and sustainable energy generation. The Province stimulates and facilitates this, but businesses and business parks are the key actors in the implementation.
- Climate resilience of business parks needs to be improved by tackling heat stress and water nuisance at the parks.
- Increasing greenery at business parks contributes to biodiversity, climate resilience, and a healthy and enjoyable work environment. Improvements can be made via green façades or roofs, and in the public areas.
- To improve circularity at the parks, three approaches are recognized. First, exchanges of residual and waste streams. Second, researching the waste streams at the parks to enable waste exchanges. And lastly, there should be areas at the business parks that provide information and support for businesses on circularity and their residual streams.
- A healthy living environment at business parks should be facilitated by ensuring the parks are inviting for healthy activities such as walking, bicycling etc.
- Mobility and accessibility are also an important theme in the strategy. Accessibility of business parks in an important factor for companies to establish at a park. Employees increasingly yearn for possibilities to use public transportation to work and business parks also largely influence traffic in surrounding areas (Province Zuid-Holland, 2020).

4.1.2.3 Circular Zuid-Holland Spatial Strategy (2022)

The Circular Zuid-Holland Spatial Strategy describes the spatial organization of circular activities in the province of Zuid-Holland to achieve a fully circular economy in 2050. The policy officer explains this strategy "highlights the spatial side of circularity more. You see that business parks have a significant role in the circular economy, especially as they often have a high environmental category and are water-bound, which are the hot-spots for circularity" (Policy officer Province of Zuid-Holland, 2023). The strategy follows three pillars.

Pillar one entails developing and strengthening the circular main structure and the essential spatial conditions. This includes a "healthy and circular soil and water system; connection to a sustainable energy system; a logistics system that is tailored to circular material streams; and converting the waste system to a raw materials and residual flows system" (BVR et al., 2022, p. 7).

The second pillar aims to create spatial links that enable development of circular chains. These spatial links include areas for sourcing, production and processing of materials, as well as space for circular hubs to organize the circular material flows and connect with users (BVR et al., 2022).

The last pillar focusses on 'circular arena's', that are area-oriented collaborations between actors in the province including inhabitants, the government, entrepreneurs, knowledge institutions and social organizations. In order to realize a circular economy, actors and areas need to collaborate (BVR et al., 2022).

4.1.3 Financial support and subsidies

National, provincial and local authorities offer financial support and subsidies for sustainable and/or circular development of business parks or businesses. Below the options for financing that are currently in effect (december 2023) are summed, a detailed explanation of the options is provided in Appendix G.

- An Entrepreneurial fund
- Business Investment Zone (BIZ)
- Business association
- Other municipal of provincial specific initiatives
- Subsidies at the national level:
  - Energy investment deduction (EIA)
  - Investment subsidy for Sustainable Energy and Energy Saving (ISDE)
  - Stimulation sustainable energy production and climate transition (SDE++)
  - Environmental investment deduction (MIA) and Random depreciation of environmental investments (Vamil)
  - Accelerated climate investments in industry (VEKI)
  - Demonstration Energy and Climate Innovation (DEI+)
  - Subsidies for energy innovation Top Sector Energy
  - WBSO tax scheme for research and development
- Subsidy at the Province of Zuid-Holland
  - Subsidy sustainable business parks
  - Business parks planning subsidy

4.2 CASE 1: AMBACHTSEZOOM, HENDRIK-IDO-AMBACHT

Ambachtsezoom is a business park in the municipality of Hendrik-Ido-Ambacht. To evaluate the park, three actors have been interviewed:

- The project manager of Ambachtsezoom, employed by the municipality;
- The park manager, employed by a park management organization and hired by park Ambachtsezoom;
- And an entrepreneur at the park that is member of the board/park management.

Additionally, publicly available documents and information, as well as documents supplied by interviewees have been consulted.

4.2.1 Initiation, vision and ambition

This section elaborates on the initiation process of Ambachtsezoom, and the sustainable and circular vision and ambition of the park.

4.2.1.1 Initiation

Business park Ambachtsezoom is a greenfield project in the municipality of Hendrik-Ido-Ambacht (HIA). The municipality is the initiator and project manager for the park. The first plans to develop a business park in the area date back to 2002 (Municipality HIA, 2018). But plans to develop a sustainable and circular business park started later, after the local council became inspired after a visit to Park Park20|20, a business park in Hoofddorp that's based on Cradle to Cradle principles (Project manager, 2023). The definitive land-use plan for circular business park Ambachtsezoom was approved in 2018 (Municipality of Hendrik-Ido-Ambacht, 2018).

4.2.1.2 Vision and ambition

In preparation of the park the municipality developed a vision, values, ambitions and targets for the park in collaboration with a variety of actors, including the local business association (NL: Ondernemersvereniging), South-Holland Environment Agency, network operator Stedin and circular experts. These are anchored in a manual named "Handboek Circulariteit Bedrijvenpark Ambachtsezoom" (Municipality HIA, 2018; Project manager, 2023; OD205 et al., 2022)

The vision of Ambachtsezoom reads "In a creative and entrepreneurial manner we work together and take our responsibility for the next generation in Hendrik-Ido-Ambacht. Ambachtsezoom is a by cradle-to-cradle and circularity inspired business park where the people are the centre" (Ambachtsezoom, 2022).

The ambition of Ambachtsezoom is to be the "first full-service circular business park in the Netherlands", and to "reduce negative impact and strive towards a large, positive footprint for human and planet" via a Cradle to Cradle approach (Ambachtsezoom, 2022). The project manager explains the ambition is translated into eight objectives for water, air, soil, energy, biodiversity, human, materials, and profit. The core of the objectives is to improve in comparison to the current situation (Q1.1, Project manager, 2023).

> Q1.1: *"These are extraordinary objectives for a business park. In essence, we say the current situation has to improve. We have performed a baseline measurement and we want that all these eight theme's improve as a result of development of the park. Which is peculiar as the area used to be agricultural area" – Project manager, 2023*

4.2.2 Organization and actors' roles

This section elaborates on the roles of the municipality, park management, the park manager and entrepreneurs at the park in sustainable and circular development of Ambachtsezoom.

4.2.2.1 Municipality and project manager

The municipality of Hendrik-Ido-Ambacht is initiator for the development of circular business park Ambachtsezoom. They have set the ambitions and vision for the park, complemented by the manual on circularity that contains the requirements for businesses to establish at the park. The project manager of Ambachtsezoom is employed by the municipality, and responsible for the acquisition of plots at the park and monitoring if development is in compliance with the requirements in the manuals. The municipality guides business during the entire development process, via conversation and by providing manuals and external experts on e.g. circularity, from the first conversations until construction has been completed. Currently, the project manager also partakes in the park management board, until the park is further developed (Project manager, 2023).

4.2.2.2 Park management

Businesses that establish at Ambachtsezoom become part 'cooperative association park management Ambachtsezoom'. This association elects board members for the park management. Other members of the park management are the park manager, that responsible for the execution of the day-to-day tasks of park management, and the municipality for the time being (Park manager, 2023; Ambachtsezoom, 2020).

Park management at Ambachtsezoom has different roles at the park, e.g. executive, initiating or advising roles for topics including sustainability, safety, liveability and collectivity at the park. Among other tasks, park management is responsible for collective safety and security via collaboration with a local security company and smart security camera's. They also contribute to achieving the sustainable and circular objectives of the park though the organization of "an ATES-system, active waste management, collective material purchase, water management and striving for BREAAM certified buildings and terrain" (Ambachtsezoom, 2020). Moreover, they are responsible for "management and maintenance of the public domain at the park, signage and mobility optimisation". And lastly, promoting relationships at the park and other collective services (Ambachtsezoom, 2020).

4.2.2.3 Park manager

The park manager at Ambachtsezoom is employed by a park management organization. Commissioned by the park management at Ambachtsezoom, the park manager is responsible for the day to day execution of Park management a couple of hours a week. He explains that the members of the park management participate on a voluntary basis, and don't have much time to implement the policies they develop and that is where the park manager comes in (Park manager, 2023).

The park manager is also the link between the network of entrepreneurs, the municipality and the park management. He is for example for communicating the needs of the entrepreneurs to park management, or informing and checking with entrepreneurs who wants to participate in the initiative the park management instructs the park manager to implement. The connection with entrepreneurs is very important to ensure they are familiar with the park manager and know who to contact in case they have any questions or concerns and so their needs are met (Park manager, 2023).

The exact range of tasks of the park manager are highly dependent on the specifics of the park. It always starts with the basis of for example maintenance of the park and safety and security. But for a newly developed park such as Ambachtsezoom, duties differ than those at an older park where park management tasks haven't been executed in 20 years (Park manager, 2023). Tasks of the park manager

described on the website of Ambachtsezoom are: “The first contact point for entrepreneurs at the park; Supervision, management and maintenance for a clear, complete and safe business park; All current affair at the park; Assisting in collective initiatives such as energy saving, minimising environmental effects, reuse of waste streams, collective purchase and sharing economy”; and organisation of business meetings with the entrepreneurs and municipality with the aim of stimulating social interaction between companies at the park, other organisation and associations, and the municipality (Ambachtsezoom, 2020).

4.2.2.4 Entrepreneurs and businesses

Entrepreneurs at the park have their core business as main focus. In the development of the park they are responsible for developing their real estate in compliance with the requirements the municipality has for Ambachtsezoom. In progression of sustainability and circularity at the park, they are key in the implementation of new initiatives at the park and establishing new synergies and collaborations at the park. Something the park management and park manager facilitate and support.

4.2.3 Sustainable and circular initiatives at the park

This section elaborates upon the sustainable and circular initiatives that are explored, implemented or passed over in development of business park Ambachtsezoom.

4.2.3.1 Business individual energy efficiency, renewable energy generation and storage

Businesses at Ambachtsezoom are required to be all-electric and self-sufficient in their energy supply. A preparatory research revealed this option to have the lowest costs and allows the most freedom for Ambachtsezoom (Municipality HIA, 2022). Most businesses have installed solar panels on their rooftops to accommodate their electricity demand, and businesses are advised to instal heat pumps for heating and cooling their buildings. They have the option to instal thermal energy storage in ATES’s, potentially in collaboration with neighbouring businesses. Lighting within buildings and outside are LED, and businesses are urged to use dimmable appliances (Municipality of Hendrik-Ido-Ambacht, 2022).

The municipality provides business with the possibility to earn a discount on the price of their plot, by implementing additional sustainable and circular measures. Among the measures, is generating a surplus of electricity of at least 5 percent, implementing grey water facilities such as grey water toilets, installation of bird houses and prevention of toxic substances and materials. The municipality is also open to alternative suggestions by businesses (Municipality of Hendrik-Ido-Ambacht, 2022; Project manager, 2023).

4.2.3.2 Circular building design and construction

Businesses at Ambachtsezoom are required to develop their real estate using circular design and cradle to cradle principles. The municipality follows the same rules for the design and construction of the public area at the park. Materials that are used in the construction of the building have to be cradle to cradle certified, and design for disassembly is expected. These requirements translate into use of demountable montage techniques such as screws and bolts, clicking systems, etc. Techniques such as gluing, kitting and mortaring must be avoided. Installations have to be pluggable and system walls and ceilings are required. Standardisation and modularity are principles that are considered in the design of real estate, to support adaptability and reusability of materials and spaces (Project manager, 2023; Entrepreneur, 2023; Municipality of Hendrik-Ido-Ambacht, 2022).

Entrepreneurs and the municipality are required to establish a material passport in collaboration with an external party (Entrepreneur, 2023). This passport provides all relevant information on the

materials that have been used in construction at the park, which contributes to future use of the materials (Municipality of Hendrik-Ido-Ambacht, 2022).

4.2.3.3 Exchange of energy, materials and water

Sharing of resources and materials is a growing initiative at the park. An example of a material synergy at the park is a company that uses 'waste' carton and packaging materials from another company for the packaging and transport of the products in their web shop (Park manager, 2023). In the future, the park manager aims to gain more insight in the waste streams at the park and facilitate in forming more of these types of collaboration (Q1.2, Park manager, 2023).

> Q1.2: *"For circularity the cooperation Ambachtsezoom can still make progress in how to connect and link entrepreneurs. I increasingly get more insight in the waste streams [...] We have two window frame companies that have a lot of waste that can literally be used as raw material one street over as packaging material [...] That is the next phase at Ambachtsezoom, how can we improve this? We have to gain insight in the waste streams, and what companies raw materials and waste materials are." – Park manager, 2023*

Ambachtsezoom aims to create resource loops at the park as much as possible. The park facilitates future implementation of symbiosis for energy, materials and more, as can be concluded from a few of the measures described above. As the park is relatively new, finding synergies takes a while. More synergies are foreseen for the future.

4.2.3.4 Collective utilities and infrastructure

The municipality has explored the possibility of connecting to the district heating network of HVC Dordrecht. This initiative has not been pursued as the investment costs for such a network were too high because of the distance between the park and HVC were too large (Project manager, 2023).

Currently, Ambachtsezoom is in the process of establishing an energy cooperation. Currently, a number of businesses at the park generate a surplus of electricity that is fed into the grid. The park wants to combine the excess electricity from solar panels at the park, and enable the possibility to share the energy between companies at the park in addition to selling to the grid (Entrepreneur, 2023; Park manager, 2023).

4.2.3.5 Collective waste management

Waste collection is organized collectively at Ambachtsezoom. Park management has selected two local waste management parties the entrepreneurs can enter into contracts. Via this measure the park aims to limit waste transport related emissions, as the chosen parties are local the distance between them and the park is limited. Moreover, as there are only two parties that collect waste at the park, collection moments can easily be combined resulting in less transport (Park manager, 2023).

Waste separation is a responsibility of the businesses themselves and not something that is organized collectively. Additionally, there is limited to no insight in the waste streams at the park. The next step foreseen by park management is to gain more insight into the waste streams at the park, to enable facilitation of material and waste synergies (Park manager, 2023; Entrepreneur, 2023).

4.2.3.6 Sustainable mobility and transport

Sustainable mobility is stimulated by the municipality, but entrepreneurs are responsible for the organization themselves. A number of businesses have installed electric vehicle charging stations on their plots (Entrepreneur, 2023). The interviewed entrepreneur explains they want to switch to electric

vans in the future, but plans to wait until vans have more powerful electric batteries. They also mention installation of charging stations on their plot that are publicly available (Entrepreneur, 2023).

4.2.3.7 Collaborative models for appliances, tools and services

Businesses at Ambachtsezoom share their assets in a variety of ways, for example by renting their service machines such as aerial work platforms to each other. Another example are the construction contractors and frame experts at the park that 'share' their personnel. Companies 'hire' or 'employ' employees of the other company then they require additional personnel or lack enough projects for all of their staff (Park manager, 2023).

4.2.3.8 Collective commercial firm facilities and provision of services

Park management at Ambachtsezoom is responsible for a number of collective services, including the optic fibre network at the park, security, surveillance and camera systems. They also facilitate for example collective checking of fire extinguishers at the park, and the park manager is in the process of organizing AED's . Furthermore, maintenance and upkeep of the communal area, by e.g. gardeners, is something the park management organizes (Park manager, 2023; Project manager, 2023). Entrepreneurs are offered participate in this initiative for maintenance of their private outside area, which provides them with an economic advantage and again limits transport by different parties (Entrepreneur, 2023).

4.2.3.9 Knowledge sharing, guidance and communication

The municipality has developed several documents that function as manuals and guides on topics including the circular vision and ambition of the park and how businesses are required to adapt this vision in their real estate, climate and biodiversity at the park and the process for establishing at the park. These guides and manuals are freely available on the website of Ambachtsezoom.

Entrepreneurs that want to establish at Ambachtsezoom also receive guidance from a circular expert that is provided by the municipality and included in the price for the plots at the park. This expert guides the entrepreneurs during the entire development process and is available to answer all their questions (Q1.3, Entrepreneur, 2023; Municipality of Hendrik-Ido-Ambacht, 2022).

> Q1.3: *"There was a circular expert that was hired by the municipality that you could request meetings with. So during the design phase you where guided [...] the municipality organized that really well." – Entrepreneur, 2023*

Moreover, Ambachtsezoom has a communication app similar to a social media platform that has been developed specifically for the par. The app is used to share the newsletter and for people at the park to connect by adding each other, sending messages and posting things. The app can also be used by businesses to request of offer materials, which enables new synergies (Project manager, 2023; Entrepreneur, 2023).

4.2.3.10 Flora and fauna

Ambachtsezoom strives towards flourishing flora and fauna at the park. To support biodiversity in the area and provide an enjoyable environment at the park. the municipality has created an area at the park called the "Middeltocht". This area consist of a canal surrounded by plants to create a natural habitat for insects, amphibians, birds and other animals. Across the park, insect and bird houses are installed, and (temporary) flower fields are present. Businesses are also encouraged to contribute to biodiversity at the park, e.g. via the requirement to have a green area of 3 meters that connects it to the public road at the park and to install green roofs and green facades (Municipality of Hendrik-Ido-Ambacht, 2022; Park manager, 2023).

The flora and fauna at Ambachtsezoom is in full development, as growing trees, plants and flowers is a process that takes time. The park is currently in the process of becoming home to a number of bee colonies, which they will produce honey with (Project manager, 2023; Entrepreneur, 2023).

4.2.4 Physical location specific and business specific features

This section elaborates upon the physical location specific features of business park Ambachtsezoom.

4.2.4.1 Owner of land

The municipality is the owner of the plots and project manager for Ambachtsezoom. Consequentially, the municipality is the actor that determines the vision for the new park and impose strict requirements for businesses to fit this vision. Implementation of a new vision or rules, and imposing new sustainable and circular requirements at the park would be more difficult when the park would already exist. At existing business parks, many different building owners, renters and businesses are present that each have different interests and opinions making it harder to implement such requirements (Project manager, 2023).

4.2.4.2 State of building stock

As all real-estate at the park is newly developed in an energy neutral and self-sufficient manner. The buildings are all future proof and compliant to national requirements and regulation, entrepreneurs are all set (Q1.4, Park manager, 2023).

> Q1.4: *"If you establish at Ambachtsezoom, as entrepreneurs you have nothing to worry about for the future. You are energy neutral, you are natural gas free, you supply or generate electricity, so everything is settled." – Park manager, 2023*

4.2.4.3 Accessibility

Ambachtsezoom is located directly next to the highway and thus highly accessible by car and for freight transport. The park is also at walking distance from a metro station and bus station.

4.2.4.4 Proximity and clustering of companies

The proximity of businesses at Ambachtsezoom is recognized by entrepreneurs as an advantage and useful in finding collaborations for sharing of services and materials. They find is useful to be able to easily and quickly contact other companies at the park when they need a service, product, machinery etc. It allows them acquire the product or service fast and near, which also provides some environmental advantages as the product is transport over a shorter distance (Park manager, 2023).

4.2.5 Social location specific and business specific features

This section elaborates upon the social location specific features of business park Ambachtsezoom.

4.2.5.1 High degree of organization

Park management at Ambachtsezoom consist of the municipality, a park manager and a board of entrepreneurs at the park. Together they are responsible for organising, initiating or advising on a number of services and initiatives at the park. This high degree of organization facilitates a hands on approach for initiatives, and keeps all parties involved.

4.2.5.2 Relationship and communication between businesses

Employees at the park are very familiar with each other, which creates a safe and pleasant environment for everyone on the park. This results in some type of social control and everyone keeps an eye out for each other and their materials and buildings. This is something park management wants

to accentuate and amplify (Park manager, 2023). The mobile application that the park has is a unique feature of park Ambachtsezoom, that facilitates communication between the businesses at the park.

4.2.5.3 Sustainable and circular ambition and attitude of businesses

The motivations of businesses to establish at Ambachtsezoom diverge. Some have sustainability targets and goals that align with those of Ambachtsezoom. Others establish at the park because it is the only option available that fits their needs (Entrepreneur, 2023; Park manager, 2023). However, as the requirements for businesses to be allowed to establish at the Ambachtsezoom are strict, in the end the businesses at the park are likeminded and all ambitious when it comes to sustainability and circularity (Q1.5, Park manager, 2023)

> Q1.5: *"At other business parks there are often businesses that are pioneers and leading in sustainability/circularity. At Ambachtsezoom this is not the case, as everyone is at that level."* *– Park manager, 2023*

The level of sustainability and circularity at Ambachtsezoom is new for all entrepreneurs at the park. This creates an environment and attitude at the park where businesses are more open to try new things as everyone is still figuring things out. At existing parks there are certain habits and 'rules of the game', and businesses are less open to trying and implementing new things. People also are more curious for information and to know how things at the park work (Park manager, 2023).

Not all entrepreneurs at the park were ambitious to be sustainable and circular from the beginning. They felt the requirements were extreme and in some cases refused or opposed certain measures. However, after implementing the requirements and experiencing the advantages, their attitude changed and they are actually glad they had to implement all these sustainable measures.

This experience can also influence how they implement circularity and sustainability in their own business operations. The entrepreneur that was interviewed explains that they previously weren't prioritizing it in their business operations. But after experiencing the development at the park and learning about the possibilities and advantages they try to implement it in their work where possible. (Q1.6, Entrepreneur, 2023).

> Q1.6: *"In the beginning I resisted to the rules at the park. I am a contractor/builder so I thought what nonsense I can't use glue, can't use masonry, everything has to be demountable. So I had to revise my way of thinking and eventually I realised I could keep resisting but it would be better to embrace it. So I recommend all entrepreneurs to please embrace circularity and sustainability. Don't just look at the financial aspects, but also look at the chances and opportunities and especially look at the future." – Entrepreneur, 2023*

4.2.5.4 Sustainable image of park

For the municipality and businesses at Ambachtsezoom the circular and sustainable image of the park contributes to their own image as well. By developing and establishing at the first circular business park in the Netherlands, they demonstrate they are serious about the environment and sustainability. Businesses and the municipality are proud of the park, and what they have accomplished. They communicate this by inviting their customers and interested parties to the park, publishing interviews and more (Entrepreneur, 2023; Park manager, 2023)

4.2.6 Regional and local characteristics

This section elaborates upon the characteristics of the region and area where business park Ambachtsezoom is located.

4.2.6.1 Characteristics of municipality

The municipality Hendrik-Ido-Ambacht is a relatively small municipality. As a result, the project manager of Ambachtsezoom is responsible for a wide range of tasks. The coordination of development at the park is very centred, and doesn't depend on a wide range of actors (Project manager, 2023)

As previously explained, the municipality decided the park would be circular after they became inspired by another business park. This ambitious attitude was translated into very strict and progressive requirements for the development of the park. They decided the park could be a pilot to see how they could further implement sustainability and circularity in the municipality. Moreover, the project manager of the park was specifically selected by the municipality due to his ambitious and progressive vision, that was in line with that of the local council had (Project manager, 2023). The municipality also is highly involved with the entrepreneurs in the municipality (Entrepreneur, 2023).

Support of the local council is mentioned as an important factor in the development of Ambachtsezoom. They have to be supportive of the rules at the park and strict towards entrepreneurs, to ensure the development of the park occurs following the requirements and ambitions of the park. The park manager explains that entrepreneurs sometimes contact the local council or alderman to request exemption for certain rules or requirements at the park. In these cases it is very important that they are strict and support the ambitions of the park. He elaborated that this might be difficult, but the local politicians in Hendrik-Ido-Ambacht do this very well (Project manager, 2023).

4.2.6.2 Grid capacity and grid congestion

In early development stages of the park, the municipality and network operator Stedin have anticipated on the effects of the park on the electricity grid. This proactive approach to prevent grid congestion at the park, has enabled the development of an all-electric park that can feed electricity into the grid without congestion problems. This energy is regionally deployed. (Project manager, 2023).

4.2.6.3 Sectors, industry and business parks in area

Ambachtsezoom functions as an example for other business parks and municipalities. The park regularly has visitors that receive presentations and tours around the park, to learn about the current practices and development of the park (Entrepreneur, 2023)

Other business parks in the region also function as examples for Ambachtsezoom. An example is a business park in the municipality that already has its own energy cooperation. Ambachtsezoom uses this park as an example for the establishment of its own energy cooperation (Entrepreneur, 2023).

4.2.7 Regional spatial-economic strategies and environment policy

This section elaborates on the regional spatial economic strategies and regional environment policy relevant in sustainable and circular development of business park Ambachtsezoom.

4.2.7.1 Regional and local importance of the park

Ambachtsezoom is a business park for local entrepreneurs. The municipality has a strict vision for the businesses that can establish at the park, they have to contribute to the ambitions of the park and be local or 'lightly regional' (Project manager, 2023).

4.2.7.2 Sustainability policy and strategies in the municipality

The municipality of Hendrik-Ido-Ambacht is currently in the process of developing circular and sustainable policies. Around the time the project of Ambachtsezoom started, the local council became enthusiastic about sustainability and circularity and decided the park could function as a pilot for the theme's. The project provides valuable lessons that are used in the development of policy and strategies in the municipality, and for business parks in the region (Q1.7, Project manager, 2023).

Q1.7: *"Around the time I joined the project, the local council of Hendrik-Ido-Ambacht became enthusiastic about circularity and sustainable development. They decided that Ambachtsezoom would become an example for the municipality [...] Currently, I have several colleagues dedicated to sustainability. When I started this was not the case, so slowly the municipality started embracing sustainability and circularity. [...] So the municipality is currently developing policy on all fronts, and the development of Ambachtsezoom was ahead of this." – Project manager, 2023.*

4.2.7.3 Scarcity of available land for business/commercial development

There is scarcity of available land for industrial and commercial development in the region. Consequentially, businesses sometimes have to opt for parks that are newly developed following ambitious sustainable and circular principles. The entrepreneur that was interviewed explains he had been looking for real-estate that had space for an office, construction area and an outside area. This was not available in existing business parks in the region, thus the only option for them was to develop it themselves. Plots that fit their expectations were only available at Ambachtsezoom, and thus came with circular requirements (Entrepreneur, 2023).

4.2.7.4 Regional Energy Strategy

The Regional Energy Strategy Drechtsteden 1.0 does not mention business park Ambachtsezoom specifically, whilst other business parks in Hendrik-Ido-Ambacht have been mentioned in the strategy. The development of the park is however in line with the sustainable ambitions that are mentioned in the RES, e.g. the development of energy efficient real estate and installation solar panels on commercial rooftops (Drechtsteden, 2021). Electricity surpluses at Ambachtsezoom can be part of the sustainable energy transition in the region, but this is currently not recognized in the strategy.

4.2.7.5 Vision on Heat Transition.

Ambachtsezoom is included in the Vision on Heat Transition of Hendrik-Ido-Ambacht. In the strategy, the park is labelled as a 'new construction location' that is developed following latest natural gas free and sustainable real estate regulation. The document explains development of Ambachtsezoom requires a customized approach, that is in line with the transition path foreseen for the specific area. The park has decided on an all-electric approach, that has been implemented already. The option of a district heating network was explored, but dismissed (Municipality of Hendrik-Ido-Ambacht & Over Morgen, 2021).

4.2.8 Policy instruments

This section elaborates upon the policy instrument relevant in sustainable and circular development of business park Ambachtsezoom.

4.2.8.1 Park policy

Ambachtsezoom has a solid park policy. The municipality is the owner of the ground at the park and has very strict requirements for the businesses that can to establish at the park. In the acquisition of the plots, they only sell plots to businesses that are local and contribute to the circular ambitions of the park. Business that are to environmentally harmful or have no added value for the park, cannot establish at Ambachtsezoom. The less plots are available at the park, the more critical the municipality is in their selection for businesses to establish at the park. At present, they only sell plots to local businesses (Project manager, 2023; Entrepreneur, 2023).

Moreover, the municipality has developed an extensive list of requirements businesses have to implement in their real estate at Ambachtsezoom. The project manager emphasized the important of sticking to the park policy, and to monitor if measures are actually implemented and agreements are

complied with (Q1.8, Project manager, 2023; Entrepreneur, 2023). There is no policy regarding business operations the park allows, as long as the environmental category doesn't exceed 3.2 (Project manager, 2023).

> Q1.8: *"The most important thing is to stick to the ambitions of the park. Many entrepreneurs want to negotiate the term and conditions, but you have to be very strict and be consistent in maintaining the ambitions. [...] You can always find reasons to deviate from the requirements [...] but once you allow that the floodgates open. [...] So retain the ambitions and stay stern [...] That is a lesson I learned and want to convey to other future developers of business parks." – Project manager, 2023.*

4.2.8.2 National regulation

National regulation and national government influence is mentioned as a potential factor that has contributed to the progressive and ambitious plan forming for Ambachtsezoom. Sustainability became a relevant issue in national politics during the beginning stages of development of the park, which influenced local councils to develop a circular and sustainable business park (Project manager, 2023).

4.2.9 Economic context

This section elaborates on the economic context of sustainable and circular development of business park Ambachtsezoom.

4.2.9.1 Upfront investments and long-term financial advantages

Developing at Ambachtsezoom is more expensive than buying or developing at a 'normal' business park. This is the result of larger upfront investments that are required for the implementation of the circular requirements of the park. Entrepreneurs often address this 'issue' in conversations with the project manager and park manager. They sometimes don't realise the long-term financial advantages these high costs have. These advantages include for example the possibility of generating energy surpluses that entrepreneurs can sell. Moreover, it is only a matter of time before other businesses also have to make these investments, as they have to comply with national regulation for a sustainable and circular future (Entrepreneur, 2023; Project manager, 2023; Park manager, 2023).

The park manager also mentions that one of one of biggest financial successes for businesses at the park are the increasing ground prices at Ambachtsezoom. Ground prices are increasing faster than the prices at existing, non-sustainable and circular parks, resulting in an increase in value of their real estate.

4.2.9.2 Financial incentives

As explained before, Ambachtsezoom offers a discount on the plot price if businesses implement additional, optional circular or sustainable measures. Businesses are open to implement these, but the entrepreneur explains that for many businesses the initial investments for the obligatory measures were already so high the additional measures was not financially lucrative. Potentially, more entrepreneurs will reevaluate implementing these measures in the future (Entrepreneur, 2023).

4.2.9.3 Business case and financial effects and situation businesses

Both of the variables mentioned above, and in previous sections of the chapter, substantiate the importance of a positive business case and financial effects of measures and initiatives for entrepreneurs.

4.2.9.4 National economic situation

In the years before Covid19, the nitrogen crisis, employment crisis, the Ukrainian war and energy crisis, the national economy was doing very well. Businesses preferred developing their own real-estate and

demand for commercial and industrial plots was very high. However, the factors named above have resulted in increasing development costs, increasing interest rates for loans etc. Consequentially, the demand for businesses to develop themselves is decreasing. Moreover, businesses that bought plots postpone the start of construction and development of new real-estate.

As businesses at Ambachtsezoom are self-sufficient in their energy supply, the increasing energy prices affected businesses at the park less than businesses that aren't self-sufficient. Some entrepreneurs at the park even make profits by selling energy back to the grid (Park manager, 2023).

4.2.10 External context

This section contains the remainder of variables that couldn't be assigned to the other evaluated categories, but were still discussed as relevant in the sustainable and circular development of business park Ambachtsezoom.

4.2.10.1 Social pressure to be sustainable

For businesses, pressure from society and their employees can influence the extent to which they incorporate sustainability in their business operations. Due to changing attitudes towards sustainability and increased awareness for the necessity for action, more companies feel pressure to become more sustainable (Entrepreneur, 2023).

4.3 CASE 2: DE BOEZEM, PIJNACKER

De Boezem is a business park in Pijnacker-Nootdorp, consisting of a newly developed section Boezem Oost, and an older section Boezem West. This chapter elaborates upon the development of the park, the sustainable and circular measures and initiatives at the park, and the variables that have an influence on them. To evaluate the park, three actors at the park have been interviewed:

- The project manager, employed at the municipality of Pijnacker-Nootdorp;
- The park manager, employed at a park management organization and hired by the park management of De Boezem;
- and an entrepreneur at the park that is the chairman of the park management of De Boezem since two years.

Additionally, publicly available documents and information, as well as documents supplied by interviewees have been consulted.

4.3.1 Initiation, vision and ambition

This section elaborates on the initiation process of De Boezem, and the sustainable and circular vision and ambition of the park.

4.3.1.1 Initiation

The municipality of Pijnacker-Nootdorp is the initiator of the newly developed section Boezem Oost, and the revitalisation of Boezem West. Boezem West was developed between the 1960's and 2001, and is mainly occupied by local SME's. Boezem Oost is an expansion of Boezem West, developed to enable the SME's in Pijnacker-Nootdorp to expand their business and relocate to Boezem Oost, amongst other reasons (Project manager, 2023). The final land-use plans for Boezem Oost were approved in 2016.

4.3.1.2 Vision and ambition

The future profile for the park is described as "a future proof and attractive business location", that is "evolved into a green and sustainable park where companies gladly establish and employees work happily" (Municipality of Pijnacker-Nootdorp, 2023).

The ambition for the parks is anchored in four pillars: a pleasant work environment, enjoyable residency, good and sustainable accessibility, and a climate neutral business park. Each pillar consist of various theme's that are all connected to each other and help develop the park in an integral manner. To illustrate, the pillar 'climate neutral' consists of circularity, energy transition and grid capacity and among theme's in the other pillars are sustainable mobility, climate resilience, greening and more (Municipality of Pijnacker-Nootdorp, 2023).

4.3.2 Organization and actors' roles

This section elaborates on the roles of the municipality, park management, the park manager and entrepreneurs at the park in sustainable and circular development of De Boezem.

4.3.2.1 Municipality

The municipality of Pijnacker-Nootdorp is project manager and initiator for development of De Boezem Oost and the revitalisation of Boezem West. The project manager at De Boezem, is also the project manager for development of Business park Heron.

The project manager at the municipality is responsible for the allotment of grounds at De Boezem and determines the requirements for businesses and which businesses can establish at the park. The project manager explains that the municipality previously didn't have specific requirements for real

estate at the park or the businesses that wanted to establish at De Boezem, just that the business fit the vision the municipality has for the park. The municipality did monitor the development plans businesses created, and sometimes encouraged businesses sustainable thinking to some extent. For example by suggesting grass paving instead of 'regular' parking spaces, or help determine how to utilize residual space on their plots. This approach changes in the new selection procedure, as further explained in section

The municipality has also been an important actor in the implementation of collective and individual sustainable measures at De Boezem. They have been the driving force behind the implementation of solar panels and other initiatives, by mobilising businesses and applying for subsidies. However, the project manager explains the tasks of being the driving force is too intense for the municipality to continuously pick up. They are also part of the e-team at the park that is developing a strategy for the energy transition at the park.

The municipality aims to adapt a more facilitating role in sustainable development of the park. This would entail a more prominent role for park management and entrepreneurs to recognize potential at the park and propose initiatives, which the municipality will the facilitate and support where possible. For example in communication and providing experts or via subsidies or legislation. The project manager emphasizes that the ambition to explore and implement measures and initiatives has to be present at the entrepreneurs, and that the municipality will facilitate these initiatives where possible (Project manager, 2023).

4.3.2.2 Park management

Park management at De Boezem consist of entrepreneurs at the park and the park manager (De Boezem, n.d.). The aim of park management is to create and maintain a future proof business park, and promote the interests of the entrepreneurs. Moreover, they are responsible for the organization of a variety of activities and services at the park, including safety and security at the park, maintenance, mobility etc.

Moreover, they are responsible for achieving the vision and ambition for the park in collaboration with the municipality and entrepreneurs at the park. Together with the municipality, they have been responsible for identifying and implementing a number of initiatives at the park such as installation of solar panels on rooftops and increasing energy efficiency of real estate at the park (Park manager, 2023; Chairman park management, 2023). Park management also has been responsible for collective application for subsidies. And is key in motivating and keeping entrepreneurs involved in sustainable developments at the park. The chairman comments this requires a constant push and pull strategy. Currently they are making efforts for initiatives such as shared mobility and collective waste management, and have many more plans for the future of the park (Park manager, 2023; Chairman park management, 2023).

4.3.2.3 Park manager

The park manager at De Boezem is employed by a park management organization in the region. Their role is to supports the park management in their approach to revitalise and improve the park, as the board members also have their core business to focus on and the duties of park management require a lot of attention and time. The park manager is responsible for the organization of collective services at the park, such as security, (law) enforcement, maintenance of the park, traffic safety and parking, as well as the development of theme's such as sustainability, mobility, circularity etc. (Park manager, 2023).

The park manager is familiar with the business operations and businesses at the parks, knows which services or resources they have to offer, what they might need. The park manager at De Boezem is also the park manager for all other parks in the municipality of Pijnacker-Nootdorp, including business park Heron. Thus they are the main point of contact for both the municipality, as well as the entrepreneurs at the business parks in the municipality.

The overview the park manager has regarding all developments and business operations at the business parks in the municipality, allows them to facilitate collaborations and synergies between companies. The park manager explains that generating business to business and relations between companies is one of the theme's they focus on, within park boundaries but also with other parks in the municipality (Park manager, 2023). Interviewees at both business parks and the municipality emphasize the pleasant the collaboration with the park manager, and the crucial role they have in (sustainable) development of the parks.

4.3.2.4 Entrepreneurs and businesses

Entrepreneurs and businesses at the Boezem can join the 'association business park De Boezem' voluntarily. This association represents the interests of the businesses at the park and enables the connection and cooperation between the businesses at the park.

Entrepreneurs at De Boezem are ultimately responsible for execution of sustainable development of the park. A large section of De Boezem is owned by the businesses that are located there. Accordingly, they are the actors that are in control of implementing sustainable energy and circular measures in their real estate and business operations (Municipality of Pijnacker-Nootdorp, 2023).

This is mainly important in Boezem West, as much of the real estate there is dated. Some entrepreneurs have already implemented a variety of sustainable measures, but a lot of potential is not utilized yet. In a meeting with entrepreneurs of the park, the municipality inventoried the willingness and plans of entrepreneurs at the park to invest in updating their real estate. A vast majority of the attendees at the meeting indicated they are investing in updates in within 5 years (Municipality of Pijnacker-Nootdorp, 2023) However, it is important to realise this is the response of the entrepreneurs that were attending this meeting of the business association, and thus not a reflection of all businesses at the park.

At Boezem Oost the real estate has been developed energy efficiently, so part of the energy transition has been set in motion already. However, there is still a lot of untouched potential at the park so entrepreneurs in this section are also key in the transition of De Boezem. The park management and municipality will guide and facilitate the entrepreneurs in the transition of the park.

4.3.3 Sustainable and circular initiatives at the park

This section elaborates upon the sustainable and circular initiatives that are explored, implemented or passed over in development of business park De Boezem

4.3.3.1 Business individual energy efficiency, renewable energy generation and storage

There is a high contrast between the energy efficiency of real-estate at Boezem Oost and West. The real-estate at Boezem Oost is all-electric, energy neutral and is energy self-sufficient. Businesses have implemented a variety of techniques and measures to achieve this, including energy efficient design, solar panels, heat pumps (Park manager, 2023). At Boezem West, most of the real estate at Boezem West was developed before 2001 (Municipality of Pijnacker-Nootdorp, 2023). A share of entrepreneurs at the section have implemented measures to increase the energy efficiency of their real-estate. Examples of measures include installing energy efficient façade cladding via a subsidy program. This has however only implemented in a very limited number of buildings at the park, and

much improvements still have to be implemented (Park manager and Chairman park management, 2023).

De Boezem is progressive when it comes to the installation of solar panels on rooftops at the park. Twelve percent of the businesses at de Boezem have installed rooftop solar panels, which is double the average of parks in the Netherlands. This is partially due to panels on the newly developed buildings in Oost, but at West a number of entrepreneurs also have installed a large amounts of panels. For this the park has collectively organized a subsidy application (Park manager, 2023; Pijnacker-Nootdorp, 2023)

4.3.3.2 Circular building design and construction

De Boezem has not obligated business to implement circular building measures. Any measures businesses have implemented, were on their own initiative. No specific measures have been discussed, but in development of the park, circular measures might be included more (Project manager, 2023).

4.3.3.3 Exchange of energy, materials and water

Sharing of resources occurs sporadically at De Boezem, sharing of waste materials, appliances and assets are found the most.

There are entrepreneurs at De Boezem that have circular business operations or focusses. For example the 'retail recyclestraat' that a large outdoor store at the park has, that evaluates the opportunities for a second life of 'waste' clothing pieces that are collected by the store (Project manager, 2023; Municipality of Pijnacker-Nootdorp, 2023).

A consultancy firm has researched the circular potential of De Boezem. In sectors at the park including the "food industry, plastics industry, waste and recycling and construction industry" the combined circular potential adds up to 16 percent of the jobs at the park. However, this is potential business have to seize themselves (Municipality of Pijnacker-Nootdorp, 2023)

4.3.3.4 Collective utilities and infrastructure

Business park de Boezem has an energy team (E-team), that consists of the municipality, network operator Stedin, the board of De Boezem, entrepreneurs at the park and sustainability experts (Park manager, 2023). The goal of this team is to accelerate the energy transition at the park with the aim of being self-sufficient by 2030 (Chairman park management, 2030). The team deals with challenges surrounding sustainable electricity generation, balancing supply and demand, reducing peak load, installing a battery and implementing a smart-grid (Municipality of Pijnacker-Nootdorp, 2023)

The municipality and management are exploring installation of an electric battery to store the energy surplus from solar panels at the park. Though the exploration of this initiative is still in early stages, the municipality is already acting on the plans by reserving an area at the park for the potential implementation of the measure. This initiative can be part of the solution to the feed-in grid congestion problem the park faces (Park manager and Board, 2023). A heating network at the park is not among the options that are being explored.

4.3.3.5 Waste management

At present, waste management has not been organized collectively at De Boezem. Park management has reached out to a waste processing company that is located at the park, with the request for a collective contract for businesses at the park and a strategy for separation of carton, plastic and residual waste. The company is however unable to provide a plan up until now, so park management remains waiting. However, once it is organized at De Boezem, they can implement this at the other parks in the municipality as well (Park manager, 2023). One difficulty that was discussed is that

businesses at the park have contracts that end at different times. The park manager elaborates this will result in a situation where 'someone' has to carry the financial risk in the beginning period of the intended collective waste management (Park manager, 2023).

4.3.3.6 Sustainable mobility and transport

Businesses at De Boezem are responsible for sustainable mobility themselves. Some of the entrepreneurs at the park have installed EV charging stations. Businesses at the park are encouraged to integrate electric vehicles and install charging stations. The municipality will facilitate this need by ensuring enough grid capacity.

Infrastructure at De Boezem is mostly aimed at cars and fright transport, which results in most employees taking the car to work. Chances to improve this are found in sustainable mobility and improving the accessibility of the park (Municipality of Pijnacker-Nootdorp 2023). Opportunities for shared mobility at De Boezem are being explored. Previously, a trial with shuttle busses to the park was done. This however proved to be a very expensive solution and is currently not in process anymore (Park manager, 2023). The park plans to explore rental bikes available to bike from the park to the nearby tram station (De Boezem, n.d). In addition to this initiative, 'bicycle suggestion strips' will be explored in the future.

4.3.3.7 Collaborative models for appliances, tools and services

Generating business-to-business is something the park manager is focussed on within the municipality.

4.3.3.8 Collective commercial firm facilities and provision of services

Park management at De Boezem organized a number of collective park services, including safety and security at the park, maintenance of public area and management of parking.

4.3.3.9 Knowledge sharing and guidance

Sharing knowledge and success stories helps other businesses and entrepreneurs to become inspired and motivated, especially when these stories are shared by entrepreneurs themselves (Project manager, 2023). The municipality and park management recognize this, and facilitate this by organizing four meetings a year to which entrepreneurs from all business parks in the municipality are invited. Each meeting features one topic that information is shared on, for the last meeting this was sustainability. The goal of the meetings is for companies to get to know each other in an informal setting, become familiar with each other's business operations, and share their knowledge and success stories. The project manager emphasizes that the latter is very important in progressing sustainability at business parks (Q2.1, Project manager, 2023). The meetings are also very helpful for the municipality to gain insight in what is happening at the parks and what the entrepreneurs deem important and relevant (Project manager, 2023).

> Q2.1: *"That [progressing sustainability] might have to do with sharing and propagating what you do, especially if you are successful. It is the most powerful when entrepreneurs share this themselves. If I, as a municipality share the success stories, it will come across less strong than if an entrepreneur shares this himself. So that is what we try to facilitate and organize". –Project manager, 2023.*

The park manager explains that in their experience a lot of businesses don't know where to start to become more sustainable. So the park manager and municipality are in the process of developing a manual with the basic steps for sustainable development of for businesses, to guide entrepreneurs at the business parks in the municipality. This manual will be first developed for a different business park

in the municipality, namely Oost Ambacht. But when finalized it can be expanded to the other parks in the municipality as well.

The manual will consist of a step-by-step guide for a variety of initiatives and measures entrepreneurs can implement to become more sustainable. The aim of the manual is to navigate entrepreneurs through the overload of information they receive on sustainability, and provide them with practical tools on how to implement the measures. In the manual, the business-to-business approach of park management is featured through for example listing solar panel suppliers that are located at one of the park in the municipality (Q2.2, Park manager, 2023).

> Q2.2: *"I work at various business parks and notice that there are many companies that simply have no idea where to begin. [...] And with this manual businesses can check okay if we want to become more sustainable, what can we do? Turn of the vending machines at night.... [...] or for solar panels: At Oost Ambacht there are several solar panel supplier, that can help the entrepreneurs and advise them. [...] And what we want to do is indicate per step, what businesses need to do. So check if your roof is suitable, get insurance, and so on. And then we say you can request a quote from these suppliers at the park, you can apply for subsidy here etc." – Park manager, 2023*

Moreover, the municipality is in the process of developing a sustainability dashboard for entrepreneurs at the business parks in the municipality. This initiatives is explained in the chapter of Business park Heron, as the initiative is being developed for that park. When the dashboard is optimized, it will also be implemented at De Boezem (Project manager, 2023; Park manager, 2023).

4.3.3.10 Flora and fauna

De Boezem currently has little to no nature, especially section West. The park has the ambition to become a green and sustainable park, and plans on improving greenery at the park. Initiatives the park might implement include small interventions in the public area such as greening of parking spaces, stimulating businesses to improve their greenery through green strips on their plots, green roofs and façade's and a collective gardener (Municipality of Pijnacker-Nootdorp, 2023). Through these initiatives the park becomes more pleasant, climate resilient and greener.

4.3.4 Physical location specific and business specific features

This section elaborates upon the physical location specific features of business park De Boezem.

4.3.4.1 Owner of land

The municipality is owner of the available plots at Boezem Oost. This enables them to developed a vision for the park that is in line with their ambitions as a municipality, and determine the requirements for businesses that they allow to establish at the park accordingly. The municipality is in the process of redeveloping the selection procedure for remaining plots in the municipality, to steer business in a more sustainable and circular direction as is explained in section 4.3.8.2. (Project manager, 2023). At Boezem West, a large section of the park is owned by the businesses that are present at the park (Municipality of Pijnacker-Nootdorp, 2023).

4.3.4.2 State of building stock

There is a large contrast between the real-estate at Boezem West and Oost. Nearly all real-estate at Boezem West is over 20 years old and will require renovation in the nearby future, which provides an opportunity for revitalising the real-estate and redevelop it in a more sustainable manner. At Boezem Oost real estate was developed after 2010, with a high-end appearance and is energy efficient (Municipality of Pijnacker-Nootdorp, 2023).

4.3.4.3 Accessibility

De Boezem is well accessible for car and fright transport. The park is also accessible via public transport, with the metro at a ten minute walking distance and a bus stop next to the park. The park is not very pedestrian and bicycle friendly, as there are no walking paths and cycling lanes in large parts of the park (Municipality of Pijnacker-Nootdorp, 2023).

4.3.4.4 Efficient use of space

The use of space at De Boezem West is not optimized and efficient. Sections of the park are used for different business operations than intended, examples include office spaces, social functions, leisure and catering industry. Moreover, the park allows residency in sections which results in major restrictions in business operations at the park (Park manager, 2023; Pijnacker-Nootdorp, 2023). At Boezem Oost, these issues are not present. All plots have been sold to businesses keeping the maximum environmental category and efficient land-use in mind.

The municipality of Pijnacker-Nootdorp is working on a new economic vision that has a larger focus on circularity and "eco-system thinking'. For the remaining plots, there is a possibility that the future requirements for businesses at business parks contribute to more material and energy symbiosis. However, as a large share of the parks are already is filled with businesses, it it's deemed unlikely this perspective will significantly change the parks (Project manager, 2023).

Lastly, the municipality has strategically reserved an area at the park to potentially install electric batteries in the future (Park manager, 2023).

4.3.4.5 Business specific features

De Boezem houses a wide range of businesses that differ in size and business operations. Boezem West mostly houses SME's with an environmental category up to 3.2. Contrastingly, Boezem Oost is home to more large sized companies with environmental categories up to 4.2.

A share of companies, especially at Boezem Oost, are ambitious when it comes to sustainability. However, in West the entrepreneurs and companies are to diverse to have them all join in on initiatives Mostly larger companies recognize the opportunities transforming to e.g. a more sustainable energy system can provide for them. The smaller companies are less involved (Park manager and Chairman park management, 2023).

4.3.5 Social location specific and business specific features

This section elaborates upon the social location specific features of business park De Boezem.

4.3.5.1 High degree of organization

De Boezem has a park management and share of members that is highly involved and concerned with marking progress at the park. Besides collective organization of some measures, management takes a leading role in keeping members involved and motivated to participate in meetings and initiatives (Chairman park management, 2023). If the experience and participation of parties is good, this functions as a magnet for others to become involved, resulting in growth of the collective at the park (Chairman park management, 2023).

The municipality, park manager and chairman of the park management al emphasize that this organisation at the park a big advantage at De Boezem.

4.3.5.2 Relationship and communication between businesses

Most of the entrepreneurs at the park originate from Pijnacker and are familiar with each other. This relationship between the businesses at the park creates an enjoyable working environment at the park, and can contribute to establishing synergies in the future (Park manager, 2023)

4.3.5.3 Sustainable and circular ambition and attitude of businesses

Entrepreneurs that have established at Boezem Oost are mostly ambitious when it comes to sustainability. At Boezem West, a number of (mostly) large companies at the park also recognize the importance of sustainability. They see the potential advantages that implementing sustainable energy measures and collective organization can provide to them. As these large companies are responsible for a large share of the parks' energy usage, they can contribute greatly to the sustainability of the park.

Some businesses at the park don't see or feel the necessity of sustainability and circularity, especially smaller non-production related businesses. The park management does try to involve these parties in the sustainable initiatives they want to implement at the park, and hopes to motivate and inspire them with the manual that is explained in section 4.2.3.9 (Q2.3, Chairman park management, 2023).

> Q2.3: *"I think we have a beautiful park with committed park members. It is a constant push and pull strategy, and not like all members always come to the board meetings. You have to keep approaching them and the experience has to be good, then the involvement and commitment follows. In my experience as chairman in the past two years, this has had an attracting effect on the parties and we -the park association- keep getting bigger as a collective." – Chairman park management, 2023.*

4.3.6 Regional and local characteristics

This section elaborates upon the characteristics of the region and area where business park De Boezem is located.

4.3.6.1 Physical characteristics of surrounding region / area

Business park De Boezem is surrounded by a residential area and greenhouse horticulture, which the municipality of Pijnacker-Nootdorp is known for. The sector is the most important employer in the municipality (Municipality of Pijnacker-Nootdorp, n.d.), and requires large amounts of high temperature heating. Moreover, horticulturists in the region generate large amounts of electricity they deliver back to the grid which provides some trouble for De Boezem as explained in the next section.

4.3.6.2 Characteristics of municipality

The municipality of Pijnacker-Nootdorp is highly involved in the development of De Boezem as project manager of Boezem Oost and one of the driving forces behind revitalising Boezem West. The municipality is proactive in exploring and stimulating sustainable development at the parks in the municipality. Not just the project manager is involved, but also the responsible councillor and the rest of the local council. Park management and the council have has a number of constructive sessions where many of the council members participated, which is special (Park manager and Chairman park management, 2023). Park management and entrepreneurs compliment the municipality on their role, and explain the collaboration is effective and pleasant.

4.3.6.3 Grid capacity and grid congestion

For the development of Boezem Oost, the municipality and Stedin have anticipated on grid capacity in early stages of development. As a result, connecting de Boezem and its businesses to the grid does not

cause any problems. However, delivering surplus energy to the grid is a problem due to peak loads. Greenhouse horticulture in the region has a serious influence in this situation. Many of the horticulturist surrounding the park, have shifted towards energy generation as business operation during the covid pandemic. These horticulturist are connected to the same transformer station as park Boezem. The e-team focusses on this problem (Park manager and Chairman park management, 2023).

4.3.6.4 Sectors, industry and business parks in area

As elaborated before, the park manager at Boezem is also park manager in other parks in the municipality including business park Heron. The relationship with other parks in the municipality provides a positive influence on sustainable development in park Boezem, and the other parks. An example is the deployment of initiatives and measures that were successful in one park, to other parks. Additionally, the economy of scale proves an advantage in organization of for example educational meetings etc. (Park manager, 2023).

The park manager has a very good overview of the different businesses in the municipality, what they have to offer or require, what connections can be made, not only within the business park but also with other parks. Lastly, business to business that is generated between business at the parks has a positive influence on the regional/local economy (Park manager, 2023).

4.3.7 Regional spatial-economic strategies and environment policy

This section elaborates on the regional spatial economic strategies and regional environment policy relevant in sustainable and circular development of business park De Boezem.

4.3.7.1 Regional and local importance of the park

Businesses and offices provide significant employment opportunities in the municipality and form an important sector in the local economy. De Boezem West houses mostly local SME's, Boezem Oost offers an opportunity for the local SME's to expand their businesses. Additionally, Oost offers place for larger more regionally oriented businesses as well (Municipality of Pijnacker-Nootdorp, n.d.; Project manager, 2023).

4.3.7.2 Sustainability policy and strategies in the municipality

Pijnacker-Nootdorp currently hasn't integrated and developed much policy and strategies that include sustainability and circularity, but is currently working on a new economic strategy that will be finished in 2024. In this strategy, theme's such as sustainability and circularity are highlighted. In previous years, the focus for policy was mostly on renewable energy, especially geothermal energy. This is due to the importance of horticulture in the municipality, and them employing geothermal energy on large scales.

The project manager explains there is reciprocity between policy in the municipality and desires/demand from companies (Project manager, 2023), and the sustainability dashboard provides input for these strategies and policies. Active participation by actors at the park is something that is mentioned by interviewees as something that they appreciate. The park manager is for example included in the development of the area-oriented environment program for De Boezem. However, in other local or regional strategies the park such as the vision on heat transition, they were less involved (Park manager, 2023).

4.3.7.3 Area-oriented environmental program

The municipality has developed an area-oriented environmental program (NL: gebiedsgericht omgevingsprogramma) for De Boezem, as part of a pilot for the new Environment and Planning Act'. Sustainability is a crucial part of this program, an can be concluded from the vision and ambitions in the program that have been explained in section 4.3.1. The program touches upon relevant policies,

the current situation at the park, trends and developments, the future vision and ambitions, strategies and actions and lastly, monitoring (Project manager, 2023; Park manager, 2023; Municipality Pijnacker-Nootdorp, 2023).

4.3.7.4 Scarcity of available land for business/commercial development

Commercial lots in the region are scarce, thus there is a great interest in plots in the region. This motivates the municipality to be a little stricter in their demands from businesses that want to buy and develop on the plots (Project manager, 2023).

4.3.7.5 Regional energy strategy (RES)

The RES Rotterdam-Den Haag does not specifically mention business park De Boezem. The ambitions the e-team has, are in line with the ambitions of that are described in the RES. These ambitions include increasing energy efficiency of commercial and industrial real estate and deploying solar panels on commercial and industrial real estate (RES Rotterdam Den Haag, 2021).

4.3.7.6 Vision on heat transition Pijnacker-Nootdorp

In the vision on heat transition by the municipality of Pijnacker-Nootdorp, De Boezem is not specifically mentioned. The strategy explains that for newly developed business parks the transition was already started as they are developed (nearly) energy neutral. The strategy describes facilitating installation of solar panels at business park has contributed to the goals for renewable energy generation in the municipality (Municipality Pijnacker-Nootdorp, 2021).

4.3.7.7 MRDH Business park strategy Zuid-Holland

Business park De Boezem is the only park that is included in the evaluation of the MRDH Business park strategy 2023-2030. The strategy describes de Boezem West should focus on becoming more sustainable and improving land-use efficiency. These points of attention are recognized by the municipality and park management, as can be read in this chapter and the area-oriented environment program (MRDH & Ecorys, 2022).

4.3.7.8 Circulair.Biz

Circulair.Biz is a platform initiated by actors including the province of Zuid-Holland and regional Environmental Agencies (NL: omgevingsdiensten) to facilitate business parks in the region by analysing their potential in a circular economy. For De Boezem Oost, waste streams have been analysed and the circular potential described. Most of the waste streams are marked as recyclable, and for nearly all streams the eco-costs are lower than the value of the stream (Circulair.biz, 2023).

4.3.8 Policy instruments

This section elaborates upon the policy instrument relevant in sustainable and circular development of business park De Boezem.

4.3.8.1 Park management

Park management at De Boezem has a role in the implementation of a number of measures initiatives, as explained in section 4.3.2.2.

Another very important role for park management is keeping members of the park involved and motivated to participate in meetings and initiatives (Chairman park management, 2023). If the experience and participation of parties is good, this functions as a magnet for others to become involved, resulting in growth of the collective at the park.

4.3.8.2 Park policy and selection procedure

De Boezem is a business park with a focus on local entrepreneurs and offers place for businesses with environmental categories up to 3.2 in Boezem West, and 4.2 in Boezem Oost. In the past, maximizing environmental categories at the park wasn't a priority. But with the current scarcity of space for commercial and industrial real estate, the municipality aims to maximize the potential of environmental categories at the park. However, due to the scarcity of commercial real estate and plots in the region, the municipality favours providing development opportunities for several local entrepreneurs that might have lower environmental categories, than providing all that space to one or two larger companies from further away that might have higher environmental categories (Project manager, 2023).

In previous years sustainable and circular policy in the municipality was not advanced enough to obligate businesses to follow certain circular or sustainable requirements. But the urgence for this has grown, and accordingly sustainable and circular themes are integrated in the new economic vision the municipality of Pijnacker-Nootdorp will publish in 2024 (Project manager, 2023).

Following this, a new selection procedure will be implemented too. In this new approach the municipality sets a level of ambition for four themes: energy efficiency and sustainable energy generation, water and climate resilience; sustainable construction. Businesses have to develop a plan to fit the ambitions and reach the required 'score'. For each theme suggestions for measures and their contribution to the score are provided, but businesses are free to determine their approach to fit their own ambitions and capacities. To ensure an objectively verifiable method, scoring is based on widely recognized approaches such as MPG and BENG. The project manager comments that due to the limited available area for commercial development in the region, they will be a bit more strict and ambitious for the remaining plots (Q2.4, Project manager, 2023).

> Q2.4: *"Commercial plots are very scarce, so in that sense it motivates the municipality to be a little strict with the remaining plots. If a company feels the ambitions at the plot are too high, then maybe it isn't the right company for the plot and we'll search for a company that does suit the level of ambition." – Project manager, 2023*

4.3.8.3 Subsidies

Subsidies have contributed to the implementation of several measures at de Boezem. At Boezem West, a collective application for a subsidy to improve the energy efficiency of real-estate led to the installation of energy efficient façade cladding by some entrepreneurs. Moreover, a collective application for subsidy for the installation of solar panels led to installation of a significant amount of solar panels on rooftops at the whole park (Project manager, 2023; Park manager and Chairman park management, 2023).

Park management and the municipality had important roles in these processes. Many subsidies have to be requested as a collective, so having a park management organization at the park makes this process a lot easier. For these initiatives, park management at De Boezem applied for the subsidies and received the funds for the initiatives. After businesses have implemented measures, the park management reimburses their costs with the receives subsidies (Park manager and Chairman park management, 2023).

The municipality is also a key actor in the process of applying for subsidies and implementing initiatives. For the solar panel project, they had a leading role in 'recruiting' participants and providing experts for the technical aspects of the projects. However, taking on this role is very time intensive for the

municipality, and not a standardized practice. The role is more reserved for park management and entrepreneurs, and the municipality will have a more facilitating role than a leading role (Project manager, 2023; Park manager and Chairman park management, 2023).

4.3.9 Economic context

This section elaborates on the economic context of sustainable and circular development of business park De Boezem.

4.3.9.1 Streams of funding for initiatives

Business park de Boezem has two streams of funding the park can use to implement sustainable and circular initiatives. The first is funding from the business association (ondernemersvereniging) at De Boezem, which businesses at the park can join. The second is funding from the Entrepreneurial fund of Pijnacker-Nootdorp. The municipality of Pijnacker-Nootdorp has an entrepreneurial fund *fonds*), to which entrepreneurs and business are required to contribute financially based on the property value of the business. The municipality is divided in thirteen areas, that can all claim funding to finance initiatives, including sustainability or circular measures. The obligation of businesses to join both associations, and having two streams for funding proves a great advantage for the implementation of sustainable and circular measures (Q2.5, Park manager, 2023).

Moreover, subsidies contribute to the implementation of measures as is explained in the previous section.

> Q2.5: *"We receive funding through two channels, one is a contribution from the entrepreneurs at the park and the other the entrepreneurial fund, which is also paid for by entrepreneurs This is extremely important when it comes to driving/boosting sustainable and circular initiatives. Otherwise you only have the regular business association that has to cover the costs with a limited number of members, which won't work. [...] So in my opinions an entrepreneurial fund is a very good indicator for successful business parks." – Park manager, 2023*

4.3.9.2 Financial effects and situation businesses

A financial trigger is an important driver for businesses to establish at De Boezem Oost, besides environmental ambitions. Many of the businesses at the park are required and expected to decrease their environmental footprint by law or by their clients and customers. By establishing by at De Boezem Oost, businesses comply to these expectations (Park manager, 2023). Also implementing energy efficiency measures and generating electricity provide financial advantages to businesses.

4.3.10 External context

No variables that couldn't be assigned to the other evaluated categories, but were still discussed as relevant in the sustainable and circular development of business park De Boezem.

4.4 CASE 3: HERON, NOOTDORP

Heron is the newest business park in the municipality of Pijnacker-Nootdorp. This chapter elaborates upon the development of the park, the sustainable and circular measures and initiatives at the park, and the variables that have an influence on them. To evaluate the park, four actors have been interviewed:

- The project manager who is employed at the municipality of Pijnacker-Nootdorp;
- The park manager who is employed at a park management organization and hired by park management of Heron;
- A general manager at one of the larger companies at the park, who is part of the park management of Heron;
- And a consultant that is hired by the municipality to research and progress sustainability at the park.

Additionally, publicly available documents and information, as well as documents supplied by interviewees have been consulted.

4.4.1 Initiation, vision and ambition

This section elaborates on the initiation process of Heron, and the sustainable and circular vision and ambition of the park.

4.4.1.1 Initiation

The municipality of Pijnacker-Nootdorp is initiator for business park Heron. The first intentions for development of a business park in the area date back to 1997, but the final land-use plan was accepted in 2012 after which development of the park started. Since then numerous businesses have established at the park. At present a number of plots are still available (Municipality of Pijnacker-Nootdorp, 2012; MRDH, n.d.).

4.4.1.2 Vision and ambition

Business park Heron characterizes itself as a sustainable, safe and accessible business park, with the ambition to "be a frontrunner in sustainability" (Heron, n.d; MRDH, n.d.).

Actors at the park have developed a vision for sustainability at the park, as they wanted to give direction to sustainability at Heron themselves in addition to the vision the municipality has. This vision reads "In 2026, business park Heron contributes to a sustainable Pijnacker-Nootdorp by reducing carbon emissions by 35 percent, reducing transport movements by 50 percent and to employ 150 people with lower employment prospects through collective, innovative, sustainable, social and safe entrepreneurship" (Q3.1, Park manager, 2023; Heron, n.d).

> *Q3.1: "The municipality creates its own vision [...] Subsequently, as a park we asked ourselves 'What do we want with our park?', as we also feel the need to act as principals for action at the park. Therefor we created our own vision for the park in one sentence. [...] Meanwhile, it has to be updated a little bit as it is already two years old, something we plan on doing." – Park manager, 2023*

The park selects three annual spearpoints to progress at the park that year. This step-by-step approach allows the park to focus on a select number of topics at once, which prevents an overflow of additional work-load for businesses at the park in addition to their day-to-day business. At present, sustainability is an important theme at the park. Generating business-to-business and mutual relations is a second spearpoint, which can contribute to establishment of more synergies and collaborations at the park as

business become more acquainted. Lastly, the park always focusses on the basics of a clean, whole and safe park (Park manager, 2023).

Business park Heron has yet to establish its own vision for circularity, but is in the process of exploring what being a circular business park encompasses. In this process the park adapts the definition by the province of Zuid-Holland, which reads a park "is organized circular when at least 30 percent of the companies exchange waste, knowledge and/or resources among each other or with nearby parks, at least 10 percent of space is dedicated for storage and processing of streams within its own cluster and production processes are to be made circular. In 2030 is a reduction of 50% realised for primary raw materials (BVR et al., 2022). This definition is adapted in further evaluating circularity at the park, and as ambition in becoming one of the first existing business parks to gain the title 'circular business park' (Consultant, 2023).

4.4.2 Organisation and actors' roles

This section elaborates on the roles of the municipality, park management, the park manager and entrepreneurs at the park in sustainable and circular development of Heron.

4.4.2.1 Municipality

The municipality of Pijnacker-Nootdorp is initiator and project manager for Business park Heron. The project manager at Heron, is also project manager for development of De Boezem. The project manager is responsible for the acquisition at the park, and evaluates if the businesses and their plans fit the vision the municipality has for the park.

The municipality sets the requirements for businesses that want to establish at the park. In previous years, the municipality has a fairly mild approach for determining if businesses could or could not establish at the park. If an entrepreneur showed interest and ambition regarding sustainability and fit the vision the municipality, possibilities for establishment of the company were discussed. The project manager underpins this by explaining that for example large-scale logistic businesses or business complexes didn't fit the vision for the park, thus these bids would be rejected. The park manger corroborates this and mentions that it is very pleasant municipality was so critical with respect to who they let establish at the park (Project manager, 2023; Park manager, 2023).

For the implementation of initiatives and measures at Heron, the municipality has taken on a supporting role. The project manager explains that the entrepreneurs at the park are the most important actors in identifying and utilizing potential sustainable initiatives at the park. In previous years, the municipality has made efforts to set up initiatives. But experience shows implementation is most successful when the efforts start with the entrepreneurs (Project manager, 2023).

Lastly, the project manager contributes a little to the basis for the organization at Heron (Project manager, 2023).

> Q3.2: *"We regularly take our role to capitalize the opportunities that are present, provided that there is energy among the entrepreneurs. That is very important, that the energy also have the energy. […] As the municipality we can say to companies that we think it is important that you all act circular, but ultimately the entrepreneurs have to choose it." – Project manager, 2023*

4.4.2.2 Park management

Park management at Heron consists of some of the entrepreneurs at the park and the park manager. They are responsible for decision making and a variety of collective services at the park. The park manager explains that park management / board of Heron has an significant role at the park, and that

they in the end are responsible for decision making at the park. In decision making, the role of the park manager includes informing the management on important topics and issues with the feedback she receives from entrepreneurs at the park, as well as personal observations, and advises the board.

Park management at Heron has regular contact, about six times a year they meet and discuss a number of relevant topics (General manager, 2023). They decide on three spearpoints to target and progress at the park, of which sustainability is one.

Lastly, the park management makes an effort to motivate other entrepreneurs to join in on initiatives.

4.4.2.3 Park manager

The park manager at Heron is also park manager at business park De Boezem from chapter 4.3, and has a similar role at business park Heron. Equal to the position the park manager has at that park, they are the contact person for entrepreneurs at Heron too. The park manager informs the board about relevant topics they speak about with the entrepreneurs at the park, and is also in good contact with the municipality. Moreover, the park manager advices both businesses at the park, as well as the park management of Heron.

The park manager is also responsible for the for execution of the plans the park management at Heron decides on and for the organization of collective park services.

4.4.2.4 Entrepreneurs and businesses

The entrepreneurs and businesses at Heron are the most important drivers of sustainable and circular initiatives, in collaboration with park management. In collaboration with the municipality and park management, the businesses are key in deciding which initiatives and measures will be implemented at the park, and the actual implementation thereof. As briefly mentioned in the previous section, experience of the municipality has proven implementation of measures is most successful when entrepreneurs are initiators. Moreover, they are ultimately responsible for collaborating and synergies at the park. The park manager can facilitate this by informing on potential collaborations (Project manager, 2023; Park manager, 2023).

The entrepreneurs and businesses at Heron are obligated to join the association of businesses at the park, that is used to organize the collective services among other things.

A few businesses at the park are pioneers when it comes to sustainable real estate development or business operations. These types of businesses have a stimulating effect on other businesses at the park (Park manager, 2023).

4.4.3 Sustainable and circular initiatives at the park

This section elaborates upon the sustainable and circular initiatives that are explored, implemented or passed over in development of business park Heron.

4.4.3.1 Business individual energy efficiency, renewable energy generation and storage

Heron is an all-electric business park, and businesses are free to develop their real estate to fit this requirement. Businesses at the park have implemented a variety of measures that suit their ambitions, business operations, capacity, etc. Buildings are developed with well insulated building envelopes, energy efficient building installations and appliances, automated climate systems.

One of the larger companies at the park has an office that is nearly energy neutral and LEED Platinum certified, the highest ranking for sustainable buildings. The building is equipped with solar panels on nearly all roof area, has a green roof that functions as insulation and an ATES for its thermal energy demand. The building has a mostly automated building installation without radiators, light switches,

etc., a climate ceiling, on-off switches at every workplace to ensure all electric appliances are turned off after the workday is over, and Led-lights in most of the building. In the section of the building without led-lights, the business is waiting for so called 'natural moments' for replacement, keeping the circularity in minds (General manager, 2023). Other businesses have implemented similar measures, to their own capacity.

4.4.3.2 Circular building design and construction

At the individual level, businesses have implemented circular measures and initiatives on their own initiative. Some businesses at the park have been highly ambitious in their building design. For example, the large company introduced in the previous section sources its building materials locally as much as possible and 30 percent was reused, e.g. asphalt from the nearby highway in the concrete frame. Also a lot of bamboo was used in the building and office supplies such as walls and desks (General manager, 2023).

In addition to this, it is relevant to mention that there are companies at the park that have circular business operations, or revolve around circular principles. For example, a company that focusses on reuse and high-end recycling of cars and car parts (Park manager, 2023).

4.4.3.3 Exchange of energy, materials and water

Resource synergies at Heron happen occasionally, but not at large scale. An example that is mentioned is the reuse of waste packaging materials within businesses by other businesses to package their parcel. These types of synergies however do not occur at large scale yet (Park manager, 2023).

With time, park management is expected to also enable more synergies and collaborations. And the initiative of knowledge sharing also contributes to more of these synergies (Park manager, 2023; Project manager, 2023).

4.4.3.4 Collective utilities and infrastructure

To support and stimulate renewable energy at the park, Heron offers businesses the opportunity to join collective purchase of energy through an external party. Moreover, municipality has facilitated collective purchasing of solar panels for roof tops at the park (Project manager, 2023).

Previously, a district heating network that would consist of business park Heron, business park Oostambacht and horticulture in the region was explored. However, as many companies still have high depreciation costs of their current installations, there was insufficient interest in the network for it to be pursued (General manager, 2023; MDRH, 2023).

An increasing number of businesses at the park is installing solar panels on their rooftops. To optimise use of the energy these panels generate, Heron has explored the installation of a collective electric battery to store excess electricity. This initiative however is costly and not all companies have the same financial capacities. As a result, the initiative was not implemented at the park. Connecting to a nearby solar-field was also explored, but not pursued (General manager, 2023).

As can be concluded from the reasoning above, financial factors are important in the decision for the implementation of initiatives at the park. In addition to this, other factors include support and interest by businesses at the park, political support and technical possibilities (General manager, 2023).

4.4.3.5 Waste management

Waste management at Heron is currently not organized collectively. The municipality is working on obtaining insights in the waste streams at the park, to later evaluate how circularity at the park can

improve in the future and what potential for 'waste' material synergies could be. This initiative is part of the sustainability dashboard that is further elaborated on in section 4.4.3.9.

4.4.3.6 Sustainable mobility and transport

Businesses are responsible for the organization of mobility themselves. Some businesses have installed charging stations at their plots and have integrated electric vehicles in their vehicle policies (General manager, 2023).

The potential for (semi) collective charging stations for electric vehicles is currently being explored. The initiative was proposed by a touring car transport company at the park, that suggested the charging stations are publicly available during the daytime and available to charge their vehicles during the night. However, determining the exact conditions and arrangements regarding costs etc. are a challenge (General manager, 2023).

Furthermore, there has been a pilot with shared bicycles at the park. Employees of the business where the bicycles where stalled used them, but other employees at the park not so much. The initiative is no longer present (Park manager, 2023).

4.4.3.7 Collaborative models for appliances, tools and services

Business-to-business is an objective at the park, and within the municipality. Businesses find each other, and the manager also facilitates this. Examples of collaborations at Heron include companies renting transport services from a company at the park, as it is easy and the transport company uses biofuels in their busses which contributes to sustainable transport, or making use of security services from a company at the park daily (General manager, 2023; Park manager, 2023).

The project manager mentions an example of a business park that has a platform for entrepreneurs to offer and request materials and services. This initiative was brought up in the business association, but there was no interest for it at that point in time. The project manager does mention that such an initiative has potential to progress circularity so it might be reexplored in the future. For example by adding it to the sustainability dashboard that is further elaborated in section 4.4.3.9

4.4.3.8 Collective commercial firm facilities and provision of services

Park management at business park Heron organizes a number of joint commercial firm facilities. Among these facilities camera security, regular park security, ice-clearing of roads and property in winter and a park clean-up day once a year (Project manager, 2023; General manager, 2023).

4.4.3.9 Knowledge sharing, guidance and communication

A consultancy firm is developing an online sustainability dashboard for business park Heron, and the companies at the park, that has several functions. The dashboard informs on the current sustainability performance and situation of the businesses at the park, and the park as a whole. For example how much energy companies use, how much carbon emissions this is accompanied by etc. The municipality and businesses can use this information to evaluate where they stand now, and how much still needs to be done to accomplish their sustainable goals. This information in the dashboard is also used by the municipality in further developing their sustainable and circular policy. Secondly, the dashboard enables companies and the municipality to model the effects of implementing sustainable measures or combinations thereof. This contributes to developing a plan and approach in their sustainability journey. Currently, the dashboard mainly focusses on energy related monitoring and modelling, but the consultancy firm is in the process of adding waste streams and waste management as well (Project manager and consultant, 2023).

Participation in the dashboard initiative is without obligation and companies are responsible for the data input themselves. The completeness and accuracy of data is thus highly dependent on the input by the businesses at the park. It is commented that obtaining data from the companies is difficult sometimes, as businesses first focus on their core business operations and the gathering and reporting on data for the dashboard is additional work for them. However, the success of the dashboard is dependent on the approach and input from the entrepreneurs. Ultimately, after the development of the dashboard is finished and everything works according to the expectations and plans, the dashboard will be implemented at the other parks in the municipality as well (Park manager, 2023; Project manager and consultant, 2023).

Sharing of knowledge and success stories is mentioned as important at business parks Heron, just at is was important at business park De Boezem (section 4.3.3.9). At Heron, the park management has meetings around six times a year to discuss a variety of matters including the new measures and initiatives the members have found and implemented (General manager, 2023). Moreover, the park hosts a park cleaning once a year where employees at the park walk around to pick up rubbish. This is another fun and informal way for them to get to know each other (General manager, 2023).

In the beginning development stages of the park, the municipality of Pijnacker-Nootdorp, Province of Zuid-Holland and the park's business association had plans to develop 'Huis van Heron'. Huis van Heron was intended to be a physical location at the park, where local or regional entrepreneurs and residents, as well as other visitors, could be welcomed and receive the latest information on sustainability topics such as circularity, renewable energy, climate resistance, biodiversity and green environment etc. Additionally, entrepreneurs and visitors could seek specific advice on initiatives and business cases. The initiative was very important and significant for the park but ultimately not implemented due to several factors, including financial factors and an insufficient support base (Park manager, 2023; Project manager, 2023).

Another initiative that was explored but not implemented had to do with social sustainability. The idea was to provide ten young adults with lower employment prospects/ with a labour market disadvantage with schooling at the park for the duration of one academic year. These students would have lectures in the mornings, and work at companies at the park for low rates during the afternoon. Sadly, this initiative was never employed due a mismatch in scheduling, the work activities the students were to do in the afternoon only took place in the morning or at night. Furthermore, in some instances the companies commented the working level was too low (Park manager, 2023).

4.4.3.10 Flora and fauna

Plant and animal friendly park management is implemented at Heron, and in the area development plan ecology and biodiversity have been considered. This is evident by initiatives such as leaving enough green areas at the park, planting trees and flowers at the park, implementing a recreational walking lane and seating elements etc. (General Manager, 2023; MRDH, n.d.)

4.4.4 Physical location specific and business specific features

This section elaborates upon the physical location specific features of business park Heron.

4.4.4.1 Owner of land

The municipality is owner of the available plots at Heron, and is thus in change of the acquisition of available land. This allows them to set requirements for the plots and select businesses that fit the vision for the park. For more information of the approach, see section 4.3.8.2.

4.4.4.2 State of building stock

Real estate at Heron is developed all-electric and in an energy efficient manner. Depdning on ambitions of the companies, additional measures have been implemented.

4.4.4.3 Accessibility

Business park Heron is well accessible by car and fright transport as the park is adjacent to the highway, as well by public transport due to the metro station that connects the park to both The Hague and Rotterdam. This is an important feature of the park, that is advertised on Heron's website and mentioned by the general manager as one of the main motivations for their company to establish at the park. (General manager, 2023). Easy access by metro can provide an environmental advantage when employees and visitors use this form of transportation over individual transport by car.

4.4.4.4 Effective and strategic use of space

Before, business park Heron had no requirements for businesses that wanted to establish at the park to promote and facilitate synergies at the park. However, as further elaborated upon in section 4.3.7.2 the municipality is working on a new economic vision that has more attention for circularity and 'eco-system thinking', which is linked to the principles of industrial symbiosis.

A number of plots at Heron is still available, and the project manager and municipality are critical in the process of giving out these plots. With the new selection procedure, there is a possibility that the requirements for these remaining plots will help facilitate more material and energy synergies , and other collaborations at the park. However, as a large share of the park already is filled with businesses it is unlikely the park will significantly change as a result of new companies and the requirements (Project manager, 2023).

4.4.4.5 Business specific features

Heron is home to a range of locally and regionally focussed entrepreneurs and businesses. Businesses can have operations with a maximum environmental category ranging from 3.1 to 4.1/4.2 depending on the location at the park (Municipality of Pijnacker-Nootdorp, 2012). Business and operations at the park can mostly be characterised as high-end. The park manager explains that these are the types of businesses that often aspire to be more sustainable, energy efficient and circular and thus fit the vision for the park (Park manager, 2023).

4.4.5 Social location specific and business specific features

This section elaborates upon the social location specific features of business park Heron.

4.4.5.1 High degree of organization

As first introduced in section 4.4.2, Heron has a high degree of organization and short lines between the park management, park manager, the municipality and the entrepreneurs at the park.

The park manager at Heron is mentioned as a great advantage is that the park manager, and the fact that all business parks in Pijnacker-Nootdorp have the same park manager. This person is very familiar with all companies, what they have to offer and what they require. This overview enables them to connect companies and aids the establishment of connections and synergies. The park manager also functions as a direct line from the parks to the municipality, and vice versa. These short lines between all actors are recognized as a positive aspect at the park and in the municipality (Q3.3, Park manager, 2023).

Q3.3: "The lines are short, thus signals we receive that are like 'yes, we want to do something with circularity and there is energy to do that', will be received by the municipality very quickly and we will start working on them. And that would translate into policy if that were the case." – Project manager, 2023

Additionally, the park manager organizes a number of activities, such as an information session or training, for all parks in the municipality, which provides an economy of scale. Lines between the park and the municipality are short. This enables quick signals regarding the desired at the park.

4.4.5.2 Relationship and communication between businesses

The trust, familiarity and involvement between actors at the park is very important to facilitate business-to-business, synergies and collaborations. To enable exchanges of services and resources, the familiarity with the services and resources other companies at the park and surrounding parks offer is important. As discussed in section 4.4.3.7, these relationships between companies have resulted in various collaborations for services and some resources.

The park manager explains that establishing these relationships at Heron requires a bit more support and attention than in other business parks in the municipality, due to the businesses at the park being less local and of larger scale (Park manager, 2023).

4.4.5.3 Sustainable and circular ambition and attitude of businesses

Business park Heron is home to a number of entrepreneurs and businesses that are very committed to sustainability and circularity. These "ambassadors" or pioneers have implemented various measures and initiatives for sustainable design and building of their offices and warehouses. These are the types of people and businesses that help bring sustainability at Heron further, as they are constantly thinking of and in search for new measures and initiatives to implement (Q3.4, Project manager, 2023)

*Q3.4: "There are a few entrepreneurs that occasionally want to take the lead. I think that is very decisive [...] th*ose ambassadors of circularity are important in this, to really speed it up and draw attention to it. [...] These are companies that are very pleasant to work with, and they also take the time to consider something like this." – *Project manager, 2023*

4.4.5.4 Core business operations are the main priority

The core business operations are the main priority for businesses, and sustainability is an 'extra'. Especially circularity is not a priority for many businesses (Project manager, 2023). The financial capital and human capital businesses have influences their involvement in sustainable and circular initiatives. This becomes evident in the response the municipality and estate have gotten for the sustainability dashboard. It's mostly larger companies that have the personnel and financial capacity to participate in initiatives that request time and money. For many businesses, sustainability is not a priority as all their focus goes to their main business operations.

4.4.5.5 Sustainable image of park

The entrepreneurs and businesses that have established at the park are proud of their achievements and sustainable characteristics of their establishment at the park. The sustainable image of the park is used in promoting and communicating the park.

4.4.6 Regional and local characteristics

This section elaborates upon the characteristics of the region and area where business park Heron is located. As the park is located in the same municipality as business park De Boezem, the characteristics

of the municipality and those of sector, industry and business parks in the region are equal to those detailed in section 4.3.6 of the chapter on Business park De Boezem. The variables that were different Heron are included in this section.

4.4.6.1 Physical characteristics of surrounding region

The municipality of Pijnacker-Nootdorp is known for its greenhouse horticulture. This sector uses geothermal energy that could potentially provide surrounding area's too. For business park Heron, a heating network was explored that would comprise of the neighbouring horticulturists and business park Oostambacht. This initiative was however not pursued.

4.4.6.2 Grid capacity and grid congestion

Currently, no problems with the grid capacity and net congestion are present or anticipated for Heron.

4.4.7 Regional spatial-economic strategies and environment policy

This section elaborates on the regional spatial economic strategies and regional environment policy relevant in sustainable and circular development of business park Heron.

4.4.7.1 Regional and local importance of the park

Businesses and offices provide significant employment opportunities in the municipality, and form an important sector in the local economy (Municipality of Pijnacker-Nootdorp, n.d.). Heron is a relatively small business park, and employs around 2000 employees (Heron, n.d.). Pijnacker-Nootdorp considers the local economy to be very important, and aims to offer local/regional SME opportunities at their business parks. Due to its prominent location in the region, Heron is not only wanted by local SME's, but also regional, larger businesses and even internationally oriented businesses. (Project manager, 2023).

4.4.7.2 Sustainability policy and strategies in the municipality

The sustainability policies and strategies in the municipality of Pijnacker-Nootdorp have been elaborated upon in chapter 4.3 De Boezem, section 4.3.7.2.

4.4.7.3 Land-use plan

The land-use plan of business park Heron describes the park as a high-end sustainable business park. In het plan, three levels for sustainable development are recognized: arrangement of the area, buildings and business operations. The plan describes a number of measures and initiatives at the level of park arrangement, including a sustainable energy system through limiting energy use, renewable energy supply and efficient use of fossil fuels. The municipality strives towards not using gas unless technical, economic or for other reasons is unfeasible. For material use, the strategy describes limited material use and exploring sustainable materials. The water system at the park has to contribute to sustainable functioning of the water system in the municipality, so spatial and business functions are to be accommodated to the water system. For nature and ecology, the park aims to maintain and support nature through for example nesting boxes or green roofs, connection to surrounding nature areas and collective ecological area development and maintenance. For mobility, the plan describes efficient land-use, good accessibility also with public transport, and limiting transport by car through for example facilities that stimulate bicycling. Collective waste separation and management is foreseen for the park management (Municipality of Pijnacker-Nootdorp, 2012).

At building level, the plan instructs the use of fsc wood, no heavy metals and a GPR-score of at least 7. Sustainable energy is generated through solar panels or rooftops, and potentially small-scale wind turbines. Sustainable water management is encouraged via limiting water use through reuse, rainwater use for toilets etc. (Municipality of Pijnacker-Nootdorp, 2012).

4.4.7.4 Regional energy strategy (RES)

The RES Rotterdam Den-Haag does not specifically mention business park Heron.

4.4.7.5 Vision on Heat Transition

In the municipal vision on heat transition by the municipality of Pijnacker-Nootdorp, Heron is not specifically mentioned. The strategy does mention that newly developed business parks are already almost energy neutral, and that the energy transition has already in motion at those parks. The municipality has facilitated solar panels on rooftops, which has contributed to the ambitions and targets (Municipality of Pijnacker-Nootdorp, 2021).

4.4.7.6 MRDH

The Metropoolregio Rotterdam Den Haag (MRDH) has developed several strategies that are relevant for business parks in the municipality Pijnacker-Nootdorp. "De Strategie werklocaties 2019-2030" focusses on Next Economy business parks, that are crucial for the prospective earning capacity and international competitiveness of Zuid-Holland, of which Heron is one (MRDH, n.d.). In collaboration with the Province and other parties, MRDH has researched circular business parks in the region. However, due to the fact Heron is relatively young and not completely filled yet Heron was seen as a less relevant park in their research on circularity in the region, and thus not incorporated in further research and scans they performed (Q3.5, Project manager and consultant, 2023).

> *Q3.5: "*In the past I have joined MRDH, that had an initiative about circularity of business parks throughout the region which I found very interesting. But in this initiative Heron actually emerged as a less important park for circularity, because the park is still relatively young and not completely filled yet." – Project manager, 2023

4.4.8 Policy instruments

This section elaborates upon the policy instrument relevant in sustainable and circular development of business park Heron.

4.4.8.1 Park management

Park management at Heron has regular contact, about six times a year they meet and discuss a number of relevant topics. Among these topics are sustainability, but also security. In section 4.4.2 al tasks that are accommodated by park management are mentioned.

4.4.8.2 Park policy

Business park Heron allows companies with a maximum environmental category between 3.1 and 3.2/4.1 or higher, depending on the location at the park (Municipality of Pijnacker-Nootdorp, 2012). Previously, the park didn't have specific regulation for businesses to establish at Heron, as long as the company is ambitious on sustainability, develops a plan and fits the vision for the park. As elaborated for business park De Boezem, this approach will change in the foreseeable future (Project manager, 2023; Park manager, 2023). An explanation of the new approach is provided in Section 4.2.8.1, of the chapter on business park De Boezem.

Residency is not allowed at the park as this could interfere with business operations at the park when residents would complain about, for example, noise, smell, transport (Park manager, 2023).

4.4.8.3 Subsidies

For the exploration and implementation of sustainable initiatives and measures business park Heron has utilised subsidies, and is in the process of applying for more subsidies. The municipality supports this, e.g. by providing subsidies for developments related to the sustainability dashboard or taking the

lead in applying for subsidies at the province (Project manager, 2023). The consultant explains they used the business parks planning subsidy from the Province of Holland to evaluate which sustainable initiatives the businesses at the park could implement (Consultant, 2023). At present, they are in the process of applying for subsidies for circularity so the park can achieve the status of 'circular business park' as established by the province of Zuid-Holland (Consultant, 2023).

4.4.9 Economic context

This section elaborates on the economic context of sustainable and circular development of business park Heron.

4.4.9.1 Entrepreneurial fund and park association

Business park Heron has two streams of funding the park can use to implement sustainable and circular initiatives. The first is funding from the association of undertakings at Heron. All businesses that establish at Heron are required to join and contribute to this association by the sales agreement. The second is funding from the Entrepreneurial fund of Pijnacker-Nootdorp. This set up is explained in more depth in the chapter of business park De Boezem. Again emphasizing, this way of organizing is mentioned as a great success factor for sustainable development in the municipality (Park manager, 2023).

4.4.9.2 Financial effects of measures and initiatives

The financial effects can be an important driver or barrier in the implementation of measures and initiatives. The topic has come up several times during the interviews as something that can be difficult to organize for collective initiatives. For example as not all businesses have the same financial capacities, or some businesses might gain larger advantages from certain measures than others.

Moreover, the profitability of initiatives is part of the motivation for businesses to pursue an initiative, in addition to the environmental and social advantages (Q3.6, Consultant, 2023).

> *Q3.6: "We are also going to look further at how to further promote circularity at Heron. [...] Achieving financial returns is of course important for entrepreneurs. And ultimately, in addition to the social and energetic performance, in the end it must also generate some money." – Consultant, 2023.*

4.4.10 External context

No variables that couldn't be assigned to the other evaluated categories, but were still discussed as relevant in the sustainable and circular development of business park Heron

4.5 CASE 4: GROOTE HAAR, GORINCHEM

Groote Haar is a future business park that will be developed in the municipality of Gorinchem. To evaluate the park, two actors were consulted:

- The project manager employed by the municipality for Groote Haar, who was interviewed.
- And a Policy advisor at the municipality that has been involved in the project for the past 25 years for soil and sustainability, who provided a written response to the interview questions.

Additionally, publicly available documents and information, as well as documents supplied by interviewees have been consulted.

4.5.1 Initiation, vision and ambition

This section elaborates on the initiation process of Groote Haar, and the sustainable and circular vision and ambition of the park.

4.5.1.1 Initiation

The first plans for the business park date back to the end of the last century, when the municipality was exploring expansion options for residential and business areas. Initial plans assigned the north of Gorinchem for residential development and the eastern side for a new business park. However, the province of Zuid-Holland determined the North of the municipality as the designated area for a new business park, as the area wasn't fit for further development of residential area due to natural area 'Het Groene Hart' that is located there. Following this decision, the municipality started the purchase of land in the area (Municipality of Gorinchem, 2017).

In 2011, the first land-use plan "Gorinchem Noord" was brought into procedure, containing plans for business park Groote Haar and a connection to highway A27. This document was annulled by de Raad van State in 2012, as an agreement with Rijkswaterstaat on the connection to the A27 was not reached. In 2015, an agreement was reached with Rijkswaterstaat and in 2017/18, the land-use plan for business park and windfarm Groote Haar and the highway connection A27 became definitive (Municipality of Gorinchem, 2017).

Currently, the municipality has acquired the territory for the park and completed the required spatial procedures. The realisation of the A27 connection by Rijkswaterstaat is the next step in the development of the park, starting next year. In the meantime, the municipality is in preparation of e.g. further formulating and substantiating sustainability plans for the park and more. If everything goes to plan, sales of the first plots start by 2025. By 2026 the A27 connection should be finished, after which construction of the park can begin (Project manager, 2023).

4.5.1.2 Vision and ambition

The municipalities, envisions Groote Haar as a sustainable and future proof business park (Municipality of Gorinchem, 2017). In the past 25 years, the park has had a variety of sustainability visions and ambitions (Policy advisor, 2023). Sustainability has always been an important topic in the development of the park.

The municipalities ambition for business park is high. At present, the municipality is in the process of actualising their ambitions for the park and formulating an invitation to tender that contains requirements for businesses that want to establish at the park. In this process the municipality might use other sustainable and circular business parks as a source of inspiration for development, ideas and suggestions for Groote Haar. The project manager mentions business park Ambachtsezoom in Hendrik-Ido-Ambacht and the manuals and documents that were developed for the park as an example for

how the municipality might communicate their ambitions and visions for the park (Q4.1, Project manager, 2023).

> *Q4.1: "Ambachtsezoom in Hendrik-Ido-Ambacht with all those beautiful pictures makes me very happy, and all those pretty books. [...] I have asked -my colleagues- to* see if we should also develop something like that, so that we can also communicate what our ambition is in a decent manner."
> – Project manager, 2023

4.5.2 Organisation and actors' roles

This section elaborates on the roles of the municipality, park management, the park manager and entrepreneurs at the park in sustainable and circular development of Groote Haar.

4.5.2.1 Municipality

The municipality of Gorinchem is the project initiator and developer. In collaboration with a number of expert parties, they have developed plans for Business parks and wind farm Groote Haar. The municipality is currently in the process of further detailing the vision and ambition for Groote Haar. The land-use plan is currently the leading document with plans and ambitions for the park. In the foreseen future, an updated plan for the park will be formed. This plan contains the requirements for businesses that want to establish at the park, the organisation of the park via park management, organisation of the energy system at the parks etc.

4.5.2.2 Park management

The municipality envisions a park management organisation for the park. The exact specifics for this group are not clear yet. The municipality is still thinking of who the park management should consist of, which ambitions the park management should have, and what tasks are intended for them. The project manager explains that foresee a crucial role for park management for the collectivity at the park (Project manager, 2023). This includes for example organizing collective services and purchases, including waste management and energy generation or purchase, and facilitating in synergies for energy and material rest streams (Policy advisor, 2023).

4.5.2.3 Park manager

The municipality has foreseen a park management for the park, a park manager might be part of this park management. The municipality is still developing the exact structure for this management.

4.5.2.4 Entrepreneurs and businesses

Entrepreneurs and businesses are responsible for developing real estate following the guidelines of the municipality. As the park is not in construction yet, and the municipality is still formalising plans and organisation of the park, the exact roles for entrepreneurs and businesses are not established yet.

4.5.3 Sustainable and circular initiatives at the park

This section elaborates upon the sustainable and circular initiatives that are explored, implemented or passed over in development of business park Groote Haar.

As business park Groote Haar is expected to start construction in 2026, the initiatives for the park are still in preparation. Some of the proposed measures have been legally anchored in the land-use, other measures are optional or still being explored. Factors such as the latest innovations or companies that establish at the park are of influence. The following measures have been proposed and mentioned in the land-use plan and interviews

4.5.3.1 Business individual energy and circular construction

Business park Groote Haar requires a GPR-norm of 'high level of sustainability' for buildings at the park, indicating advances optimization of the building concept through sustainable choices in all phases of building development (policy, design, realisation and renovation). The methodology assessed the building on five theme's: energy, environment, health, user quality and future value. Within these theme's, topics such as energy performance and circular material use are assessed (GPR, n.d.)

In the upcoming invitation to tender, the municipality might include specific measures businesses have to implement in the development and design of their new buildings (Project manager, 2023).

Solar panels on roofs and green roofs are among the measures the municipality plans on incorporating in the upcoming invitation to tender. In 2016/2017 the idea was to require 25 percent of rooftop area dedicated to solar panels, and 25 percent to green roofs. Currently, the idea by the municipality is collaborate with the businesses to evaluate their ambitions and develop a plan on how to arrange their rooftops in consultation with businesses (Project manager, 2023).

4.5.3.2 Exchange of energy, materials and water

Exchange of resources is among the tasks the municipality plans for the park management to organize (Policy advisor, 2023).

4.5.3.3 Collective utilities and infrastructure

Business park Groote Haar is a gas free business park, that is self-sufficient in its energy supply. To provide businesses at the park in their thermal energy demands, a collective thermal energy system is planned for the park. Among suggested alternatives is the installation of a digestion plant at the park, but the feasibility of this option strongly depends on the market demand of the businesses that locate at Groote Haar. Alternatively, a heating system consisting of heat pumps, free cooling and seasonal storage in an ATES is considered. For this suggestion, it is stated higher temperature storage at greater depth is considered to ensure coverage of peak demand and prolonged cold periods (Municipality of Gorinchem, 2017). The options for such a system have been explored in collaboration with Royal HaskoningDHV. Their research concluded the it is recommended to organize collective supply at the park, but that a definitive advice/choice can't be made yet due to the high investment costs and uncertainty in demand and purchase of future companies at the park (Project manager, 2023). The potential of a heating network at the park will be explored again when the park is almost filled with businesses (Policy maker, 2023).

Another key feature of the business park is construction of Windfarm Groote Haar is legally anchored in the land-use plan. This windfarm consists of two turbine windfarm with a maximum capacity of 7MW next to the business park. The windfarm will be developed by a local energy cooperation and net operator Eneco (RES Regio Alblasserwaard, 2021). In the land-use plan it was agreed upon at least ten percent of the energy generated by the windfarm is used at the business park. Various actors have commented that this agreement is unfeasible, as it is impossible to verify how much of the energy used at the park originates from the turbines. An alternative for this agreement will be sought in collaboration with the developers of the farm. A potential solution could be offering contracts to businesses at the park, so the energy of the windfarm is still indirectly used at the park (Q4.2, Project manager, 2023).

Q4.2: "We have spoken about it with Eneco and other parties and they all say this just insane, we cannot prove it and we cannot realize it. [...] We have to come to an agreement with the party who will actually operate the wind turbines on what the obligation is going to be. So what are you going to do to ensure you still get customers at the business park". – Project manager, 2023

The land-use plan mentions potential plans for a solar panels field. The issuance of business park Groote Haar is spread over 20 years, thus sections of the plan area won't be sold and built on. These sections could potentially be filled with solar collectors (Municipality of Gorinchem, 2017).

4.5.3.4 Waste management

Collective waste management is among the measures that are foreseen for the park management to organize.

4.5.3.5 Sustainable mobility and transport

Initiatives for sustainable mobility are explored and considered for Groote Haar. An example is encouraging construction of charging stations at the park, to stimulate electric mobility for businesses at the park. Potentially, construction of charging stations might be incorporated into the upcoming invitation to tender. Additionally, facilities for public passenger transport are among the explored options (Municipality of Gorinchem, 2017).

4.5.3.6 Collaborative models for appliances, tools and services

Collaborative models for appliances, tools and services among firms was not discussed in the interviews.

4.5.3.7 Collective commercial firm facilities and provision of services

The municipality plans on establishing a park management at Groote Haar, that will be responsible for a number of activities and tasks. Among these tasks are organizing waste management, collective energy supply and energy efficiency measures, (window)cleaning, organization of communal outdoor (Municipality of Gorinchem, 2017). Other tasks envisioned for the park management include for example facilitating in collaborations and synergies for rest streams (Policy advisor, 2023). The exact task allocation for park management will be included in the upcoming invitation to tender (Project manager, 2023).

4.5.3.8 Flora and fauna

The municipality plans on developing plans for biodiversity at the park (Policy officer, 2023).

4.5.4 Physical location specific and business specific features

This section elaborates upon the physical location specific features of business park Groote Haar.

4.5.4.1 Owner of land

The municipality is the owner of the land-area where Groote Haar will be developed and project manager for the park. business park Groote Haar. Accordingly, the municipality is the actor that is planning the development and construction of the park, and the driving force behind the exploration of initiatives and measures in collaboration with other parties.

4.5.4.2 Accessibility

In preparation of Groote Haar, the municipality agreed upon a connection of the park to the A27 highway that is adjacent to the park. This connection is currently in preparation and an important component in the development of Groote Haar (Project manager, 2023; Policy advisor, 2023).

4.5.4.3 Proximity and clustering of companies

The land-use plan mentions potentially clustering of companies with the aim of optimizing (re)use of residual and wastewater streams.

4.5.4.4 Business characteristics

Groote Haar is intended to house large-scale businesses and businesses with high environmental categories. The energy demand of the businesses that will establish at the park, influence the choice for the thermal energy system that will be implemented in the park. The energy demand, energy generation and waste generation of businesses also influence the potential energy and waste synergies that can be established at the park (SAB, 2017)

4.5.5 Social location specific and business specific features

No businesses have established at business park Groote Haar yet, thus currently no social location specific and business specific features are present.

4.5.6 Regional and local characteristics

This section elaborates upon the characteristics of the region and area where business park Groote Haar is located.

4.5.6.1 Physical characteristics of surrounding region

The Betuwe Route is a fright rail line connecting the Maasvlakte to the German border. This line intersects the municipality of Gorinchem, separating the north side of the municipality from the rest. The construction of this line has impacted the course of the development process of Groote Haar. In the earliest development stages of park, the construction of the railway was used as occasion for the municipality to negotiate the connection of the business park to the A27 highway. Coming to agreements and construction of the highway are a main factor in the longevity of the process (Project manager, 2023).

Particular in developments for the connection to the A27, is the fact this connection is located in neighbouring municipality Molenlanden. Thus clear agreements with this municipality were made about their collaboration in this project and their responsibilities regarding all relevant procedures, the land-use plan etc. (Project manager, 2023).

4.5.6.2 Grid capacity and grid congestion

The grid capacity in the municipality of Gorinchem is nearly reached and grid congestion forms a serious thread in the region (Stedin, 2023). The municipality recognizes this problem, and is searching for a solution for the problem in collaboration with net operator Stedin, and in coordination with the RES (Policy advisor, 2023).

Smart and efficient use of the grid is required, and a combination of solar energy and wind energy contributes to a balanced grid load. Additionally, direct use of generated energy is a potential part of the solution (Gorinchem, 2023). Business parks could pose a key solution in solving the problem (Policy advisor, 2023).

4.5.6.3 Characteristics of municipality

The political position/affiliation of the municipal executive is of influence in the development of sustainable business parks and the implementation of sustainable measures, as the municipal executive is responsible for decision making in the municipality.

The municipality of Gorinchem has a reasonably right-wing municipal executive, resulting in the risk of a lower support base for ambitious sustainability plans. However, a number of very innovative projects are currently being launched/put on the market in the municipality, e.g. a new tender for electrical ferry's for the ferry service of Gorinchem (Q4.3, Project manager, 2023)

> Q4.3: *"Within the municipality of Gorinchem, the ambitions for the business park vary considerably. There are those who say sell quickly, then our debt burden has been reduced a lot and then we can invest in other projects. [...] And those that say we must achieve the highest ambition and we ourselves may have to develop things there that are not yet in the market. So that varies greatly." – Project manager, 2023*

4.5.6.4 Sectors, industry and business parks in area

Gorinchem is a municipality with multiple business parks and a lot of industry, and the potential this brings for synergies is recognized by the municipality. They plan on exploring more circularity on all business parks, starting with the energy sector in coordination with the RES (Q, Policy advisor, 2023). The potential of industry and other business parks are both recognized in the vision on heat transition and RES (Project manager, 2023).

4.5.6.5 Public opinion and participation

Public opinion and participation have been of influence in the development process of Groote Haar. To illustrate, business park Grote Haar offers accommodation to businesses with high environmental categories. In response to concerns of citizens in the region, the municipality composed a list of companies and business operations in higher environmental categories that are, and are not welcome at the park (Q4.4, Project manager, 2023).

> Q4.4: " *The park has the opportunity to accommodate high environmental categories. In the surrounding area of the park the people became restless as a result of messages that, for example, fireworks would be stored there or there would be an oil cracking installation. [...] So we have included a whole list of companies in the land-use plan describing what we do want and what we do not want at the park". - Project manager, 2023*

4.5.7 Regional spatial-economic strategies and environment policy

This section elaborates on the regional spatial economic strategies and regional environment policy relevant in sustainable and circular development of business park Groote Haar.

4.5.7.1 Regional and local importance of the park

Business park Groote Haar is a regional business park, developed with the aim of attracting and retaining business activities in the region, as well as increase employment opportunities in the region (Municipality of Gorinchem, 2017). The park is of provincial significance, due to its potential to accommodate large scale businesses and businesses with maximum environmental categories (Project manager, 2023). These characteristics were the basis for the Province to assign such a large designated area for development of the business park (Project manager, 2023).

Windfarm Groote Haar contributes to sustainable development of businesses, resulting in a better competitive position of business in Gorinchem and a positive influence on the regional employment opportunities (Municipality of Gorinchem, n.d.)

4.5.7.2 Sustainability policy and strategies in the municipality

At present the municipality of Gorinchem does not have specific policies for sustainability at business parks. In collaboration with "*Industriële Kring Gorinchem",* they are exploring how to address sustainability in the foreseen future (Policy advisor, 2023). The Environment Agency OZHZ also has a role in this process, as the party that is responsible for monitoring sustainability measures (Policy advisor, 2023).

In the municipal wide sustainability vision, Gorinchem focusses on three pillars: municipal acting, biodiversity, and sustainable energy. The municipal vision is translated to business park Groote Haar in the land-use plan, that is further elaborated upon in section 4.5.7.3 below.

For renewable energy, the municipalities strategy is captured in the Renewable Energy Strategy of the region Alblasserwaard, further elaborated in the next section.

Regarding circularity, the municipality does not have a specific strategy. For waste streams, they coincide with the circular strategy of the regional waste processing company "reinigingsdienst Waardlanden". The main focus in this strategy is however municipal residential waste, business parks are of lesser importance in this strategy (Policy advisor, 2023).

Moving forward, the municipality is going to explore circularity at business parks. Starting with the energy system, plans will be developed in coordination with business park and windfarm Groote Haar and the RES strategy (Policy advisor, 2023). As explained in section 4.5.2.2, a role for this is foreseen for the future park management at Groote Haar (Policy advisor, 2023).

4.5.7.3 Land-use plan

As previously explained, the land-use plan contains detailed plans for the development of business park and windfarm Groote Haar. The agreements in this document, are leading in the development of Groote Haar. But the municipality is currently in the process of further exploring and updating the plans and conditions for the park (Q4.5, Project manager, 2023).

> Q4.5: *"The Spatial Planning Act offered the option to develop plans with a broadened scope, which it not only includes spatial conditions, but also other conditions. We have done that, but now this must be further substantiated, so what is the meaning of 'the most sustainable business park in the region?, And what measures do we take and how are we going to achieve this?'. This process has now begun, so we can tell companies the requirements and expectations when we start selling the plots on the business park in 2025, and companies can start building in 2026. [...] We'll be making those updates in the coming years.." - Project manager, 2023*

4.5.7.4 Regional energy strategy (RES)

Groote Haar and the municipality of Gorinchem are part of the RES-region Alblasserwaard. Ambitions in the region are 20 percent energy savings in 2030, 35 percent of the total energy demand covered by renewable energy sources and local and regional collaborations for sustainable thermal energy (RES region Alblasserwaard, 2021).

Windfarm Groote Haar is mentioned in these plans, and contributes to the future ambitions of the region. Installation of solar panels on rooftops is another important part of the strategy, the ambition of Groote Haar of requiring solar panels on rooftops is thus in line with the strategy. Furthermore, installation of solar collector fields on unexploited areas is also mentioned in the strategy. The potential plans of Groote Haar to temporarily instal a solar collector field would also be in line with the

strategy. Lastly, the collective thermal energy system is in line with the ambitions of local and regional collaborations for thermal energy.

Overall, the development plans at Groote Haar and the Regional Energy Strategy are aligned and complementary. In the interviews, coordination with the RES is mentioned, the RES is adjusted and coordinated with the vision on heat transition.

4.5.7.5 Vision on heat transition

The municipality has developed a vision on heat transition. In this vision, business park Groote Haar is marked as an area where it is uncertain whether individual/small-collective solutions or a collective heating network is the most profitable solution. It is stated further research has to be performed. These statements are in line with findings and development plans of business park Groote Haar. The strategy highlights the park could pose opportunities for in the surrounding area's as coupling might be a possibility, so monitoring and coordinating with developments at the park is relevant for the future (Municipality of Gorinchem, 2021). Overall, business park Groote Haar is well incorporated in the vision on heat transition and its potential is recognized.

4.5.7.6 Residential development plans

Residential development in Gorinchem is puts pressure on businesses and business parks in the region. As previously mentioned, in the earliest development stages of Groote Haar the location for the park was adapted to fit residential development plans.

At present, the only option for the municipality to develop more residential areas is by transforming business parks in the region. As a result, two business parks in the municipality are on the verge of being (partially) transformed to residential areas. It is expected that some businesses that are currently located at these two parks, will migrate to business park Groote Haar as the park provides the room for these to divert and stay in the municipality (Q4.6, Project manager, 2023).

> Q4.6: *"The only way the municipality can add housing, through area transformation and densification in the city. And the expectations are that a number of companies on those business parks will relocate to this park. That won't be the companies with environmental category 5. It won't be energy producers but a plastic moulder or woodworking company and so on. So that is a different category". - Project manager, 2023*

4.5.8 Policy instruments

This section elaborates upon the policy instrument relevant in sustainable and circular development of business park Groote Haar.

4.5.8.1 Park management

Park management is mentioned as a key policy instrument in the implementation of sustainable and circular initiatives at the park. The municipality is in the process of determining who park management will be and what the exact tasks of the management will be (Project manager, 2023). However, a number of activities have already been anticipated for park management at the park, e.g. evaluate measures companies at the park can implement, facilitate in establishment of collaborations and synergies, support in collective buying of resources and services, waste management etc. (Policy advisor, 2023).

4.5.8.2 Park policy and selection procedure / invitation to tender

The invitation to tender is a document that contains the requirements the municipality has for businesses to establish at the park (Project manager, 2023). These requirements are mainly aimed at

building and business specific measures, and an addition to the measures that are anchored in the land-use plan. This approach is chosen to ensure the requirements at the time of issuing plots for the part are as recent as possible, an adapted to the latest innovation and regulation. In the land-use plan, the following measures and initiatives are mentioned for the invitation to tender: installation of solar panels on rooftops, energy-efficient design and construction and/or a sustainability scan, wind energy at individual scale, installation of green roofs, stimulating electric mobility and potentially requirements for charging stations for each company, and lastly, the establishment of park management, their tasks and participation of businesses in park management (Municipality of Gorinchem, 2017).

4.5.8.3 Changing national regulation

Regulation is constantly evolving and changing, demanding continuous anticipation in the development of business park Groote Haar. During the past 25 years, there have been several occasions where the municipality had to evaluate and adapt its plans to correspond with the latest regulation. This constant process of evaluating and adapting, has resulted in long delays and high additional costs (Project manager, 2023). Changes and enhancements in Nitrogen regulation are an example or regulation that have complicated and delayed construction for the park (Q4.7, Project manager, 2023)

> Q4.7: *"You think you have the correct permits, but then new things come up you have to comply with. So it is a continuous process of adapting and checking 'what do I need now, what has changed etc'. [...] So continuous developments and regulations that you have to anticipate on. When you move to the implementation phase you couldn't have thought of all of this ahead of time. [...] And as a result these projects take a very long time". - Project manager, 2023*

4.5.9 Economic context

This section elaborates on the economic context of sustainable and circular development of business park Groote Haar.

4.5.9.1 Delays in development as a result of funding difficulties

Economic features have had a significant impact on the development of business park Groote Haar. In the planning of the park, delays resulted from time it took Rijkswaterstaat to find funding for the A27 connection. Consequentially, also has financially affecting the municipality. Delays in the process that result from the new nitrogen regulations also have a negative financial impact on the project.

4.5.9.2 Financial support by municipality

The municipality recognizes companies might not be able to afford some of the (potentially) required measures, such as large amounts of solar pv panels on roofs. In the exploration of how to implement these measures, they're exploring alternative possibilities. For example the park management renting the roofs of businesses for exploitation of solar panels (Q4.8, Project manager, 2023).

The wind farm is (partially) financed through an energy cooperation, members of the cooperation can invest in the project in return for an interest rate. (RES Drechtsteden, 2021).

> *Q4.8: "In consultation with entrepreneurs who are establishing at the park, we will look at how they can design their roof. We have thought of the possibility that it might be difficult for some businesses -to install solar panels-, so potentially the park management organization will rent the roofs of those companies if necessary, so that they can operate solar panels on them." – Project manager, 2023." - Project manager, 2023*

4.5.9.3 Financial interest of municipality

The financial setbacks in the run-up to the development of the park, might influence the approach of the municipality for the selection procedure for establishment at the park. The project already knows significant financial losses, and the municipality has a financial interest. This results in a field of tension between keeping the park financially attractive for businesses and staying highly ambitious for sustainability (Q4.9, Project manager, 2023).

> *Q4.9: " Within the municipality of Gorinchem, the ambitions for the business park vary considerably. There are those who say sell quickly, then our debt burden has been reduced a lot and then we can invest in other projects. [...] And those that say we must achieve the highest ambition and we ourselves may have to develop things there that are not yet in the market. So that varies greatly. - Project manager, 2023*

4.5.10 External context

This section contains the remainder of variables that couldn't be assigned to the other evaluated categories, but were still discussed as relevant in the sustainable and circular development of business park Groote Haar.

4.5.10.1 Innovation

Innovation is an important theme in the development of the park, mostly anchored in the sustainability measures that will be implemented in the park. The development plans for the park allow room for innovation through for example the Invitation to tender, that can easily be actualised and adapted to fit the latest developments in the field (Municipality of Gorinchem, 2017).

5 CROSS CASE ANALYSIS

This section evaluates and compares the four case studies and provides an overview of the main similarities and differences between the parks. A summarizing overview of the case studies and their similarities and differences is provided in Appendix H, below the similarities and differences are aggregated into six theme's.

5.1 ORGANIZATIONAL STRUCTURE AND DEVELOPMENT APPROACH

A similarity between the parks is that the municipalities are the initiators and project managers. The municipality determines which businesses are allowed to establish at the parks and following what requirements. In these requirements and the development approach, the municipalities differ. Hendrik-Ido-Ambacht has developed a set of very specific circular requirements the businesses that establish at the park have to comply with. Moreover, they require businesses to be self-sufficient in their energy supply and all electric. As a result all buildings at the park are constructed modular and following cradle-to-cradle principles, and all businesses have organized their energy system at building level. Contrastingly, Pijnacker-Nootdorp requires businesses that establish at De Boezem and Heron to be all-electric and sustainable, but gives businesses the freedom to an approach that fits their own ambitions and capacities. Gorinchem is in the process of redefining the requirements they have for businesses that will establish at Groote Haar, but these requirements will include energy and circular topics.

In further development of the parks, park management and entrepreneurs are key. At all parks, the park management and park manager are the actors that actively are exploring new initiatives and opportunities, and involve the entrepreneurs in the process. In the end, the entrepreneurs and businesses are key in the implementation and execution of measures and initiatives. This starts with compliance to requirements of the municipality when establishing at the park. But continues in further circular and sustainable development. The municipalities and park management provide the tools and facilitate, but the businesses have to seize the opportunities, implement the measures or establish the connections and synergies. Moreover, it was mentioned that entrepreneurs sharing their experiences with each other can help inspire and motivate other entrepreneurs to participate in initiatives or implement measures.

5.2 EXPLORED AND IMPLEMENTED SUSTAINABLE AND CIRCULAR INITIATIVES AT THE PARKS

All parks follow a similar path for circular and sustainable development. New real estate at the parks is developed all-electric and energy efficient. Sustainable energy generation at the individual level is a focus point, especially via installation of solar panels of rooftops. Real estate is developed circular at Ambachtsezoom, and at the other parks when entrepreneurs had private ambitions for circular development. Park management and park managers organize the basics at the park collectively. This includes security and safety, maintenance of public area and green, telematics, as well as meetings and with entrepreneurs. Collaborations and synergies for services and (waste) materials occur in increasing number the more entrepreneurs get to know each other and the longer they are settled at the parks.

A difference is found in how the parks organize waste management. Ambachtsezoom offers collective contracts with two waste management companies to entrepreneurs at the park, and at Heron and De Boezem the businesses organize waste management themselves. At De Boezem efforts have been made to organize waste management collectively, but the waste company is unable to offer a

collective contract. All parks have indicated the ambition to obtain insight in material streams at the park, to facilitate material and waste synergies in the future.

A difference between Groote Haar and the other parks is found in the approach the municipality has for the energy system at the park. The municipality of Gorinchem approaches the system at park level. They have planned two wind turbines that either directly or indirectly supply the businesses at the park with energy, as well as a collective thermal energy system that will be detailed at a later stage. The other municipalities initially require businesses that establish at the park to organize their energy system at building level. Initiatives at park level are explored at a later stage of development. Collective energy initiatives and energy synergies are not present at the parks yet, but are being explored. For Heron and Ambachtsezoom, district heating networks were explored but not pursued due to financial reasons and insufficient interest in participation in the initiative by entrepreneurs. Collective energy storage, e.g. electric batteries at the parks are being explored to storage energy surpluses and enable electricity synergies. Coupling of production processes have not been discussed as future plans.

5.3 POLICY AND STRATEGIES

All municipalities are currently in the process of developing and updating sustainable and circular policy. In this process, the business parks are used as input. In Hendrik-Ido-Ambacht, the Ambachtsezoom is used as a trial to evaluate this approach of circular and sustainable development and lessons learned are used in further development of the municipality. In Pijnacker-Nootdorp information from e.g. the sustainability dashboard, as well as information that is discussed in the annual meetings between business parks and the municipality are used to form policy and strategies. In current policy and strategies, such as the regional energy strategies, the potential of the business parks is recognized and explored to a limited extent.

Park policy at the parks has different forms, but similarities can be identified. All municipalities are strict when it comes to deciding if a company can establish at the park. The company has to fit the vision for the park and requirements that are set in for example the land use plans. As elaborated in the previous section the approach for requirements differ per municipality.

A difference is seen in the future plans that are developed for the parks. Ambachtsezoom is already very advanced, and thus does not have a specific long-term plan for the transition to become more sustainable or circular. Actors at the park are aware of what can be done to even further improve sustainability and circularity and is taking steps to implement this, e.g. more (waste) material synergies or further improve energy efficiency at the park via the energy cooperation. Contrastingly, for de Boezem the municipality has developed an area-oriented environment program as part of the new Environment and Planning Act, that contains the ambitions for the park and measures and actions for various actors on how to achieve the ambitions. At Heron, the sustainable and circular transition of the park is more the responsibility of the entrepreneurs themselves, via the sustainability dashboard and supported by the municipality. Lastly, Groote Haar is currently updating their plans and requirements for the park but will likely follow the path of Ambachtsezoom.

5.4 SOCIAL AND PHYSICAL PARK CHARACTERISTICS

A similarity between the parks is the high degree of organization. All parks have a park management that consists of entrepreneurs at the park that has an executive, initiating and advising role. Tasks include the organization of collective initiatives, e.g. safety and security or maintenance of the park, as well as leading in progressing sustainability and circularity at the parks, e.g. as the party that can apply for collective subsidies or exploring new initiatives. The park management is supported by a park

manager they hire for the daily execution of park management tasks. The park manager is the link between the entrepreneurs at the park, park management and the municipality. In both Hendrik-Ido-Ambacht and Pijnacker-Nootdorp, there is one park manager that is responsible for all other parks in the municipality as well.

Familiarity and trust between businesses, the park manager and park management is mentioned as a characteristic at all parks. Ambachtsezoom and De Boezem are parks with mostly smaller scale, local businesses where this characteristic is somewhat naturally present at the park. At Heron, connecting the businesses requires a bit more effort. At all parks, park management boosts familiarity via regular events, meetings and communication. Facilitating the connection between businesses was mentioned as especially important at business parks Heron, where larger businesses with a more regional orientation are present. When businesses are familiar with each other's business operations, they can more easily find helps them in finding each other for collaborations and synergies. And being friendly and familiar with each other helps in easy communication, knowing how and where to find each other when needed and also provides an enjoyable ambiance at the park. Ambachtsezoom has a mobile application specifically developed for the park that is used by entrepreneurs and management to communicate, facilitate the collectivity at the and enable the search for collaborations and synergies at the park.

The attitude towards sustainability and circularity of the businesses at the parks vary. Some businesses are already ambitious and progressive when it comes to sustainability and circularity before establishing at the parks, and deliberately chose a park that fits that ambition. Other businesses establish at the parks as there is very limited land available for commercial and industrial development in the region. Their vision on circularity and sustainability was not a driver to establish at the park, and sometimes they felt that striving towards the level of sustainability and circularity envisioned at the parks was too much. This was especially the case at Ambachtsezoom, that requires a lot of measures to be implemented. However, evaluating the economic situation of establishing at a sustainable park their attitude often changed and now they are glad they are at this level of circularity and sustainability. At De Boezem Oost, mostly the larger companies that are either required by law to become more sustainable or experience great financial advantages are ambitious and involved in the initiatives at the park.

All parks are well accessible for cars and fright transport via nearby highways. For Groote Haar, the highway connection even was a requirement made by the municipality for development of the park at this location.

In Ambachtsezoom, De Boezem Oost and Heron the space at the parks is used efficiently. Meaning the business park character is anchored by ensuring only companies that have to establish at business parks are allowed to there, and residency is prohibited. Only at De Boezem West the land-area is not used to a maximum efficiency as there are a few houses at the park and a number of business activities that require establishment at business parks are present. The municipality and park management are aware of this obstacle for efficient use of space, and will tackle this in the future.

5.5 REGIONAL AND LOCAL CHARACTERISTICS

The municipalities at all parks are highly involved in the development of the park and implementation of sustainable measures and initiatives. Although the municipalities did not have specific sustainable energy or circular policies for business parks, or businesses, is in their municipality, they are all committed to improving the sustainability of the parks in the municipality.

The limited available development areas in the region are mentioned by the municipalities as an opportunity to be strict in who they allow at the park and what requirements for the park are.

Grid congestion is not an issue for Ambachtsezoom. But for the other business parks this can pose an critical risk in further development of sustainability at the park. Especially when more electricity is required at the parks due to the all-electric approach, and feed in from businesses that want to deliver back to the grid. The options for collective electric batteries and synergies at all parks that are being explored could pose a solution for this problem.

Other business parks and industries in the direct surroundings of the parks are not mentioned in the future plans for synergies for energy or materials at the parks. At Heron, a district heating network with local horticulturists and another business park was explored but not pursued. The business parks in the region are however very important in sharing their experiences and lessons for the implementation of initiatives. As well as for business-to-business.

5.6 FINANCIAL AND ECONOMIC CONTEXT

The financial effects and business case of initiatives are stated to be one of the most important factors for entrepreneurs at the parks in deciding to participate or implement. If an initiative or measure does not provide financial advantages to a business, it is unlikely that they will participate in an initiative or implement the measure, unless required by law. For example, at De Boezem a large share of companies have participated in an initiative for solar panels on rooftops as a result of collective subsidy application, efforts by the municipality and park management, and the financial advantages the solar panels provide businesses. Contrastingly, at Heron a collective electric batteries or a district heating network have been explored but the costs and dilemma who is responsible for the costs has resulted in the park not pursuing the initiatives.

All parks have a business association that the business have to be part of and financially contribute to. The earnings of this association are used to hire the park manager and invest in the collective services and initiatives at the park. . In Pijnacker-Nootdorp, there is an Entrepreneurial fund that businesses in the municipality have to be part of and contribute to. Business parks, among other sectors', can apply for funding via this Entrepreneurial fund to explore and implement sustainable activities and initiatives. The project manager, park manager and board members all mention this as very big advantage of the municipality that contributes greatly to the possibilities of progressing sustainability and circularity at the parks.

Subsidies are also mentioned as an important contribution to the exploration and implementation of measures and initiatives at the park, both at the individual level as collective level. A high degree of organization, park management and business association are often crucial in the application for subsidies.

Moreover, developing at a sustainable or circular business park is often more expensive than at 'normal' business parks due to the upfront investments the sustainable and circular measures require. At Ambachtsezoom, this was frequently mentioned by entrepreneurs that want to establish at the park but are met with the 'higher costs' of developing following the circular measures. However, after implementing all measures and requirements the entrepreneurs are often glad they have made the investments due to the financial advantages it provides them in the long run. Advantages include the no or limited energy costs, value increases of their real estate due to circular and sustainable characteristics, potential profits from selling energy surpluses etc.

6 DISCUSSION

This chapter starts with an interpretation of the results from the cross case analysis in the form of key findings and lessons learned. Afterwards, the limitations of the research are discussed. Followed by the scientific and practical

6.1 KEY FINDINGS AND LESSONS LEARNED

The evaluation of four sustainable and circular business parks in Zuid-Holland, and cross case analysis provides some key findings that answer sub-research question 4: "*What lessons can be learned from the sustainable business parks in Zuid-Holland, the Netherlands, for the future development of sustainable/circular business parks?".*

6.1.1 A strong organizational structure is essential

As elaborated on in section 5.1, the organizational structure and development approach is equal in the evaluated business parks. The roles and tasks of the municipality, park management, park management and entrepreneurs is very similar, if not equal. All parks have successfully implemented a variety of sustainable and circular initiatives, that are dependent on the ambitions and potential of the park and surrounding region. It can thus be concluded that the organizational structure and development approach the parks have results in successful sustainable and circular development of business parks.

Reasons for the success of this strong organizational structure can be found in e.g.: (1) the specific requirements the municipality can set for businesses to establish at the park as they are project manager; (2) a park management that is highly involved and ambitious on progressing sustainability at the park, which translates in for example the identification of new potential initiatives and motivating and guiding of entrepreneurs; (3) a park management organization that can function as coordinating party in the organization of collective initiatives, as well as subsidy applications; etc.

Valladolid (2021) recognizes these features in what he defines as the success factor 'policy instrument: facilitator'. He describes the facilitator as an actor that has five main tasks: connect actors, enable the context, help companies look at their surroundings, initiate ideas, and remove burdens. In his study, either the park management or municipality had the role of facilitator at the business park. This study indicates there isn't one facilitator during the sustainable and circular development of the park, but rather that different actors alter between the tasks of the facilitator during the development process. Other success factors Valladolid (2021) has documented can also be recognized in the approach, e.g. 'strict with their selection' and 'sustainable vision'.

6.1.2 Energy transition is more advanced than the circular transition in business parks

In the evaluated parks, the energy transition is more advanced than the circular transition. As explained in section 5.2, a pattern is identified in the development at the parks and implementation of initiatives. This pattern is also recognized by the policy expert at the province, who stated: "It usually starts with agreements about security and then later about energy, which generates easy money. Circularity comes later and takes longer because they are not quite there yet. Things more often happen at an individual level within companies" (Personal communication, policy officer Province of Zuid-Holland, 2023).

At all parks, efforts have been made for a future proof energy system at building and/or park level. This includes initiatives such as energy efficient building design, renewable energy generation, and (exploration of) energy storage. In further progressing sustainability and circularity at the parks, energy

initiatives are more often mentioned and seem to have a higher priority. Circular initiatives, and Industrial symbiosis initiatives are also implemented or pursued, but to a lesser extent. The initiatives that are implemented often mostly result from social features and efforts than from utilization of physical potential of the park, as is further discussed in the next section.

6.1.3 Differentiation in implementation of IS and circular initiatives with foundation in social or physical features.

Circular and industrial symbiosis initiatives that have a foundation in social (park) features are present at all parks. Examples of these initiatives include collaborations in sharing or exchanging services and appliances, joint provision of services by park management ,and sharing of waste materials. The more companies become familiar with each other's business operations, the more of these initiatives are established. Contrastingly, circular initiatives that have a foundation in physical (park) features, such as circular construction principles or coupling of production processes, energy and water synergies that require infrastructure, are implemented to a limited extent.

6.1.4 Scale of initiatives mostly individual company level or business park level, regional level less present

Circular principles can be implemented at various scales including individual company level (micro), business park level (meso) and in local, regional and national economies (macro) (Ghisselini et al., 2019). The same distinguishment can be made for other initiatives, related to for example sustainable energy.

Evaluation of the four business parks shows that initiatives and policy that focus on the regional scale are less present in sustainable and circular development of the parks, than the individual company scale or business park scale. The potential of business parks at the regional level is increasingly gaining attention in policy, e.g. Regional Energy Strategies, visions on heat transition, and the ambition of closing material loops in the future circular economy. However, these ambitions and strategic plans are not reflected at the evaluated business parks (yet).

Initiatives at regional scale that are present at the parks include the delivery of excess electricity to the grid, business-to-business generated at local scale and sharing of experience and knowledge. However, by far the most initiatives that are implemented occur within park boundaries or focus on individual buildings. This applies to the initiatives that are being explored and pursued as well. Moreover, the role the evaluated business parks (can) have in the regional and local energy transitions is not significantly demonstrated in regional and local strategic documents on these transitions. For three out of four business parks, these strategic documents communicate that a strategy and approach at park level should be developed, and the relation to the surrounding areas are not strategically documented.

The conclusion that the initiatives focussed on the regional scale are less present in the development at the parks, does not automatically indicate that the scale should be pursued more. The scale at which initiatives can best be implemented differs per situation and case, and is dependent on a variety of factors such as financial factors, physical potential, and how collaborations and organization of the measure can be organized (Rli, 2023).

6.1.5 Integral and strategic planning approach required for long-term sustainable development

Business parks are being developed in a circular and sustainable as part of working towards a sustainable future and to achieve the national and international climate goals. The targets for this desirable future are set, but what this future entails exactly is very unsure. The Netherlands

Environmental Assessment Agency (2023), for example, has developed four potential future visions on what the future economy in the Netherlands could look like, which all vastly differ.

An integral and strategic planning approach for the business parks is required to help prevent lock-in and path dependence in development of the park. Such an approach allows the park to be flexible and progress towards a sustainable future, regardless of what this future may looks like. An example to substantiate: It is stated the future circular economy is accompanied by a transition in business operations and spatial requirements. A potential future scenario requires circular activities such as collecting, disassembling and processing of 'waste' materials, for which business parks are suitable locations (Province of Zuid-Holland, 2020; Rli, 2023). Expectations are that these activities will require an additional 870 hectare of land by 2030 (Rli, 2023), whilst the province of Zuid-Holland is already experiencing a scarcity for available commercial development land. It could be said that business parks should take these future requirements into account in development of the park. However, as previously explained the potential of a future scenario with very different spatial requirements and activities is also plausible.

Acknowledging these uncertainties and anticipating them through an integral and strategic planning approach in development of the business park is required to ensure long-term sustainable development of the park. Such an approach was currently not mentioned in the interviews in the case studies. And in evaluation of developments at the parks it can be concluded that most of the park arrangements and construction are not adaptive to various future scenarios. Building on the situation outlined above, examples of how the uncertainties of the future could be included in strategic planning include adoption of circular construction principles. For example, design for maximal functional lifespan, whereby elements in a building are adaptive and can be adjusted based on changing needs'. However, as can be concluded from the case studies such a construction approach is likely to only be implemented when required by municipalities or park developers.

6.1.6 Economic advantages and well-organized funding system are important success factors

Economic advantages and convenience are often mentioned as motives for implementation of new sustainable and circular measures, collective services and utilities and for collaborations for services, products and material/waste synergies. The ecological advantages are concomitant. Examples include: the installation of solar panels that reduce the amount of energy businesses have to buy and simultaneously result in an increase in renewable energy generation; Economies of scale in collective contracts for park maintenance or waste processing, that results in lesser transport movements and thus transport emissions; or businesses sharing, lending and renting products of other businesses at the park as it is convenient, which limits the consumption of new goods and products. This finding corresponds to the findings by Valladolid (2021) and Susur et al. (2019), who both state motivations for participation in industrial symbiosis and utility sharing are almost always economic, and more important than the social and environmental effects of the initiatives. The findings contradict results by Heeres et al. (2004), who claim that economic and environmental effects are of equal importance.

Moreover, a well-organized funding system is highly conducive for sustainable and circular development of business parks. The parks have a park management and park association that entrepreneurs have to contribute to financially. With the fundings from the association, the park manager is hired. Moreover, many subsidy applications have to be applied to as a collective, which is possible when there is a park association. Lastly, an entrepreneurial fund can provide significant funding for the implementation of sustainable and circular measures. This initiative is however dependent on the organisation of the municipality, and thus not something that the business park can organize.

6.1.7 Entrepreneurs are key actors in implementation, and guidance, facilitation and stimulation is required

Guidance, facilitation and stimulation of entrepreneurs and actors at business parks is a key policy instrument and objective in the sustainable and circular development of business parks. These actions require input from and form benefits for actors at all levels, but is especially important for entrepreneurs, Entrepreneurs are sometimes unaware of the possibilities and potential of sustainable and circular measures, or how to approach and implement them. Moreover, they often need to focus on their core business operations and have insufficient capacities, in terms of time, finances, specific knowledge etc., to investigate and implement measures. These findings are also recognized by van der Bent et al. (2021) and Rli (2023).

Park management, municipalities and the province can facilitate this information as organizational actors. Communication between entrepreneurs also enables formation of synergies and collaborations, and when entrepreneurs their experiences and success stories with other entrepreneurs it can inspire and motivate. Park management and park managers can facilitate the implementation of new measures and synergies by informing entrepreneurs on potential measures and initiatives they can implement or by matching companies to establish business-to-business or material synergies, both at the park and in the other parks they manage. Moreover, park managers are the link between the park and the municipality so they are key in providing valuable input to the municipalities regarding the needs at the business parks. The municipality has an overview of local developments and creates the municipal policy that effect the sustainable development of the business parks. They for example have the responsibility to inform park management and entrepreneurs on potential subsidy possibilities or potential interesting developments in the municipality. Lastly, the province requires input from municipalities and business parks for the development of accurate strategies for sustainable development of the parks. Moreover, they can share knowledge with the municipalities on how they can approach circularity and sustainability.

6.1.8 The development approach of these parks facilitates policy development and collective learning

The development approaches in the business parks can be categorised as what can be identified as what Boons et al. (2016) call ‘government planning’ and ‘Facilitation – collective learning’ (visualized in Figure 6.1). In their research, they established various types of ‘dynamics’ for industrial symbiosis development at the business parks, that are assumed to be applicable to other sustainable and circular initiatives in this discussion.

Sustainable and circular development of business parks is ahead of the development of policy in the municipalities, as stated in section 5.3. Municipalities are currently in the process of developing new economic strategies and policy that include theme’s such as circular economy and the energy transition, in which business parks are used as pilots and input. As the municipalities are also the initiator of the project, this approach can be recognized as the governmental planning dynamic. In this dynamic, a government actors picks up an initiative from existing examples, and is used as input in policy and implemented. Progress of implementation is monitored and the results are fed back into policy (Boons et al., 2016).

The Facilitation – Collective learning dynamic, encompasses the approach discussed in the previous section (section 6.1.7). In this dynamic, a facilitator picks up an initiative from existing examples and translates it into a specific context. This results in a collective learning process of the facilitator and other involved actors, where knowledge is obtained and experiences are exchanged, to ultimately result in development of new initiatives (Boons et al., 2016).

Based on this research and evaluation of the case studies, it can be concluded that these have resulted in successful development of sustainable and circular business parks, and a combination of the two is possible.

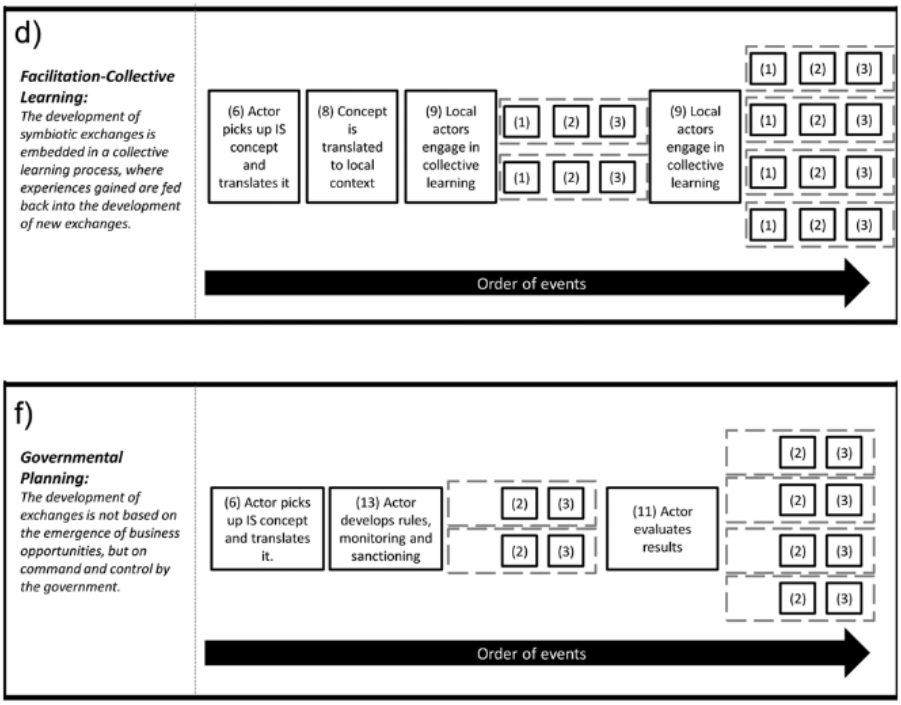

Figure 6.1 Industrial symbiosis dynamics: Facilitation-collective learning and Government planning (Boons et al., 2016).

6.2 RESEARCH IMPLICATIONS

This section addresses the academic significance of the research.

6.2.1 New and actualised data on sustainable and circular BP's in the Netherlands

The thesis contributes to the limited pool of literature on sustainable and circular business parks in the Netherlands.

A large share of EIP literature is concerned with industrial complexes with heavy industrial activities and where potential is found in e.g. the coupling of production processes. Business parks with 'lighter' industrial activities have different characteristics, achieve sustainable and circular development through other types of initiatives. This thesis provides new data and actualised data on the initiatives that are implemented in these types of business parks.

Moreover, a lot of literature on sustainable and circular business parks (EIP's) is concerned with parks outside of the Netherlands. Literature that does focus on the Netherlands is often dated and evaluated the same parks. This thesis provides new and actualised data of parks in the Netherlands.

6.2.2 Evaluation of existing literature on sustainable business parks and EIPs

To build on the previous implication of new and actualised data, The research provides actualised insights in the developments and practices in the parks, and challenges or further substantiate statements in existing (older) literature. For example: Boons and Lambert (2002) state "collective management is virtually absent in most cases, not to mention selection, clustering, and zoning, that "even trivial topics such as social security, traffic control, fire protection, and signposting are not adequately regulated", and that "a structured platform for deliberation between the interested

parties, which is a necessary condition for eco-industrial parks, fails in most of the cases" (Boons and Lambert, 2002, p. 478). This research contradicts these claims and implies that an evolution has occurred in site management of mixed-industrial parks. In all parks evaluated in the research, a park management and a park manager are present to ensure the basics such as security, and maintenance are in order. Moreover, this 'structured platform for deliberation' in present and actively organized at all parks in various forms, e.g. meetings for the parks associations, gatherings for entrepreneurs in the municipalities, and in one case even a mobile application developed specifically for the park to enable communication between enterprises.

6.2.3 Evaluation of EIP development process expanded with regional and local context: characteristics and spatial-economic policy strategies

Business parks are of great significance in national, regional and local economies, and their sustainable and circular transitions. Vice versa, regional and local characteristics, strategies and policy influence the development and potential of sustainable and circular development of business parks. These features were not reflected in the existing frameworks on business park (EIP) development by Eilering and Vermeulen (2004) and Valladolid (2021). This research has incorporated these features through the two new variables: (1) regional and local characteristics; and (2) Regional spatial-economic strategies and environment policy.

6.3 PRACTICAL IMPLICATIONS

This section addresses the practical significance of the research, in further sustainable and circular development of BP's.

6.3.1 Contribution of knowledge and practical examples for further development sustainable and circular BP's and implementation of initiatives

As introduced in the problem statement, a barrier in the development and progression of sustainability and circularity in SME business parks is the lack of knowledge and need for practical examples (Eilering and Vermeulen, 2004; Patricio et al., 2018). Moreover, the importance of sharing information and knowledge is emphasized by interviewees, in governmental policy and literature by i.e. van der Bent et al. (2022), Valladolid (2021), and more.

This research contributes to these needs, by providing practical examples, information, knowledge and experiences on various subjects:

- An overview of the options for sustainable and circular initiatives that can be implemented in business parks in the Literature review in Chapter 2, Section 2.4.
- A detailed evaluation of the current practices and developments in four sustainable and circular business parks, in which experiences and viewpoints of actors with various functions in the development process are reflected.
- An overview of environment policy and strategies at national level, as well as in the province of Zuid-Holland.
- Key findings and lessons learned based on the evaluation of four business parks;
- Recommendations to actors in the development of the business parks in upcoming section 7.7.

6.3.2 Reflection on current practice and developments for evaluation of progress and development of policy and strategies

The research can be used to evaluate the current practice and progress on objectives that have been established in policy and strategies.

For the province of Zuid-Holland, and potentially other provinces, the research provides insights in the developments in business parks, as well as experiences and viewpoints of municipalities, park management and entrepreneurs. The research can be used to evaluate the progress and status of the objectives they have identified in their strategies and policy.

For municipalities, the research provides insights in the approaches other municipalities have. Differences in approaches and their results are documented, which municipalities can use to evaluate their own approaches and to gain inspiration from other municipalities. The documentation of initiatives and measures that are, or are not, explored and implemented, and the reasoning behind it, can inspire the municipalities and support them further deciding on a future approach and potentially implementation. Moreover, the developments and experiences at the parks provide valuable information municipalities can use in further development of their sustainable and circular policy. Lastly, the responsibility of municipalities in progressing sustainability and circularity at business parks is emphasized.

For the park manager and park management, the research again can function as a source of inspiration for further development of the park. Moreover, the crucial role park managers and the rest of park management have is emphasized towards other actors. Lastly, developments at other levels, including provincial and municipal level are documented which helps adapt an approach that is coordinated with governmental developments.

For entrepreneurs and enterprises the research provides insights into the sustainable and circular measures other businesses have implemented, which they can use as inspiration. Moreover, the research highlights the critical role they have in achieving the sustainable and circular goals. The research also provides an overview of the developments that occur at other levels. And lastly, the study emphasizes the benefits and advantages that implementation of sustainable and circular measures can have, even if they require larger upfront investments.

6.4 LIMITATIONS

This section discusses the limitations of the research.

6.4.1 Terminology and interpretation of definitions

The interpretation of results is sensitive to the interpretation and definitions of the words used in the thesis. To substantiate the word ‘business park’ is examined.

As first introduced in Section 2.3, there are a variety of business park archetypes and definitions found in literature and policy. The exact definitions and characteristics of the parks differ between the various types of sources and languages, and are sometimes used interchangeably. Moreover, translations often result in a blurred definition of a word, as the definition of the ‘same’ word might differ (slightly) between languages.

In this thesis the word ‘business parks’ is used for what is called a ‘bedrijventerrein’ in Dutch policy. However, translating ‘bedrijventerrein’ using an online translator yields other words as well, including ‘industrial park’ which has different characteristics and potentials. Moreover, the business parks in this thesis can be identified as ‘mixed-industrial parks’ or ‘mixed-use ecopark’ based on their characteristics. And as they have implemented industrial symbiosis initiatives they can also be categorized as ‘eco-industrial parks’.

These difficulties of translating were also experienced in the documentation of policy and strategies, as it was often difficult to find the correct translation of documents and terminology.

All of these variations result in sensitivities in the interpretation of results. Efforts have been made to be able to accurately navigate the terminology used in this thesis, but it is important to be aware of this limitation in using results and findings of the research.

6.4.2 Scope of the study and selection of case sites

The scope of the study and selection of cases in the thesis limit generalizability of the results, as the business parks that are evaluated in the thesis have several characteristics that are equal.

First, the scope of the study was set to Zuid-Holland the Netherlands, and within Zuid-Holland a total of four business parks in three municipalities were evaluated. This limits the generalizability of the results for other sustainable business parks outside of the scope, as other provinces and municipalities might have other approaches and policies regarding (sustainable) business parks, the energy transition and circularity.

The sample of potential case sites was first narrowed down to parks with some form of organizational structure, as van der Bent et al. (2021) and the Province of Zuid-Holland implied these parks are more likely to have sustainable and circular initiatives and are easier to get in contact with. With this selection, the generalizability to other parks without such a structure is unsure. Next, the sample of parks was narrowed down to parks that the Province of Zuid-Holland categorised as 'mixed park', high-end park or high-tech park. The generalizability of the results is thereby unsure for parks categorised as industrial park, agribusiness or distripark. Following, the selection of potential cases is based on openly available information on sustainability and circularity at the parks. So potentially, other parks could have fit the scope of the study but were excluded because of the readily available information on initiatives.

Lastly, as a result of responses on first contact requests the case study sample of cases has resulted in a sample that has the same characterises that can be very indicating of the development and progression of sustainable and circular business parks. E.g. for all parks the development is initiated by the municipality and are they are the project manager, the parks have a park management and park manager, there is scarcity for available commercial development land etc. The generalizability of results is thus limited as the sample of parks have very similar characteristics.

6.4.3 Dynamic nature of sustainable and circular developments

There are a lot of ongoing developments regarding sustainability and circularity at various levels. The government is developing policy and strategies at all levels. Examples include the municipalities that are developing sustainable and circular strategies, that have not been included in this thesis as they weren't finished yet, but will be very shortly. Their official approaches add valuable and interesting information in the reflection of development of the parks and the relationship between the two. Moreover, per 2024 the new Environment and Planning act becomes effective, which changes the approach to spatial planning and development in the country. Some steps in the development approaches that are evaluated in this thesis might thereby be different from this moment on.

This dynamic nature of sustainable and circular development might results in a situation where the results in this thesis might not be true anymore when some of the factors that were evaluated in the research change in the (nearby) future.

6.4.4 Limited perspectives in the case studies

The information in the case studies is provided by a limited number of interviewees. At each park a maximum of four people were interviewed, with various roles including project manager, park manager or park management member and entrepreneurs at the park. Each of the interviewees

however is highly involved in progressing sustainability and circularity at the park. This might present a view on the situation and development of the park from the perspective of actors that for example are always looking for ways to improve the park and that are ambitious and passionate about sustainability. The perspective of an actor at the park that is less involved in the development process, specifically entrepreneurs that are not part of the park management but just present as company at the park, could provide other interesting and valuable views and information on the development.

Lastly, as the research is qualitative and interviews are the main source of information, it is important to note that statements made by interviewees are interpreted in a certain way by the researcher. Other researchers might interpret statements differently, filter information differently etc.

7 CONCLUSION

This chapter provides a recap of the research and answers the main research question and sub-research questions. Moreover, recommendations are given for actors in the development of circular and sustainable business parks.

7.1 SUB-RQ 1: SUSTAINABLE AND CIRCULAR INITIATIVES IN BUSINESS PARKS

Sub-research question 1 reads: "*What options for sustainable and circular initiatives can business parks implement in sustainable and circular development?".* This question was answered in the literature review in Chapter 2 section 2.4.

Business parks can implement a variety of collective initiatives that are aimed at production processes and streams, and at site arrangement and park organization. Moreover, enterprises can implement individual initiatives focussed on energy efficiency or circular construction. A summary of options for sustainability and circularity in business parks is provided in Table 7.1.

Table 7.1 Overview of sustainable and circular initiatives in business parks

	Collective initiatives	**Individual initiatives**
Streams and production processes	• Exchange of energy, materials and water • Collective use of utilities, infrastructure and firm functions • Collective waste management • Shared mobility and collective transport of goods and people • Collaborative models for appliances, tools etc. • Circular design principles in public space	• Renewable energy generation and energy storage • Reuse of energy from waste streams • Waste management
Site arrangement, park organization and architecture/ construction	• Effective and strategic use of space • Joint commercial firm facilities / provision of services • Multimodal transport and high quality public transport	• Energy efficient building construction, installations and appliances • Circular construction

7.2 SUB-RQ 2: POLICIES AND STRATEGIES FOR SUSTAINABLE AND CIRCULAR DEVELOPMENT OF BP

Sub-research question 2 reads: *"What are the current policies and strategies on sustainable and circular development of business parks by the national, provincial and municipal governments?".* This question is answered in Chapter 4, by means of interviews with a policy officer at the province of Zuid-Holland, interviews with actors at business parks evaluation of secondary data including governmental documents on policy and strategies and government websites.

Table 7.2 provides an overview of the current policies and strategies on sustainable and circular development of business parks at the (inter)national and provincial level. Strategies at the municipal level are currently being developed.

Table 7.2 Overview current policies and strategies on sustainable and circular development of BP´s

Level	**Theme**	**Policy title**
Inter-national	Climate	The Paris Agreement
		EU Green deal

National		The Climate Act
		Climate Plan
		National Climate Agreement
		The Environment and Planning Act
	Energy transition	The National Strategy on Spatial Planning and the Environment
		Regional Energy strategies
		The Environmental Quality Decree of the Netherlands
		Vision on Heat Transition.
EU	Energy efficiency	Energy efficiency directive
National		Energy saving obligation from Environmental Management Activities Decree
		Energy label C obligation for offices
	Circular economy	Government-wide programme for a Circular Dutch Economy by 2050
		Raw Materials Agreement
		Transition agendas: zooming in on five sectors
		Circular economy implementation plan 2019-2023, 2020-2023, 2021-2023.
		National Circular Economy Programme 2023-2030,
		Government-wide programme for a Circular Dutch Economy by 2050
		Raw Materials Agreement
Province ZH	Sustainable + circular BP	Circular Zuid Holland: Accelerate together
		Business park strategy Zuid-Holland
		Circular Zuid-Holland Spatial Strategy

7.3 SUB-RQ 3: CURRENT PRACTICES AND DEVELOPMENTS AT BUSINESS PARKS

Sub-research question 3 reads: *"What are the current practices, initiatives and developments at sustainable and circular business parks in Zuid-Holland?".* For four business park a detailed documentation on the current practices and developments is provided through evaluation of ten variables introduced in the theoretical framework from section 3.2. Information used in this evaluation is obtained from interviews with actors at the business parks and an evaluation of secondary data, including internal documents provided by interviewees, park websites etc. The question is answered in the case studies in in Chapter 4, section 4.2 – section 4.5.

The studied parks are: (1) Business park Ambachtsezoom in Hendrik-Ido-Ambacht; (2) Business park De Boezem in Pijnacker; (3) Business park Heron in Nootdorp; and (4) Business park Groote Haar in Gorinchem. The ten variables are: (1) Initiation, vision and ambition; (2) Organization and actors' roles; (3) Sustainable and circular initiatives at the park; (4) Physical location specific and business specific features; (5) Social location specific and business specific features; (6) Regional and local characteristics; (7); Regional spatial-economic strategies and environment policy; (8) Policy instruments; (9) Economic context; and (10) External context.

Table 7.3 provides an overview of main characteristics of the parks. A very simplified summary of current practices and development entails: All parks require certain level of sustainability and circularity of businesses to establish at the park, most often focused on individual initiatives focussed on energy generation and building design and construction. All parks have a strong organizational structure that enables the implementation of collective initiatives such as joint provision of services, and that facilitates the exploration and implementation of new initiatives. On the short term, business at the park start to establish synergies and collaborations for (waste) materials, services, sharing of appliances and tools, etc. All parks are in the process of exploring and implementing new initiatives for improvement of sustainability and circularity, for example collective electric batteries or more (waste) material synergies. Large scale exchange of resources such as energy, water and materials are not present at the parks. Parks have a key role in development of policy by municipalities, but current local and regional policy and strategies have had limited influence in development of the parks.

Table 7.3 Overview main current practices and developments at the parks

	Organizational structure & development approach	Circular and sustainable initiatives at the parks	Policy and strategies	Social and physical park characteristics	Regional and local characteristics	Financial and economic context
Ambachtsezoom, Hendrik-Ido-Ambacht	• First circular business park -> cradle-to-cradle • Strict and specific requirements	• All-electric and self-sufficient • Mobile application • (future) Energy cooperation • Collective waste management contracts • Collective services • Flora and fauna	• Park policy • Municipality developing policy, park as input • Manual Circularity	• All businesses at same level of sustainability • Local importance • Familiarity and trust between all actors	• No grid congestion issues • Experience exchanges with other parks in the region • Scarcity of land for commercial development -> strong position municipality	• Business case important for entrepreneurs • Various financial advantages: land prices, energy cost, … • Financial incentives at park
De Boezem, Pijnacker	• Oost (new) vs. West (old) • Ambitious and hands on park management & municipality	• Oost all electric • High share of solar pv • E-team • No collective waste management, but efforts were made	• Area-oriented environmental program • Municipal policy in development • Subsidies very important	• Wide variety of businesses + residency • Big difference between Oost and West • Some pioneers • Connection between local entrepreneurs • Space reserved for collective energy initiatives	• Municipal wide approach for sustainable and circular development at BP's • Grid congestion issues • Scarcity of land commercial development	• Several streams of funding: • business association, entrepreneurial fund, subsidies • Financial effects important entrepreneurs
Heron, Nootdorp	• Park management and entrepreneurs are key actors • Specific sustainability and circular targets, need actualization • Exploring title "circular business park'.	• All electric • Sustainability dashboard • Collaborations between companies in services, waste material exchanges • Collective services by park management	• Municipal policy in development • Subsidies important	• Pioneers • Very well accessible • Local and regional companies • Connection requires more attention	• Prominent location so also wanted by larger, international companies • No grid congestion issues • Energy collaboration other industry in the region explored, not pursued • Scarcity of land commercial development	
Groote Haar, Gorinchem	• Construction in near future • Land use plans, currently actualizing	• Collective energy system + wind turbines • High ambition: construction, industrial symbiosis, collective organization by park management	• Park policy being actualized and developed • Changing regulation influences development process	• Local and regional entrepreneurs	• Expansion of residential area • Scarcity of land commercial development • Highway connection • Included in regional environment policy •	• Tension in future approach of land issuing due to financial context • Financial support possibly implemented , e.g. renting roofs for exploitation of solar energy

7.4 SUB-RQ 4: KEY FINDINGS AND LESSONS LEARNED

Sub-research question 4 reads *"*What lessons can be learned from the leading sustainable business parks in Zuid-Holland, the Netherlands, for the future development of sustainable/circular business parks?". This question is answered in Chapter 6, Section 6.1. A summary of the key findings and lessons learned is presented below:

1. A strong organizational structure is essential;
2. Energy transition is more advanced than the circular transition in business parks;
3. Differentiation in implementation of IS and circular initiatives with foundation in social or physical features;
4. Scale of initiatives mostly individual company level or business park level, regional level less present;
5. Integral and strategic planning approach required for long-term sustainable development;
6. Economic advantages and well-organized funding system are important success factors;
7. Entrepreneurs are key actors in implementation, and guidance, facilitation and stimulation is required
8. The development approach of these parks facilitates policy development and collective learning

7.5 MAIN RESEARCH QUESTION

The main research question of the thesis reads: "W*hat are the current practices and developments in sustainable and circular business parks in Zuid-Holland, the Netherlands in their contribution to local, regional and national circular and energy transitions?".*

The four evaluated business parks contribute to local, regional and national circular and energy transitions in several ways. The parks and businesses at the park implement a variety of sustainable and circular initiatives mostly focussed on individual company scale or business parks scale. Initiatives include energy efficient and/or circular construction, renewable energy generation and storage, collective firm facilities and joint provision of services, collaborative models for appliances, tools and services, and waste material synergies. Initiatives at regional scale are of limited presence, and those that are present are often aimed at sharing of knowledge and business-to-business.

Furthermore, the parks function as key sources of information to facilitate collective learning and government planning. Park managements of the parks actively facilitate sharing of knowledge and experiences with relevant actors such as the province, municipalities, other parks and entrepreneurs and businesses which to ultimately result in development of new initiatives. Moreover, government actors utilize the experiences and developments at the park as input in development of policy and strategies on sustainable energy and circular development.

Lastly, a remark on the practices and developments at the parks in relation to the long term national sustainability objectives of a completely circular economy and a nearly completely carbon neutral energy system by 2050. The targets of the desirable future are set, but the outcome of what this future will look like, and the role of business parks in this future, is undetermined. Current practices and developments at the parks determine the path, or potential paths, the business parks can follow in further transitioning to a sustainable energy and circular future at the national, regional and local scale.

7.6 RECOMMENDATIONS FOR FUTURE RESEARCH

This section presents the recommendation for future research, as well as recommendations for various actors in circular and sustainable development of business parks.

- Literature on sustainable and circular development of business parks in the Netherlands is still limited, more research can provide valuable information that will contribute to future development of parks.
- At the evaluated business parks, the energy transition is more advanced than the circular transition. Further research on variables that have contributed to these differences can provide valuable insights for further progressing the circular transition at the parks as well.
- There are numerous factors that influence scale of implementation of initiatives. Further research on the implementation of initiatives at local or regional scale is required to evaluate if pursuing and implementing more initiative at this scale is desirable, and how this can best be achieved.
- Evaluation of business parks with different characteristics contributes to the generalizability of results. Examples of parks with other characteristics include brownfield projects instead of greenfield, BP's in other provinces and municipalities, projects where a non-governmental actors is project manager, industrial parks instead of business parks etc.
- In this thesis the development of business parks is evaluated from the perspective of actors that are actively involved in the organization of the parks. The research has shown that companies and entrepreneurs are key actors in progressing the sustainability and circularity of business parks and the implementation of initiatives. Further research that highlights the viewpoint and experiences of businesses and entrepreneurs can provide highly valuable information that can facilitate authoritative actors in refining their strategies and policies.
- Investigate the integral and strategic planning approach to ensure long-term sustainable development.
- This thesis is performed from an Industrial Ecology perspective. Spatial planning is an important aspect in the sustainable and circular development of business parks and the implementation of initiatives at all scales. Further research that investigates the spatial planning of the transitions at business parks can contribute to progressing the parks.

7.7 RECOMMENDATIONS FOR ACTORS IN SUSTAINABLE AND CIRCULAR DEVELOPMENT OF BP

This section contains recommendations for actors at business parks to support future sustainable and circular development of business parks.

7.7.1 Governmental authorities

- A strong organizational structure at business parks is highly conductive for the organization and implementation of circular and sustainable initiatives at business parks. Park managers have very important roles in the organization of collective initiatives, and a collective organization is required for the application of a variety of subsidies. Obligating a strong-organizational structure, and facilitation of a park manager is recommend.
- The exact role of business parks in the future sustainable energy and circular economy is undetermined, but current developments at the parks influence the path business parks pursue. It is recommended to guide business park in sustainable and circular development in a way that enables present action and development whilst taking into account the uncertainties of the future. Van den Berghe (2023) emphasizes the necessity of 'forecasting and Backcasting techniques for tailor-made sustainable development of business parks.

- Municipalities and provinces have the capacities to facilitate the exploration and implementation of local and regional initiatives. The focus of the business park and its park management is (often) limited to the boundaries of the park. If the park manager also manages other parks in the region this boundary is expanded, but one park manager cannot carry the organization of regional initiatives. It is recommended regional and local authorities enable these local and regional initiatives. More specifically collaborations and synergies in for example (waste) materials, sharing of tools and appliances etc., as there are enabled by familiarity and trust between entrepreneurs and facilitating these social factors is relatively easy through for example an online platform or gatherings and meetings.
- A well-organized funding system is critical in the implementation of sustainable and circular initiatives. The evaluated parks all have a business association, and the municipalities have an entrepreneurial fund which were marked as a key success factors in the development of the parks and implementation of (new) measures. It is recommended to develop such a funding system to support the sustainable energy and circular transition at business parks.

7.7.2 Park developer and project manager

- The current requirements that are set for businesses at the park, determine a part of the sustainable and circular potential (role) of the park in the future. To illustrate, it is assumed the average lifespan of the structure of a building is 50-60 years, and light renovation is executed after 25 years (Graaf & Schuitemaker, 2022; Netherlands Enterprise Agency, 2010). And, it is assumed that spatial requirements and activities at business park will change in the future path, e.g. as location for collecting, disassembling and processing of 'waste' materials in the circular economy. The ability to efficiently adapt business park to these uncertain future requirements, is dependent on the requirements and developments that are currently made. Unless circular construction principles such as design for maximal functional lifespan (whereby elements in a building are adaptive and can be adjusted based on changing needs), adapting real estate at the park will require large interventions. It is recommended to acknowledge and implemented these uncertainties in development of the park and the requirements that are set for development.

7.7.3 Park management and park manager

- A lot of potential for sustainability and circularity at business parks is found in collaboration and synergies for (waste) materials, appliances and tools, services etc. An important enabler of these potential at business parks is found in initiatives that are based on social features, such as familiarity and trust between companies. It is recommended to park managers and park management to facilitate these social features. For example by means of an online platform as was developed at Ambachtsezoom, or regular meetings between entrepreneurs at the park and with other business parks, as is done in the municipality of Pijnacker-Nootdorp.
- The acknowledgements explained in the recommendations for park developer and project manager are also relevant in progression of sustainable and circular development at the park. Where the developer and project manager set the starting point for the business parks, the park management is largely responsible for continuing the sustainable and circular development of the park.
- Sharing of knowledge and experiences is very valuable in sustainable development of business parks. It is recommended to collaborate with other business parks and actors in development of the parks to learn from their experiences, become inspired etc.

7.7.4 Businesses and entrepreneurs

- Business and entrepreneurs are key actors in the implementation of initiatives in the energy transition and circular transition. The national objectives for a sustainable and circular future are set, thus the need for transitioning is inevitable. The main recommendation to entrepreneurs that has been discussed in the interviews with actors is to keep an open mind towards sustainable and circular initiatives. Embracing opportunities that arise now will contribute to being future resilient. Even small changes can yield environmental and financial benefits.

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A. OVERVIEW OF TRANSLATIONS NL-ENG

This appendix provides an overview of relevant translations NL-ENG that are present in this thesis. As introduced in Section 2.3, and further discussed in Section 6.4.1, terminology and definitions of words vary in various sources and interpretation. For this reason, translations that were used in this thesis are documented in table X

Table A.1 Overview of translations of relevant words and documents NL-ENG

NL	ENG
Activiteitenbesluit milieubeheer	Environmental Management Activities Decree
Bedrijven investeringszone (BIZ)	Business Investment Zone (BIZ)
Bedrijventerreinenstrategie Zuid-Holland	Business park strategy Zuid-Holland
Besluit kwaliteit leefomgeving (Bkl))	The Environmental Quality Decree of the Netherlands
Bestemmingsplan	Land-use plans
Energiebesparingsplicht uit Activiteitenbesluit Milieubeheer	Energy saving obligation from Environmental Management Activities Decree
Energielabel C-verplichting kantoren	Energy label C obligation for offices
Gebiedsgericht omgevingsprogramma	Area-oriented environment program
Gemeentelijke Programma's voor energietransities	Municipal programs for energy transitions
Grondsoffenakkoord	Raw Materials Agreement
Klimaatakkoord	National Climate Agreement
Klimaatplan	Climate Plan
Klimaatwet	The Climate Act
Nationale Omgevingsvisie	The National Strategy on Spatial Planning and the Environment
Omgevingsdiensten	Environmental Agencies
Omgevingswet	The Environment and Planning
Ondernemersvereniding	Business association
Regionale Energiestrategieën (RESsen	Regional Energy strategies
Rijksbrede programma Nederland circulair in 2050	Government-wide programme for a Circular Dutch Economy by 2050
Rijksbrede programma Nederland circulair in 2050	Government-wide programme for a Circular Dutch Economy by 2050
Ruimtelijke strategie circulair Zuid-Holland	Circular Zuid-Holland Spatial Strategy
Strategie Circular Zuid-Holland: Samen versnellen	Circular Zuid-Holland: Accelerate together
Transitieagenda's: inzoomen op 5 sectoren	Transition agendas: zooming in on five sectors
Transitievisie warmte	Vision on Heat Transition
Uitvoeringsprogramma Circulaire Economie 2019-2023, 2020-2023 & 2021-2023	Circular economy implementation plan 2019-2023, 2020-2023, 2021-2023.
Uitvoeringsprogramma Circulaire Economie 2023-2030	National Circular Economy Programme 2023-2030
VN-klimaatakkoord van Parijs	The Paris Agreement

B. FACTORS IN THE IMPLEMENTATION OF INDUSTRIAL SYMBIOSIS AND UTILITY SHARING

This appendix is part of Section 2.3.1.1 and 3.2.1, and contains an overview of the factors and sub-factors influential in the implementation of industrial symbiosis and utility sharing as established by Valladolid (2021).

Table B.1 Factors in the implementation of IS and Utility sharing (Valladolid, 2021).

Factor	Sub-factor	Type of factor	InnoFase	IPKW	Biopark Terneuzen	Total codes in the three cases
Vision and ambition	Province's initiative	None			•	4
	Municipality's initiative	None	•			3
	Private initiative	None		•		3
	Sustainable vision	Success	•	•	•	22
	Develop vision collaboratively	Success	•		•	7
	Future map	Success		•	•	10
	Visit an existing EIP	Success	•		•	6
Location-specific physical features	Complementary companies	Success	•	•	•	11
	Short distance between companies	Success	•	•	•	7
Location-specific social features	Companies know what other companies do	Success	•		•	6
	Easy communication	Success	•	•	•	10
	Joint problem solving	Success	•	•	•	16
	Knowledge sharing	Success	•	•	•	6
	Collaborative culture	Success	•	•	•	19
	Trust	Success	•		•	7
	Companies focus on their core business	Constraining	•	•	•	18
	Lack of understanding between different actors	Constraining	•	•	•	5
Business-specific features	Companies that produce/require a huge amount of residue	Success	•	•	•	5
	Disposed to make long-term investments	Success	•	•	•	6
	Entrepreneurial mind	Success	•	•	•	10
	Financial capacity	Success	•	•	•	10
	Industrial type companies	Success	•	•	•	7
	Sustainability vision	Success	•	•	•	19
	Willingness to commit	Success	•	•	•	9
	Spider in the web	Success	•	•		8
	Different industral standards	Constraining	•	•		6
Opportunity identification	By government	Success	•		•	10
	By research institutions	Success	•	•	•	12
	By companies themselves	Success	•	•	•	18
	By consultancy	Success			•	6
	By park management	Success		•		2

Table B.1 Continued

Factor	Sub-factor	Type of factor	InnoFase	IPKW	Biopark Terneuzen	Total codes in the three cases
Organisation of decision-making	Companies decide what projects to pursue	Success	•	•	•	8
	Different decision-making models difficult cooperation	Constraining	•	•		3
	Have decision-makers together	Success	•			14
	Have an informal cooperation	Success	•			3
	Park management	Success		•		3
	Lots of interests	Constraining	•	•	•	8
	One decision-maker	Success		•		14
	Steering committee	Success			•	2
Policy instruments/ Facilitator	Connects actors	Success	•	•	•	35
	Enables the context	Success	•	•	•	15
	Helps companies look at their surroundings	Success	•	•	•	11
	Initiates ideas	Success	•	•	•	8
	Removes burdens	Success	•	•		9
Policy instruments/Regulations	National regulations force companies to be sustainable	Success	•	•	•	11
	Lag behind innovation	Constraining	•	•		16
	Changeful government	Constraining		•	•	9
	European Union's requirement to tender	Constraining	•			7
	Inefficient process	Constraining	•	•		17
	Regulations on nitrogen emissions prevent activities	Constraining	•	•		7
Policy instruments/ Park policy	Contribute to circularity	Success	•	•	•	10
	Environmental class 4 and 5	Success	•			4
	Strict with their selection	Success	•	•	•	9
Policy instruments/ Other	Subsidies	Success	•	•	•	19
	Promotion	Success	•	•	•	14
Economic features	Business case	Success	•	•	•	25
	Every participant gains	Success	•	•	•	6
	Low risk of failure	Success	•		•	14
	Clear agreements	Success	•	•		2
External context	Economic conditions	Constraining	•		•	9
	Market conditions	Constraining		•	•	4
	Public opinion	Constraining		•	•	9
	Human capital	Constraining		•		1
	Sustainability importance	Success	•	•	•	4

C. LIST OF BUSINESS PARKS IN ZUID-HOLLAND WITH AN ORGANIZATIONAL STRUCTURE

This appendix is part of Section 3.3.1. The first column of the table provides the list of business parks with some form of organizational structure that was provided by the Province of Zuid/Holland in van der Bent et al. (2022). The second and third column contain the name of the business park and categorization of the park, by the Province of Zuid-Holland (2022).

van der Bent et al. (2022)	**open data source Excel Province of Zuid-Holland (2022)**	
	Name of park	**Park categorisation**
1) ABC Westland		Agribusiness
2) Ambachtsezoom		High-end
3) Antoniapolder		Mixed
4) Avelingen Oost - West	Oost	Mixed
	West	Industry
5) Barendrecht-Oost		Agribusiness
6) De Boezem	Boezem Oost	Mixed
	Boezem West	Mixed
7) Coenecoop	Coenecoop I+II	Mixed
	Coenecoop III/West	Mixed
8) DistriparkA12		Distribution
9) Dutch Fresh Port		-
10) Gelkenes		Mixed
11) Gouwepark		Mixed
12) Green Business Club		-
13) Groote Lindt		Industry
14) Halfweg – Molenwatering	Halfweg I	Mixed
	Halfweg II	Mixed
	Halfweg III	Distribution
	Halfweg IV	Mixed
	Molenwatering	Mixed
15) Kickersbloem	Kickersbloem 1 en 2	Mixed
	Kickersbloem 3 fase 1-2-3	Mixed
16) Merwede Vierhaven	1e Merwedehaven+Oostpoort	Mixed
	2e Merwedehaven	Industry
	3e Merwedehaven	Industry
17) De Nieuwe Wetering		Mixed
18) Nissewaard	Halfweg 1 t/m 5 + molenwatering	See 14)
	Schenkel	Mixed
	Industriestraat	Mixed
	Moleneind	-
	Harregat Zuidland	Mixed
	Polyanderweg (Heenvliet) • Heenvliet-Dorp • Poldergebied Heenvliet	 Mixed -
19) Noordoost Kwadrant		Mixed
20) Oosteind - Kooihaven		Mixed
21) OV De Bosschen		Mixed
22) Pijnacker - Nootdorp	De Boezem	See 6)
	Oostambacht	Mixed
	Bedrijvenpark Heron	High-end

	Ruyven	Distribution
23) Pothof		Distribution
24) Rijnhoek – Bodegraven	Rijnhoek	High-end
25) Samen Meer Waarde		-
26) Sandelingen	“de sandeling”	Mixed
27) Seggelant II	Seggelant II	Mixed
28) Spaanse Polder	Spaanse Polder	Mixed
	Spaanse Polder (Schiedamse deel)	Mixed
29) Stellendam	Korteweg stellendam	Mixed
30) Vinkenwaard Noord + Zuid	Vinkenwaard	Mixed
	Vinkenwaard-Zuid	Mixed
31) VSB (Vereniging Bedrijven Schiebroek)		Mixed
32) Westvlietweg 3		Mixed
33) ZKD (Zichtenburg Kerketuinen Dekkershoek)		Mixed

D. LISTS OF GUIDING QUESTIONS FOR INTERVIEWS

This appendix lists the interview questions used as a guide in the interviews is in the case studies, small deviations were made to suit the specific interviewee or business park. All interviewees were Dutch and the interviews were held in Dutch. An English transition of the questions is provided.

D1. QUESTIONS TO THE MUNICIPALITY

Introductie – *introduction*

1) Kunt u zichzelf kort voorstellen en toelichten wat uw relatie is tot het Bedrijvenpark?
   Can you briefly introduce yourself and explain your relationship to the business Park?

Circulaire visie gemeente en rol (circulaire) bedrijvenparken (algemeen) -*Circular vision of the municipality and role of (circular) business parks (general)*

2) Hoe zien de duurzaamheids- en circulaire visie van Gemeente … eruit? En in samenwerking met welke partijen is deze visie ontwikkeld?
   What do the sustainable and circular vision of the Municipality ... look like? And in collaboration with which parties has this vision been developed?
3) Welke rol is in deze visie weggelegd voor (circulaire) bedrijvenparken?
   What role is reserved for (circular) business parks in this vision?
4) Op welke manier wordt deze visie in de praktijk vertaald naar bedrijvenparken in uw gemeente?
   How is this vision translated into practice in business parks in your municipality?
5) Hoe houdt de gemeente hierin rekening met andere ontwikkelingen in de gemeente?
   How does the municipality take other developments in the municipality into account?
6) Hoe wordt hierbij rekening gehouden met ontwikkelingen in aangrenzende gemeenten / de provincie?
   How are developments in neighbouring municipalities/the province taken into account?
7) Welke vormen van beleid en regelgeving zijn er van toepassing in uw gemeente om bedrijvenparken te sturen en ondersteunen om meer circulair en duurzaam te worden?
   What policies and regulations apply in your municipality to guide and support business parks to become more circular and sustainable?

Het bedrijvenpark en de rol van de gemeente - *The business park and the role of the municipality*

8) Wat is de duurzaamheids- en circulaire visie/ambitie van Bedrijvenpark … ?
   What is the sustainability and circular vision/ambition of Business Park...?
9) Hoe sluit deze aan op de circulaire en duurzame visie van uw gemeente?
   How does this fit in with the circular and sustainable vision of your municipality?
10) Hoe ziet het ontwikkelingsproces van Bedrijvenpark … eruit? En wat is de rol van de gemeente hierin (geweest)?
    What does the development process of Business Park... look like? And what is (has been) the role of the municipality in this?
11) Welke duurzame/circulaire initiatieven en samenwerkingen zijn/worden er geïmplementeerd in het park?
    a) Uitwisseling van materiaal en/of energie (rest)stromen?
    b) Collectieve inkoop/opwekking van materialen en/of energie?
    c) Collectieve services en voorzieningen? Bijv. afvalverwerking, vervoer, beveiliging etc.
    d) Duurzame/circulaire bouw?

e) Enz…

Which sustainable/circular initiatives and collaborations have/are being implemented in the park?
a) Exchange of material and/or energy (residual) flows
b) Collective purchasing/generation of materials and/or energy?
c) Collective services and facilities? E.g. waste processing, transport, security etc.
d) Sustainable/circular construction?

12) En bij welke initiatieven/samenwerkingen in het park is uw gemeente direct betrokken (geweest)?
And in which initiatives/collaborations in the park is your municipality directly involved?
13) Door welke partij(en) zijn deze duurzame/circulaire initiatieven geïdentificeerd?
Which party(ies) identified these sustainable/circular initiatives?
14) (Hoe is de uitvoer en implementatie van de initiatieven en samenwerkingen verlopen?)
(How has the execution and implementation of the initiatives and collaborations progressed?)
15) Wordt er bij ontwikkelingen in het park ook gekeken naar ontwikkelingen/initiatieven/potentie in de regio van het park?
When developing in the park, are developments/initiatives/potential in the region of the park also taken into account?

Afsluitend – closing

16) Wat heeft ervoor gezorgd dat Bedrijvenpark … zo vooruitstrevend en succesvol is (geworden) ten opzichte van andere bedrijvenparken?
What has made Business Park ... so progressive and successful compared to other business parks?
17) Hoe denkt u dat -we- er in de toekomst voor kunnen zorgen dat meer bedrijvenparken in de voetsporen van Bedrijvenpark … treden?
    - Zijn er zaken die hiervoor moeten veranderen bij gemeenten/bedrijvenparken/overheid/…?

How do you think that in the future we can ensure that more business parks follow in the footsteps of Business Park ...?
    - *Are there things that need to change at municipalities/business parks/government/...?*
18) Heeft u nog aanvullingen op bovenstaande of overige opmerkingen die u graag wilt delen? Of vragen aan mij?
Do you have any additions to the above or other comments that you would like to share? Or questions for me?
19) Heeft u nog andere contacten die interessant zijn voor mij om te spreken?
Do you have any other contacts that would be interesting for me to speak to?

D2. QUESTIONS TO PROJECT MANAGERS, PARK MANAGEMENT

Introductie – *Introduction*

1) Kunt u zichzelf kort voorstellen en toelichten wat uw relatie tot bedrijvenpark … inhoudt?
Can you briefly introduce yourself and explain what your relationship with the business park entails?
2) Hoe ziet het ontwikkelingsproces van bedrijvenpark … eruit? En wie zijn er bij dit proces betrokken?
What does the development process of business park ... look like? And who is involved in this process?
3) Wat zorgt ervoor dat bedrijvenpark … vooruitstrevend is ten opzichte van andere bedrijvenparken?

What makes the business park ... progressive compared to other business parks?

Visie en strategie van het park – vision and strategy of the park

4) Wat is de visie van bedrijvenpark …. ? En wie zijn er betrokken geweest bij het ontwikkelen van deze visie?
   What is the vision of business park ... ? And who was involved in developing this vision?
5) Hoe vertaald deze visie zich in de praktijk?
   How does this vision translate into practice?
6) Is er regelgeving of beleid op het park geïmplementeerd om naar deze visie toe te werken?
   Have any regulations or policies been implemented at the park to work towards this vision?

Circulaire initiatieven en samenwerkingen op het park – circular initiatives and collaborations

7) Welke duurzame en/of circulaire initiatieven en samenwerkingen zijn er momenteel geïmplementeerd in het park?
   What sustainable and circular initiatives and collaborations are currently implemented in the park?
8) Hoe sluiten deze aan op de visie en ambitie van het park?
   How do these fit the vision and ambition of the park?
9) Hoe zijn deze initiatieven en mogelijkheden geïdentificeerd? Welke partijen zijn hierbij betrokken geweest en hoe?
   How were these initiatives and opportunities identified? Which parties were involved and how?
10) Hoe is het implementatie van deze initiatieven verlopen? Welke partijen zijn hierbij betrokken geweest en hoe?
    How has the implementation of these initiatives gone? Which parties were involved and how?
11) Zijn er initiatieven die niet van de grond zijn gekomen of niet geselecteerd zijn? En waarom?
    *A*re there any initiatives that were eventually not implemented or were not selected? And why?
12) Welke ontwikkelingen zijn er voor de toekomst gepland?
    What developments are planned for the future?
13) Welke rol heeft de provincie gehad in de ontwikkelingen in het park?
    What role has the province had in the developments in the park?
14) Welke rol heeft de gemeente gehad in de ontwikkelingen in het park?
    What role has the municipality had in the developments in the park?
15) Welke rol hebben beleid en regelgeving gehad in de ontwikkelingen van het park?
    What role have policy and regulations had in the developments of the park?
16) Zijn er in dit ontwikkelingsproces van duurzame en circulaire initiatieven in het park zaken geweest die u in het vervolg anders zou aanpakken?
    Have there been any issues in this development process of circular and sustainable initiatives in the park that you would approach differently in the future?

Regionale rol – regional role

17) Is er een rol weggelegd voor het park in de regio?
    - Ja; wat is deze rol en in samenspraak met wie is deze rol ontwikkeld?
      En hoe is er in de ontwikkelingen van het park rekening gehouden met deze rol?
    - Nee; Welke rol is er mogelijk in de toekomst voorzien voor het park?

    Does the park have a specific role in the region?
    - *Yes; what is this role and in consultation with who has this role been developed?*
      And how has this role been taken into account in the developments of the park?
    - *No; What possible role is envisioned for the park in the future?*

18) Zijn er ontwikkelingen in de regio/omgeving van het park geweest die van invloed zijn geweest op de ontwikkelingen in het park?
Have there been developments in the region/environment of the park that have influenced developments in the park?
19) Zijn er bij de ontwikkeling van het park afstemmingen geweest met initiatieven in de regio? Welke en hoe?
Was there coordination with initiatives in the region during the development of the park? Which and how?
20) Zijn strategieën en visies van de gemeente of provincie van invloed geweest op de ontwikkelingen in het park?
Have strategies and visions of the municipality or province influenced the developments in the park?
21) Worden jullie als park betrokken in het ontwikkelen van deze plannen? Op welke manier?
Are you as a park involved in developing these plans? How?

D3. QUESTIONS FOR ENTREPRENEURS AND BUSINESSES

Introductie- *Introduction*

1. Kunt u zichzelf kort voorstellen en toelichten wat uw relatie tot het bedrijvenpark inhoudt?
Can you briefly introduce yourself and explain your relationship with the business park?

Visie en strategie van uw bedrijf en het bedrijvenpark - Vision and strategy of your company and the business park

2. Wat is de duurzaamheidsvisie van uw bedrijf? En wie zijn er betrokken geweest bij het ontwikkelen van deze visie?
What is your company's sustainability vision? And who was involved in developing this vision?
3. Hoe vertaald deze visie zich in de praktijk?
How does this vision translate into practice?
4. (Hoe) heeft de visie van het park invloed gehad op de keuze van uw bedrijf om hier te vestigen?
How) did the vision of the park influence your company's choice to locate here?
5. En hoe verhouden de visie van uw bedrijf en die van het park zich tegenover elkaar?
And how do the vision of your company and that of the park compare?

Duurzame en circulaire initiatieven en samenwerkingen op het park- Sustainable and circular initiatives and collaborations at the park

6. Welke individuele of collectieve duurzame/circulaire initiatieven is uw bedrijf momenteel bij betrokken?
What individual or collective sustainable/circular initiatives is your company currently involved in?
7. Wat was de motivatie voor uw bedrijf om deel te nemen aan deze initiatieven/ deze initiatieven te implementeren?
What motivated your company to participate/implement these initiatives?
8. Hoe sluiten deze aan op de visie en ambitie van uw bedrijf?
How do these fit with the vision and ambition of your company?
9. Hoe zijn deze initiatieven en mogelijkheden geïdentificeerd? Welke partijen zijn hierbij betrokken geweest en hoe?
How were these initiatives and opportunities identified? Which parties were involved and how?
10. Hoe is het implementatie van deze initiatieven verlopen? Welke partijen zijn hierbij betrokken geweest en hoe?

has the implementation of these initiatives gone? Which parties were involved and how?

11. Zijn er initiatieven die niet van de grond zijn gekomen of niet geselecteerd zijn? En waarom?
    Are there any initiatives that did not get off the ground or were not selected? And why?
12. Welke ontwikkelingen heeft uw bedrijf voor de toekomst gepland?
    What developments does your company have planned for the future?
13. Welke rol hebben de provincie en/of gemeente gehad in de duurzame ontwikkelingen waar uw bedrijf bij betrokken is?
    What role has the province and/or municipality had in the sustainable developments in which your company is involved?
14. Welke rol hebben beleid en regelgeving gehad in de ontwikkelingen waar uw bedrijf bij betrokken is?
    What role have policy and regulations had in the developments in which your company is involved?
15. Zijn er in het ontwikkelingsproces van duurzame/circulaire initiatieven in het park of uw bedrijf zaken geweest die u in het vervolg anders zou aanpakken?
    Have there been any issues in the development process of sustainable/circular initiatives in the park or your company that you would approach differently in the future?

<u>Regionale rol – regional role</u>

16. Is er (vanuit een duurzaamheids- of circulair perspectief) een rol weggelegd voor uw bedrijf op het park of in de regio?
    - Ja; wat is deze rol en in samenspraak met wie is deze rol ontwikkeld?
      En hoe is er in de ontwikkelingen van het park rekening gehouden met deze rol?
    - Nee; Welke rol is er mogelijk in de toekomst voorzien?

    Is there a role (from a sustainability or circular perspective) for your company in the park or in the region?

    - *Yes; what is this role and in consultation with who has this role been developed?*
    - *And how has this role been taken into account in the developments of the park?*
    - *No; What role might be envisioned in the future?*
17. Zijn er ontwikkelingen in de regio/omgeving van het park geweest die van invloed zijn geweest op de ontwikkelingen in uw bedrijf?
    Have there been developments in the region/environment of the park that have influenced developments in your company?
18. Zijn er bij de ontwikkeling in uw bedrijf of op het park afstemmingen geweest met initiatieven in de regio? Welke en hoe?
    Have there been any coordination with initiatives in the region during the development in your company or at the park? Which and how?
19. Zijn strategieën en visies van de gemeente en/of provincie van invloed geweest op de ontwikkelingen in uw bedrijf of in het park?
    Have strategies and visions of the municipality and/or province influenced developments in your company or in the park?
20. Worden jullie als bedrijf betrokken in het ontwikkelen van regionale visies of plannen? Op welke manier?
    Are you as a company involved in developing regional visions or plans? How?

E. CONSENT FORMS FOR INTERVIEW PARTICIPANTS

E.1 CONSENT FORM IN DUTCH

U wordt uitgenodigd om deel te nemen aan een interview voor het afstudeeronderzoek van Esmee Vogelaar, voor de master Industrial Ecology van de TU Delft en Universiteit Leiden.

Het onderzoek

Het onderzoek focust zich op duurzame en circulaire bedrijvenparken in Zuid Holland. Het doel van het onderzoek is om in beeld te brengen hoe het ontwikkelingsproces van duurzame en circulaire parken eruit ziet, welke factoren van invloed zijn op dit proces en wat de rollen van verschillende stakeholders hierin zijn. Uitkomsten van het onderzoek waardevol voor toekomstige initiatieven voor het plannen en ontwikkelen van duurzame en circulaire bedrijvenparken.

Uw deelname

Uw deelname aan dit onderzoek is volledig vrijwillig, en u kunt zich elk moment terugtrekken zonder reden op te geven. U bent vrij om vragen niet te beantwoorden.
Informatie die u verstrekt wordt in geanonimiseerde samenvattingen verwerkt in het onderzoek. In de scriptie wordt u benoemd met functietitel, uw naam en andere persoonsgegevens worden niet genoemd.

Omgang met uw gegevens en potentiële risico's

Het is belangrijk om met zorg met uw gegevens om te gaan en eventuele risico's te minimaliseren. Daarom worden de volgende acties ondernomen:

- Persoonlijke data en interview opnames zijn niet inzichtelijk voor personen buiten het onderzoeksteam, dit team bestaat uit de onderzoeker (Esmee Vogelaar) en twee begeleidende professoren van TU Delft.
- Persoonlijke data wordt opslagen op een door TU Delft aangeboden dataopslag en contact verloopt uitsluitend via email van TU Delft, om zo de kans op datalekken en inzage van persoonsgegevens door derden te minimaliseren.
- Alle persoonlijke data en interview opnames worden één maand na afronding van het onderzoek verwijderd uit de TU Delft dataopslag.
- Informatie die u als deelnemer verstrekt, wordt verwerkt in een geanonimiseerde samenvatting:
    - Persoonlijke data zoals naam en emailadres worden niet opgenomen in het scriptierapport en/of de samenvatting. In de samenvatting en het scriptierapport wordt u aangeduid met functietitel en werkgever.
    - In de samenvatting wordt enkel informatie die relevant is voor het onderzoek is opgenomen.
    - De geanonimiseerde samenvatting wordt opgenomen in de bijlage van het scriptierapport. Voorafgaand krijgt u de samenvatting toegestuurd en de mogelijkheid commentaar te geven op de informatie die hierin is opgenomen. Na publicatie van het onderzoek is het niet meer mogelijk aanpassingen aan te brengen.
- Het scriptierapport wordt na afloop gepubliceerd in de *TU Delft Education Repository,* een openbare bibliotheek met theses en onderzoeken van studenten aan TU Delft. Dit houdt in dat door u geleverde informatie en de geanonimiseerde samenvatting ook publiek beschikbaar zijn.

- Indien u bezwaar hebt op een van de bovengenoemde zaken, bent u vrij dit aan te geven en zal in overleg een gepaste oplossing gezocht worden.

Onderstaande vakjes graag aanvinken	Yes	No
A: ALGEMEEN – DOEL ONDERZOEK, DEELNEMERS TAKEN EN VRIJWILLIGE DEELNAME		
1. Ik heb de informatie over het onderzoek gelezen en begrepen, of deze is aan mij voorgelezen. Ik heb de mogelijkheid gehad om vragen te stellen over het onderzoek en mijn vragen zijn naar tevredenheid beantwoord.	☐	☐
2. Ik doe vrijwillig mee aan dit onderzoek, en ik begrijp dat ik kan weigeren vragen te beantwoorden en mij op elk moment kan terugtrekken uit de studie, zonder een reden op te hoeven geven.	☐	☐
3. Ik begrijp dat mijn deelname aan het interview en onderzoek betekent: • Dat er video- of geluidsopnames worden gemaakt van het interview om juist samenvatten van het interview mogelijk te maken; • Dat de informatie die ik geef verwerkt wordt in een geanonimiseerde samenvatting, die opgenomen wordt het scriptierapport van Esmee Vogelaar en eventuele publicaties.	☐	☐
B: POTENTIELE RISICO'S AAN DEELNAME EN DATA BESCHERMING		
4. Ik begrijp dat mijn deelname betekent dat er persoonlijke identificeerbare informatie wordt verzameld, met het risico dat ik hieruit geïdentificeerd kan worden.	☐	☐
5. Ik begrijp dat de volgende stappen worden ondernomen om het risico van een databreuk te minimaliseren, en dat mijn identiteit op de volgende manieren wordt beschermd in het geval van een databreuk: • Persoonlijke data en interviewopnames worden op een door TU Delft aangeboden opslag bewaard; • Persoonlijke data en interviewopnames worden één maand na afronding van het onderzoek verwijderd; • Contact verloopt uitsluitend via email van TU Delft; • Informatie wordt verwerkt in een geanonimiseerde samenvatting, waarin enkel informatie relevant voor het onderzoek is opgenomen. • U in het onderzoeksrapport aangeduid wordt met functietitel en werkgever, uw naam wordt niet genoemd.	☐	☐
C: ONDERZOEKSPUBLICATIE, VERSPREIDING EN TOEPASSING		
6. Ik begrijp dat informatie die ik verstrek in de vorm van geanonimiseerde samenvattingen wordt opgenomen in het scriptierapport en eventuele publicaties die mogen volgen. En dat mijn functietitel en werkgever daarin genoemd worden.	☐	☐
7. Ik geef toestemming om mijn antwoorden, ideeën of andere bijdrages anoniem te quoten in resulterende producten.	☐	☐

Onderstaande vakjes graag aanvinken	Yes	No
D: DATA OPSLAG, TOEGANG EN HERGEBRUIK		
8. Ik geef toestemming om de geanonimiseerde samenvatting van het interview op te nemen in afstudeerrapport, opdat deze gebruikt kunnen worden voor toekomstig onderzoek en onderwijs.	☐	☐
9. Ik begrijp dat de toegang tot het afstudeerrapport, en daarmee de geanonimiseerde samenvatting van het interview, publiek is na publicatie van het onderzoeksrapport op de TU Delft repository.	☐	☐

Handtekeningen

_____ _____ _____

Naam deelnemer Handtekening Datum

Ik, **de onderzoeker**, verklaar dat ik de informatie en het instemmingsformulier correct aan de potentiële deelnemer heb voorgelezen en, naar het beste van mijn vermogen, heb verzekerd dat de deelnemer begrijpt waar hij/zij vrijwillig mee instemt.

Esmee Vogelaar_____ _____ _____

Naam onderzoeker Handtekening Datum

Contactgegevens van de onderzoeker voor verdere informatie:

Esmee Vogelaar, [phone number] , E.I.A.Vogelaar@student.tudelft.nl

E.2 CONSENT FORM IN ENGLISH

All interviewees in this research were Dutch. For that reason the consent form was primarily only developed in Dutch. The need for a translation of the form did not arise during the research. Below a translation of the form is provided purely for the documentation of the research.

Consent form, thesis research Esmee Vogelaar

You are invited to participate in an interview for Esmee Vogelaar's graduation research for the master's degree in Industrial Ecology at TU Delft and Leiden University.

The research

The research focuses on sustainable and circular business parks in Zuid-Holland. The aim of the research is to map out what the development process of sustainable and circular parks looks like, which factors influence this process and what the roles of various stakeholders are in this. Results of the research are valuable for future initiatives for planning and developing sustainable and circular business parks.

Your participation

Your participation in this study is completely voluntary, and you may withdraw at any time without giving a reason. You are free not to answer questions.
Information you provide is processed in anonymized summaries in the study. In the thesis you are mentioned by job title, your name and other personal data are not mentioned.

Handling your data and potential risks

It is important to handle your data with care and to minimize any risks. Therefore, the following actions are taken:

- Personal data and interview recordings are not accessible to people outside the research team, which consists of the researcher (Esmee Vogelaar) and two supervising professors from TU Delft.
- Personal data is stored in a data storage facility offered by TU Delft and contact is exclusively via email from TU Delft, in order to minimize the risk of data leaks and access to personal data by third parties.
- All personal data and interview recordings will be deleted from the TU Delft data storage one month after completion of the research.
- Information that you provide as a participant is processed in an anonymized summary:
    - Personal data such as name and email address are not included in the thesis report and/or summary. In the summary and the thesis report you will be referred to by your job title and employer.
    - The summary only includes information that is relevant to the research.
    - The anonymized summary is included in the appendix of the thesis report. You will be sent the summary in advance and will be given the opportunity to comment on the information contained therein. After publication of the research, it is no longer possible to make adjustments.
- The thesis report will be published afterwards in the TU Delft Education Repository, a public library with theses and research by students at TU Delft. This means that information you provide and the anonymized summary are also publicly available.

- If you object to any of the above matters, you are free to indicate this and an appropriate solution will be found in consultation.

Please tick the boxes below	Yes	No
A: GENERAL – PURPOSE OF RESEARCH, PARTICIPANTS DUTIES AND VOLUNTARY PARTICIPATION		
1. I have read and understood the information about the study, or it was read to me. I have had the opportunity to ask questions about the research and my questions have been answered satisfactorily.	☐	☐
2. I am participating in this study voluntarily, and I understand that I may refuse to answer questions and withdraw from the study at any time without giving a reason.	☐	☐
3. I understand that my participation in the interview and research means: • That video or audio recordings are made of the interview to enable correct summarization of the interview; • That the information I provide is processed in an anonymized summary, which is included in Esmee Vogelaar's thesis report and any publications.	☐	☐
B: POTENTIAL RISKS OF PARTICIPATION AND DATA PROTECTION		
4. I understand that my participation will involve the collection of personally identifiable information at the risk of identification.	☐	☐
5. I understand that the following steps are taken to minimize the risk of a data breach, and that my identity will be protected in the following ways in the event of a data breach: • Personal data and interview recordings are kept in a storage facility offered by TU Delft; • Personal data and interview recordings will be deleted one month after completion of the research; • Contact is exclusively via email from TU Delft; • Information is processed in an anonymized summary, which only contains information relevant to the research. • You are referred to in the investigation report by job title and employer, your name is not mentioned.	☐	☐
C: RESEARCH PUBLICATION, DISTRIBUTION AND APPLICATION		
6. I understand that information I provide in the form of anonymized summaries will be included in the thesis report and any publications that may follow. And that my job title and employer are mentioned there	☐	☐
7. I give permission to anonymously quote my answers, ideas or other contributions in resulting products.	☐	☐
D: DATA STORAGE, ACCESS AND REUSE		

Please tick the boxes below	Yes	No
8. I give permission to include the anonymized summary of the interview in the graduation report, so that it can be used for future research and education.	☐	☐
9. I understand that access to the graduation report, and thus the anonymized summary of the interview, is public after publication of the research report on the TU Delft repository.	☐	☐

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Name participant Signature Date

I, **the researcher**, certify that I have correctly read the information and consent form to the potential participant and, to the best of my ability, have ensured that the participant understands what he/she is voluntarily agreeing to.

Esmee Vogelaar_____ _____ _____

Name reseracher Signature Date

Contactgegevens van de onderzoeker voor verdere informatie:

Esmee Vogelaar, [phone number] , E.I.A.Vogelaar@student.tudelft.nl

F. EXPLANATIONS OF (INTER)NATIONAL AND PROVINCIAL POLICY

This section contains an overview of international, national and provincial policy related to sustainable and circular development of BP's.

Table F.1 (Inter)national policy on climate

Level	Year	Title	Explanation	
International	2016	The Paris Agreement VN-klimaatakkoord van Parijs	In 2016, then State Secretary Dijksma of Infrastructure and the Environment signed the UN Paris Climate Agreement on behalf of the 27 member states of the European Union. The aim of the agreement is to limit global warming to well below 2 degrees Celsius compared to 1990. With a clear prospect of 1.5 degrees Celsius.	From: (Informatiepunt Leefomgeving, n.d.-c)
		EU Green deal	Following the UN Climate Agreement and subsequent developments, the European Union has ultimately set itself the goal of becoming the first climate-neutral continent in the world. The initial goal is to emit a net 55% less greenhouse gases by 2030 than in 1990. Europe must be climate neutral by 2050 at the latest, according to the European Green Deal.	
National		Klimaatwet The Climate Act	The Climate Act provides the framework for the development of Dutch climate policy. This policy is aimed at reducing greenhouse gases. The aim is to emit 49% less greenhouse gases by 2030 and 95% less by 2050 compared to 1990. The underlying goal is to limit global warming and climate change (Article 2, paragraph 1 Climate Act).	
		Klimaatplan Climate Plan	Article 3 of the Climate Act states that a Climate Plan must be established. This plan contains the main elements of the climate policy for a period of 10 years. The first Climate Plan was adopted in 2019 and covers the period 2021-2030. The Climate Plan contains the measures to achieve the objectives of the Climate Act. It also discusses current scientific insights, technological possibilities, innovation, international developments and the economic consequences for society as a whole.	
		Klimaatakkoord National Climate Agreement	The Climate Agreement is a further elaboration of the Climate Act and the Climate Plan. This agreement is an agreement between a large number of organizations and companies in the Netherlands. This states how the substantive measures will be implemented and by whom	
		Omgevingswet The Environment and Planning Act	The Environment and Planning Act is aimed at achieving and maintaining a safe and healthy physical living environment and good environmental quality. Climate mitigation, climate adaptation and energy efficiency are part of this.	

Table F.2 National policy energy transition

Year	Title	Explanation	
	The National Strategy on Spatial Planning and the Environment *(NL: Nationale Omgevingsvisie)*	Ambitions regarding the transition to sustainable energy sources Energy transition is one of the priorities. The NOVI contains assessment principles that help make choices for the design of the physical living environment. The NOVI provides direction to the environmental vision of provinces and municipalities.	
	Regional Energy strategies *(NL:* Regionale Energiestrategieën (RESsen))	In the RES, governments work with social partners, network operators (for gas, electricity and heat), the business community and, where possible, residents to develop regionally supported choices. They do this for the generation of sustainable electricity (35 TWh), the heat transition in the built environment (from fossil to sustainable sources) and the required storage and energy infrastructure (Ministry of Economic Affairs and Climate Policy, 2019).	
	The Environmental Quality Decree of the Netherlands *(NL: Besluit kwaliteit leefomgeving (Bkl))*	The Environmental Quality Decree of the Netherlands contains mandatory instructions that the municipality must implement in the environmental plan. Municipalities must reserve sufficient space in the environmental plan for the generation and transport of energy (Articles 5.157 to 5.159, Bkl). For example, space for high-voltage cables.	
	Municipal programs for energy transitions *(NL: Programma's voor energietransities)*	Municipalities and provinces can choose to draw up a program for energy. Click here for an explanation of this concept (opens in popup). The program is a policy document and is therefore only binding for the government that establishes it.	
	Vision on heat transition (NL: Transitievisie warmte)	The climate agreement instructs municipalities to have a vision on heat transition ready by 2021. The vision on heat transition can be cast in the form of a program. The municipality has a choice in this. In the vision, the municipal council sets a realistic timetable within which districts will switch from natural gas. For neighbourhoods whose transition is planned before 2030, the potential alternative energy infrastructures are also known (for example all electric or a heating network).	

Table F.3 (Inter)national policy on energy efficiency

Year	Title	Explanation	
	EU Energy efficiency directive	The European Energy Efficiency Directive (EED) concerns, among other things, the obligation for companies to carry out an energy audit. The responsibility for supervision of the regulations for and the implementation of energy audits lies with the Netherlands Enterprise Agency (RVO).	From: (Informatiepunt Leefomgeving, n.d.-a)
	Energy saving obligation from Environmental Management Activities Decree *(NL: Energiebesparingsplicht uit Activiteitenbesluit Milieubeheer)*	Obligation for the implementation of energy efficiency measures for companies with an annual energy consumption of over 50.000 kWh electricity or 25.000 m3natural gas.	

	Energy label C for offices	The Energy Label C obligation states that office buildings must have a valid label with a maximum value for primary fossil energy use of 225 kWh per m² per year as of January 1, 2023. This is equivalent to a label C for a building that only has an office function. If the building does not meet the requirements, it may no longer be used as an office as of January 1, 2023. This arises from Article 5.11 of the Building Decree and - after the introduction of the Environmental Act - from Article 3.87 of the Building Works and Living Environment Decree (Bbl).	

Table F.4 National policy on circular economy

Year	Title	Explanation	
2016	Government-wide programme for a Circular Dutch Economy by 2050 (NL: Rijksbrede programma Nederland circulair in 2050)	The government-wide programme for a Circular Dutch Economy by 2050 outlines how we can transform our economy into a sustainable, fully circular economy by 2050. The programme describes what we will need to do to ensure we use raw materials, products and services in a smarter and more efficient way.	From: (Ministry of Infrastructure and Water Management, 2023b)
2017	Raw Materials Agreement (NL: Grondsoffenakkoord)	In January 2017 in The Hague, 180 parties signed the Raw Materials Agreement. The agreement sets out what is to be done to ensure that the Dutch economy can make the transition towards a Circular Economy and has the support and commitment through the whole Dutch society. It was signed by various parties from government, industry, trade unions and environmental organisations. The agreement started the multistakeholder dialogue on how to organise the transition, e.g. by starting the process of drafting transition agenda's together.	
2018	Transition agendas: zooming in on five sectors (NL: Transitieagenda's: inzoomen op 5 sectoren)	The government and the signatories to the Raw Materials Agreement drew up 5 transition agendas. There is a transition agenda for each of the following sectors and value chains: Plastics, Consumer goods, Manufacturing, Building & Construction, and Biomass and Food. These 5 sectors and value chains are important to the economy but also impact heavily on the environment. The agendas set out how the sectors in question can become circular by 2050, and what actions need to be taken.	
2019-2021	Circular economy implementation plan 2019-2023, 2020-2023, 2021-2023. Uitvoeringsprogramma Circulaire Economie 2019-2023, 2020-2023 & 2021-2023	The Circular Economy Implementation Programme translates the 5 transition agendas into concrete actions and projects to be put into effect between 2019 and 2023, it is updated every year.	
2023	National Circular Economy Programme 2023-2030, Uitvoeringsprogramma Circulaire Economie 2023-2030	The government has presented the National Circular Economy Programme 2023-2030, which sets out a mix of measures for the years ahead aimed at using products and raw materials more sparingly. Reducing the material footprint of the Dutch economy is the recurring theme. New interventions will be investigated, specific targets will be set on specific product groups as well as stricter norms and pricing incentives, and high value retention of products and materials will be scaled up.	

G. FINANCIAL SUPPORT AND SUBSIDIES FOR SUSTAINABLE DEVELOPMENT OF BUSINESS PARKS

This Appendix elaborates upon the financial support and subsidies for sustainable development of business parks, from Netherlands Enterprise Agency (2022).

Table G.1 Overview of financial support and subsidies for sustainable development of business parks, from Netherlands Enterprise Agency (2022)

Initiative	Description
Entrepreneurial fund *(NL: Ondernemersfonds)*	An entrepreneurial fund is a facility in a municipality in which participating entrepreneurs pay a surcharge on real estate tax (OZB). So called 'drawing-areas', e.g. business parks, can receive funding to finance collective initiatives, projects and investments from the entrepreneurial fund. The municipality monitors that the money is spent on collective projects. An advantage of an entrepreneurial fund is that the business park can receive long-term financing, because entrepreneurs contribute the money themselves.
Business Investment Zone (BIZ) *(NL: Bedrijven investeringszone)*	A BIZ is a demarcated area, e.g. business park, where entrepreneurs collectively invest in the quality of their business environment. The entrepreneurs in the BIZ jointly draw up a BIZ plan. The municipality assesses the plan and imposes a levy, which it returns to the BIZ in the form of a subsidy to ensure all entrepreneurs contribute to the plan. The activities of a BIZ are additional to the tasks of the municipality and often concern maintenance, safety and cleanliness. Sustainability can also be tackled from a BIZ. Just like with an Entrepreneurs Fund, there is a mandatory contribution for affiliated companies. The agreements apply for 5 years, which requires extra attention to the continuity of the collaboration. The money that the entrepreneurs make available together may only be used for activities included in the BIZ plan.
Business association *(NL: Ondernemers-vereniging)*	Companies on a business park often unite in a business association. From this association they can take initiatives for sustainability. Businesses can submit an idea or initiative to the association. Financing sustainability may be possible through the municipality or province.
Municipal or provincial initiatives	Some municipalities or provinces have an (extra) ambitious sustainability objective. They then offer companies (sites) to join that ambition.
Subsidies (National / general)	
Energy investment deduction (EIA) *(NL: Energie-investeingsaftrek)*	A tax scheme whereby a company may deduct parts of its investments in energy-saving measures from its profits. Please note: a profit must be made. This may also be calculated over several years, within a margin of savings per euro invested. The investments must yield a certain saving, i.e. be profitable, but not such a saving that the investment fully pays for itself (without EIA). The use of EIA is determined on the basis of an energy list with concrete applications or a CO2 reduction plan.
Investment subsidy for Sustainable Energy and Energy Saving (ISDE) *(NL: Investeringssubsidie Duurzame energie en Energiebesparing)*	A subsidy for specific applications for both private individuals and companies, based on an equipment list.
Stimulation sustainable energy production and climate transition (SDE++) *(NL: Stimulering duurzame energieproductie en klimaattransitie)*	Subsidy for generating sustainable energy, paid out per kWh generated. SDE++ is particularly interesting when using solar panels, but there are conditions attached to the amount of solar panels.

Environmental investment deduction (MIA) and Random depreciation of environmental investments (Vamil) *(NL: Milieu-investeringsaftrek en Willekeurige afschrijving milieu-investeringen)*	With the MIA, a company benefits from an investment deduction of up to 36% of the investment amount. With the Vamil, the depreciation of the measures can be brought forward, which provides a tax advantage.
Accelerated climate investments in industry (VEKI) *(NL: Versnelde klimaatinvesteringen industrie)*	subsidy intended for proven innovative measures with high investment costs and therefore a longer payback period. Please note: SMEs benefit from the VEKI assessment and are treated with priority.
Demonstration Energy and Climate Innovation (DEI+) *(NL: Demonstratie Energie en Klimaatinnovatie)*	Intended for innovative pilot projects for reducing energy use or CO2 emissions and for investing in renewable energy sources and/or the circular economy.
Subsidies for energy innovation Top Sector Energy *(NL: Subsidies energie-innovatie Topsector Energie)*	Subsidies for entrepreneurs, scientists and knowledge institutions, intended to investigate the feasibility of future options for starting a sustainability project.
WBSO tax scheme for research and development *(NL: WBSO: fiscale regeling voor research en development).*	Tax innovation scheme for companies (including starters and self-employed persons) that carry out development and/or research projects and want to reduce their Research & Development (R&D) costs.
Subsidies by province of Zuid-Holland	
Subsidy sustainable business parks *(NL: Verduurzaming bedrijventerreinen, subsidie)*	Business parks as a collective apply for subsidies for the following activities: • Energy on business parks: (1) the production of energy from renewable energy sources; (2)building-related measures for energy saving; (3) the connection to a local heat network; (4) the exchange of energy between companies. • Sustainability at business parks: (1) measures for climate adaptation; (2) measures to increase biodiversity. • Transition to a circular economy: (1) the collective organization of goods and services and mutual exchange of materials; (2) the collective processing of waste or raw materials, or the application of circular materials in the design of public space (Province of Zuid-Holland, 2023)
Business parks planning subsidy *(NL: planvormingssubsidie)*	Business parks can apply for subsidies to sustainable planning of their park. Activities include: • drawing up a multi-year program for the further development of an association of entrepreneurs • conducting an exploratory preliminary investigation, aimed at making a sufficiently supported request to a municipality to adopt an ordinance. • conducting a feasibility study or making a business case for: (1) energy efficiency; (2) on site sustainable energy generation; (3) a collective fibre optic network; (4) collective camera security; (5) improving road safety and/or parking facilities; (6) establishing or improving collective commuter traffic for employees; (7) fostering of greenery and biodiversity. • Analysis of opportunities and improvements by an area manager or specialized consulting firm (Province of Zuid-Holland, 2023b)

H. SUMMARIZING OVERVIEW OF THE CASE STUDIES AND THEIR SIMILARITIES AND DIFFERENCES

This Appendix contains the summarizing overview of case studies characteristics that functions as the basis for the cross case analysis, to enable an evaluation of main similarities and differences between the parks.

Table H.1 Summarizing overview of case studies, and their similarities and differences

	Ambachtsezoom	De Boezem	Heron	Groote Haar
Initiation, vision and ambition	• Municipality initiated • Clear vision and ambition for circularity and sustainability broadest sense. • Inspired by other park	• Municipality • Vision and ambition established in new 2023 strategic document as part of new Environment and Planning Act	• Land-use plan 2012 • Sustainable vision with specific targets • Three annual spearpoints to improve • Exploring title of 'circular business park'.	• Construction starts in a few years, waiting on other parties before start is possible • Sustainable and future proof park, details are being actualised
	• Municipality project initiator and manager -> they determine requirements and level of ambition' • Ambachtsezoom focus on circularity (which includes renewable energy) – Heron and Boezem mostly focus on renewable energy and energy efficiency, and leave room for ambitions and strengths of companies – Groote Haar will actualise later			
Organisation and actors' roles	• Municipality initiator • Construction start 2021? • Park management and park manager	• Municipality initiator for new section + revitalisation old. Role of supporter • Entrepreneurs and businesses key actor in implementation • Park manager + management very important role in motivating and informing on sustainability.	• Municipality project manager • Park manager and park management involved in development • Entrepreneurs most important actor in deciding which initiatives to pursue	• Municipality is initiator and project manager • There will be park management, but the details will be determined later •
	• All parks have park management and a park manager that is also manager in other business parks in the municipality. • Both have a very important role in the organization and implementation of new sustainable and circular initiatives • Entrepreneurs are the actor that ultimately determine what gets implemented and are the implementors			
Sustainable and circular initiatives	• All-electric and self-sufficient in energy supply • Circular construction and material passport • Limited sharing of materials, efforts to gain insight in material flows in future to enable more synergies • Energy cooperation is being set up, with collective battery. • Waste collection managed through two contracts being offered,	• West is old and not energy efficient, some measures have been implemented by ambitious entrepreneurs. Oost is all-electric • A lot of sol1ar panels on rooftops as a result of subsidy efforts • Circular potential in operations have to be seized by businesses • E-team that concerns itself with the future energy system at the park	• Energy and circular measures in construction not required, some businesses have progressive buildings • Resource exchanges sporadically • Service exchanges daily • Collective district heating network explored, but not pursued because of insufficient interest from businesses due to high depreciation costs for current installations.	• Sustainability and circularity are part of requirements for businesses to establish • Energy, material and water exchanges are foreseen, details not clear yet. Park management will facilitate in this. • Park management plans to have a collective thermal energy system • Two wind turbines are part of the project

	entrepreneurs decide themselves • Sustainable mobility stimulated • Mobile application for the park to connect entrepreneurs, and enable collaborations for appliances and services. Collective services organized by park management • Knowledge sharing and guidance via manuals and the mobile application • Flora and fauna important aspect of sustainability at the park	• Efforts have been made for collective waste management but the waste management company is unable to provide a plan. • Trial with shuttle busses was done, but proven very expensive. Other initiatives will be explored • Collective park services organized by park manager • Sharing knowledge and success stories helps other businesses and entrepreneurs important in the municipality. Meetings in municipality are being organized • Manual being developed to guide businesses to take sustainable steps • Improving flora and fauna objective for future	• Waste management individually • EV Charging stations are being explored, pilots with bicycles was semi-successful • Joint commercial services and facilities organized by park manager • Dashboard being developed that will guide entrepreneurs towards sustainable future • Information location 'huis van heron' was planned, but not pursued. •	• Collective waste management planned
	• Energy efficient building and generation are implemented the most at individual level: regulation / financial advantages • Circularity if a business is required to or when it is very ambitious itself • Collective services are organized by park management and very similar at all parks • Waste management at Ambacht is through 2 offered contracts, so semi-collective. At the other parks not collective. Difficult to organize. • Knowledge sharing and guidance important at all parks • Collective mobility options are expensive, efforts for collective charging stations are made. • Flora and fauna increasingly important • Service exchanges happen most often, material exchanges sometimes but park managers and municipalities plan on gaining insight in waste streams to facilitate collaborations. This will come with time and there are other things that have priorities. However, through facilitating relationships between companies, they might find each other • Individual energy systems / all electric individual level most cost friendly, lots of uncertainties in demand etc make it hard to plan collective from beginning.			
Physical	• Municipality owner of land • State of the art building stock • Highly accessible by car and fright transport because next to highway. Ok accessibility by public transport compared to other cases. • Proximity is advantage in	• Municipality owner of land in Oost. In West businesses are owners, so municipality cannot force them to action • Building stock in Oost is new, in West it's old but ready for renovation in upcoming years.	• All-electric? Energy efficient building stock • Great accessibility via metro station and highway • Space used effectively. Municipality strict with selling plots • Heron is the most regionally oriented park in the municipality,	• Municipality owner of land • Highway connection will be constructed • Clustering might be implemented at the park • Businesses with high-environmental categories and of larger scale are welcome •

	collaborations for appliances and services, not used in creating energy or water synergies	• 'eco-system thinking' might be more important in the future • Strategic land reserved for electric battery • Efficiency in West can increase, there are businesses that are not necessarily required to establish in a business park and there are some houses at the park that restrict business operations.	with larger companies and some companies with circular business operations. •	
	• Accessibility is good for all parks and taken into account in development of the park • Municipalities are strict with selling the plots, and ensure business park character by maximizing environmental categories and prohibiting residency • In land use the municipalities also think of spatial demands for initiatives such as collective batteries. • clustering specific for material or energy synergies is not mentioned as strategy			
Social	• Park manager and park management + high degree of organization • Local businesses that are familiar with each other • Mobile application • No pioneers at the park, because every-one more or less at the same level of sustainability • Attitudes changed after experiencing advantaged • Sustainable image of park is used to inspire and educate other business parks and municipalities	• Park manager and park management very hand on and progress sustainability and circularity. • Businesses are local and familiar with each other. • Some entrepreneurs are ambitious on circularity, others don't see the necessity	• High degree of organisation, park management and park manager highly involved • Information sessions in municipality, and good contact between companies at the park • Pioneers or ambassadors contribute highly to development at he park and are helpful in pulling other entrepreneurs • Core business operations come before sustainability for a lot of entrepreneurs	-
	• High degree of organization and familiarity and trust help a lot in creating synergies and collaborations, as well as inspiring entrepreneurs to implement measures • Ambachtsezoom does not 'need' pioneers, as everyone is at same level. But at Heron and Boezem there is a significant difference between the ambition of entrepreneurs. • Core business operations stay main focus of businesses			
Regional characteristics	• Ambitious municipality that supports and sticks to ambition	• Horticulture in the municipality threatens the grid	• Horticulture in the municipality, potential for	• Nature in region has had influence on project

	of Ambachtsezoom • Grid capacity and congestion not a problem due early anticipation • Other business parks in the region can function as examples, e.g. in starting energy cooperation	capacity of De Boezem • Municipality is highly involved and takes steps to improve sustainability • The municipality and park manager use other parks in the region for economy of scale and to generate business to business •	district heating network. • Municipality is highly involved and takes steps to improve sustainability • The municipality and park manager use other parks in the region for economy of scale and to generate business to business • No grid congestion and capacity problems	development plans • Grid capacity and congestion is an issue in the region, municipality and net-operator working towards solution • The public opinion was important in developing plans for the park, as citizens were concerned with the high environmental categories at the park
	• All parks have actors at the municipality that are ambitious and want to bring sustainability and circularity further • Grid congestion is an issue in some cases • Developments in region are sometimes recognized as potential, but there is still a lot that needs to be taken care of within park boundaries			
Economics and strategies	• Park has local importance • Sustainable and circular policy in development in municipality, Ambachtsezoom used as pilot/input • Scarcity of available commercial development land, this results in municipality that can be strict with requirements • Not included in RES • Park specific approach in vision on heat transition	• New economic strategy in development, which includes sustainability and circularity. • Reciprocity between park and municipality in terms of information and needs. • The municipality has developed an area-oriented environmental program for De Boezem, as part of a pilot for the new 'Omgevingswet', that contains extensive planning for sustainable development • Scarcity of commercial development land, provides an advantage for municipality as project developer • Not included in RES • Not included in Vision on heat transition	• New economic strategy in development, which includes sustainability and circularity. • Reciprocity between park and municipality in terms of information and needs. • Park not included in RES of vision for heat transition •	• Park has regional focus, with larger companies. This is also the reason for the large section of land available for the park • Policy on sustainability focusses on three pillars: municipal acting, biodiversity, and sustainable energy. • Circular strategy is developed by waste management company, but focusses mostly on residential waste • RES does not mention the park, but plans of the park fit vision of RES • Vision on heat transition highlights potential of for surrounding area's as coupling might be possible. Residential development plans have influenced project plans: location of park + other parks in municipality will be

				transformed to residential areas
	• Municipalities are in process of developing sustainable and circular strategies, park function as pilots and lessons / input in this. • Scarcity of available land in the region make that municipalities can be more strict in their requirements for businesses. • Regional and municipal energy transition strategies barely include the parks, parks have to develop their own transition paths			
Policy	• Very strict park policy with very specific requirements for businesses and how to develop at park • National regulation and politics are mentioned as potential factor for ambitious plans for the park	• Park policy and selection procedure will change per 2024, to include sustainability and circularity more. • Subsidies contributes highly to the initiatives and measures that were implemented at the park.	• Park policy and selection procedure will change per 2024, to include sustainability and circularity more. • Municipality strict with selling plots • Subsidies contribute to sustainable and circular development of park.	• Park management role will be determined later, but a large role is foreseen • Municipality will set requirements for businesses, mainly aimed at building and business specific measures • Tension between strict requirements but still wanting to sell the plots. • Changing national regulation, e.g. nitrogen regulation, has large negative influence on the timescale and costs of the project.
	• Municipality strict with selling plots. • Ambachtsezoom very specific requirements, Pijnacker-Nootdorp limited specific requirements but does require sustainable development • Subsidies important in sustainable development and implementation initiatives			
Economic context	• Developing at Ambachtsezoom expensive due to the large amount of sustainable and circular requirements, however these are upfront investments • Entrepreneurs experience financial advantages after development due to increasing ground princes, lower energy costs, etc. • Financial incentives are places by the municipality when businesses add additional sustainable and circular measures • A business case and the financial effects of measures and initiatives are mentioned as an	• Funding at the park via various paths, including subsidies, entrepreneurial fund and a (non-obligatory) business association • Finances are a large trigger for the implementation of measures, or decision not to implement	• Economic effects important factors in pursuing or not pursuing initiatives • Multiple streams of funding large advantage in municipality in sustainable and circular development. • Obligatory business association + entrepreneurial fund •	• Delays and unforeseen circumstances have had large financial influences on the projects • Municipality recognizes not all businesses have financial capacity for all measures, so will find a suitable solution together.

	extremely important factor in deciding whether or not to implement it • The national economic situation has positive or negative influences on the developments at the park			
	• Business case of initiatives very (most) important for businesses in deciding yes/no for initiative • Multiple streams of income via businesses association and entrepreneurial fund (and subsidies) big advantage for the implementation of measures. • National economic situation influences developments, e.g.: covid crisis, nitrogen crisis, energy crisis etc. = unforeseen circumstances			
External	• Social pressure to become more sustainable influences approach and ambition of businesses			• Innovation was taken into account in planning of park