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Doughnut Urbanism

An assessment framework for urban development through a Doughnut Economy perspective using the 'Suikerzijde Noord' as case

(Groningen, the Netherlands)

Master Thesis

Name:	Tarnim Hassan
E-mail:	T.Hassan.2@student.rug.nl
Studentnumber:	S4065999
Supervisor:	Dr. W.S. Rauws
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University of Groningen – Faculty of Spatial Sciences

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Abstract

The Doughnut Economy by Kate Raworth is rapidly gaining traction in urban planning as a promising perspective for more circular city development. Doughnut Economics departs from the idea that a thriving society is one that a solid social foundation (inner ring of the doughnut), while adhering to planetary boundaries (outer ring of the doughnut). This research aims to explore how this doughnut thinking can be applied in local urban development. It proposes, an assessment framework for 'Doughnut Urbanism' in which the social and ecological domain are operationalised for urban development planning, with specific emphasise on the potential synergies and trade-offs. It then offers a first test of this assessment framework in the form of an ex-ante evaluation of the Suikerzijde Noord urban development plan in Groningen, the Netherlands. Using a combination of document analysis and an innovative hybrid of Q-sorting and interviews, it reveals that the Suikerzijde Noord is mainly strong in its emphasis on housing and mobility. The plan, however, cannot be a prime example of Doughnut Urbanism as energy, biodiversity and land conversion receive less attention. Ultimately, it is argued that Doughnut Economics offers a well-thought circular discourse in which urban planning can be viewed. However, it needs a tool to make it practical and concrete. The Doughnut Urbanism assessment framework offers a first step towards such a tool. And, when used, it shows that in practice holistic thinking in socio-ecological interactions is not yet fully achieved.

Keywords: Doughnut economics, urban development, circular society, circularity, urban degrowth, Sustainable Development Goals

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CBS – 'Centraal Bureau voor Statistiek' –	Central Bureau for Statistics
DEAL –	Doughnut Economics Action Lab
ICS -	International Council for Science
MDG –	Millenium Development Goal
MER – 'Milieu Effecten Rapportage'	Environmental Impact Analysis
PBL – 'Planbureau voor de Leefomgeving'	Dutch Environmental Assessment Agency
PT –	Public Transportation
SDG –	Sustainable Development Goal
SES – 'Stedelijke Ecologisch Structuur'	Urban Ecological structure
TCI -	Thriving City Initiative
TOD –	Transit-Oriented Development
UN –	United Nations
WKO – 'Warmte-Koude-Opslaginstallatie'	Thermal energy installation

1 Introduction

1.1 Societal foundation and the planet's limits

From the industrial revolution onward, Dutch planning practice has brought forth a multitude of good practices. However, as argued by Lodder *et al.* (2014) the contemporary spatial planning system in the Netherlands was: *"... based on technological developments, demographic and economic growth, without integrating benefits for ecological and societal values."* (p. 152). It is argued that this results in system failures in Dutch spatial planning (Rotmans and Loorbach, 2009). Examples of such failures include ineffective use of space, loss of ecosystem services in urbanized areas, and social problems such as a lack of access to affordable housing.

Still, in 2022, the local natural limits of ecological services and the greenhouse gasses on a global scale are continuously being transgressed. For example, the Netherlands has had its 'overshoot day' already on April 22th this year (*Persbericht Dutch Overshoot Day 2022 - Earth Overshoot Day*, 2022). Consequently, vital planetary processes can destabilise (O'Neill *et al.*, 2018). In terms of development, most countries transgress the planetary boundaries at a faster pace than reaching minimum social foundation levels. Meaning that food security, access to water or more sociological aspects such as political voice or gender equality are not reaching basic levels (Fanning *et al.*, 2021). Furthermore, no nation has achieved all the basic needs for citizens to thrive, the so-called social foundation, while maintaining a globally sustainable level of consumption of resources (O'Neill *et al.*, 2018).

The social foundation in the context of the Netherlands knows several dimensions which are under pressure. Examples of dimensions that make up this social foundation are access to affordable and sustainable housing, mobility and energy, but also more abstract dimensions such as political voice and social equity (Thriving Cities Initiative, 2020). For one, housing has become an issue in the Netherlands in recent years; it is among the top 3 of increased average European housing prices in 2020 (Calcasa, 2021; CBS, 2021). Especially dense urban areas, such as Groningen, have to accommodate the growing urban population (Centraal Bureau voor de Statistiek, 2019). All while doing so in a sustainable manner. This indicates the need for a different way of urban development: one that enables a thriving society while respecting the boundaries of our growth.

1.2 The rise of Doughnut Thinking

The Doughnut Economy concept is suggested by Kate Raworth as a helpful framework to rethink the organization of economic systems and society at large (2016). In short, the concept of the Doughnut Economy suggests seven ways to transform our growth-driven thinking and poses the question *"What enables human beings to thrive?"* as one of the fundamental questions for society (Raworth, 2016, pp.43).

If we were to implement the thoughts and ways of the doughnut economy, which will be referred to as doughnut *thinking,* it will likely have implications on planning practice. In academic literature, however, not much is written about doughnut *thinking* or the doughnut economy and its influence on planning practice (Scopus, 2022). Nevertheless, the principles of doughnut thinking are being implemented in cities across the world, one of the leading cities being Amsterdam (DEAL, 2020). In the context of the Netherlands, the Doughnut Economy has been applied in Amsterdam as part of a series of pilot cities. In this pilot, the cities' urban metabolism is mapped, to gain insights into what condition the city currently is in terms of the indicators of the Doughnut Economy (Raworth, 2020). Integration and holistic thinking are called for by many planning academics in different fields such as infrastructure planning, circular initiatives and implementation of nature-based solutions (Arts *et al.*, 2016; Kabisch *et al.*, 2016; Reike, Vermeulen and Witjes, 2018). However, putting this into practice is often encountered with difficulties, especially in seizing synergies between different components and mitigating trade-offs (Spijkerboer *et al.*, 2019). This makes for an important reason to conduct this research, to try to draw lessons for the doughnut thinking's implications for planning practice. Moreover, the synergies and trade-offs are the basis on which interactions are identified between different components of planning practice. Therefore, these two concepts are used in combination with doughnut thinking.

In this research, we will address the gap in knowledge in the implementation of doughnut thinking in urban planning. An assessment framework for local implementation of doughnut thinking (in the field of urban planning) will be developed and tested on local urban development. Thereby, creating a starting point for exploring the wider implications of doughnut thinking on planning practice. Finally, it will lead to lessons for local-level operationalization of doughnut thinking in planning practice.

1.3 Research problem & research questions

This research aims to explore how doughnut thinking can be applied in local urban development. To do so, this research focuses on 1) the development of an assessment framework for doughnut thinking, 2) testing this assessment framework in urban development, and 3) drawing lessons for the local-level implementation of doughnut thinking in urban development planning.

In Groningen, the Netherlands, the 'Suikerzijde' project is an effort of the municipality to create a new 'urban, robust, but also green, generous and inviting new part of the city.' and a 'complete and versatile district.' (Sweco, 2020b). The first plans for the northern part of this new district will be developed and sustained using Circular Economy principles, which in turn are based on the environmental vision of the municipality as a whole named *the next city* (Gemeente Groningen, 2020b). Meaning, the municipality actively is trying to render to smart combined solutions

(synergies), and how to deal with trade-offs in their plans. Therefore, this case lends itself to an exploration of applying doughnut thinking in spatial planning.

The objective of exploring how doughnut thinking can be applied in local urban development is guided by the following question:

"How to assess the social and ecological dimensions of Doughnut Thinking in urban development projects? And what are the perceived trade-offs and synergies between these dimensions in the Suikerzijde Noord project in Groningen, the Netherlands?"

To do so, four sub-questions structure this study:

1. How can doughnut thinking be operationalized in urban planning to facilitate the assessment of urban development projects?
2. How are trade-offs and synergies between social dimensions of doughnut thinking assessed in the planning outcomes of the Suikerzijde Noord?
3. How are trade-offs and synergies between the social and ecological domain of doughnut thinking assessed in the planning outcomes of the Suikerzijde Noord?
4. What lessons can be learned about assessing Doughnut Thinking in development of new urban districts?

1.4 Reader's guide

In the following chapters, this research will cover the questions. In chapter 2 the theoretical basis is laid by defining the relevant concepts and answering the question of how the doughnut economy can be operationalized in the planning of urban districts, by using relevant theory on circular discourses and urban developments. Consequently, an assessment framework is developed to make a doughnut thinking based assessment of local urban developments. Chapter 3 explains the methodology of this research and how the case will be assessed using this assessment framework, to 'test' it. This will be done using a combination of document analysis and interactive interviews, as part of an overarching case study of the Suikerzijde Noord project in Groningen, the Netherlands. In chapter 4 the findings and results are presented and analysed; the findings are presented in light of the assessment framework, and a link is drawn between the case and said assessment framework. In chapter 5 the question of what broader lessons can be learned for operationalizing doughnut thinking in the planning of urban districts is answered, by drawing conclusions. Finally, this research is reflected upon in chapter 6.

2 Theoretical framework

This chapter explains the development of an assessment framework by stating the theoretical basis central in this research. First, the key concepts of Doughnut Economics and relevant theory are discussed, and what it means for urban development to conceptualize Doughnut Thinking (section 2.1). The City Portrait framework is used as a basis to develop an understanding of social and ecological lenses through which to view a local urban development (section 2.2). Then the relevant possible trade-offs and synergies are identified between these domains (2.3). Finally, an assessment framework (section 2.4) is developed concerning the local urban development.

2.1 Doughnut Economics and local urban development

2.1.1 Economy, planning, and the Doughnut

A reformation in economic thinking is directly relevant to the approach of urban planning as it alters the way planners and decision-makers can or will approach new urban planning developments (or revitalizing old ones). 20th-century planning scholar Lichfield (1968) argues for the contribution of economics to urban planning and vice-versa. He argues that comprehensive knowledge of both macro- and microeconomics is necessary for effective decision-making in planning, as they are co-dependent (e.g., in urban development and land-use planning). Another work where this link between urban planning (and urbanization in particular) and economics is emphasised is the book the Economics of Urban Areas by Brian Goodall (1972), in which various aspects of urban economics are laid out. One aspect considered is that from the point of view of economists a city can be seen as the product of markets. One of the roles of the urban planner is to – on behalf of decision-makers – intervene by for example design or regulation to mediate market effects. Examples given of the outcome of unconstrained market effects can be seen in cities such as Houston, Texas, in the form of wide urban sprawl. While at the other end of the extreme, highly structured, and intervened-in cities exist such as cities in the former Soviet Union or Brasília in Brazil. These cities are then not seen as the product of the market, but rather the product of decision-makers' wishes (Bertaud, 2018). The pronounced link between economy and planning is therefore important to explore as there are direct implications for urban planning when using different economic models.

In 2012 Kate Raworth published a paper for an Oxfam initiative, followed up by her book in 2017, on introducing a novel economical model: Doughnut Economics (Raworth, 2012, 2017). The model has since then gained popularity in progressive civil society spaces (Narberhaus, 2021). First, it is important to dive into the core concept of doughnut economics, after which its position to other similar concepts and urban development is discussed.

Doughnut economics explains seven ways in which one can think of economics in the 21st century. It builds upon the premise that 20th-century economic thinking is outdated and serves a

different purpose as to what society is proposed to need in the 21st century. The seven ways of transformation are as follows: Change the goal, see the big picture, nurture human nature, get savvy with systems, design to distribute, create to regenerate and be agnostic about growth (see figure 1).

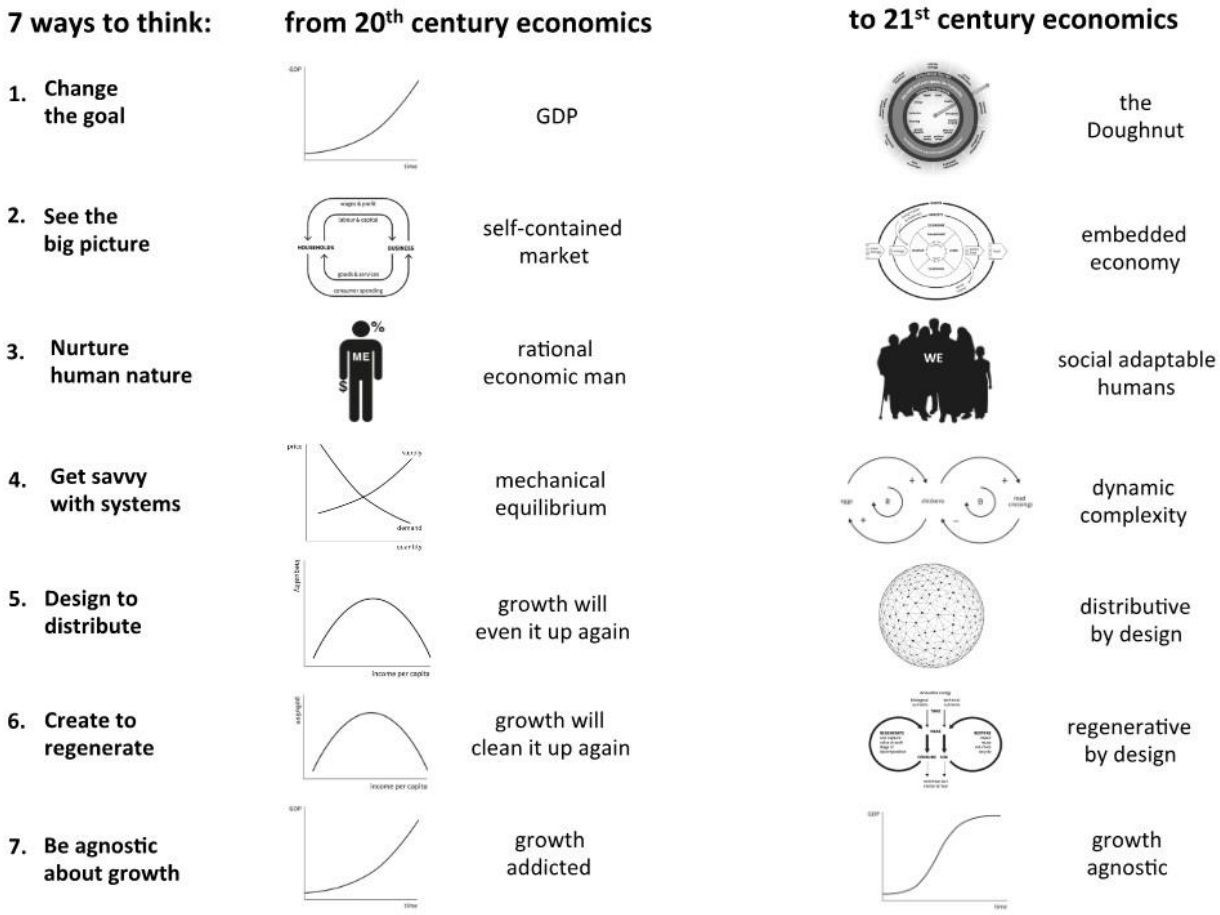

Figure 1: *The seven ways of doughnut economics, this research focusses on the first way of thinking (Source: Raworth, 2017)*

In this research the emphasis is on the transformation of the goal; the change from a growth-driven perspective towards the goal staying within the planetary boundaries whilst not compromising on the social foundation for society to thrive. The doughnut visualizes the maintaining (or creation) of a thriving society while respecting the boundaries to our growth (see figure 2). The focus on transforming the goal is chosen for this research as it is most suitable for applying doughnut economics to urban developments, as the goal for urban developments is mostly based on growth. The other ways are either more focussed on the reformation of economic thinking itself or are not tangible enough to apply in the context of urban development.

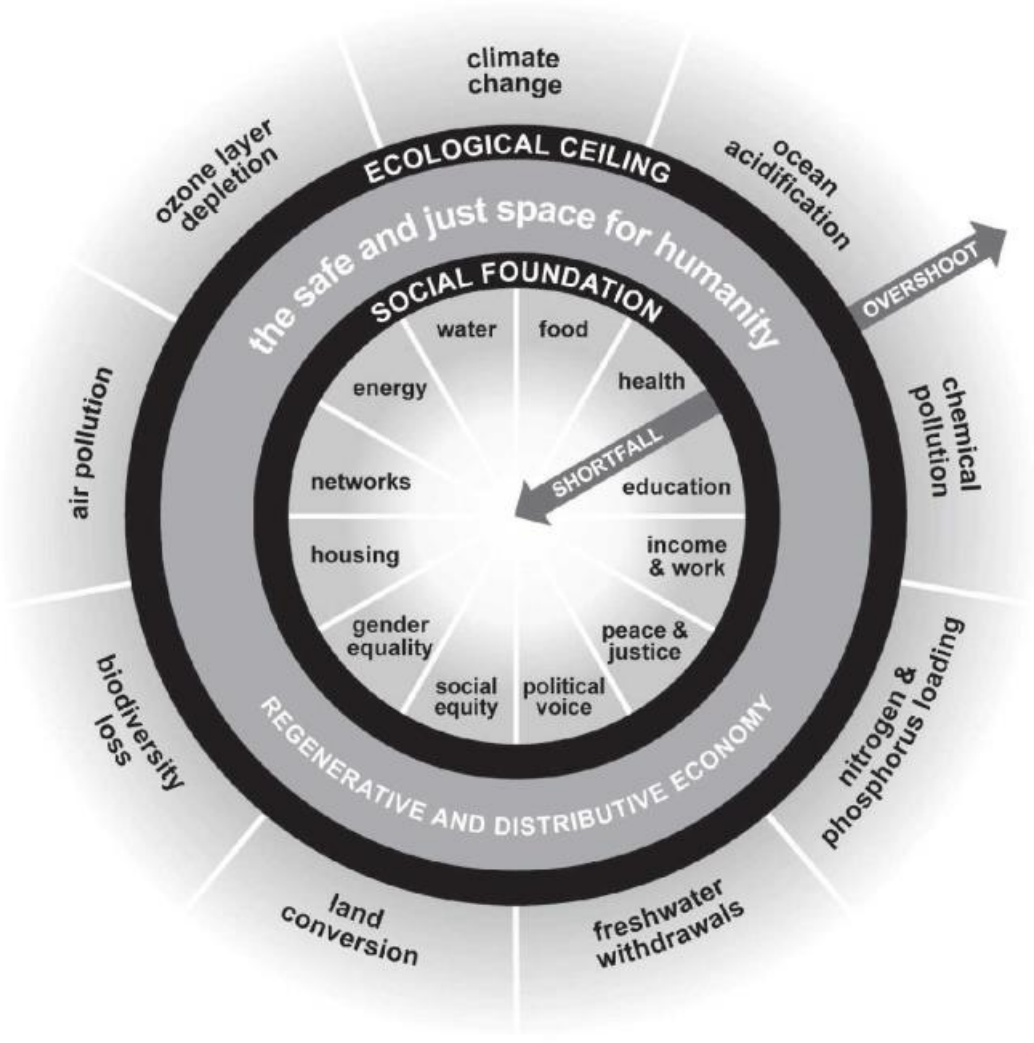

Figure 2: *The Doughnut (Source: Raworth, 2017)*

According to the doughnut model, on the one hand, there is a social foundation of human rights to be respected with concerns of water, food, health, education, income & work, peace and justice, political voice, social equity, gender equality, housing, networks, and energy. These aspects are mostly based on United Nations' set Sustainable Development Goals (SDG), which are an urgent call for action by all countries in a global partnership (UN, 2015; Raworth, 2016). However, it is worth mentioning that these underlying goals are often criticized. From a human geography perspective on being too complex to translate to effective public policy and being too ambitious, universal and absolute to be successful (Langford, 2016). Furthermore, geographers remark that the goals are sometimes ill-defined, with widely used terms such as ‘sustainable’, ‘resilience’, and ‘modern’ while also being contradictory (Liverman, 2018). Another scholar suggests that the SDGs do include often overlooked issues that have been brought forward in urban research in the past decades, however being sceptical about the use of path-dependent narrow methods of measuring

them (e.g. quantified indicators) (Kaika, 2017). Nevertheless, the SDGs are used as a broad basis for the social foundation in the doughnut economy concept.

On the other hand, ecological standards are in place based on the work of Rockström *et al.* (2009), later updated by Steffen *et al.*, (2015). In their work planetary boundaries are identified, which, if transgressed, *could* have a large irreversible impact on earth's functions. The ecological ceiling consists of 9 segments: Climate change, ocean acidification, chemical pollution, nitrogen & phosphorus loading, freshwater withdrawals, land conversion, biodiversity loss and air pollution. This offers a tangible idea of where the limits to society's growth lie. It is important to note that, firstly, the challenge arises when these ceilings are to be adapted to smaller geographical scales. In some of the ecological ceiling's segments, the global boundaries might not be transgressed, while on the regional scale it could well be the case in the form of local pollution (Bogardi, Fekete and Vörösmarty, 2013). Secondly, a common misconception is a notion that these boundaries are absolute limits. This also leads to critique that the planetary boundaries discourse gives a sense of false security when policies are designed based on quantitative and absolute limits, as marked by Montoya, Donohue and Pimm (2018), at least in terms of the biodiversity dimension. Rockström and colleagues (2018) reply to this critique by stating that planetary boundaries often mistakenly are taken as tipping points while such a notion is never claimed by them, they argue. Relevant to this research, one can argue that the doughnut model rather indicates the segments which should be considered and prioritised when developing new urban areas. For example, instead of focussing on housing and fulfilling the minimum environmental considerations, a holistic view is used to consider both the environment and building new houses.

In short, the doughnut as a goal instead of mere growth is proposed by Raworth. This doughnut consists of a multitude of minima and maxima that are divided into ecological ceilings and the social foundation.

2.1.2 Positioning Doughnut Thinking

Next to Doughnut Thinking, many other alternatives have been proposed over the past years to transform or influence societies using circularity discourse. A few examples are urban degrowth (Savini, 2021), *Buen Vivir* - which is applied in the Ecuadorian constitution - (Kothari, Demaria and Acosta, 2014), *Laudato Si'* (Pope Francis, 2015) and the Third Industrial Revolution (Rifkin, 2009). The differences between a variety of concepts with seemingly similar discourses are studied by Calisto Friant et al. (2020). On the one hand, a distinguishment in terms of the discourse's approach towards social, economic, environmental, and political considerations is made into *holistic* and *segmented*, on the other hand, a distinguishment is made between a *sceptical* and *optimistic* stance on technological innovation and ecological collapse of society. This leads then to a typology consisting of four circularity discourses: Reformist Circular Society

(*Holistic and Optimistic*), Technocentric Circular Economy (*Segmented and Optimistic)*, Transformational Circular Society (*Holistic and Sceptical)*, and the Fortress Circular Economy (*Segmented and Sceptical*, see table 1).

Table 1: *Circularity Discourse Typology (Source: Calisto Friant, Vermeulen and Salomone, 2020)*

		Approach to social, economic, environmental, and political considerations	
		Holistic	*Segmented*
Technological innovation and ecological collapse	*Optimist*	Reformist circular society (e.g., doughnut economics)	Technocentric circular economy (e.g., circular economy)
	Sceptical	Transformational circular society (e.g., urban degrowth - Savini, 2021; Xue, 2021)	Fortress circular economy

The doughnut economics discourse can be placed under the reformist circular society discourse. This is due to its holistic nature; covering a wide range of societal aspects, and its optimistic outlook on developments that can reform the status quo, while being agnostic about growth. It is important to cover these characteristics to understand the way doughnut economics can be operationalized in doughnut *thinking* for urban planning and development purposes. Furthermore, seemingly similar discourses such as urban degrowth and circular economy are placed respectively under the types of transformational circular society and technocentric circular economy. The transformational circular society is more focused on transforming the foundation of the philosophy used (e.g. sceptic stance on capitalism) (Calisto Friant, Vermeulen and Salomone, 2020). As doughnut thinking uses a holistic view of contemporary planning, it is more relevant to zoom into its position relative to for example urban degrowth, rather than the segmented forms of circularity discourse.

Based on the theory of doughnut economics we conceptualize doughnut *thinking* as using the foundation of doughnut economics and applying it in a specific setting. In the case of this research, it is specified to local urban development. While doughnut economics applied in urban development received much media attention (e.g. Green European Journal, 2020; Time, 2021), not much is known in academic research on its application in urban development. As urban degrowth is researched more, it makes it interesting to investigate it as it contrasts with doughnut thinking. This contrast is evident in the scepticism of the degrowth concept, while the doughnut thinking stance has a more optimistic worldview.

The concept of degrowth in general is the notion that we can live well with less (D'Alisa et al., 2014). It criticizes seeing economic growth as an all-encompassing solution for social wellbeing and instead calls for society to use fewer resources and organize a life of simplicity while taking care of the 'commons' (i.e., the cultural and natural resources accessible to all members of society).

Different from doughnut economics, it doesn't offer notions of being agnostic about growth, instead rejecting it altogether (Kothari, Demaria and Acosta, 2014). Using the typology of Calisto Friant, Vermeulen and Salomone (2020) it would fall under a transformational circular society.

Urban degrowth focuses on the debate on degrowth's potential as an inspiration for urban planning to rethink its role and function in urban development. It is deemed to fall under the category of transformational circular societies (Calisto Friant, Vermeulen and Salomone, 2020; see table 1)). It is furthermore argued that mainstream planning (in for example the Dutch context) is rather a system-maintainer rather than a system-transformer (Xue, 2021). Savini (2021) criticises how the path-dependency of existing institutions, regulations and governing approaches keep urban development pursuing economic growth and proposes three ideal transitions towards urban degrowth.

In respectively territorial organization, development paradigm and the approach to land use organization the following is proposed: 1) Polycentric autonomism: moving away from dependency on other regions for production, consumption, and material exploitation to eliminate competition between regions; 2) Finity: setting standards of sufficiency in terms of land development instead of creating scarcity; 3) Habitability: socio-spatial organization build on balance and relation, meaning creating a multiplicity of land use in urban development, rather than zoning single-use plots (i.e. Euclidean zoning). Although being different in the way degrowth views economic growth, the transitions coincide with doughnut thinking as it calls for sufficiency, regenerative consumption and focussing on balance within boundaries. This ultimately makes the comparison and the likeliness between urban degrowth and doughnut thinking (other than their differences in worldview) strong in its foundation of consideration of the environment.

The doughnut thinking discourse can be explained as one of the worldviews available to modern planners to practice alternative ways of urban planning, next to other forms of circularity such as urban degrowth. In the context of doughnut economics the Creating City Portraits guide, brought forward by the Thriving City Initiative is suggested as a means to achieve this on a local urban geographical scale (Thriving Cities Initiative, 2020).

2.2 City portrait guide

The Thriving City Initiative offers a guide to creating so-called city portraits, in which doughnut thinking can be downscaled to a city or place (TCI, 2020). This initiative is brought forward by practitioners from the 'Doughnut Economics Action Lab' (DEAL, 2022). Using the Creating City Portraits guide, we can use different lenses to explore different city targets. This methodology is based on applying doughnut thinking using four lenses, through which a city or neighbourhood can be viewed. The lenses used are local-social, local-ecological, global-social, and global-ecological. Each of these has its central question (see figure 4). In this research, we limit ourselves to the use of the local-social and local-ecological lenses in the context of a Dutch urban development, as the research capacity is limited.

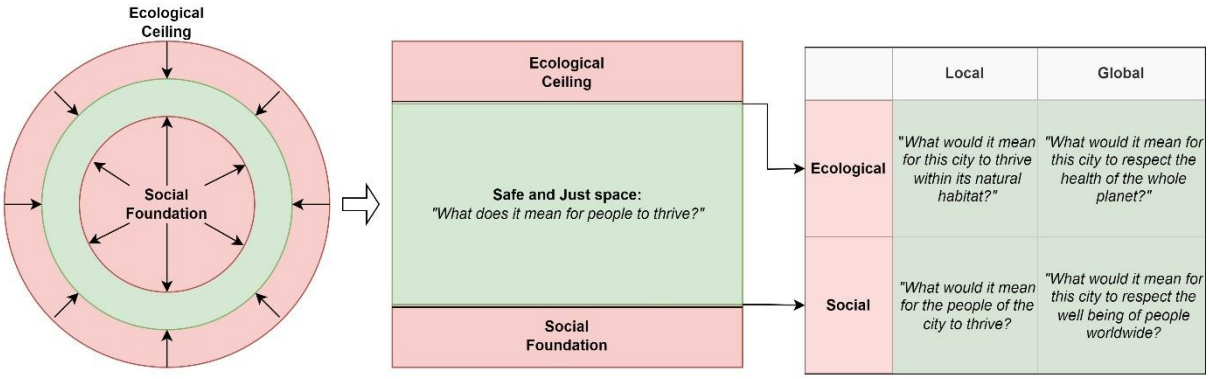

Figure 3: *The Four Lenses of the City Portrait, as conceptualized from the Doughnut Economy (source: TCI, own work)*

2.2.1 Local-social domain

The first lens poses the question of '*what would it mean for the people of this city to thrive?'.* To find an answer the guide suggests a fragmentation into 16 dimensions across 4 categories (see figure 5). Although taking a similar shape as the original doughnut, it is important to note that this figure only entails the social aspects on a local scale.

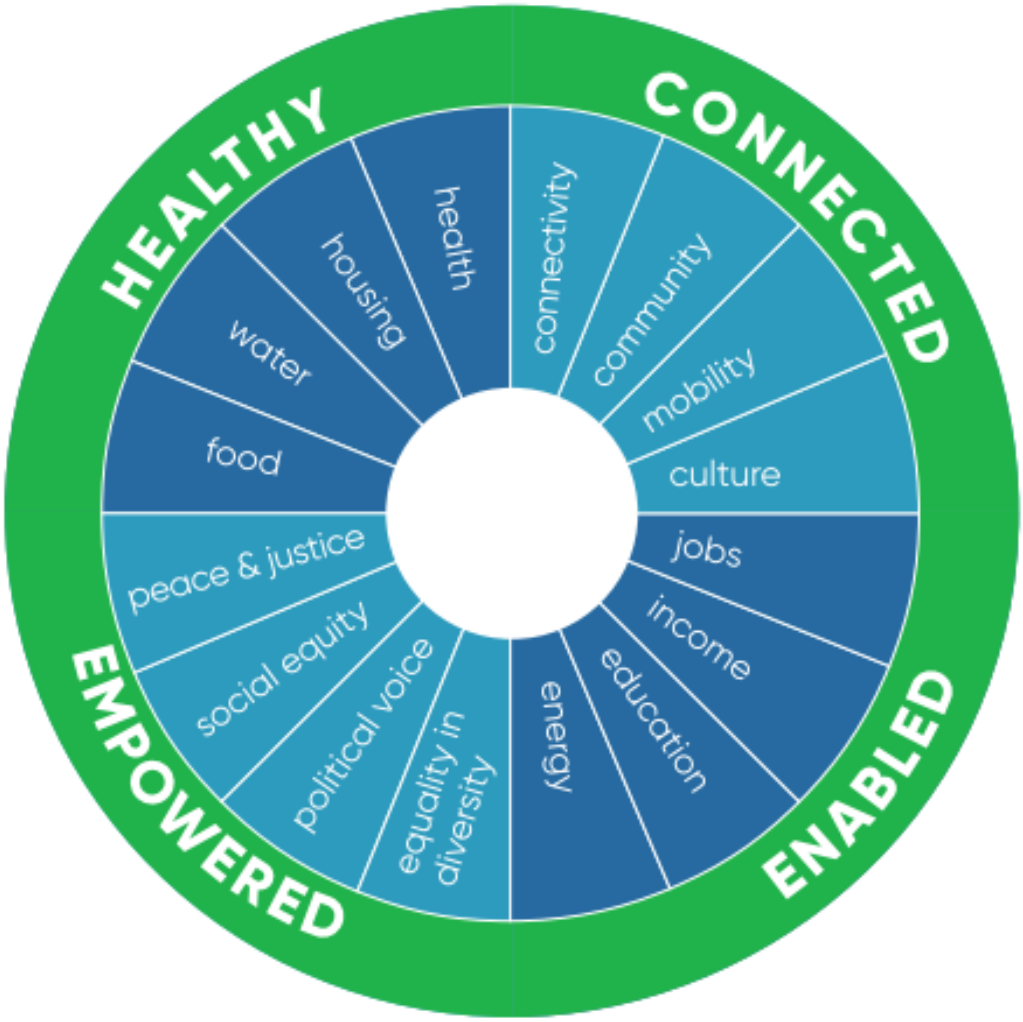

Figure 4: *Local-social dimensions (Source: TCI)*

The dimensions that are considered relevant to local urban developments are listed below. They are a translation from the original doughnut economics model to the applicability of a city (TCI, 2020). Therefore, they are based on the same principle of SDGs (UN, 2015). An attempt is made at identifying which SDGs are relevant to which dimension. Consequently, using these relevant SDGs, possible trade-offs and synergies (or co-benefits) can be identified based on academic literature (such as Bowen *et al.*, 2017; Dolley *et al.*, 2020). The relevant dimensions in the context of local urban developments - *and examples of targets for a hypothetical city (TCI, 2020)* – are (not in any particular order):

- Housing (Goal 11 – Sustainable cities and communities): *´There is sufficient availability of affordable and decent homes.'*
- Water (Goal 6 – Clean water and sanitation): *'Public water is accessible, attractive, clean, and safe for all users.'*
- Food (Goal 2 – Zero Hunger): *'Pressure on the local food system is reduced.'*
- Connectivity (Goal 9 – Industry, innovation, and infrastructure): *'The digital city is designed in collaboration with citizens, and many other city actors. The municipality's interaction with citizens is accessible, understandable and inclusive.'*
- Community (Goal 11 – Sustainable cities and communities): '*The city is an inclusive and connected city*'
- Mobility (Goal 9 – Industry, innovation, and infrastructure): '*The city is accessible to everyone via public transport, safely and sustainably.'*
- Energy (Goal 7 – Affordable and clean energy)*: 'Make the city natural gas-free before 2040.'*

The local-social lens is the set of dimensions that collectively form the city's (or neighbourhood's) social foundation. The relevant dimensions to investigate in urban developments are to be identified in the context of the selected case and are chosen based on their relevance to spatial planning.

To establish the primary dimensions, the work of the Netherlands Environmental Assessment Agency ('Planbureau voor de Leefomgeving' or PBL) offers insights into the contemporary dilemmas in Dutch urban planning (Hajer and Dassen, 2014). They establish that the 21st-century urban planner must deal with the following aspects: Demography (i.e., communities), air, water, food, biota, mobility, freight, building materials, waste, and energy. Given these aspects, one can view the following dimensions in the local-social domain as directly relevant to spatial planning (see highlighted dimensions in table 2): Housing, water, food, connectivity, community, mobility, and energy. Examples of how spatial planning is directly relevant are zoning of residential areas, investment programs and infrastructure projects to name a few.

Choosing the dimensions above is not to say that spatial planning does not have an indirect impact on the other dimensions. A large body of spatial planning research is focussing on indirect impacts, such as the whole of the empowerment category (e.g. Manderscheid and Richardson, 2011). However, this research is limited to the primary dimensions' impact, as the complexity involved in researching 'deeper' or secondary impacts would be too time-consuming.

2.2.2 Local-ecological domain

To achieve a full picture the interactions should be mapped with other lenses. The local-ecological lens is relevant here, as the scale will be limited to a local-level while including the planetary boundaries. From the local-ecological lens, the main question posed is: *"What would it mean for the city to thrive within its natural habitat?".* This calls, however, for a highly context-specific approach, as each region, city and neighbourhood has a unique local ecosystem to take into consideration (TCI, 2020). An effort is made in determining relevant dimensions to spatial planning using the PBL's document on challenges in the Dutch urban planning context (Hajer and Dassen, 2014; see also section 2.2.1). In combination with the SDGs, this creates an idea of what the ecological domain entails for the Dutch setting. Therewith, we can assess how the implementation of local-social dimensions in an urban development interacts with the local-ecological domain.

Given the doughnut model in figure 2, the contemporary planning dilemmas in the Dutch context, and examples given by the TCI guide, three categories of local-ecological importance and *directly* relevant to urban development are considered, namely: Water, air, and land. They are chosen as the generic categories as it covers the ecological ceiling of the doughnut while leaving space for contextual consideration depending on the specific context (TCI, 2020). These categories subsequently consist of the dimensions: freshwater withdrawals, air pollution, biodiversity support and land conversion (see figure 2). It is worth noting that freshwater withdrawals here, other than the social dimension of water, are focused on the impact of freshwater withdrawals on the ecology, rather than society. Similar to the summation in 2.2.1, the most relevant SDGs (UN, 2015) and examples of the dimensions (TCI, 2020) include:

- Freshwater withdrawals (Goal 6 – Clean water and sanitation): *'Freshwater withdrawal is done in an ecologically sustainable manner.'*
- Air pollution (Goal 3 – Good health and well-being): *'The city has clean air.'*
- Biodiversity support and land conversion (Goal 15 – Life on land): *'Make the city for people, plants, and animals; with green spaces in all neighbourhoods, and well-kept parks and forests. Land use is limited to what is necessary'*

2.3 Possible trade-offs and synergies in planning urban districts

2.3.1 Trade-offs and synergies across SDGs

As the principles of doughnut thinking are rooted in a balance between natural and societal stakes, it is important to find possible trade-offs and synergies between the different dimensions in a newly created local urban development. There will inevitably be many tensions, and urban development trade-offs will involve sacrificing one piece of a goal for the gaining of another goal (McNeill, Verburg and Bursztyn, 2012; Bowen *et al.*, 2017).

Doughnut thinking literature does not offer comprehensive literature on possible trade-offs and synergies yet. However, the holistic perspective that SDGs offer is consistent with the philosophy of doughnut thinking, as it is a holistic framework as well (Calisto Friant, Vermeulen and Salomone, 2020). Therefore, this section presents an overview of trade-offs and synergies that could be found in SDG implementation.

Trade-offs are defined as sacrificing one part of a goal in a certain dimension in exchange for improvements in another (Bowen *et al.*, 2017). Practically this means that a trade-off is any negative consequence in one dimension for the betterment of (a part of) another dimension. In this research, synergies are defined as co-beneficial improvements in the built environment and society, across multiple dimensions (Sharifi, 2021).

Moreover, the possible trade-offs and synergies are not black and white; per context certain dimensions could be prioritized over others by society (e.g., housing could be perceived as more important than ecology). This means that there can be certain degrees of perceived trade-offs and synergies, as such a gradation of trade-offs and synergies can be made.

A study in Spain shows that almost 80% of the SDG targets had interactions, either as trade-offs or synergies (Ramos and Laurenti, 2020). In urban planning, in particular, development interventions can influence the trade-offs between the SDGs (Dolley et al., 2020). Therefore, we investigate common trade-offs and synergies between different SDGs. These SDGs are translated from the dimensions in the local-social and local-ecological domains (sections 2.2.1 and 2.2.2). The relevant SDGs are goals 2 (zero hunger), 6 (clean water and sanitation), 7 (affordable and clean energy), 9 (industry, innovation, and infrastructure) and 11 (sustainable cities and communities) for the social dimensions, and goal 15 (life on land) and 3 (good health and well-being) for the ecological dimensions.

An analysis of linkages between all underlying targets of SDGs of the International Council for Science (ICS, 2015) offers insights into possible trade-offs and synergies relevant to this study. In short, we use the knowledge available about SDGs to argue for linkages that might occur on the local dimensions. Identified trade-offs for the SDGs mentioned are as follows: Food systems (goal 2) can put pressure on biodiversity (goal 15) due to the use of monocultures in food production. Also, an increase in housing (goal 2) results in additional pressures on existing food systems, due

to an increasing population. Water is used for most forms of energy production; consumption of energy (goal 7) increases consumption of water (goal 6). Also, more use of water will put more pressure on ecosystems (goal 15). Other dimensions such as air pollution (goal 3) and biodiversity and land conversion (goal 15) show trade-offs with housing. New housing development and their related activities show an increase in air pollution (goal 3) (Kenniscentrum InfoMil, no date) and significant ecological impacts (goal 15). Also, some forms of land conversion (goal 15) (e.g., industry) cause air pollution. Last, significant trade-offs are identified in the use of classical energy sources on ecosystems and biodiversity.

Next to trade-offs, the following synergies are identified, in the same study (ICS, 2015), between the various goals: An increase in the share of renewable energy (goal 7) will lead to a decrease in climate change and pollution, which drive biodiversity losses (goal 15). Also, modern, and renewable energy and access to water (goal 6) are important for food security and nutrition (goal 2), making it a fruitful source of potential synergies. Furthermore, there is a potential for synergies through sustainable agriculture and embedment in the local ecology (goal 15). Between energy and air pollution, another chance for synergies presents itself in the form of clean energy, as goes for mobility and air pollution. The last synergy that is identified is that connectivity in the form of efficient energy grids is essential for the distribution of clean energy.

Next to the synergies as identified by the ICS, Baró *et al.* (2014) identify that increased biodiversity (goal 15) can help reduce air pollution (goal 3) due to increased ecosystem services. Furthermore, opportunities to pioneer in terms of low-carbon energy solutions as a community present themselves (Tummers, 2021). The last one is that proper connectivity (both social and physical) can lead to a stronger sense of community (goal 11) through social capital (Manzi *et al.*, 2010).

2.3.2 Potential trade-offs and synergies from a local-social stance

While the SDGs indicate global problems and a sense of top-down steering, it is argued that the integration of bottom-up approaches is key in achieving SDGs and mobilizing new actors (Hajer *et al.*, 2015). Hence, the importance of contextualizing the SDGs down to the local scale. Food for example is not incorporated into this investigation, as from a Dutch perspective it entails a complex combination of both local, regional, and global resources and stakes.

In this research, the emphasis is on viewing an urban development through a social lens, after which its implications for the ecological domain are investigated. In light of broader contemporary planning dilemmas in the Dutch context (Hajer and Dassen, 2014), the focus will be on the following hypothesised trade-offs and synergies within the local-social domain, as translated from table 3:

Table 2: *Trade-offs and synergy examples between dimensions in the local-social domain (Green indicate potential synergies, red indicate potential trade-offs, capitalized letters refer to figure 5).*

	Housing	**Community**	**Connectivity**	**Mobility**	**Energy**	**Water**
Housing	X	The form of the neighbourhood corresponds with the sense of community (Talen, 1999) **[A]**	Proper affordable housing can increase (social) connectivity (Healthy Places by Design, 2021) **[B]**	Research shows the potential for higher degrees of mobility at the cost of affordable housing (Chen, Chen and Timmermans, 2008) **[C]**	Energy-efficient housing shows the potential for synergies (Baniassadi *et al.*, 2021) **[D]**	Synergy possibilities for water systems in new housing (Haupt, 2019) **[E]**
Community		X	A stronger local (social) connectivity will have a symbiotic effect on a sense of community as well (Manzi *et al.*, 2010) **[F]**	Increasing local mobility in the form of walkability can increase a sense of community (Jun and Hur, 2015) **[G]**	Potential for community-based energy alternatives**[H]**	Communities can create initiatives to save water **[I]**
Connectivity			X	Walkability also has a positive effect on (social) connectivity (Jun and Hur, 2015) **[J]**	Synergies in solutions such as smart grids on a local scale **[K]**	X
Mobility				X	Local energy consumption can be reduced by using active transportation **[L]**	X
Energy					X	In-house solutions to decrease water consumption go hand in hand with decreased energy consumption **[M]**
Water						X

2.3.3 Trade-offs and synergies in the local-ecological domain

Now that the internal trade-offs and synergies within the local-social domain are clear, its implications for the local-ecological domain can be mapped. The potential implications of the social dimensions in the ecological domain are divided into three dimensions in table 3. However, they will depend on the context of the local urban development at hand. For example, a small redevelopment in a neighbourhood will be insignificant to a million-city compared to a medium city. (Red capitalized letters indicate its position in the assessment framework).

Table 3: *Trade-offs and synergies in the ecological domain (Green indicate potential synergies, red indicate potential trade-offs, capitalized letters refer to figure 5).*

	Biodiversity and land conversion	**Air pollution**	**Freshwater withdrawals**
Housing	The conversion of land into housing areas entails a trade-off with loss of local biodiversity (i.e. disruption of ecosystems). An example of minimizing this effect is that compact developments minimize the impacts of urbanization on native mammals (Villaseñor *et al.*, 2017). **[N]**	In the short-term, realization of new buildings will increase air pollution (Wieser *et al.*, 2021). **[Q]**	
Community	Depending on communities, potential synergies can present themselves in the form of co-beneficial initiatives with the surrounding ecosystems. However, communities need to be physically able to do so and socially enabled (i.e. some forms of local gardening) (Mattijssen, Buijs and Elands, 2018). **[P]**	X	X
Connectivity	X	X	X
Mobility	The need for subsequent mobility also will entail a trade-off with loss of local biodiversity, however, in sustainable urban mobility policies, biodiversity is often overlooked (Louro, Costa and da Costa, 2019). **[O]**	Usage of motorized vehicles will give rise to local air pollution, creating a trade-off. **[R]**	

Energy		Energy can be an opportunity for synergy with combatting air pollution if done correctly, examples are the usage of locally produced energy from renewable sources (Caat *et al.*, 2021). **[S]**	
Water			Access to water inevitably leads to more freshwater withdrawals. **[T]**

2.4 Doughnut Urbanism Assessment Framework

In figure 5 the assessment framework is visualized in which the potential trade-offs and synergies are placed concerning the social and ecological domain of doughnut thinking and concerning urban development. This gives an overview of how the potential trade-offs and synergies are present when considering applying doughnut thinking.

We depart from the two main questions of '*What would it mean for the people of this city to thrive?*' and '*What would it mean for the city to thrive within its natural habitat?*'. This is operationalized in respectively the social and ecological domains. In turn these domains consist of and contain the dimensions. Between these dimensions different interactions are at play in theory. These interactions are labelled with letters which are further described in tables 2 and 3.

The links represent the potential for either synergies, trade-offs or both between the dimensions that can be considered in the context of urban development, with hypothetical trade-offs and synergies given in tables 2 and 3. In application, the linkages do not exclude the possibility of mixes of synergies and trade-offs.

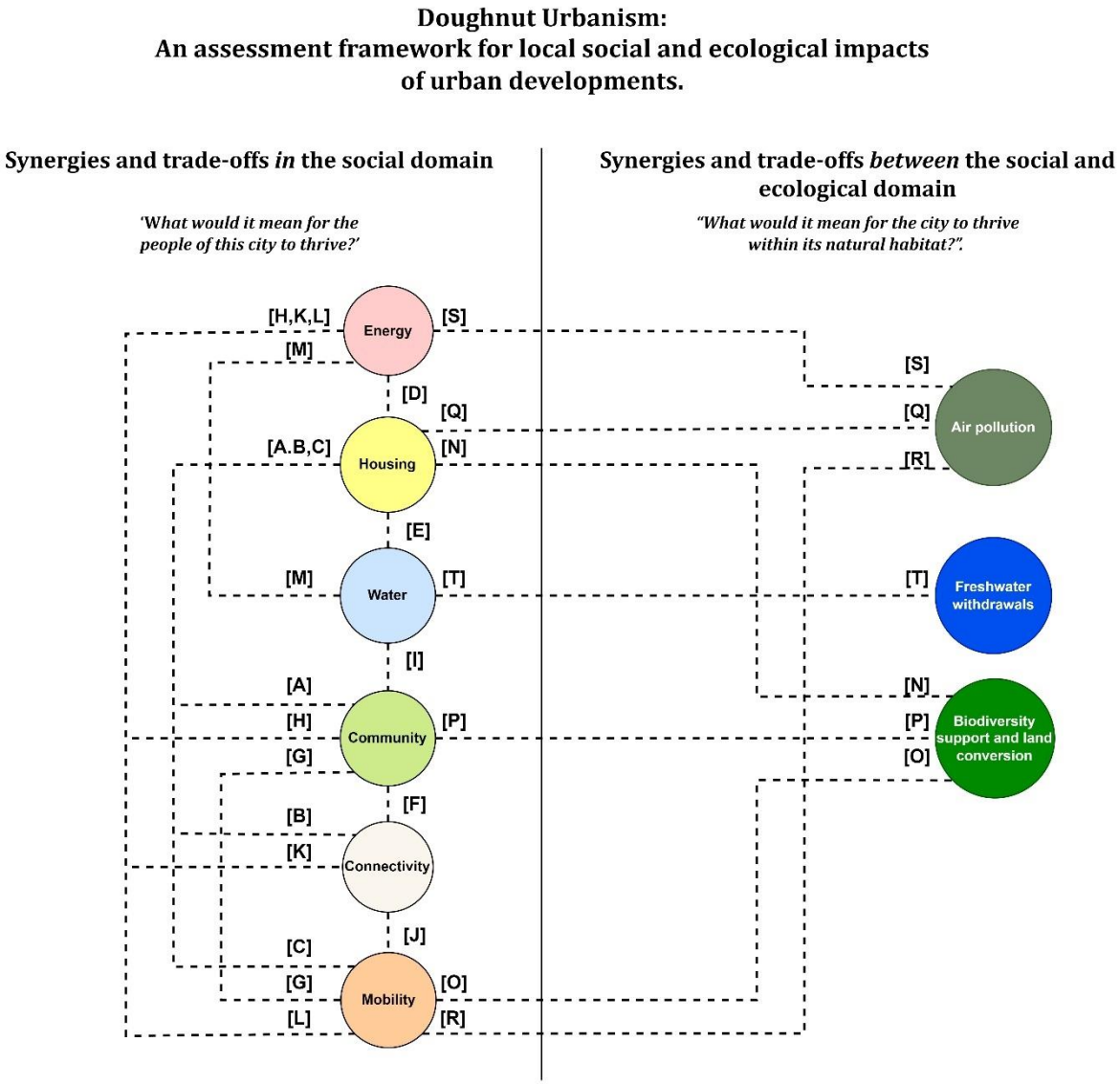

Figure 5: Assessment Framework for the social and ecological domains of urban development. Capitalized letters refer to potential trade-offs and synergies as identified in the literature and summarized in tables 2 and 3.

3 Methodology

To operationalize doughnut thinking, the developed assessment framework is tested using the case of the Suikerzijde Noord. Using the assessment framework, the perceived trade-offs and synergies are mapped. The nature of this research approach is an explorative case study research on a qualitative basis. Two methods are used in this research, first, document analysis is conducted to identify relevant social and ecological dimensions for the Suikerzijde-case. Secondly, a combination of Q-sorting and semi-structured interviews offer insights into the trade-offs and synergies between these as perceived by involved project managers and other actors. The full research design is as follows:

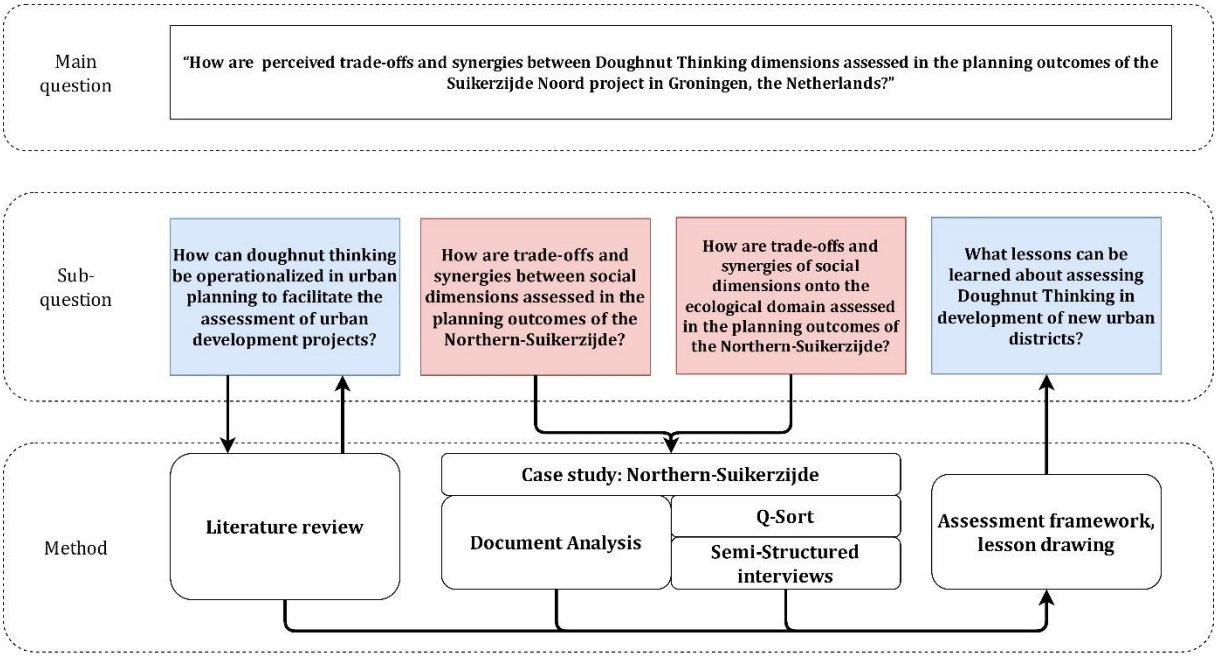

Figure 6: *Research design, red indicates empirical research questions. Blue indicates theoretical or concluding research questions.*

In short, the sub questions are answered by a literature review, document analysis, semi-structured interviews, and lesson drawing. In figure 10 the sub-questions and the used methods are presented. Together, answer(s) can be drawn for the main question.

3.1 The Suikerzijde Noord

In this study, the assessment framework is tested using a case study approach. This is done to give the theoretical knowledge gained until now, a practical and real-life example. A case study is fit for this as it gives in-depth insights into the practical effect of applying the instrument made, as a case study offers insights into what generalizations can be made from analysing a single unit (Gerring, 2004).

In Groningen, a to-be-created neighbourhood will be an effort of the municipality to create a new 'urban, robust, but also green, generous and inviting new part of the city.' and a 'complete and versatile district.' (Gemeente Groningen, 2022, see figure 6). The first plans for the northern part of this new district will be developed and sustained using Circular Economy principles, which in turn are based on the environmental vision of the municipality as a whole named *The next city* (Gemeente Groningen, 2020b). Therefore, this case lends itself to an exploration of applying doughnut thinking in spatial planning. The Suikerzijde will be located on the old floodplains of the sugar factory operating until the 2000s. Since then it has been a location for the local ecology to thrive (Sweco, 2020b). Figure 6 gives an impression of the central square envisioned by the makers. The map in figure 7 depicts the location of the neighbourhood relative to the city of Groningen.

Figure 7: *Impression of the central square 'Pioniersplein' in the Suikerzijde (source: Gemeente Groningen).*

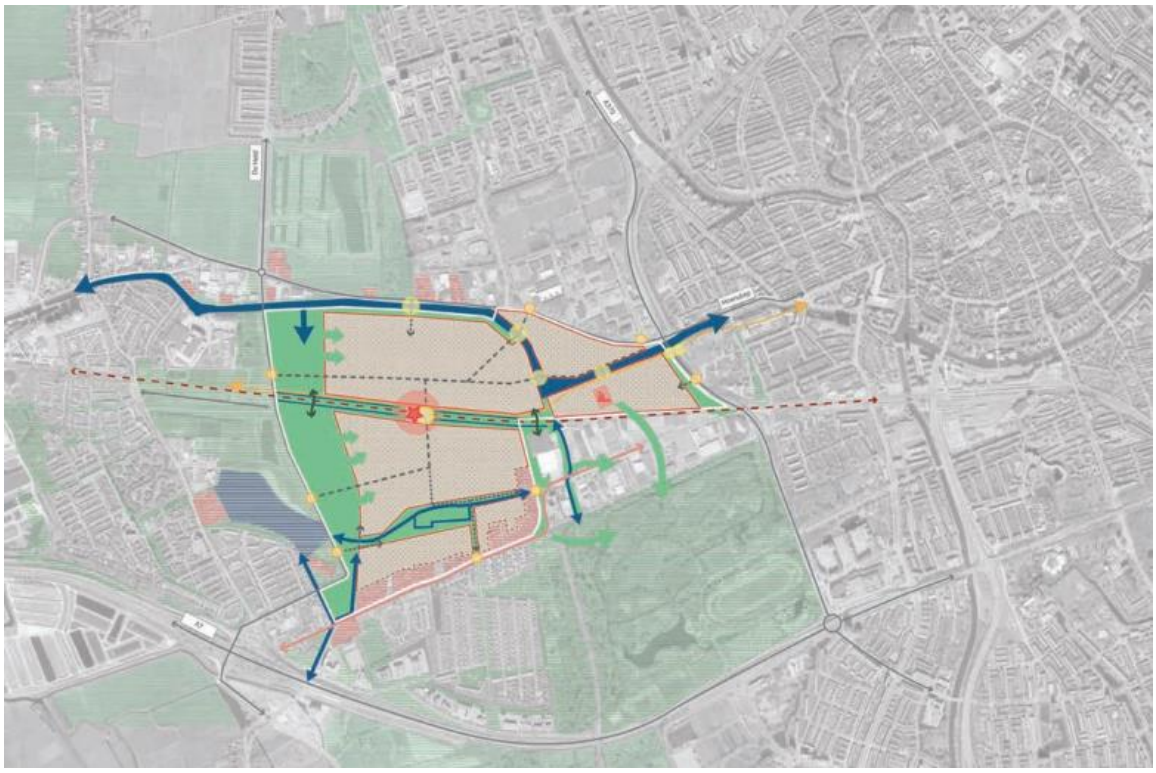

Figure 8: The Suikerzijde in relation to the city of Groningen (source: Gemeente Groningen)

The case of the Suikerzijde Noord is investigated content wise and in light of the assessment framework. This case is selected due to its location in the Dutch context, as the doughnut economics theory as of yet lends itself better to operationalization in global-north settings (TCI, 2020). Furthermore, it is selected as it is almost finished in terms of planning, while not yet being realized. This makes this project as novel as possible for participants involved. Also, the vision of the municipality is assessed by using this case. As said earlier, the municipality has an environmental vision *The next city* in which circular thinking is claimed to be used in new projects. However, this is not the focus of this research. The case will be discussed more in depth in section 4.1.

3.2 Document analysis

First, a document analysis is conducted. The goal of the document analysis is twofold: 1) to find out which dimensions are addressed and how they are operationalized in the plans, and 2) to map possible synergies and trade-offs in practice as input for statements in the subsequent Q-sort process. In doing so first an extensive understanding of the plans in de Suikerzijde Noord is created. Secondly, it helps to formulate probes during interviews and creates a basic knowledge of the occurring dimensions in its context. Ultimately, its goal is to partly answer the questions: *"How are trade-offs and synergies between social dimensions of doughnut thinking assessed in the planning outcomes of the Suikerzijde Noord?"* and *"How are trade-offs and synergies between the social and ecological domain of doughnut thinking assessed in the planning outcomes of the Suikerzijde Noord?".*

Together the documents offer a broad and whole picture of the Suikerzijde Noord, as they cover all dimensions, and cover different perspectives and scales. The selected documents, and the addressed dimensions are described in table 4.

The 'Stedenbouwkundig plan eerste deelgebied' offers concrete plans of the design and nature of the first part that is to be built in de Suikerzijde Noord (Gemeente Groningen, 2020a). The 'Milieueffectenrapport' and its amendments cover environmental effects and report on how all dimensions are influenced (Sweco, 2020a, 2020b, 2021). It ranges from for example water management to mobility to energy and is by far the most comprehensive part of the documents analyzed. Furthermore, it is mandatory by Dutch law to conduct this report in order to proceed with any project. Its amendments are partly revisions as requested by the municipality. For example, amendment 2 is an analysis on the differences in effects on different dimensions of two scenarios (see document analysis for more information). The third document, 'structuurvisie de Suikerzijde' covers the abstract level of the vision behind the Suikerzijde and how it fits and integrates in the municipality and region. The fourth and last document is the design of the public space of Suikerzijde Noord ('ontwerp openbare ruimte de Suikerzijde Noordoost'). It offers a tangible view into the final steps of the planning and design of the first parts of the neighbourhood.

Table 4: *Selected documents for document analysis*

	Documents:	***Stedenbouwkundig plan eerste deelgebied***	***Milieueffectenrapport Hoofdrapport (MER)***	***Milieueffectenrapport amendment 1***	***Milieueffectenrapport amendment 2***	***Structuurvisie de Suikerzijde***	***Ontwerp openbare ruimte de Suikerzijde Noordoost***
	In English:	*Urban plan first district (i.e. Suikerzijde Noord)*	*Environmental assessment Main report*	*Environmental assessment Amendment 1*	*Environmental assessment Amendment 2*	*Structure vision of the Suikerzijde*	*Design public space the Suikerzijde North-East*
	Date:	*March 2020*	*06-03-2020*	*20-10-2020*	*26-03-2021*	*21-06-2021*	*02-03-2021*
Social domain	Housing	X	X	X	X	X	X
	Water	X	X			X	
	Connectivity	X		X		X	X
	Community	X		X		X	X
	Energy	X	X	X	X	X	X
	Mobility	X	X	X	X	X	X
Ecological domain	Air pollution		X				
	Freshwater withdrawals	X	X				
	Biodiversity and land conversion	X	X	X		X	X

The data that will be extracted is in the form of tables that are filled in per dimension. In other words, information on how each dimension is dealt with within the planning outcomes of the Suikerzijde Noord. The information is extracted by using a guide for the document analysis (see Appendix A). This guide is used to offer structure and standardization to the information extracted.

Findings are used as input and inspiration for the statements in the Q-sorting process. This will lead to insights for example inequality of consideration for different dimensions, which is the basis for identifying possible tensions that could lead to trade-offs and synergies in this project. Relevant findings in the documents are presented in chapter 4.

3.3 Q-sorting and semi-structured interviewing

In the second part, the trade-offs and synergies are assessed using the assessment framework presented in this research. To do so a hybrid method between Q-methodology and semi-structured interviewing is used. First, general statements on trade-offs and synergies between dimensions are offered to participants. Of these statements, participants must select the ones that they agree and disagree most with. Ultimately, the dimensions that are connected to the selected statements are discussed in the subsequent interview. This way insights are gained into what participants feel are the strongest synergies and trade-offs. Furthermore, participants are interviewed on the dimensions they feel are most controversial (in the case of trade-offs) and full of opportunities (in the case of synergies). In this section, this is further explained.

3.3.1 Q-Sorting

Inspired by Q-methodology, Q-sorting is a part of the whole of Q-methodology. The traditional outcomes of Q-methodology do not fit this research, as it views the group's tendency rather than giving individual insights (Hammarberg, Kirkman and De Lacey, 2016). However, Q-sorting, as a part of the Q-methodology, offers valuable insights when dealing with many variables. This is important in this study because it forces participants to prioritize dimensions above others. However, as will be seen, the basis for the statements is already selected by the creation of the assessment framework: every linkage will be covered in the form of a statement. The criteria for each statement are unambiguously stated, mildly provoking, without jargon and tailored to the context of de Suikerzijde. Content-wise each statement covers only two dimensions and either a trade-off or synergy between them. Furthermore, they are kept intentionally broad to probe and trigger various examples from the planning process (see appendix B for the full list of statements).

The process of Q-sorting is as follows: 1) the participant gets a deck of statements, in the form of cards, and 2) the participant is asked to place the cards on a pyramid-shaped Likert scale of the least to the most agreeable (or relevant) statement. An example of a Q-sorting pyramid is shown in figure 2.

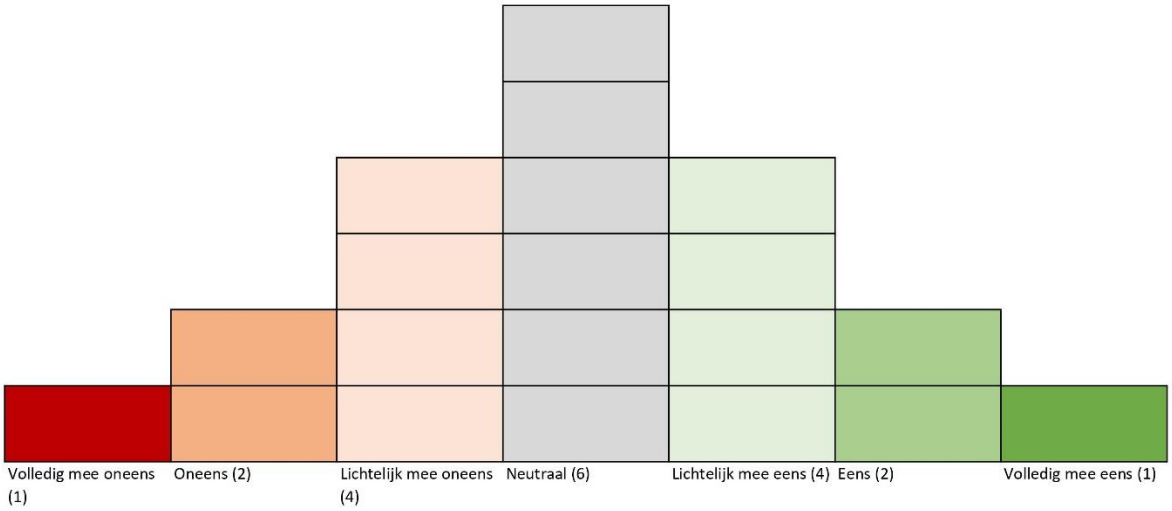

Figure 9: *Q-sorting grid for 20 statements.*

The statements (*n= 40*) are the possibility for a trade-off and/or synergy between certain dimensions. They are kept intentionally broad, so that in the subsequent interview participants have the liberty to explain the matter. In appendix B the selection of statements can be viewed. It is the intention that by covering the linkages shown in the assessment framework, the Q-set sufficiently covers all relevant dimensions. The following aspects are considered when explaining the sorting process:

- All statements are in the context of the Suikerzijde Noord development
- The explanation is that the sorting process reflects their perception and/or opinion in the role as professional and not personally.

The following sorting will be documented by using pictures for future references. It is of interest to also check for possible recurring 'controversial' statements in the analysis, i.e. statements that are picked more frequent in the sorting phase as more agreeable/disagreeable or relevant (Watts and Stenner, 2005). However, the main reason for using this method is to funnel the interview towards the subjects that are most relevant to the interviewee (or are most dominant in the ongoing debate behind the scenes of this case). Secondly, it keeps the interview alive and serves as a source of inspiration to spark discussion. In figure 9 the process can be seen in practice.

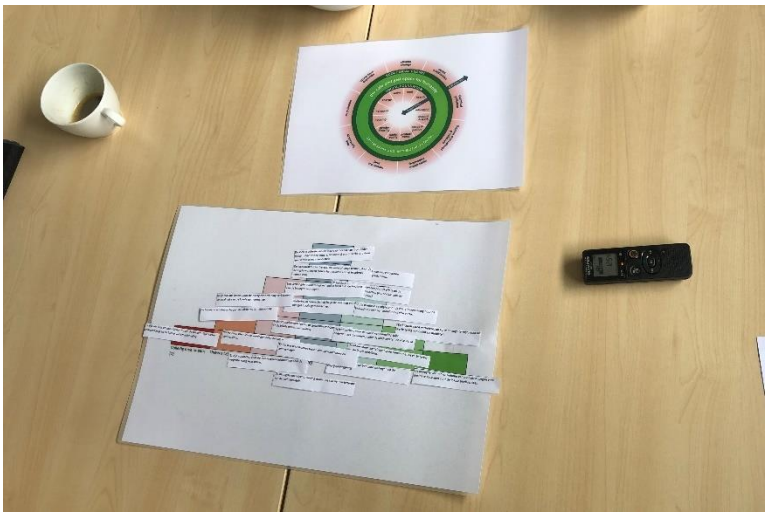

Figure 10: *Q-sorting process in practice*

3.3.2 Semi-structured interviewing

Where normally the focus in Q-methodology is on the quantitative analysis following the Q-sorting process, in this research the focus will be on the additional part that is involved after sorting: exploring the underlying reasons for the decisions participants made. In the form of individual semi-structured interviews, the most relevant, disagreeable, and agreeable statements are covered in the interviews. From the 40 statements, the six most 'controversial' or relevant statements to the participant are further questioned. On the one hand the most relevant statements are interesting to dive further in to. On the other hand, it is also interesting to shed light on statements that are deemed less relevant by the expert in questions, and how or why these statements are perceived as such. Furthermore, it helps prioritizing the most important links between dimensions, and therefore, from a pragmatical standpoint, keep the interviews relevant to the interviewee.

The interview guide is available in appendix B. The data that is extracted reflects the views of participants on synergies and trade-offs considering the planning outcomes of the Northern-Suikerunie development. Participants get to give further information on their choices, making it possible to assess the strongest linkages in the assessment framework.

As it is not fixed which participant will select which linkages as most 'controversial', the interviews will be analyzed inductively. Key information is collected on how and why some specific trade-offs and synergies between dimensions are assessed as they are by the participants. This will lead to insights into how trade-offs and synergies are perceived.

3.3.3 Participants

Given the holistic approach of the doughnut economy and the developed assessment framework, the participants are approached to cover all of the following dimensions:

- Housing
- Water
- Connectivity
- Community
- Energy
- Mobility
- Air pollution
- Freshwater withdrawals
- Biodiversity and land conversion

Twelve persons were approached, of which five were willing and able to participate. A second round of approaching expert was conducted through professional and social networks of both me and with help of the supervisor. Finally, this resulted in not being able to cover all dimensions as

intended. On the one hand this is a shortcoming. On the other hand, the participants that did participate had an important role in the project which enabled a broad and wide coverage of almost all dimensions.

The main criterion is that participants are involved in the planning process of the Northern Suikerzijde, meaning they either participated or for example actively opposed (parts of) the plans. As will be evident in the results, some dimensions were less important than others. The following participants have been interviewed:

***Table 5**: List of participants, their perceived role, and what dimensions are covered in the respective interview.*

Participant title	Perceived role	Dimensions covered
Project manager 1 [PM1]	Financial and process management	Housing, community, mobility
Project manager 2 [PM2]	Process management, ecology, and mobility challenges	Housing, connectivity, Community, mobility, biodiversity, and land conversion
Mobility expert external [ME1]	Advocating Public Transport	Mobility, connectivity, energy, biodiversity and land conversion
Mobility expert municipality [ME2]	Advocating the municipality's mobility vision in planning processes	Mobility, connectivity, energy, biodiversity and land conversion
Ecological Non-Governmental Organization [EN]	Advocating ecological and landscape values	Ecology, community, housing

3.4 Data analysis

Following the two-step data collection (i.e., document analysis and interviews), the data analysis aims to come to insight as to how trade-offs and synergies are assessed. The document analysis gives insights into how the dimensions are addressed in the outcomes; this will be presented as the context for the outcomes of the interviews. The interviews are analyzed inductively for recurring themes which then can be seen as the most prevalent trade-offs and synergies between the Doughnut Thinking dimensions. Subsequently, using the assessment framework, these can be framed in the context of all the selected linkages between dimensions. Finally, conclusions can be drawn as to what lessons can be learned for the operationalization of Doughnut Thinking in local urban developments.

Practically, the data collected from the document analysis are presented per dimension in the results chapter. The data from the interviews is going through the following process:

1. Transcribing and anonymizing of the data.

2. Inductive and deductive coding of data, using the statements that are discussed as codes (software used: ATLAS.ti 22).
3. Development of inductive recurring codes.
4. Categorizing groups of codes and how they are connected.
5. Identifying themes most relevant to the assessment of Doughnut Thinking in the Suikerzijde Noord (i.e. most relevant to the research objective (David R. Thomas, 2006)).

3.4.1 Coding

The coding is done in a hybrid fashion. On the one hand, deductively using the assessment framework and its links (see figure 5). This results in 20 codes for synergies and 20 codes for trade-offs (see Appendix F). This is done to see how the theoretical assessment framework plays out in real-world cases. However, in doing so there might be a loss of valuable findings made during the interviews (David R Thomas, 2006). Therefore, the deductive coding scheme is complemented with inductive coding for the most recurring themes outside of the set of existing codes. This will be categorized as findings beyond the assessment framework. The findings from coding are then translated to the assessment framework, and the other findings will be stated separately.

3.5 Data management and ethical considerations

Data that has been collected for this research is handled with care for ethical consideration throughout the research process. Prior to interviews, interviewees are briefed in the form of a short information PDF through e-mail, with an accompanying description of this research. Each participant is briefed on the research during the interview and an informed consent form is signed, as well as verbally confirming the informed consent (see Appendix D). This form explains the research objective, the contents of the interview, and informs that the interviewee may quit the study at any time without consequences.

The collected data is anonymized, and interviewees are referred by initials of their functions (for example project manager 1 is PM1), to reduce persona traces. The computer on which data is stored is only accessible by the researcher. Raw data (i.e. transcripts and recordings) is removed after completion of this research, however, processed data is visible in this thesis.

In this research only the original quotes that are used can be seen in appendix E. Full transcripts of the interviews may be requested for future reference, if deemed necessary. They are not included in the appendices as they offer little added value while sharing information that may be sensitive.

The document analysis is conducted using publicly available sources, which does not harm any copyrights as the sources are merely analyzed and not copied or distributed. Taking into account

the transparency and ethical considerations in these steps the validity and legitimacy of this research is guaranteed.

4 Results

In this chapter the results of the document analysis and interviews are presented and interpreted. First, a general understanding of the social and ecological dimensions at play in the Suikerzijde Noord is presented. Secondly, the interactions within the social domain are addressed as found in the document analysis and interviews. Thirdly, the interactions between the social and ecological domain are discussed as well. Then, other interactions beyond the assessment model that are found are presented in the form of themes. Finally, by means of a synthesis, the main findings are condensed and linked to the assessment model. The results presented (other than section 4.1) are a combination of findings from the document analysis and interviews.

4.1 Suikerzijde Noord

In this section the Suikerzijde Noord is presented in order to create an understanding of the context for the interactions discussed in 4.2, 4.3 and 4.4. At the basis of this understanding lays the documents that are analysed as explained in chapter 3. The full tables of data on the document analysis can be found in appendix A.

In the Suikerzijde Noord, the emphasis of the project is to capture the large demand for housing in Groningen (Sweco, 2020b). This part of the broader Suikerzijde project is currently in the last phases before completion of the plans and lends itself as a scaled-down representation of the Suikerzijde project. In 2020 ambitions were to have around 2000 houses built in Suikerzijde Noord (Gemeente Groningen, 2020a). In the first phase however, the municipality wants to create 750 houses in the first building fields A, B, C and D. Final decisions on future housing areas will stay open for interpretation for now, depending on what decision-makers want in terms of density for the second phase in the future (Sweco, 2021).

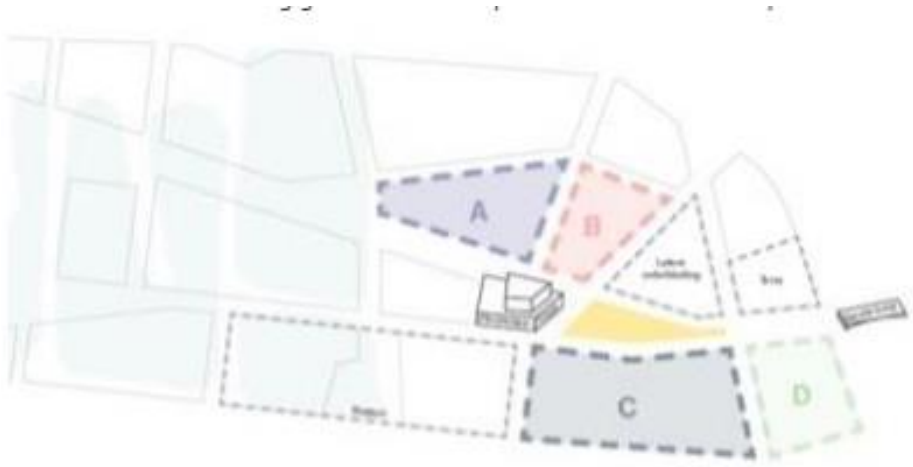

Figure 11: *Development fields first phase Suikerzijde Noord (source: Gemeente Groningen)*

The ambition is to create a green-urban and central-city atmosphere, using mixed building typologies (Sweco, 2020b). The mixed houses consist of city houses, freestanding houses, collective blocks and high rises, and the building fields will have sufficient space to give room for inner areas such as squares and public gardens (Sweco, 2020a).

Water as a dimension in the Suikerzijde Noord serves a multitude of ambitions and goals. Firstly, the water management system should be functional and climate-resilient in terms of drought, heat stress, water nuisance and flooding (Gemeente Groningen, 2020a; Sweco, 2020a; De Suikerzijde, 2021). Secondly, it should serve optimal drainage to the Hoendiep, an adjacent channel (De Suikerzijde, 2021). Thirdly, the overarching water vision of the municipality has the ambition to present Groningen as a water-rich city. The water should be accessible and enjoyable to citizens (Gemeente Groningen, 2020a, 2021). These goals and ambitions are met with plans to incorporate green-blue infrastructure for cooling and countering urban island heat effects (Gemeente Groningen, 2021).

In terms of connectivity the Suikerzijde Noord addresses it in the form of social contacts, connectivity between and with green and 'blue' areas, and connectivity in terms of mobility (Sweco, 2020a). On an abstract level, the perspective for connectivity is a development axis starting from the centre of Groningen towards the heart of Suikerzijde (Gemeente Groningen, 2021). Both physically and socially Suikerzijde is to be intertwined with surrounding areas, by offering good infrastructure as well as programming of amenities (Gemeente Groningen, 2021). As stated in the 'Structuurvisie de Suikerzijde' (Gemeente Groningen, 2021, p. 25): *'The former suikerunie terrain formed a white, inaccessible stain on the map. We want to use the area as a link in the fabric of city, village, neighbourhoods, and strokes.'* This has arguably trickled down into the ambition of the design to connect the Northern Suikerzijde with its surrounding neighbourhoods (De Suikerzijde, 2021).

The way the streets are connected and designed is described in the urban plan (Stedenbouwkundig plan; Gemeente Groningen, 2020a). It shows a network of streets and lanes with principal profiles that offer space to dimension-spanning challenges in mobility, climate adaptation, functionality (i.e. cables and pipes) and liveability (see figure 11).

A. 'Singel': a wide central street, comparable to a main artery
B. 'Stadsstraat': City street, secondary neighbourhood street
C. 'Spoorlaan': Lane adjacent to the railway
D. 'Groene oever aan het Hoendiep': Green banks along the Hoendiep
E. 'Groenstraat': Green street
F. 'Park rand': Fringes of the park
G. 'Kade': Quay
H. 'Fietsstraat': cycling lane

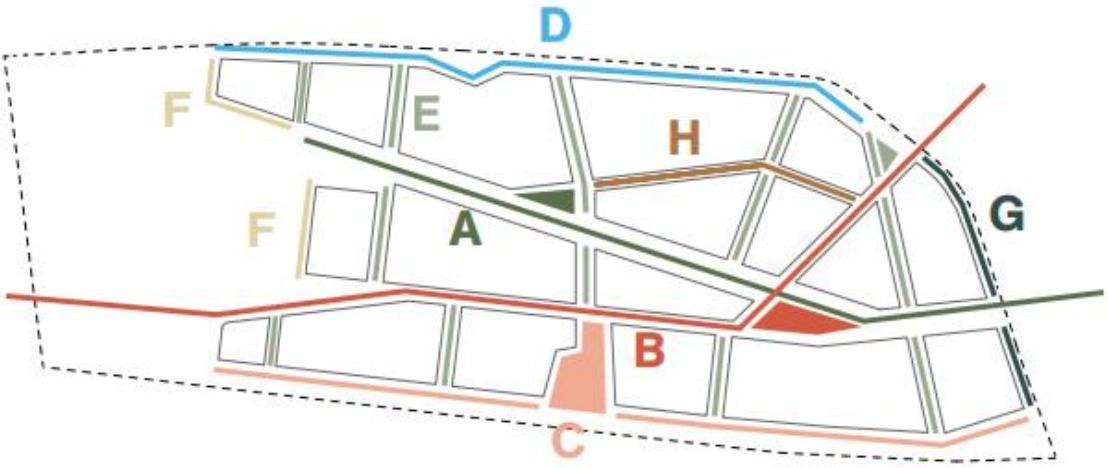

Figure 12: *Variety of street lay-outs in Suikerzijde Noord, letters indicate the principal profiles (source: Gemeente Groningen)*

The central building, the 'Pioneers gebouw', is proposed to provide public services (Gemeente Groningen, 2020a). The environment is proposed to include a variety of public amenities such as schools, terraces, shopping facilities, sport, and other cultural facilities (Sweco, 2020b).

in terms of energy, the municipality as a whole has the following goals: 1) the ambition to be gas-free by 2035 (Gemeente Groningen, 2020a), 2) the ambition to be CO2-neutral by 2035 (Gemeente Groningen, 2020a) and, 3) the wish to adjust for the ongoing energy transition (Sweco, 2020a). The goals of municipality are to be achieved by: not connecting new buildings to the natural gas infrastructure, emphasising on thermal heating systems ('Warmte-koude opslag' or WKO systems), emphasising on solar power on roofs in combination with green roofs, making public space electricity consumers as efficient as possible, and having buildings facilitate their own electric power supply (Gemeente Groningen, 2020a).

In this project mobility is an extensively discussed dimension in de Suikerzijde Noord. The municipality states that its ambition is to: 1) mitigate barriers and the closed-off character of 'the island in the city', 2) connect the area with the inner city, Hoogkerk (a nearby town), and the suburbs, 3) focus on sustainable mobility and 4) make use of Transport Oriented Development (TOD) theorem (Gemeente Groningen, 2020a; Sweco, 2020a).

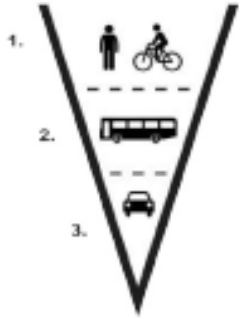

Figure 13: *Order of traffic, first slow modes, then PT, then cars (source: Gemeente Groningen)*

This is achieved by several strategies, instruments, and design features. Firstly, a focus on sustainable mobility is achieved by prioritising slow modes before PT, and PT before the car (see figure 12). This is in line with the ambition of the municipality to create a district that is walkable, cyclable while remaining accessible. Secondly, connecting

the area with the rest of the municipality needs to be achieved. Thirdly, TOD is achieved by creating a hub for high quality public transport, ideally with a new train station (Gemeente Groningen, 2020a; Sweco, 2020b).

Internally mobility will be mainly 'slow modes' such as walking and cycling, externally by focussing on well-connected cycling paths, walkable city principles and well-connected PT (Gemeente Groningen, 2021).

In the documents Air pollution and Freshwater withdrawals are only discussed as norms that should be adhered to. The MER shows that the quantified limits and norms for these dimensions are met (Sweco, 2020a).

Biodiversity and land conversion is the dimension under the ecological domain that is relevant to discuss in the context of Suikerzijde Noord. Several items are addressed within this dimension: Biodiversity is supported and strengthened, and promoted by accentuating green in the fabric of the city (Gemeente Groningen, 2020a, 2021), the water bat and 'Geoorde Fuut' need a compensation area for the loss of their habitat (Gemeente Groningen, 2020a), circularity in resources (Sweco, 2020b), making use of core qualities of the area such as: the landscape, the water, industrial heritage, and quay (Gemeente Groningen, 2021), and finally the development of a green city district; a diverse neighbourhood where a rich and large mix of vegetation improves the biodiversity and quality of life in symbiosis with the community (De Suikerzijde, 2021).

Suikerzijde Noord achieves this by: Green spaces and parks, green banks along the 'Hoendiep', a minimum of 16 m^2 of public green area per housing unit, a landscape zone in the northern part of the neighbourhood, and compensation areas for the loss of habitat for the water bat and 'Geoorde Fuut' nearby (Gemeente Groningen, 2020a; Sweco, 2020b). Suikerzijde Noord will have a green structure in the form of a network of: 'Singels', green streets, a park, green courtyards, and a green zone along the fringes of the plan-area.

4.2 Interactions in the social domain

Within the social domain several interactions are determined within the Suikerzijde Noord. These are structured as the links that are present in the assessment framework, divided into synergies and trade-offs. The frequency of the interactions as mentioned in interviews can be seen in table 7.

Table 6: *Frequency table for social domain interactions in interviews. SYN: Synergy, TRA: Trade-off, [letter]: reffers to placement in the assessment framework*

Code	Mentioned
● [C] SYN Housing-Mobility	12
● [C] TRA Housing-Mobility	12
● [G] TRA Community-Mobility	11
● [G] SYN Community-Mobility	10
● [J] TRA Connectivity-Mobility	9
● [D] TRA Housing-Energy	8
● [J] SYN Connectivity-Mobility	8
● [F] SYN Connectivity-Community	4
● [D] SYN Housing-Energy	4
● [B] SYN Housing-Connectivity	4
● [L] TRA Energy-Mobility	4
● [A] TRA Housing-Community	3
● [A] SYN Housing-Community	3
● [E] SYN Housing-Water	2
● [F] TRA Connectivity-Community	2
● [L] SYN Energy-Mobility	1
● *[H] TRA Community-Energy*	*0*
● *[B] TRA Housing-Connectivity*	*0*
● *[I] TRA Water-Community*	*0*
● *[H] SYN Community-Energy*	*0*
● *[I] SYN Water-Community*	*0*
● *[M] SYN Energy-Water*	*0*
● *[K] SYN Connectivity-Energy*	*0*
● *[M] TRA Energy-Water*	*0*
● *[K] TRA Connectivity-Energy*	*0*
● *[E] TRA Housing-Water*	*0*

As can be seen the most frequently addressed interactions are concerning mobility in relation to housing and community. Furthermore, energy in relation to community, water and connectivity are not addressed in the conducted interviews. Finally, interactions with housing are seen as the most frequent occurring dimension that is discussed, which is in line with the main purpose of the ambition of the Suikerzijde in general. Links that have not been discussed in interviews, can be the result of a participant bias. However, it could also be the result of the one-sided nature of the project. The combination of many mentions of for example housing versus a limited view on

energy could be an indication of a lesser degree of holistic thinking which is key in operating in a circular manner (i.e. Doughnut Urbanism). The perceived synergies in de Suikerzijde Noord within the social domain exist between Housing, Connectivity, Mobility, and foremost Community. Synergies between Energy, Water and Connectivity are least perceived, both during interviews as well as in documents. This is assumed to be due to the focus of the project on foremost Housing and Community, in which synergies are likely more compatible than with other dimensions such as Water or Energy. One link that is unexpectedly not or rarely discussed is the Energy-Housing synergy.

4.2.1 Synergies

Within the synergies in the social domain, the following ones have been identified as most relevant and the main synergies for de Suikerzijde Noord: Housing and Mobility, Housing and Community, Community and Mobility, and Connectivity and Community.

Firstly, the synergy in housing and mobility can be found in that the focus on sustainable modes of transport first, then PT and then cars, will increase the quality of housing (Gemeente Groningen, 2020b). This is underlined by participant *ME1*: *"If you lower the possibilities of parking, and you facilitate sustainable alternatives, I think living would be nicer."*- (Appendix E, 1.). Also, *ME2* agrees: *"Maybe it's the other way around. That by building a station there, you increase the quality of the houses."* (Appendix E, 4.). Also, housing is mixed with other amenities in such a way that it helps mode choices in the direction of sustainable mobility. As PM1 exemplifies: *"Especially by locating amenities closeby, you create proximity. So that people don't need to get into the car because they have to drive far for their groceries."* – (Appendix E, 2.). By a mix of sustainable mobility and high-density urban principles, connectivity is increased in the physical sense of the word, mostly by physical mobility measures (De Suikerzijde, 2021; Gemeente Groningen, 2021). In short, housing and mobility are in synergy in that: 1) sustainable mobility is perceived as making neighbourhoods more liveable, and 2) that by mixing other functions with housing, sustainable mobility is perceived to be promoted.

Secondly, housing and community in the Suikerzijde Noord should be intertwined and form a symbiosis, according to the municipality. The municipality wants to do so while integrating different functions into one area. The ambition is to create an inclusive and mixed neighbourhood in terms of community (Gemeente Groningen, 2020b). This is underlined by *PM1*: "*… So that mix of living and working, and rich and poor, that is something we loaded into the plan from the beginning. Specially to create a community in which people have the possibility to help each other.*" (Appendix E, 3.). Furthermore, minimum percentages for social housing and more houses for mid-income households are recommended as this will accommodate a variety of socio-demographic groups to facilitate mixed living environments (Sweco, 2020b, 2020a). These mixed living

conditions are then in line with the ambitions of the municipality of integrating the different functions such as living, working and recreation into a compact neighbourhood (Gemeente Groningen, 2021). In short, synergies are perceived in housing and community by creating a mixed living environment in terms of 1) housing typology and policies, 2) functions such as work, living and recreation, and 3) socio-demographics.

Thirdly, mobility and community are perceived to have a synergetic effect as well. On the one hand, as the quality of a community can influence mobility movements. As *ME2* states: *"If you cannot ground in a neighbourhood, you tend to search that outside the neighbourhood. That results in an increase of external movements [out of the neighbourhood]."* (Appendix E, 5.) This claim is not mentioned in any of the documents analysed. The other way around, it is the ambition to stimulate the quality of the community by increasing sustainable mobility. As *ME1* states: *"… And with good cycling facilities, good PT-facilities and good pedestrian facilities. Then you get people on the streets and the Jane-Jacobs'isque streets with gardens and liveable neighbourhoods … and, well, people that play in the street of their house."* (Appendix E, 6.). Thus, mobility and community are perceived as interconnected and synergetic to each other. This can be an indication of consideration of circular discourse in practice.

Lastly, and similarly, connectivity and community are perceived as presenting synergies. Specifically, social connectivity in Suikerzijde Noord is achieved by: 1) mixed living environments in which social contacts are stimulated, 2) Compact city principals and mixed functions which increase engagement between work and living environments (Sweco, 2020a; Gemeente Groningen, 2021), and 3) good programming of amenities such as recreation, nature and work will increase the social cohesion of the area (Gemeente Groningen, 2021). This in turn offers a varied and multiplicity of urban life, thus increasing the quality of the local community. The combination of community and social connectivity results in a so-called connected neighbourhood. As *PM1* states: *"… And one of the core themes is that it becomes a connected neighbourhood, and that does not only imply roads, cars and that kind of stuff. But that people connect with each other. With emphasis not only a residential area."* (Appendix E, 7). In context of doughnut thinking this is an indication of a combination of several social foundation factors, which shows the operationalizing of circular thoughts.

4.2.2 Trade-offs

Mentions of trade-offs within the social domain are scarce in the documents that are analysed. However, some trade-offs have been identified, and in interviews more perceived trade-offs presented themselves. These can also overlap with synergies between the same dimensions. For example: an increased mobility in car-based travel would be a perceived trade-off towards the housing dimension. However, if sustainable mobility is increased instead, this would have

synergetic effects with the housing dimension. Even if both examples are in the Mobility-Housing interaction. The following perceived trade-offs have been identified as most relevant in Suikerzijde Noord: Housing, Community and Mobility; Connectivity and Mobility; Housing and Energy, and Mobility and Energy.

The first perceived trade-off is a combination of Housing and Mobility, and Community and Mobility. In the analysis these two interactions had a high degree of overlap, making combining them logical. Trade-offs are perceived when trying to fit in mobility with housing and the community on a more concrete level. This is exemplified by *ME1*: *"You can say nice station and a nice neighbourhood. But, if a bus needs to drive through it and it rides over many speedbumps, it is not comfortable for that bus to drive through it. […] So, you must find an optimal balance between a liveable place and still have a bus drive through it.".* (Appendix E, 8.) Furthermore, car mobility is perceived as trading off most with community and housing, as it is not to be ignored but also not facilitated to much. *PM1: "… So partly by getting the car out of the street view as much as possible, so you have more quality to live. However, you cannot ignore the car."* (Appendix E, 9.). *ME1* underlines that one cannot ignore car mobility altogether: *"If you can only come somewhere by bike, then a part of the people cannot access that [place]. Because some people can't cycle or walk."*. (Appendix E, 10.) Another argument given for trading off sustainable mobility for housing is that some people prefer housing with the possibility to park. *ME2*: *"That [parking facilities] takes care so it won't be a neighbourhood where you don't want to buy a house. Because somebody has a car and wants to live somewhere and want to be able to park it somewhere."* (Appendix E, 11.) This indicates concerns of the ability to sell or rent houses by the municipality, which in turn shows the focus of the municipality in the housing dimension. Also, there is a first indication of a rigid pattern of car focussed concerns, as mobility is still partly done by car.

Secondly, trade-offs are perceived when considering physical connectivity and mobility. This is interpreted by most experts as a balance of staying connected (internal and external), while supporting sustainable mobility at the same time. On the one hand, the municipality discourages cars by policies such as maximum speeds of 30 km/h and short and paid parking (Gemeente Groningen, 2020a). However, while trying to avoid cars, the neighbourhood still needs to be reachable (Sweco, 2020a). The perceived trade-off of staying connected is described by participant *ME1*, in the context of PT: *"We want to connect this poststamp to the rest of the network as well, but the rest of the network should not suffer too much from it."* (Appendix E, 12.). Also, for car mobility this perceived trade-off is present as participant *PM1* suggests: *"In Groningen many people, even though almost everybody uses the bike, still need a car for a lot of other destinations."* (Appendix E, 13.) *ME2* underlines that car mobility is still an important aspect of physical connectivity and mobility: *"We must deal with people that still need to use the car. We want to create an ideal world where we think: Hey, that car isn't there, while it is."* (Appendix E, 14.)

Thirdly, trade-offs are perceived between housing and energy. *PM1* states: *"If you make it very black and white you have to choose between extra social rent housing or energy neutral housing. And partly that is a political choice, like where do I put my money in?"* (Appendix E, 15.). This presents a trade-off between social housing (i.e. housing) and energy neutral housing (i.e. energy), which both are dimensions the municipality wants to address, however are conflicting in this example due to financial concerns. As the participant indicates, there is a second rigid thinking pattern in that housing is seen as a contrasting choice between energy neutral housing and social housing, while there are examples of course of a combination of the two.

Also, mobility and energy show trade-offs. The biggest trade-off is perceived in electric driving. As *ME2* states: *"I think we don't know half of what is waiting for us if everybody starts driving electric."* (Appendix E, 16.). Showing that participant *ME2* perceives electric driving as a trade-off for energy, as it introduces another energy burden on the local energy demand and grid. This makes for a driver towards decisions to navigate away from electric vehicles.

In conclusion, the perceived trade-offs consist of mostly mobility related subjects versus the housing, community, and connectivity dimensions. Also, energy was prevalent as a dimension of trade-offs with housing and mobility in particular. All the while, interactions with the water dimension in the social domain, do not show perceived trade-offs in the conducted interviews.

4.3 Interactions between the social and the ecological domain

The interactions between the doughnut urbanism's social and ecological dimensions are presented and described in this section. The frequency of the interactions in the socio-ecological domain is presented in table 8:

Table 7: *Frequency table for socio-ecological domain interactions in interviews. SYN: Synergy, TRA: Trade-off, [letter]: refers to placement in the assessment framework*

Code	Mentioned
● [N] TRA Housing - Biodiversity & Land Conversion	20
● [O] SYN Mobility- Biodiversity & Land Conversion	11
● [R] SYN Mobility- Air pollution	10
● [R] TRA Mobility- Air pollution	6
● [Q] TRA Housing- Air pollution	5
● [N] SYN Housing - Biodiversity & Land Conversion	4
● [P] SYN Community - Biodiversity & Land Conversion	4
● [P] TRA Community - Biodiversity & Land Conversion	6
● [S] SYN Energy - Air pollution	2
● [Q] SYN Housing - Air pollution	1
● [O] TRA Mobility - Biodiversity & Land Conversion	1
● [S] TRA Energy - Air pollution	1
● *[T] SYN Water - Freshwater withdrawals*	*0*
● *[T] TRA Water - Freshwater withdrawals*	*0*

In the interactions between the social and ecological domain, the frequency of coded interactions between biodiversity & land conversion and housing, mobility and community stand out. Air pollution in relation to mobility (and trade-offs with housing) is also well discussed. On the other side, freshwater withdrawals and water were not mentioned or discussed in the interviews. Links that have not been discussed in interviews are that of water and freshwater withdrawals. Also, air pollution is not perceived as a major concern. Whereas in theory there are examples that this is a concern, in this project it is not perceived as relevant. This can also be seen in the Q-sorting process; both PM1 and PM2 sorted statements relating to air pollution and freshwater withdrawals towards the non-relevant end of the spectrum. When asked why these statements are often marked as lesser relevant, PM1 states that if quantified standards and norms are met, there is no reason to further worry about it. For one this serves as a slight indication of the perception that some ecological dimensions could be seen as a hurdle towards the end goal of building houses.

4.3.1 Synergies

The synergies between the dimensions in the social domain and ecological domain are most perceived in: Mobility and Biodiversity & Land Conversion; Mobility and Air pollution; Housing and Biodiversity & Land Conversion; Community and Biodiversity & Land Conversion. The perceived synergies between Biodiversity & Land Conversion in synergy with Mobility, Housing and Community is analysed first.

Firstly, synergy between mobility and biodiversity & land conversion in the Suikerzijde Noord is stated by participant *ME2* as choosing for sustainable mobility, and therefore decreasing environmental burdening transport. Participant *PM2* underlines this by agreeing to the statement:" The *types and volume of mobility makes for positive consequences of the local biodiversity."* (Appendix E, 17). However, no clear direct synergy is presented on how mobility can affect biodiversity & land conversion directly on the local scale. Instead, participants explain that sustainable mobility will lead to a better environment, on a global scale (*ME1* and *ME2* respectively): *"Actually you could say that sustainable mobility leads to less climate change."* (Appendix E, 18.), and "*Well, I think that we create a better environment by not doing mobility by car."* (Appendix E, 19). This indicates the perceived synergy between the two dimensions. However, it also shows the influence from the local scale onto the global scale.

Secondly, the community and the biodiversity and land conversion are synergetic by making use of core qualities of the area such as: the landscape, the water, industrial heritage, and quay according to documents of the municipality (Gemeente Groningen, 2021). The ambition according to the urban plans are the development of a green city district; 'A diverse neighbourhood where a

rich and large mix of vegetation improves the biodiversity and quality of life in symbiosis with the community.' (De Suikerzijde, 2021). This entails a park and body of water in the west, as explained in section 4.1. As participant *PM2* states: *"You will get a quieter place there and also a kind of corridor function".* (Appendix E, 21) Aesthetically and functionally, the historical banks are used to make the water publicly accessible. This is in line with 'nature-inclusive' building which is mentioned as one strategy to achieve the goals and vision (Gemeente Groningen, 2021). And, as participant *PM2* states: "*The people there [on the quays] can also play and do sports along the water there, while also ecology gets its place more here [the park]."* (Appendix E, 20). The quality of community is also referred to as social sustainability. And, according to the municipality, it is achieved by walking, cycling, playing, active leisure, meeting, and a 'green' experience, which the green street profiles offer (De Suikerzijde, 2021). Also, it can be interpreted that the community and biodiversity and land conversion synergies are perceived as relevant in a sense that they increase the quality of life for residents. In short, it is perceived that community and biodiversity & land conversion act as a symbiosis in: Making use of land conversion in a beneficial manner for the community, and by combining ecological value with benefits for the community. Biodiversity and land conversion is addressed in a way that complements dimensions such as water, community, and connectivity (De Suikerzijde, 2021). In the urban landscape in the form of enough greenery in the streets, and in the fringes and parks in the form of taking the overhand.

One synergy that is not in the model but is mentioned in the documents is that between water and biodiversity & land conversion. The urban plans state that water is used as a means to offer ecological and recreational space within the neighbourhood (Gemeente Groningen, 2020b). Also, optimal drainage to the Hoendiep and functioning water management are achieved in the public space by utilizing wadi's, nature-friendly water retaining banks and by removing trees to optimize water connections to the Hoendiep (De Suikerzijde, 2021).

To summarize, synergies are perceived in mobility, housing, and community with biodiversity & land conversion. Moreover, specific aspects of the mobility plans are perceived as synergetic with air pollution. Next to the interactions that are theorized, a last synergy is perceived between water and biodiversity & land conversion.

4.3.2 Trade-offs

In reference to Suikerzijde Noord in general, and trade-offs specifically, participant *PM1* states: *"You simply add something, so there will always be a worsening [of the ecological domain]. Growth never goes without."* (Appendix E, 22). One of the most controversial trade-offs perceived is between Housing and Biodiversity & land conversion. This trade-off tends to overshadow some of the other possible trade-offs occurring in the socio-ecological interactions. However, other identified trade-offs can be found between: Mobility and Air pollution; Housing and Air pollution;

Community and Biodiversity & Land conversion. Note that similarly to the interactions within the social domain, some dimensions may overlap in trade-offs and synergies.

First of all, the housing and biodiversity & land conversion trade-offs. The largest being the loss of the habitat of the water bat and 'Geoorde Fuut' for housing, which is countered with a compensation area (Gemeente Groningen, 2020a). As participant *PM1* states: *"It is not a meadow but these are floodplains with trees and animals that need attention. So the context is completely different."* (Appendix E, 24.). Still, the MER rates the protection of nature as neutral towards positive. And, in terms of species protection, the MER reports a negative effect (Sweco, 2020a). This is underlined by participant *PM1: "So if you talk about the current biodiversity, that will just be destroyed."* (Appendix E, 23.). However, according to participant *PM2*, plans are in place to create earlier mentioned compensation areas. These will be two areas of fourteen hectares. Nevertheless, nature organizations want to keep some of the floodplains intact for the local biodiversity, according to PM2. Participant EN however is opponent to this statement, indicating that: *"If these compensation fields are a success, on which there is still no consensus, it will take years or decades before it will be same or better. All while using twice the amount of land."* (Appendix E, 37). Also, EN states that due to the lack of view of for nature, or rather: *"They [municipality] just want to build and build, and I agree that it is necessary. But they see no option to really intertwine housing with nature."* (Appendix E, 36). In light of the assessment framework, this trade-off shows that there is an eye for biodiversity, however, it should be within the logic of the broader goal which is providing housing. Without diving too deep in the politics behind the scenes, this remains a major point of frustration among parties involved, which is an ongoing conflict for deciding on how this trade-off will take shape.

Secondly, housing and mobility trading off with air pollution. The MER states that no adverse effects are expected during the construction phase of houses. The air quality, while decreasing slightly, will remain far below limits. This is based on an air quality analysis, in line with national norms for conducting a MER (Sweco, 2020a). As perceived by participant *PM1,* by adding houses there is an increase of air pollution by both the houses and the accompanying mobility: *"The air pollution worsens as we are adding more buildings to a city. And that leads to more use of cars, and houses also create more air pollution."* (Appendix E, 25.). This is of course true, however, the location of the Suikerzijde, compared to a distant suburb, is fruitful. It is within reach of existing infrastructure and close-by the existing city centre. This means that trips that are made will be done by more sustainable modes, and on existing infrastructure.

Finally, community and biodiversity & land conversion. As nature-organizations plead for more nature reservation, this affects the plans in place for the community to have sufficient space to recreate and decreases liveability, according to participant *PM2*: *"That means that you have to build more compact and higher, making it less liveable and less spacious."* (Appendix E, 26.)

In short, the perceived trade-offs between housing and biodiversity are highly evident. However, other trade-offs are also identified in the form of housing and mobility with air pollution, and community with biodiversity & land conversion.

4.4 Beyond the assessment framework

In conducting this research using the Suikerzijde Noord, some underlying drivers and mechanisms have presented themselves that are not considered in the current assessment framework. The main themes that are identified beyond the assessment framework are seen in the financial aspects and planning process. These themes have been identified by induction of the conducted interviews. In table 9 the frequencies of the respective themes are presented, as identified in the interview's transcript.

***Table 8**: Frequency table for themes identified in the interviews.*

Themes	Grounded
• MISC Financial	15
• MISC Process	10

As can be seen from the frequencies, the process, and financial aspects were most referenced to in the interviews.

4.4.1 Financial Aspect

From the interviews it is argued that the financial aspect is a significant driver of decisions for all dimensions addressed in the Suikerzijde Noord. When wanting to achieve ambitions it is said to key by participant *PM1: "For me we could do the maximum possible, but where the discussion mostly is about is how you achieve such ambitions. And in the end that is about money."* (Appendix E, 27.). Also, participant *PM2* states ambitions are mainly affected by financing: "*You can have very high ambitions, and the art is to translate and take care that it is being realised in the end, with financial feasibility often of course.".* (Appendix E, 28.) Participant *PM1* also explains that he perceives the financial aspect as a burden that should be divided over various ambitions, and that a clear debate on ambitions can never be conducted without consideration for the financial context. However, *ME1* does not agree fully on this statement: "*What is the end goal, where do we want to go? And if you must attenuate it because it is too expensive, okay."* (Appendix E, 31.)

In mobility this has influenced the decisions for a new train station and/or mobility hub. and frequency of PT as participant *ME1* states: "*…and everybody agrees that a station is great, and everybody wants it. But if I ask how many trains should stop there per hour the conversation changes again. Because it costs hands full of money."* (Appendix E, 29.). In another example it changed the amount of social housing that could be provided as participant *PM1* states: *"If everybody says we*

want social housing, then I also say yes if we need it. Then I would do it. But if I can't pay it I have to return to my client and say sorry man." (Appendix E, 30.).

In short, the financial context should be considered as it impacts and drives (mostly) trade-offs. Alternatively, it can be seen as hurdle in the municipalities envisioned ambitions. No mention or discussion on financial feasibility is offered in the documents analysed.

4.4.2 Process Management

Another smaller aspect that influences interactions between dimensions in de Suikerzijde Noord is the process management of the planning phase. This influence is perceived to follow from several drivers within the process management.

Firstly, it is argued that the moment of participation is important to have influence on trade-offs or synergies. Within mobility for example it is perceived that participant *ME1* was involved after key decisions were made: *"That means that in the confirmed urban vision you may be involved too late, or that another decision is made on purpose, causing our current dilemma's."* (Appendix E, 33.).

Secondly, pressures from outside the project influence the process of creating the urban plans. For example, as participant *ME2* states in the context of creating a new train station, it is highly depended of other parties outside the municipality: *"They are national parties and ProRail [Dutch rail agency], not only local parties. You actually connect to the national network"* (Appendix E, 34.). Another example is perceived in the trade-off between housing and biodiversity as explained earlier, as participant *PM1* states: *"This [trade-off] lays very sensitive politically, and legally. We have an area and there is a certain natural value, which has to disappear because otherwise you cannot build a residential area."* (Appendix E, 35.). This shows the pressures that influence the planning process.

In short, it is perceived that process management influences interactions between dimensions by means of participation moments of actors, and pressure from third parties other than the municipality.

4.5 Synthesis

In this section the findings are referred to the original assessment framework in section 2.4. In figure 16 the interactions that are perceived in Suikerzijde Noord are indicated. Note that the interactions that are mentioned are only based on what has been perceived in the context of Suikerzijde Noord, the documents that have been analysed, and experts that have been interviewed. The central questions from the Doughnut Economy are *´What would it mean for the people of this city to thrive?'* and '*What would it mean for the city to thrive within its natural habitat?',* respectively for the social domain and ecological domain. The Suikerzijde Noord answers the question of the social domain by means of mostly focussing on housing, working and liveability. Most other dimensions within the social domain are either seen as hurdle or tick of a box that needs to be met. Similarly, this rigid pattern of thought can be found when looking at the social domain within its natural habitat. Statements such as we should comply to the standards and norms of the government are not in line with the holistic mindset necessary to create a doughnut economy based planning way. This becomes evident when looking at the interaction between housing and biodiversity and land conversion. All in all, in the Suikerzijde Noord there is a serious attempt to go towards a thriving city within its planetary boundaries. However, when looking at the essence of the doughnut economy philosophy, it is still rather growth centred and limited in creating synergies or mitigating trade-offs. The main example of this can be seen in the ambition to build houses and seeing the other dimensions as hurdles rather than opportunities for integration, especially when looking from the social domain towards the ecological domain.

Within the social domain the interactions between housing and mobility, and housing and community are perceived to have both trade-offs and synergies. Community with mobility, and community with connectivity have perceived synergies, while energy with housing and energy with mobility have perceived trade-offs.

Between the social and the ecological domain both synergies and trade-offs are perceived between mobility and air pollution, housing and biodiversity & land conversion, and community and biodiversity & land conversion. Mobility and air pollution share both as on the one hand sustainable mobility limits air pollution, but on the other hand adding a new neighbourhood always affects the air quality negatively. Synergy is perceived between mobility and biodiversity & land conversion, while trade-offs are found between housing and air pollution. An interesting finding is that water is perceived as synergetic with biodiversity and land conversion, which is outside the theorized interactions.

Aspects have been found that drive interactions between dimensions, next to the interactions themselves. The financial aspect is perceived as an overarching driver for decision making in interactions. Also, wellbeing and liveability concerns play a significant role in the plans and affects decision making for the dimensions in the social domain. Lastly, process management influences

decision making on interactions between dimensions. At last, society is going beyond the old ways of the functional city towards a more hollistic way of approaching the city in order to create a thriving city within the planetary boundaries.

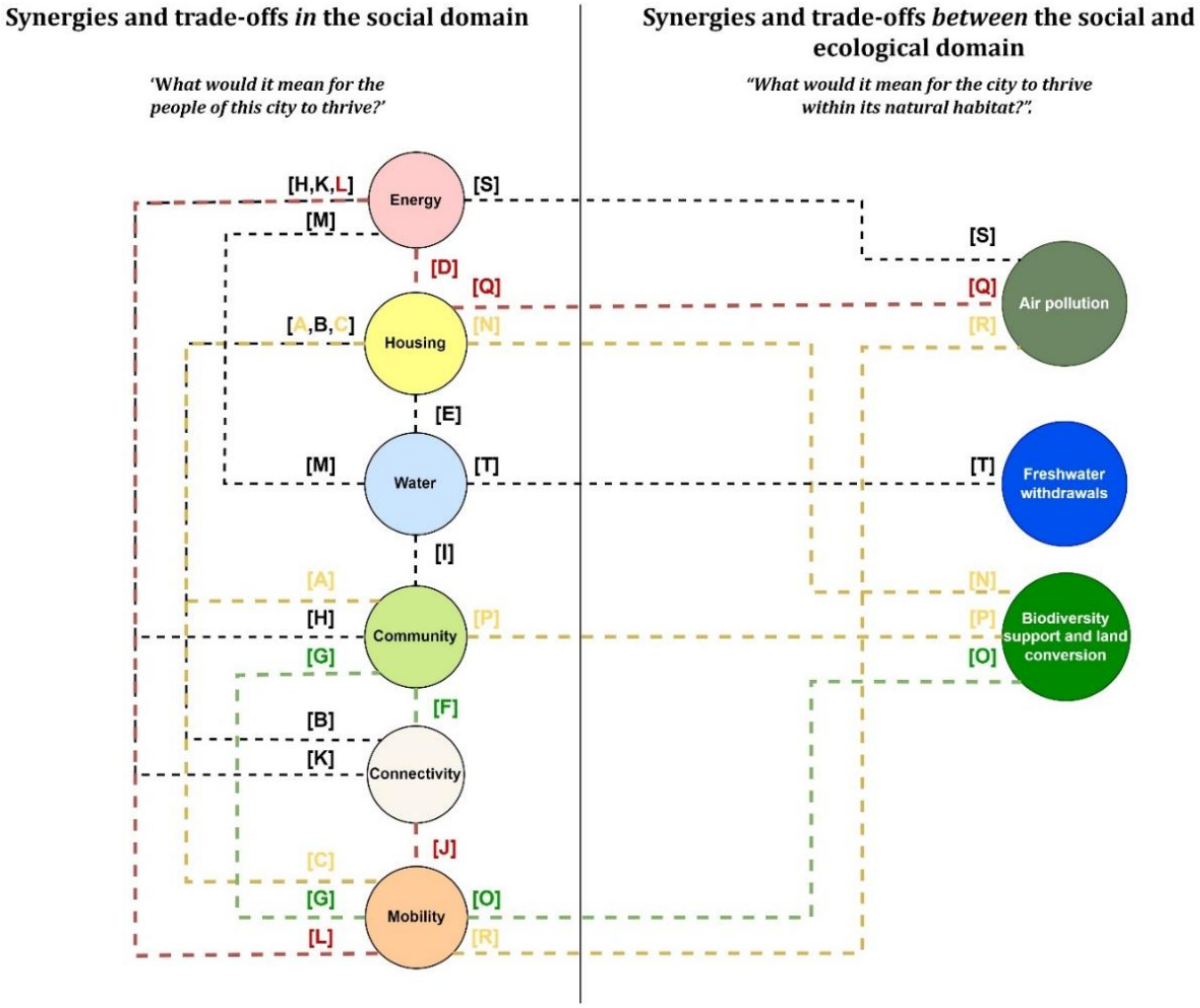

Figure 14: *Interactions as perceived in the Suikerzijde Noord. Red: trade-offs, green: synergies, orange: synergies and trade-offs*

5 Conclusion

The Doughnut Economy is a promising circular concept, however the operationalization so that actions will be taken towards the doughnut economy concept is not so straightforward. Yet, this study offers a first step towards that. It suggests a systematic approach towards analysing projects through doughnut economy, in the form of the Doughnut Urbanism assessment framework. The framework consists of dimensions in the social and ecological domain, which have interactions in the form of synergies and trade-offs. For the case of Suikerzijde Noord, perceived trade-offs and synergies are assessed using the assessment framework. From the empirical results it can be concluded the assessment framework should have an iteration. On the one hand, some interactions have been found to be not relevant in this case. These include, in part, the interactions between: Energy, Water, Air pollution, Freshwater withdrawals and Connectivity. On the other hand, some interactions are perceived to be highly relevant in de Suikerzijde Noord. The most relevant dimensions involved in these interactions are biodiversity & land conversion, Housing, Mobility, and Community. This occurs both within the social domain, as well as between the social and ecological domain. However, it can be concluded that, the social domain has a larger focus in this urban development. Moreover, rather than a holistic view as indicated in the municipalities vision of creating a circular and vibrant part of the city, it is argued that many ecological dimensions are seen as hurdles towards the main goal of creating housing.

Lessons can be drawn about assessing doughnut thinking in the development of new urban districts as this exploration shows that some dimensions might not be relevant for all cases, while others present themselves as more relevant. Furthermore, at least in this case two mechanisms or drivers are at play beyond the assessment framework, which are financial aspects and the planning process.

We can recognise Doughnut Thinking in some parts of the plan in line with the ambition of the municipality to be more circular. However, abstractly, what does this exercise tell us on the goal of having more ecological friendly urbanism in spatial planning as a whole? Many spatial questions come together in such a project, in which path-dependent ways of thinking and acting are at play: How do we build houses, which parties are participating, which stakes are prevalent and what is the hierarchy of these stakes? These patterns are not easily turned around or changed. Which is something that has been found in this project as well.

The case of Suikerzijde Noord shows that some aspects, in the context of Doughnut Urbanism, receive insufficient attention. Also, a turn in thinking is obstructed by rigid thinking patterns (for example the role of the car in the city), and that growth and profit are still at the centre of decision making. In light of the Doughnut Economics philosophy, it tells us that there is still much to gain for planning practice.

Ultimately, it is argued that Doughnut Economics offers a well-thought perspective on urban planning. However, it needs a tool to make it practical and concrete. The Doughnut Urbanism assessment framework offers a first step towards such a tool. And, when used, it shows that in practice holistic thinking is not yet fully achieved.

5.1 Recommendations and limitations

Several recommendations and limitations are identified in this research. These are the validity (both theoretical and empirical) of this research, in recommendations for further research, and in how this research can contribute to both planning practice and theory.

The first recommendation is that of the timing of assessment. In this research the assessment framework is tested ex-ante (i.e. before realization of plans). It is recommended to perform the assessment as a reflection rather than a precursive means.

A second recommendation is to better understand the metabolism at play in a city. This means that not only a focus is laid on people and financial concerns, but also on other dimensions and 'flows' such as clean water, energy, waste, clean air etc. using structural means to map urban metabolism such as this assessment framework can be of aid.

Regarding theoretical validity, while SDGs are at the basis of the Doughnut Economy thinking it could be that some of the SDGs are contradictory to the basic principles of doughnut economy. One major contradiction is the basis of goal 8 of the SDGs: Decent Work and Economic Growth. Whereas the doughnut thinking philosophy is based on an agnostic way of thinking about economic growth, the UN goals on which the social foundation is based do not match. However, this can be considered by taking care that economic growth is not the sole purpose of a development, but being in the background (i.e., being agnostic about economic growth).

A second point of concern is the limited guidance offered in implementation of the local-ecological domain compared to the local-social domain. As it may be important to consider the context, a broad generalization can be made as to what matters for a hypothetical city to thrive in its natural habitat. However, in the guide reference is made to technical and ecological knowledge, which may not be directly available to spatial planners. Therefore, in this study a choice is made to interpret the main question of the local-ecological lens as close to the original doughnut thought as possible.

In terms of empirical validity, it is acknowledged that the number of participants is on the short side. This can influence the plausibility of the conclusions that are drawn. However, due to the design of the interviews, a condense amount of information has been retrieved as their relevant dimensions are 'pre-sorted'. Moreover, the participants that are selected are covering most of the dimensions that are relevant based on the insights of the document analysis. Some of the participants that could participate are highly involved in almost all dimensions (i.e. project and

process managers). The extensive document analysis is deemed to also cover some of the 'blank' spots in the results.

Another factor to consider is that the results only indicate the start of the development of an assessment framework based on the doughnut economy. It is mostly based on theory rather than empirical evidence. Therefore, this research serves rather as a basis to reiterate on, rather than a product.

As the focus is on local developments, the global part of the doughnut economy is not included in the assessment framework. So, while doughnut *thinking* needs a holistic view, not every part of it is considered for now (i.e., the global context and effects on global dimensions).

The contribution of this study, as said before is a basis on which more cases can be assessed using Doughnut Economy as the underlying theory. Especially when tailored to the context of spatial planning, rather than society.

6 Reflection

In this research I have tried to create a basis of applying doughnut economy principles in the context of spatial planning. By exploring its operationalization in local urban developments, I believe that a foundation is created to continue onto. What went well is that, starting from only the doughnut economy theory, I have created a theoretically embedded assessment framework.

The largest bottleneck for me was the constant struggle of finding participants, I believe this is in part due to the political sensitivity currently surrounding the Suikerzijde project; some participants have cancelled. On the other hand, the timing of data collection on my side was on the late side as well.

In hindsight I would consider using multiple cases instead of one. In this way another context is created in which the assessment framework could be tested, and more experts would be available. It could very well be that if this assessment framework was used on another case the results would be completely different. The outcomes, therefore, and for the other reasons given, appear convincing as an exploration of how doughnut economy can be operationalized, rather than hard evidence.

In terms of the research process, I started of this research with great interest in the subject. However, I underestimated how novel the application of Doughnut Economy in practice is in the academic context. Luckily several circular society alternatives offered guidance during the theoretical phase. Also, without the guidance of Ward Rauws I believe I wouldn't be able to have the inspiration necessary to continue at several key moments of the research. As this research has stretched over almost 10 months, with few personal interruptions, I am content to have a product to be proud of. Ultimately, I hope that I have sufficiently contributed to the key philosophy of our faculty, which is making places better together.

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Appendix A: Document Analysis

Standard document analysis guide

Document:	Author:	Date:
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	
Q2.1: For dimension **x**, what goals or findings are stated in this document?		
Q2.2: What strategies, rules or instruments are proposed to meet these goals?		
Q2.3: What conclusion can be condensed on this dimension for this document?		
Q3: Are there any other remarks about the nature of this document?		

Stedenbouwkundig Plan Suikerzijde Noordzijde

(Gemeente Groningen, 2020a)Document: Stedenbouwkundig Plan Suikerzijde Noordzijde (excluding appendices)	Author: Gemeente Groningen	Date: March 2020
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	X X X X X X X
Q2.1: For dimension **housing**, what goals or findings are stated in this document?	"…750 houses in combination with other functions." – p. 50	
Q2.2: What strategies, rules or instruments are proposed to meet these goals?	No concrete strategies, rules or instruments are proposed in this document.	
Q2.3: What conclusion can be condensed on this dimension for this document?	Housing will be combined with other functions. 750 houses will be built in Suikerzijde Noord.	
Q3.1: For dimension **water**, what goals or findings are stated in this document?	• There will be sufficient public space allocated to the collection, retention, and discharge of heavy rainfall. • The existing 'Hoendiep' channel will be incorporated in the neighbourhood • The ambition is to have a climate resilient urban space • Water will be incorporated in the envisioned local park, incorporation other functions such as ecology, experiencing the public space and recreation. • Opportunities for floating housing are investigated.	

	• Water is used as a natural means of cooling the neighbourhood.
Q3.2: What strategies, rules or instruments are proposed to meet these goals?	• 'Watervisie Groningen' or watervision Groningen (2017) offers a spatial-economic perspective into the use of water in the city of Groningen • Water is integrated into the spatial design of the neighbourhood.
Q3.3: What conclusion can be condensed on this dimension for this document?	Water is addressed in the sense of climate adaptation. Firstly, collection, retention and discharge of heavy rainfall is addressed. Secondly, water is used as a means of countering urban heating effects. Furthermore, water is used to offer ecology and recreation space within the neighbourhood.
Q4.1: For dimension **community**, what goals or findings are stated in this document?	• De Suikerzijde becomes a neighbourhood that invites to meet and attach the western part of the city with each other. • A central location for a building with a public function and a meeting point.
Q4.2: What strategies, rules or instruments are proposed to meet these goals?	• A 'pioneers building' which, as a public building, will offer many different public functions. • By design the neighbourhood gives residents and visitors the possibility to engage with one another.
Q4.3: What conclusion can be condensed on this dimension for this document?	The main ambition or tool that will be used to improve a sense of community will be the design of the neighbourhood (mixed functions and room for interactions between residents). The pioneers building is proposed as a central location to provide public services.
Q5.1: For dimension **mobility** what goals or findings are stated in this document?	• The mitigation of barriers and the closed of character of the 'island in the city'. • Connection with the inner city, Hoogkerk (a nearby small town), and the suburbs • Prioritise slow travelmodes and public transport.

Q5.2: What strategies, rules or instruments are proposed to meet these goals?	• Development of superb cycling infrastructure. • A hub for high quality public transport, ideally with a new train station • Discouraging cars and seeking new forms of mobility by: where possible a maximum speed of 30 km/h; Short and paid parking.
Q5.3: What conclusion can be condensed on this dimension for this document?	A comprehensive strategy is in place to improve mobility altogether. Mostly focussed on non-car-oriented traffic.
Q6.1: For dimension **energy** what goals or findings are stated in this document?	• As developments in the energy transition are quick, regulations in building norms are continually developing as well. • Decisions follow the municipalities ambition to be gas-free and CO2-neutral by 2035.
Q6.2: What strategies, rules or instruments are proposed to meet these goals?	• Buildings are not connected to natural gas infrastructure • Use is being made of thermal heating systems (surface water, solar heat and residual heat). Also called 'warmte-koude-opslag' or heat and cooling storage. • Room is left (infrastructure wise) for experimenting with new developments • A special focus for solar electricity in the building of roofs, in combination with green roofs. • Public space electricity consumers will be as efficient as possible. • All-electric buildings; buildings facilitate their own electric supply
Q6.3: What conclusion can be condensed on this dimension for this document?	This document leaves concrete energy questions open for possible developments, while offering ambitious goals. The municipality wants to achieve these goals by: not connecting new buildings to the natural gas infrastructure, emphasising on thermal heating systems ('Warmte-koude opslag' or WKO systems), emphasising on solar power on roofs in combination with green roofs, making public space electricity consumers as

	efficient as possible, and having buildings facilitate their own electric power supply
Q7.1: For dimension **freshwater withdrawals** what goals or findings are stated in this document?	Water is consumed in a sustainable manner and its source recovered as well.
Q7.2: What strategies, rules or instruments are proposed to meet these goals?	No concrete strategy or rules are in place in this document.
Q7.3: What conclusion can be condensed on this dimension for this document?	Although a goal is given that water will be won in a sustainable manner, no strategy, rules, or instruments are mentioned in this document.
Q8.1: For dimension **biodiversity and land conversion** what goals or findings are stated in this document?	• "The municipality of Groningen wants to work on sustainability in the public space and infrastructure. Therefore, we are working on a 'Generiek Ambitieweb' (generic ambitionweb)." – p. 10 • Biodiversity is supported and strengthened • The water bat and eared Fuut need a compensation area for the loss of their habitat
Q8.2: What strategies, rules or instruments are proposed to meet these goals?	• Green spaces and parks • Green banks on along the Hoendiep (see picture p. 57) • A minimum of 16 m2 of public green areas per housing unit • A landscape zone in the northern part of the neighbourhood • Compensation areas for the loss of habitat for the water bat and eared Fuut.
Q8.3: What conclusion can be condensed on this dimension for this document?	In general ecology, biodiversity and land use are mentioned. However, concrete measures are limited in this document
Q9: Are there any other remarks about the nature of this document?	This document offers a broad depiction of the challenges of all mentioned dimensions. However, it offers limited concrete locations, rules, strategies, or instruments to address these ambitions. Partly this is done to keep the plans open to changes and innovations (for example in the energy domain.

	Furthermore, a high emphasis is on combining dimensions (such as using buildings roofs as mini solar parks).

Milieueffectenrapport Hoofdrapport

Document: Milieu Effecten Rapport Hoofdrapport	Author: Sweco	Date: 06-03-2020
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	X X X X X X X
Q2.1: For dimension **housing**, what goals or findings are stated in this document?	• 750 houses with an outlook towards more (of latest 1.900) • Combined use for living and working • Combined use for living and recreation	
Q2.2: What strategies, rules or instruments are proposed to meet these goals?	• The building areas have sufficient space to give room for inner areas such as squares and public gardens • The areas give flexibility for different uses, also on the long term • Minimum percentages for social housing and more houses for mid-income households • Mixed houses: city houses, freestanding houses, collective blocks and high rises.	
Q2.3: What conclusion can be condensed on this dimension for this document?	A special care has been taken to leave some areas open for future functions. Combination with other dimensions have been considered. Also, it is mentioned that mixes in type of houses stimulate the social cohesion of the area.	
Q3.1: For dimension **water**, what goals or findings are stated in this document?	Being climate resilient in: drought, heat stress, water nuisance and flooding	
Q3.2: What strategies, rules or instruments	In terms of heatstress the Suikerzijde Noord is sufficient in terms of green and water. Drought is not deemed an issue as the groundwater	

are proposed to meet these goals?	is not expected to decrease as a results of climate change. In the expected outcomes no water nuisance is expected in Suikerzijde Noord in heavy rains. Flooding from sea: if primary dikes break (i.e. sea dikes) the flooding height is estimated to be 2 meters. Flooding from channels: if regional dikes break, the Suikerzijde Noord will be protected by the railway.
Q3.3: What conclusion can be condensed on this dimension for this document?	Sufficient safe water for consumption is not mentioned, as this is likely not deemed an issue on this scale of development. In terms of climate resilience, a thorough analysis is made, in which no scenario indicates a failure of water management.
Q4.1: For dimension **connectivity**, what goals or findings are stated in this document?	• Connectivity in the form of social contacts • Connectivity with green and 'blue' areas • Connectivity in terms of mobility (see mobility)
Q4.2: What strategies, rules or instruments are proposed to meet these goals?	• By mixed living environments the social contacts are stimulated, overlap with housing. • Compact city principals increase engagement in terms of work and living environments. • Development of a strong green-blue network throughout the neighbourhood. • Nearby sporting facilities, much focus on inviting streets
Q4.3: What conclusion can be condensed on this dimension for this document?	Connectivity is considered in terms of natural 'green-blue' networks and corridors, social engagement, and mobility (physical connection to the city and within the neighbourhood)
Q6.1: For dimension **energy** what goals or findings are stated in this document?	The municipality wants to adjust for the energy transition
Q6.2: What strategies, rules or instruments are proposed to meet these goals?	• The municipality wants to make use of development of thermal storage systems (warmte koude opslag, WKO). • Energy supply is yet to be determined as of the date of publication of this document.

Q6.3: What conclusion can be condensed on this dimension for this document?	Knowing the different alternatives this document rates the effects in terms of energy transition as neutral/lightly positive. Not enough is known to fully understand the effects for energy during the time of publication of this document.
Q7.1: For dimension **mobility** what goals or findings are stated in this document?	De Suikerzijde has as goal to achieve a 'slow-traffic' friendly neighbourhood. While trying to avoid cars, the neighbourhood still needs to be reachable.
Q7.2: What strategies, rules or instruments are proposed to meet these goals?	• The province and municipality have several strategies in place to achieve these goals; some of these points are: the cyclist first, a coherent cycling network, room for the bike, bike-parking and the story of Groningen as an cycling city. • Investments are made in public transportation with surround neighbourhoods and the region
Q7.3: What conclusion can be condensed on this dimension for this document?	The MER concludes that the alternatives are very positive for 'slow-traffic' and public transportation mobility. However, for cars the mobility plans are slightly less positive.
Q8.1: For dimension **air pollution** what goals or findings are stated in this document?	The goals are in line with norms for air quality: Stof | Grenswaarde NO_2 | 40 microgram per m³ als jaargemiddelde concentratie 200 microgram per m³ als uurgemiddelde concentratie, waarbij geldt dat deze maximaal 18 maal per kalenderjaar mag worden overschreden PM_{10} | 40 microgram per m³ als jaargemiddelde concentratie 50 microgram per m³ als vierentwintig-uurgemiddelde concentratie, waarbij geldt dat deze maximaal 35 maal per kalenderjaar mag worden overschreden $PM_{2.5}$ | 25 microgram per m³ als jaargemiddelde concentratie
Q8.2: What strategies, rules or instruments are proposed to meet these goals?	The MER indicates no adverse effects during the construction phase. The MER indicates that the air quality, while decreasing slightly, will remain far below limits.
Q8.3: What conclusion can be condensed on this dimension for this document?	According to the MER limits are not reached and while ofcourse affecting the airquality, this is not a critical dimension.
Q9.1: For dimension **freshwater withdrawals** what	Maintain water quantity and quality

goals or findings are stated in this document?	
Q9.2: What strategies, rules or instruments are proposed to meet these goals?	On a water authority level water quantity and quality is maintained. Sufficient safe water for consumption is not deemed a problem in terms of quantity or quality
Q9.3: What conclusion can be condensed on this dimension for this document?	With current plans, the MER indicates that there are no large relevant issues going forward.
Q10.1: For dimension **biodiversity and land conversion** what goals or findings are stated in this document?	Resilient, future-proof, clean, varied and at the same time livable nature (omgevingsvisie provincie Groningen 2016-2020). Protection of surrounding Natura 2000-areas such as leekstermeergebied, zuidlaardermeergebied and the Drentse Aa-gebied
Q10.2: What strategies, rules or instruments are proposed to meet these goals?	Groene pepers 2009, a structurevision for green and blue sustainability ambitions. Maintenance of the quality of city nature through the urban ecological structure (Stedelijke Ecologische Structuur, SES)
Q10.3: What conclusion can be condensed on this dimension for this document?	For the Suikerzijde Noord the protection of nature is described as neutral towards positive. However, in terms of species protection, the MER reports a negative effect.
Q11: Are there any other remarks about the nature of this document?	The MER is made in 2020, two amendments are brought out since, which are analysed separately.

Milieueffectenrapport (MER) Amendment 1

Document: Milieueffectenrapport (MER) amendment 1	Author: Sweco	Date: 20-10-2020
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	X X X X X
Q2.1: For dimension **Housing**, what goals or findings are stated in this document?	• To capture the large demand for housing • Doing so in a compact city manner. • A green-urban and central-city atmosphere • A mixed building typology	
Q2.2: What strategies, rules or instruments are proposed to meet these goals?	• A maximum of 5000 houses with a minimum of 2500 houses on this area will provide enough density for a compact city while remaining green and urban • Active policies for minimum percentages for social housing and more middle class housing. • Variety of socio-demographic groups to facilitate mixed living environments.	
Q2.3: What conclusion can be condensed on this dimension for this document?	The municipality finds the strategies in place sufficient to fullfill the Next City vision of the municipality	
Q3.1: For dimension **Community**, what goals or findings are stated in this document?	• Enough programming for living, working, learning and recreation • Provisions for sport and culture on scale with the specific needs of the neighbourhood. • Liveability and connection is a central theme	

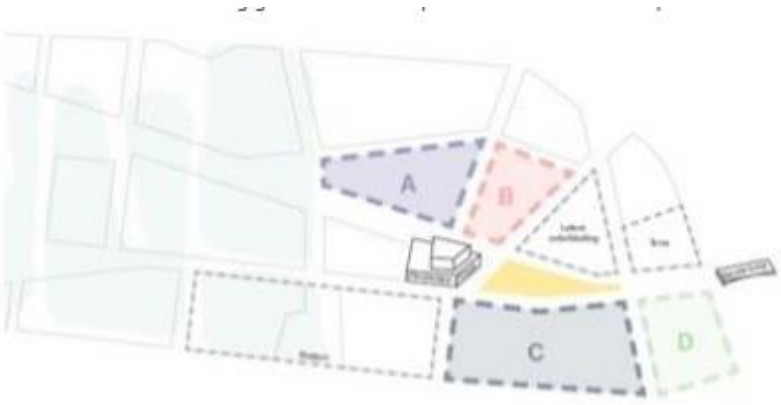
Q3.2: What strategies, rules or instruments are proposed to meet these goals?	• A diverse environment with a variety of public provisions. • Schools, terraces, shopping facilities and sport and other cultural facilities. • The Pioneersbuilding facilitates a place for meeting and other functions • The design of the public spaces invites for meeting, plating and movement
Q3.3: What conclusion can be condensed on this dimension for this document?	• The author concludes that in the plans of the Suikerzijde there is sufficient and a varied enough programming of activities. • This in turn will facilitate an environment with increased social cohesion.
Q4.1: For dimension **Energy**, what goals or findings are stated in this document?	• Energy neutrality in building-bound energy • The energy demand for electrical vehicles and user-bound demand are not considered in this document • Natural gas free • CO2 neutral
Q4.2: What strategies, rules or instruments are proposed to meet these goals?	• Indicative Alternatives are proposed for the energy supply. • Variants are proposed such as energy neutral, energy-supplying. • Solar panels are highly regarded in the document
Q4.3: What conclusion can be condensed on this dimension for this document?	The variants of energy supplying and energy supplying plus temporary production (excluding suikerzijde Noord) are regarded to be the best effect. The difference with the main MER is the investigation into possibilities of energy surpluses from the Suikerzijde.
Q5.1: For dimension **Mobility**, what goals or findings are stated in this document?	The municipality wants the Suikerzijde to be constructed around the Transport Oriented Development theorem. Furthermore, it aims for sustainable mobility.
Q5.2: What strategies, rules or instruments are proposed to meet these goals?	By developing a trainstation with mobility hub, the effects are in line with the goals of the municipality.

Q5.3: What conclusion can be condensed on this dimension for this document?	For the Suikerzijde as a whole, the mobility would be considerable beneficial for all mobility excluding motorised vehicles. The Suikerzijde Noord in particular, would benefit of such developments.
Q6.1: For dimension **Biodiversity and land conversion**, what goals or findings are stated in this document?	• Strengthening greenery • Climate adaptation • Circularity in resources
Q6.2: What strategies, rules or instruments are proposed to meet these goals?	• Compensation areas for birds and other animals. (so-called SES) • Connection between stadspark and westpark • The banks of the Hoendiep is a fully public space with green and nature friendly banks. • Suikerzijde Noord provides in climate adaptation in the form of green-blue infrastructure (such as wadi's) to deal with peak rain discharges and heatwaves.
Q6.3: What conclusion can be condensed on this dimension for this document?	In the amendment, this dimension is similarly dealt with.
Q7: Are there any other remarks about the nature of this document?	This document is an amendment on the previous MER. It is the precursor for any decision made by the municipality's council, and some questions were still unanswered. The largest question rises in the application of the 'Next City' vision of the municipality in the plans, that is the emphasis of this report.

Milieueffectenrapport (MER) Amendment 2

Document: Milieueffectenrapport (MER) amendment 2	Author: Sweco	Date: 26-03-2021
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	X X X
Q2.1: For dimension **Housing**, what goals or findings are stated in this document?	Two scenarios are conducted in this environmental assessment: the high-density scenario ('hoogstedelijk') and the spacious design scenario ('ruim opgezet'). In the first phase the municipality wants to create 750 houses in the first building fields A, B, C and D (see excerpt in Q5).	
Q2.2: What strategies, rules or instruments are proposed to meet these goals?	Not applicable	
Q2.3: What conclusion can be condensed on this dimension for this document?	In the Suikerzijde Noord, housing is open for interpretation, and it depends on what decisionmakers want in terms of density for phase 2. This document merely presents its findings on the effects each scenario has. What is clear is that 750 houses are definitely being build in the building fields A, B, C and D, which is named phase 1 from here on.	
Q3.1: For dimension **Mobility**, what goals or findings are stated in this document?	**Phase 1:** High density scenario: Relatively high density, this is beneficial for development opportunities for a train station and PT hub. Also beneficial for the replacement of car trips by train and bus-trips. The distances are	

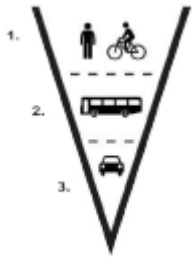
	short internally, making walking and cycling the fastest mode of transport. Spacious design: Relatively low densities, this is less beneficial for development opportunities of a trainstation and PT hub. Also less beneficial for replacement trips of cars by trains and busses. The distances are relatively larger, making walking and cycling sometime less attractive. Phase 2 has no significant differences between the different scenarios. Furthermore, an analysis is conducted to potential parking nuisance. Within the Suikerzijde (as a whole), nuisance is not expected due to policies in place that limit parking in the public space. Collective parking initiatives are named as a tool to minimize nuisance risks.
Q3.2: What strategies, rules or instruments are proposed to meet these goals?	Not applicable
Q3.3: What conclusion can be condensed on this dimension for this document?	For phase 1 the high density scenario offers better opportunities for sustainable mobility than the spacious design. Parking nuisance is prevented with parking policies such as collective parking initiatives.
Q4.1: For dimension **Energy**, what goals or findings are stated in this document?	In all scenarios, energy neutrality is theoretically viable. Both phases are treated equally in the document. High density scenario: Compact building offers less roof area for solar panels, while creating more space on the walls of buildings. The high density offers beneficial conditions for so-called collective WKO-systems (Ground-coupled heat exchanger).

	Spacious design: For solar panels the opposite presents itself. Due to the low density collective WKO-systems are relatively less viable.
Q4.2: What strategies, rules or instruments are proposed to meet these goals?	Not applicable
Q4.3: What conclusion can be condensed on this dimension for this document?	Both phases offer similar effects for the two scenarios. - Solar panels in the high density scenario are better on the walls than the roofs, while the spacious alternative offers the opposite. - The WKO-systems are better equipped for the high density scenario.
Q5: Are there any other remarks about the nature of this document?	The full effect report of course offers a more expansive view on the effects on almost all dimensions. In this document the *differences* between two scenarios are analysed for its effects in Suikerzijde Noord. The first is a high-density scenario, and the second is a theoretical spacious design of the neighbourhood. The focus is on the difference between these scenarios on the phasing and its effect on the environment. The first phase focusses on the development fields 'A', 'B', 'C' and 'D' (see below excerpt), while the second phase is on the North-western side of the Suikerzijde. 

Structuurvisie de Suikerzijde

Document: Structuurvisie De Suikerzijde Juni 2021	Author: Gemeente Groningen	Date: 21-06-2021
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	X X X X X X X
Q2.1: For dimension **Housing**, what goals or findings are stated in this document?	A diverse housing structure with similarities with the centre	
Q2.2: What strategies, rules or instruments are proposed to meet these goals?	An integration of different functions into one area.	
Q2.3: What conclusion can be condensed on this dimension for this document?	This document offers limited insights into how exactly the dimension housing is translated in practice	
Q3.1: For dimension **Water**, what goals or findings are stated in this document?	• Core qualities, of which water is one, will be part of the area. • Room is made for new forms of water provisioning. • Water discharging should be futureproof. • The water vision has as an ambition to present Groningen as a water rich city. The water should be accessible and enjoyable to citizens.	
Q3.2: What strategies, rules or instruments are proposed to meet these goals?	• Incorporating green-blue infrastructure in the plans is deemed vital for cooling and countering urban island heat effects. • 'nature-inclusive' building is mentioned as one strategy to achieve the goals and vision.	

	• The historical banks are used to make the water publicly accessible.
Q3.3: What conclusion can be condensed on this dimension for this document?	Water is used as a quality and way to achieve broader goals in the quality of the area.
Q4.1: For dimension **Connectivity**, what goals or findings are stated in this document?	• The perspective for connectivity is a development axis starting from the centre of Groningen towards the heart of Suikerzijde. • Both physically and socially Suikerzijde will be intertwined with surrounding areas. By offering good infrastructure as well as programming • 'The former suikerunie terrain formed a white, inaccessible stain on the map. We want to use the area as a link in the fabric of city, village, neighbourhoods, and strokes.' – p. 25
Q4.2: What strategies, rules or instruments are proposed to meet these goals?	• Using compact city principles and mixed functions the social connectivity is increased. • Good programming of the area in the form of functions such as recreation, nature and work will increase the social cohesion of the area.
Q4.3: What conclusion can be condensed on this dimension for this document?	By a mix of sustainable mobility and high-density urban principles, connectivity is increased in the physical sense of the word. Social connectivity follows from specific programming and quality of the public space.
Q5.1: For dimension **Community**, what goals or findings are stated in this document?	An eye for vulnerable people in society; everybody should be able to participate in society. An inclusive city with undivided neighbourhoods. The spatial and social domain should be connected.
Q5.2: What strategies, rules or instruments are proposed to meet these goals?	A varied and multiplicity of urban life. Ranging from spatious and green to inner-city life. Health and wellbeing are named as important factors to consider.

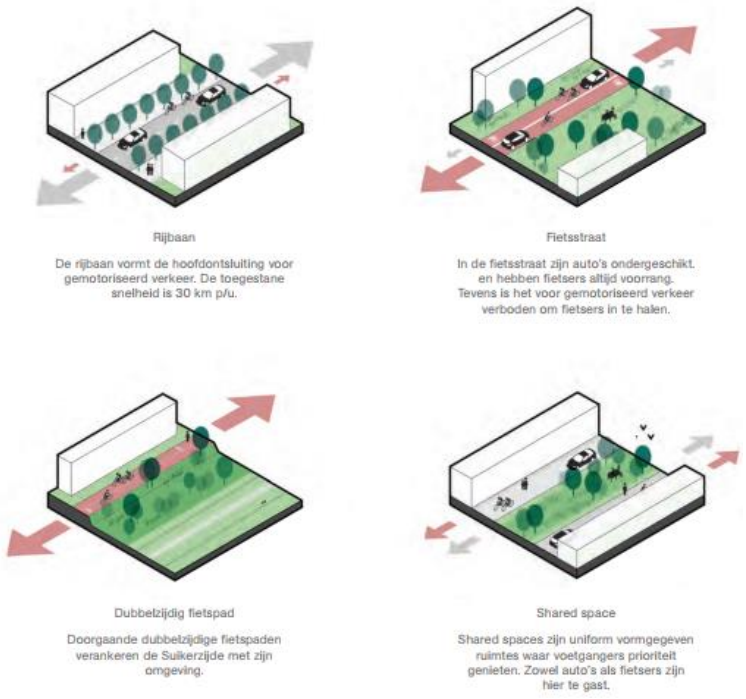
Q5.3: What conclusion can be condensed on this dimension for this document?	Using variety in the street and health and wellbeing as cornerstones in the planning of Suikerzijde, the goals are aimed to be achieved. However, no concrete solutions are offered.
Q6.1: For dimension **Energy**, what goals or findings are stated in this document?	Fully cooperate in the energy transition. Taking into consideration the innovations that are being developed before actually building houses, the municipality does not have a binding vision. Choices that are made are in line with the municipal ambition to be gas free and CO2 neutral by 2035.
Q6.2: What strategies, rules or instruments are proposed to meet these goals?	All new buildings are gas-free and energy neutral. In spatial sense three layers are divined on which energy amenities are worked out: Building level, neighbourhood level, main-structural level (municipality and regional wide view). Reference is made to scenarios in the MER.
Q6.3: What conclusion can be condensed on this dimension for this document?	The vision is to follow municipal ambitions of being free of gas and being energy neutral. This is done partly by having all new buildings conform this ambition.
Q7.1: For dimension **Mobility**, what goals or findings are stated in this document?	Sustainable mobility is the ambition of the municipality. This means that the to-be-built district is walkable, cyclable while remaining accessible.
Q7.2: What strategies, rules or instruments are proposed to meet these goals?	The largest strategy is that of prioritising slow modes before PT, and PT before the car (see figure below). This is further explained in the MER report. This strategy will be incorporated in the urban design of the district.  Internally mobility will be mainly 'slow modes' such as walking and cycling, externally by focussing on well-connected cycling paths, walkable city principles and well-connected PT.

Q7.3: What conclusion can be condensed on this dimension for this document?	Mobility is organized based on first 'slow modes', secondly PT and lastly the car. The urban design of the district creates the background on which this is possible.
Q8.1: For dimension **Biodiversity and land conversion**, what goals or findings are stated in this document?	• Making use of core qualities of the area such as: the landscape, the water, industrial heritage, and quays • Biodiversity is to be promoted by accentuating green in the fabric of the city.
Q8.2: What strategies, rules or instruments are proposed to meet these goals?	• In terms of land conversion, the municipality is taking into account the heritage of the area (prehistorically, medieval and the urbanized layer) in order to inspire further development of plans. • Creation of green routes and attention for ecology.
Q8.3: What conclusion can be condensed on this dimension for this document?	Attention is given to the biodiversity and land conversion dimension. However, as this document offers a vision, much is referred to the MER report.
Q9: Are there any other remarks about the nature of this document?	In this document the Next City vision of the municipality is used at the basis of this document. This model offers the handles for the municipality for sustainable growing. In this document in general the vision for Suikerzijde is described. Many similarities are found with the Stedenbouwkundig Plan Noord, however on a more abstract level.

Ontwerp openbare ruimte De Suikerzijde Noordoost

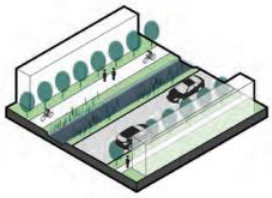
Document: Ontwerp openbare ruimte De Suikerzijde Noordoost	Author: De Suikerzijde	Date: 02-03-21
Q1: What dimension(s) does this document address?	Housing Water Connectivity Community Energy Mobility Air pollution Freshwater withdrawals Biodiversity and land conversion	 X X X X X
Q2.1: For dimension **Water**, what goals or findings are stated in this document?	• Optimal drainage to the Hoendiep. • Functioning water management.	
Q2.2: What strategies, rules or instruments are proposed to meet these goals?	• Multiplicity of use of wadi's. • Water from the wadi's is drained to the Hoendiep. • Banks with nature friendly water retention offer room for high water. • Due to the connection of wadi's to the Hoendiep, creation of ecological banks and extra water retention areas it is estimated that 60% of the existing trees will remain.	
Q2.3: What conclusion can be condensed on this dimension for this document?	Optimal drainage to the Hoendiep and functioning water management is achieved in the public space by means of wadi's, nature friendly water retaining banks and by removing trees to optimize water connections to the Hoendiep.	
Q3.1: For dimension **Connectivity**, what goals or findings are stated in this document?	Connecting the Northern Suikerzijde with its surrounding neighbourhoods.	
Q3.2: What strategies, rules or instruments are	In physical sense by a well-developed mobility strategy (see mobility)	

proposed to meet these goals?	
Q3.3: What conclusion can be condensed on this dimension for this document?	Connectivity in the public space by design is achieved through mostly physical mobility measures. This will be elaborated extensively in mobility.
Q4.1: For dimension **Mobility**, what goals or findings are stated in this document?	• The area is well accessible for all modes of transport. • The public space will not be dominated by car traffic and parking. • A healthy built environment is one where people move in a healthy manner: By foot, bike, or PT.
Q4.2: What strategies, rules or instruments are proposed to meet these goals?	• New cycling routes • High quality busroutes • A new station • New bridges and roads • Royal profiles offer space for healthy modes of transport such as foot, bike, or PT. Four concrete mobility structures are proposed: • Motorized lane: motorized lane with 30 km/h max • Cycling lane: cars must give way to cyclists, overtaking cyclists is prohibited • Double cycling lane • Shared space (pedestrians have priority)

	 *the different mobility structures, from top left to bottom right; motorized lane with 30 km/h max; bicycle lane (cars have to give way to cyclists, overtaking cyclists is prohibited); double cycling lane; shared space (pedestrians have priority)* The area will be well accessible by above area rising slow-mode connections into the different neighbouring areas. Reference to 'stedenbouwkundig plan noordoost'
Q4.3: What conclusion can be condensed on this dimension for this document?	The area is to be well accessible to all modes of transport. However, walking, cycling and PT have priority. This is done by laying the foundation of accessibility, that is the infrastructure, in a royal way (i.e. spacious) with attention for the sustainable modes of transport. Concrete mobility structure scenarios are offered in fourfold. The emphasis is both on internal accessibility as well as to the outward neighbourhoods.
Q5.1: For dimension **Community**, what goals or findings are stated in this document?	Suikerzijde Noord is to be mostly part of lively and green public space that invites to meet and move. Social sustainability increases wellbeing of the community
Q5.2: What strategies, rules or instruments are	By creating an accessible and open public space, which is not car-centred, a place is created that invites to meet and move.

proposed to meet these goals?	Social sustainability is achieved by walking, cycling, playing, active leisure, meeting, and green experience. The green street profiles offer, among others, a place to meet and invite to naturally play.
Q5.3: What conclusion can be condensed on this dimension for this document?	This document concludes that by design the public space will invite the community to 'meet and move' and promotes 'social sustainability'. However, it is not clear how exactly.
Q6.1: For dimension **Biodiversity and land conversion**, what goals or findings are stated in this document?	• The development of a green city district. • A diverse neighbourhood where a rich and large mix of vegetation improves the biodiversity and quality of life. • A symbiosis with the community
Q6.2: What strategies, rules or instruments are proposed to meet these goals?	De Suikerzijde achieves this by a robust green structure, in the form of a network of: • 'Singels' • Green streets • A park • Green courtyards • Robust green zone along the fringes of the planarea Six types of green structures are proposed: • Main axis': important connections for mobility, greenery is linear • Green residential streets: local traffic and direct residents. Set up wide. • Linear greenzone: Long green fringes, connect different residential streets or other locations to each other. • Urban park (named the Dikepark): A green 'oasis' of de Suikerzijde Noord. Room for sports, (water)ecology and recreation.

- Squares: Places for public and commercial life to thrive. Local economy is stimulated by high quality of visitation and livelihood.
- Specialities: places where relicts of the current dike landscape can be playfully used in the future landscape.

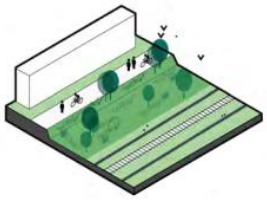


Hoofdassen

Hoofdassen zijn belangrijke verbindingen voor auto, fiets en voetganger. Groen dat hieraan gekoppeld is is vaak lineair van aard en structurerend voor de verbinding.

Groene woonstraten

Groene woonstraten zijn straten gericht op zeer lokaal verkeer en de directe bewoners. Ze zijn wijds van opzet en geven ruimte voor ontmoeten, spelen en ontdekken.

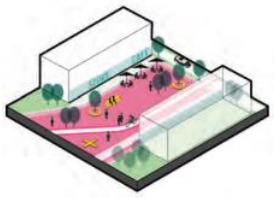


Lineaire groenzone

Lineaire groenzones vormen lange, groene randen aan het plan en verbinden zo verschillende woonstraten of andere plekken aan elkaar.

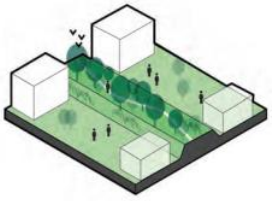
Dijkenpark

Het Dijkenpark vormt de groene oase van de Suikerzijde Noord, waar er ruimte is voor sport, (water)ecologie en recreatie.



Pleinen

De pleinen vormen de levensaders voor het publiek en commercieel leven in de Suikerzijde. Lokale economie wordt gestimuleerd door een hoge verblijfskwaliteit en veel reuring.



Verbijzonderingen

Verbijzonderingen zijn een relict van het huidige dijkenlandschap met haar vloeivelden. Bijzondere dijkstructuren kunnen worden ingezet als speelelementen of landschappelijke structuur.

The specialities come from the ambition to keep the current landscape structures in several places. Specifically, the old dike bodies of the floodplains, old bunkers in green, and existing tree strongholds.

Streets with wadi's are placed differentiated in two forms: symmetrical (with the wadi in the centre of the profile), and asymmetrical (with the wadi on one side and extra wide). This way other use and more biodiversity is anticipated.

	The banks of the Hoendiep are part of the linair greenzone. Liniair greenzone, the fringes of the planarea consists of: • Diversity of tree- and plantspecies • Variety of open and closed • Variety of nature friendly banks and existing dikes • A more closed walking paths versus open spaces to sit in the grass and 'fantastic' climbing trees. • Biodiversity is strengthen by introducing high grasses, herbs and flowers that attract insects, and small mammals.
Q6.3: What conclusion can be condensed on this dimension for this document?	Biodiversity and land conversion is addressed in a way that, according to this document, complements dimensions such as water, community, and other dimensions. The dimension in addressed specifically in twofold. In the urban landscape in the form of enough greenery in the streets, and in the fringes and parks in the form of taking the overhand. Different types of green structures are introduced.
Q7: Are there any other remarks about the nature of this document?	In the public space plan the design of the public space is shown and described. Special attention is given to including existing robust greenery, monumental and potentially monumental trees. The different streets are explained and shown using cross-sections. As the focus is on the public space, the fulfilling of the building fields is left outside this documents scope. Compared to other documents this document offers concrete insights in the final plans, in terms of design and lay-out of the public space.

Appendix B: Statements Q-sorting

Synergy statements (in Dutch)

	Synergiën	Link
A	De beoogde woningen hebben een positief effect op de kwaliteit van de lokale gemeenschap (b.v. sociale cohesie onder ondernemers en bewoners).	SYN Housing-Community
B	De beoogde woningen zorgen voor een verbeterde connectiviteit (niet mobiliteit gerelateerd).	SYN Housing-Connectivity
C	Een verhoogde mobiliteit gaan hand in hand met de kwaliteit van de beoogde woningen.	SYN Housing-Mobility
D	Er zijn koppelkansen in de beoogde woningen en de energievoorziening	SYN Housing-Energy
E	De beoogde woningen helpen de lokale waterhuishouding.	SYN Housing-Water
F	Een verbetering in connectiviteit helpt de kwaliteit van de (toekomstige) lokale gemeenschap.	SYN Connectivity-Community
G	De sociale cohesie van de lokale gemeenschap (bijv. onder toekomstige ondernemers, bewoners) wordt verbeterd door een verbetering in mobiliteit	SYN Community-Mobility
H	De gemaakte keuzes voor de energievoorziening verbeteren de kwaliteit van de lokale gemeenschap	SYN Community-Energy
I	Er zijn win-win situaties benut tussen de toekomstige lokale gemeenschap en de lokale waterhuishouding	SYN Water-Community
J	De lokale connectiviteit gaat goed samen met de verbetering van de lokale mobiliteit.	SYN Connectivity-Mobility
K	Er zijn win-win situaties tussen energievoorziening en connectiviteit	SYN Connectivity-Energy
L	Er zijn positieve gevolgen voor de energievoorziening door de beoogde vormen van mobiliteit of vice versa.	SYN Energy-Mobility

M	U ziet koppelkansen tussen de gewenste energievoorziening en de lokale waterhuishouding.	SYN Energy-Water
N	Het bouwen van nieuwe woningen helpt de lokale biodiversiteit.	SYN Housing-Biodiversity & Land Conversion
O	De beoogde vormen en volume van mobiliteit zorgen voor positieve gevolgen voor de lokale biodiversiteit.	SYN Mobility- Biodiversity & Land Conversion
P	De leefbaarheid voor de lokale gemeenschap (bijv. ondernemers, bewoners) helpt de biodiversiteit en vice versa.	SYN Community-Biodiversity & Land Conversion
Q	De luchtkwaliteit verbeterd, op korte of lange termijn, door de beoogde woningen (zowel het bouwen als het in gebruik nemen van).	SYN Housing-Air pollution
R	De luchtkwaliteit verbeterd, op korte of lange termijn, door de verbetering van de lokale mobiliteit.	SYN Mobility- Air pollution
S	De beoogde energievoorziening draagt bij aan een verbetering van de luchtkwaliteit	SYN Energy-Air pollution
T	Er zijn voordelen voor de lokale waterhuishouding door de vergrote vraag naar water.	SYN Water-Freshwater withdrawals

Trade-off statements (in Dutch)

	Trade-offs	Link
A	De beoogde woningen hebben een negatief effect op de kwaliteit van de lokale gemeenschap (b.v. ondernemers en bewoners).	TO Housing-Community
B	De woningen zorgen voor problemen omtrent connectiviteit (niet mobiliteit gerelateerd).	TO Housing-Connectivity
C	Een verhoogde mobiliteit gaat ten koste van de kwaliteit van de beoogde woningen.	TO Housing-Mobiliteit
D	De beoogde woningen zitten energieopwekking in de weg.	TO Housing-Energy
E	De beoogde woningen vormen een probleem voor de lokale waterhuishouding.	TO Housing-Water
F	Een verbetering in connectiviteit gaat ten koste van de kwaliteit van de (toekomstige) lokale gemeenschap.	TO Connectivity-Community
G	Er zijn compromissen tussen de sociale cohesie van de lokale gemeenschap (bijv. onder toekomstige ondernemers, bewoners) en mobiliteit	TO Community-Mobility
H	De kwaliteit van de toekomstige gemeenschap gaat ten koste van gemaakte keuzes voor de energievoorziening.	TO Community-Energy
I	Het schuurt tussen de toekomstige lokale gemeenschap en de lokale waterhuishouding.	TO Water-Community
J	De lokale connectiviteit gaat niet goed samen met de verbetering van de lokale mobiliteit.	TO Connectivity-Mobility
K	Er zijn compromissen tussen energievoorziening en connectiviteit	TO Connectivity-Energy
L	Er zijn nadelige gevolgen voor de energievoorzieing door de beoogde vormen van mobiliteit of vice versa.	TO Energy-Mobility

M	U ziet problemen tussen de gewenste energievoorziening en de lokale waterhuishouding.	TO Energy-Water
N	Het bouwen van nieuwe woningen gaat ten koste van de lokale biodiversiteit.	TO Housing-Biodiversity & Land Conversion
O	De beoogde vormen en volume van mobiliteit zorgen voor nadelige gevolgen voor de lokale biodiversiteit.	TO Mobility- Biodiversity & Land Conversion
P	Er zijn compromissen tussen de leefbaarheid voor de lokale gemeenschap (bijv. ondernemers, bewoners) en de biodiversiteit en landgebruik	TO Community-Biodiversity & Land Conversion
Q	De luchtkwaliteit verslechterd, op korte of lange termijn, door de beoogde woningen (zowel het bouwen als het in gebruik nemen van).	TO Housing-Air pollution
R	De luchtkwaliteit verslechterd, op korte of lange termijn, door de verbetering van de lokale mobiliteit.	TO Mobility- Air pollution
S	De beoogde energievoorziening draagt bij aan een verslechtering van de luchtkwaliteit	TO Energy-Air pollution
T	Er zijn nadelen voor de lokale waterhuishouding door de vergrote vraag naar water.	TO Water-Freshwater withdrawals

Appendix C: Interview Guide

Tools

- Voice recorder
- Consent form
- Pyramids
- Set of statements
- Foto Doughnut
- Interview guide
- Notepad and pen

Introduction

Welkom, en bedankt voor het willen meewerken aan mijn onderzoek over Doughnut Thinking in de context van stedelijke ontwikkelingen. Allereerst zal ik uitleggen aan u wat mijn onderzoek globaal inhoudt. Het doel is om bij te dragen aan onderzoek wat gericht is op het toepassen van het concept van Doughnut Economics van Kate Raworth, misschien klinkt u dat al bekend in de oren. De Gemeente Groningen heeft in haar visie ook een vorm van circulair denken opgenomen, maar dit concept gaat iets verder door de samenleving er ook bij te betrekken i.p.v. vooral te focussen op materiële circulariteit.
Het concept stelt als doel het welzijn van mensen binnen de perken van wat onze planeet kan bieden.

<FOTO DOUGHNUT>

Dit ideale wereldbeeld zou natuurlijk heel mooi zijn als het kan uitgewerkt worden in de echte wereld, maar dat vraagt om een toepasbaarheid slag. Daarom is dit onderzoek gericht om bij te dragen op het ontwikkelen van een toetsingsmanier om projecten zoals het Suikerzijde-project. Hierbij staat ten grondslag de interacties tussen verschillende 'dimensies', dat wil zeggen afzonderlijke aspecten zoals huisvesting, lokale ecologie en energievoorziening bijvoorbeeld.

Consent

Ik zou u er graag aan willen herinneren dat ik dit gesprek opneem voor onderzoeksdoeleinden. Voordat we verder gaan wil ik u dan ook vragen of u het hiermee eens bent en of ik de data mag gebruiken voor verdere analyse? Verder is dit natuurlijk vrijwillig, dat betekent dat u ook mag stoppen wanneer u dat wilt.

[START RECORDING]

Dit is interview (x) op (x). Met …

Warming up (getting to know, 5 min.)

Q1: Hoe zou u uw rol omschrijven binnen het planning process van Suikerzijde Noord?

Q2: En wat is uw impressie van het project in het algemeen?

Interactive part (10 minutes)

Explain Q-sorting process. offer the statements and the Q-grid and let participant start selecting the statements. Offer time and space while doing so to avoid biases. Take a picture of the outcome!

1. Introduce two pyramids and the two sets of statements.
2. *"Aan de hand van statements komen de interacties tussen verschillende dimensies van de doughnut economy (maar dan vertaalt naar lokale schaal) terug in dit gesprek. Hierbij maken we onderscheid tussen 'synergies' ofwel koppelkansen, en 'trade-offs' ofwel compromissen."*
3. Explain that the set of synergies is destined for the left one, and the trade-offs for the other one.
4. Explain that some statements might come across as overlapping or broad. This is done on purpose for further talking about it in the second part.
5. Explain that the statements are regarding the Suikerzijde Noord, and that they can take the statements as broadly as they want within the project (no right or wrong).
6. Take a picture of the outcomes, explain the following part: interviewing about the six most prevalent statements per synergy/trade-offs.

Second part: interviewing (30 minutes)

Explain that we will go further in depth in the most 'controverse' statements to the participants these are the 6 extremes of each pyramid. We have filtered the most important links, as it were. For each statement the following questions:

Q3: Waarom verkiest u deze statement boven de anderen?

Q3.1: Hoe ziet u dit terug in het Suikerzijde Noord project?

Q4: Wat weet u over deze koppelkans/compromis in de praktijk?

Q5: Wat vindt u daarvan?

Question deeper if necessary.

Closing

Het einde van dit interview is in zicht, ik heb nog een laatste vraag.

Q6: Zijn er nog specifieke vlakken die ik niet heb behandeld die u graag wilt bespreken?

Q7: Wie zou ik nog meer moeten spreken? Of zijn er documenten die wellicht interessant zijn?

Repeat protocol:

1 Anonymity

2 Transcript on factual incorrectness.

[Thank the respondent]

[END RECORDING]

Appendix D: Informed Consent Form

[Insert full name please]

Hereby consents to be a participant in the current research performed by Tarnim Hassan.

I have agreed to take part in the study entitled Doughnut Thinking in Spatial Planning: Assessing the 'Suikerzijde Noord' project (Groningen, the Netherlands) and I understand that my participation is entirely voluntary. I understand that my responses will be kept strictly confidential and anonymous. I have the option to withdraw from this study at any time, without penalty, and I also have the right to request that my responses will not be used.

The following points have been explained to me:

1. The goal of this study is to explore the possibilities of applying Doughnut Economics in practice. More specifically in the form of developing an assessment tool for local urban developments, in this case the Suikerzijde Noord.
2. Participation in this study should help advance our understanding of how different dimensions are addressed in the Suikerzijde Noord project, and possible perceived relations between them.
3. I shall be asked to answer question related to the points under 1 and 2.
4. My responses will be treated confidentially and my anonymity will be ensured. Hence, my responses cannot be identifiable and linked back to me as an individual.
5. The researcher will answer any questions I might have regarding this research, now or later in the course of the study.

Date: Signature researcher:

Date: Signature participant:

Appendix E: Original quotes in Dutch

1. Als je het parkeren nog omlaag schroeft en je zorgt voor goede duurzame alternatieven, dan is het volgens mij ook altijd prettiger wonen.
2. Juist door voorzieningen dichtbij te brengen creëer je nabijheid. Dat mensen dus ook niet in de auto hoeven te stappen omdat ze ver moeten rijden om uh hun boodschappen te doen.
3. …dus die mix van wonen en werken en rijk en arm dat hebben we in het begin al in het plan geladen. Juist met het idee dat het een gemeenschap wordt waar mensen elkaar gaan helpen.
4. Maar misschien is het wel andersom dat je als je daar een station bouwt, dat de kwaliteit van je woningen weer omhoog gaat. Ja.
5. Ik bedoel, als je niet kunt aarden in de wijk, dan heb je weer ben je weer geneigd om dat buiten de wijk te zoeken waardoor je geneigd bent om veel verplaatsingen buiten de wijk te maken waardoor we weer naar buiten en terug moeten.
6. met goeie fietsvoorzieningen, goeie OV voorzieningen en goeie voetgangers voorzieningen. Dan krijg je de mensen op straat en dan krijg je Jane Jacobs achtige dingen met uh met tuintjes en leefbare wijken en mensen die op straat zijn. En nou ja, die spelen in de straat van huis.
7. En een van de kern themas is dat het een verbindende wijk is en dat gaat niet alleen over wegen autos en dat soort dingen. Maar dat mensen ook met elkaar in verbinding komen. Met nadruk dus geen woonwijk zijn.
8. Dan kan je wel zeggen gaaf station en ook gave woonwijk. Maar als er een bus doorheen moet en die rijdt over allemaal drempels heen, dan is het niet comfortabel voor die bus om er overheen te rijden. […] Dus je moet een soort van optimale balans zoeken tussen een leefbare plek maken en toch een bus erdoorheen laten rijden.
9. Dus deels is het door de auto uit het straatbeeld zoveel mogelijk te krijgen zodat je zo veel meer kwaliteit hebt om te leven. Aan de andere kant de auto niet negeren.
10. Als je alleen maar ergens met de fiets kunt komen, dan kan een deel van de mensen er dus niet komen, want sommige mensen kunnen niet fietsen of lopen.
11. Dat [parkeergelegenheid] moet er ook voor zorgen dat het niet een wijk is waar je geen huis wil kopen. Want iemand die heeft een auto en die willen ergens wonen en die wil hem ergens kwijt.
12. Wij willen deze postzegel ook goed verbinden met de rest van het netwerk, maar de rest van het netwerk moet er niet te veel last van hebben.
13. In Groningen hebben veel mensen ondanks dat iedereen ongeveer op de fiets gaat toch nog voor een heel aantal andere bestemmingen een auto nodig
14. Kijk we hebben wel te maken met dat mensen nog steeds gewoon een auto hebben. We willen een ideale wereld creëren waarbij we denken van: hee, Die auto is er niet, maar die auto is d'r.

15. Als je het heel zwart wit maakt of je kiest tussen uh uh extra sociale huurwoningen of een energieneutrale woning. En deels is dat een politieke keuze. Van, waar stop ik m'n geld in?
16. Ik denk dat we half niet weten wat er ons te wachten staat, denk ik, als iedereen elektrisch gaat rijden.
17. De beoogde vormen en volume van mobiliteit zorgen voor positieve gevolgen voor de lokale biodiversiteit
18. Ja, eigenlijk kun je wel zeggen dat dat duurzame mobiliteit leidt tot minder. Uh klimaatverandering.
19. Nou, ik denk dat we een beter milieu creëren door de mobiliteit niet met de auto te doen.
20. Dat de mensen daar ook langs het water kan sporten en spelen en dat soort dingen. En hier krijgt de ecologie meer zo'n plek.
21. Je krijgt daar wat meer een rustige plek en ook een soort van corridor functie.
22. Je voegt gewoon iets toe, dus het zal altijd een verslechtering zijn [van het ecologisch domein]. Groei gaat nooit zonder.
23. Dus als je het hebt over de huidige biodiversiteit, dan ga je dat gewoon finaal vernietigen. dat gaat kapot zeg maar omdat nu liggen d'r vloeivelden en van die vloeivelden leven dieren of foerageren die, en dat gaat verdwijnen.
24. Het is geen weiland maar het zijn vloeivelden met bomen en dieren die de nodige aandacht vragen, dus de context is totaal anders.
25. De luchtkwaliteit is verslechterd en dat komt omdat je meer woningen aan een stad toevoegt en dat leidt tot meer gebruik van auto's, en van huizen ook meer luchtvervuiling.
26. Dat betekent dus dat je compacter hier gaat bouwen en hoger en minder leefbaar, minder leefbaar, ok en dus ook minder brede straat en minder ruimte voor…
27. Wat mij betreft doen we het maximale, maar waar de meeste discussie over gaat hoe je zo'n ambitie haalbaar maakt. En dat gaat uiteindelijk gewoon over geld.
28. Je kunt hele hoge ambities hebben en dan is het uiteindelijk ook wel de kunst om dat te vertalen en te zorgen dat dat ook gerealiseerd wordt en dat dat ook uh overeind blijft in de uiteindelijke uitwerking en met de financiële haalbaarheid vaak natuurlijk.
29. En iedereen is het erover eens dat een station gaaf is. En dan zeg ik ook maar hoeveel treinen per uur moeten er dan stoppen? En dan heb je weer een nieuw gesprek en dan kost dat handenvol geld.
30. Als iedereen sociale huurwoningen wil, dan zeg ik ook ja als we dat nodig hebben. Dan gaan we dat doen. Maar als ik het niet kan betalen, dan moet ik naar m'n opdrachtgever en zeggen van sorry jongen. Hoe dan?

31. Wat is eigenlijk eindbeeld waar we heen willen? En als je dan daar wat voor moet afzwakken omdat het te duur is, oké.
32. Als je geen bereikbaarheid hebt is je plek niet leefbaar, want dan kun je niet komen. Heb je te veel bereikbaarheid? Krijg je Amerikaanse steden.
33. Dat betekent dus dat je binnen de stedenbouwkundige visie die al is vastgesteld, misschien ook wel wat te laat bent aangehaakt of dat er bewust een andere keuze is gemaakt, waardoor je nu dus voor onze dilemma's komt te staan.
34. Ja, het zijn landelijke partijen natuurlijk niet alleen maar lokale partijen. Het zijn landelijke partijen en ProRail. Je sluit aan eigenlijk op het landelijke netwerk.
35. Deze [trade-off] ligt ook heel politiek gevoelig op dit moment hoor. En juridisch gevoelig. We hebben een gebied en daar zitten we bepaalde natuurwaarde. En die natuurwaarde die moeten verdwijnen omdat je anders geen woonwijk kunt maken.
36. Zij willen maar bouwen en bouwen, en ik ben het er mee eens dat het nodig is. Maar ze zien geen opties of het echt te integreren met de natuur.
37. Als de compensatievelden een success zijn, wat nog niet duidelijk is, dan duurt het alsnog tientallen jaren voordat het hetzelfde is of beter. Terwijl je het dubbele aan grond nodig hebt.

Appendix F: Code tree

Category	Theme	Code	Letter in assessment framework
Synergy	Social	SYN Housing-Community	A
		SYN Housing-Connectivity	B
		SYN Housing-Mobility	C
		SYN Housing-Energy	D
		SYN Housing-Water	E
		SYN Connectivity-Community	F
		SYN Community-Mobility	G
		SYN Community-Energy	H
		SYN Water-Community	I
		SYN Connectivity-Mobility	J
		SYN Connectivity-Energy	K
		SYN Energy-Mobility	L
		SYN Energy-Water	M
	Social on ecological	SYN Housing-Biodiversity & Land Conversion	N
		SYN Mobility-Biodiversity & Land Conversion	O
		SYN Community-Biodiversity & Land Conversion	P
		SYN Housing-Air pollution	Q
		SYN Mobility- Air pollution	R
		SYN Energy-Air pollution	S
		SYN Water-Freshwater withdrawals	T
Trade-off	Social domain	TRA Housing-Community	A
		TRA Housing-Connectivity	B
		TRA Housing-Mobility	C
		TRA Housing-Energy	D
		TRA Housing-Water	E
		TRA Connectivity-Community	F
		TRA Community-Mobility	G
		TRA Community-Energy	H

		TRA Water-Community	I
		TRA Connectivity-Mobility	J
		TRA Connectivity-Energy	K
		TRA Energy-Mobility	L
		TRA Energy-Water	M
	Social on ecological domain	TRA Housing-Biodiversity & Land Conversion	N
		TRA Mobility-Biodiversity & Land Conversion	O
		TRA Community-Biodiversity & Land Conversion	P
		TRA Housing-Air pollution	Q
		TRA Mobility- Air pollution	R
		TRA Energy-Air pollution	S
		TRA Water-Freshwater withdrawals	T