
Leiden Donut Coalitie

# The Leiden City Sketch

January 2023

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# Executive Summary

> *TO ENSURE EVERYBODY HAS A STRONG SOCIAL FOUNDATION (SUCH AS HOUSING, WATER AND FOOD) WITHOUT OVERSHOOTING THE PLANETARY BOUNDARIES.*

That is the aim of the Doughnut Economics Model which is at the core of the Leiden Donut Coalitie (LDC). The Leiden Donut Coalitie (LDC) wants to apply this vision to the city of Leiden. The aim of our project was to provide the LDC with a starting point in the form of a "City Sketch", which forms an overview of Leiden's current status in its transition towards a sustainable city. The City Portrait Methodology consists of four lenses: the Local-Social, Local-Ecological, Global-Social, and Global-Ecological lens. As our sketch only forms a first step in this process, it is solely focussed on the Local-Social and Local-Ecological Lenses that respectively map Leiden's social and ecological goals through its set policies and current performance. The different themes these lenses consist of were applied to Leiden by collecting data from a variety of open sources, such as policy documents and databases. A main take-away of both our Sketch and the feedback we received during the Groene Ideecafé is that the sustainability policies and targets should be made more concrete and specific by the municipality of Leiden to ensure that the targets are more clear; more easily develop the right tools to measure progress; and make policy making more transparent. In addition, our team conducted a case study on the current state of communication between different citizen-led sustainability initiatives and the municipality. Based on the interviews it appeared that bigger, longer existing, and more professionally organised initiatives tend to have better communication with the municipality. The main recommendation that came out of this case study is that the municipality should appoint an official or a team to act as a direct line of communication for citizen-led initiatives in Leiden. Finally, we provided possible future steps that need to be followed to utilise our City Sketch to create a sustainable future for Leiden. We for instance advice to assign a transdisciplinary team, which involves individuals who are familiar with the local context, to transform our City Sketch into a full-fledged City Portrait and perhaps even a City Selfie.

# Team

Our research team consisted of five master students of the Governance of Sustainability program at the University of Leiden. Our varying educational backgrounds gave our team an interdisciplinary approach to tackle sustainability issues from different perspectives. To collaborate as smoothly as possible, we mutually agreed upon different team roles. This was based on our strengths and weaknesses, as well as what was most comfortable to each of us. These roles were not set in stone as our group was very versatile and flexible and therefore meeting roles were rotated over the course of the project. In this way, all members had the opportunity to contribute in different ways and keep the group dynamics consistently engaging. Our vision for this project was to ensure that Leiden meets the social and ecological needs of today without compromising those of the future.

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# 1. Background and Context

To combat today's ecological crises there is a global need to become more sustainable. As a 'wicked' problem, this requires a multi-level and interdisciplinary approach [1]. With the global trend of urbanisation, cities play a crucial role in the transition towards a sustainable future [2]. Kate Raworth has formulated the Doughnut Economics Model to describe what is needed to create such a safe and just space for humanity [3]. The model is shaped like a doughnut, with the inner-circle indicating the social foundation – basic needs such as housing, water and food – and the outer circle representing the planetary boundaries – for example air pollution, climate change and biodiversity loss (Figure 1). The green ring between the two circles represents the safe space, which indicates an area of ecological safety and social justice. By remaining within this area, a safe and balanced space can be achieved for humanity to socially prosper, without overshooting the planetary boundaries.

The Doughnut Economics concept was developed as a sustainability framework that combines environmental planetary boundaries with social concepts [4]. Hence, it visualizes overshoots of twelve different United Nations social priorities and nine ecological ceilings set by Earth scientists (Figure 1). This model was downscaled to the city level in the form of a 'City Portrait Methodology'. It functions as a diverse, ever-changing, and energising Portrait to guide the transformation into a thriving city that respects the wellbeing of the people and planet [5]. It is a relatively new concept and has been piloted in Amsterdam, Portland, and Philadelphia [5].

Due to its novelty, there are limited resources for applying the model to other cities, but this also provides opportunity for methodological optimisation. Additionally, the model facilitates easy comparisons between cities where it has been applied. Therefore, the framework provides us with much more than a simple visualisation of the sustainable development in a city.

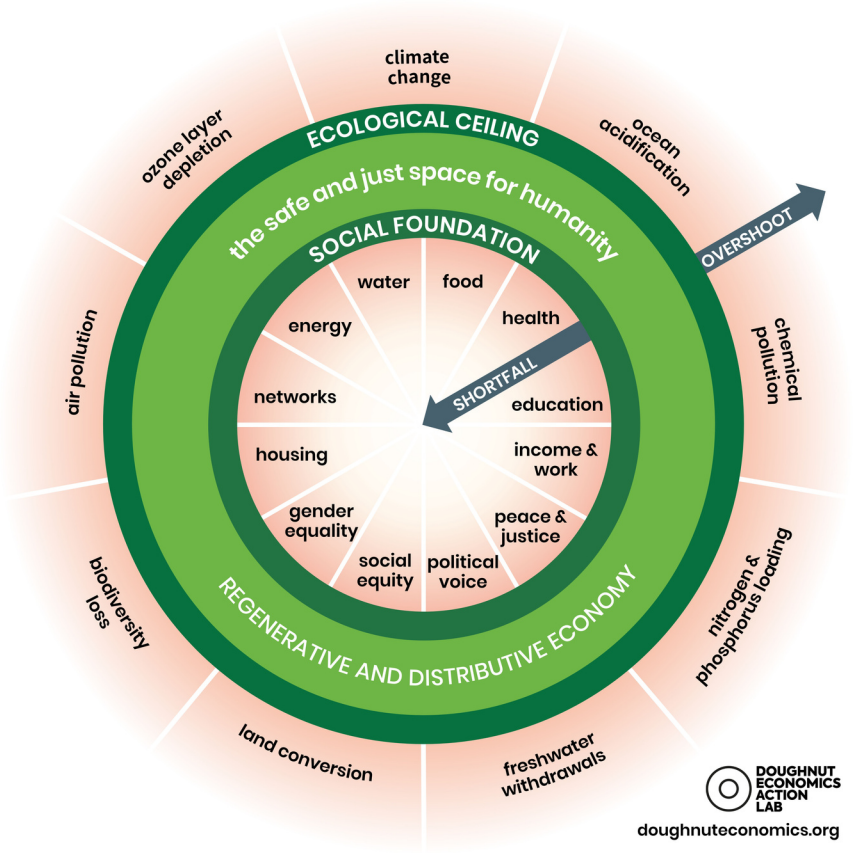



**Figure 1.** Kate Raworth's Doughnut model of social and planetary boundaries.

# 2. Problem Statement and Aims

## 2.1 Commissioner LDC

With Kate Raworth's vision in mind, the 'Leiden Donut Coalitie' (LDC) was founded to create a community that brings together people and organisations to strengthen the various sustainability initiatives, networks, and platforms in Leiden [6]. The LDC collaborates with the municipality, and local organisations, businesses, and citizens to enhance the development of a city which meets both the social and ecological goals required for a sustainable future. It is an initiative made up of a core team of five people: Ckees van Oijen, Edith van Middelkoop, Michael Jansen, Ant Brandenburg, and the late Gert-Jan Cornel. For this project, the main commissioner and point of contact was Ckees van Oijen, with whom regular meetings and check-ins were organised.

## 2.2 Commissioner's Problem and Research Goals

After the successful establishment of Amsterdam's City Portrait, the LDC questions whether this methodology could also be tailored to the local ambitions and goals of Leiden and prove beneficial to the city. Applying the City Portrait Methodology could identify current gaps and opportunities for sustainability improvement in Leiden. As such, our team was tasked to initiate the Leiden City Portrait project and critically evaluate whether it would be beneficial to the city and its citizens to fully develop this project at a later stage.

The goal of our project was to provide the LDC with a starting point in the form of a small-scale version of the City Portrait, which we refer to as the "City Sketch". This is a representation of the current sustainability initiatives, challenges, and policies of the city. In addition, one of the biggest challenges the LDC encountered within their network concerns communication with the municipality, specifically by local initiatives. Good communication between stakeholders is crucial for the success of local initiatives [7, 8]. In practice it can be a difficult and confusing process for citizens to get in touch with the right person within the municipality, which complicates citizen's participation. Therefore, we performed an exploratory case study of the current state of communication between the different local sustainability initiatives and the municipality. With the results, we anticipated to find common problems and starting points to improve the communication between the initiatives and the municipality of Leiden.

## 2.3 Research Questions

Based on the above-mentioned goal of this project and requests of the commissioner, we have agreed upon a number of deliverables: creating the City Sketch; presenting a preliminary version to the citizens of Leiden at the Groene Ideecafé; providing future steps to further develop our City Sketch into a City Portrait; providing a critical evaluation of the City Portrait Methodology; and doing a case study on citizen-led sustainability initiatives in Leiden. Based on these deliverables we have formulated the following research questions to guide our research:

1. How can the City Portrait Methodology be applied to Leiden and is it the appropriate tool to create Leiden into a sustainable city?
2. What are the insights we gained during the preliminary feedback session at the 'Groene Ideecafé' into either the method or the sustainability status of Leiden?
3. What is the current state of the communication between the citizen-led sustainability initiatives and municipality of Leiden?
4. How can the City Sketch be further developed into a City Portrait?

# 3. Approach and Methods

## 2.2 City Portrait Methodology and City Sketch

To help the LDC with their goal of making Leiden more socially and ecologically sustainable, we have applied the City Portrait Methodology to the city. This methodology has been formulated by the Doughnut Economics Action Lab (DEAL) and provides in-depth methods and guidelines for each of the four lenses which embody a City Portrait [9]. As exemplified by Figure 2 these four lenses – the social and ecological lenses at both the local and global scales – interact with each other and are each guided by an essential question: how the city, its people and its environment can thrive within these four contexts. Additionally, they each require different data inputs and methods [9].

However, as the full City Portrait was too extensive and ambitious for the timeframe of this project and due to resource constraints, we have agreed upon downscaling it to the formulation of a City Sketch of Leiden. By narrowing down the City Portrait to a City Sketch, we were able to fully focus on interpreting the two Local Lenses in-depth. This way, we could make an extensive indication of the current social and ecological progress of Leiden. As the construction of a complete representation of the city is an iterative process, it requires continuous adaptation until a satisfactory image of the social and ecological vision of the city is created. Hence, the City Sketch provides the LDC with a good starting point to evaluate the ongoing sustainability status of Leiden. As a simplified precursor, it enables them to further develop it into the City Portrait, or even a City Selfie that covers all intricate interconnections and links between the four lenses.

The City Sketch explores visions, quantitative data, qualitative data and policies shedding a light on the current progress and future development of the city towards a sustainable future. After collecting the data, a holistic picture of the city was synthesized. The collected data can highlight the benefits of pursuing specific social and ecological sustainability strategies. Concurrently, it exposes possible conflicting and/or synergistic goals and initiatives in Leiden by pointing out the currently existing blind spots [9]. This way, it allows easier information sharing between fields and facilitate a more efficient action plan to address sustainability areas which are falling behind.

The interconnectivity of problems or solutions may be revealed, providing insight for both policymakers, and engaged citizens.


**Figure 2.** The four lenses compromising the City Portrait

## 3.2 The Local Lenses

As we only focused on the local lenses for this project, we will discuss and explore these methods more in depth. For the two local lenses, the current performance of the city of Leiden can be evaluated by comparing it to the municipality's targets and policies.

The Local-Social Lens focuses on the social priorities and ambitions of Leiden, which can be identified from the municipality's goals and targets as provided in their policy documents, such as the Leiden Omgevingsvisie 2040 and the Beleidsakkoord 2022-2026. The Local-Social Lens consists of 16 themes which should envision an equitable social life for Leiden citizens within the social foundation of the Doughnut model [9]. These 16 themes can be categorised into four main categories: 1. Healthy (food, water, health, housing), 2. Connected (internet connectivity, mobility, community, culture), 3. Enabled (education, work, income, energy), 4. Empowered (political voice, social equity, equality in diversity and peace, justice). The city targets collected must be categorised based on scope, focus, and target date. Additionally, a representative target must be selected for each of the 16 social themes defined within the City Portrait Methodology and the Sustainable Development Goals (SDGs).

Indicators were selected to represent these social themes for the city snapshot and compared [9]. Indicators were predominantly identified through Leiden in Cijfers, an extensive database on several themes (e.g., population, security or social cohesion) available for several years and often at a district or neighbourhood level [10]. Moreover, the Centraal Bureau voor de Statistiek database, which gathers national statistical information, was utilised as they also provide district level data. To identify and select relevant targets and indicators, we consulted previously created City Portraits for inspiration which could apply to the context of Leiden, such as the Portland City Portrait and the Amsterdam City Portrait. The latter was especially used as Amsterdam and Leiden are located close to each other, which provides a similar local context.

After gathering all the relevant target and indicator data, we investigated, validated, and narrowed down the targets and snapshots to specifically suit the Leiden goals and the city context.

The Local-Ecological Lens compares the functions of a healthy local ecosystem to how a city can mimic ecosystem functions, indicating how a city can transform itself [9]. It starts with identifying a reference site based on a healthy local ecosystem and its key desired ecosystem services – e.g., freshwater provision, air quality and temperature regulation [9]. Once again existing City Portraits were consulted, with the Amsterdam Portrait being the most relevant for the Leiden ecological context. For our City Sketch we decided to utilise the desired ecosystem services as provided in the Amsterdam City Portrait: Water Provision, Air Quality Regulation, Temperature Regulation, Energy Harvesting, Biodiversity Support, Erosion Protection, and Carbon Sequestration. This was done because the local ecological contexts of Amsterdam and Leiden are very comparable. These ecosystem services encompass all necessary aspects of these urban environments: water, air and land. This also makes a possible future comparison between cities easier. What followed was an analysis of the current Leiden ecological targets as a first proxy for setting ecological performance standards, which is what we aim for in our City Sketch. These policy targets of Leiden were identified from relevant policy documents such as the 'Omgevingsvisie 2040' and various climate and environment related policy documents.

Furthermore, the resource that was predominantly used for selecting indicators and data on the ecological performance of Leiden was the 'Leiden in Cijfers' database. Similar to the Local-Social Lens, the most appropriate and relevant indicators and data available for assessing each target were identified and used to create a snapshot of Leiden's current performance.

## 3.3 Groene Ideecafé

The Groene Ideecafé is an initiative in Leiden that is organised monthly to help sustainability initiatives and to stimulate discussion and involvement on sustainability topics, such as the environment, biodiversity, nutrition, and health [13]. We hosted the Groene Ideecafé on the 12th of December 2022, where we discussed our findings with citizens of Leiden to validate them and receive feedback. During this meeting we divided the audience into groups to discuss the Local-Ecological and Local-Social Lens. For the Ecological Lens, we divided them up based on the different nature themes: Water Provision, Air Quality Regulation, Temperature Regulation, Energy Harvesting, Biodiversity Support, Erosion Protection, and Carbon Sequestration. Attendees could choose a table based on the theme they were most interested in or knowledgeable on. Here they could discuss whether the snapshots were a suitable indicator for the theme and whether they reflect Leiden well. On post-it notes they could give comments and provide suggestions for other options. The same set-up was used for the Social Lens, with this time only four categories: Healthy, Connected, Empowered, Enabled.

## 3.4 The Case Study

We conducted a case study to examine the communication between different sustainability initiatives and the Leiden municipality. It was expressed that communication and citizen participation is a major challenge for sustainability initiatives, rendering this case study valuable for the LDC as a "network of networks". We have conducted semi-structured interviews with eight sustainability actors who play a leading role within a local initiative or in the municipality. We focussed on citizen-led sustainability initiatives in Leiden that were already in contact with the LDC. We spoke to members of Bomenbond, Duurzame Energy Merenwijk, Leidse Gesprekken, Leidse Laptoppers, an energy ambassador, people involved in the sustainability of the local food chain and an employee of the municipality. During these interviews, we specifically wanted to learn more about the current state of the communication between these initiatives and the municipality.

Our interview method was based on the theory of the participation communication assessment (PCA) method [11]. We adapted the first component of PCA, namely understanding the socio-cultural context, through the identification of the key issues and stakeholders and assessment of the needs, problems, risks, and opportunities. In addition, our research also specifically focused on the active involvement of those affected by the problem being studied, which is the case for community-based participation [12]. This resulted in seven main questions for the interviewees (Appendix I).

All interviews were conducted over a period of three weeks, either in Dutch or English. Once the interviews were concluded they were summarized, anonymized, and analysed for trends and points of improvement in communication between the citizen-led initiatives and the Leiden Municipality.

# 4. Findings

## 4.1 How is Leiden Doing?

Visualised below (Figure 3; Figure 4) are two local lenses of Leiden. The Local-Social Lens has been organized in its four broader categories of Healthy, Connected, Empowered and Enabled, which are then further divided into the 16 themes. The Local-Ecological lens has been organised in seven themes, namely: Water Provision, Air Quality Regulation, Temperature Regulation, Energy Harvesting, Biodiversity Support, Erosion Protection, and Carbon Sequestration. These figures provide an overview of the targets and snapshots on the seven ecological themes and 16 social themes for the city of Leiden. As such it indicates Leiden's ecological and social goals through its set policies and their current progress and performance.

# WHAT WOULD IT MEAN FOR THE PEOPLE OF LEIDEN TO THRIVE? (FIGURE 3)

| | CITY TARGET | CITY SNAPSHOT |
|---|---|---|
| Health | Leiden wants to stimulate its citizens to have a healthier lifestyle by enabling everyone to do sports, move, and play in the city's public spaces [14]. | Around 42.1% of Leiden's citizens aged 18 or older are overweight and 18% are smokers in 2020. More than half (53.9%) have a moderate-to-high risk of depression or anxiety in 2020 [15, 16, 17]. |
| Housing | Leiden strives to decrease the housing shortage by building 6680 houses by 2030, of which 30% social housing; create more student housing; make the housing stock and surroundings more sustainable [18]. | As of mid-2022, Leiden has 61.605 homes, with 42% being owner-occupied homes and 58% rental properties. There is also a shortage of low-cost and mid-priced rental properties [19]. |
| Water | Leiden guarantees access to clean, affordable drinking water [14]. | The drinking water quality nationally almost always meets the legal standards [20, 21, 22]. |
| Food | Leiden wants to provide knowledge on healthy food and make healthy food affordable through agreements with schools, sport canteens, and other municipal accommodations [23]. | In 2021, 747 households in Leiden used the Food Bank [24]. |

| | CITY TARGET | CITY SNAPSHOT |
|---|---|---|
| Connectivity | Leiden wants to ensure a variety of meet up functions in its neighborhoods, with enough closeness through the mix in functions. It also wants to ensure good digital connectivity for all residents and areas [14]. | 11.8% of Leidenaren aged 18 or older experienced severe loneliness in 2020. In 2021 96% of Leiden residents have access to the Internet at home, at work, at school or elsewhere [25, 26] |
| Community | Leiden 'belongs to all of us': it is a home for everyone, people are invited to participate, and an eye is kept out for vulnerable groups [14]. | In 2021, 80% of Leiden's residents reported to have sufficient social contacts and 54% reported to feel at home with the people who live nearby. In the same year, Leiden scored 6.1/10 for social cohesion [27] |
| Mobility | To keep Leiden accessible, it aims for a transition in mobility through more dependable OV and stimulation of biking and walking. Improve road safety and emissionfree zones in 2025 [28]. | In 2021, most of Leiden's residents used one's own bicycle (91%), with 64% biking daily on workdays. Besides bikes, the most used means of transport are the train (79%), one's own car (74%) and the bus (61%) [29, 30]. |
| Culture | Leiden wants to enable citizens from all ages and backgrounds by using culture for education and talent development [31]. The cultural sector is supported through subsidies and the exposition of art in public spaces [32]. | In 2021, 37% of residents attended a cultural activity, 45% of the inhabitants actively participated in art and culture, and a total of 683.085 people visited a museum. In 2015, Leiden had 12.9 municipal monuments per 1000 inhabitants, this is higher compared to the national average of 3.3 [29]. |


| | CITY TARGET | CITY SNAPSHOT |
|---|---|---|
| Peace and Justice | Leiden wants a city that is and feels safe in terms of residing, working and living in partnership with others [32, 41] | In 2019, 29% of Leidenaren were victims of crime, most commonly: bicycle theft (5%), vehicle destruction (5%), hacking (6%), cyber bullying (5%), and buying and selling fraud (4%). Noticeably, the number of sexual crimes has increased from 0.1% in 2017 to 0.5% in 2019 [42]. |
| Social Equity | In Leiden everyone has the right to security of existence and equal opportunity [32]. | The share of private households belonging to the 40% households with the lowest household income nationally was 40.3% in 2021. Moreover, in 2021, 66% of residents reported to be satisfied with the population composition of their neighborhood [27, 43]. |
| Political Voice | Leiden wants to involve residents in the big and small challenges that we face as a compact city with transparent and clear communication [32]. | In 2021, the voter turnout for the national elections was 81% in Leiden [44]. |
| Equality in Diversity | Leiden aims to give substance to the Rainbow Agreement and Leiden Inclusive and work on inclusive municipal services [32, 45]. | In 2021, 39.9% of the Leidenaren reported to have experienced discrimination based on race/skin color, 32.9% based on gender, and 31.2% based on nationality [27]. |

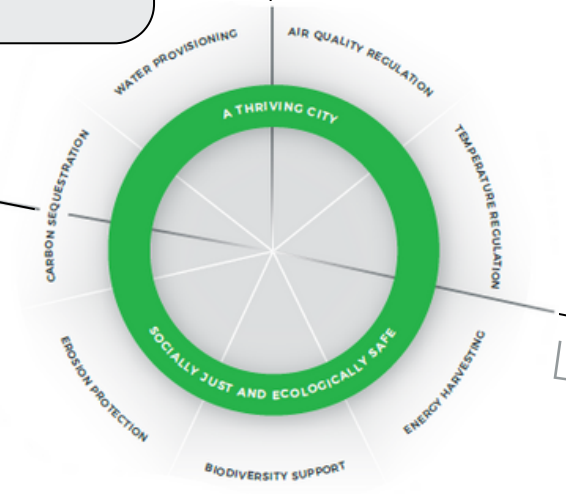
| | CITY TARGET | CITY SNAPSHOT |
|---|---|---|
| Jobs | Leiden has an interest in creating jobs, through good connections between supply/demand, education, the labour market, employment, and business locations [14, 33] | In 2021, Leiden had an unemployment rate of 4.6%, higher than the national average of 4.2%. Moreover, 734,5 jobs were available per 1000 residents aged 15-74, in 2021, higher than the national average of 685,7. [27] |
| Income | Leiden wants to investigate innovative approaches to improve the social security, reducing poverty and debts. An example is actively taking over debts and giving out municipal rehabilitation credits [32]. | In 2021, 16.5% of Leiden's residents struggled to make ends meet. In 2022 1.1% received unemployment benefit and 3.6% social assistance benefit [27, 34]. |
| Education | Leiden wants equal opportunity in education to ensure all children at school can participate well [14]. | In 2020, 48% of the Leidenaren had high, 33% middle, and 19% low educational attainment. Low literacy was 9% (which is below the national average of 12%). In 2021, 15% of the children had an educational disadvantage [35, 36, 37]. |
| Energy | Leiden wants to speed up the energy transition; increase the use of various sustainable energy sources [38]; enable energy saving and work toward a natural gas free city [14] . | In 2020, the share of renewable energy was 4.2% of the total energy consumption. In 2021, 10% of Leiden's households had registered solar panels [39, 40]. |

# WHAT WOULD IT MEAN FOR LEIDEN TO THRIVE WITHIN ITS NATURAL HABITAT? (FIGURE 4)

WATER

AIR

LAND




## WATER PROVISION

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Coastal dunes purify water as it infiltrates and filters through the sand. | Continue to utilize dunes for water filtration. Possibly increasing filtration rates to provide more water for growing population. |

**CITY TARGET**

Expand underground infrastructure like sewage and drinking water supply [14].

**CITY SNAPSHOT**

Dunea manages over 2420 hectares of dunes for water filtration in Leiden-Den Haag area [49].

## AIR QUALITY REGULATION

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Leaves can capture ultrafine air-pollutant particles and are also able to absorb gaseous pollutants. | Leiden could strategically place green infrastructure which can improve air quality. |

**CITY TARGET**

Have a green-blue framework including green schoolyards, city- and roof gardens [14].

**CITY SNAPSHOT**

Leiden is strategically introducing green roofs around central train station to improve current levels of particulate matter that are above WHO guidelines (PM2.5) [50].

## TEMPERATURE REGULATION

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Forests regulate rainfall and cool local air temperatures through a process of evapo- transpiration. | Leiden could reduce heat island effect with green buildings. |

**CITY TARGET**

Leiden wants to create more greenery in public and private spaces, and create more green and cool routes to prevent heat stress [14].

**CITY SNAPSHOT**

Heat island effect is present in the city centre, outside the city centre it is on average 3-4 degrees cooler due to larger canals [51, 52].

## CARBON SEQUESTRATION

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Land-based and sea-based plants absorb and store $CO_2$, as do phytoplankton in the ocean. | Leiden could have multiple projects to increase urban green spaces and green roofs in the city, while maintaining natural areas. |

**CITY TARGET**

Leiden wants to have car-free areas in the city and be climate neutral in 2050 [14].

**CITY SNAPSHOT**

In 2020, there were 431 tonnes of $CO_2$ emissions, a 12.9% decrease compared to 2019, and 16 hectares of forest/natural terrain remain in 2017, indicating 0% change since 2012 [56, 58].

## EROSION PROTECTION

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Marine plants and molluscs, such as oysters, slow down waves and reduce their power to erode the shore. | Leiden could Increase vegetation around water banks to reduce erosion rates and stabalize land. |

**CITY TARGET**

Leiden wants (to maintain) nature-friendly water banks [14].

**CITY SNAPSHOT**

Zandmotor: 21.5 million m^3 of sand is deposited south west of Leiden to nourish coastline near Leiden, regulating erosion and flooding [57].

## BIODIVERSITY SUPPORT

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Forests provide protective locations for nests and dens, as well as structures to support plant growth. | Leiden could revitalize natural areas, create more green roofs, and install insect hotels throughout the city. |

**CITY TARGET**

Leiden wants to contribute to the restoration of biodiversity by making the city 'nature inclusive' and 'internalising biodiversity in society' [55].

**CITY SNAPSHOT**

Since 2012, area of natural terrain has not changed in Leiden, while agriculture areas have decreased by 14.3%, and developed areas only increasing by 1.2% [56].

## ENERGY HARVESTING

| HOW NATURE DOES IT | TO WORK LIKE NATURE |
|---|---|
| Through photosynthesis, plants turn sunlight into energy. | Leiden could rely on alternative energy sources as opposed to fossil fuels. |

**CITY TARGET**

Leiden wants to transition from fossil fuel-based heat and energy to clean alternatives and work toward a natural gas free city [14, 53].

**CITY SNAPSHOT**

15,844 solar panels were installed in Leiden as of 2020, a 48% increase compared to 2019, and average natural gas consumption in Leiden in m3 was 820 m3 in 2020 a 1.2% decrease compared to 2019 [54].

### 4.1.2 Social Results

Leiden appears to be on track with providing the essential social foundation for its citizens (Figure 3). However, there are several themes that need to be addressed to fully ensure every person's social needs in Leiden are met, such as housing, food and health.

Although the target and snapshot for food appear to mismatch, which will be addressed in the following section, the food snapshot does indicate that a relatively large number of households (747) rely on foodbanks. From 2019 to 2020 the proportion of households depending on the foodbank has increased by 22%, perhaps attributed to the COVID-19 crisis [24]. However, this trend does not appear to continue as in 2021 the number decreased slightly by 2.6% [24].

Additionally, Leiden appears to have a shortage of affordable rental housing, and especially a lack of social housing as indicated by the city snapshot (Figure 3). This is reflected in the targets of reducing house shortages as well as of increasing both social and student housing (Figure 3). Currently, Leiden is on track in achieving their ambitious target with the addition of new homes, as can be seen in the housing monitor of 2022, which indicates that since 2017, 3,472 new homes have been added to the housing stock and 409 new homes just in the first half 2022 (1 July 2021 – 1 January 2022) [19].

In the Health category, the percentage of overweight individuals is quite high (Figure 3). In addition, the risk of mental health, including depression and anxiety, is even higher amongst individuals 18 and older (Figure 3), with the percentage of moderate to high risk of mental health, being above the national average by 8% [17]. This sheds light on a possible policy gap, as we could not identify policy goals specifically addressing mental health risk and predominantly the policy targets focused on physical health, even though the snapshot indicates a different area of concern. This further demonstrates a disconnect between the city targets and performance snapshot indicators.

Leiden needs to shift focus towards equality in diversity as they are falling behind in the Empowered category. High proportions of the citizens in Leiden are experiencing a form of discrimination, with 39.9% experiencing it based on race/skin colour, 32.9% on gender, and 31.2% on nationality (Figure 3). These are serious issues highlighted that need to be considered to ensure every person's social needs in Leiden are met.

Although the exact progress of Leiden is difficult to pinpoint within the Local-Social Lens, for most social aspects, such as costs of living, household waste and gender equality, Leiden scored above or on average, compared to other Dutch cities [46]. It does appear that under the Connected category Leiden is performing well, with social cohesion and community feeling scoring relatively high (Figure 3).

Moreover, Leiden appears to perform well in terms of mobility and connectivity, with adequate public transport facilities and Leiden citizens predominantly utilising bikes, as well as almost all the population having access to the internet. Culturally, Leiden might not appear to be thriving to its full potential (Figure 3). However, this was heavily influenced by COVID-19, as in 2019 the percentage of residents attending a cultural activity was 73%, 36% higher than in 2021 [29]. Even though the Empowered category was difficult to quantify, people in Leiden appear to have a distinguished political voice with a voter turnout of 81% in the most recent election (Figure 3), which could also be reflective of the high number of students residing in the city.

### 4.1.3 Ecological Results

Leiden has environmental targets established across land, water, and air; however, some are vague and abstract. Leiden is doing well when it comes to Energy Harvesting, as the number of solar panels has greatly increased, while gas consumption has slightly decreased (Figure 4). This is a step in the right direction to achieve their target of becoming a natural gas-free city. Reducing the reliance on fossil fuels pushes the city towards being carbon neutral, which has cascading effects on other ecological themes.

Air Quality is a serious problem in Leiden, as there are high levels of fine particulate matter (Figure 4), which has direct impacts on the citizens' respiratory health. Alarmingly, the indicator data obtained was from an international citizen-science program, while air quality should be monitored by the municipal government.

However, there are strategic plans to incorporate additional green roofs in high traffic areas in the city. Green infrastructure as such have been proven to reduce particulate matter in urban settings.

Leiden also has difficulties regulating temperature, as the heat island effect is present in the city centre [55,56]. Regulating temperature is a challenge among all urban settings, however, the city of Leiden aims to mitigate the heat island effect by setting policy goals to have a green-blue framework [14].

Strategies for improving air quality and regulating temperature address the respective problems, and the two indicators should be closely monitored, as they are directly related to human health and wellbeing. Further, the green-blue framework and green roofs will likely have positive impacts on both Carbon Sequestration and Biodiversity Support as well. It is already evident that there are interconnections between different targets and snapshots, with solutions having added positive impacts across multiple ecological themes.

Carbon Sequestration is a difficult theme to quantify on a city-scale. Urban vegetation acts as a carbon sink in a city and could be a method of reaching Leiden's target of being carbon neutral [14]. $CO_2$ emissions have decreased between 2019 and 2020 by 12.9% [58], however, the COVID-19 pandemic may have inflated this statistic between the two years. Nevertheless, decreasing $CO_2$ output, and keeping a static area of natural terrain [56] pushes Leiden towards their carbon-neutral goal.

When comparing sustainability performance to other Dutch cities, Leiden measures above average for CO2 emissions from transportation [46].

Biodiversity flourishes in natural, undisturbed land. In Leiden, the area of natural terrain has historically decreased, but has remained static since 2012 [56]. This is a promising first step in promoting support for biodiversity. Land use change due to agriculture is one of the main drivers of biodiversity loss, which makes the fact that the amount of agricultural land in Leiden has decreased by 14.2% between 2012 and 2017 [56], another positive indicator of biodiversity support. This however does not represent the actual biodiversity status of Leiden, as we will discuss in the next section. When comparing sustainability performance to other Dutch cities, Leiden scores below average for nature and water [46].

Some indicators for the Local-Ecological Themes are measured in different manners. This creates two types of metrics. Whether the indicators are dynamic in Leiden (Trend) or a static measurement (Status), is important to distinguish. A summary of these indicator types, along with yearly changes for the Trend types can be found below (Table 1).

**Table 1.** Local-Ecological Lens summary table. The type of metric refers to whether the snapshot indicator is a static measurement, or is not changing, making it a 'Status', while a 'trend' type refers to metrics that are changing (yearly, bi-yearly, etc.)

| Theme | Indicator metric | Type | % Change |
|---|---|---|---|
| Air Quality | Particulate matter (PM2.5) | Status | |
| Energy Harvesting | Number of solar panels | Trend | +48% (2019 vs. 2020) |
| | Natural gas consumption (m3) | Trend | -1.2% (2019 vs. 2020) |
| Water Provision | Dune filtration (hectares) | Status | |
| Biodiversity Support | Natural terrain area (hectares) | Status | |
| | Agricultural area (hectares) | Trend | -14.2% (2012 vs. 2017) |
| Erosion Protection | Amount of sand deposited along coast (m3) | Status | |
| Carbon Sequestration | Co2 emissions (tonnes) | Trend | -12.9% (2019 vs. 2020) |
| | Natural terrain area (hectares) | Status | |
| Temperature Regulation | Temperature (°C) | Status | |

## 4.2 Results Groene Ideecafé

The Groene Ideecafé provided us with the opportunity to receive feedback on our preliminary results and gain more general recommendations on the sustainability in Leiden. During the brainstorm session, the attendees could freely discuss our City Sketch and general sustainability in the city. After collecting and analysing their input, we formulated general conclusions and recommendations. Although these recommendations are important to consider for our City Sketch, they mainly relate to the sustainability policies of Leiden. The following take-away points mainly concern suggestions for the Leiden municipality to possibly integrate when making future policies. The take-away points are divided in the same categories and themes that we used for the Local-Social and Ecological Lenses:

<u>Social Themes</u>

*Enabling*

- **Jobs:** A diversity of jobs is important, and re-education needs to play a more important role.
- **Income:** The prevention of poverty needs to be high on the agenda. Herein higher minimum wages and assistance with budgeting and preventing new debts is crucial.
- **Education:** The (local) government needs to pay for all necessities children need to fully participate at school, as the income of the parents must not influence the children's ability to succeed. Additionally, education needs to take place more outside in order to incorporate an understanding of nature/biodiversity in their upbringing.
- **Energy:** Investments are needed in solar panels on and the isolation of rental housing, as sustainability should not be a privilege for the wealthy.

*Empowerment:*

- **Peace and Justice:** The neighbourhood committee finds it difficult to make themselves heard on issues (e.g. related to education or housing).
- **Social Equity:** New forms of housing, such as mixed housing/community living, are needed to solve the huge housing shortages that status holders, students, and elderly deal with. In this way, the micro-level challenge in terms of cohesion of new people entering a neighbourhood can be solved, as these groups can assist and learn from each other.
- **Political Voice:** Democracy is more than elections only and therefore citizens' participation needs to be improved. The municipality needs to come and talk with the people more.
- **Diversity:** Empowerment of "buurthuizen", neighbourhood committees, and schools is very important, as they play a key role in achieving diversity.

*Connectivity*

- **Connectivity:** The (financial) support of sport and cultural clubs is an important feature in the creation of connectivity between people in the city. However, not only the interconnection between people, but also the connection between people and nature is important, so investing in public parks and other nature in the city is crucial.

- **Mobility:** It is important to keep the city centre accessible for elder and disabled people.
- **Culture:** In terms of cultural facilities, it is important to consider the availability for people with a different heritage/cultural background (e.g. diversity of churches/mosques).

*Healthy*

- **Health:** The city design needs to take into consideration that more green is healthy, both for the people and biodiversity in general. In addition, poverty is linked to an unhealthy lifestyle (as healthier food is more expensive), so in order to increase health poverty needs to be reduced.
- **Water:** Collection and buffering is important to be able to meet the demands for water consumption. An additional benefit is that it aids with the prevention of urban floodings.
- **Food:** Healthy food needs to be cheaper and more available in school canteens.

<u>Ecological Themes</u>

- **Air Quality:** Should have a higher priority and be measured in the entire city by the municipality.
- **Temperature Regulation:** More green roofs will help with temperature regulation in the city due to increasing heat resistance. Additional advantages in terms of nature regulation are for instance aiding with water management and reducing the reflection from buildings.
- **Carbon Sequestration:** Can be reduced with less cars and scooters in the city, more horizontal and vertical green (also outside the city centre), the usage of natural building materials for construction, and an overall reduction of energy usage.
- **Biodiversity Support:** All new building projects must be nature inclusive, with enough space for nature to grow freely. Cleaner canals are also important to improve water biodiversity.
- **Energy Harvesting:** Neighbourhood-level energy initiatives need to be stimulated and citizens should be given the option to choose the type of energy they want to use.
- **Erosion Protection:** To solve the problem of soil being 'flushed away' during high precipitation, there need to be more areas where water can overlap the land (e.g. Poelgeest).

Overall, the input from the citizens of Leiden was very useful. The feedback showed us that our City Sketch is mainly accurate, but that citizens have certain points they want to highlight specifically. Additionally, the attendees made clear that the policies of Leiden need to be more specific in terms of sustainability measures and goals. An example is that the air quality should be monitored in the entire city in order to formulate concrete, quantifiable targets on how much it needs to be improved. This would also make it easier to make a snapshot of the current status and give an indication of the progress Leiden is making by comparing the measurements over the years. In this way, possible problems in terms of measurability and data availability can be overcome.

## 4.3 Methods Review

Throughout the iterative research process of formulating this lens, several interesting observations have been made by the team, for both Local Lenses.

The targets we identified for the food theme, within the Local-Social Lens, were mostly related to population health and nutrition rather than broad affordability and access to food. Simultaneously, the food related snapshot is not the most reflective of the target. The snapshot concerns the number of households using foodbanks, as there was no data indicating Leiden's performance on healthy food. This identifies an opportunity for Leiden to more closely monitor health impacts from food.

Another interesting observation was that it was difficult to convey clear targets and a snapshot for drinking water in Leiden, as drinking water management occurs at the regional level by the company Dunea, which oversees 17 municipalities [48]. Therefore, the snapshot for Leiden covers the national drinking water quality data. This is, however, still representative for Leiden, as the Netherlands' drinking water quality is one of the highest in Europe without major quality differences across the country [49].

Moreover, it was specifically a challenge to identify the targets and snapshots for the Empowered category, as it is composed of complex themes such as equity, equality, and diversity, which are particularly hard to quantify.

Even though this was difficult for the majority of social categories due to the large quantity of available policies and data, it was especially the case for the Empowered category as narrowing down would lead to less reflectivity and representation of equity, equality and diversity in Leiden. The reason for this is that empowerment is about representation of all different groups in our society, and therefore leaving out policies or data on certain groups is exclusive and contrary to the mission of the Portrait Methodology. Further, it is exactly the opposite of Empowerment, and we aimed for our research to be as encompassing as possible.

Similar to the social water theme, it was difficult to find an appropriate snapshot for the Water Provision Theme, as the private company Dunea manages the water provision for the entire western region of South Holland. Consequently, the snapshot does not specifically reflect how Leiden is doing on water filtration and provision, but instead on how many hectares of dunes are managed by Dunea for water filtration.

Furthermore, it was challenging to find representative data to indicate Leiden's performance on Biodiversity Support and Erosion Protection. Due to their dynamic nature, these themes are relatively hard to measure on the city-wide scale. This made it difficult to find data on whether biodiversity is being restored and/or increasing and whether soil erosion is being mitigated and measured. Therefore, we decided to look at land use for biodiversity and the Zandmotor for erosion, while both are not as representative for the selected targets.

Another example is that the snapshot for Carbon Sequestration indicated a reduction in CO2 emissions, but this is only a proxy and does not indicate actual carbon sequestration.

After having created and agreed upon our final version of the local lenses, we can say that the variety of social and ecological aspects included is very positive. However, for the Social Lens the targets, snapshots, and indicators themselves are at times too abstract, broad, or vague. The set social categories and themes are open to interpretation due to their abstract nature. This does, however, allow more flexibility in choosing the targets and snapshots, which makes the method applicable to different cities with their own perspectives, priorities, and problems that need to be addressed. Overall, the Local-Ecological Lens was less abstract compared to the Local-Social Lens as there is less room for interpretation. This made the Ecological Lens more straightforward to complete, as the themes are more specific and the required data for the snapshots more obtainable. Consequently, we were able to show trends in the snapshots of several themes. A downside to the Ecological Lens is, however, that several themes such as Air Quality or Temperature Regulation are not isolated to one location which makes it hard to quantify for the local context of Leiden.

Moreover, we observed that, while the Social Lens method has four broad categories and 16 specific themes, municipal policies are often not specific enough and too broadly formulated. The social targets are therefore often rather vague in their wording, while we were able to make the snapshots much more specific.

## 4.4 Case Study Results

Within Leiden there are many citizen-led sustainability initiatives, such as renewable energy cooperatives and circular economy initiatives. All these initiatives need to communicate with the municipality to share information and resources and receive fundings and permits. Through interviews with members of Bomenbond, Duurzame Energy Merenwijk, Leidse Gesprekken, Leidse Laptoppers, an energy ambassador, people involved in the sustainability of the local food chain and an employee of the municipality, we aimed to extract differences and similarities in the communication processes between the municipality and the initiatives. We did not focus on specific points for any of the initiatives but looked at overarching topics. While the specifics differed per initiative, there were a lot of similarities in the topics they mentioned, both on the positive and more challenging side of communication. Anonymised summaries of the interviews can be found in Appendix II. A brief summary of some important findings is as follows:

- New, smaller initiatives are generally less positive about the communication with the municipality than larger, longer existing, and more professionally organised ones;
- The quality of communication depends on who you communicate with within the municipality (personal connections are important);
- The municipality often acts technocratic: citizen-involvement often happens when plans are already made, and they can no longer be changed. This coincides with a lack of transparency of the decision-making process;

- There is a trust issue due to a lack of available knowledge on (sustainability) topics within the municipality;
- There is a lack of clarity on certain procedures (e.g. funding) due to them being too bureaucratic in nature;
- It is difficult to reach those responsible, as communication with the municipality is mainly through government officials who are not able to make decisions.

The perspectives on communication with the municipality greatly depends on the initiative. Initiatives that are bigger, longer existing, and/or more professionally organized are mainly positive about the communication with the municipality. The smaller citizen-led initiatives mainly focus on the challenges with communication. The quality of communication does not only depend on the initiative itself, but also on who they are able to communicate with within the municipality. Personal networks with people who work at the municipality greatly determines whether they have a 'way in'. This might be one of the reasons why longer existing initiatives are more positive about the communication. The longer an initiative exists, the more connections their members have with individuals from the municipality. This results in more direct lines of communication and an overall better experience. Another issue is that initiatives mainly come in contact with officials who are not always able to give permission and/or make the decisions to aid them.

A challenge most initiatives mentioned is that the municipality handles issues in a technocratic or bureaucratic manner. Involvement of citizens in decision or policymaking processes is often at a too late-stage when plans are already made by the municipality. Initiatives thus need to adjust their schedule to that of the municipality if they want to be included. In line with this, some initiatives mentioned a lack of transparency and clarity from the municipality when it comes to procedures about policy making and funding/subsidies. Another challenge that arose is that not all policy makers have comparable knowledge on sustainability subjects that some initiatives have. Resultantly, some initiatives feel like they must explain everything they do every time they meet a different policy maker. To bridge this gap, the municipality does consult certain initiatives whenever they are in need. For example, when the municipality wants to be in contact with citizens or have broad meetings around the energy transition, they invite the initiatives in Leiden that work on those themes.

The municipality has a positive view on the communication with citizen-led initiatives. Initiatives know how to find them, and the communication is good, although not without challenges. One of the main challenges is that the municipality has many different interests besides sustainability, and they need to balance all of them. This does not always align with the interests of the initiatives, which can be difficult.

## 4.5 Results Conclusion

We were able to meet the required deliverables and answer the research questions. Firstly, we applied the City Portrait Methodology to Leiden in the form of a City Sketch, covering both the Local-Social and Local-Ecological Lens. These lenses respectively indicate Leiden's social and ecological goals through its current policies and performance. An important remark is that it was difficult to formulate a snapshot for the water indicator as drinking water management is in the private hands of Dunea. A specific remark concerning the Local-Social Lens was that the Empowered category was difficult to quantify due to its complexity. This ties into the general notion that some parts of the City Portrait Methodology are too abstract, broad, or vague. Where this was partly due to the multi-interpretable nature of the targets, snapshots and themes, it also relates to the often too broad formulation of municipal policies.

The City Sketch has also allowed for many insights on the social and ecological performance of the city. Leiden has made progress towards their own sustainability goals and excel in transitioning to more sustainable energy sources. However, improving air quality and regulating city-centre temperatures pose a significant challenge. Strategies to solve these problems are promising and can be a roadmap to a cleaner city for all. Although the proxy-indicators suggest progress towards support for urban biodiversity, and improved carbon sequestration, it is still unclear how Leiden is performing under these themes. ore direct metrics that match Leiden's targets would benefit this aspect of the City Sketch.

There also appears to be a mismatch between policymakers and the ecological researchers who gather ecological data in the city. Socially, Leiden is performing well in terms of social cohesion, mobility, drinking water, political voice, income, energy and connectivity, but there are still challenges ahead. Unemployment, housing, food security, and health are areas Leiden is currently struggling with. There are connections here, as lack of affordable housing plays a role in affordability of food, the health of the citizens, and general wellbeing. The measurement of mental health also requires great improvement, as a metric to track this statistic is lacking. These areas need to be addressed by Leiden to ensure all citizens' social needs are met within the social foundation of the Doughnut.

In addition, the feedback session at the 'Groene Ideecafé' provided us with many insights into what the citizens think about the method and the sustainability status of Leiden. As we already concluded, many citizens shared the sentiment that the sustainability policies, and with that the targets and goals, are often too broad and abstract. By doing more measurements and creating more quantifiable targets, it can be made easier to see the progress Leiden is making in terms of sustainability. In addition, by making more concrete and specific policies, the municipality of Leiden can:

1. Ensure that the targets are clearer to citizens, which may also improve citizen's engagement;
2. More easily develop the right tools to measure the progress the city is making in terms of sustainability;
3. Create more transparency in terms of policy making.

Lastly, our case study gave us a good idea of the current state of the communication between the citizen-led sustainability initiatives and municipality of Leiden. The main sentiment of the initiatives was that the communication with the municipality seems to highly depend on their size, lifetime, and connections within the municipality. Those initiatives that are able to meet these requirements were overall more positive about the communication with the municipality, while those who do not meet them experienced more issues. Finally, some sustainability initiatives mentioned a lack of transparency and clarity from the municipality in terms of the policy making process and funding procedures.

In the following chapter, we will give recommendations on what needs to be done to improve sustainable development of Leiden. In chapter 7, we also answer the final research question on how our City Sketch can be further developed into a City Portrait and transformative action.

# 5. Recommendations

## 5.1 Summary of Recommendations by Stakeholder

The LDC is interested in the applicability of the City Portrait Methodology in Leiden. Without having developed a full City Portrait or diving into the City Selfie, our preliminary research completing the City Sketch has led to a series of recommendations for the LDC, as well as citizens of Leiden and the municipality.

A summary of recommendations for each stakeholder in Leiden is provided below, and a more detailed description with reasoning follows. These recommendations are based on observations and findings during our research. Following these recommendations will make continuing with the City Portrait more efficient, and ultimately facilitate the sustainable development of Leiden.

**LDC**

- Carry on with the City Portrait Methodology in Leiden.
- Maintain the City Portrait, updating it regularly to remain current and reflect the current Leiden sustainability performance in comparison to the long-term goals.
- Introduce the City Portrait methodology to citizen-led initiatives, for them to adopt it into their mission and to quantify their contribution towards the sustainable development of Leiden.
- Use your network of connections to bring individuals with specific sustainable expertise together to assist the municipality of Leiden as well as citizen-led initiatives in adopting the City Portrait Methodology.

**Leiden Policymakers**

- Utilize results from the City Portrait Methodology to formulate policies that directly address the areas where Leiden has poor sustainability performance compared to city targets, visions and goals.
- Consider the interconnectedness of the City Portrait to help creating policies that meet social needs without compromising ecological boundaries.

- Create more specific and measurable long-term social and ecological targets and goals for the city of Leiden.

**Municipality of Leiden**

- Continue to consult citizen-led sustainability initiatives in decision-making processes and actively seek feedback and advice from other citizen organisations.
- Increase communicative effort towards smaller and less connected citizen-led initiatives to gain different perspectives on decision-making and innovative ideas.
- Introduce a point of contact for all citizen-led organisations and initiatives in Leiden in order to overcome bureaucratic obstacles that currently strain the communication between new initiatives and the municipality and ultimately prospering.
- Develop a detailed framework or instruction manual for citizens to follow if they wish to form a formal organisation or initiative group that aims to improve sustainable performance in Leiden.

**Researchers/DEAL Team**

- Develop standardized definitions for the Social Themes.

**Citizen-led Initiatives**

- Embrace the City Portrait Methodology and identify themes the initiative aims to address.
- Quantify the impact that the initiative has on the sustainable development of Leiden.

## 5.2 Feasibility and Applicability of the City Portrait Methodology

The Doughnut Economics Model is the holistic approach to sustainable development that can help with addressing social needs and ecological limits. We recommend that the City Portrait Methodology is further applied to Leiden, and the City Sketch can form the first step in doing this. The model casts a wide net over a variety of social and ecological principles, however, this comes with pros and cons. Despite our analyses pinpointing positive and negative aspects of the City Portrait Methodology, the weaknesses and threats from Table 2 can be overcome by further developing and improving the relatively new methodology. Following our recommendations would be a strong start towards negating the cons of the City Portrait Methodology.

The City Portrait could make sustainability a lot more approachable. Specifically, the Ecological Lenses become less daunting when the variables are reduced to how nature would approach them. In this way, the Portrait forms a useful tool for citizens who lack a natural science background to become involved in the sustainable development of Leiden. Furthermore, this can also assist policymakers with limited sustainability knowledge with building a more sustainable, safe, and just future for Leiden.

The Social Lenses encompass a wide array of important principles. However, these principles are abstract and can be open to interpretation, especially compared to the more straight-forward Ecological Lenses. The vagueness of the Social Lens provides flexibility to cities to tailor the lens to their own priorities. Where this is useful within the city, it does complicate a (quantitative) comparison between cities. As some variables in this lens could mean different things to different people, we recommend the development of standardized definitions of each category and theme in order to facilitate clear, concise, and comparable frameworks. For example, under the 'Healthy' category, there is the 'Food' theme. It is unclear whether this is referring to the health standards of food production, nutrition in affordable food, food availability, etc. Standardised definitions beyond one-word descriptors would clarify grey areas in the City Portrait Methodology.

The City Portrait Methodology is not suitable for short-term targets. Since there is only room within the Portrait for one or two targets per theme, not all specific short-term targets can be included. Additionally, short-term targets can change quickly which complicates keeping the Portrait up to date. Nevertheless, the City Portrait Methodology is useful for an overview of the long-term sustainability vision of the city. Most of the targets included in the City Sketch are long- or medium-term targets, as they give a broader view of the city's plan to stay within the safe space of the social foundation and the ecological ceiling. Even when using long- and medium-term targets, the Portrait should be updated either yearly or bi-yearly.

A major advantage of the City Portrait Methodology is that it combines principles that would otherwise be mutually exclusive. Bridging the gap not only within the Social or Ecological Lenses, but also between them reveals overlaps and gaps in current policies. Tying these concepts together, creates the ability to develop policies that can strategically address more than one issue Leiden is facing.

The municipality of Leiden has many targets for different sustainable goals, but they can at times be vague and undescriptive. This might be purposeful, as loose definitions of targets make them easier to achieve. However, vague targets make it difficult to select appropriate indicators and accurately track sustainable development in Leiden. For this reason, it is recommended that Leiden formulates more concrete and specific targets to help gauge sustainable performance and motivate improvement in the city. Developing targets with accompanying metrics would be extremely beneficial for the Portrait Methodology. Measurable goals render striving towards reaching them much easier. An example of this would be to instead of aiming to "increase green space in Leiden", establishing targets such as "introduce an additional X square kilometres of green space in Leiden".

Ultimately, there are both advantages and disadvantages of this model, but the positives outweigh any negatives, as further explained in the following section. Ultimately, the City Sketch has revealed the potential of the Portrait Methodology and has shown feasibility in the city of Leiden.

## 5.3 Strengths, Weaknesses, Opportunities, Threats of the City Portrait Methodology

**Table 2.** SWOT analysis of the City Portrait Methodology

| | | |
|---|---|---|
| **Internal** | **Strengths** | **Weaknesses** |
| | 1. Bridges gap between social and ecological priorities | 1. Lacks standardized definitions |
| | 2. Comprehensive and holistic | 2. Lacks explanation of nuances |
| | 3. Clearly shows areas of improvement/excellence | 3. Predefined indicators |
| | 4. Easily interpreted | 4. Restricted by data collection |
| **External** | **Opportunities** | **Threats** |
| | 1. Tool for strategic city planning | 1. Time and resource costs |
| | 2. Tool for evidence-based policymaking | 2. Comparing rather than improving |
| | 3. Benchmark for intercity-learning and collaboration | 3. Biases, selective data, data manipulation |
| | 4. Education for citizens | 4. Results can become quickly outdated |
| | 5. Improve accountability | |

### Strengths

**1.Bridging the gap:** A unique strength of the city portrait methodology is connecting normally exclusive ecological and social priorities, which allows for observations of interconnectedness, and dependencies.

**2.Comprehensive and holistic:** The City Portrait Methodology aims to capture an overview of all facets of the sustainability performance of a city, which is normally difficult to obtain.

**3.Revealing areas of improvement and excellence:** The City Portrait Methodology shows gaps in the sustainability performance of a city, nudging for improvement, but also shows areas in which a city excels, justifying current practices.

**4.Interpretation:** The results of the City Portrait Methodology does not require any specific expertise to understand. The goal is for anyone, from any field, wealth class, or background to interpret and use the information presented through this framework.

### Weaknesses

**1.Lacking standardized definitions:** Without standardized definitions of indicators, there is room for error and misunderstanding. Specifically with the social indicators, their vagueness fosters different interpretations from different users of this methodology.

**2.Lacking explanations of nuances:** All city targets and snapshots are complicated and are nearly impossible to summarize in one sentence. Each case has its own nuances, or other factors that are contextually important. The City Portrait Methodology fails to consider this and does not require any result explanations.

**3.Predefined indicators:** The indicators of the City Portrait Methodology are predefined, which does show potential for comparative analyses between cities, however, this also restricts the ability of a city to fully capture its sustainability performance. Some cities might have unique characteristics that fall outside of these predefined indicators.

**4.Restricted by data collection:** The City Portrait Methodology heavily relies on data collection by researchers, the city itself, or private institutions. If parameters directly related to the indicator or city target are not collected, users of the City Portrait Methodology must rely on proxy data, which can sometimes be unreliable.

## Opportunities

**1.Tool for strategic city planning:** The City Portrait Methodology can serve as a tool to strategically plan future city developments. Areas can be designed to better achieve city targets, meet social needs of citizens, and mitigate environmental degradation.

**2.Tool for evidence-based policymaking:** A city council or municipal government can refer to and rely on the City Portrait Methodology to introduce new policy that addresses issues highlighted in the analysis, and specifically target a social or ecological priority. Further, the analysis might also reveal opportunities for policies that can address multiple issue at once.

**3.Benchmark for intercity-learning, communication, and collaboration:** The City Portrait Methodology can act as a standardized metric for benchmarking sustainability performance. In turn, this can serve as a tool for cities to learn sustainable practices from other cities, and also facilitate collaborative efforts to develop sustainably in tandem.

**4. Education for citizens:** Since the City Portrait Methodology is easily interpreted, it allows for citizens with limited educational background to understand the sustainability status of their city. Once aware, citizens can participate in local decision making, as well as citizen-led initiatives to help build their city towards a sustainable future.

**5.Improve accountability:** The dynamic and iterative nature of the City Portrait Methodology allows for observations to be made over time, which can reflect the impact of decision makers in a city. This means that the direct impacts of certain policies will become evident, and reflected in this analysis, which can ultimately improve the accountability of policymakers. Without the City Portrait, some environmental impacts that were not previously monitored, would continue unnoticed.

## Threats

**1.Time and resource cost:** Since the City Portrait Methodology is holistic and provides a sustainability overview of an entire city, it naturally requires an investment of time and resources. Resources can be broken down into human capital but also funding. For cities with tight budgets or limited time, or personnel, the City Portrait Methodology becomes difficult.

**2.Comparing rather than improving:** Ideally, the City Portrait Methodology motivates cities to improve their sustainability performance. However, there is the risk of the tool being used to simply compare performance and rank cities amongst each other, rather than sparking improvement and sustainable development.

**3. Biases, selective data, data manipulation:** Since there is no neutral party involved in a City Portrait Methodology analysis there is always the risk of biases in data collection and processing; of a city being selective in which data is used for specific sustainability indicators, as well as a risk of individuals manipulating data to make the city appear more sustainable. This stresses the importance of collaboration when using this methodology.

**4. Results can become quickly outdated:** Cities are ever changing and are sometimes referred to as an organism. Because of this nature, a City Portrait can sometimes become outdated if data collection and interpretation fails to keep up with updates in policies, behaviours, and initiatives in the city.

The City Portrait Methodology is relatively new, and naturally comes with a wide array of strengths and opportunities, but also a set of weaknesses and threats. Based on our findings and observations, we still find that the City Portrait can be a useful tool in assessing sustainable performance, and that the weaknesses and threats can be mitigated by further developing and constantly improving the process by listening to feedback and findings improvement areas while implementing the framework.

## 5.4 Citizen-led Initiative Communication with the Leiden Municipality

Communication between the initiatives and municipality is crucial for information sharing, consulting for policy formation, requesting/granting permission for certain activities, and sharing resources. Reciprocal communication between the two parties can be mutually beneficial and foster prosperity for both.

It is excellent that the municipality has consulted certain citizen-led sustainability initiatives on sustainability policies, and this should definitely be continued. This process fills the knowledge gap of some of Leiden's policy makers, as a lack of sustainability knowledge and awareness has been observed. Therefore, consulting sustainability professionals and initiatives contributes to solving this problem.

The municipality of Leiden successfully communicates with bigger, longer existing and more professional initiatives. Herein, personal connections to people within the municipality play an important role. This leads to a disadvantage for smaller initiatives, which become more marginalised due to their lack in size and network connections. Hence, it is recommended that the municipality focusses their efforts on actively making connections with these less engaged initiatives. Doing so might enhance sustainable development and lead to fresh ideas and perspectives for innovative problem-solving policymaking.

Additionally, there appears to be a lack of clarity for many citizen-led initiatives when it comes to communication. Some are unsure of the formal process to kickstart communication with the municipality.

A clear and concise pathway to establishing two-way communication between the two parties would benefit citizen-led sustainable development in Leiden. Specifically, instructions for start-up initiatives to become recognized by the municipality would be helpful. It is recommended that the municipality appoints one or multiple officials to be the direct line of communication for citizen-led initiatives in the city. This would funnel communication to one department, who could redirect them to the appropriate part of the municipality, rather than initiatives trying to contact different individuals within the municipality themselves. Such formalisation would streamline communication and allow citizen-led initiatives to function more efficiently, and therefore contribute more to a sustainable future for Leiden.

# 6. Limitations

The research done for this report has some limitations that should be noted for full transparency:

**Time Constraints:** This project spanned from mid-September 2022 to January 31st, 2023. This is a limited amount of time for a full overview of the status of sustainable development in Leiden. This is why we further downscaled the City Portrait to a City Sketch. We narrowed our scope to the local level, to have a detailed overview of one aspect of the City Portrait, rather than a brief overview of many aspects. With additional time, further analysis into the Global Lenses could have been completed.

**Resource Constraints:** When identifying social and ecological snapshots, our research was limited by which parameters the city of Leiden records. If there was no snapshot directly related to the policy documents, we aimed to find the closest snapshot that addresses the city targets, goals, and visions for that indicator.

**City Portrait Methodology:** The City Portrait Methodology aims to show what is happening in the city; however, it fails to ask the question as to why certain things are happening. This is an extra step that could be pursued, as including explanations for each indicator could prove helpful for making policy decisions. However, the main point of the City Portrait is to provide a concise and easy to digest figure, which does not necessarily need an explanation to understand.

**Water Management:** In the Netherlands, the Hoogheemraadsschap & private companies govern water provision. These parties are responsible for certain regions of the country. The company Dunea is responsible for drinking water provision for Leiden and 17 other municipalities [47]. This renders it difficult to collect water provision data specifically for Leiden. Furthermore, Leiden has little control over water acquisition, treatment, and provision. This makes it even more difficult for Leiden to strive towards sustainable development, if they cannot control this valuable resource.

**Groene Ideecafé Feedback:** Receiving feedback from the citizens of Leiden is one of the most valuable sources of information for this project. Through the Groen Ideecafé, we aimed to validate our findings and ensure they were aligned with the views of the citizens. However, we had no control on which individuals would be attending the Groen Ideecafé. We believe that not all demographic groups of Leiden were represented in the audience that provided us with feedback. The audience primarily composed of middle-aged individuals who were already involved through citizen-led initiatives or had previous interests in the field of sustainability. For this reason, our feedback on our preliminary findings were biased.

In the future, we advise gathering feedback from a more representative group of citizens. There are multiple ways this can be achieved. A more diverse group of citizens could be invited to the Groene Ideecafé. Another possibility is to hold multiple evenings throughout the city, for example in 'buurthuizen'. Instead of a Groene Ideecafé, different or smaller workshops could also be held throughout the city. We do suggest making an effort to diversifying attendees (for example by inviting people through different sources), since bringing people together can lead to new discussion insights.

**Quantifying Social Lenses:** Due to the subjectiveness of the indicators of the Social Lens, it is worth noting that conclusions drawn from some variables, such as 'happiness' might be weak, since this metric depends heavily on the individuals sampled, the neighbourhood one resides in, among many other factors.

Moreover, it must be noted that it is difficult to give a definite statement on the current social performance of Leiden. We have attempted to find the most representative data for each theme. However, as the snapshots are solely based on data that was publicly available, they do not provide a complete picture. Furthermore, as the social themes are relatively abstract, there is no objective way to quantify whether the indicated performance is high, low, good, or bad. As we have not conducted a comparative analysis, we cannot provide an indication on Leiden's performance in comparison to other cities. Nevertheless, we can provide some preliminary comments on Leiden's social performance.

**Ecological Field Research:** The City Portrait Methodology suggests picking a representative ecological reference site in the city to conduct field research for comparative analyses. However, this was not feasible for us due to time and resource constraints. Although we have done our best to find the best possible and representative data for each snapshot, the data shown is based on what we found in literature and available data banks, as we did not measure any of the snapshots ourselves. Furthermore, we do not know to which extent certain themes are influenced by factors external of Leiden. For example, there appears to be dangerous particulate matter concentrations in the city of Leiden, but we do not know if they are sourced from the city.

**COVID-19 pandemic:** Almost all findings in this analysis were from 2020 onwards.

In 2020 the COVID-19 pandemic affected everyday operations, which in turn, affects the data collected for both social and ecological indicators. The data collected is still representative of the city of Leiden, however, there might be significant changes between pre- and post-2020 data.

# 7. Future Steps to Transform Our City Sketch

## 7.1 What's Next?

The City Sketch is only a first step and should be continued and developed into a full City Portrait of Leiden (see Section 7.2 for more). Eventually this Portrait can be turned into a City Selfie of Leiden indicating interconnections between all four lenses. To achieve this, it is recommended that it is spearheaded by a transdisciplinary team that has both a quantitative and qualitative sustainability foundation and is active in Leiden. Additionally, they should be assisted by a range of officials from different municipal departments, as well as citizen-led organizations bridging community networks. Although continued by researchers, the City Portrait would be most successful if it was adopted by the city of Leiden to be maintained and updated in an iterative process.

The City Portrait could, once fully developed, also be adopted by the city council in Leiden to help the municipality with agenda-setting and highlighting areas of concern. Citizens of Leiden increasingly demand their political voice to be heard, and the future development of this report can assist them with this. Some political parties in Leiden have already expressed their interest in the Doughnut Economics Model [60], emphasizing its contemporary relevance. This shows the need for the continuation of this research, in order to create a holistic picture of sustainable development in Leiden. Upscaling the City Sketch to the City Portrait, and eventually City Selfie, can also result in more, currently unrevealed interconnections both between and within social and ecological properties on two different scales – global and local.

The City Portrait is dynamic and requires adaptation to new policies, but also to the needs of both current and future generations. For this reason, the creation of a City Portrait is an ongoing process. The ever-changing social and environmental priorities and visions of Leiden and its citizens play an essential role. Once formed the full City Portrait, should be updated after every city council election, since policies often change afterwards, and can be updated in between if mayor policy changes occur. Because of the continuous nature of the framework, the decision to continue with the development of the City Portrait should be made vigorously. As explained, this method can provide many benefits to the city and citizens of Leiden, but only if people are willing to put the time and work needed to fully develop it.

## 7.2 From City Sketch to City Portrait

Evolving the City Sketch to a City Portrait will require building on the findings of this report. The City Sketch has many local implications and reflects the current sustainability performance in Leiden. However, it fails to thoroughly connect the lenses with each other, nor does it consider the global impacts of the city. Here we provide steps to transform this City Sketch into a City Portrait, based on the City Portrait Methodology [9].

Transforming the City Sketch into a City Portrait can be done by forming a taskforce, initiated by the municipality of Leiden and including a range of different stakeholders. The municipality should initiate the task force since they have the organisational strength and knowledge to do so, and the connections to all the other stakeholders that need to be involved.

The Leiden Donut Coalitie should be predominantly involved in this taskforce since they have in-depth knowledge of the Doughnut Model and strong bonds within the city. Moreover, a stakeholder that should be considered are the citizens of Leiden. This can be done by including citizen-led initiatives, but also citizens that are not part of an initiative. Citizens of Leiden are the most knowledgeable of what is occurring in the city and have a more hands-on experience on how to tackle certain issues. Decisions directly affect them, and therefore should be a part of decision-making and problem-solving. In addition, the businesses in Leiden should be included as well.

They have a different stake than citizens but nonetheless are an important part of urban dynamics and will be affected by decisions that come from the policy process. Lastly, researchers, both from natural as well as social sciences, need to also be involved. The Doughnut Economics Model has a basis in both types of science and therefore requires a transdisciplinary approach to execute and utilize it to its maximum potential.

### 7.2.1 Creating the Global Lenses

The first step to turn the Sketch into a Portrait would be to create the Global-Social and the Global-Ecological Lenses.

In the Global-Social Lens, the connections Leiden has with other parts of the world and how these connections generate an (in)direct, global impact are assessed. The four categories are the same as in the Local-Social Lens, but the themes are slightly different. Instead of 16 themes, there are only eight: Health, Food, Culture, Community, Jobs, Education, Peace & Justice, and Equality in Diversity. The indicators are also different from the Local-Social Lens. The targets are global targets, specifically the Sustainable Development Goals (SDGs) and the snapshots are global statuses. By making the Global-Social Lens more comprehensible, it can help to illustrate the interconnections within the city. One needs to identify the actors within Leiden and the activities that they engage in. Leiden has already started with this step, as they have organised teams in the city to address different SDGs, known as the Leiden 4 Global Goals [61].

Next, one needs to identify which social groups are affected by these activities on a global scale. For example, the effects households in Leiden have through their consumption of services and products. Where this leads to income and opportunities for some, it has negative impacts for others.

The Global-Ecological Lens compares Leiden's consumption of resources to what it could fairly use in a globally sustainable world. For the Global-Ecological Lens, the planetary boundaries are the starting point, with the following: Climate Change, Ocean Acidification, Excessive Fertiliser Use, Ozone-layer Depletion, Air Pollution, Excessive Land Use, Freshwater Use, Overfishing, and Waste Generation. Multiple principles can be used to determine how much the Leiden city overshoot is based on its national pressure and the city boundary, compared to these planetary boundaries. Usually the calculation is performed based on an equal per capita approach and an input-output analysis of how much resources Leiden uses. National footprint levels are available, and for the Amsterdam Portrait they were downscaled based on an income-adjusted approach. The city overshoot level is then calculated by dividing each income-adjusted city footprint theme by its respective per capita boundary. We have made a start with these calculations (see Appendix V). However, due to time and resource constraints we decided to focus on the Local Lenses and thus have not validated the data. When completing the Global-Ecological Lens, investigating our data and calculations should be the initial step.

### 7.2.2 City Selfie: Making Interconnections

When the four lenses of the City Portrait are done, interconnections can be made. These interconnections are context specific. Examples are provided within the City Portrait Methodology, such as car culture. Owning a car has cultural aspects, which makes it part of the Local-Social Lens, however, driving cars also has a severe Global-Ecological impact. Layering all ongoing initiatives and project onto the City Portrait would create a City Selfie. This final step creates a complete overview of the sustainability in Leiden.

## 7.3 Turning the City Portrait into Transformative Action

Below are nine sequential steps to facilitate transformative sustainability action in the city of Leiden [9]. These steps can be spearheaded by the same taskforce that created the City Portrait.

**1. Mirror:** Reflect on the current sustainability performance. In this step, data is collected for social and ecological indicators and congregated into one place, in order to give a holistic overview of Leiden. This step is partially completed, with the formulation of the City Sketch. However, a connection should be made between Local and Global Lenses, as well as the Social and Ecological lenses, to form a complete picture. The newly added data should also be reflected upon in order to fully understand the sustainability status of Leiden.

**2. Mission:** The taskforce should describe what it would look like for Leiden to thrive, in other words, what the ultimate goal is for Leiden. Collaboration helps identify common goals and facilitates the formation of actionable steps to achieve them. For this step, inclusion of citizens is essential. People from all age groups, backgrounds, demographics, neighbourhoods, income class, and gender should be included. Once a common mission is established, individuals are much more likely to collaborate to foster transformative action.

**3. Mobilize:** Assemble stakeholders in Leiden that are key to transformative action. This means bringing together changemakers, policymakers, activists, interested citizens, government officials, and other stakeholders that play a role in fulfilling the previously established mission.

**4. Map:** Consult the policymakers in Leiden, and investigate exactly what targets, policies, visions, or goals are currently established. This will allow for the mapping of the current direction the city is headed to and can help project the sustainability trajectory of Leiden in their aim to reach these targets.

**5. Mindset:** With the City Portrait and the established goal in mind, think about what is needed to achieve that goal. Consider the societal shifts that are needed to achieve them, and the groups of people that will be most affected by these shifts. In this step, it is also important to keep in mind the traditional values of the city, and possible non-negotiable changes that are likely to result in pushback or resistance if implemented.

**6. Methods**: In this step, one must take into account all previous steps, and use them as tools to create the method to expand the insights provided by the Portrait Methodology. Tailor the Portrait to the city of Leiden from a new perspective, utilizing things learned in the previous steps. Expanding the analysis done in the City Portrait will turn the framework from theoretical to practical, as it considers real-life nuances which might previously be overlooked. When it is clear what is needed to achieve Leiden's goal, implement these actions within the city. It is important to make these actions as concrete as possible, and to create a clear timeline. One of the later steps is to monitor, to ensure that progress can be monitored and measured and that it is clear when an action has been successful.

**7. Momentum:** Capitalize on the momentum of the City Portrait and the previous steps. Devise a mechanism that results cycles of iterative transformation of policies and action in Leiden. It is important to learn from the outcomes of different actions, and fine-tune policies accordingly. Momentum will keep this iterative process going, ideally without an end-date in sight. This step will keep Leiden on track to improving sustainable performance, regardless of unexpected crises or changes to the city, as the transformative action is now adaptable.

**8. Monitor:** Monitor the actions that have been put into place. Sustainable performance must be tracked, and assessed comparatively, using the City Portrait indicators, and the targets, goals, and visions of the city of Leiden. Monitoring will keep the city accountable for its actions, and also encourage actions which favour sustainable development in the city.

**9. Make:** Make the Portrait Methodology fun and engaging. Share success stories with the community to propel the project forward. Have fun during the process, and reap the benefits of a structured, iterative, sustainable development plan.

Following these nine steps to transform the City Portrait into transformative action will help with the creation of a sustainable future for Leiden and a just and safe place for its citizens to live in.

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# Appendix I. Interview Questions

For the interviews we asked the following question to learn more about the communication between the citizen-led sustainability initiatives and the municipality. These questions were slightly altered for the civil servant of the municipality, as we wanted to ask their point of view on how the municipality felt about communication with the initiatives.

1. What initiative are you working on and what is your role herein?
2. What is the main goal/priority of the initiative?
3. What resources or assistance does the municipality offer for the initiative?
4. How does the initiative communicate with the municipality?
5. How frequently does the initiative communicate with the municipality?
6. How do you feel about the (communicative) effort of the municipality?
7. Which other stakeholders/partners/businesses is your initiative interacting with?

# Appendix II. Anonymised Summary of the Interviews with Stakeholders

Interview 1

- The initiative communicates with the municipality mostly through one person, through a weekly call or email (via the contact form) with the same municipality worker.
- Communication appears to be really dependent on the initiative. New smaller initiatives don't seem to be a priority for the municipality and hence they need to scale up first before being considered.
- Initiatives also need to jump through many bureaucratic hoops and if something goes wrong in these procedures they can be easily dismissed by the municipality.
- The new non-hierarchical model is confusing for municipality and reporters. This structure makes the municipality very closed off.
- Even though some municipal workers want to engage and assist these initiatives, they often aren't able to because everything is planned out in advance.
- -The municipality is understaffed, with minimal resources and funding as they are very saving orientated, making communication difficult.

Interview 2

- The representative of the initiative and the municipality are not "on speaking terms".
- The municipality's lacks in its support for bottom-up energy initiatives.
- The quality of communication also greatly depends on who you communicate with within the municipality.
- There is a lack of transparency of the decision-making process.
- The municipality keeps communication and actions very technocratic, and are not very willing to collaborate with citizens (there is no place where they are welcome to discuss matters). Often citizens' involvement happens at a late stage when it's too late to be changed.
- The overall trust in the municipality is very low, partly due to their lack of knowledge on sustainability topics within the municipality.

Interview 3

- Communication was conducted through one particular civil servant, who also helps the initiative to communicate and network with other relevant actors within the municipality.
- There is good back and forth communication which is definitely reciprocated by the municipality, who are also consistently transparent about resources and information.
- However, as things often had to be explained to new people who are unfamiliar with the initiative, this required them to start from scratch every time.
- The ability to make the initiative stand out, is very dependent on who you are talking to.
- A challenge is that initiative need to repeatedly re-request funding through specific bureaucratic procedures rather than it being replenished.

Interview 4

- There is one dedicated person from the municipality that they always communicate with.
- Communication is on a monthly basis (but more during high point project).
- Overall, the municipality is enthusiastic about the project and in their communication.
- Although they receive funds, there is still a lack of clarity about the pitch and procedure of subsidies (and the role of Stadslab herein).

Interview 5

- There is monthly communication with the municipality via two contact persons.
- There were no concrete collaboration efforts as the municipality was not willing to have agreements with individual small initiatives.
- At the start of the initiative the municipality was a bit reluctant, but they helped more once it became more concrete.
- The municipality was not willing to help financially (they say due to a lack of funds).
- A problem is that communication with the municipality is mainly through government officials, but they are not the people that make the decisions or can give permission.
- Bad communicational efforts from the municipality have led to some difficult relationships in the past. This may be due to a lack of knowledge on sustainability within the municipality.

Interview 6

- There is good, trustful relationship with a small group of people that work within the municipality, who invite them over for meetings with other municipality workers.
- Although the initiative is taken seriously, there is a lack of assistance and resource provision. More money and resources need to be dedicated to bottom-up initiatives.
- The municipality is not very active in their engagement, whereby it often takes a month for certain conversations to be held.
- The municipality lacks time and people, so they are less efficient with resources during developments in Leiden.
- The city is not transparent in terms of policy making.
- There needs to be easier ways to contact civil servants, as it is difficult to reach to them for help.

Interview 7

- There is communication with two strategic employees within the municipality (via mail and WhatsApp) around ten times per month.
- Although the effort is mainly one sided, there is the possibility to hold meetings with the municipality.
- The municipality is very open in their communication.
- The longer an initiative exists, the more the municipality offer. Connections within the municipality are key.
- Currently citizens are not offered enough speaking time (3 min.) to participate in the council.
- The municipality is willing to take into account feedback in terms of citizen's participation for their current policies.

Interview 8

- The goal of the municipality is to support initiatives instead of being seen as somebody that stands in their way (easier said than done). Support initiatives and let them come with their own plans.
- Want to give initiatives a seat at the table, equal to other parties (such as Vattenfall) .
- Personal relations are important.
- The meetings are good, people know how to find the municipality and the other way around.
- They can facilitate, but most of the work is for the initiative itself. This can lead to discussions.
- Critique that it takes too long before the municipality comes with a plan. Municipality has different interests which sometimes makes it difficult.
- Most successful initiatives go for gradual change instead of disruptive change. This will change over the years because our generation goes more for disruptive system change. This will mean more/different work for the municipality.

# Appendix III. Additional Background Information of Local-Social Lens

*Possible Healthy Indicators*

**Health**

- Maybe an indicator of health can be obesity/overweight – same one used in Amsterdam as it increases your risk for a myriad of other diseases.
  - 42.1% overweight individuals 18 years of age and older (with a Body Mass Index (BMI) of 25.0 kg/m2 and above, based on self-reported height and weight) (https://www.rivm.nl/media/smap/overgewicht.html). (Amsterdam City Portrait)
- Maybe % of smokers and drinkers can be other indicators – also increases rick for other diseases.
  - 18% smokers in Leiden – differs across neighborhoods (https://www.rivm.nl/media/smap/rokers.html?gemeente=Leiden).
  - 10.3% heavy drinkers, 7.5% drinkers, 40.6% meets alcohol guideline (https://www.rivm.nl/media/smap/zwaredrinkers.html?gemeente=Leiden).
- What about mental health indicators?
  - Moderate/high risk of anxiety or depression – 53.9% (Amsterdam City Portrait)
- Life expectancy: 82.5 regionally (https://vzinfo.nl/levensverwachting/regionaal/bij-geboorte).
- Only unnatural death equal to the rest of NL and mental illnesses higher amongst women
- In Leiden cancer and hearth and vascular diseases are most important causes of death (26.6 and 20.8%). (https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/gezondheid)
- Live expectancy at birth is 81.3 in Leiden, on one the lowest in the region.
- Higher number for chronic illness (65+) than in the region (52% compared to 46%). Higher number of diabetes for 65+ (14% and 12%) and higher number of function limitations for 65+ (28 and 23%). Higher number of severe hindrance due to condition for 65+ (9 and 7%). For ages 18-64 all numbers are the same as in the region.
- In the second and fourth grade of high school the use of stimulants is lower than in the region. For adults and elderly (18-64 and 65+) the use of stimulants is higher than in the region. The number of smokers and excessive drinkers decreased in recent years among all ages. (https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/leefstijl) .
- 77% of children in 2nd and 4th grade work out weekly, 76& in the region. For 18-64 it is 63% in Leiden and 57% in the region and for 65+ it is 37% for both groups.
- There is less obesity for adults of all ages in Leiden compared to the region. For children it is equal to or 1% higher (for ages 10-14) than the region.

## Water

- Drinking water quality(Amsterdam City Portrait) Drinking water quality is nationally almost always above the legal standard. (https://www.rivm.nl/drinkwater/drinkwaterkwaliteit/ https://www.dunea.nl/drinkwater).
- Water system – how many people it serves (Portland City Portrait)
- Groundwater quality (Maybe more for ecological)

## Food

- Food banks? (Amsterdam City Portrait) - – In 2021, 747 households in Leiden used the Food Bank. (Voedselbank Leiden)
- Food security (Portland City Portrait)
- Average % of income spend on groceries/food ?
- % of restaurants/cafes/eating places?

## Housing

- Leiden scores poor for the % of owner-occupied homes (44th)
- 61.605 homes in 2022.
- Social housing (Amsterdam City Portrait)
  - 11.150 households are in social housing in 2022 (https://www.waarstaatjegemeente.nl/jive?cat_open_code=cgdhirpjj1hjg3&presel_code=sdg_4&geolevel=gemeente344&geoitem=1680 / CBS Lokale Monitor Wonen)
- Ability to cover rent and basic needs? (Amsterdam City Portrait)
- Percentage of renters/homeowners?
- The total number of plans now stands at 8,446. Together with the 3,472 homes realized, this leads to a total of 11,918 homes. (Rapportage WoningbouwmonitorgemeenteLeidenmeting 2022-1)
- As of 1 July 2022, 3,262 social rental homes are planned until 2030. This is a slight increase from the 3,180 from the monitor from six months earlier. (Rapportage WoningbouwmonitorgemeenteLeidenmeting 2022-1)
- The supply of rental properties far exceeds the target. This applies in particular to rental properties in the free sector (from €764 = medium and expensive rent). The shortage is particularly apparent in the low-cost and mid-priced segment. (Rapportage WoningbouwmonitorgemeenteLeidenmeting 2022-1)
- As far as the social rental sector is concerned, at the end of 2017, 19,109 home seekers were registered in WoningNet Holland Rijnland in Leiden for a social rental home, of which 5,155 are actively looking for a home (27%). (http://palleiden.nl/wp-content/uploads/2019/08/2019-08-15-190329-Woonvisie-Leiden-2020-2023-Goed-Wonen-in-Leiden.pdf).
- The number of clients in shelters for the homeless rose from 361 homeless people in 2015 to 594 in 2017. (http://palleiden.nl/wp-content/uploads/2019/08/2019-08-15-190329-Woonvisie-Leiden-2020-2023-Goed-Wonen-in-Leiden.pdf).
- The percentage of households that are very satisfied or satisfied with their current dwelling – 81.8& overall in Leiden.

*Possible Connected Indicators:*

## Connectivity

- Safe and convenient access to daily needs? (Portland City Portrait)
- Internet access(Amsterdam City Portrait) - in 2021 96% of Leiden residents who have access to the Internet at home, at work, at school or elsewhere.
- Severe Loneliness in individuals aged 18 years and older – 11.8% in 2020 (https://www.rivm.nl/media/smap/eenzaamheid.html?gemeente=Leiden). (Amsterdam City Portrait)
- Playgrounds are good (56%), youth facilities are good (46%), roads are well maintained (69%), greenery is well maintained (77%), in 2021. (https://leiden.incijfers.nl/dashboard/dashboard/leefbaarheid-en-voorzieningen)

## Community

- Neighborhood/city satisfaction score as a place to be a part of a community (Portland City Portrait)
- Active neighborhood emergency teams (Portland City Portrait)
- Rating of neighbourhoods (Amsterdam City Portrait)
- Percentage of residents with sufficient social contacts – 80% in 2021 (BronStadsenquete Leiden)
- Percentage of residents who can ask for help from local residents – 61% in 2021 (BronStadsenquete Leiden).
- Social cohesion - scale score scale score (0 - 10) 6.1 - (https://opendata.cbs.nl/#/CBS/nl/dataset/85146NED/table?searchKeywords=sociale%20veiligheid).

## Mobility

- Biking habits – 27% bikes weekly and 64% bikes daily.
- 17% have an electric bike.
- The most used means of transport is one's own bicycle (91%), followed by the train (79%), one's own car (74%) and the bus (61%).
- Average bike journeys on workdays (Amsterdam City Portrait)
- City's public transport rating (Amsterdam City Portrait)
- Met dagelijks circa 77.000 treinreizigers en 28.000 busreizigers vormt het stationsgebied een zeer belangrijk regionaal OV-knooppunt.
- Ambitions mobiliteitsnota:
  - Leiden as biking city
  - More space for walking
  - Stimulate Public Transport
  - Strenghtening the main roads (hoofdontsluitingsstructuur)
  - Car-free city centre (autolow + autovrijestraten)
  - Emissions free distribution in city centre
  - Parking in the right place
  - Support share concepts
  - Use new technologies
- Different zones for mobility: city centre, residential and business areas, and combinations. Differs per zone which mode of transport is most important.

## Culture

- Number of events, museums, and activities in Leiden?
- % which visits cultural performance – 73% (2019 – pre-covid number) and 37% in 2021.
- In 2020, a total of 787.102 people visited Leiden museums and in 2021 683.085 people visited Leiden Museums (Jaarstukken 2021)
- Percentage of inhabitants actively participating in art and culture 45% in 2021.
- 77% of citizens believe that Portland is a better place to live because of the arts (Portland City Portrait)
- In 2017, the City's Kunstenplan introduced a programme of after-school activities in arts and culture, predominantly for children from low-income households. (Amsterdam City Portrait)
- Municipal monuments per 1000 inhabitants – 12.9 in 2015 compared to the national average of 3.3

*Possible Enabled Indicators*

## Jobs

- Leiden scores poor unemployment – 4.5% unemployment (in 2021) doing rather well. (Portland City Portrait)
- 72.389 employed people - 2021
- The city business climate a rating (Amsterdam City Portrait)
- 734,5 jobs per 1000 residents, in 2021, higher than the national average of 685,7. (https://www.waarstaatjegemeente.nl/dashboard/dashboard/werk-en-inkomen).

## Income

- Percentage people with Unemployment benefit % - 1.1% average in 2022 (https://leiden.incijfers.nl/dashboard/Dashboard/Inkomen-en-uitkeringen/)
- Percentage people with social assistance benefit– 3.6% in 2022.
- The proportion of households living in poverty life ?
- The average household income in Leiden is below the Dutch average (€47,900)
- Percentage of residents who find it difficult to make ends meet 2021 – average 16.5% (StadsenWijkenquete)(Portland City Portrait)
- Low-income households – 12% in 2020 (https://www.waarstaatjegemeente.nl/jive/).
- 11,7 % children with chance of living in poverty in 2020. 6.9% in the region. But less children in 2020 than in 2015 (2.200 compared to 2.300). 8.2% children in families living from assistance payments (bijstandsgezinnen??) https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/bevolking-en-armoede)

## Education

- Educational attainment Leiden – High (48%), Middel (33%), Low (19%) (https://leiden.incijfers.nl/jive).
- Teachers available? (Amsterdam City Portrait)
- % early school leavers in secondary and vocational education - 1.9% (slightly higher than the national average of 1.7%). (https://gdindex.nl/dashboard/dashboard/onderwijs)

- Educational disadvantages per municipality – overall in Leiden 15% of children (toddlers and primary school) in 2021 (https://dashboards.cbs.nl/v4/onderwijsachterstanden/).
- Absenteeism due to illness and skipping classes has increased since 2013 with 33% and 3.8% respectively to 51% and 5.3% in 2021 (https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/participatie).
- Low literacy – 9% below the national average of 12% in 2020 (https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/participatie).
- Less kids in practical schooling and 'vmbo'. More in 'havo' and approximately the same in 'vwo' and the first 2 years of high school. (https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/bevolking)

**Energy**

- Natural-gas free (Amsterdam City Portrait)
- 10% of households have registered solar panels in 2021. (https://klimaatmonitor.databank.nl/dashboard/dashboard/woningen).
- Requested Sustainable Energy Investment Grant (ISDE) - is an allowance for households that want to invest in sustainable energy. This subsidy can be used for the purchase of a heat pump, solar boiler, pellet stove and biomass boiler. – 10.9 per 10.000 households. https://www.vattenfall.nl/producten/energie/duurzaamheidsindex/.
- Renewable energy in Leiden in 2020 was 4.2% (https://klimaatmonitor.databank.nl/dashboard/dashboard/hernieuwbare-energie).
- Registered electric passenger cars – increasing over the years – 1% in 2020 (https://www.waarstaatjegemeente.nl/dashboard/dashboard/energietransitie).

*Possible Empowered Indicators*

**Peace and Justice**

- People at the municipality – district level have reports
- Social District profile (made for or by organisations: Incluzio and Libertas).
- Crime rate? (Amsterdam City Portrait)
  - The Security Monitor shows that 29% of Leiden residents was a victim of any crime in 2019: traditional (18%) plus cybercrime (13%).
  - A common offense is, for example, bicycle theft (5% of Leiden residents), followed by vehicle destruction (5%). Cybercrime concerns hacking (6%), bullying via the internet (5%) and buying and selling fraud (4%). With regard to violent crimes, it is striking that the number of sexual crimes, although the percentages are very low, has increased from 0.1% in 2017 to 0.5% in 2019.
  - Domestic abuse rate (Amsterdam City Portrait)
    - 6 reports Domestic violence per 1000 households in 2021(https://eengezonderhollandsmidden.nl/dashboard/dashboardthemas/sociale-omgeving).

## Social Equity

- Income inequality lower than national average (Portland City Portrait).
- 16% of residents in lower-income neighbourhoods feel they lack control over their lives — higher than the national average of 11%. (Amsterdam City Portrait).
- Share of private households belonging to the national 40% of households with the lowest household income – 40.3% (https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84799NED/table?ts=1668701084761).

## Political Voice

- Voter turnout (Amsterdam City Portrait).
- Voter turnout for the Election of the House of Representatives in 2021 was 81% with a total of 75,405 votes (InhoudsopgaveVerkiezingTweede Kamer in Leiden 2021).
- Power to influence city decisions (Portland City Portrait).

## Equality in Diversity

- Discrimination experience(Amsterdam City Portrait)
  - Discrimination based on race/skin color in the last 12 months – 39.9% in 2021.
  - Gender discrimination in the last 12 months – 32.9% in 2021.
  - Discrimination based on sexual orientation in the last 12 months – 9.3%.
  - Discrimination on grounds of nationality in the last 12 months – 31.2%.
- The Leiden Urbanization Memorandum showed that there are four areas in Leiden where concentrations of social rental housing in the 'cheap' and 'affordable' rent classes were built in the 1950s, 1960s and 1970s, and social problems arise. indeed more manifest than in a smaller neighborhood with shared social housing. These are Haagwegkwartier-Zuid, De Hoven (on the north side of Willem de Zwijgerlaan), part of Hoge Mors and Slaaghwijk. The Haagkwartier-Zuid and De Hoven appear to belong to the two road areas with the most important, others in the field of labor participation, problem behavior = and social self-reliance. (De Woonvisie)
- Gender Diversity: Employment rate of women in % of employment rate of men – 90.6% higher than the national 88.5%.
- Income diversity.
- Average income lower for colored people (Portland City Portrait)

# Appendix IV. Additional Background Information of the Local-Ecological Lens

*Possible Water Provision indicators*

**Water management**

- Construction of Lakenpark will increase water storage, and slow drainage after heavy rainfall.

**Dune management**

- Dunea manages over 2420 hectares of dunes for water filtration in Leiden-Den Haag area.

*Possible Water Provision Targets*

- Leiden is more climate-adaptive designed & built.
- Leiden has more green and water (Green-blue framework): this is better usable and experienceable, with greater biodiversity and better ecological and recreative connections.
- Preventing heatstress by more green and cool routes.
- Sustainable sewage and space for water collection and buffering.
- Expand underground infrastructure like sewage and drinking water supply.
- Improve ecological water quality.
- Accessibility of water. (Omgevingsvisie 2040).
- In 2030, rainfall is caught, stored, and then discharged with the goal to limit harmful nuisance for citizens (Woonvisie).

*Possible Air Quality indicators*

**Natural Area**

- 16 hectares of forest/natural terrain remain in 2017 (0% change in 2017 since 2012).

**Green Roofs**

- Leiden has plans to install green roof projects in high traffic areas (https://www.urbangreenbluegrids.com/sponge/pilots/green-roofs-on-leiden-station-area/).

**Particulate Matter:**

- Particulate matter in Leiden slightly greater (15.8 ug/m3) WHO's guidelines (15 ug/m3) for PM2.5 and slightly below (36.2 ug/m3) that for PM10 (45 ug/m3).

**Urban Green Space**

- Leiden has an urban green space project: (Lakenpark): Improving existing park, adding a pond, aimed to increase climate resilience and promote biodiversity (60% green area, up from 20%), diverse flora will be planted (https://www.urbangreenbluegrids.com/sponge/pilots/leiden-lakenpark/).

*Possible Air Quality targets*

- Promote cleaner and more efficient modes of transport (Mobiliteitsnota).
- Research into how distribution can be emission free (possibly through the canals).
- Zero Emission City logistics resulting in emission-free zones in 2025.
- Omgevingsvisie 2040: the emissions for greenhouse gases have decreased; Car-free areas in the city. Safe design of streets with (where possible) priority to walking and biking.

*Possible Air Quality targets*

- Have a green-blue framework; green and challenging schoolyards, city- and roof gardens; Limit noise, light, vibration and smell pollution / hinder; climate neutral in 2050.

*Possible Temperature Regulation Indicators*

**Land Use**

- Forest/natural terrain remains consistent at 16 hectares in 2017 since 2012.
- 216 hectares of agriculture area in 2017 (-14.3% since 2012).
- 1361 hectares of built up area (+1.2% since 2012).

**Urban Green Space**

- Leiden has an urban green space project: (Lakenpark): Improving existing park, adding a pond, aimed to increase climate resilience and promote biodiversity (60% green area, up from 20%), diverse flora will be planted (https://www.urbangreenbluegrids.com/sponge/pilots/leiden-lakenpark/).

**Temperature**

- Heat island effect is present in city centre, outside city centre is on average 3-4 degrees cooler due to larger canals.

**Green Roofs**

- Leiden has plans to install green roof projects in high traffic areas (https://www.urbangreenbluegrids.com/sponge/pilots/green-roofs-on-leiden-station-area/).
- Leiden wants to create more greenery in the city, increase the quality of the existing greenery, and connect existing green areas (Leiden biodivers en klimaatbestendig Uitvoeringsprogramma 2020-2023, p. 20).
- A greener city with more trees provides shade that has a cooling effect and reduces the radiation temperature. In addition, green on and around buildings, such as green roofs, reduces the amount of heat that is absorbed (Leiden biodivers en klimaatbestendig, p. 17).
- Omgevingsvisie 2040: Leiden is more climate adaptive designed & built; Leiden has more green and water (Green-blue framework): this is better usable and experienceable, with greater biodiversity and better ecological and recreative connections; Preventing heat stress by more green and cool routes; green and challenging schoolyards, city- and roof gardens; Prevent heat stress by greening the public and private space; green-blue framework contributes to quality of living environment of humans, plants and animals; nature inclusive building.

*Possible Biodiversity Support Indicators*

**Land Use**

- Forest/natural terrain remains consistent at 16 hectares in 2017 since 2012.
- 216 hectares of agriculture area in 2017 (-14.3% since 2012)
- 1361 hectares of built up area (+1.2% since 2012).

*Possible Biodiversity Support Indicators*

**Urban Green Space**

- Leiden has an urban green space project: (Lakenpark): Improving existing park, adding a pond, aimed to increase climate resilience and promote biodiversity (60% green area, up from 20%), diverse flora will be planted (https://www.urbangreenbluegrids.com/sponge/pilots/leiden-lakenpark/).

**Green Roofs**

- Leiden has plans to install green roof projects in high traffic areas (https://www.urbangreenbluegrids.com/sponge/pilots/green-roofs-on-leiden-station-area/).

*Possible Biodiversity Support Targets*

- Leiden wants to contribute to the restoration of biodiversity by making the city 'nature inclusive' and 'internalising biodiversity in society' (Leiden biodivers en klimaatbestendig, p. 8, 13).
- This is inherently linked to making the city greener, with the creation of green areas that primarily aid biodiversity (Leiden biodivers en klimaatbestendig, p. 16).
- A new 'beheerplan Groen' will be created that aids biodiversity by for instance: replacing low-quality trees, monitoring exotic species, planting flowers in verges, not removing leaves, and planting native and biological plants (Leiden biodivers en klimaatbestendig, p. 27).
- Leiden actively contributes to the knowledge aggregation on biodiversity through research done by Naturalis, CML (Centrum voor Milieuwetenschappen Leiden), and the Hortus (Leiden biodivers en klimaatbestendig, p. 18).
- Omgevingsvisie 2040: Leiden has more green and water (green-blue framework): this is better usable and experienceable,w ith greater biodiversity and better ecological and recreative connections; strengthening biodiversity and nature-inclusive development; green-blue framework connects small and large green spaces: 'from facade to Green Heart (Groene Hart)' and contributes to a green and biodiverse living environment.

*Possible Erosion Protection Indicators*

**Land Area**

- Land area decrease -1.4% (2002 to 2022).

**Zandmotor**

- 21.5 million m3 of sand deposited southwest of Leiden to nourish coastline near Leiden, regulating erosion and flooding.

**Surface Water Area**

- Surface water area increased +43.4% (2002 to 2022).

*Possible Erosion Protection targets*

- Preservation and enhancement of open, robust and interconnected landscapes that extend to the banks of the Oude Rijn;
- Nature-friendly banks; Preventing dehydration and subsidence, coordination with above and below ground (construction) work. (Omgevingsvisie 2040)

*Possible Carbon Sequestration Indicators*

**CO2 emissions**

- 431 tonnes of CO2 emissions in 2020 (-12.9% compared to 2019).

**Land Use**

- 16 hectares of forest/natural terrain remain in 2017 (0% change since 2012).

**Urban Green Space**

- Leiden has an urban green space project: (Lakenpark): Improving existing park, adding a pond, aimed to increase climate resilience and promote biodiversity (60% green area, up from 20%), diverse flora will be planted (https://www.urbangreenbluegrids.com/sponge/pilots/leiden-lakenpark/).

**Green Roofs**

- Leiden has plans to install green roof projects in high traffic areas (https://www.urbangreenbluegrids.com/sponge/pilots/green-roofs-on-leiden-station-area/).

*Possible Carbon Sequestration Targets*

- The emissions for greenhouse gases have decreased; Car-free areas in the city.
- Safe design of streets with (where possible) priority to walking and biking.
- Have a green-blue framework; green and challenging schoolyards, city- and roof gardens; Limit noise, light, vibration and smell pollution / hinder; climate neutral in 2050. (Omgevingsvisie 2040).

*Possible Energy Harvesting Indicators*

**Solar Panels Installed**

- 5,139 solar panels installed in Leiden in 2020 (+39% compared to 2019).

**Natural Gas Consumption**

- Average natural gas consumption in Leiden in m3 was 820 m3 in 2020 (-1.2% compared to 2019).

**Energy Initiative**

- Leiden has initiative to provide help for people to transition their homes to become more sustainable (and another specifically for low income households).

**Renewable Energy**

- 292 TJ of renewable energy generated in 2019 (+15.8% compared to 2018).

*Possible Energy Harvesting Targets*

- Transition from fossil fuel-based heat to clean alternatives, e.g., stopping with gas) (Transitievisie Warmte, 2021, p. 5, 12)
- Leiden aims to be climate neutral by 2050 (Transitievisie Warmte, 2021, p. 5).
- Omgevingsvisie 2040: The built environment of Leiden is largely natural gas free: sustainable electricity is generated within the city with solar panels. The rest of the sustainable electricity will come from outside the city due to the limited amount of space within the city.
- Climate neutral in 2050; Energy saving, generation of sustainable energy and work toward a natural gas free city; water as energy carrier.
- Burgerberaad Energietransitie: Insolation offensive for citizens that cannot afford it - beleidsakkoord 22-26.

# Appendix V. Initial Findings for the Global Ecological Lens

For the Global-Ecological Lens, the starting point is the nine established planetary boundaries, which together outline the ecological ceiling of the global 'Doughnut'. To create this lens, Leiden's share of the planetary boundaries, as well as its national environmental footprint share, must be defined. Further methods for calculating both shares are provided in the City Portrait methodology as well as possible data sources such as the EXIOBASE database and the Global Footprint Network [9].

Visualised below is a start for the Global-Ecological Lens of Leiden. This is an excel sheet obtained from the Amsterdam City Portrait and, as a start, adapted for Leiden (Figure 1). The highlighted numbers in red, which originally corresponded to Amsterdam specifically, have been altered for Leiden using data obtained from the databank LeidenInCijfers. The following variables were changed: total population, total household waste separated, average disposable household income and total number of households. In this excel sheet, a calculation for the city overshoot is conducted based on its national pressure and the city boundary. Leiden appears to have a much higher ecological footprint than Amsterdam (Figure 1).

This result appears rather surprising, as Leiden is a much smaller city compared to Amsterdam with a smaller population; expecting a lower city overshoot.However, this result could possibly be attributed to the data utilised. The Amsterdam calculation is based on data from 2011 and data ranging from 2016 to 2019. To allow for comparison and maintaining consistency, data from the same years was utilised for the Leiden overshoot. As this report is written in 2022-2023, this data could be outdated and not reflective of the current state of Leiden.

| Table 4. City footprints, boundaries and overshoot in Amsterdam's Global–Ecological lens (with formulas) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Metric | Dimension | Indicator | Name | Unit | City Footprint | City Boundary | City Overshoot |
| City Estimate | Excessive fertilizer use | Nitrogen emissions to water | Leiden | tonnes | 23867 | 1019 | 23,4 |
| City Estimate | Climate Change | Carbon dioxide, fossil | Leiden | tonnes | 13938876 | 579240 | 24,1 |
| City Estimate | Freshwater Withdrawals | Blue water withdrawals | Leiden | Mm3 | 825 | 66 | 12,5 |
| City Estimate | Air Pollution | PM2.5 emissions | Leiden | tonnes | 1924 | | |
| City Estimate | Waste Generation | Total household waste separated | Leiden | Percent | 34 | | |
| City Estimate | Excessive Land use | Ecological Footprint (Cropland) | Leiden | global hectares (gha) | 1633810 | 65487 | 24,9 |
| City Estimate | | Ecological Footprint (Forest Products) | Leiden | global hectares (gha) | 439800 | 84010 | 5,2 |
| City Estimate | | Ecological Footprint (Grazing Land) | Leiden | global hectares (gha) | 820777 | 24730 | 33,2 |
| City Estimate | | Ecological Footprint (Fishing Grounds) | Leiden | global hectares (gha) | 33516 | 18003 | 1,9 |
| City Estimate | Ozone-Layer Depletion | | | | | | |

| Table 5. Data sources used to downscale footprints and boundaries to the city level in Amsterdam, including scaling indicators (which are called in the formulas that calculate the values in Table 4) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Metric | Dimension | Indicator | Scale | Name | Year | Data Source | Unit | Value |
| Footprint | Excessive fertilizer use | Nitrogen emissions to water | National | Netherlands | 2011 | EXIOBASE 3.3.17 (https:// | tonnes | 276192 |
| Footprint | Climate Change | Carbon dioxide, fossil | National | Netherlands | 2011 | EXIOBASE 3.3.17 (https:// | tonnes | 161305506 |
| Footprint | Freshwater Withdrawals | Blue water withdrawals | National | Netherlands | 2011 | EXIOBASE 3.3.17 (https:// | Mm3 | 9545 |
| Footprint | Air Pollution | PM2.5 emissions | National | Netherlands | 2011 | EXIOBASE 3.3.17 (https:// | tonnes | 22265 |
| Footprint | Waste Generation | Total household waste separated | City | Leiden | 2019 | Afvalmonitor Database (h | Percent | 34 |
| Footprint | Excessive Land use | Ecological Footprint (Cropland) | National | Netherlands | 2016 | Global Footprint Network | global hectares (gha) | 18907019 |
| Footprint | | Ecological Footprint (Forest Products) | National | Netherlands | 2016 | Global Footprint Network | global hectares (gha) | 5089514 |
| Footprint | | Ecological Footprint (Grazing Land) | National | Netherlands | 2016 | Global Footprint Network | global hectares (gha) | 9498315 |
| Footprint | | Ecological Footprint (Fishing Grounds) | National | Netherlands | 2016 | Global Footprint Network | global hectares (gha) | 387858 |
| Footprint | Ozone-Layer Depletion | | | | | | | |
| Boundary | Excessive fertilizer use | Nitrogen emissions to water | Global | World | 2011 | Steffen et al. (2015) | tonnes | 62000000 |
| Boundary | Climate Change | Carbon dioxide, fossil | Global | World | 2018 | World Resources Institut | tonnes | 35245000000 |
| Boundary | Freshwater Withdrawals | Water withdrawals blue | Global | World | | Steffen et al. (2015) | Mm3 | 4000000 |
| Boundary | Air Pollution | | | | | | | |
| Boundary | Waste Generation | | | | | | | |
| Boundary | Excessive Land use | Biocapacity (Cropland) | Global | World | 2016 | Global Footprint Network | global hectares (gha) | 3984702394 |
| Boundary | | Biocapacity (Forest Products) | Global | World | 2016 | Global Footprint Network | global hectares (gha) | 5111762779 |
| Boundary | | Biocapacity (Grazing Land) | Global | World | 2016 | Global Footprint Network | global hectares (gha) | 1504757189 |
| Boundary | | Biocapacity (Fishing Grounds) | Global | World | 2016 | Global Footprint Network | global hectares (gha) | 1095444660 |
| Boundary | Ozone-Layer Depletion | | | | | | | |
| Scaling | Population | Total population | Global | World | 2017 | World Bank (https://datab | people | 7530000000 |
| Scaling | Population | Total population | National | Netherlands | 2017 | Eurostat (https://ec.europ | people | 17080000 |
| Scaling | Population | Total population | City | Leiden | 2017 | Eurostat (https://ec.europ | people | 123753 |
| Scaling | Household Income | Average Disposable Household Incom | National | Netherlands | 2017 | Statistics Netherlands (ht | euros | 40953 |
| Scaling | Household Income | Average Disposable Household Incom | City | Leiden | 2017 | Statistics Netherlands (ht | euros | 407000 |
| Scaling | Household Size | Total households | National | Netherlands | 2017 | Statistics Netherlands (ht | households | 7794075 |
| Scaling | Household Size | Total households | City | Leiden | 2017 | Statistics Netherlands (ht | households | 67769 |

**Figure 1.** Global-Ecological Lens Excel Sheet.

# Appendix VI: Project Timeline

**Project Commission**

06/09/2022

Leiden City Portrait project commissioned by the Leiden Donut Coalitie.

## September

**Introductory Meeting**

09/09/2022

Conduct a team meeting including Commissioner Ckees Van Oijen and Supervisor Sharlene Gomez discuss the proposed design and approach.

Team Meeting

13/09/2022

**Present Proposed Design**

15/09/2022

Present the proposed project design and deliverables to the commissioner and garner feedback and/or approvals.

**Meet Leiden Donut Coalitie**

21/09/2022

Meet the  full Leiden Donut Coalitie and gather their thoughts on the project.

**Draft Proposal Deadline**

25/09/2022

**Get Feedback**

28/09/2022

Two separate supervisor and client feedback session on draft project proposal.

## October

**Consulting Proposal Deadline**

04/10/2022

Submit the proposal with applied feedback.

**City Sketch**

05/10/2022

Start working on the City Sketch by collecting all relevant documents and initiate analysis.

Team Meeting

10/10/2022

Team Meeting with Ashley

10/10/2022

Document Check

14/10/2022

Have a meeting with the commissioner to confirm selected documents are relevant for the City Sketch. Followed by continued analysis

Groene Ideecafé - Samen brengen we een duurzame toekomst dichterbij Leiden
17/10/2022

Amsterdam Doughnut Coalition - Donut Deal Dag visit.

18/10/2022

Supervisor Meeting

19/10/2022

Monthly supervisor meeting for process and progress check.

Team Meeting

25/10/2022

## November

Team Meeting

02/11/2022

Energy Network Event

05/11/2022

Mid-Term Presentation

08/11/2022

Presentation of preliminary City Sketch findings. specifically Local Lens, to peers and commissioner.

Leiden City Sketch Update Meeting - Commissioner

09/11/2022

Meeting with comissioner to update him on progress with the city sketch and preliminary case study research.

Finalisation of Local Lenses

14/11/2022

Complete the local lenses of the City Sketch and begin the formulation of the global lenses - as in-depth as possible.

Groene Ideecafé - Niet bouwen, wel wonen in Leiden: hoe kan dat?
14/11/2022

Team Meeting

15/11/2022

Leiden Donut Coalitie Meeting

16/11/2022

Update Meeting Commissioner
21/11/2022

Team Meeting

23/11/2022

Evaluating social lens

City Sketch Deadline

28/11/2022

Completion of the City Sketch, local lenses to full extend and global lenses within resource capabilities.

Case Studies Initiation

29/11/2022

Start working on analysing citizen participation and communication within Leiden initiatives. Find an appropriate framework for cross comparison.

Team Meeting

30/11/2022

Evaluating ecological lens

Team Meeting

01/12/2022

## December

Deadline Agenda Groene Ideecafé

05/12/2022

Completion of planning, organising and agenda setting for Groene Ideecafé.

Team Meeting

05/12/2022

Update Meeting Commissioner

07/12/2022

Team Meeting

11/12/2022

Case Study Interview 1

12/12/2022

Groene Ideecafé

12/12/2022

Present City Selfie findings with the Leiden Donut Coalitie to Leiden residents and other guests to obtain feedback.

Team Meeting

18/12/2022

Case Study Interview 5

22/12/2022

Case Study Interview 6

24/12/2022

Team Meeting

09/01/2023

Symposium

12/01/2023

Case Study Interview 2

15/12/2022

Case Study Interview 3

15/12/2022

Case Study Interview 4

20/12/2022

Case Studies Deadline

23/12/2022

Completion of the case studies analysis and initiation of final report writing.

Case Study Interview 7

27/12/2022

## January

Case Study Interview 8

11/01/2023

Final Project Presentation

17/01/23

Present the research and the outcomes of the project to our supervisor, the commissioner, and our peers.

Team Meeting

18/01/2023

Finalisation of Draft Project Report.

22/01/2023

Ensure writing is complete and allow for layout and textual editing.

Supervisor Meeting

23/01/2023

Final Project Report Draft Deadline

24/01/23

Get Feedback

25/01/23 and 27/01/2023

Two separate supervisor and commissioner feedback session on draft project report in time for alterations before the final deadline.

Team Meeting

27/01/2023

Commissioner Feedback Meeting

27/01/2023

Updating and Editing

26/01/23 - 30/01/2023

Incorporate feedback from supervisor and client into project report as well as finalising and graphical editing.

Final Project Report Deadline

31/01/2023