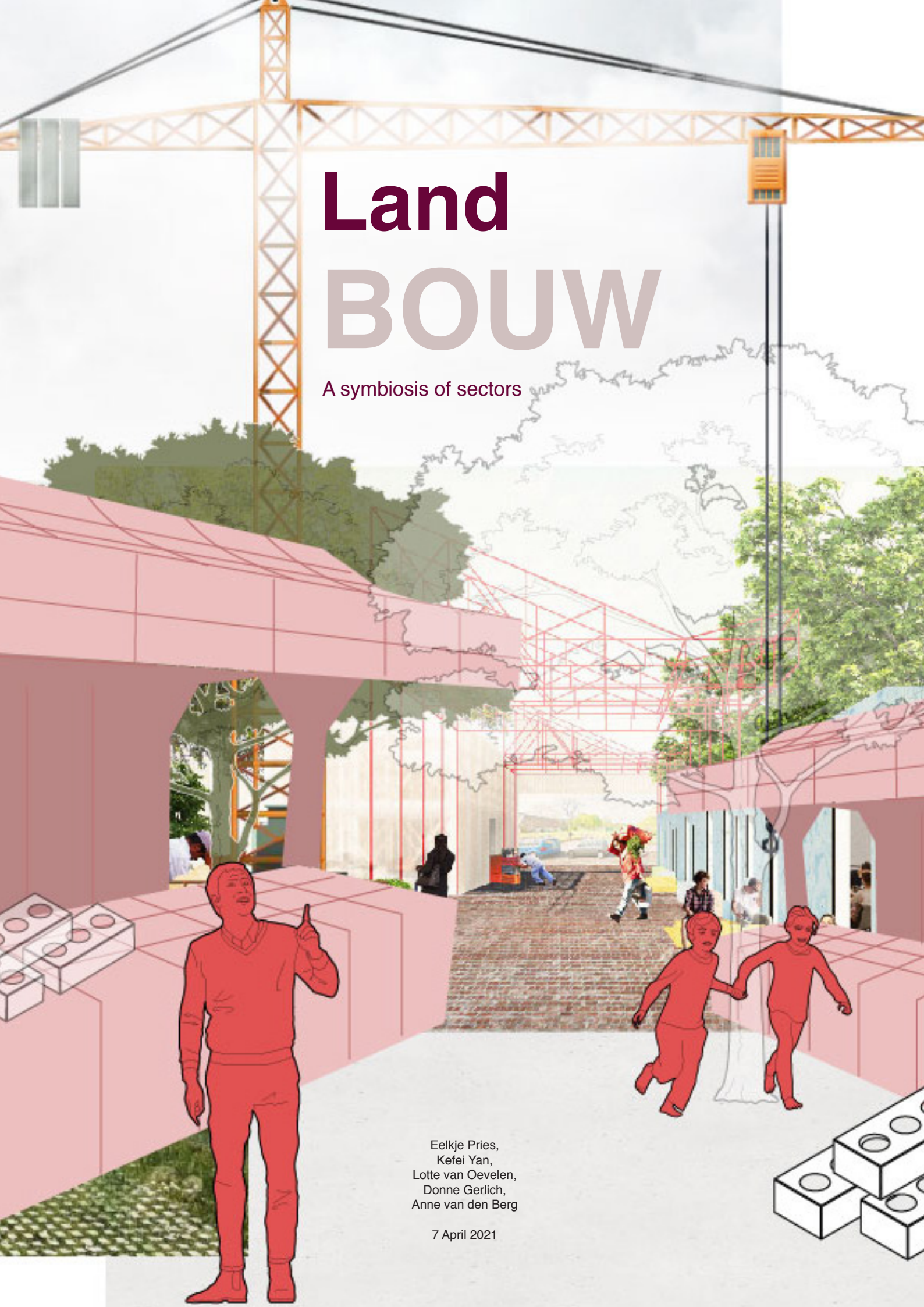
Land BOUW

A symbiosis of sectors



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7 April 2021

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Preface

LandBOUW proposes a regional strategy for the area of South Holland. This in order to create and interlink circular systems of agri-food and construction flows. Hereby, we focus on the waste flows of the agri-food sector as a resource for the construction sector.

The report is made during the mastertrack Urbanism at the Faculty of Architecture and the Built Environment at the TU Delft and combines two courses; ‘Research and Design Studio: Spatial Strategies for the Global Metropolis’ and ‘Research and Design Methodology for Urbanism’.

The motivation and guidance during the process of the studio helped us to look further, grow and set this strategy. Hereby, we would like to thank the teachers of the studio course: Caroline Newton, Alexander Wandl and Lei Qu, but also the teachers of the methodology course: Marcin Dabrowski and Roberto Rocco.

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April, 2021

Old remaining waters,
Cycle loops around this place.
Till it dazzled, dazed, famished,
Till it somehow, eventually
Erased.

Decomposed in yellow grass,
Cracked and dried,
See growing darkness out of dust,
Vanishing in stride.

Where rooms, untouched, unused, forgotten.
Waited to kiss the ground,
Where the bodies of the buildings,
Puzzled in pieces,
Never broken down.

See narrow streets, wide visions,
Waving rivers, coming back.
Where the nutrients we never used,
Eaten by walls we ever had.

The charm of wrinkled faces,
Relieved harmed souls, deeply rooted.
Dance world, indestructible
Dance on flows extend.
Dance on flows, dance on flows,
Dance on flows

Again

Abstract

The province of South Holland has many important stakeholders and drivers that impact the economy of the whole of The Netherlands. This, together with the increasing global need for circularity, is why the province has an important task in the near future to take steps towards a circular economy. To address this task, this report has chosen to look into the agri-food sector, because of their high economical significance in South Holland, and the construction sector, because of the current and future high demand for housing. Both sectors also create large residual material flows.

Minimizing the high amount of waste from both sectors is essential in order to reach a circular region. The existing approach in creating a circular economy is to often look at individual sectors and their material flows. This is logical, but adverse with the idea of circularity, where all chains are closed. We believe, however, that these problems don't have to be solved within 'their' sector.

Our vision to solve this problem is as follows: "In 2050, the material flow of the agri-food sector will be closed. All before-known waste is now used as a resource for the construction sector. Because of this, the waste of the construction sector is reduced. Because of the collaborative sector chains, they could now be seen as one interlinked sector. The South Holland agriculture sector is now a leading example for a symbiotic and self sufficient interlinked chain."
Our ambition is to create a new movement within the circular economy. Bottom-up initiatives show that it is possible to create interlinked sectors. This project will be a pilot in upscaling this idea, and proving this is possible and has greatly beneficial outcomes. The pilot focuses on using agri-food residual flows as a resource for the construction industry of South Holland, but can be an inspiration to interlinking other sectors.

To approach the interlinking of sectors, we envision a few strategies. We will be bringing the pieces of different policies together, use education and knowledge as glue between the sectors, and use transport and infrastructure to support the connection. Spatially, this results in four types of transition areas, a new living environment where the two sectors come together, also impacting the surrounding areas. This also impacts citizens from a socio-economic perspective, because more cross-sector jobs will be created and competition between businesses will be stimulated, which drives them to become more circular.

Keywords:
Circular economy, South Holland, agri-food, construction, symbiosis

Content

1. Introduction of the topic

The content of this chapter:

Introduction

Research and design are constantly aiming to respond to issues that society faces at that moment. But because we face different issues each time, this leaves us in a constant state of transitioning. Some transitions our society has focused on in recent years are climate change, sustainability, and a transition from a linear to circular system of flows. Action has been taken on larger scales, like the global, European, and national level, to address these challenges, through examples like the Paris Agreement and the United Nations Sustainable Development Goals (sdgs.un.org, 2015).

However, plans should also be made on a smaller scale to ensure that these plans are actually implemented, instead of only being abstract visions of a better future. On a provincial level, this is done through strategies like from the province of South Holland. Their ambition, supported by the signing of the 'Nationaal Grondstoffenakkoord', is to cut the use of raw materials in half by 2030, and give The Netherlands a fully circular economy by 2050 (Provincie Zuid-Holland, 2019). To help achieve this ambition and turn this transition towards circularity into action, this project will respond to the inquiry of the province to expand their strategy and make it more feasible on a smaller scale.

The decision was made to place our thematic focus on two sectors that we believe need the most reform of their material flows: the construction- and demolition sector, and the agri-food sector. Both sectors currently produce the most negative environmental outcomes and provide many possibilities for reform, both separately and combined. To provide this project with a more specific context, a development trend has also been chosen as one targeted towards makers industries. We believe there are great opportunities in the smaller initiatives to collaborate and together create a circular economy on a larger scale.

This introduction will firstly investigate problems and challenges the world faces, to explain the issues we are facing on a global level. Secondly, there will be an overview of challenges and opportunities in both the agri-food and construction sector to find where similarities lie, and where a crossover between sectors is possible. To conclude the introduction, a few research questions will be posed to guide further research in this project. The next steps in this project will be to answer the research questions through analysis, creation of a vision and further expansion of our strategy and its consequences.

1.1. Problem statement

This chapter will focus on highlighting the aforementioned challenges society is facing, since these challenges also play a great role on the provincial scale. This is even more so in the province of South Holland, because the province is one of the main economic drivers of The Netherlands (Socio-Economic Profile of Zuid-Holland, n.d.). The port of Rotterdam is a great contributor to this, being the largest port in Europe (Port of Rotterdam, 2021). Also, Rotterdam and the Hague are a part of the Randstad metropolis, which has a great influence on the rest of The Netherlands. This together with other important areas in the province, like Dordrecht, Westland, and the Green Heart, make it a province popular to live in (RabobankResearch, 2019). The other side to this, however, is that this also creates a strain on the housing market, in a country where housing demand is already high (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2020).

A province with many people means a lot of influence, which can create either opportunities or threats. To analyze all these aspects, a SWOT analysis was executed, which can be seen in Figure 1.1.

The different themes were taken from different scales and not only on a provincial one, because we believe that factors from all scales can impact the province. Some of the found strengths include the strong economy due to the agri-

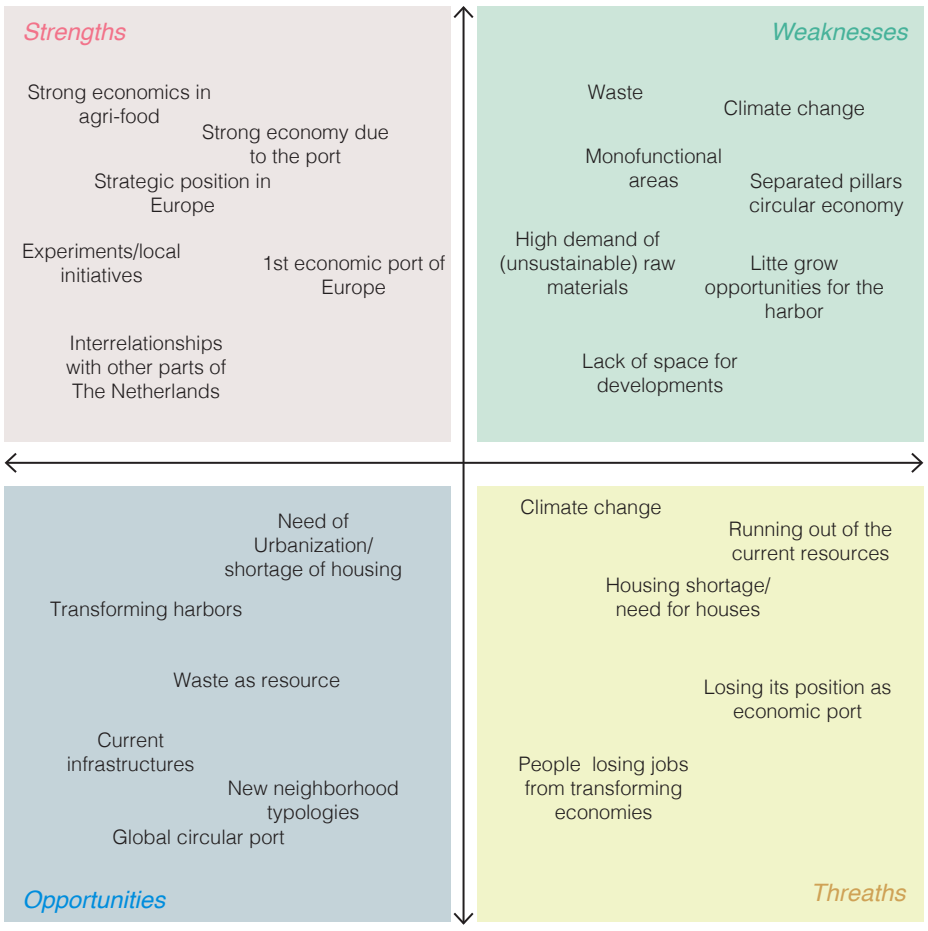


Figure 1.1 | SWOT-analysis for the province of South Holland (Authors, 2021)

food sector and the port, and the great amount of innovation being achieved through local initiatives. Opportunities the project can benefit from, are using waste as a resource, making use of the current infrastructure and new building opportunities because of the housing shortages. Main weaknesses and threats include the high amount of produced waste and climate change, which we found are some of the main challenges the province is facing and should be addressed.

Currently, short-term decisions and – seemingly – cheaper solutions from powerful stakeholders can cause a negative influence on society to choose the easier way out, only enhancing the threats of climate change and the housing shortage. To prove that positive influence can create positive outcomes, great strides could be made in South Holland towards a more circular economy, as an example for other larger areas. So because of its impact on the province, we will first address the following main challenges on the larger scale.

1 Climate change

Global warming is happening, and its effects are being felt around the world. As of now, the impacts on the planet, including severe storms, heatwaves and melting of icecaps, seem to accelerate, as shown by Figure 1.2 (NASA, n.d.) below. Scientists predicted this outcome years ago, but still the only real debates are mostly about how fast and how far the climate will change, and only partly about what society should do to slow or counteract the effects and limit the damage. These debates with higher-scale stakeholders work somewhat, but do not always provide smaller-scale solutions to follow through with plans.

The constantly increasing emission of greenhouses makes scientists believe that global temperatures will keep rising in the upcoming decades. According to NASA (n.d.-b), a panel of more than 1,300 scientists predict that these temperatures will rise up to 10 degrees Fahrenheit in the next century.

CARBON DIOXIDE	GLOBAL TEMPERATURE	ARCTIC ICE MINIMUM	ICE SHEETS	SEA LEVEL
↑ 415 parts per million	↑ 2.1 °F since 1880	↓ 13.1 % per decade	↓ 428 billion metric tons per year	↑ 3.3 millimeters per year

Figure 1.2 | An overview of the current numbers on climate change and global warming (Authors, 2021. Information edited from NASA, n.d.)

2 Overdrafted raw materials

Since the rapid process of industrialisation in the early 20th century, the use of raw materials has grown out of control, continuously without paying attention to the efficiency of usage. This resulted in a lot of waste and loss of resources, which caused a state of shortage for most of them. And this is a problem, because society relies heavily on material resources for almost all of its activities. Besides, many steps in the production process of materials have a significant impact on the environment. This way, the overuse of raw materials also contributes its fair share to climate change.

According to statistics from the United Nations Statistics Division (n.d.), the global material footprint rose from 43 billion metric tons in 1990 to 54 billion in 2000, and 92 billion in 2017. And even though the issue of the increased footprint has been known for some time, the rate of natural resource extraction has accelerated since 2000. At the current rate, the global material footprint will increase up to 190 billion metric tons by 2060 if no action is taken. Besides, the global use of raw materials is growing faster than both our population and our GDP. This means steps should be taken to increase the sustainability of the use of materials, to decrease the loss of resources and the material footprint and counteract climate change.

3 Housing shortage

As was mentioned before, the province of South Holland is a popular place to live in, and especially somewhere close to the Randstad and other larger cities. One big reason for this is the trend of globalisation, where multinationals locate their businesses in the big cities to be well connected to their other locations. This leads to people wanting to move closer to the cities to have more job opportunities. This development is amplified by the visible trend of the aging of the population in The Netherlands, where the younger generation moves out to the city to have more amenities, universities and jobs nearby, with the older generation staying behind in the smaller villages (NOS, 2017).
As a result of this higher demand for housing, and not enough supply to keep up with it, house prices and rent has exploded. This causes huge bidding wars between buyers, with only the rich being able to even take part in the competition of buying a house.

The government and other political leaders are trying to build as many new homes as possible to keep up with the high housing demands, using new initiatives and locations close to the cities to accommodate everyone. However, this newly built housing close to and in the cities is mostly too expensive for lower-income families to afford, which is how gentrification arises, slowly transforming neighborhoods from affordable for everyone, to high-income only, increasing inequalities within the city. So, the housing shortage is not only a bad consequence for the economy, but also for social justice and increasing inequalities.

And the end's not near, because experts conclude that construction developments are slowing down because of the Covid-19 pandemic (Platschorre, 2020). This means political leaders on every level should help contribute to this housing shortage, to make sure this development is counteracted.

1.1.1. Opportunities in agri-food

The agri-food sector in The Netherlands is one of the biggest exporters of food in the world. And the sector in South Holland specifically is a big contributor to the export, with a size of around 3 billion euros and 25.000 workers. The agri-food sector in South Holland mostly consists of horticulture, arable farming, and dairy farming clusters. Horticulture is especially prominent in the province, with four of the seven national horticulture green ports being located here (Mul et al., 2017). Important areas where these activities take place in South Holland are Westland, areas in the Green Heart and the island of Goeree-Overflakkee.

However, being a big sector brings its challenges when it comes to circularity. According to Mul et al. (2017), the agri-food sector yearly produces 3,4 megatons of agricultural products, but with 4,3 megatons of residual flows. Besides the CO2 emissions, which are not included in this number, these residual flows mostly come from the waste of food products and other materials used to produce these products. The agri-food sector also uses a lot of energy, for example to run lights at night in the greenhouses, which is also an important challenge that must be tackled. Other important challenges the province themselves have found from research (Mul et al., 2017), are mainly focused on making more space available for farming, turning the sector from energy-consumption to energy-production, and making use of raw materials from other sectors by using regional symbioses.

Even though these challenges are substantial, there are also a lot of opportunities in the sector to respond to the challenges. As was said earlier, the agri-food sector is a big economic driver for the province and creates a lot of jobs for the area. Because of this influence, the sector can help a lot in changing the course of residual flows and turn it into a strength. It is an opportunity for this sector to use the residual flows from production to supply new biobased materials to other sectors through symbioses. The great strides in innovation that this sector makes in the province can also play a big role in this and can help create the technology needed to achieve these new steps. The same is the case for turning the agri-food sector into an energy supplier and finding new ways to create more space for farming, for example through multifunctional use of the space. Other opportunities that Mul et al. (2017) have found, is using residual flows to counteract subsidence and better the ground quality, as well as develop new acreage in the North Sea.

‘Being a big sector brings its challenges when it comes to circularity’

(Authors, 2021).

1.1.2. Opportunities in construction

Not only the agri-food sector, but the construction sector is also a great contributor to the economy. Partly because of the increasing housing shortage in South Holland, there is an ongoing demand for building materials. The production of these materials is around 12 million tons, of which 95% is being reused in some way already. However, this is not enough to supply for the need for raw materials, because the construction sector needs an additional 50 to 60 megatons to cover all needs for materials for construction and transformation (Mul et al., 2017).

Because of this high need for materials, a lot of them are reused after demolition. Only 4 megatons of the materials become part of the residual flows, which is not a lot compared to the input for the sector. These residual flows mostly exist because unsustainable materials were used to construct buildings in the past, where (parts of) these buildings are now demolished to make room for other types of functions.

Important challenges in this sector have partly been mentioned before, but they mostly surround the growing population and the consequent increased demand for housing. More and more development areas have been assigned by the government to fulfil their ambition for 1 million built homes by 2030.

However, this ambition must go hand in hand with the ambition to create these homes sustainably, to support the future circular economy. The challenge hereby is to make sure all critical raw materials are phased out of the cycle of the sector and only more sustainable alternatives are entering. Also, used materials should get back in the cycle without loss of quality.

‘The construction sector needs an additional 50 to 60 megatons to cover all needs for materials for construction and transformation’ (Mul et al., 2017).

An added challenge provided by the research from Mul et al. (2017) is to find and sustain the balance in the increasing need for materials to achieve different objectives regarding climate change and the circular economy. Because the raw materials are not only needed for the buildings themselves, but also for added measures to make them sustainable, like windmills and solar panels. Finding this balance and relieving the tension in that market is important.

These challenges also open doors for many opportunities however, because this need for materials and housing gives us the chance to build the homes the right, circular way this time, so these will remain sustainable for future generations. The main opportunities lie in creating a fully circular life cycle of materials and make the materials themselves circular as well. This in turn creates new opportunities for design and research into innovative ways to achieve this. Other opportunities stemming from the research revolve around the application of circular business models, which can take circularity to a larger scale.

1.1.3. Parallel to crossover

The main policy document used for this strategy is 'Zuid-Holland Circulair' by Drift and Metabolic (2018). This policy sets the government basis for circularity in the South Holland. Drift and Metabolic (2018) state that South Holland is one of the most material intensive areas of The Netherlands and therefore key-player in the transition (Drift, Metabolic, 2018). Starting here is a complex task, but also creates opportunities on multiple scales. The document divides its program into three pillars: agri-food, construction and plastics.

Even though, this policy sets the basis, it is not the only governmental policy used for circularity in South Holland. The document 'Ruimte voor Biobased bouwen (Rijksoverheid, 2020) goes deeper into the construction pillar and scales up to a national level. Hereby, a collaboration with experts and several governments creates a broad knowledge and exploratory strategy towards a biobased building sector (Rijksoverheid, 2020). When we scale down, 'Van zooi naar mooi' (Gemeente Rotterdam, 2019) represents a circular strategy for the city of Rotterdam. This strategy sets goals looking at construction, agri-food, consumption and health care (Gemeente Rotterdam, 2019).

These policies are some examples that address the awareness on political level, but also the circular strategies and future spatial developments within The Netherlands. However, these policies also show the downside of division into pillars: There are no (or few) links among several pillars, whereby the sector becomes islands in itself and some opportunities are forgotten or not taken into account.

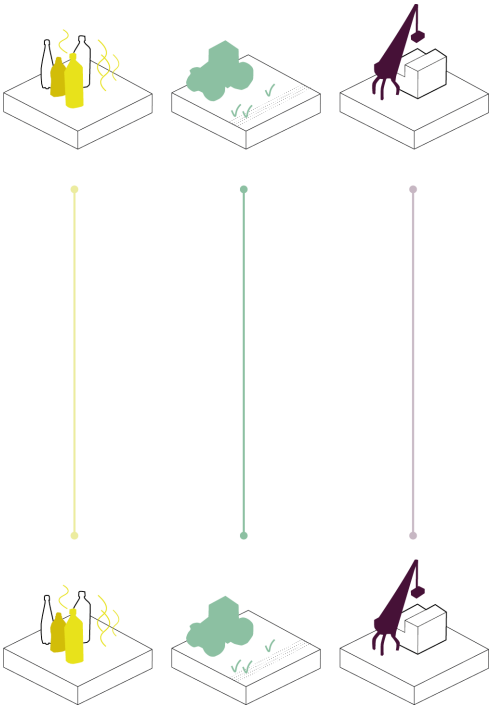


Figure 1.3 | Linear approach (Authors, 2021)

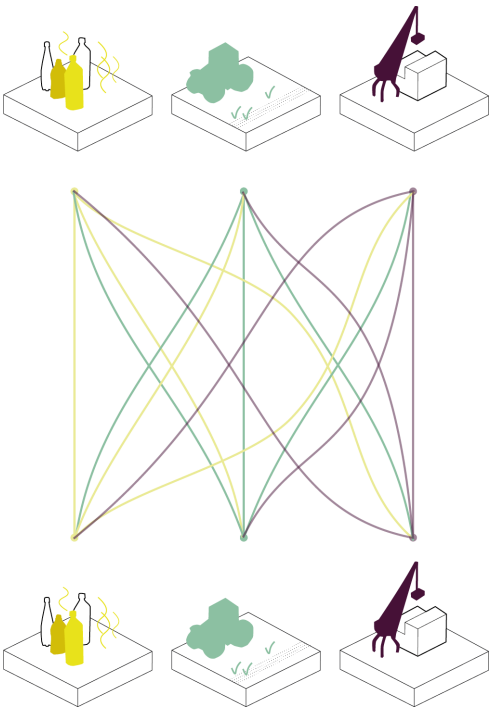


Figure 1.4 | Holistic approach (Authors, 2021)

This division is not only visible at a strategic political level, but feeds down into the actual built environment. Programs and initiatives are focusing too much on 'one side of the story'. A more holistic approach would create more combinations between pillars and more diversity in order to achieve the goals of a circular economy. This strategy sets the first steps into intertwining the sectors.

Symbiosis

In our strategy, residual organic waste flows can be seen as the linking crossover. The outflow of waste from the agri-food sector is more than one third of the inflows. This number is an alarming sign, the sector is not reaching the circular goals of the municipality.

On the other hand, this waste can be used as a resource for insulation and construction materials. This opportunity translates waste into 'nutrients' for the construction sector whereby not only the outflows of the agri-food sector decrease, but also reduces the outflows of the construction sector and the use of less sustainable materials.

In this strategy, we dive deeper into this system and the strategy that facilitates the process to become more circular. Hereby, connecting the pillars of the circular policies by government, results in South Holland as a test area spatially.

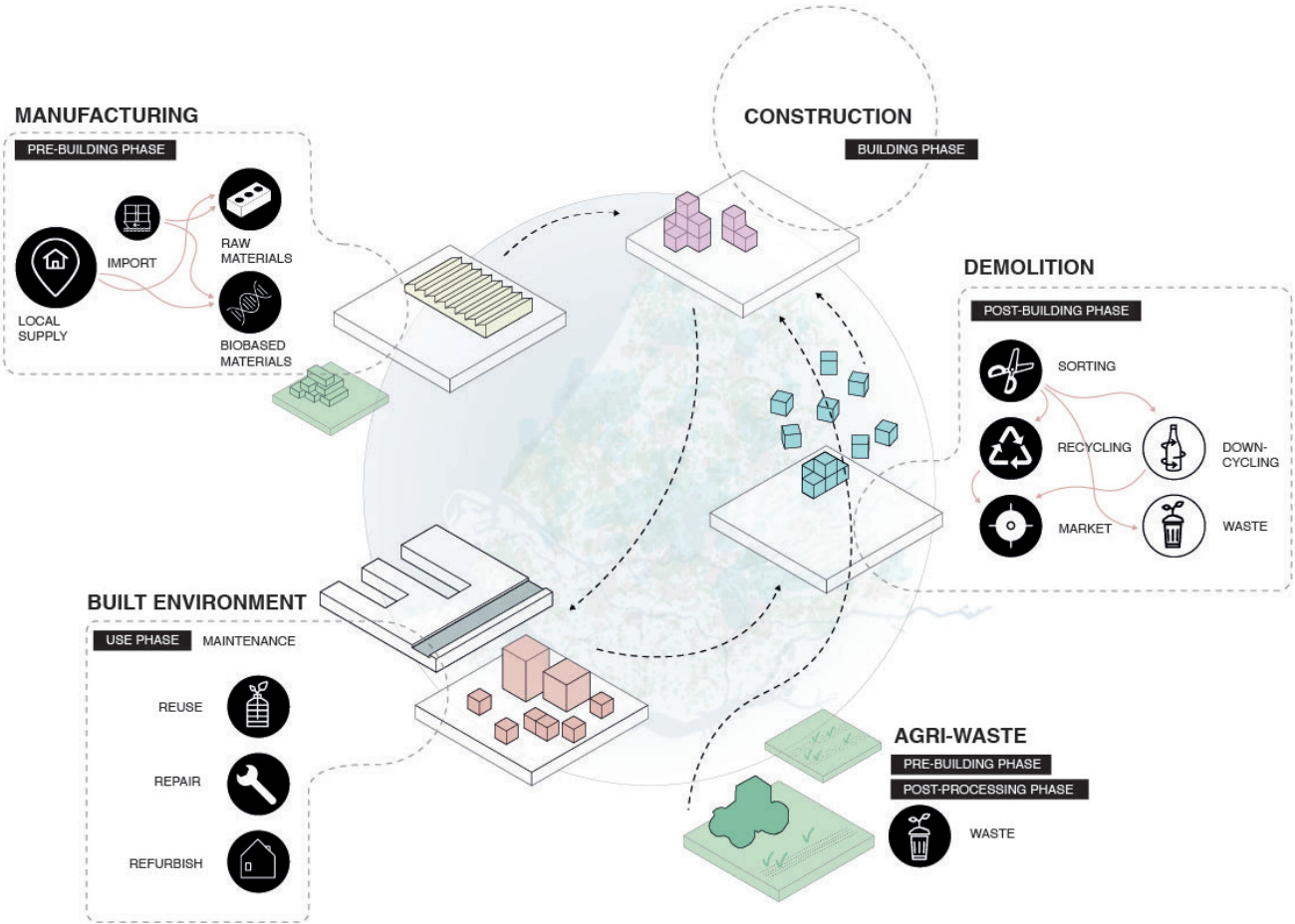


Figure 1.5 | Symbiosis of chains (Authors, 2021)

1.2. Research questions

To address the aforementioned problems and opportunities and guide the project, we will answer the following research question:

> **How can a symbiosis between the agri-food and construction sector be created in order to contribute to a more circular economy in South Holland?**

To divide this question into sub questions, the DESTEP-method (Stek, n.d.) (Amenta, L., van Timmeren, A., 2018) is used to cover all different factors that could either impact or have consequences from the symbiosis. These factors include Demographic, Economic, Social, Technological, Ecological and Political. Because of the strong connection between Demographics and Social, these two factors were merged into one. We also expanded the Ecological factor into Environmental, because we felt the spatial aspect was missing in this method. This analysis created the following sub questions:

1. Economic
   How does the circular economy benefit from symbiosis?
2. Social I Cultural
   How does a symbiosis impact society?
3. Technical
   How can residual flows be used to create a shorter and interlinked chain?
4. Environmental
   What impact does a shorter and interlinked chain have spatially and ecologically?
5. Political
   How can politics help achieve a symbiosis between the two sectors?

2. Theory

The content of this chapter:

2.1. Theoretical framework

To answer the research questions and set a clear framework for the problem statement, corresponding theory has been set forth. From this, a conceptual framework has risen. In the following sub-chapters it will be explained how the theories supported the follow-up research and how the basis of the final strategy came about.

Theoretical framework
The theoretical framework provides direction by clarifying the means by which the research questions are approached. The most important concepts are taken from the problem statement, the research questions and the conceptual framework, which will be elaborated on in the next chapter. The following theories will be explained to form a base for the framework: sustainability, circular economy, symbiosis, transition zone, spatial and social conditions and material flows. These terms are explained in more detail below together with its mutual coherence.

2.1.1. Sustainability
One clear meaning of the word sustainability is not existing. For example, Johnston et al. state that there are around 300 definitions (2007). According to Oxford Languages (n.d.) sustainability is about the ability to maintain something at a certain level. In this case, environmental sustainability, avoiding the exhaustion of natural resources to counteract climate change. This extraction and reprocessing of raw materials leads to permanent environmental damage (Mot et al., 2018) and can therefore be considered as non-sustainable. A chance to encourage sustainability in multiple sectors by decreasing the fact that residual flows are not used. If the residual flows get used again, more raw materials are saved and therefore it contributes to sustainability.

2.1.2 A circular economy
The concept of circularity was found as a new way of rethinking material chains (Figure 2.1 and 2.2) from a linear material flow to a circular one, so the life cycle of materials doesn't end at its use, but is being reintegrated into the chain. The national government of The Netherlands is working together with the business community, social organizations, knowledge institutions and other authorities on a sustainable economy for the future. In this circular economy, residual material flows and materials are used over and over again. The government-wide Circular Economy program sets out what is needed for a circular Netherlands in 2050 (Ministerie van Algemene Zaken, 2020b). The difference between circularity and a circular economy is that circularity is achieved in an economic or industrial system with a focus on rerouting the waste flows (MacArthur, 2013).

2.1.3. Symbiosis
As explained earlier, we will be introducing the concept of symbiosis into the circular economy. Symbiosis has often been explained as a biological concept, describing it as 'an interaction between two different organisms living in close physical association, typically to the advantage of both' (Oxford Languages, n.d.). A symbiotic economy is also a new sustainable economic model, creating opportunities between ecosystems and human activity, so merging biology with industry. We take it one step further and create an industrial symbiosis: a new concept of systems between two different economic systems, agri-food and construction, as a base of creating a more sustainable material flow. This also impacts the way different sectors look inside their own sector for answers, and encourages them to widen their peripheral vision towards other solutions and new ways of thinking.

2.1.4. Transition area
Together with the symbiosis, the transition area is created between the agri-food sector and the construction sector. This transition area is created as a system between the production chains from both sectors. Consequently, there is this economic and business transition zone. But most importantly, on a spatial level, new physical transition areas have to be created and built to organise the symbiosis of both sectors.

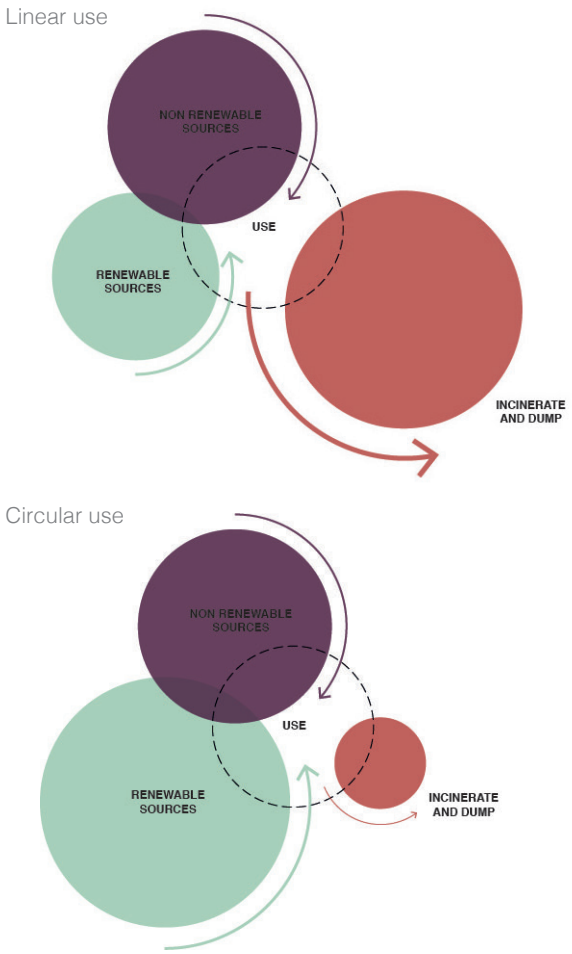


Figure 2.1 | Linear use versus circular use (Authors,2021)

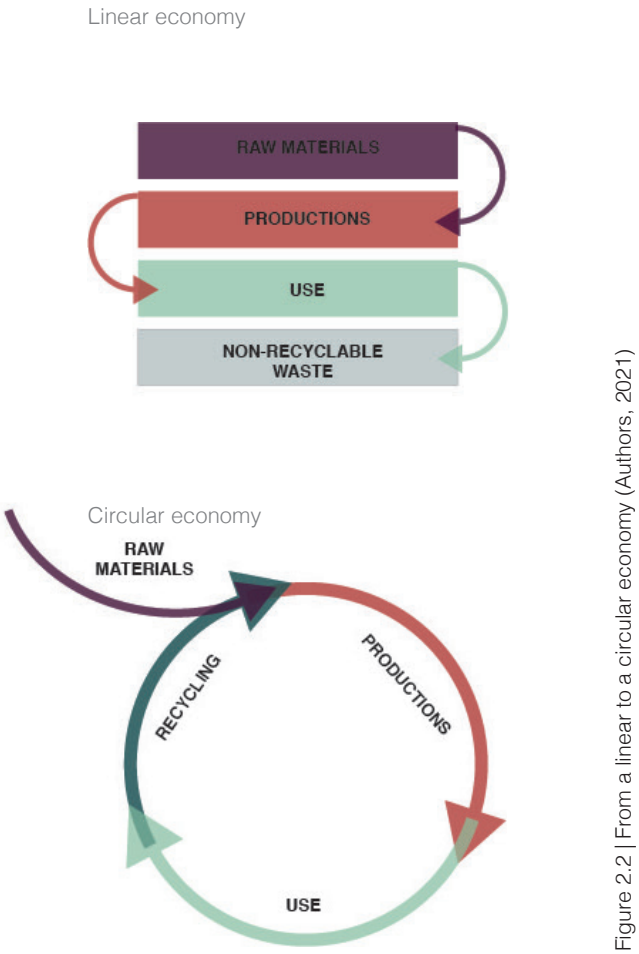


Figure 2.2 | From a linear to a circular economy (Authors, 2021)

2.1.5. Spatial and social conditions

The spatial and social conditions from the potential transition zones are important factors for the chance of the succeeding of the vision. Logically, the spatial and social conditions in which the symbiosis can be introduced and have a positive effect back on the spatial and social dimension. These two conditions are also mostly slightly interlinked with each other. For example, when the spatial condition for the new transition zones is pleasant, for instance related to the accessibility, it is attractive to work at those locations. A pleasant work environment in this way also provides a better social life. These subjects are mostly related to the social and spatial justice of a place or system (Delgado et al., 2015). These terms are rather broadly defined, but can be seen as terms that are about giving fair chances for everyone to participate in society equally.

2.1.6. Material flows

To meet the need for production and consumption, materials flow through the economy (Centraal Bureau van Statistiek, 2020a). A ‘material flow’ describes the way a material flows through the different stages of the process. From a raw material being extracted to the end of its cycle, mostly being used for consumption, and thrown away. The material flow is aimed at completing a production process.

For our strategy, the definition of material flows is based on the same idea of the circular chains, explained in the definition of the circular economy. This new material flow shifts to becoming an unending one, going back into the production process earlier. Concluding, the linear flow becomes a circular one.

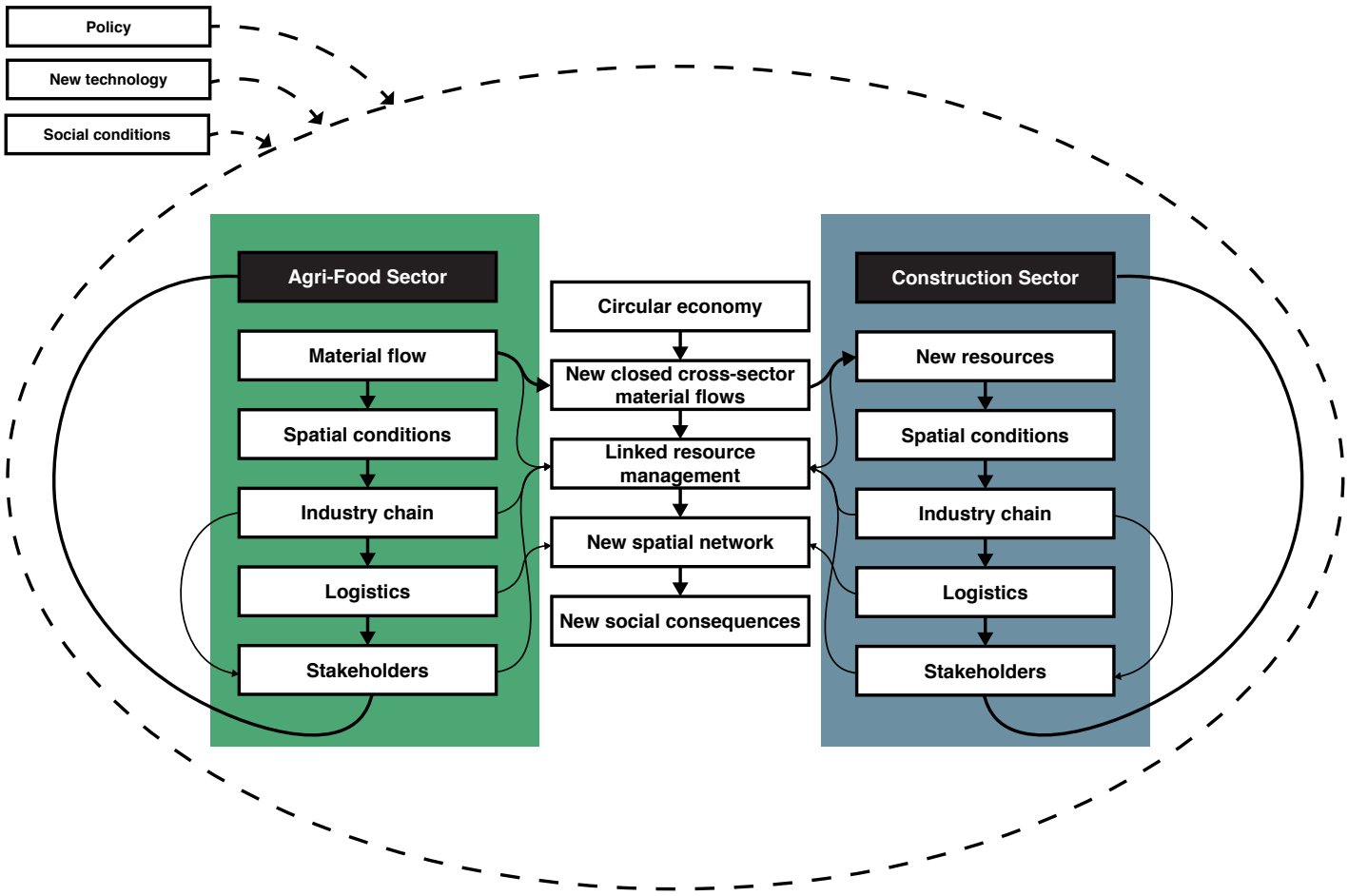


Figure 2.3 | Conceptual Framework
(Authors, 2021)

‘Better Together’

(Authors, 2021)

2.2. Conceptual framework

Figure 2.3 shows the conceptual framework for this project. This model is used as a schematic overview of the variables from the theory and the relationships between them in the research, and is based on the theory described before.

The material or resource flows of both sectors, agri-food and construction, are contrasted and independent of each other. They meet at a starting point for the transition of residual flows from all phases in both chains, to provide alternative resources for the construction sector. This will be an important step to become more sustainable, by reducing the loss of raw materials. In this case, a new symbiosis flow is realized in between that fits the circular use of materials and creates a circular economy.
Additionally, it will cultivate a larger closed loop, which will be more suitable for the circular economy environment.

The exchange and integration of residual flows is only a driving force for the further exchange of materials, knowledge and energy. The symbiosis system can promote innovation, collective learning, industrial transformation and collaboration between organizations, which is an inevitable trend of future development in a circular economy (Doménech & Davies, 2010).

On the contrary, policy, technologies and social conditions will also influence the context of the environment for the symbiosis system. The clearer and stricter the policies are, the better the systems changes can happen. The policies seem to be separated by individual pillars per sector. An opportunity will be to bring the policies together and in that way interlink the sectors. Secondly, new technologies can provide preferable conditions to realise the new symbiosis system.
It can not always be predicted in what timeframe inventions are realized and will boost this strategy. Nevertheless, it can be seen that the sudden emergence of a technological development in the agricultural or construction sector can provide a boost in changing the traditional way of working to a more sustainable variant.

Lastly, the social conditions are important to create a mindset change. If these conditions are optimal, people are more willing to use new systems. If not, people feel less safe and comfortable. This could lead to more resistance and the will to stick to traditional ways.

We hope to achieve a sustainable economy by taking the integration of residual flows as an initiative, based on the existing models and conditions of the two largest economic drivers, to form a symbiosis system that can promote each other with the social environment.

2.3. Research methodology

During the research process, several methods are used to generate information and to draw conclusions, both from qualitative and quantitative sources. Hereby, in some aspects our research is limited because of the short time frame and the lack of certain information. This has led to some assumptions and interpretations that should be researched further. Thereby, field research is not possible these days. We found out that video's, documentaries and Google Maps can function as good alternatives to 'field trips'. In this way, a broad variety of information comes relatively easy to our minds.

Furthermore, additional literature and policies and GIS analysis were mostly used at the beginning of the process in order to gain more knowledge and understanding of flows and programs.

From this base on, aims and ideas were added by doing mostly mapping analysis and research by design. These methods were needed to translate the gained information into a spatial strategy. Thereby, these methods showed also what topics (academic) information was missing.

The following Figure shows the methods used during the project. These methods are linked to the phases of the process.

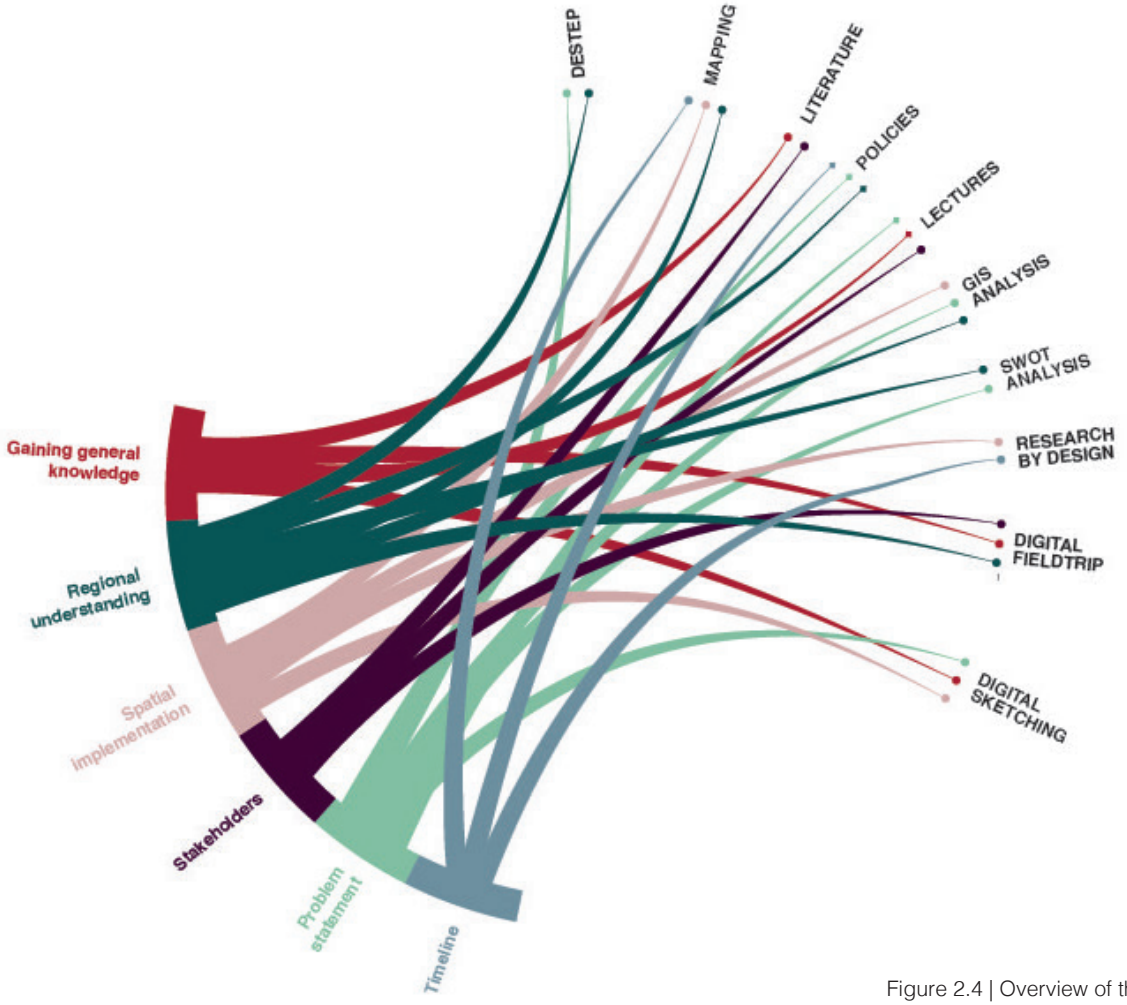


Figure 2.4 | Overview of the used research methods (Authors, 2021)

3. Current situation

The content of this chapter:

3.1. The agri-food sector

The prevailing natural conditions, a temperate climate with a fair rainfall distribution, relatively fertile soils in a flat landscape, favour a varied and productive agriculture in South Holland. The sector in the province has supporting governmental policies, a solid education and a high-tech agricultural technology system (Commission on Sustainable Development [CDS], 2008, P.7). The agri-food sector is still very important and successful as an economic factor in such a densely-populated and highly-industrialised country.

South Holland, where horticulture, arable farming and livestock farming accounts for a large portion in the agri-food sector, has always played an important role in The Netherlands. As we mentioned in the introduction, every year, 6 million tons of products are produced with a value of 5.5 billion euros (Province of South Holland, 2016). The sector accounts for 103,170 jobs in 2016 and 16,526 branches are registered (LISA, 2016). Within the agri-food sector, the economic focus is on food production and floriculture, with more than 85% of all branches active in production and cultivation. This production takes place in cattle breeding, horticulture, arable farming and in greenhouse horticulture. More than half of the national greenhouse horticulture area is located in South Holland. Relying on convenient transportation and a large urban population, South Holland has formed a whole industrial chain from production and processing to sales.

3.1.1. Locations

The land used for agriculture in the province of South Holland, including the land for arable farming, horticulture, greenhouse horticulture, livestock farming and grassland, amounts to more than 135 thousand hectares, or 48% of the total land area of the province (Drift & Metabolic, 2018, P.46).
However, the functions of various regions are different, thus forming a diversified spatial layout (Figure 3.1). We analyzed the spatial distribution of current agricultural activities to explore their positional relationship and spatial flow trends (LISA, 2018).

Production
In terms of production, Westland, Boskoop and Pijnacker are the main agricultural production areas, gathering arable farming, glass horticulture and crop farming. The 'Bollenstreek' and the Green Heart areas focus more on horticulture and livestock framing (Figure 3.2).

Westland
Westland is the heart of agriculture, the centre for greenhouse horticulture and one of the six greenports in The Netherlands, close to the Port of Rotterdam. Besides, Westland also focuses more on arable farming and crops. Westland has taken a lot of responsibility for the agriculture of South Holland.

Boskoop
Boskoop is one of the six greenports in The Netherlands, it is the world's biggest joined floriculture area. Boskoop is famous for its nurseries, particularly woody plants and perennial nurseries, of which around 774 are situated on long stretches of land, divided by narrow canals. Now it focuses more on arable farming, crops and woods, and tries to attract young people to participate in agriculture and promote agricultural education.

The Green Heart areas
The Green Heart can be seen as a vast farm centering a ring of cities, as the area consists of a series of landscapes, water and cities. It is an important open area that is continuously protected by the government. Due to the large number of natural areas, the Green Heart area focuses more on livestock farming.

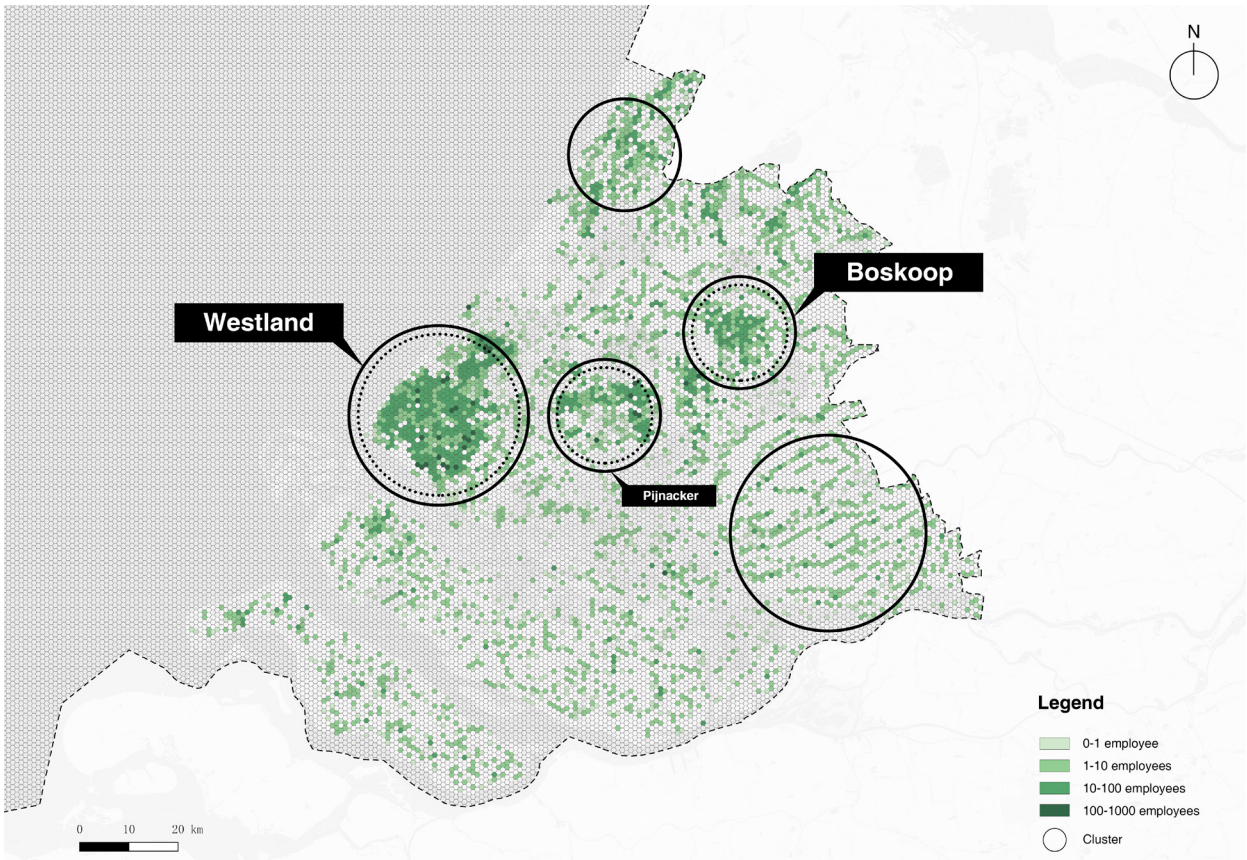


Figure 3.1 | Density of agri-food sector (Authors, LISA 2018 and OSM, 2021)

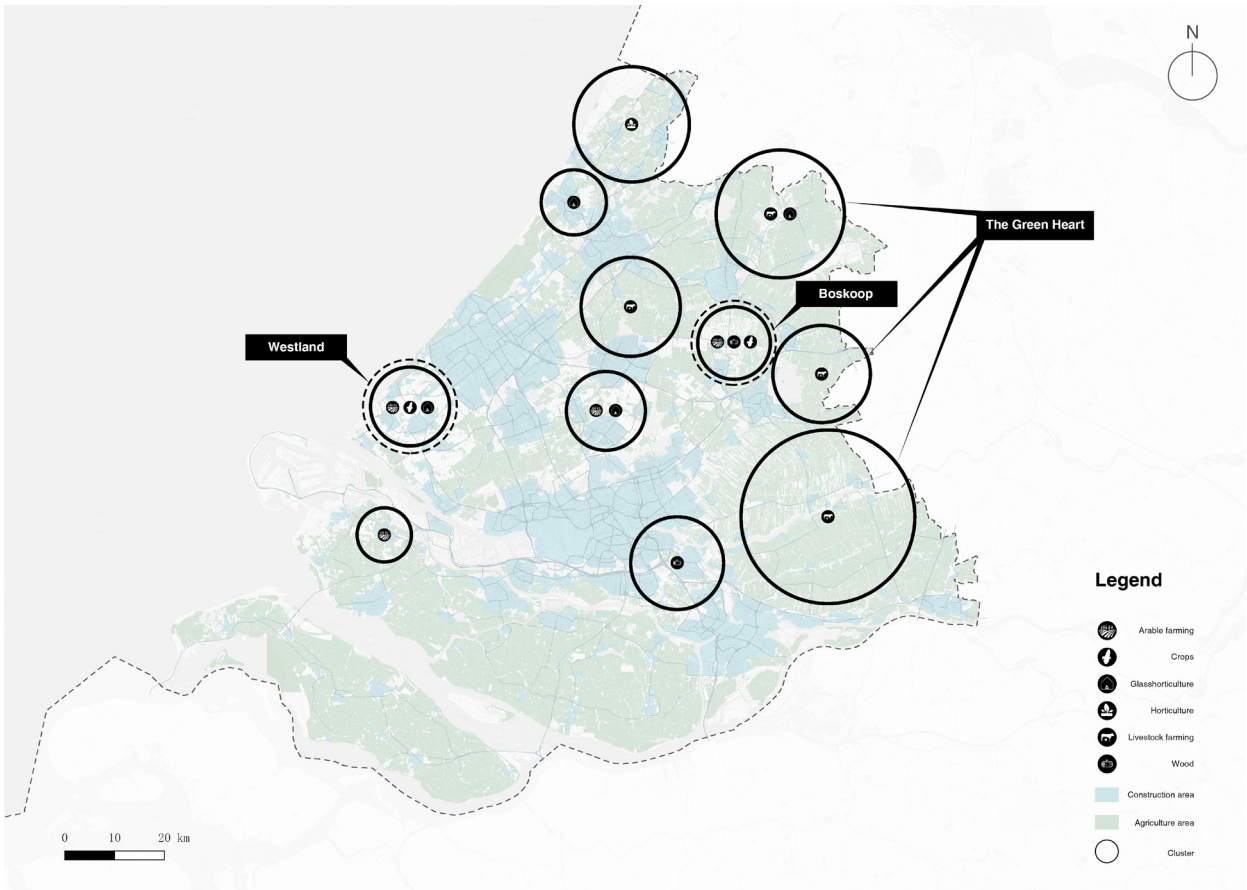


Figure 3.2 | Distribution of production industries (Authors, LISA 2018 and OSM, 2021)

Processing

In the process of processing, in addition to Westland, Boskoop and Pijnacker, the Hague and Rotterdam are also indispensable (Figure 3.3).

Westland

In Westland, growers, knowledge institutes, plant breeders and many other types of companies and organisations are working together to develop innovation concepts that can be applied to guarantee sustainable development for cities around the world. In order to reduce residual material flows and improve efficiency, many processing companies are located in Westland, thus forming an industrial chain of production, processing and logistics.

Boskoop

Just like Westland, Boskoop, which is a greenport, is also forming a concentrated agricultural industry chain, so that many processing industries are also developed and introduced in Boskoop. Most of them are engaged in the processing of fruit and other arable farming.

the Hague and Rotterdam

the Hague and Rotterdam are the largest urban areas in South Holland, providing a huge market for agriculture. Many processing industries, especially in livestock and arable farming, are located here in order to put their products on the market as soon as possible.

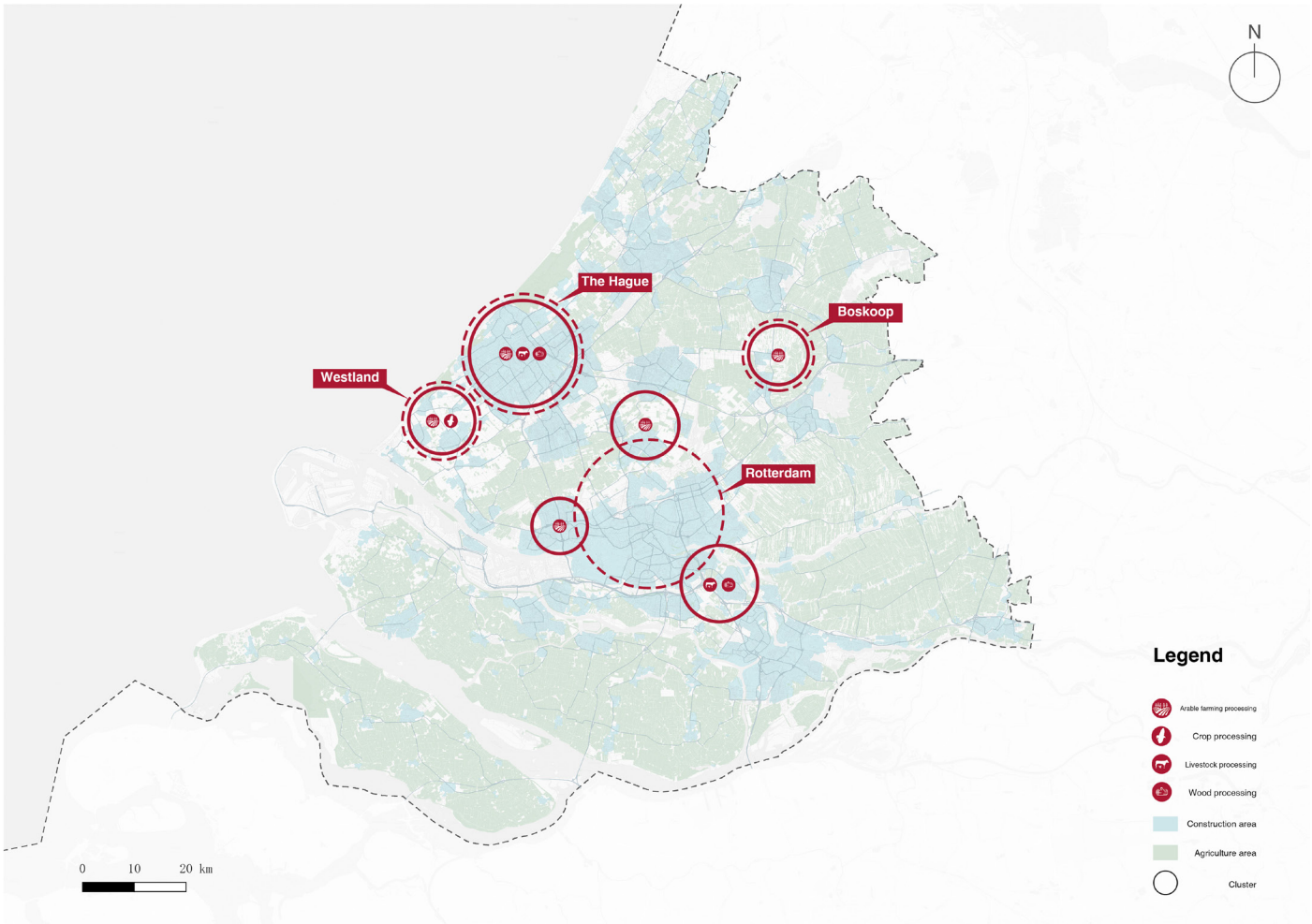


Figure 3.3 | Distribution of processing industries (Authors, LISA 2018 and OSM, 2021)

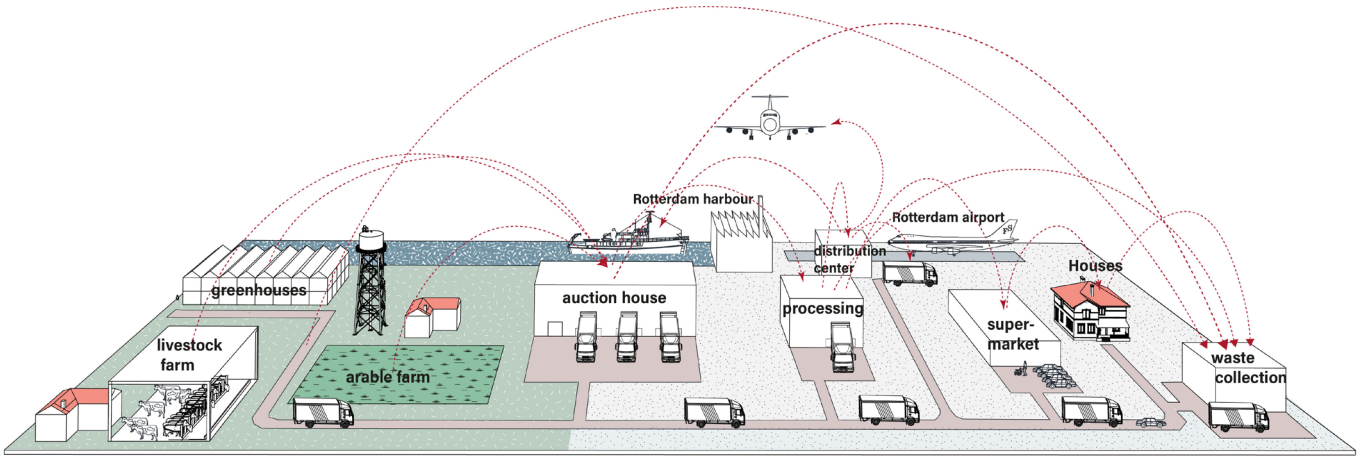


Figure 3.4 | systemic section agri-food supply chain (Authors, 2021)

3.1.2. The supply chain of the agri-food sector

The supply chain of the agri-food sector (Figure 3.4) consists of the primary production, the auctioning, the processing/packaging of the product, distribution, the market and lastly the place where the product is used (mostly inside the consumer). The first step, the primary production, can be located in a livestock farm, in the greenhouse, an arable farm, an open horticulture farm or grassland and fodder crops farm, depending on what product is produced. LandBOUW focuses mostly on plant-based organic materials within the agri-food sector.

When looking at the supply chain of the agri-food sector, what is striking is that a lot of steps are taken in order to reach the houses of the end user. This means transportation in between all off these steps. The agri-food sector is the second biggest exporter in the world, which is why a lot of the produce in South Holland is exported to the rest of the world by truck, airplane or boat before it is in the supermarket. In order to achieve a circular agri-food sector, it is needed to reduce the steps that connect the primary farmer and the final consumer, the physical distance in between these should be reduced and the cultural and social proximity should be increased (United nations industrial development organization, 2020).

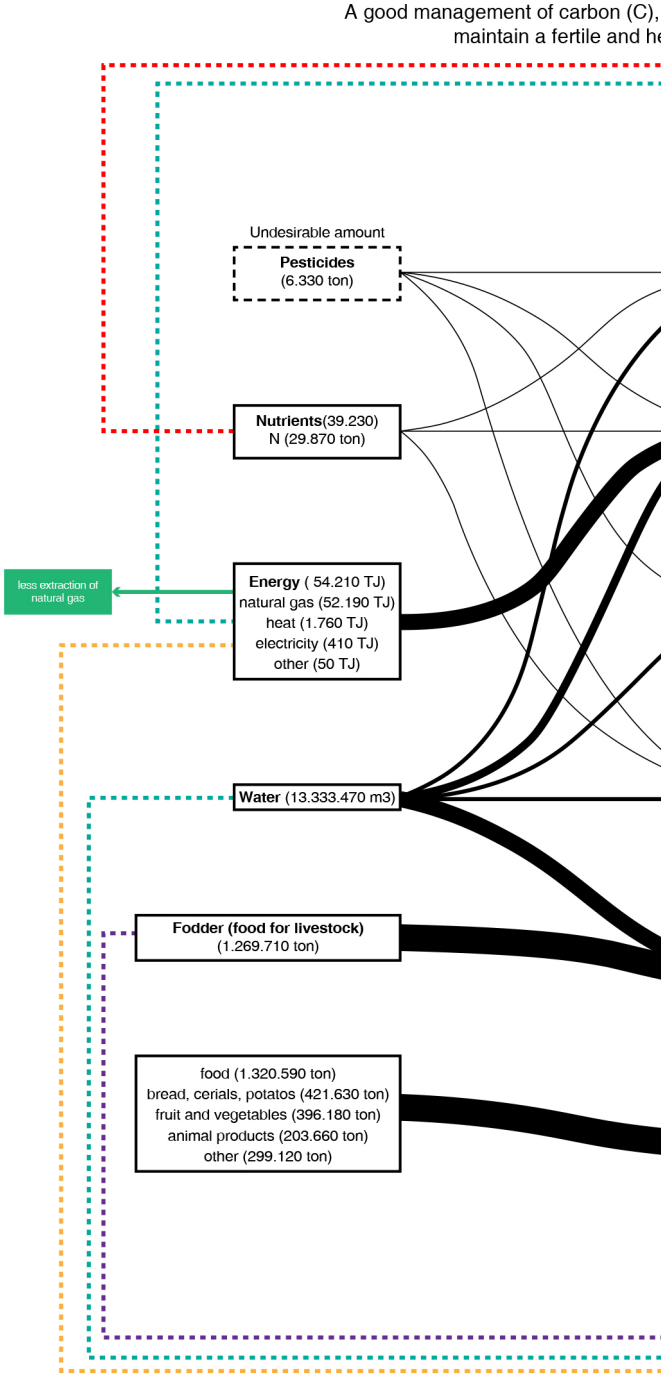
A change in the existing food chains is difficult to achieve, because the sector is traditional and profit oriented. Food chains are designed to deliver value to end consumers. This is why the economic decisions made by producers and consumers together determine market outcomes (King et al, 2000).

3.1.3. Material flows

For the material flows in the agri-food chain in South Holland, we use a macroscopic approach to embody the whole-stage process from production to processing to transportation to residual material recycling. The analysis aims to reflect the input and output of the whole sector, also to present the material flow trends at different stages spatially, the functions that each area focuses on, and the resulting agglomeration phenomenon. The further processing of primary products into end products is not included in this analysis, as is the production of animal feed or nutrients such as fertilizer.

From the Figure 3.5, Energy, water and fodder are the most important inputs. A large amount of energy and water are used in glass horticulture, fodder and water are put into livestock farming. These two are the two most representative forms of agriculture in South Holland. At the same time, a large amount of output also brings many possibilities for sustainable development:

1. 3,597,390 ton CO2 emissions can be potential recycle energy
2. Some of the 1,145,190 ton output from arable farming can be supplied to fiber or other sustainable construction materials
3. 4880TJ of electricity can be put into secondary use
4. 3,827,000 ton fertilizer waste, especially 18,720 ton nitrogen is bad for biodiversity, however, phosphorus in urine can be harvested in built environment
5. 1,028,870 ton organic waste are going to energy sector to create biofuel while are going to be taken as fodder as well



nitrogen (N), phosphorus (P) and potassium (K) in agriculture is crucial to
ealthy soil and allow adequate plant growth and development.

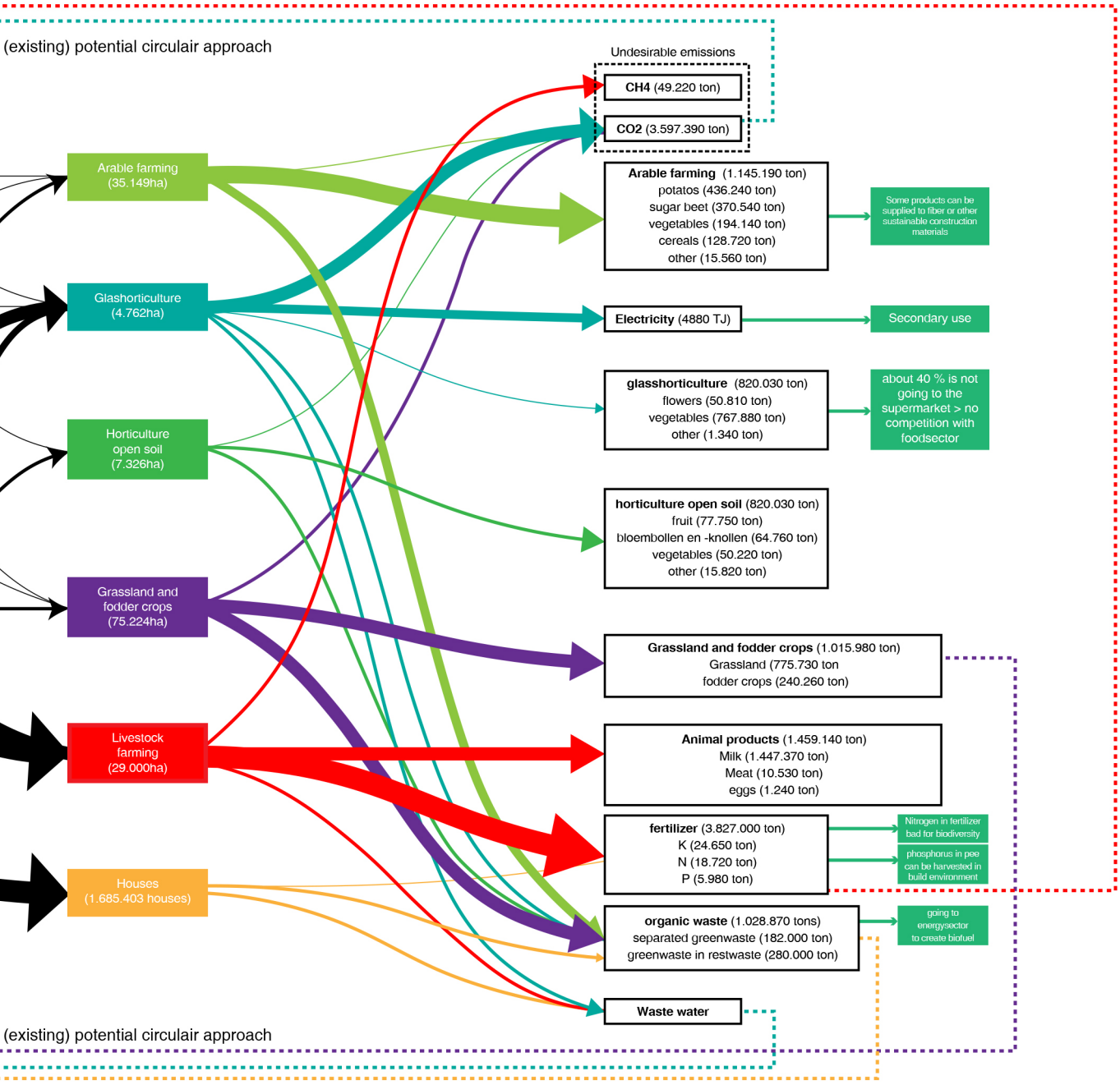


Figure 3.5 | Material flow of agri-food sector (Authors, Drift & Metabolic, 2018, P.44-P.45)

From the Figure 3.6, we can clearly see that only a small part of the raw material products is processed nearby, and most of the outflows from the agricultural areas all over South Holland to the processing industries concentrated in the big cities and then to the storage, export port, wholesales and retails. Each retail point sells the processed products to every household, and only a small part of the waste is collected, processed and recycled in the end.

The current material flow presents a macroscopic circle spatial layout, different links are separate and independent, which makes it a long but step-by-step process from raw materials to waste treatment.

The agri-food material flow analysis is based on data from LISA (2016) on different types of agricultural activities, distribution industries and location of wholesales, and on input / output tables for energy, water, emissions and residual flows developed by Metabolic (Drift & Metabolic, 2018, P.45).

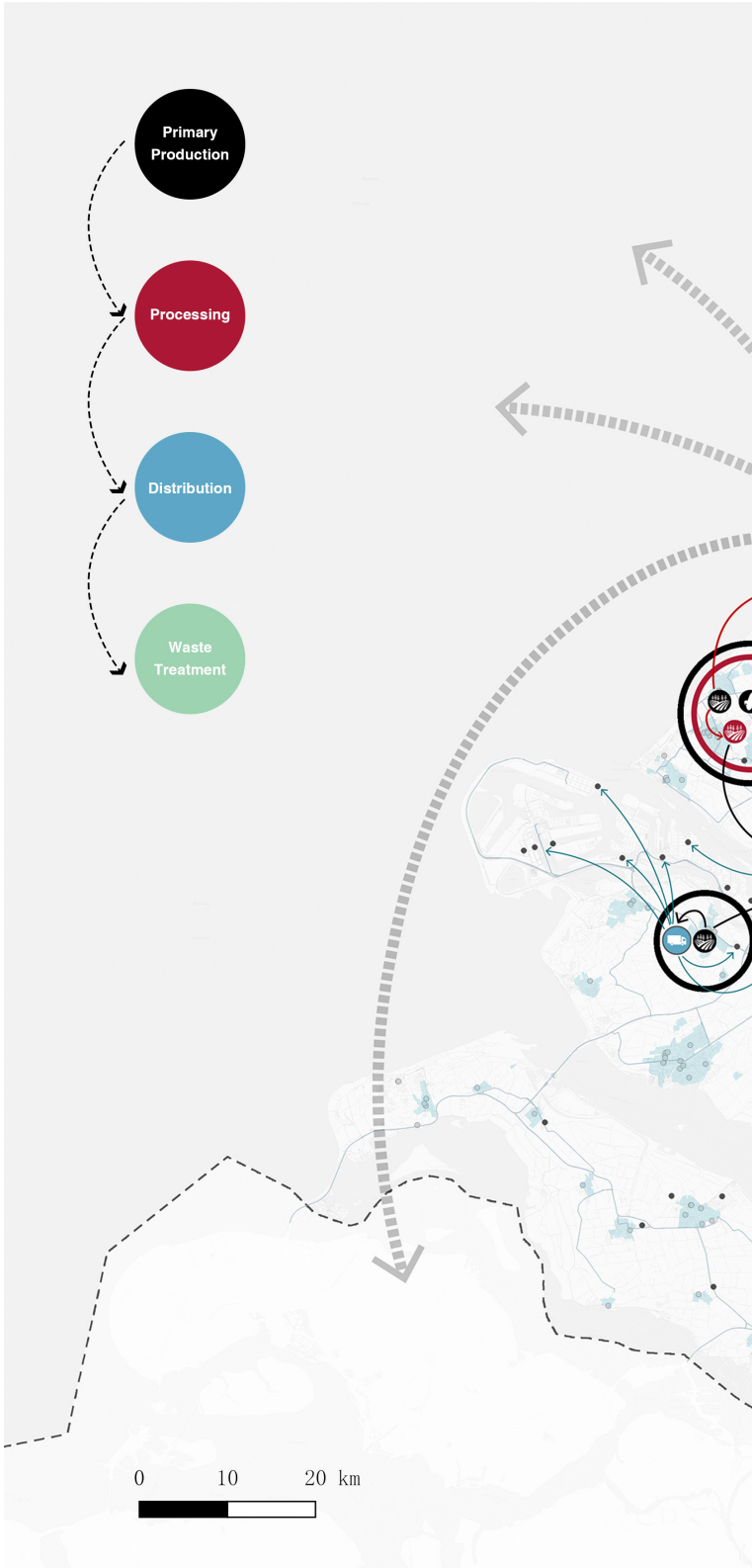
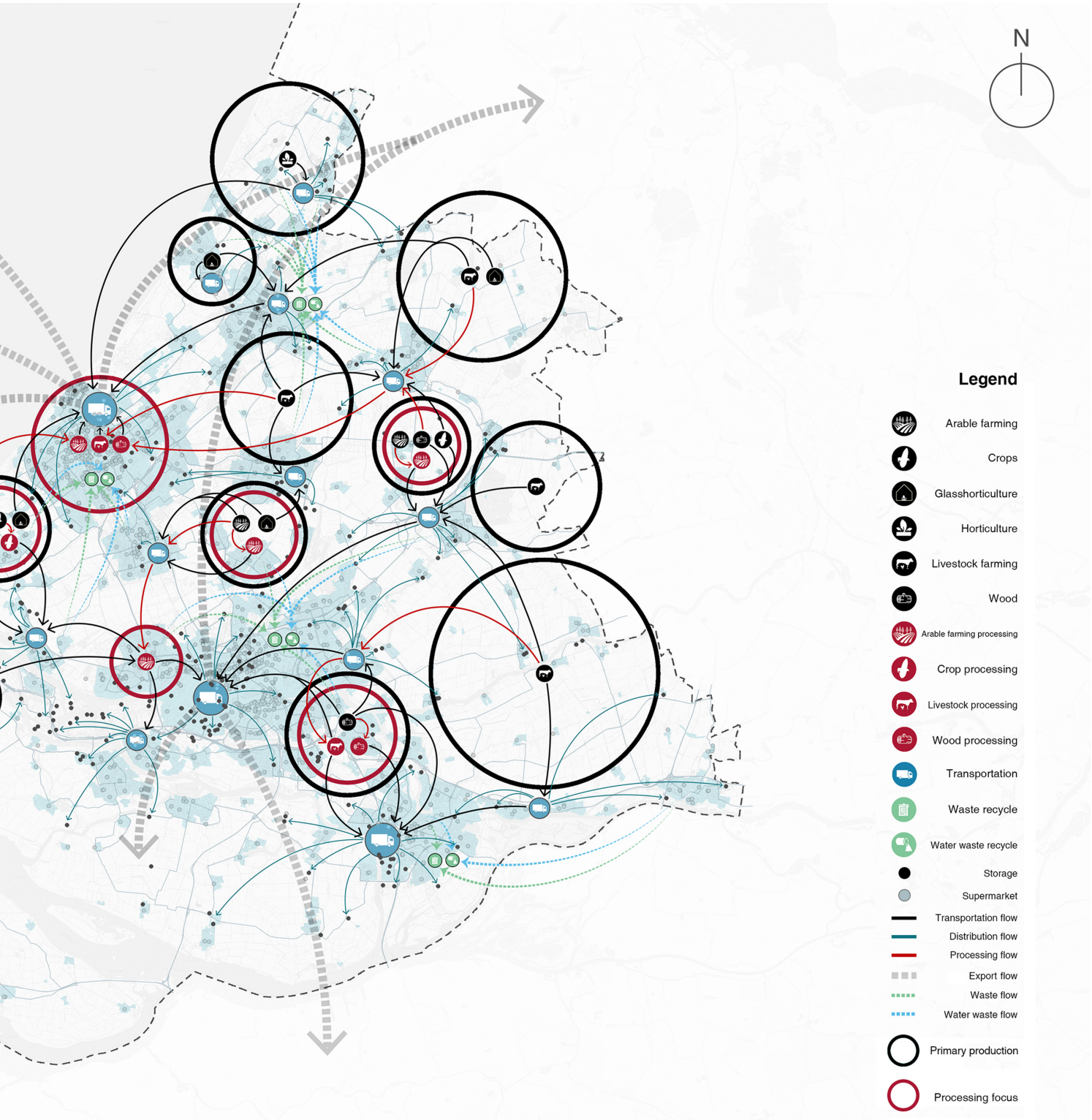


Figure.3.6 | Spatial material flow of agri-food sector (Authors, LISA 2018 and OSM, 2021)


N
Legend
Arable farming
Crops
Glasshorticulture
Horticulture
Livestock farming
Wood
Arable farming processing
Crop processing
Livestock processing
Wood processing
Transportation
Waste recycle
Water waste recycle
Storage
Supermarket
Transportation flow
Distribution flow
Processing flow
Export flow
Waste flow
Water waste flow
Primary production
Processing focus

3.1.4. Concluding

There is no doubt that the agriculture in South Holland has huge potential for sustainable development, already some approaches show this potential circularity that provides support for other sectors such as energy and materials.

In the current material flow, there are links that need to be optimized from beginning to end, and the complicated intermediate procedures increase the cost and waste. This also brings out how to distribute these functions to various regions and establish direct contact with the community. At the same time, how to recover and reuse a large amount of waste to form a closed loop or to enter another industry (Figure 3.7).

The agri-food chain is a very important element in the ecosystem of South Holland. It is a driver of economic growth, jobs, and innovation, but also a partnership of entrepreneurs, governments, educational and knowledge institutions in a so-called “triple helix”. Together these parties work towards a healthy, vital and sustainable future for circular agriculture (Drift & Metabolic, 2018, P.48).

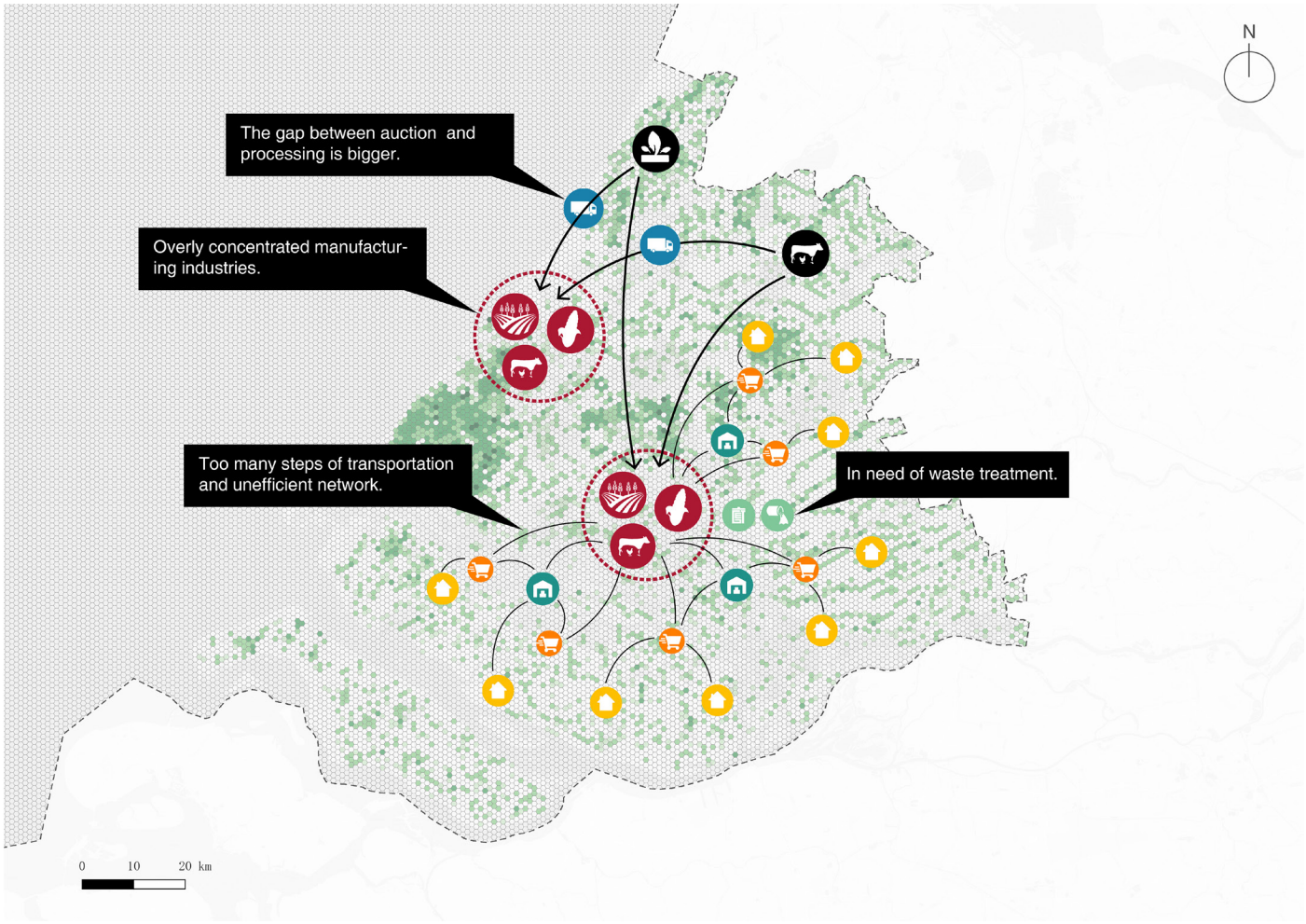


Figure 3.7 | Conclusion of agri-food sector (Authors, LISA, 2018 and OSM, 2021)

‘LandBOUW focuses mostly on plant-based organic materials within the agri-food sector’

(Authors, 2021).

3.2. The construction sector

The construction sector is now playing a more important role in the circular economy of South Holland, because of the large flows of materials that the sector entails. It accounts for an annual production of around € 13 billion, and, with 33,440 business locations within the sector, creates 105,050 jobs (LISA, 2018).

South Holland is determined to completely transform its construction sector in the coming years. The province states that in 2050 it will make large-scale use of general available (non-critical) or renewable (biobased) raw materials. In addition, the construction chain must be of circular design in which all phases, from new construction to dismantling and renovation, are fully circular in design. South Holland will also have to get started with the raw materials transition in the construction industry, especially given the economic importance of the sector, sustainability and sustainable growth is of great importance. Ultimately, the greatest gain can be achieved in extending the lifespan of buildings and the higher quality reuse of materials and raw materials.

3.2.1. Locations

Where to construct?

South Holland is in urgent need of the construction sector, not only because of its economical influence, but also because of a large number of areas to be redeveloped. From the Figure, you can see that the buildings built between 1930-1975 cover a considerable proportion in urban construction areas. Rotterdam and the Hague are the two obvious cores with some scattered areas in need of redevelopment around (Figure 3.8).

Raw materials

However, there is just little raw materials in South Holland that can not support the construction volume. Most of the wood and mining resources are concentrated in the Hague and Rotterdam, while most of the sand, gravel and clay resources are in Dordrecht (Figure 3.9).

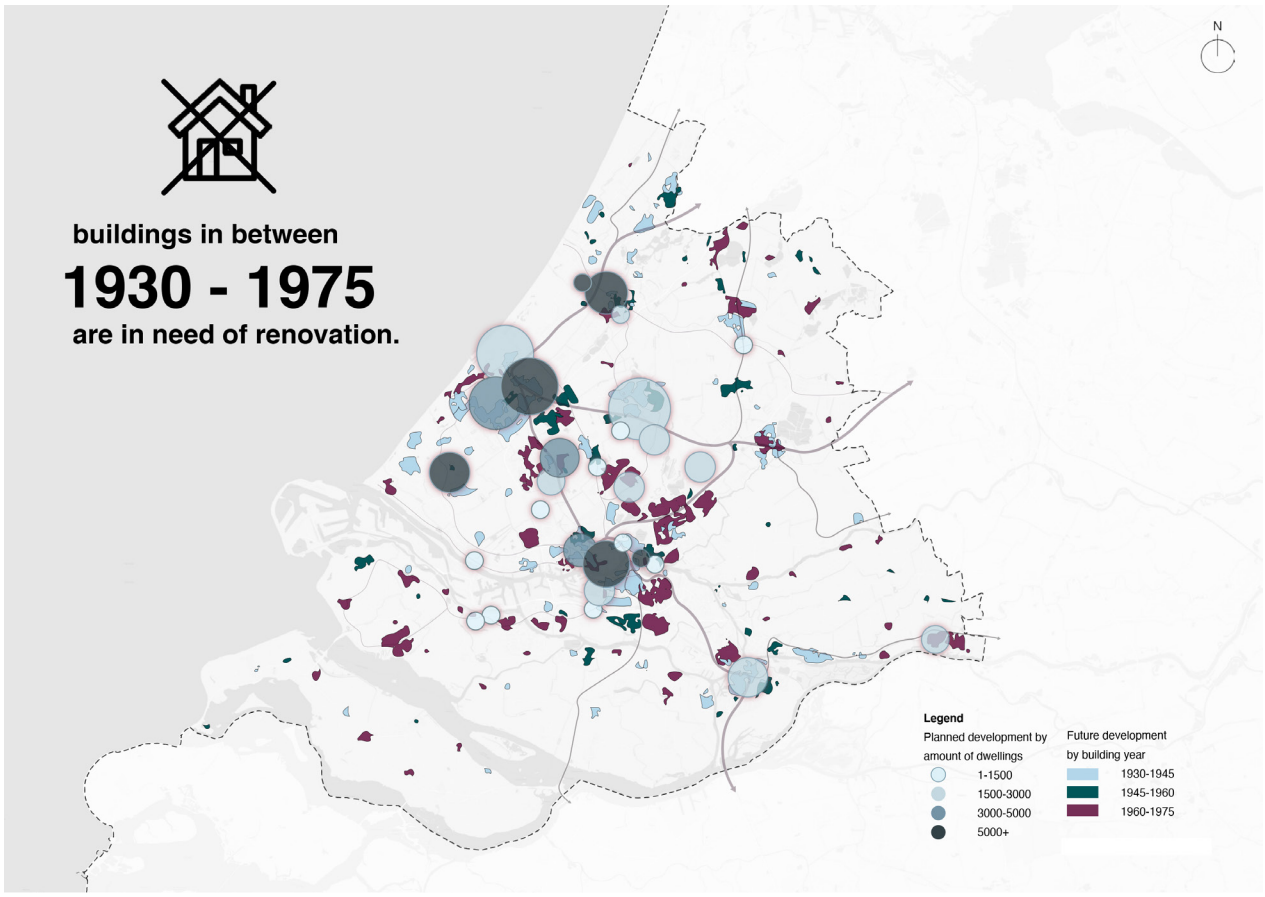


Figure 3.8 | Areas in need of renovation and redevelopment (Authors, LISA, 2018 and IABR, 2018)

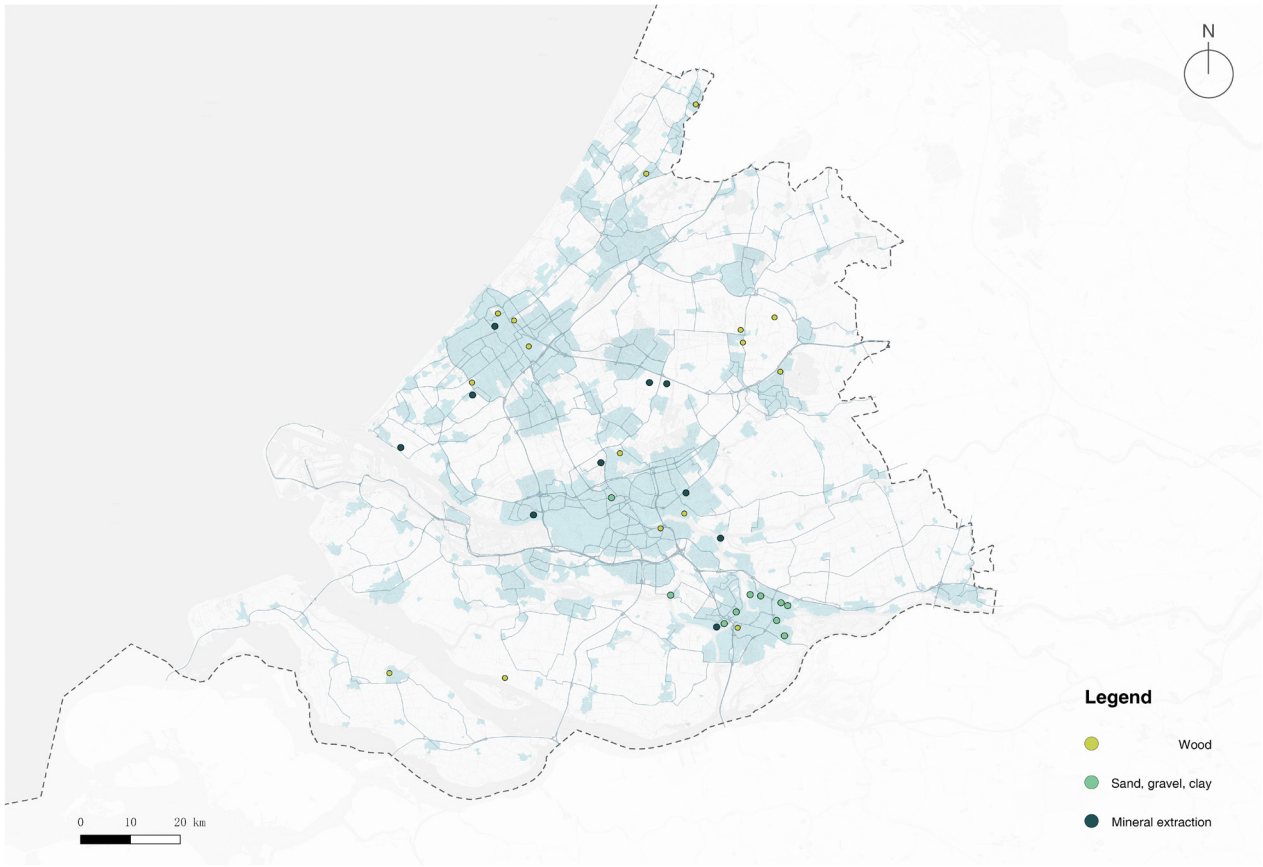


Figure 3.9 | Locations of raw materials (Authors, LISA, 2018 and OSM, 2021)

Manufacturing and constructing
Most of the manufacturing companies concentrate in the Hague, Rotterdam, Leiden, Dordrecht, Gouda and Zoetermeer. Especially the high-tech manufacturing industries located in the Hague, Rotterdam and Zoetermeer. There is no doubt that the Hague-Rotterdam region is the core of the entire South Holland manufacturing industry in the construction sector, half-encircled by a series of secondary clusters. We treat construction activities as mainly happening in new urbanization areas, so that we think that most of the activities of construction companies are also in the same location without specific display (Figure 3.10).

Rotterdam, the Hague and Dordrecht
There are a large number of areas that need to be renewed, so there are also a large number of construction and manufacturing industries attached to this region, where there are enough employees as well. Here are various types of material manufacturing industries, especially many high-tech manufacturing companies relying on some universities and knowledge institutes.

Leiden, Gouda, Alphen aan den Rijn
These cities relying on highway development have certain areas that need to be renewed and large areas that can be newly constructed. The manufacturing industries in these cities give priority to traditional directions such as wood, stone, metal, concrete and cement.

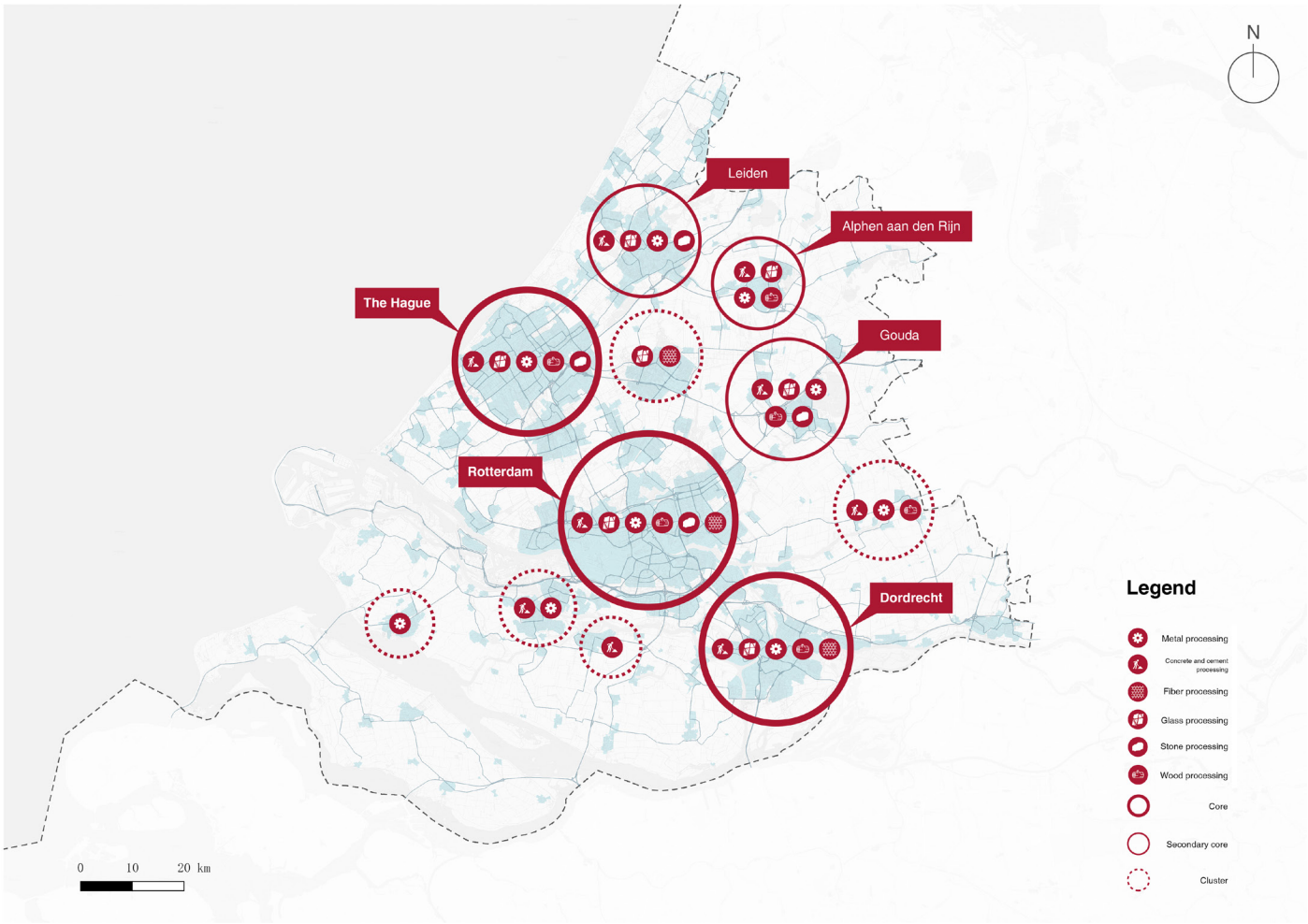


Figure 3.10 | Locations of manufacturing industries (Authors, LISA 2018 and OSM, 2021)

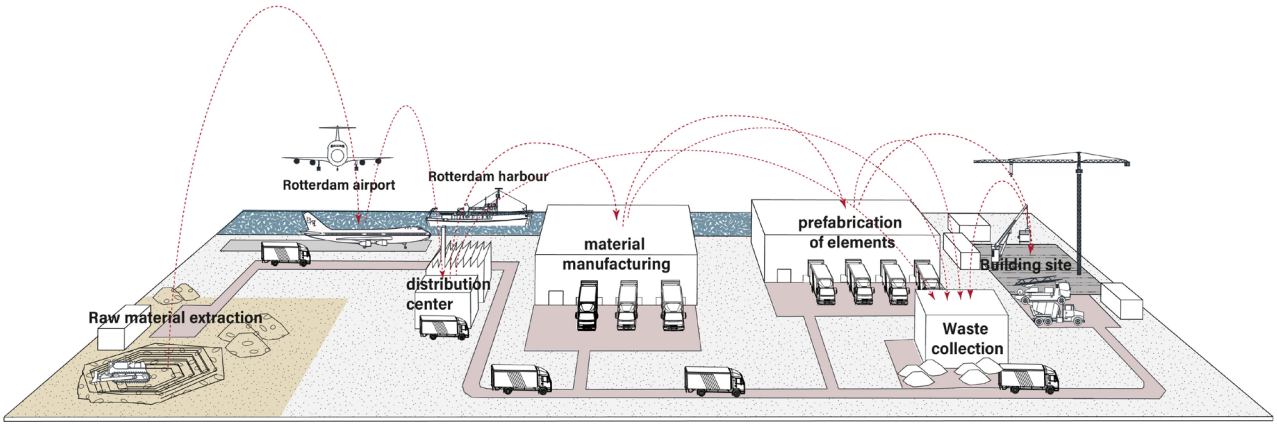


Figure 3.11 | systemic section construction material supply chain (Authors, 2021)

3.2.2. The supply chain of the construction sector

The construction sector is different from other industries. It has one of a kind products, temporary organization and specific site production (Segerstedt & Olofsson, 2010). This makes it a complex supply chain with a lot of nodes. Each of these nodes mostly have separate communication with making forecasting and production and ordering decisions (Taylor & Bjornsson, 2021). Because the material supplier is not able to communicate this to the entire chain, all other nodes fulfill their orders causing unnecessary inventory at the next stage of the chain.

In the systemic section above a generalisation of the supply chain of construction materials is shown. It consists of firstly the raw material extraction, distribution, material manufacturing, the prefabrication of materials and the building site. The existing construction sector uses raw materials that are not extracted in South Holland itself. This means that the first requires a lot of transportation. By using a more locally produced materials, emissions are reduced.

3.2.3. Material flows

For the material flows in the construction chain in South Holland, we also use a macroscopic approach to present the whole-stage process from extraction of raw materials to waste treatment. The analysis also aims to present the spatial trend of the material flow at different stages, concentration and function focus of the construction industry. It only represents general trends rather than accurate ones, the secondary processing of construction products is not included.

From the Figure 3.12, it is obvious that raw materials are in short so that most are transported from other provinces or imported abroad. Even though raw materials are relatively limited, traditional metal processing and concrete processing still cover most areas. The materials are mainly transported to the companies adjacent to the new urbanization areas for processing before being put into constructions. Some such as fiber processing, need to be transported to the Hague and Rotterdam before being transported to construction sites. Concrete is by far the largest incoming raw material flow within the construction sector of the province of South Holland with around 2.1 Mton, almost 50% of the material flows released consist of demolition and renovation of stony rubble (1.1 Mton) (Drift & Metabolic, 2018, P.34). These are directly wasted or recycled of low quality, and a small part of other valuable materials is collected by waste treatment companies gathered in big cities for reuse.

Therefore, the material flow of the entire construction industry presents a situation of partial centralization and multiple dispersion. Rotterdam and the Hague are still the convergence points of many streams, but Leiden, Gouda, and Dordrecht also play very important roles.

This analysis only includes the types of construction industries in LISA (2018) and the potential redevelopment areas in IABR (2018).

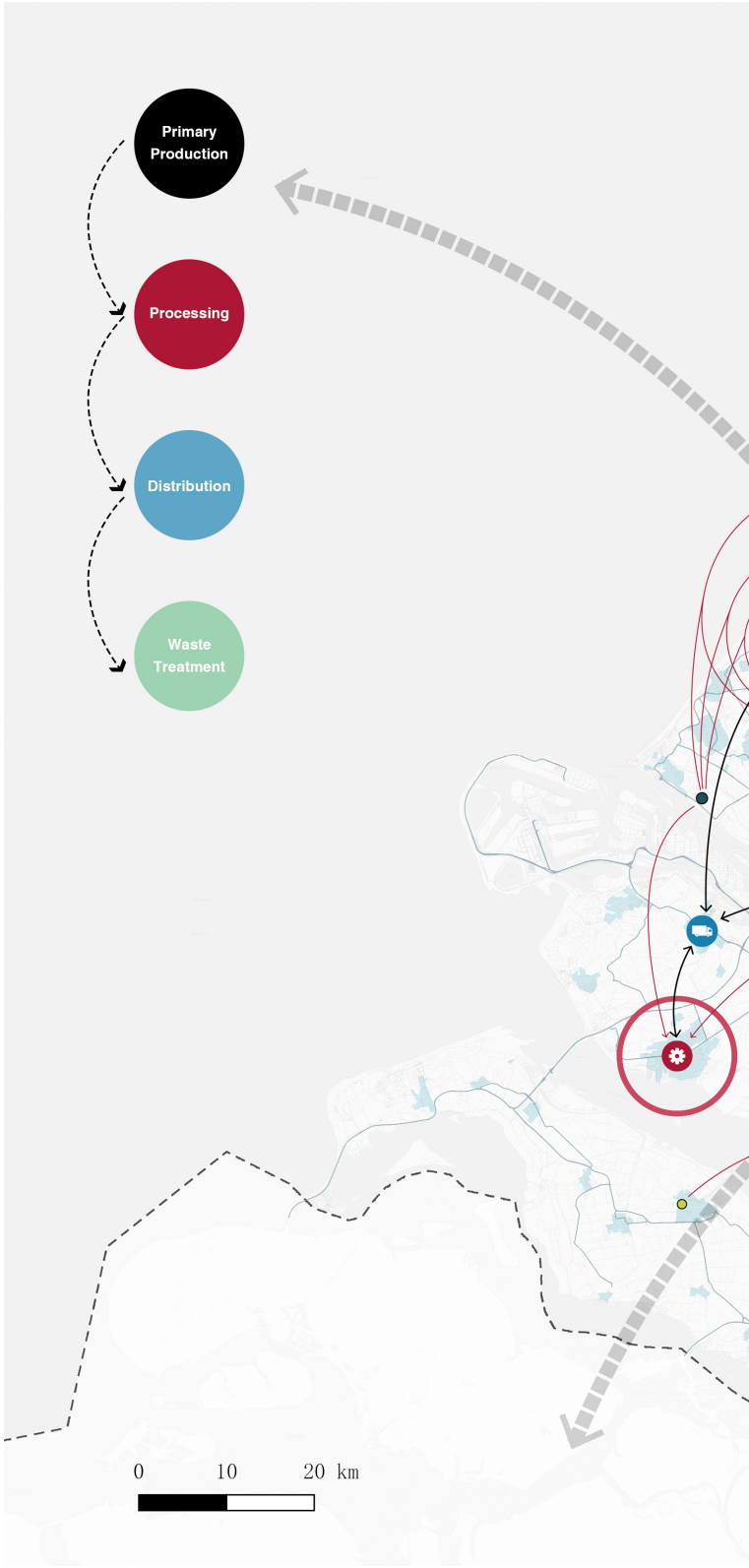
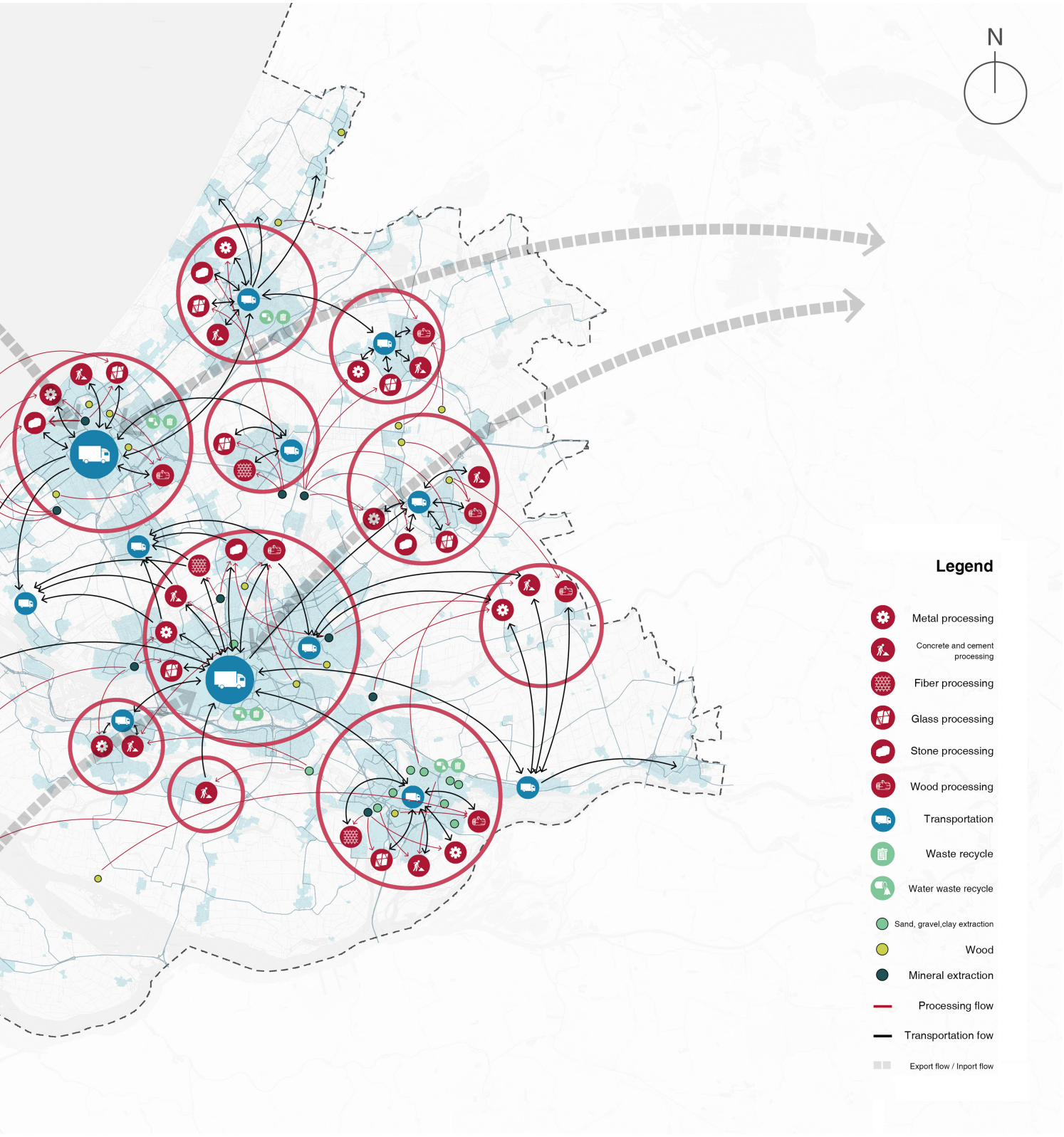


Figure 3.12 | Spatial material flow of construction sector (Authors, LISA, 2018 and OSM, 2021)


N
Legend
Metal processing
Concrete and cement processing
Fiber processing
Glass processing
Stone processing
Wood processing
Transportation
Waste recycle
Water waste recycle
Sand, gravel,clay extraction
Wood
Mineral extraction
Processing flow
Transportation fow
Export flow / Inport flow

3.2.4. Concluding

In conclusion, the biggest problem facing the construction industry is how to solve the shortage of raw materials, and how to create new sustainable materials. This will be an important foundation for a circular economy. Agricultural products or waste are an important source of sustainable materials. What follows is the lack of high-tech processing industries, which will also be a link in South Holland that needs to be improved urgently, to support the production of sustainable materials.

In addition, some new urbanization areas are far away from the manufacturing industries, which reduces transportation efficiency and generates a lot of unnecessary waste. Establishing a distributed industrial layout can not only shorten the gap, but also improve the efficiency of waste recycling (Figure 3.13).

The construction industry will serve as an important economic development foundation, technical support and industrial platform to promote the circular economy.

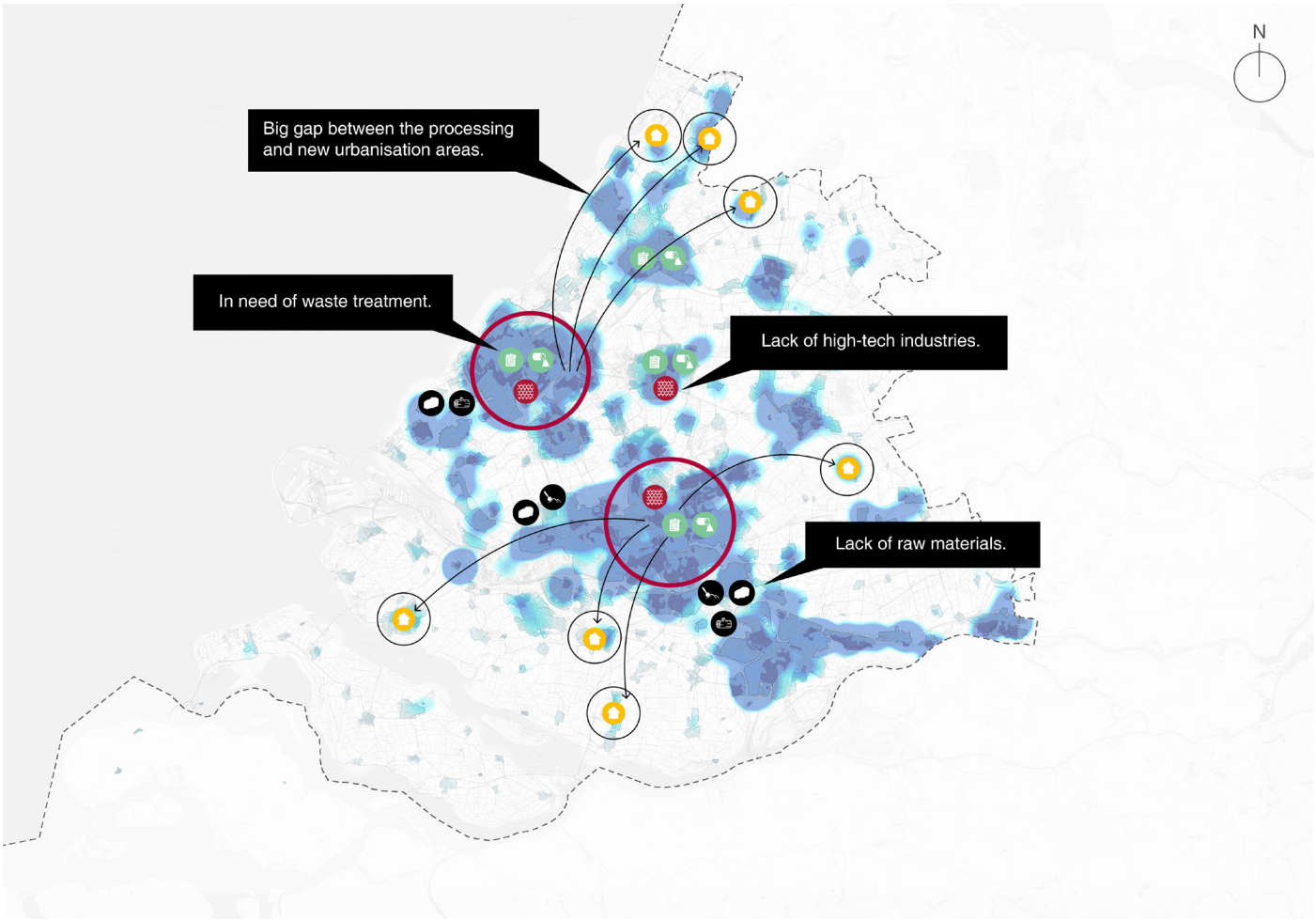


Figure 3.13 | Conclusion of construction sector (Authors, LISA, 2018 and OSM, 2021)

‘The biggest problem facing the construction industry is how to solve the shortage of raw materials, and how to create new sustainable materials’

(Authors, 2021).

3.3. Potential symbiosis

There are certain similarities and common points between the two departments in terms of material flow and spatial distribution, which provides potential motivation for the symbiosis of the two (Figure 3.14).

3.3.1. Sharing energy

Both the construction sector and the agriculture sector generate a large amount of CO2 emissions and surplus electricity. They can be used for secondary use and serve each other. For example, biofuel produced by organic waste from agricultural activities can provide energy for the construction industry.

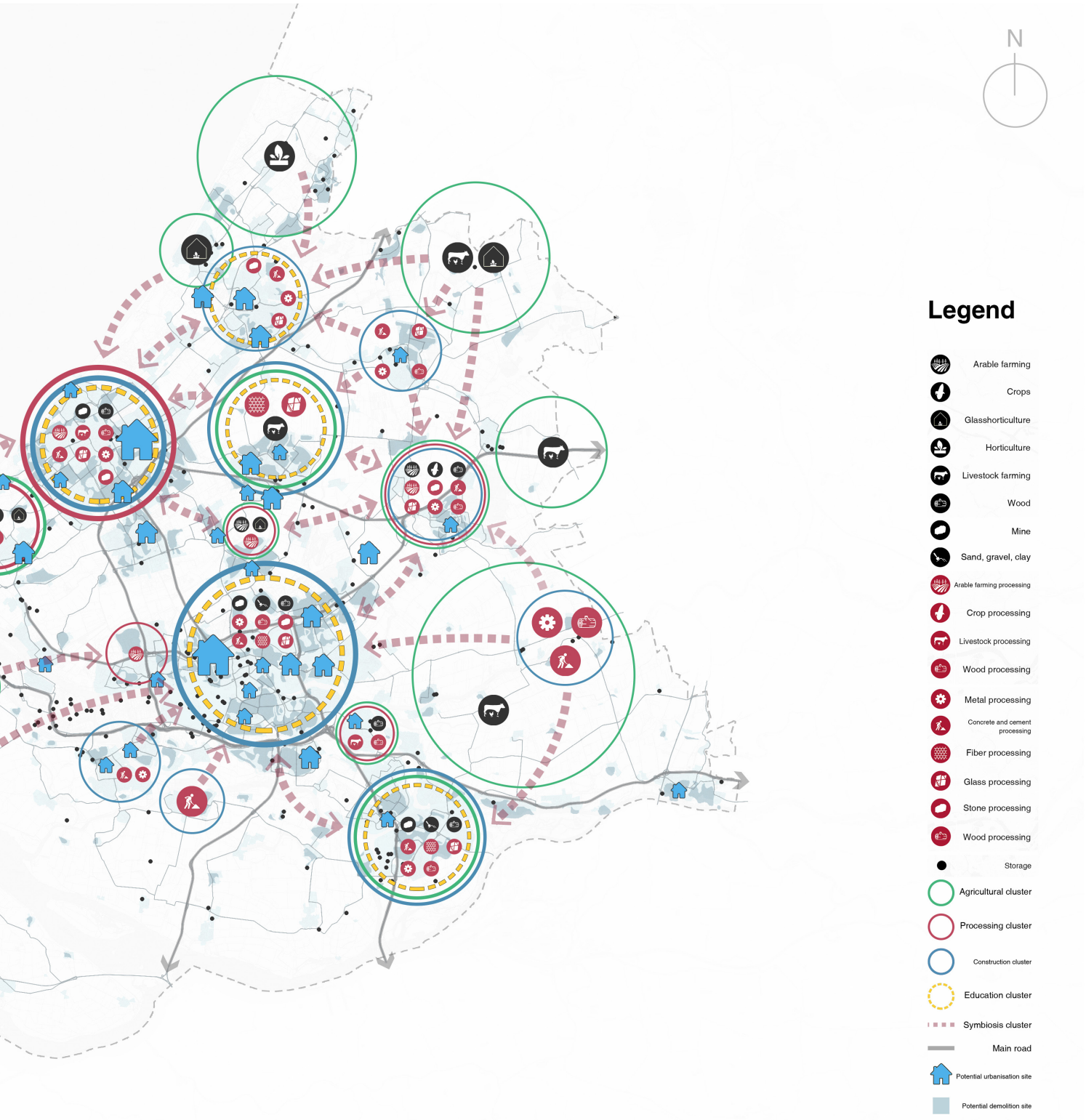
3.3.2. Mix-use areas

Both sectors have the problem of excessive agglomeration in terms of spatial distribution, and many of these industries can be dispersed to the edge of the secondary center to shorten the gap in the middle. The new suitable construction areas are limited, which means that mix-use will be a good way to accommodate the two sectors at the same time.

3.3.3. Waste as resources

As we mentioned before, some products from arable farming and organic waste can be viewed as potential resources for specific sustainable construction materials. These resources can be obtained from all stages in the supply chain. These organic products can be food that for example does not make the cut in the auction or is wasted along the chain. Another way to extract organic materials is to use byproducts that are thrown away along the production or processing of the agri-food sector. LandBOUW has chosen to use these materials because this will be a relatively accessible resource which has unused potential. Other resources for biobased materials need a new production place, whereas in this vision the production space can stay relatively the same and thus have the least spatial implications.

Figure 3.14 | Spatial material flow of potential symbiosis (Authors, LISA 2018 and OSM, 2021)

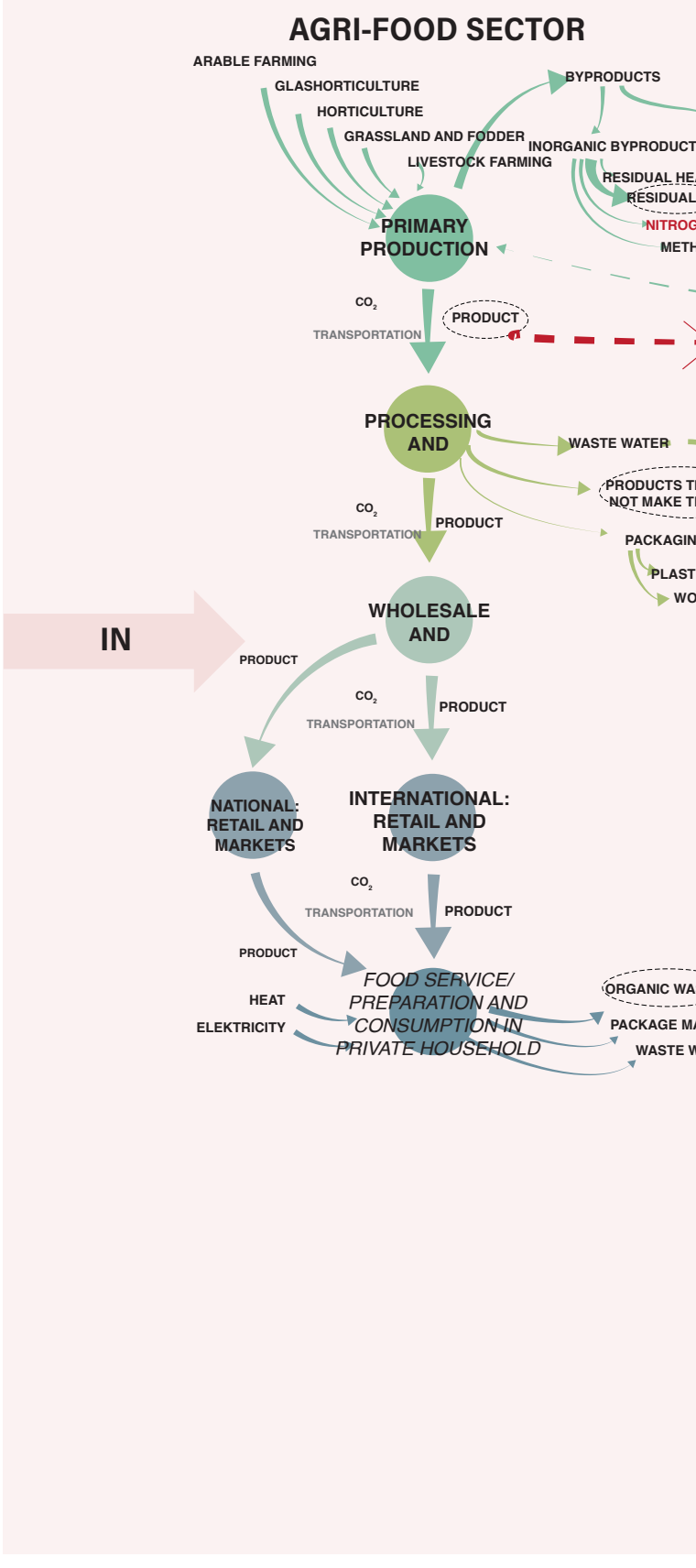

N
Legend
Arable farming
Crops
Glasshorticulture
Horticulture
Livestock farming
Wood
Mine
Sand, gravel, clay
Arable farming processing
Crop processing
Livestock processing
Wood processing
Metal processing
Concrete and cement processing
Fiber processing
Glass processing
Stone processing
Wood processing
Storage
Agricultural cluster
Processing cluster
Construction cluster
Education cluster
Symbiosis cluster
Main road
Potential urbanisation site
Potential demolition site

Use of residual agricultural materials would trigger a different approach in construction by allowing a number of benefits with respect to traditional materials options by having lower CO2 content, reducing health risks and cost (ARUP, 2017, P.7).

Alternative Model

Currently in Europe, methods of organic waste treatment include: recovery, incineration and landfilling. However, the waste management model is still limited within the agricultural sector, and 90% of the organic waste is recycled as fertilizers.

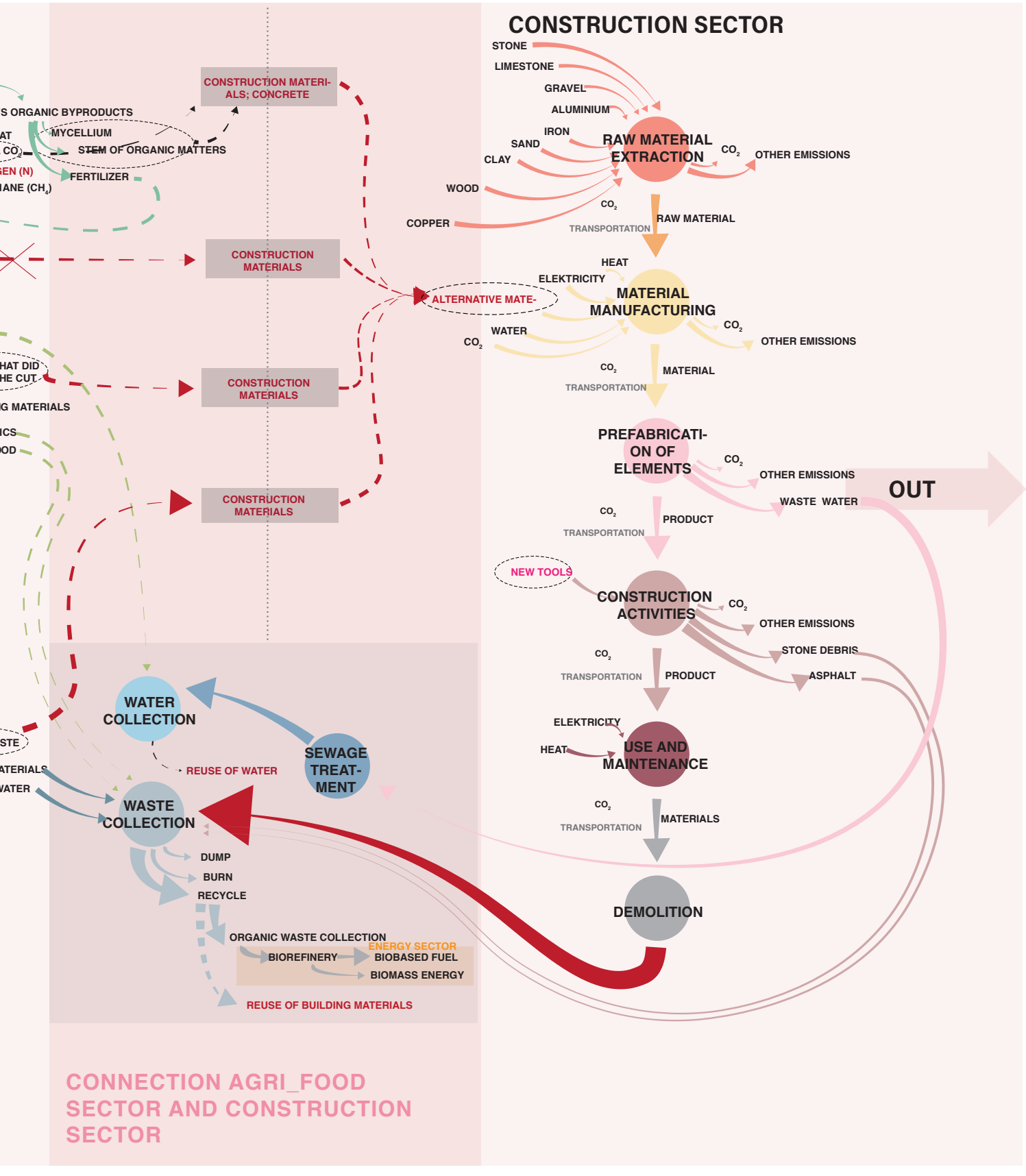
ARUP (2017) proposed an alternative model to attach more value to circularity, so that the potential increase in value for organic waste would not come at the expense of the traditional end of life. Agricultural resources transformed into construction products will get back into the biological loop, so that they can actually get even more loops into the technical cycle when repurposed or remanufactured
Therefore prolonging their life and generating exponentially more value through several loops (ARUP, 2017, P.22) (Appendix).



Legend

- Material flow
- Circular (new) material flow
- Circular material flow LandBOUW

Figure 3.15 | Connection agri-food and construction chain (Authors, 2021)



CONNECTION AGRI_FOOD SECTOR AND CONSTRUCTION SECTOR

Alternative biobased materials from residual food materials
Concrete is a hard-to-recycle material that can be replaced by many new options such as straw bales, grasscrete, hempcrete, wood, bamboo and so on (Figure 3.18, appendix). For example grasscrete is a type of continually reinforced, ready mixed concrete with stone or grassed soil from the agri-food sector allowing water to pass through the concrete. The reduction in heat island effect, management of stormwater runoff, recycled content used in the application process as well as the concrete and sub-base, the long lifespan and the low maintenance required help grasscrete to be a better option. There are many other materials that can replace concrete, such as Hempcrete, bamboo, wood and mycelium.

Another is cellulose fibers for insulation instead of metals. Cellulose fibers are fibers made with ethers or esters of cellulose, which can be obtained from many agricultural products. Cellulose fibers have been more and more popular In comparison with engineered fibers because of low density and cost, recyclable and biodegradable characteristics.
Also wheat can be used to create building panels. They can be used for envelope and internal walls and acoustic insulation. The material has a high stiffness and is resistant to water.
These alternative materials that have been realized or can be realized through technology in the future will enable the construction industry to use more environmentally friendly materials to decrease the amount of loose ends of the agri-food sector and reduce waste and pollution from the beginning of the construction sector.

Alternative biobased materials from byproducts of the agri-food sector
Particle board
Particle board is widely used in the construction industry. This particle board is based on flax-hemp shives, a byproduct. flax-hemp plates are used, among other things, in wall and ceiling systems (van Dam & van den Oever, 2012).

Potato peel
These are completely bio-based products made by mixing the peeling of potatoes that are hygenised, pressed and dried. Main constituents are lignin, cellulose, hemicellulose and proteins (ARUP, 2017) This material can be used for insulation and as an acoustic absorber. For the potato eating country that we are, this material is widely available and has low seasonal constraints.

Seeds, Stalks & Leaves
Leafs, seeds and stalks of any plant can be converted into both stiff and flexible boards for acoustic ceilings, furniture and decorative finishes for walls (ARUP, 2017).

Banana and pineapple fibers.
These fibers, the peel and the leaves can be used to obtain rugged textiles. These can be found as carpets and fibers for composite applications. These can be used for internal cladding and furniture (ARUP, 2017).
Only mostly grown in tropical areas but the processing and consuming happens In South Holland.

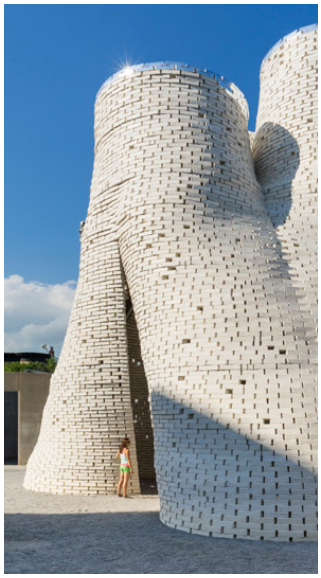


Figure 3.16 | Mushroom tower in MoMa (Arnet, n.d.).

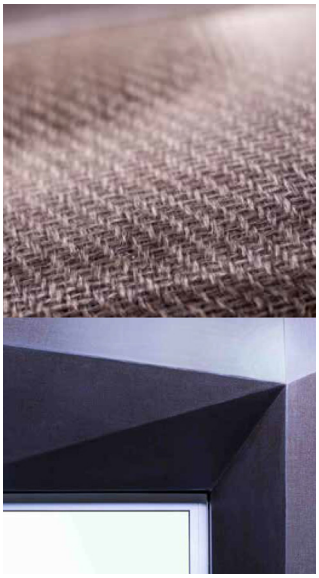
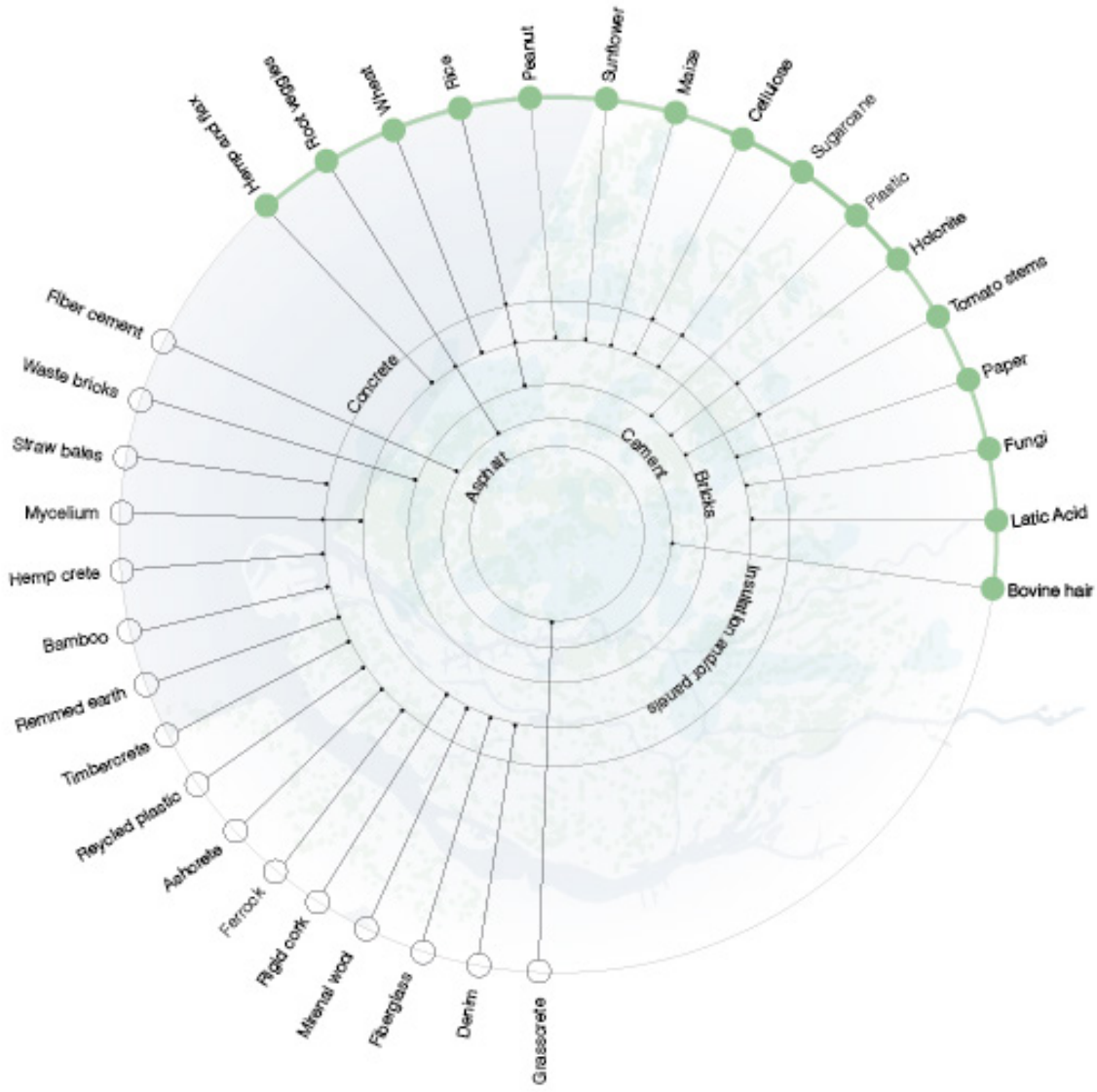


Figure 3.17 | Biocomposites (ARUP, 2017, P.13)



Legend

- Biobased materials
- Agri-food materials
- Replaced materials

Figure 3.18 | Alternative materials from the agri-food and construction sector (Authors, 2021)

3.4. Conclusion

Both the agri-food sector and the construction sector show the uneven distribution of the current industries, the gaps between steps are too large and the waste treatment is not enough to support the circular economy. However, the two development priorities of South Holland, can contribute a lot to the circular economy. A large amount of usable residual organic material flow from agriculture in South Holland can be used as raw materials for sustainable construction through high-technology. Fortunately, these two have overlapping areas which can be combined with each other.

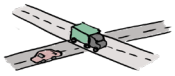
‘Use of agricultural materials would trigger a different approach in construction by allowing a number of benefits with respect to traditional materials options by having lower CO2 content, reducing health risks and cost’

(ARUP, 2017)

1 **Policies**
As South Holland has stated the 2050 vision, the government has prepared to establish new policies in combination with current regulations to promote sustainable development and waste recycling treatment for both two sectors. In this case, these policies can be combined together to promote an integrated system of these two sectors.

2 **Education and employment**
The solid education system will become an important advantage for sustainable development, playing the role of glue to promote the production of new sustainable materials, change the willingness of the public, cultivate more professionals and high-tech companies and bring out more new jobs at the same time.

3 **Infrastructure**
The physical foundation supporting all mentioned is the infrastructure system. How to build an efficient and livable infrastructure system will become the top priority. There is no doubt that South Holland will embrace a valuable development opportunity. But how to intervene as little as possible to reduce the impact on the environment will become a major goal as well.



4. Vision

The content of this chapter

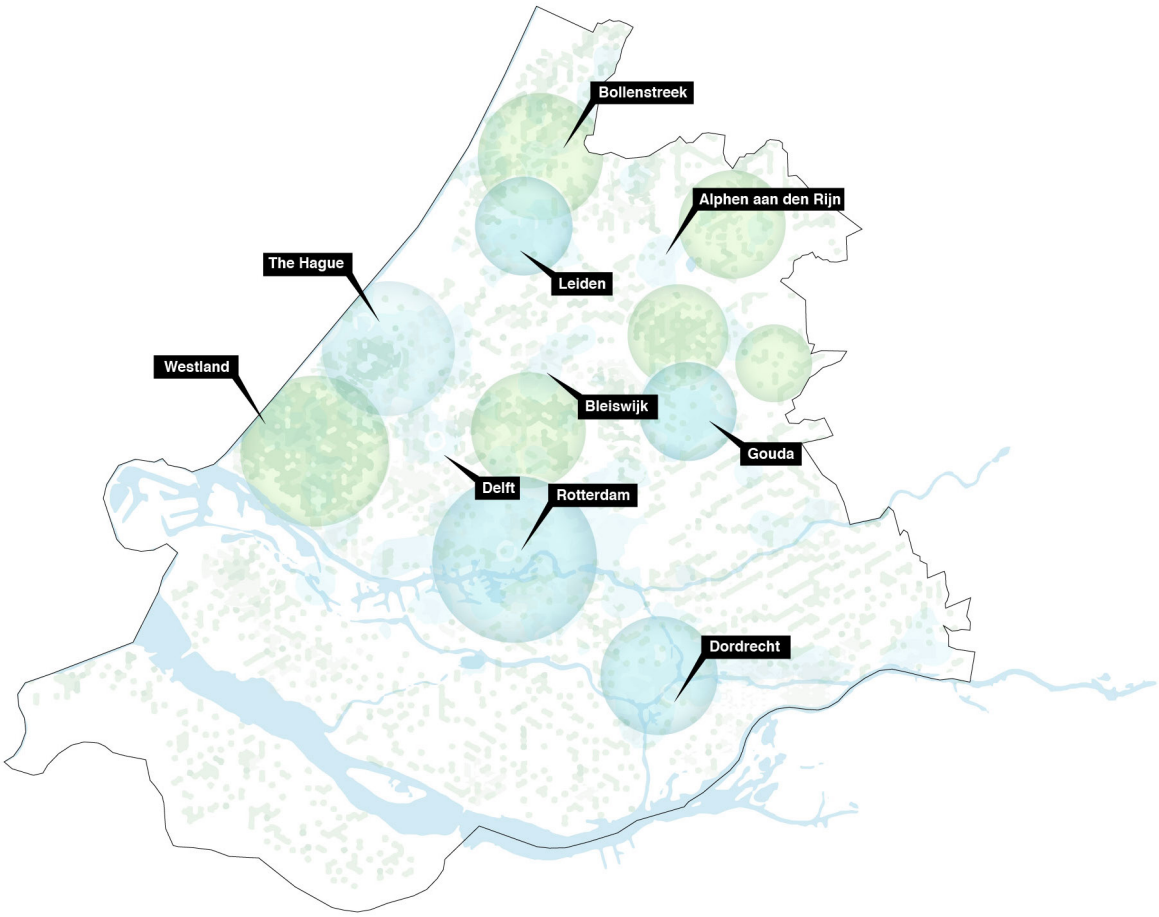


Figure 4.1 | Agri-food and construction locations (Authors, 2021)

Vision

After stating the problems and analyzing the current situation in both the agri-food- and construction sector, as well as the possibility for a symbiosis, we have concluded that the approach of the government towards the chains of the sectors and the problems within the chains itself are on the right track towards a more circular economy, but need to be enhanced through interlinked sectors to sent the ambition over the edge to a realistic one. That is why they have set the main goals for our vision.

4.1. Main goals

The approach of the government towards the chains of the sectors and the problems within the chains itself have set the main goals for our vision. The vision of LandBOUW focuses on minimizing the loose ends of the agri-food flows, supporting the construction sector with sources from the agri-food sector and other biobased materials and thereby creates a starting point to interlink different sectors. The extension of the flows should create a closed loop on the bigger view.

4.2. Vision statement

With the main goals, LandBOUW sets the following vision statement:

> ***'In 2050, the material flow of the agri-food sector will be closed. All before known waste is now used as a resource for the construction sector. Because of this, the waste of the construction sector is reduced. Because of the collaborative sector chains, they could now be seen as one interlinked sector. The South Holland LandBOUW sector is now a leading example for a symbiotic and self sufficient interlinked chain'***

In this statement, LandBOUW makes clear that the focus lies in relationships between sectors and, in this case, the wasteflows of the one sector as resources for the other sector. This does not exclude other sources to create materials, but shows another approach towards closing loops and thereby reaching a circular future.

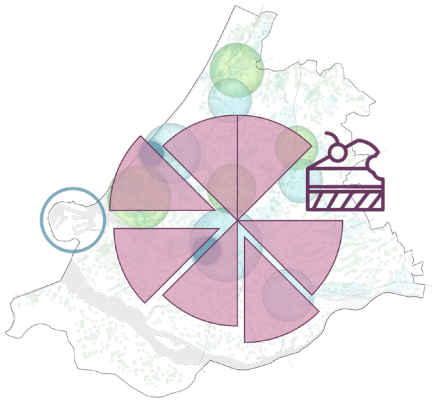


Figure 4.2 | The pie (Authors, 2021)

Figure 4.3 | The Glue (Authors, 2021)

4.3. The underlying approach

With this transition, multiple factors play a role. There is a governmental change in its approach needed, a structural change in land-use and a social change in order to support the transition and make it spatial.

Therefore our concept is based on three intertwined aims as explanation for our vision and concept for the LandBOUW strategy: the Pie, the Glue and the Connector.

4.3.1. The Pie (policies and stakeholders)
The pie focuses on the political level of the transition. At this moment, we see the parallel approach of the government as separated pieces. In order to reach the circular goals, it is needed to bring the pieces back together: as a pie. It is important to state this pillar, because the government is placed at the start of the transition and therefore reflects the rest of the process. Within this part, not only the government, but also other stakeholders play an important role. The stakeholders are the people who set up the transition, and create the bridge to spatial interventions. The pie will start the transition.

4.3.2. The Glue (knowledge and education)
The glue sticks the Pie and the Connector together. In order to translate the governmental approach into a spatial network, there is needed education and knowledge. The glue zooms in at the places itself and is mostly connected to the citizens itself. In this pillar, we go deeper into existing education clusters, start-up zones and growing knowledge areas. The glue will keep the stransition going.

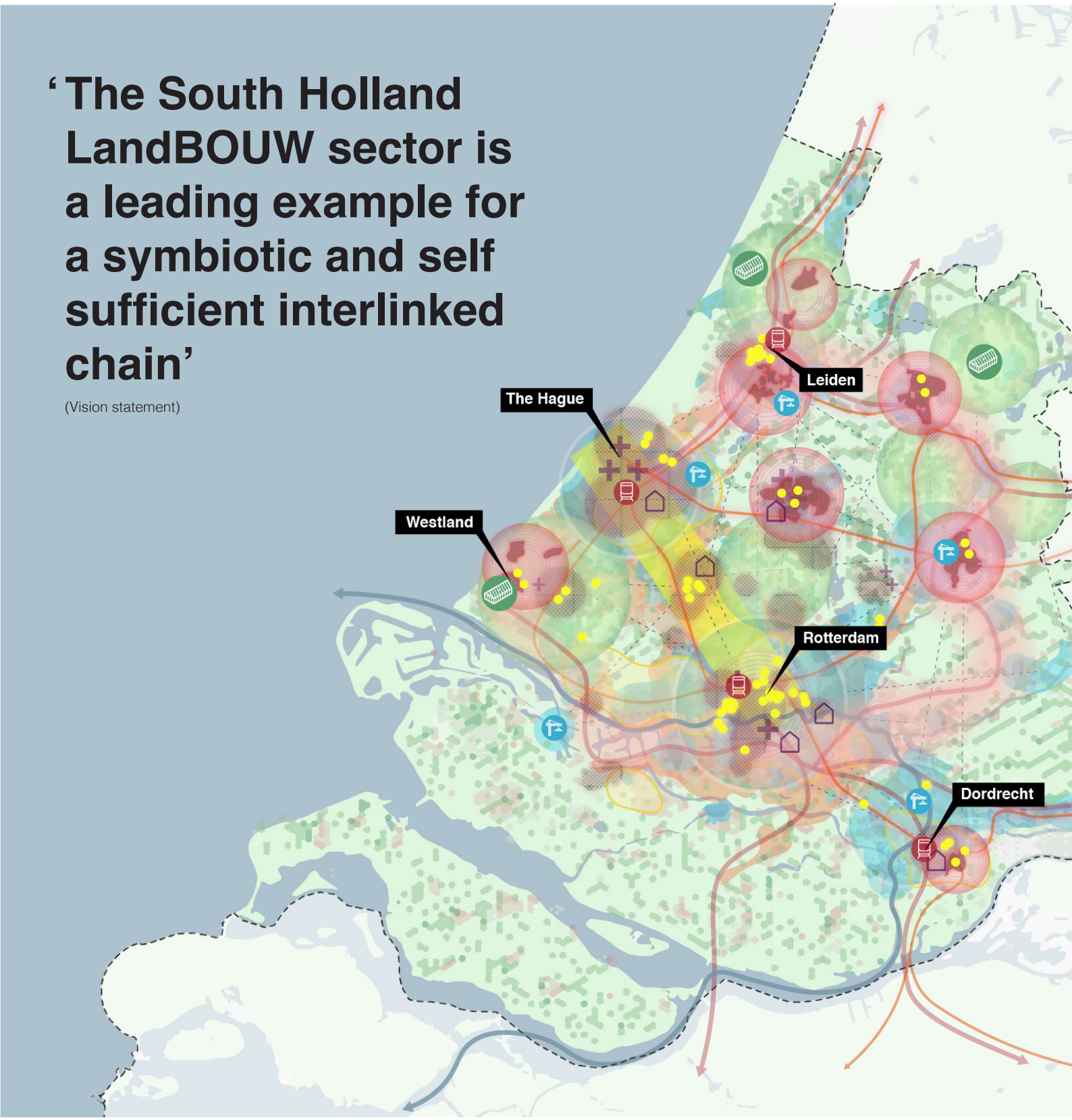
Figure 4.4 | The connector (Authors, 2021)

4.3.3. The Connector (network)
The connector reflects the spatial infrastructure of the vision. The areas should be accessible by people and products and hereby have a double function. Furthermore, the connector is not limited to the borders of the province. Contrary, this network searches for (existing) connections to other metropolitan areas near South Holland in order to scale up in future. The connector creates a smooth (and extensive) transition in future.

In South Holland, both qualities of water and land transportation are already at a relatively higher level. We hope to achieve a more complete and high-efficient transportation and logistical system based on existing connections and put as few interventions as possible in to decrease material waste. In the near future, South Holland will cooperate with other big cities to form a co-prosperous and sustainable metropolitan area.

‘The South Holland LandBOUW sector is a leading example for a symbiotic and self sufficient interlinked chain’

(Vision statement)



Legend

- Agri-food cluster
- Construction cluster
- Symbiosis area’s
- Roads
- Railways
- Development area’s
- Future (re)development
- Public transport hub
- Greenhouses
- Construction companies
- Circular start-up clusters
- Knowledge clusters
- Knowledge axis
- Waste flows
- Constr. Working population
- Accessibility 15 min.

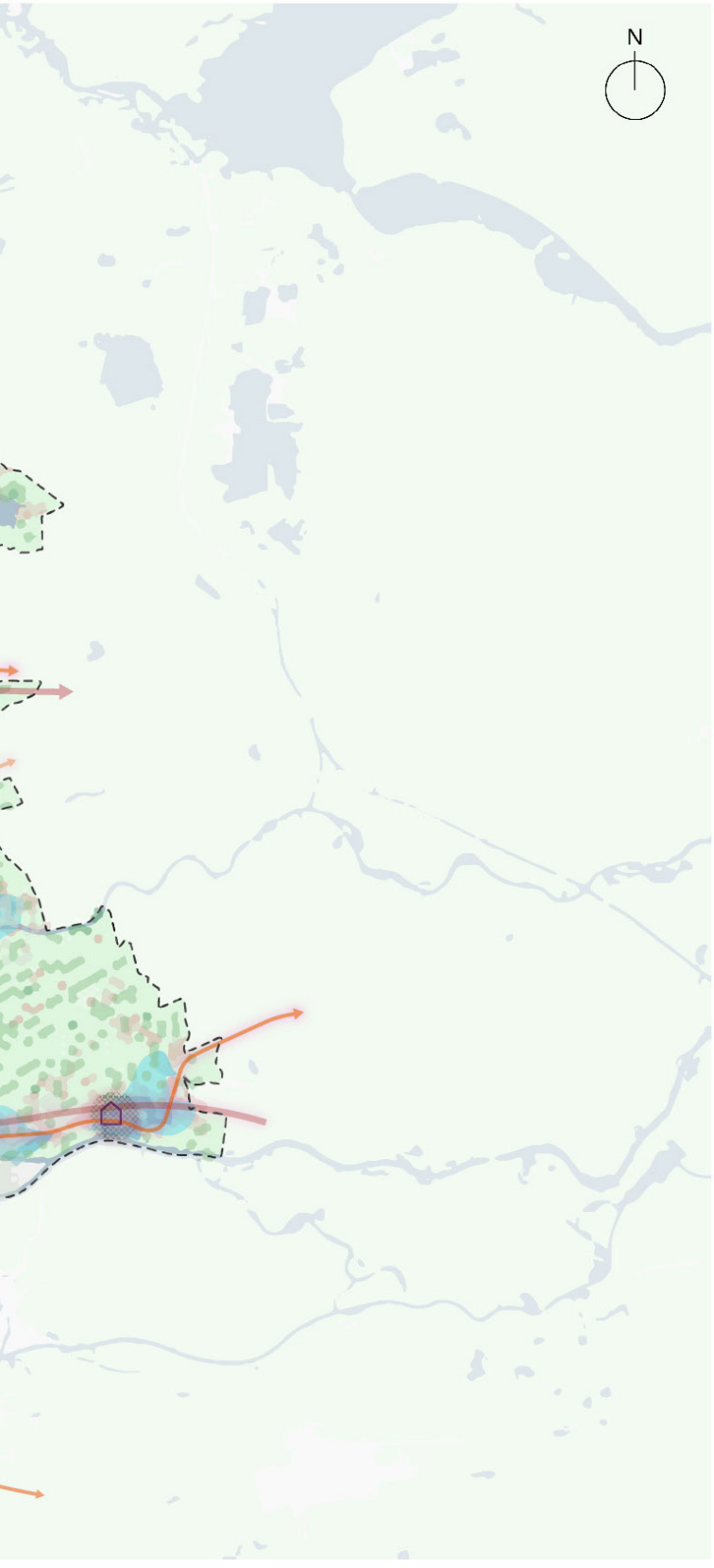


Figure 4.5 | Vision map (Authors, 2021)

4.4. Vision map

In this map, the spatial interventions are shown towards creating the symbiosis between the sectors. The axis between the Hague, Delft and Rotterdam forms the zone of existing innovative activities. This cluster contains a lot of knowledge based companies, universities, schools and waste processing oriented initiatives or circular start-ups. Also, within this cluster, the building areas already set a detailed approach to the future living environment. Therefore, this area is an important starting point of our vision and the bridge from industry to people (IABR & UP, 2016).

Secondly, the highlighted areas show the potential transition zones. These zones touch the agri-food zones or construction zones, are within the agri-food zone or can be an extension of the construction zone. In all locations, future (re)development is needed in order to create a livable and sustainable environment. Because we can assume changes over there and the strategic location, we chose these locations to look into further (Waag Society, 2021).

Thirdly, the red and pink lines represent the improved network by rail and road among the places. The places should be accessible by people and products whereby the existing infrastructure sets a good basis and can be upgraded. The added infrastructure is based on the accessibility by people. Key intervention is the railway from Westland to The Hague and Westland to Rotterdam. We see, this network is lacking behind at the moment.

5. Design strategies

The content of this chapter

5.1. Introduction

This chapter will elaborate more on the design strategy. Starting with the general explanation of the strategy. Followed by the fundamental ideas of the three approaches: the pie, the glue and the connector. Together with these approaches, the interpretation of the transition areas is explained in more detail and made explicit. Concluded by the accompanying phasing where the vision is converted into a strategy with the ultimate goal: its realisation.

5.2. The pie

The pie focuses on the political level of the transition. Within this part, not only the government, but also other stakeholders play an important role. The stakeholders are the people who set up the transition, and create the bridge to spatial interventions. The pie will start the transition. Existing policies already state a lot of possibilities to create a circular economy but synergies between the sectors are not yet explored extensively.

5.2.1. Existing policies

1. For example *Opportunities and barriers of circular agriculture* (Bianchi et al, 2020) lists the importance of trying to minimise food losses in all stages of the production chain by using waste streams and turning these into inputs for the food production chain.

2. An example of a policy document for the construction sector is *Framework Circulair Bouwen* (Platform CB'23, 2019), which states that the depletion of raw materials must be prevented. It is therefore important to build as much as possible with materials that are renewable or reusable. The impact of extraction, processing, transportation and use must also be factored into a primary consideration. The type of materials used in circular construction is changing compared to traditional, linear construction. For example, it is becoming common to use biobased materials. These materials are not exhaustive but they grow back relatively quickly in nature (or in agriculture and forestry).

3. *Zuid Hollandse Woningbouw Agenda* (the building agenda in English) talks about three things (Province of South Holland, 2020):
   1 Build fast & smart
   2 Build for the future; In the right place, where needed.
   3 Build for everyone, affordable and socially for the area as a whole.

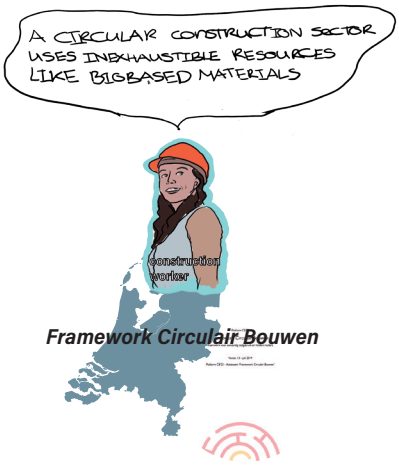


Figure 5.1 | Policy stakeholders (Author, 2021)

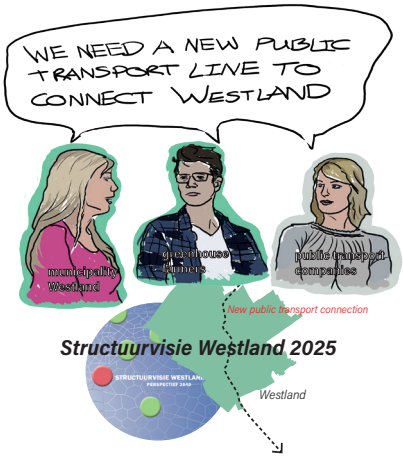


Figure 5.2 | Policy stakeholders (Author, 2021)

4. *Circulair Zuid Holland* (Province of South Holland, 2019) includes two chapters about the agri-food sector and the construction sector separately. It states that innovation needs to be scaled up and stimulated in order to achieve a circulair construction sector which will accelerate the realization of the housing need. Another point it conveys is that circular initiatives should be stimulated in the development, construction and maintenance of business parks.
For the agri-food sector it states that Greenports should strengthen their position through new, circular knowledge and earnings models. Residual organic materials should be used optimally.

5. *Structuurvisie Westland 2025* proposes a new high-quality public transport connection between Westland and the Rotterdam-the Hague region. (Gemeente Westland, 2013) This connection will make it possible for Westlanders to make use of the facilities in the region, and will make Westland more attractive for the region as a work location, which will be beneficial for the greenport. They predict that this connection will be a light rail connection.

6. *The 2030 Agenda for Sustainable Development* (sdgs.un.org, 2015) is a policy that consists of 17 Sustainable Development Goals (SDGs). This policy was adopted by all United Nations Member States in 2015. These goals recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth while tackling climate change. In particular goals 11. 'Make cities and human settlements inclusive, safe, resilient and sustainable' and goal 12. 'Ensure sustainable consumption and production patterns' are significant for the LandBOUW vision.

All these examples of policies have been combined in the LandBOUW vision. By talking with the policymakers, designers and planners of these policies, new synergies could be identified. These experts could give new dimension to the LandBOUW vision.

5.2.2. Persuading stakeholders

Awareness
In order to persuade most companies in the agriculture sector, awareness about the cause is necessary. In the construction sector knowledge about the need to switch materials has to be spreaded. Also, the user has to be made aware why he or she has to choose these new materials.

Create a market
To convince stakeholders into realizing the LandBOUW goals. It is important to create a market for the new materials. After giving the push from bottom up initiative, it needs to be taken over by the market. Creating a market requires convincing an array of customers, partners, and other constituencies to see the need to buy and sell the new products.

Create economic benefits
The primary production companies, processing companies and supermarkets need more incentive to use the new materials. Also building companies and existing material manufacturing companies need to switch making or using the existing materials. In order to persuade these stakeholders, it is needed to give an economical reason to do this. This can be done for example by taxes or funds, or just by saving money on the new resources. Another way to save money for these companies would be to make the transportation chain shorter.

Make it easy
Another way to convince stakeholders to switch materials or give up their residual materials is to make it almost too easy for them to do it. Especially for the primary production agriculture companies it is important to persuade because of their big residual flow. This can be done by placing a waste collection close which

Figure 5.3 | Agri-food stakeholders (Author, 2021)

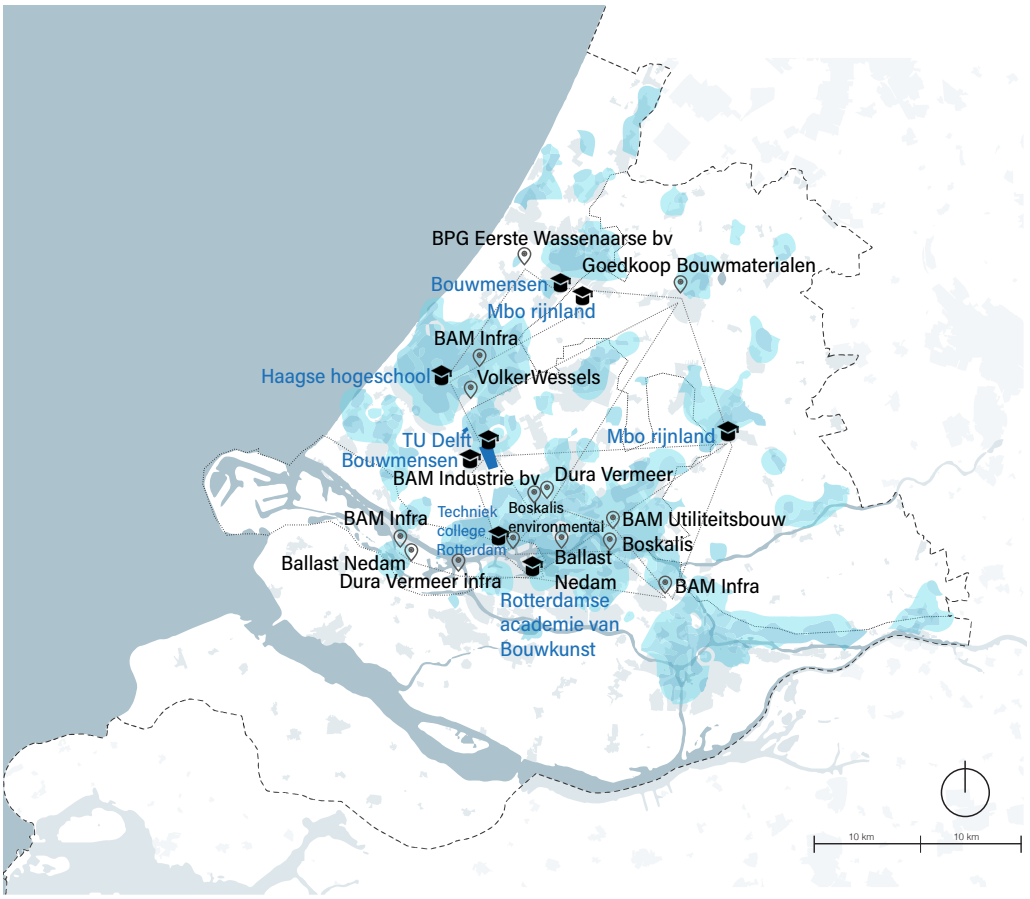


Figure 5.4 | Construction stakeholders (Author, 2021)

Figure 5.5 | Public transport stakeholders (Author, 2021)

Figure 5.6 | High-tech systems and materialsstakeholders (Author, 2021)

distributes the materials to the surrounding needing companies or simply by letting the companies themselves give their materials to their neighbours.

Knowledge
To make the switch to a more biobased building sector, more knowledge and innovation in the sectors is needed. In order to do this exchange of knowledge in between the sectors is needed. Education and research centers should be placed strategically to make knowledge accessible for all actors. To give new life to the sectors the education that intertwines the sectors should be promoted and located where it is needed.

Create a good logistics network
For most of the stakeholders it is important to have a good logistics network. Now In both the agricultural and construction sector a lot of transportation of goods is needed. By creating a more efficient or shorter logistics chain, money can be saved and emissions can be reduced.

Improve public transport network
For the knowledge sector it is important to create an efficient public transport network to make education and research centers accessible. This will also stimulate more exchange in workers for the new (intertwined) sector(s).

Create an attractive business climate
Another incentive could be an attractive business climate to establish. Creating a healthy environment for the employees of the new businesses could convince companies to establish themselves in the area.

5.2.3. Engaging stakeholders

Ongoing stakeholder meetings
All stakeholders, and especially critical stakeholders listed in the maps and appendix, should be engaged by an ongoing dialogue. The meetings will be attended by experts to spread knowledge on a specific focus area.

The meetings are held to:

1. Get feedback on the strategy and areas where we can improve, identify gaps in our approach and this will shape our planning
2. To identify commitments and progress
3. To gain knowledge about potential issues
4. Share opportunities and dilemmas
5. Discuss trends and innovation

Awareness campaign
By interviewing stakeholders, stakeholders are forced to think about the subject.

The questionnaire will include topics like:

1. Their share in creating a responsible consumption chain.
2. Their waste management
3. Their share in creating sustainable jobs and their contribution to local economies

This campaign will also include meeting with organizations and looking at their company policy.

A meeting space
Connecting stakeholders can be done by creating a space where interaction is unavoidable. By putting the two sectors together actors can learn from each other by seeing. This can also be a digital space where knowledge is exchanged and actors are in direct contact with each other.

Trigger stakeholders

Some stakeholders with at least moderate interest and high power could trigger the change that we desire. These stakeholders could be given a place within our transition zones. Some examples are listed below:

Heineken

In the annual report (Heineken, 2020) Heineken cites the UN Sustainable Development Goals (UN SDGs). One of the goals that are relevant to heineken and the LandBOUW vision is “Ensure sustainable consumption and production patterns”. Heineken supports sustainable agriculture and 58% of their raw materials come from sustainable sources. LandBOUW can help Heineken by creating the spatial conditions in order to achieve Heinekens goals. On the other hand, Heineken can help LandBOUW by funding, connecting stakeholders and creating awareness.

Royal FloraHolland

On the website Royal FloraHolland also cites the UN Sustainable Development Goals (UN SDGs). These are in line with the goals stated in LandBOUW. Flora Holland wants to offer sustainable products on the ‘Royal FloraHolland marketplace’. This marketplace can be a platform for providing transparent and reliable product and supply knowledge (Royal FloraHolland, 2020). The network of stakeholders of Royal FloraHolland can help connect the stakeholders needed to trigger the change needed.

Secondly we think that Royal FloraHolland is an interesting stakeholder to work close with because Royal FloraHolland has a zero waste ambition. The company works together with the company Milgro which to create an auction without waste and with as much reuse of raw materials as possible (Royal FloraHolland, 2020).

Milgro

MIlgro is a market leader of independent waste and raw material management. They try to reuse/ recycle waste flows or try to make the connection with other companies that find value in their residual materials. Their goal is in line with the vision of LandBOUW towards a circular economy with waste management to a higher level (Migro. com, 2020).

Milgro can help businesses to get apprehension on their residual material flows. Milgro already has many ties with the food sector and has sector specific benchmarking tools to get results.

Dura Vermeer

Dura Vermeer looks for innovative building methods and looks for application of materials where ultimately less residual flows are created while the realisation and use of the project. Dura Vermeer has the ambition to become a leader in sustainable construction in The Netherlands (DuraVermeer, 2020). Dura Vermeer could become the bridge between the manufacturing companies and the end user. Cooperation with Dura Vermeer would be beneficial to promote the use of the new materials of organic residual material flows.

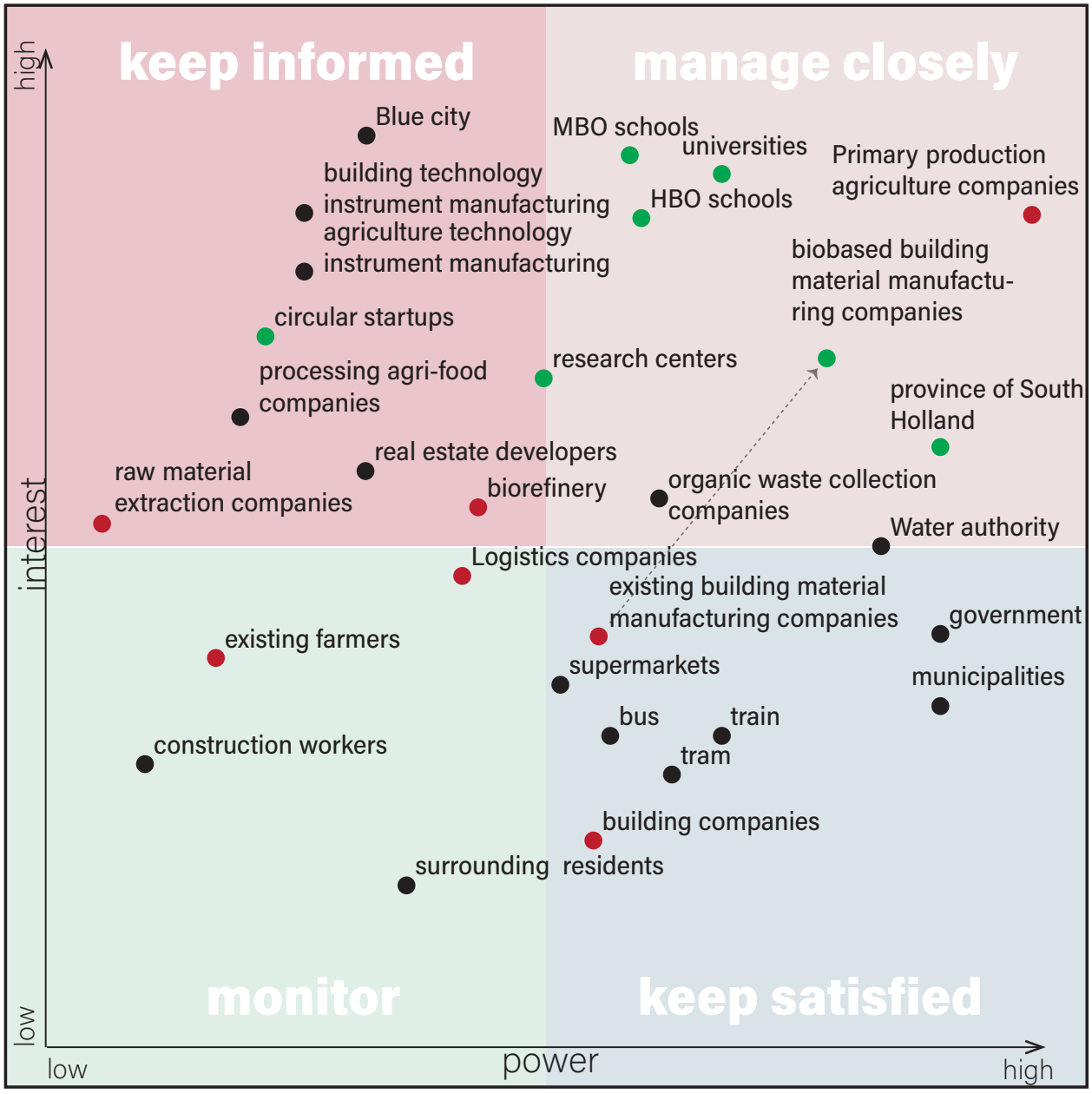


Figure 5.7 | Power interest diagram stakeholders (Authors, 2021)

In this diagram the stakeholders of LandBOUW are listed. They are arranged from low interest to high interest and low power to high power. With this diagram different management techniques for different stakeholders are identified. For example, the group that falls into the square high interest and high power needs to be managed closely.

5.3. The glue

The glue is the second pillar which is about education and knowledge. These two instruments will lead to the awareness and the insight that change for circular use of (raw) materials is necessary. Accessibility to education is part of spatial justice. It will bring another, new target group in: the students and younger people. This group is at the beginning of their job life and it is important for them to get in touch with the new systems.

By (practical) education based on a technical approach on agri-culture systems located near the agri-food sector, not only the policies get interlinked, also the old target group together with this new generation. This contributes to the awareness and creates a trigger for the need for circularity. Creating this awareness, it is important to create motivation to change. This motivation can be stimulated intrinsic or eccentric.
With the new education programs and the acquired associated knowledge, the new vision about circular use materials gets stimulated. Also, it makes the vision realistic and economically attractive. In that way the vision can be translated into a well founded strategy.

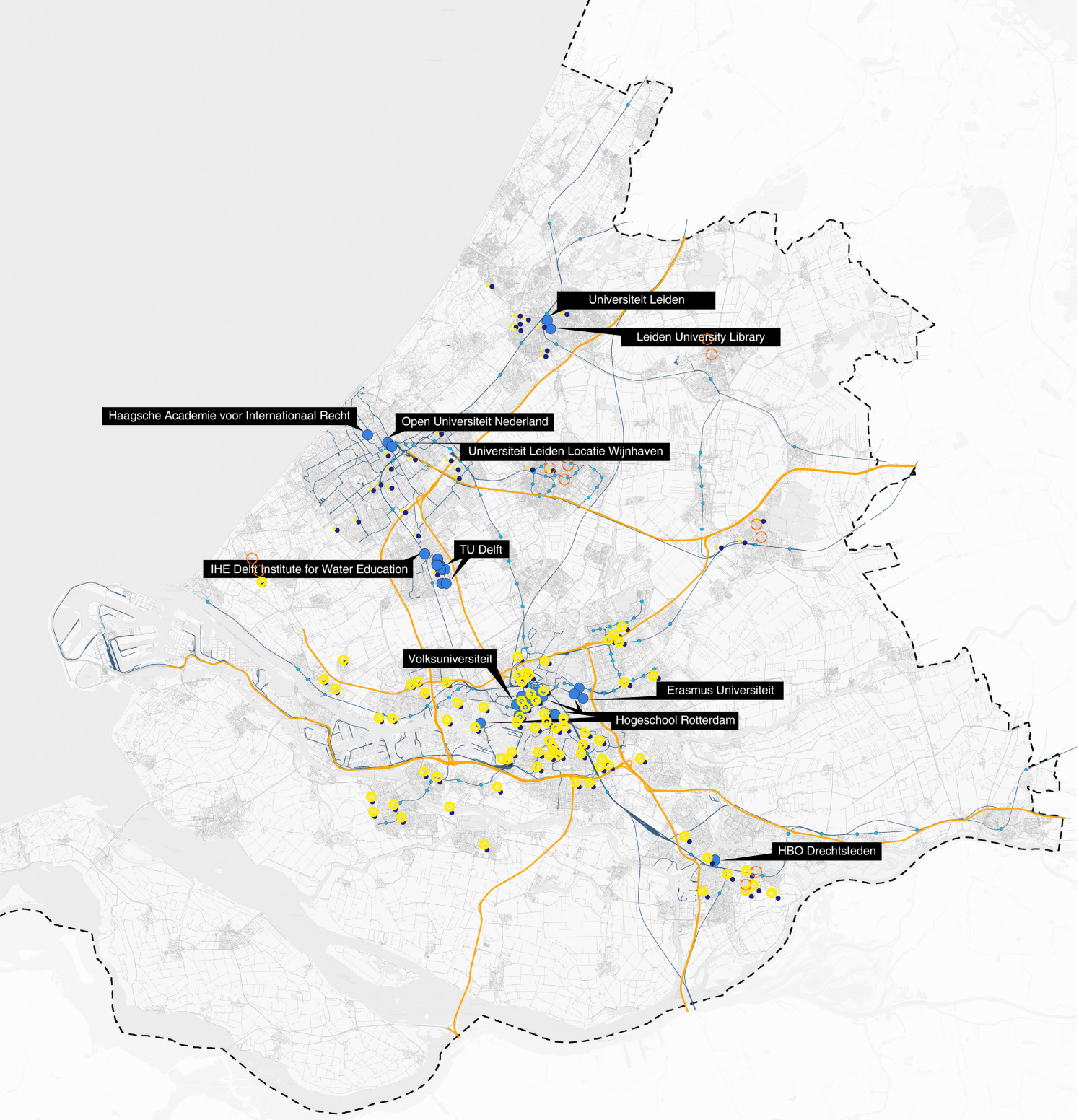
5.3.1. Accessibility to education

The accessibility to education links social justice to the accessibility to education links social justice to space. Accessibility creates an easier and more approachable way of bringing knowledge to the potential new students. Studying these subjects will be more attractive and it will give the young professionals a role in society and therefore creates social justice (Delgado et al., 2015). Social justice related to space is called spatial justice. According to Henri Lefebvre (1968) this organization of space is an essential dimension of human societies and reflects social facts and influences social relations. This view reinforces the idea of the importance of the new education being situated in an accessible place. To spatially combine the agri-food sector with the educational part, the location for the new education programs should be located in areas around agri-food.

The type of education needs to be defined and has to fill the gap in the labor market today. We took the University of Wageningen as a leading example. Wageningen University & Research is located in the province of Gelderland. This university focuses on nutrition, living environment and health (Wageningen University & Research, n.d.-b) and the school was initially founded in 1876 as the Agricultural College of The Netherlands (Wageningen University & Research, n.d.-a). In Gelderland there can be found examples of schools who combine the technical side with agriculture, such as the practical education program ‘agricultural technology’ at the school named Aventus (Aventus, n.d.) located in Apeldoorn.

For the province of South Holland there is this opportunity to have this kind of education programs as well, but then executed the other way around. Where in Gelderland the education of agriculture meets technology, in the province of Zuid-Holland it may be technology meeting agriculture. The Technical University of Delft (TU Delft, n.d.) in South Holland, mentioned as the largest and most versatile technical university in The Netherlands (FMVG, n.d.), could evenly function as an important educational institute connecting and inspiring new educational programs for the meeting of the technical world with agriculture.

Educational programs, practical or theoretical, can be set up for doing research in the residual material flows as a new resource for the construction sector. This not only increases to create knowledge for the new generation, but also increases the existing image of the city of Delft with a technical and sustainable approach of education.



The education approach

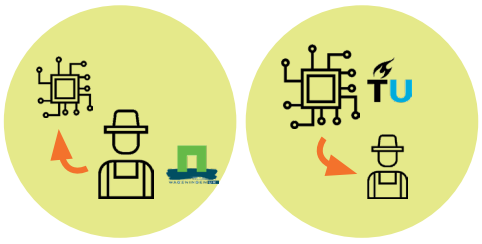


Figure 5.8 | The principle agriculture meeting technology versus technology meeting agriculture (Authors, 2021).

Legend

- Current MBO Schools
- Current HBO schools and universities
- New schools
- Railway network

Figure 5.9 | Existing knowledge clusters and new education programs (Authors, 2021, LISA 2016).

5.3.2. Job opportunities

Together with the new education program, new jobs are created. These jobs will arrive from the symbiosis of the production chains of the agri-food sector and the construction sector. But also in earlier stages, such as during the studies. Students should be motivated to do internships together with the farmers, and in that way put their knowledge in practice and also show the farmers this new insight. Simultaneously, research will have to be conducted into the use of residual flows. In that way not only the known ways of reusing materials will be applied, but a range of different options in use of residual flows will be available. This increases the opportunity for stakeholders to participate to join this approach.

The current agriculture is seen as a conservative sector with problems in finding job follow-ups (Centraal Bureau voor de Statistiek, 2021). The students and young minds can bring in a new character and interests in this redesigned sector. In that way a kind of win-win principle is created. This transition of the view on the sector is preferable, especially because it is most likely expected the decline in popularity to work in the agri-food sector will cause a lot of economic undesirables. As stated before, today the agriculture sector is still a very important economic driver (Centraal Bureau voor Statistiek, 2020b) and it is part of the Dutch identity (Weel, 2020). However, today this position is problematic in the light of the nitrogen problem and mink farms that have to be cleared due to the covid-19 crisis. Therefore, it is needed to create a change in the bad image around sustainability and keep the beneficial parts of the prominence and economic prosperity.

Jobs

Next to the change occurring in the current jobs of the agri-food and construction sector, with the interlinking of sectors several new jobs are created. These orbits mainly originated at the place where the sectors are connected to each other. So this is mainly about the research and jobs related to the reuse of the residual flows and the new education that will teach about this.

High-tech construction farmer
a companionfarmer that cares for the best organic 'byproduct'

Potato peel collector
goes around from door to door to collect potato peels

The waste manager
connects different businesses with each other and oversees exchanges of waste flows

The landBOUW stagiair
is studying an cross-sector education which combines knowlegde from both sectors

The foodbank employee
collects and reviews quality of excess food and distributes it to people in need of food

The waste collector
collects organic waste from commercial food services.

The landBOUW product developer
tries to create the best product and byproduct by genetic engineering

The envisionair
looks for future developments in the total interlinked sector

> *'What role does education and knowledge play as a base for the strategy?'*

5.3.3. Awareness

Spatially seen, by adding this new education in areas in South Holland located in the surroundings of agriculture clusters it provides awareness everyday for not only the students and farmers who will be visually reminded about the existence of these agriculture based technical schools, but also any other people who will pass these places

.

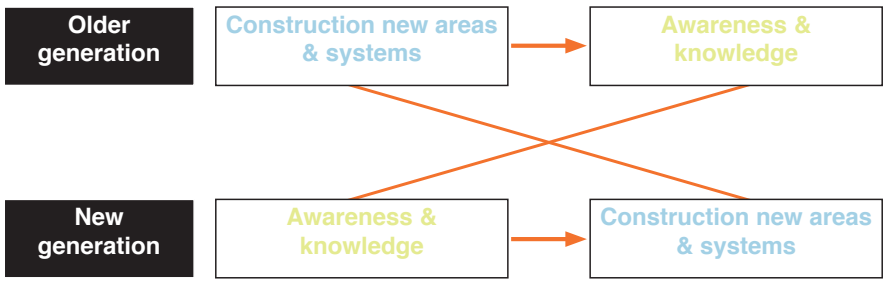
Socially, awareness is created by the principle of learning by doing for the farmers, and doing by learning for the students. In this way, the old generation meets the new generation and social connections are established. This will strengthen mutual interests in each other's workfields.

Crucial is the motivation for change. An important aspect for that is to determine the motivation for the target groups involved in the strategy. To ensure that there will be still an earth with the same amount of raw materials and biodiversity, it seems to make sense that (in the end) it would be beneficial to create sustainability through a circular economy for everybody. In fact, on a personal level people do not always seem to realize this. To understand how you can make people willing to change their mindset from the linear use of raw materials into the use of residual flows, two kinds of motivations are distinguished: intrinsic motivation and eccentric motivation.

This subquestion can be answered by the conclusion of this subchapter. Education and knowledge are used for creating the intrinsic motivation, which is a longer lasting motivation then the eccentric is. Also, education brings in a new target group. This new target group of younger people and students can give the conservative character of the agriculture sector an image boost and also strengthens the attractiveness of both the old jobs in the sector, as the newly created ones. In this way, not only the systems of the agriculture sector and the construction sector are interlinked. Likewise, the target group of the new generation with the old generation.

Figure 5.10 | Jobs created with interlinking the agri-food sector with the construction sector (Authors, 2021 & 1010 architecture urbanism et al., 2019).

Figure 5.11 | Learning by doing for the old generation and doing by learning for the new (Authors, 2021)



5.4. The connector

The infrastructure system can be viewed as a solid physical connector for LandBOUW system and circular South Holland. The perfect transportation and logistics system have strengthened the links between regions and improved the efficiency of material exchange. At the same time, good public transportation will also bring opportunities for urban development. How to build a continuous, livable, and highly accessible urban areas alongside the new system will promote collaboration within South Holland or in a more global scale on agriculture, construction and society.

5.4.1. Network

The transportation network in South Holland is mainly waterway, road and railway. Based on the previous analysis, we first improved the three systems, and then evaluated the location, level, aggregation and environmental influence of these three, which confirmed our measures such as new construction and upgrading of level have certain feasibility.

Waterway network

The main waterways in South Holland have formed a clear ring structure, which is well connected to the main cities. Only the section from the Hague via Delft to Rotterdam has a lower level. After evaluation, there will not be a big intervention to the waterway network (Figure 5.1).

Road network

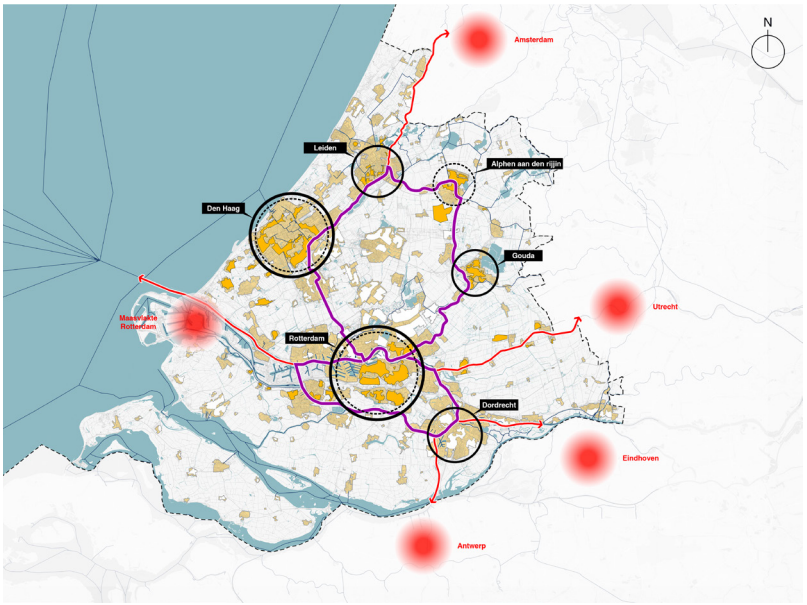
The road network is very dense and efficient, but the current main road network (Figure 5.2):

1. There is a lack of higher-class roads from the Hague to Westland and Westland to Rotterdam to support the transportation of this agricultural core, so we upgraded the classes of the two sections to carry more load, and the main roads in Westland are along the nature reserves, in which case will reduce noise pollution
2. We built two new bridges to strengthen the connection between the main loop and the area north of Rotterdam
3. The original class of the N210 from Rotterdam to the east is too low, making the Green Heart area easy to be missed. Therefore, we hope to add two lanes to the N210 to upgrade its class without causing huge environmental impact

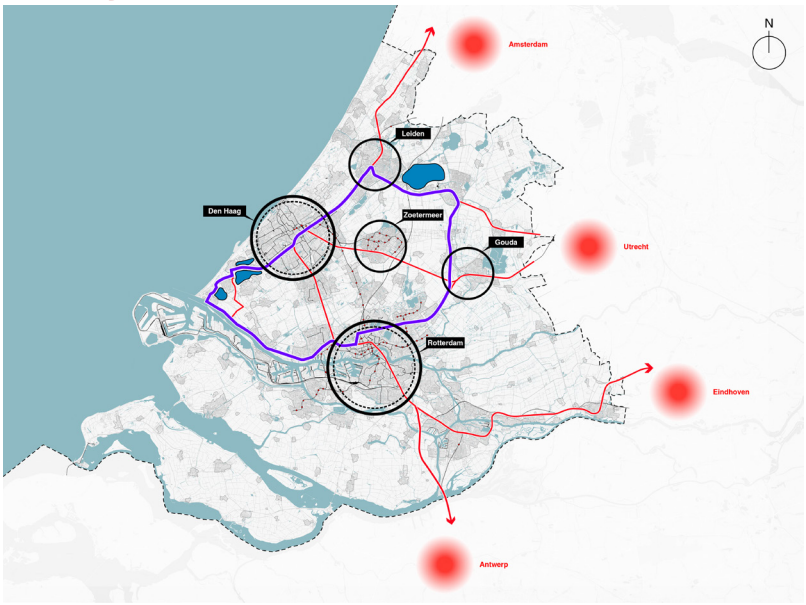
More maps about the roadways, waterways and railways? Look at the appendix.

Figure 5.12 | Conclusion of the assessment (Authors, 2021, LISA 2018 ,OSM, 2021 and CBS, 2015)

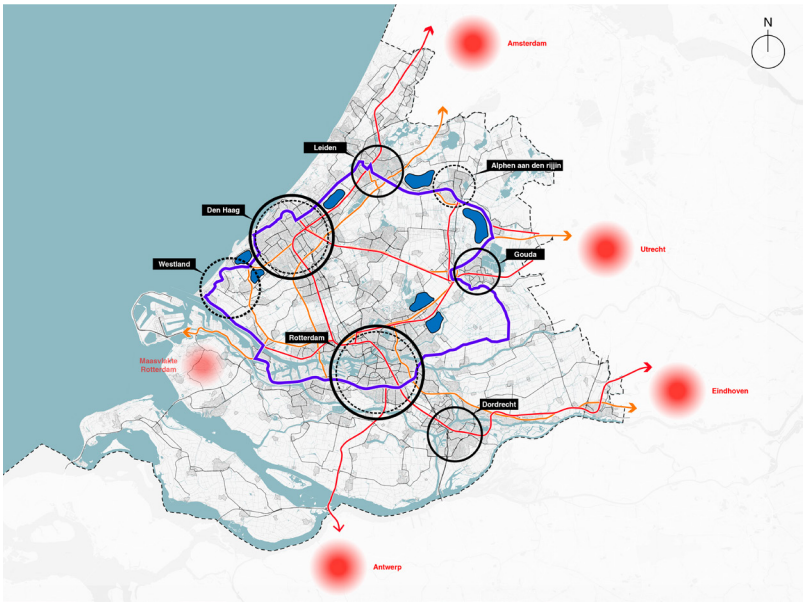
Waterway structure



Railway structure



Road structure



Railway network
The current railway network is able to connect the entire South Holland well, and continuous 15-minute service circles have been formed around the stations to facilitate the residents. However, according to previous analysis, Westland's lack of some connections caused a gap. Hereby, the biggest intervention is the application of the light rail from the Hague to Westland and from Westland to Rotterdam. This light rail will have 3 extra stops in Westland and 1 in the Hague and is connected to the metroline D of the RET rail network of Rotterdam. the Hague forms the transfer point to the different railway systems. In this way, the Westland area will become better accessible and the environmental influence is limited (Figure 5.12).

The final integrated system can connect the major cities of South Holland, and meanwhile can drive the coordinated development of small cities such as Westland and Zoetermeer. The gaps between cities along the loop of this system will be able to form the transition zones we want to intervene, linking up the entire system.

At the same time, the entire system can also be extended to metropolitans around South Holland through branches. The transition zones we intervene in will become pilots for reference by other regions, providing the possibility for simultaneous development.

5.4.2. Attractive environments

A better network will create a well-connected metropolitan area, more convenient urban life, and will also produce more and more attractive living environments. Along the new main structure, there will be many good options to build transition areas with these characteristics (Figure 5.13):

High-accessible public transportation
The new stations will complement the original broken 15-minute service circle sequence, which will also promote people to choose to work and live in different cities, and they will not worry about moving into a newly constructed sustainable area. Public transportation will also better protect the environment and reduce carbon emissions.

Sustainable pilot
The new network makes the logistics system more efficient, and the transportation system more convenient, in which case can promote the circulation of materials and the collaboration of different industries. Thus the network brings a solid foundation for new sustainable areas. At the same time, people can easily come to the new sustainable pilot areas that can provide a model for renewal in other areas.

More job opportunities
The new urban constructions brought about by the new network accommodates more industries and job opportunities, and people can go to work in another city faster and more willingly.

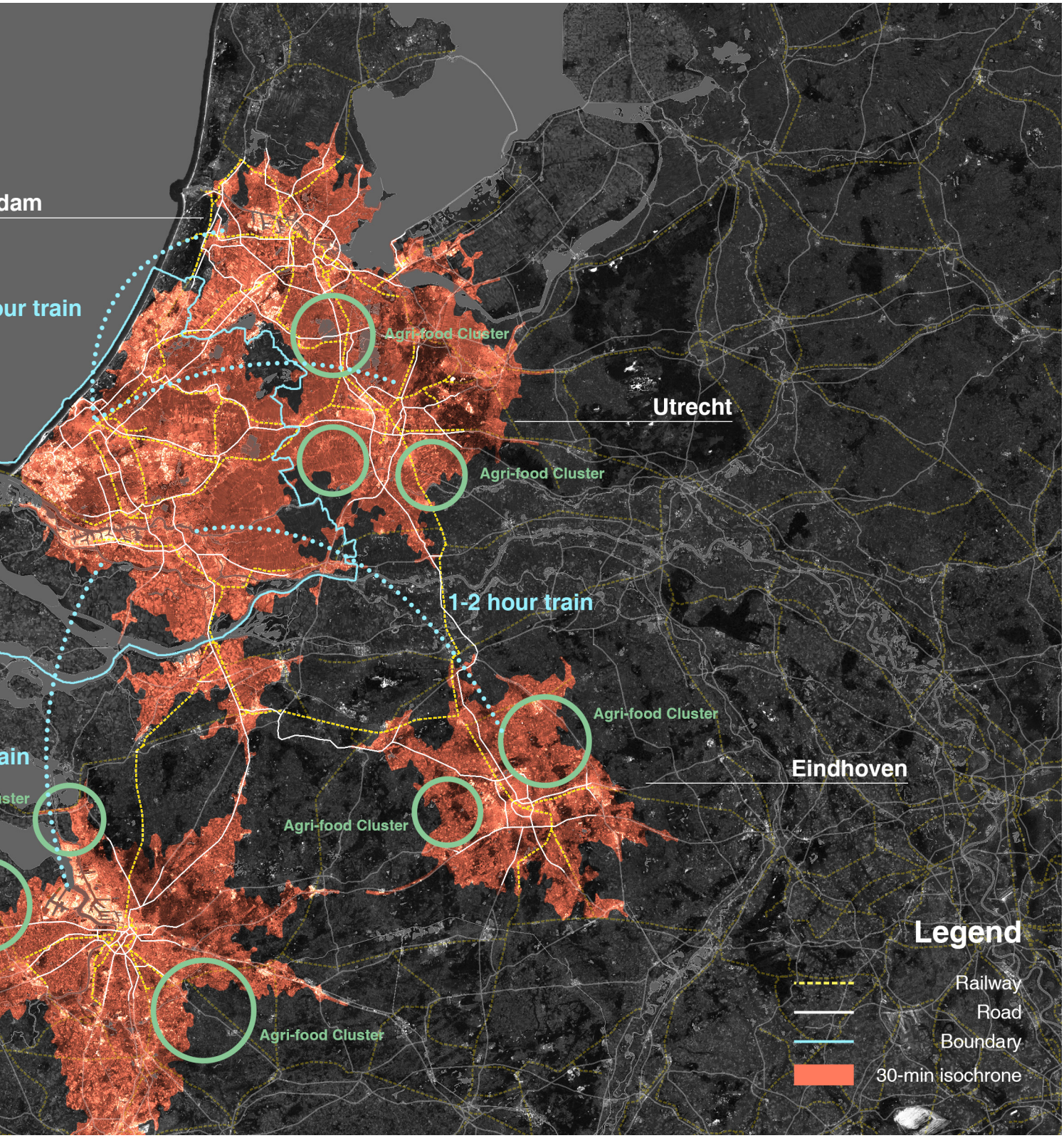
Figure 5.13 | Conclusion of the assessment (Authors, LISA 2018 ,OSM, 2021 and CBS 2015)

5.4.3. Scaling up

Building circular South Holland aims to promote the concepts and approaches of sustainable development to more cities and a wider scale. From the previous analysis, we can see that the three transportation systems are directly connected to Amsterdam, Eindhoven, Antwerp, and Utrecht, which means that South Holland has the basis for forming a larger system.

Under this circumstance, our research found that these large cities and surrounding areas also have a large amount of agricultural land and developed agricultural industries, and they also face the possibility of how to realize sustainable development. The conditions and feasibility to continue our pilot model and philosophy have been there. In addition, Rotterdam, Eindhoven and Antwerp have been committed to promoting cross-border cooperation, and The Netherlands also hopes to form a larger coordinated region. There is no doubt that the LandBOUW system will become such an entry point (Figure 5.14).

Figure 5.14 | System of larger scale (Authors, 2021, LISA 2018, OSM, 2021 and Google maps, 2021)


dam
our train
Agri-food Cluster
Utrecht
Agri-food Cluster
1-2 hour train
Agri-food Cluster
Eindhoven
Agri-food Cluster
Agri-food Cluster
Legend
Railway
Road
Boundary
30-min isochrone

5.5. Transition areas

Our vision highlighted several zones and clusters that should support the LandBOUW strategy. These places should be the areas where the waste of the agri-food transforms into resources for the construction sector, where logistic flows cross each other and come together and where people meet circularity in the smallest visible way. The places are the test areas in different phases of the transition and can be a model for other places, cities and countries.

Specifying the location
Before going into the division in categories of transition areas; it is needed to explain the current spatial principles below:

Specifying the functions
According to a study of FABRICations 'Circulair Amsterdam', there are specified functions that suit well within a circular transition zone (FABRICations, 2015). This pioneering study, analysis where to start circularity within the urban area of Amsterdam and give a clear insight in what functions fit in specific economic areas. A good example to translate a global topic to regional and local scale level. In this strategy, we took these functions and specified them to our categories (Figure 5.15).

1. Places of redevelopment
   Firstly, the places stated as a 'transition area' are related to the ages of the buildings in it. IABR and UP (2016) stated that buildings between 1930 and 1975 are likely to be developed in the near future. This analysis gave insight in what areas can be potential transition zones (IABR & UP, 2016).

2. Connections to agri-food and construction clusters
   The areas have a spatial connection to the construction sector and agri-food sector.
   The areas are connected to an existing network (railway, waterway, roadway) in order to create high accessibility by people and distribution of products

3. Size and function
   Areas less than 25 ha, within neighborhoods or only accessible by going through neighborhoods are too small and unlikely to develop as transition zones. These redevelopment places are left out.
   Current business parks and distribution centers before 1975 have the highest potential to be transformed into transition zones. (because of accessibility and functions)

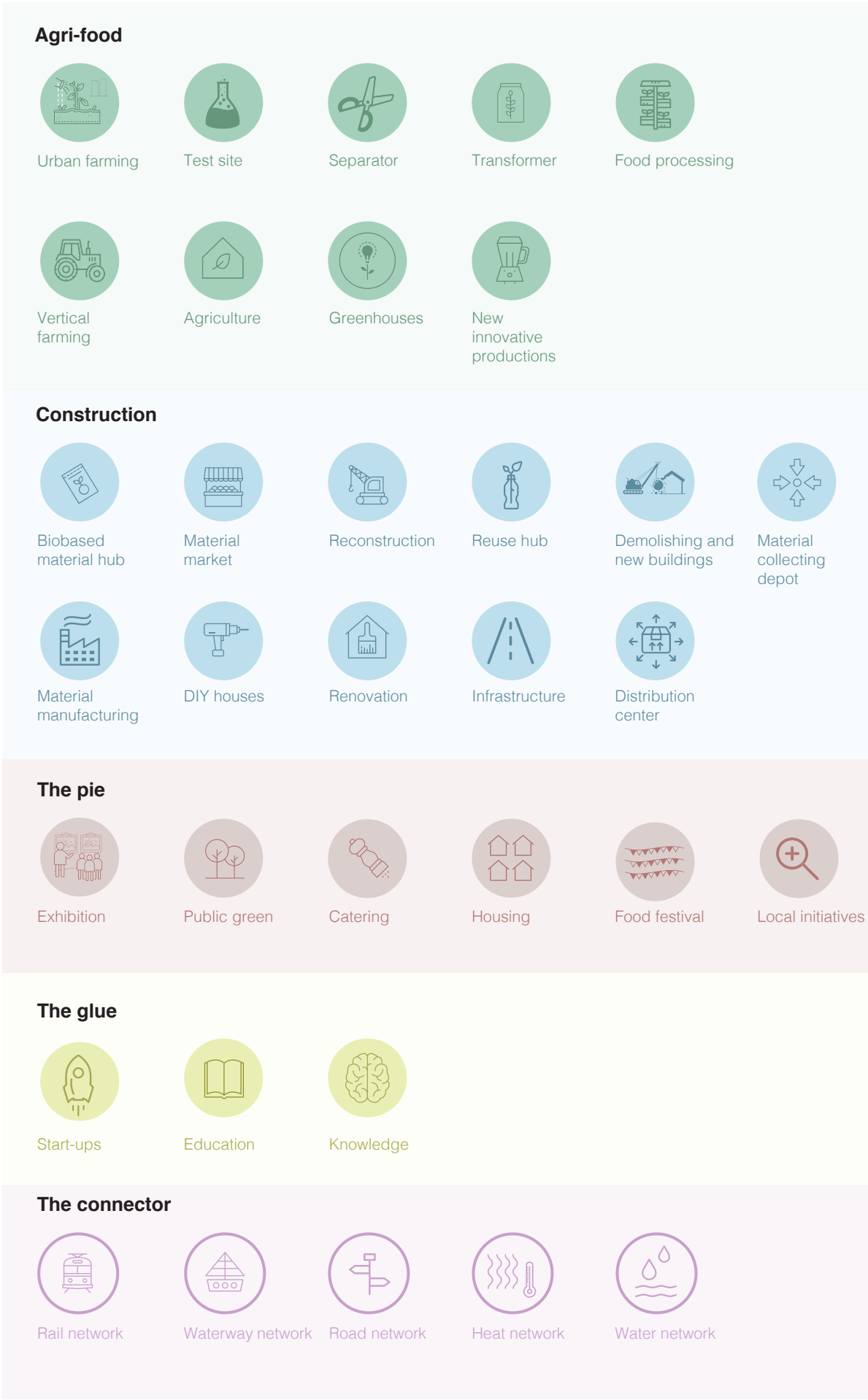
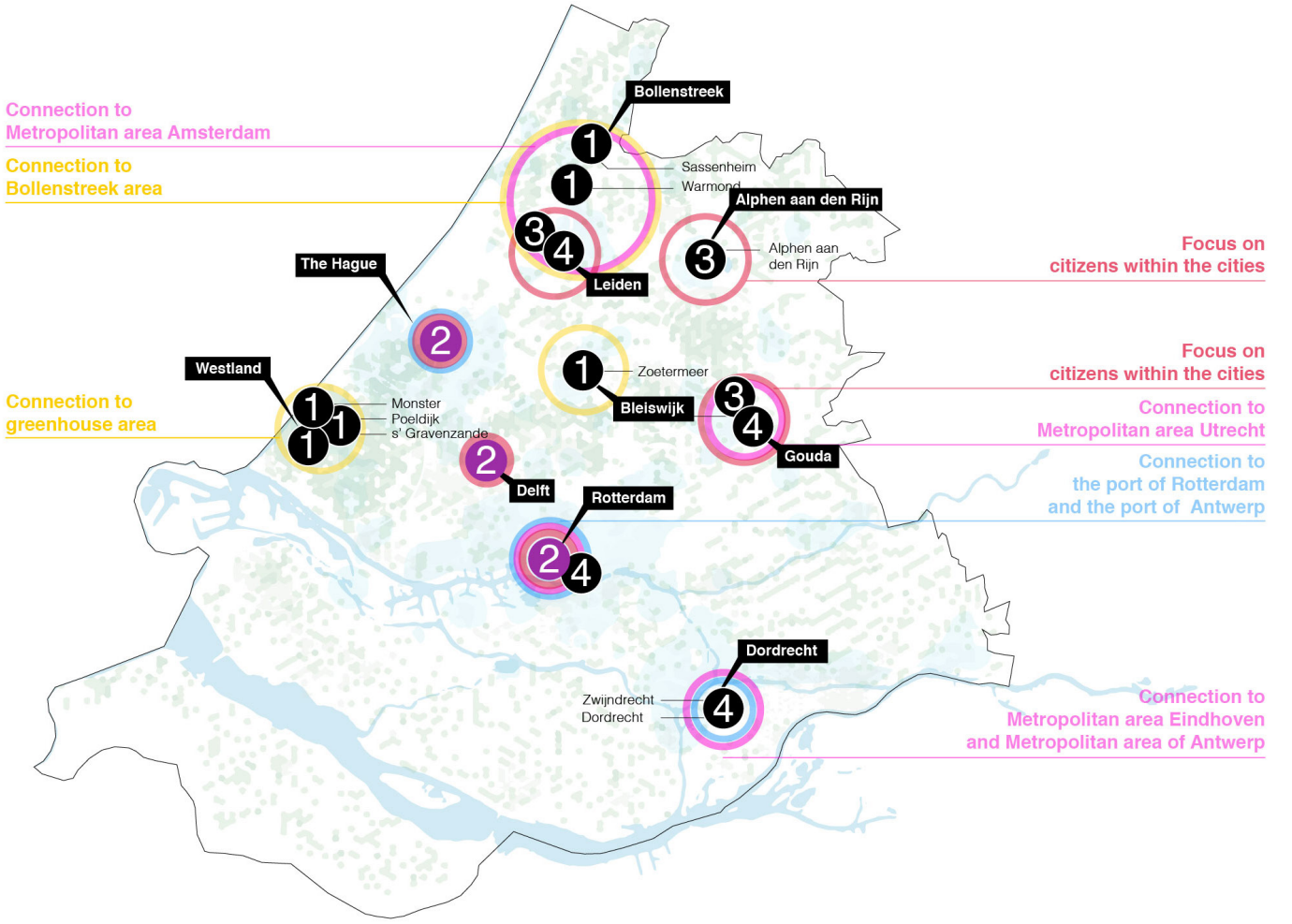


Figure 5.15 | Functions and networks (Authors, 2021)



Legend

- ❶ Innovative agri-food area
- ❷ Upcoming cluster
- ❸ Zone in between
- ❹ Border ports

- Focus on agri-food
- Focus on citizens
- Connection with ports
- Connection other metropolitan areas

Figure 5.16 | Transition areas (Authors, 2021)

5.5.1. Transition categories

In this paragraph, we will describe the different categories of transition areas, where they are places and the spatial intervention that come with this approach and categories.

The transition areas are divided into 4 categories, based on their location, economic function and existing building stock. This is because we are aware of the uniqueness of specific areas, and the location specific interventions that are needed in order to succeed in the approach.

1 (Innovative) Agri-food areas

The first category are the areas near construction sites, within agri-food areas. These locations form a great importance for the shift towards more bio-based materials. This, because the waste of the agri-food has a short distance to the construction areas. Thereby, are these locations key-players in the movement of waste itself and are therefore first on the list (start now, finish 2035).

The locations within this category are redevelopment areas in the Bollenstreek, Westland and the Zuidplaspolder that will have influence on the regional scale: Teijlingen, Monster, Poeldijk, s'Gravenzande and Bleiswijk. In these areas we look mostly at greenhouses and distribution zones within urban areas. These areas have a regional function and are well connected to current networks by railways and roads.

2 Upcoming clusters

The second category are already existing clusters or developing clusters. The clusters are mainly located in Rotterdam, the Hague and Delft. However, we see several locations spread over the city, the transforming harbors (M4H, RDM, Schie-oevers, Binckhorst) are most suitable for the shifting economy. These areas differ from the second category, because of the existing strategies and beginning transitions. Therefore, for these areas we will only focus on stimulating waste-flows and -connections. Also, education and start-up companies have great potential in these areas because of the broad variety of connections with other parts of the cities. Therefore, these areas have a more local character.

3 Zones In Between

The third category are the areas in between the agri-food zones and the construction zones. These 'gaps' are mostly neighborhoods between 1930-1975, and likely to be redeveloped in future. Because of quality improvements and the strong connection to both sectors, these areas can play a big role in the transition in the mid-term on regional scale (2030 to 2050). Most suitable areas are locations within Leiden, Alphen aan den Rijn and Gouda. Besides the connection to the sectors, the mid-size cities have potential to be linked to metropolitan areas of Amsterdam and Utrecht.

4 (Extension of the) Border ports

The fourth category are areas that could be an extension of the agri-food production or the construction sites. These areas have a connection with the existing areas and should be well accessible on the long-term. Thereby, these areas can be placed as the bridge between regional scale towards national (other metropolitan areas as Eindhoven) or international scale level (as Metropolitan area of Antwerp). We found these locations mostly at the edges of mid-size cities and in specific economic locations: 'Leerpark' Dordrecht, Port of Rotterdam, Leiden 'Bio Science Park' and Gouda have these potentials.

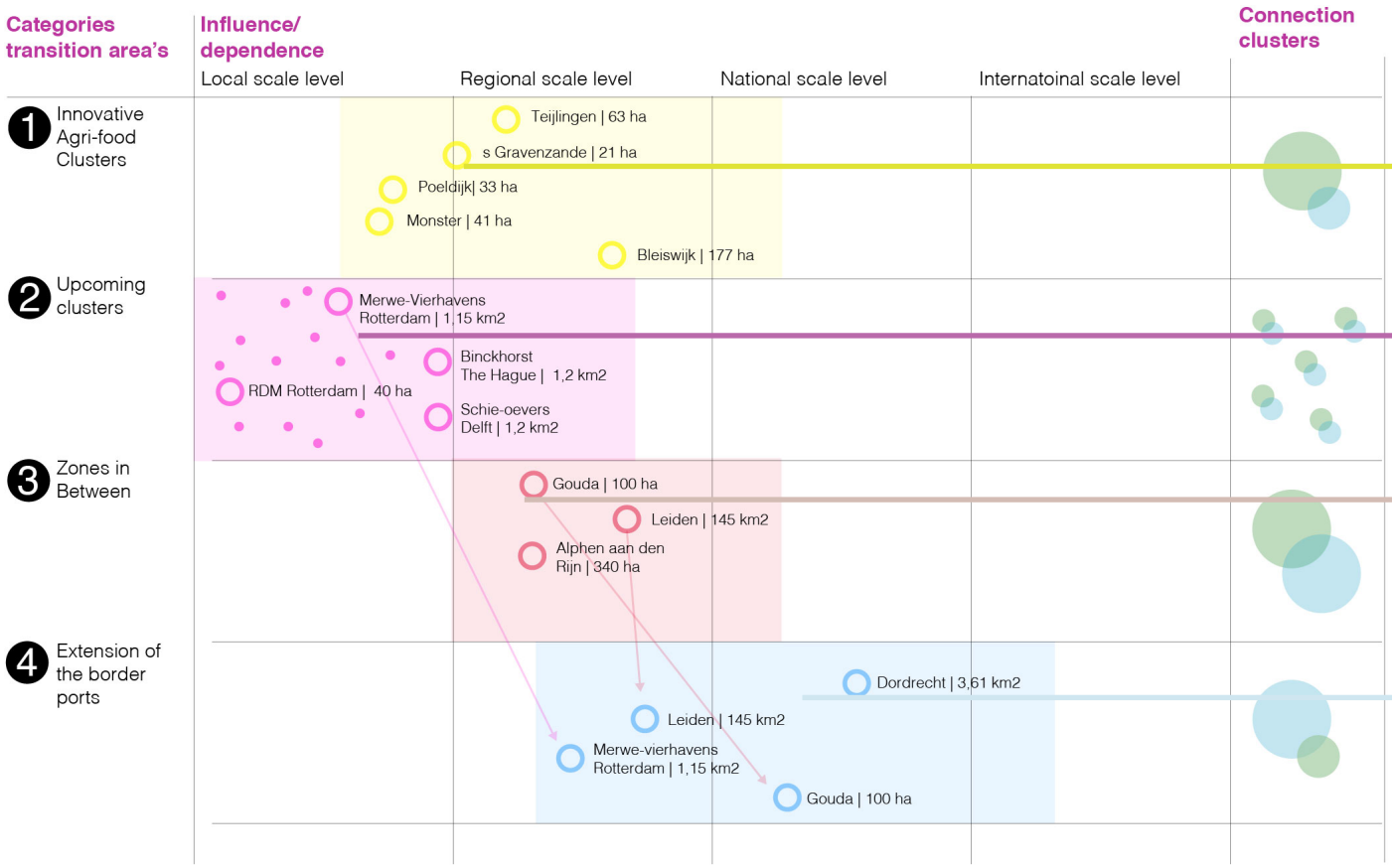


Figure 5.17 | Transition areas places per category and influence (Authors, 2021)

Zoom in: ‘s Gravenzande

Zoom in: Merwe-Vierhavens

Zoom in: Gouda

Zoom in: Dordrecht

Figure 5.18 | Zoomed in locations (Authors, 2021)

5.5.2. Spatial interventions

The spatial interventions can be described best when zooming in to four transition areas spreaded over the categories.

More background information about the transition areas?
Look at the appendix.

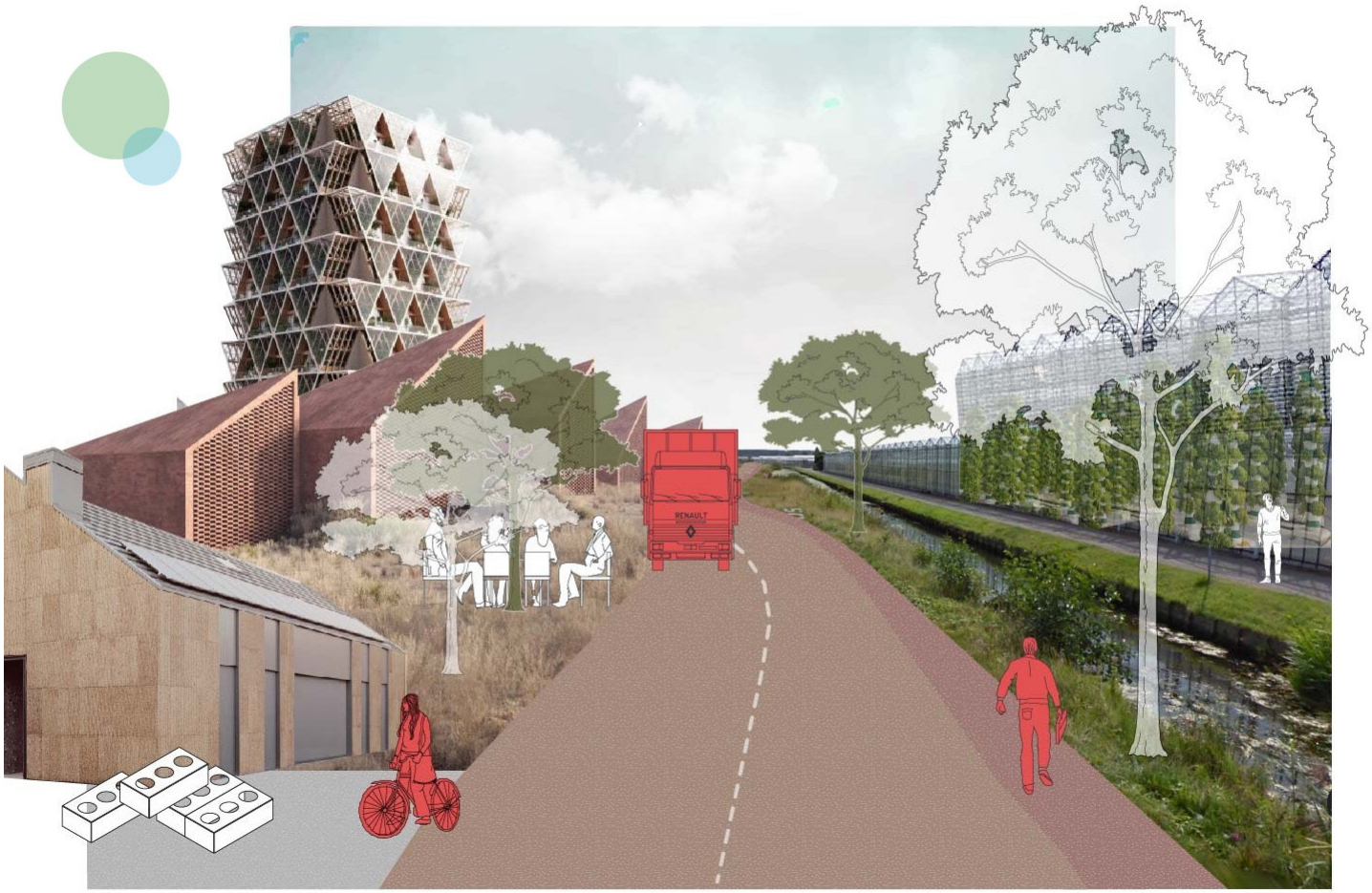
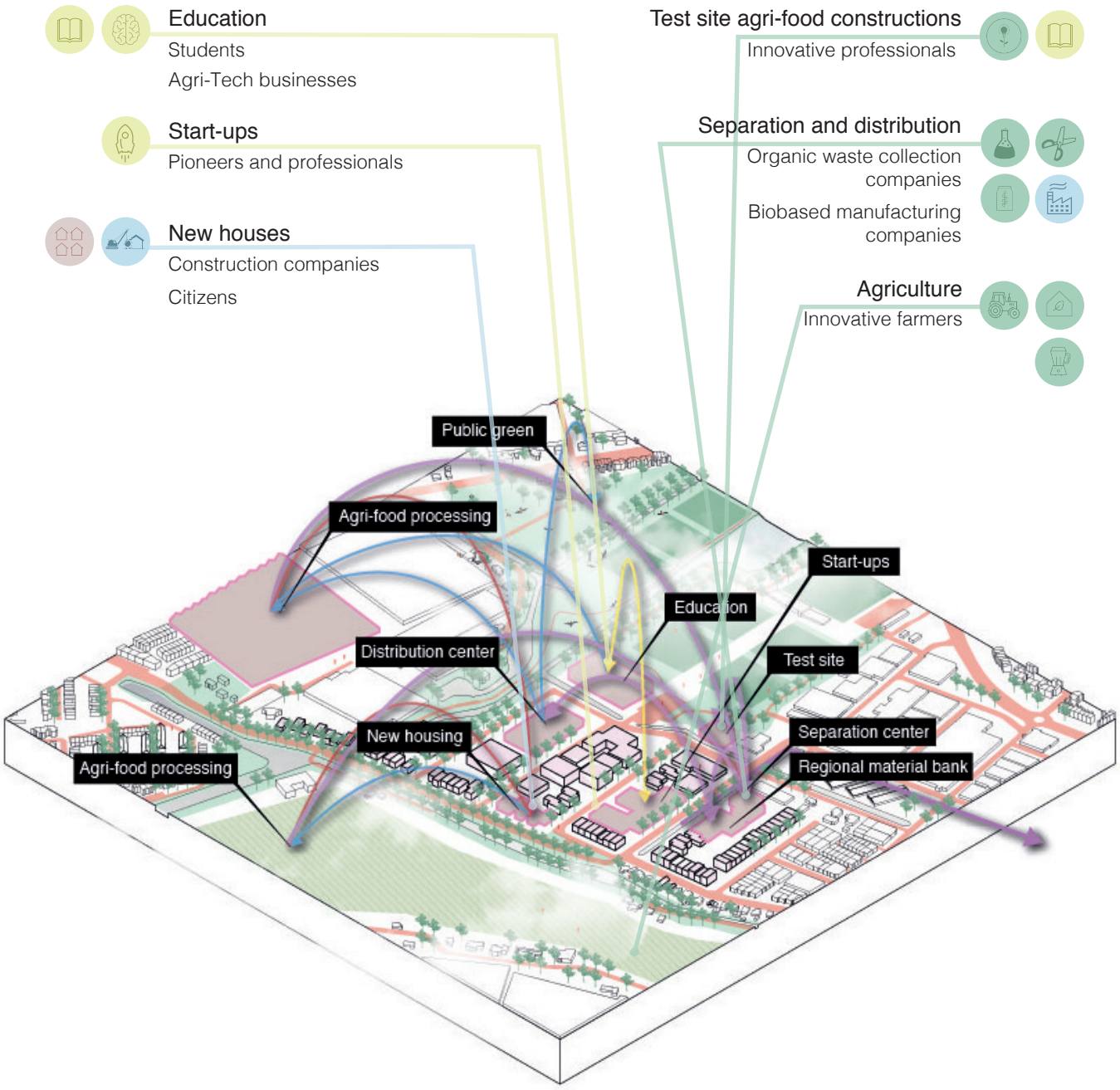


Figure 5.19 | ‘s Gravenzande (Authors, 2021)

1 **Innovative Agri-food area ‘s Gravenzande**

The example shown for the agri-food zones in s’ Gravenzande. s’ Gravenzande is located in the heart of the Westland and well connected to the N220, N467 and N211. With the construction of the rail network towards the Westland, s’Gravenzande will become a center of innovation for the agri-food industry. We assume, starting with the non-housing areas will be the most beneficial and easiest strategy in the short-term. Currently this area, of 21 hectares, functions as a distribution zone and thereby has a regional function.

The functions in this zone are mostly related to waste-processing into resources for the build sector and distribution of these products. Also, agri-food related education and start-up companies are important functions to start the transition process.



Trigger stakeholders:

- Royal flora Holland
- Milgro

Figure 5.20 | s'Gravenzande (Authors, 2021)

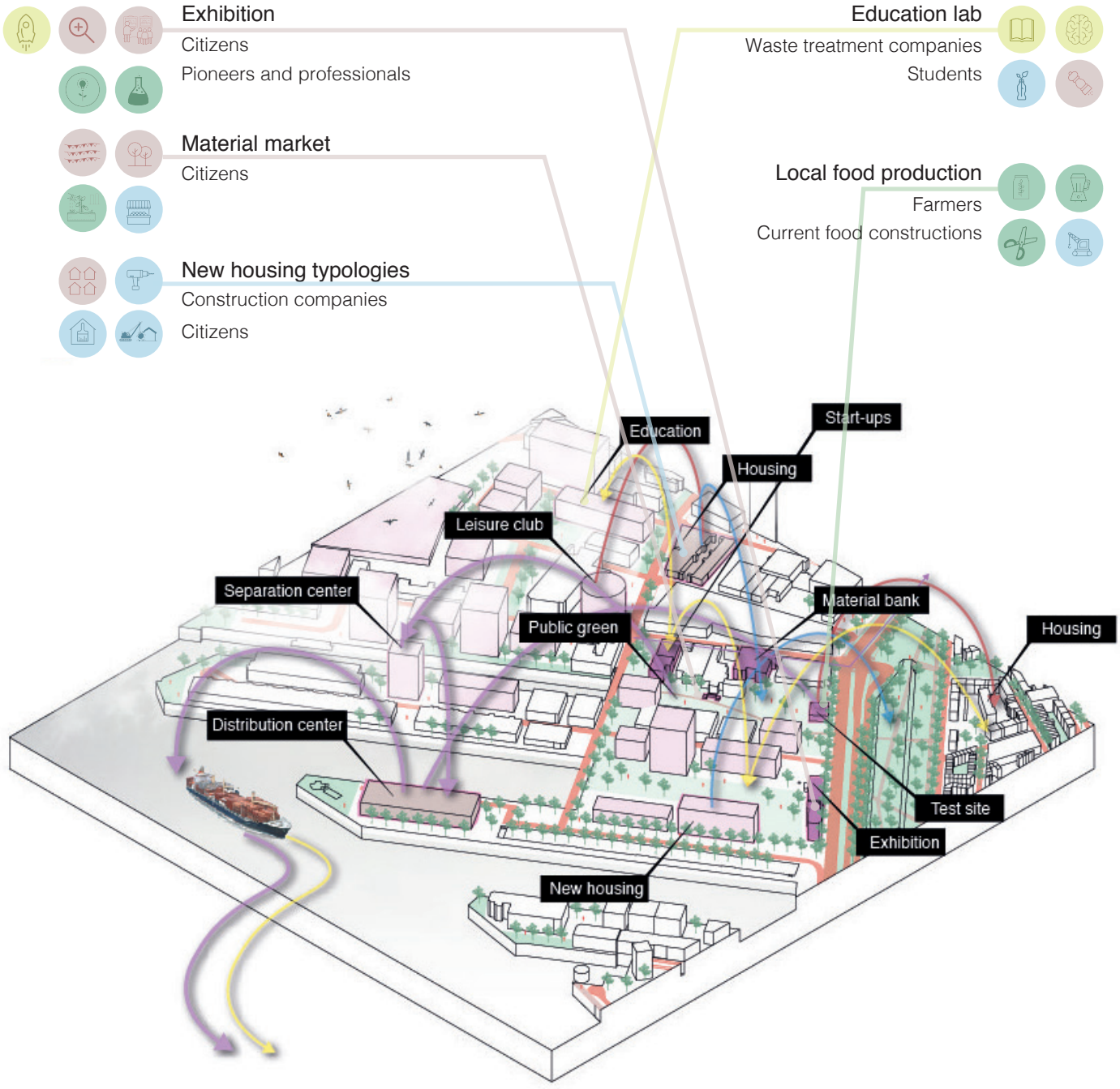
Legend

- Waste to resource flows
- Knowledge flows
- Heat flows
- Water flows
- New buildings
- Existing buildings

Figure 5.21 | Merwe-Vierhavens (Authors, 2021)

2 **Upcoming Merwe-Vierhavens Rotterdam**

The Merwe-Vierhavens in Rotterdam are already in transition and are located in Rotterdam West in between the Port of Rotterdam and the city center. In the last years, the former fruit and vegetable port has shifted towards the west of the harbor, whereby this area became a potential mixed hotspot (Delva, 2021) (IABR, Keilecollectief, 2019). Delva (2021) designed an urban plan whereby circular initiatives are incorporated and involved. Striking about this development is the experimental approach towards area development. Starting point is reaching the goal; while the interventions are flexible. Because this revedelopment is already going, the possibilities for the (designed) built environment are limited. However, we see opportunities in 'kneading' the future functions and the use of materials for new buildings. Thereby, the concept of this area fits to the concept of LandBOUW and can, on this way, strengthen each other. In conclusion, for this area, interventions lie mostly in education and awareness under smaller stakeholders, such as citizens, students and start-up companies. To keep the experimental identity, test sides, local material markets and events as markets and workshops are suitable.



Trigger stakeholders:

- Dura Vermeer
- Milgro

Figure 5.22 | Merwe-Vierhavens (Authors, 2021)

Legend

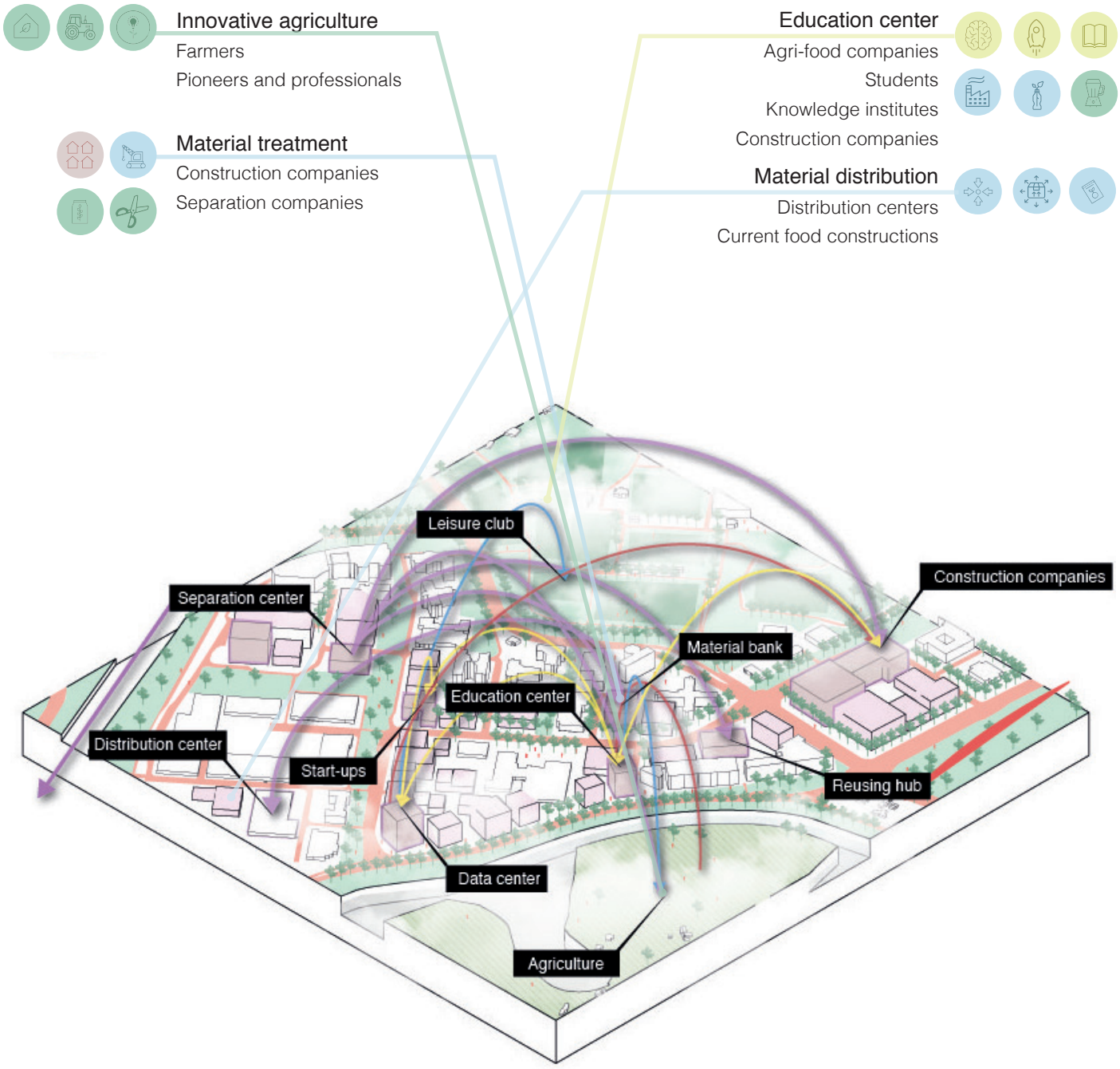
- Waste to resource flows
- Knowledge flows
- Heat flows
- Water flows
- New buildings
- Existing buildings

Figure 5.23 | Gouda (Authors, 2021)

3 **Gouda In Between**

Gouda is located in between the agri-food zone of Zoetermeer and the construction zone of Boskoop and well connected to the Highway A12 and the railway from Rotterdam to Utrecht. On this way, Gouda is not only the connection between the two sectors, but also a connection to the metropolitan area of Utrecht which creates opportunities in the long-term.

The functions in this transition zone are mostly medium sized (regional importance) and have a network identity by distributing and transforming the waste of the agri-food into resources for the near construction cluster. Specific waste-treatment knowledge companies and innovative initiatives are suitable in this area and can attract people from outside the province.



Trigger stakeholder:

- Milgro

Figure 5.24 | Gouda (Authors, 2021)

Legend

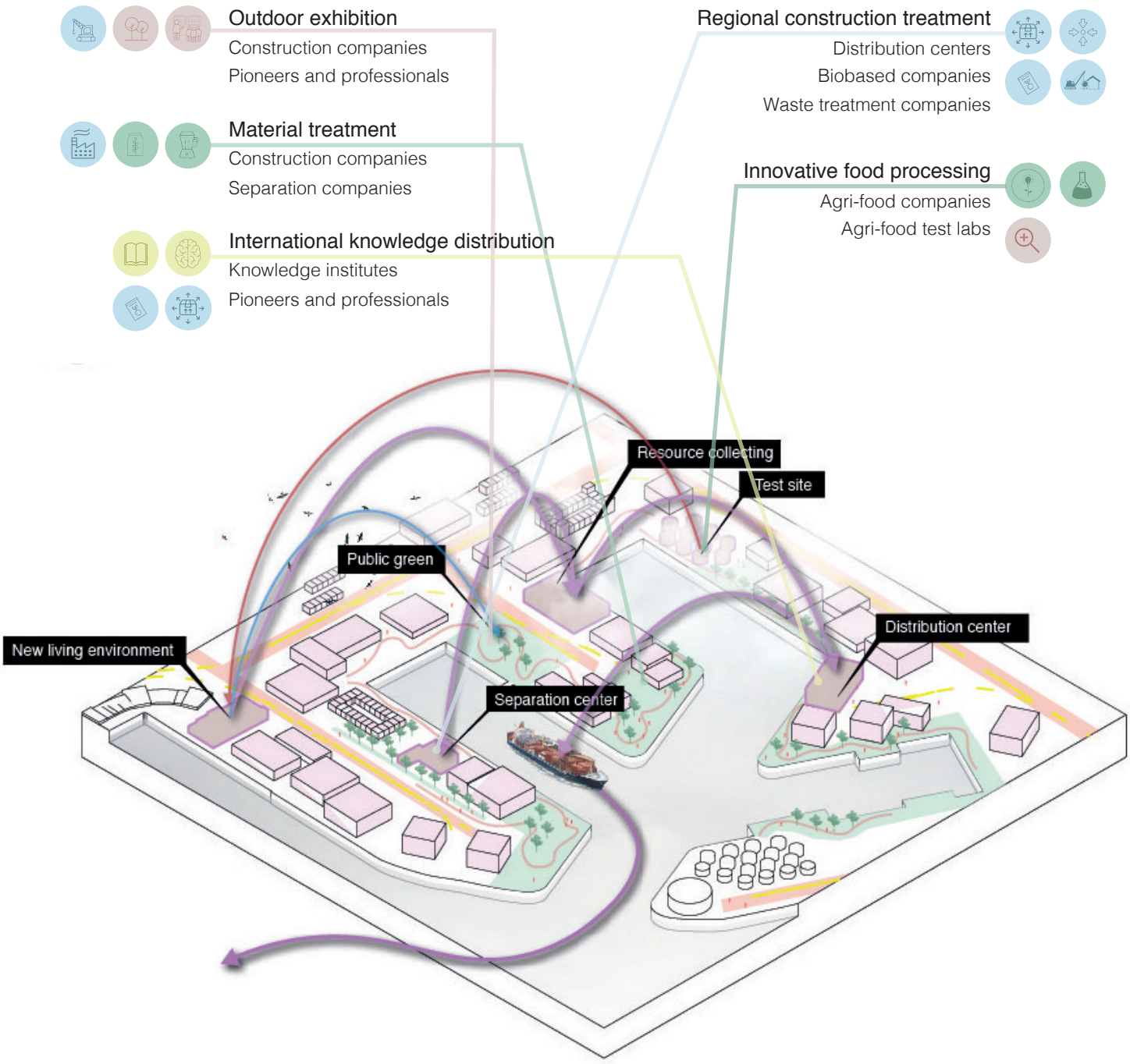
- Waste to resource flows
- Knowledge flows
- Heat flows
- Water flows
- New buildings
- Existing buildings

Figure 5.25 | Dordrecht (Authors, 2021)

4 **Port of Dordt**

The port of Dordrechts is located in the South of Dordrecht next to the Oude Maas and the railroad towards the south of The Netherlands. On the other side of the river, the port of Zwijndrecht is located, whereby these ports are an important cluster of economic activities and a supporting system of the Port of Rotterdam.

The redevelopment prognosis suggests big changes for this area in future. This, together with its strategic location from Rotterdam to metropolitan areas of Eindhoven or Antwerp, sets the ports as a possible future zone for extension of the approach. Hereby, more national and global functions are suitable mostly related to the construction sector.



Trigger stakeholders:

- Heineken
- Milgro

Figure 5.26 | Dordrecht (Authors, 2021)

Legend

- Waste to resource flows
- Knowledge flows
- Heat flows
- Water flows
- New buildings
- Existing buildings

5.6. Phasing

As mentioned before for this project it is important to create willingness and awareness to change the current idea of building with materials which are in linear use. Motivation for this change is needed and therefore the phasing is based on creating this motivation. In plan A of the project, we start with the “Motivation Creation”. If that succeeds in the near future, then we go along to plan A+. If the mindset, willingness and awareness didn’t change in this firsty designed time frame, we go to plan B and schedule the start of Plan A+ later.

> ***‘What does our timeline look like, what are important points and phases in the future? What do we want to achieve at each point?***

In Figure 5.27 the X-curve for mindset change is shown. This curve is based on the X-curve model from Drift & Metabolic (2018). The curve characterised itself by the stages based a reaction on emerging, expected and established transition phases.

5.6.1. Plan A: Motivation Creation

The phasing goes in stages. Plan A contains three of these stages and is the start of the change in mindset going from attractiveness to built like it has always been, to the attractiveness to built with circular building materials.

1 **Stage 1: Creating a kickstart with eccentric motivation**

Eccentric motivation is created by fearful punishment or promised rewards. It is about motivation that is prompted by external stimuli (dotsolutions, n.d.), such as money or punishment. Examples of eccentric motivation in this project are the change in policies, change in law, the possibility to get funds or to pay taxes for use of non-circular materials. This kind of motivation is based on rewards or punishments, this is not about the personal realization of the seriousness why the change is needed. Still, eccentric motivation could be a good way to have this kind of ‘kick start’: by making it money wise attractive to create systems for the reuse of residual flows the base is already there.

This could also provide the principle of ‘learning by doing’. For researchers, grants or funds could motivate them to actively participate in the process of thinking about other ways to reuse residual flows from the agri-food sector or the construction sector. This also works for the construction and agriculture businesses and related stakeholders. When there are financial resources, such as funds, it becomes easier for them to participate in this new vision. The government already stimulates innovations and the circular economy in various ways (Circulair Ondernemen, n.d.). This could be expanded evenmore.

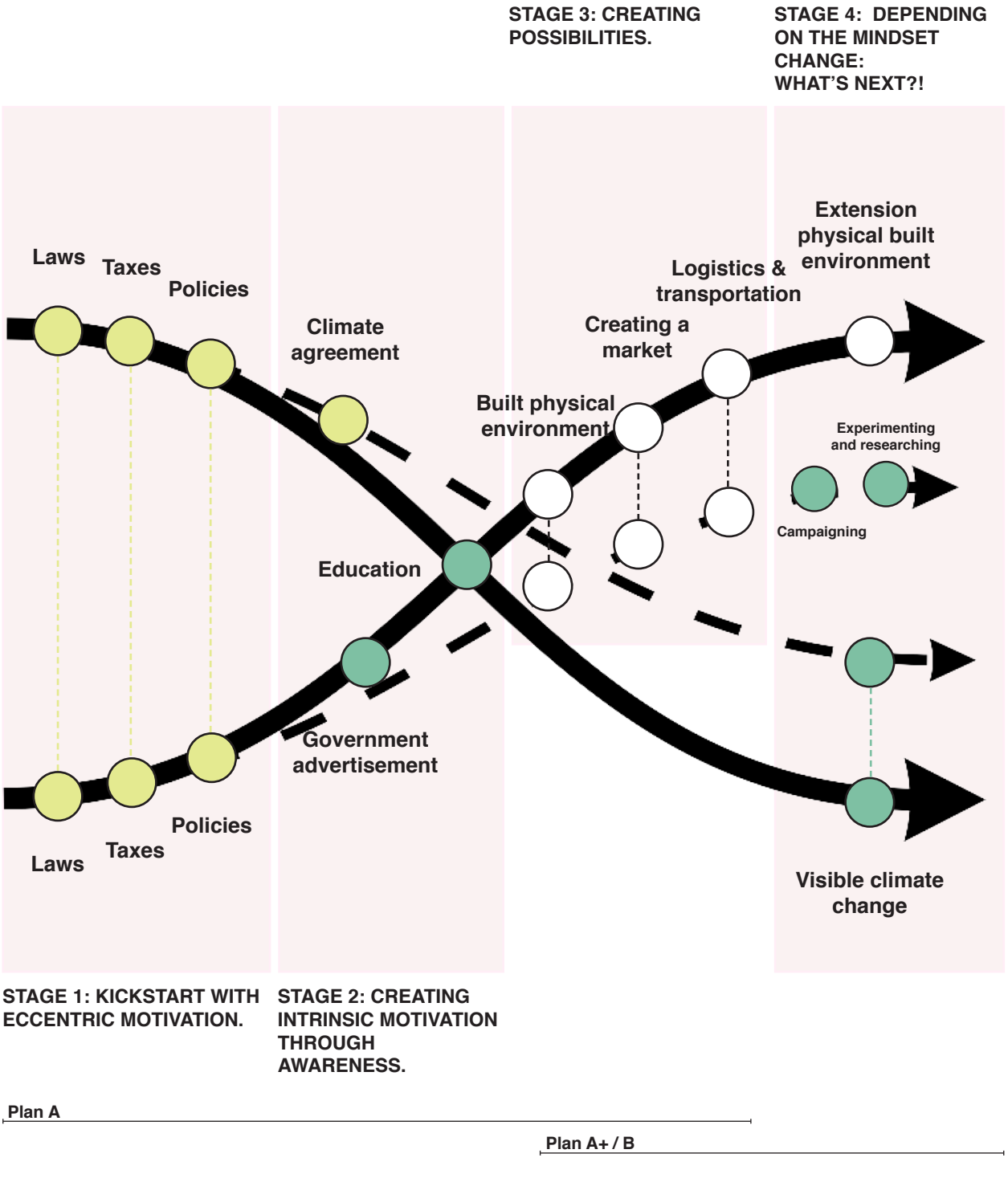


Figure 5.27 | X-curve about mindset change towards the circular use of materials (Authors, 2021).

Taxes related to linear use of materials could form an obstacle for construction firms and will create more attractiveness to build with residual flows. Also, overall taxes on waste are already being created and motivated by the dutch government to realize a shift from incineration to recycling (Ministerie van algemene zaken, 2020a). These actions most probably derived from the European Green Deal which is a roadmap to make the EU economy sustainable (Europese Commissie, 2019).

Just as the taxes, it is expected that certain laws around the Green Deal will be introduced. An example for this is the Taxonomy Regulation. As of January 1, 2022, the EU will introduce a uniform taxonomy for environmentally sustainable economic activities. The Taxonomy Regulation determines which portion of an investment is invested in an environmentally sustainable economic activity and informs investors who wish to invest in activities with a positive impact on the environment. From 2023 this will also be available for activities that contribute to another environmental objective, such as the circular economy (CM Web, 2020). This will lead preferably into an enlargement in investors in the research for new alternatives.

2 Stage 2: Creating intrinsic motivation
Through awareness and knowledge Intrinsic motivation comes from the employee himself: it is what he / she sets in motion or what he / she gets on fire for (dotsolutions, n.d.). This kind of motivation mostly lasts longer than eccentric motivation, because the person knows why they want to make the change personally and not only because of eccentric influences. With creating knowledge and understanding for the future target group, the students and young people, intrinsic motivation can be created. Changing mindset, focussing on the feeling of belonging, creating interests or having someone as an example could be helpful in this strategy to create willingness for the change in mindset for the circular use of residual flows. In contrast to eccentric motivation, intricacy motivation could lead to the principle of 'doing by learning': the students and young population will learn about circular use of residual flows in school and are creating awareness and willingness by government campaigns for example.

3 Stage 3: Creating possibilities
This stage is about providing the preferable conditions for employees of the new created interlinked sector and its stakeholders. It is part of Plan A, just as it is part of Plan A+ and B.

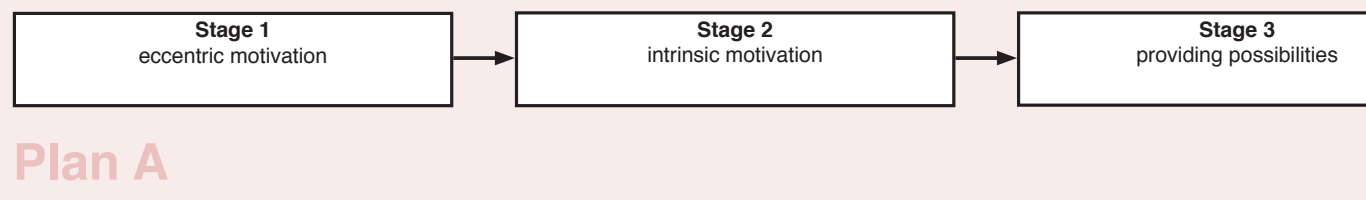


Figure 5.28 | Sequence of stages in relation to plans (Authors, 2021).

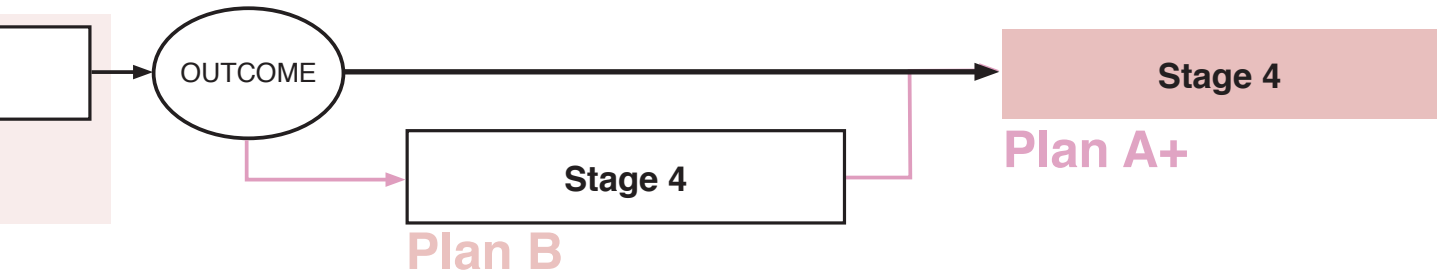
This stage forms in that way the bridge between plans, dependent on the level of success for motivation creation.

It is important to engage the stakeholders. Already at the beginning of the phasing there are laws, taxes and policies which push the employees towards a mindset change motivated by eccentric motivation. Also, the creation of intrinsic motivation has brought about a change in the mindset and motivation to participate in the sector consisting of the symbiosis of agriculture and the construction sector.

Now, economical and spatial aspects have to be improved. Starting with the motivation of startups and researchers. Followed by the creation of a market with appropriate logistics and transportation possibilities for both the work related activities as the employees. Evenso, the government should not only advertise for the creation of awareness around circular use of materials for newer generations. There should also be advertisements to create awareness for the old generation in this, the existing stakeholders.

Phasing of the physical built environment
Spatially seen, the start of the construction trajectory starts in this phase. The idea is that the start of the physical built environment starts as quickly as possible. The transition areas will be local and relatively small. Therefore, it would be more easy to realize this in a comparatively short timeframe. This applies to the “(Innovative) Agri-food Areas” and the “Upcoming Clusters” as described in chapter 5.5. It is made possible because of the fact The (Innovative) Agri-food Areas are using the current rail and road networks and have a regional function. For the Upcoming Clusters the construction works did already start, small changes in zoning plans with focus on stimulating waste-flows and -connections. Just like, providing education and start-up companies a great potential in an area with a broad variety of connections with other parts of the cities.

Later, when a lot of the existing building stock is outdated and in need of renovation, the new construction works can start for the transition zone 3 the “Zones in Between”. Next to the connection to the sectors, the mid-size cities have potential to be linked to metropolitan areas of Amsterdam or Utrecht.



5.6.2. Plan A+ : From pilot to standard

When the mindset is changed and the people are not only willing to change by eccentric motivation, but feel like they are intrinsically motivated to make a change in their usual patterns of the linear use of materials, plan A can be extended to plan A+. This plan is expected to start around 2040 or 2050.

4 **Stage 4: Depending on the mindset change: what's next?!**

In plan A there is already a start of expanding the possibilities by infrastructure and logistics. In plan A+ this got extended even more and a phase starting where the infrastructure connections from hubs in South Holland are getting extended or improved to other provinces or countries. So, this idea of circular using residual flows from other sectors into the construction sector, the idea can move and be introduced to other provinces, and surrounding countries, and setting up bigger if necessary.

The first stages were focussed on locally building. This phase is about building bigger, and not building only locally anymore. Locally building was based on the creation of awareness, in the phase we expect the awareness to be there. The strategy as a pilot changes in this stage to the strategy as a leading theme for building circular.

Phasing of the physical built environment

In this last phase the "Extension of the Border Ports" (see chapter 5.5) takes place. This is the next step in building a physical environment with not only the waste collection stations, waste treatment stations and resource distribution centers, but also the extensions of several kinds of buildings with circular used materials. The locations will have a good connection with the existing local areas, but will also be the bridge for the more regional scale.

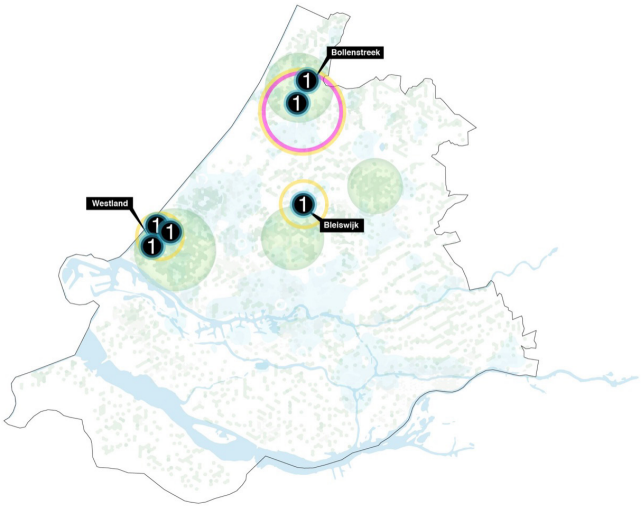
5.6.3. Plan B: Achieving goals by other roads

It could be that the expected mindset change did not happen like we most likely wanted to. This doesn't mean the plan failed. The people are just not ready, yet. Changing the mindset and the urgency of becoming circular cannot wait too long, due to the environmental consequences of the current approach. When the awareness and actions take longer than expected or are not adopted as planned, it is needed to go in a different direction in order to reach the circular goals on time.

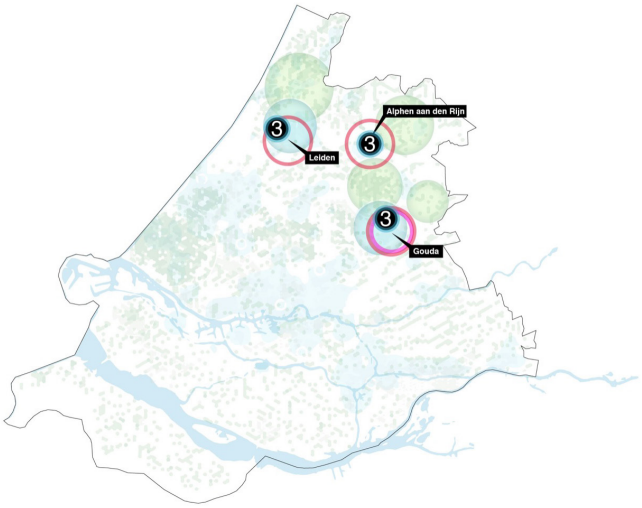
4 **Stage 4: Depending on the mindset change: what's next?!**

In stage 4, we planned the growing awareness did not go fast enough. The stimulation of the eccentric motivation through education is still happening and causing a change in the current state of mind about the linear use of materials. This is something slightly abstract, because the change in mindset, is not directly measurable, we have to make a prediction in this case

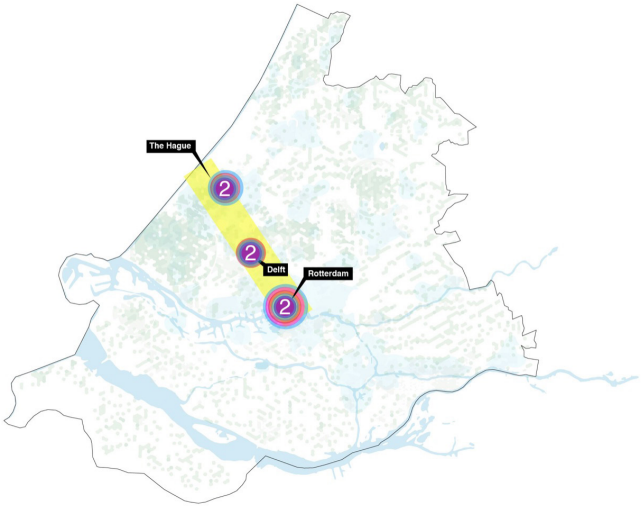
The motivation to change is not fully there, so all the measures which were taken for that have to be extended. This means for example, that there should be a role for the government in advertising more or thinking about a new way which is more from that time area to promote these kinds of mindset changes.
Also, doing research into new ways of extraction materials from residual flows should be stimulated by advertising, which will provide knowledge, or by eccentric motivation, such as new funds which will make researchers more interested to do so. In this way the strategy is resilient and flexible.



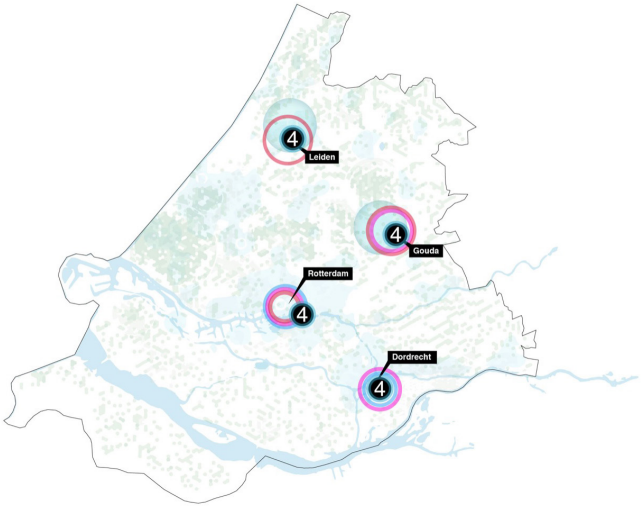
1 NOW-2040



3 2030-2050



2 NOW-2040



4 2050 - ...

Figure 5.29 | Phasing transition areas
(Authors, 2021)

5.6.4. Synergies

Synergies between the actions in the phasing are taking place. These synergies could be seen as triggers for the next phase. How stronger the trigger, how more likely the next phase will be succeeding and therefore: how the easier we go from plan A to plan A+.

What are synergies between layers that can accelerate the change?

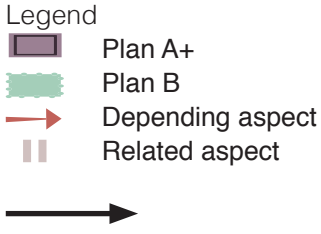
Logically, the most clear synergy which can be seen is the synergy for the success of plan A. Because of several relative factors, it is not fully predictable if the plan will succeed as quickly as we envision. So all the actions which are now in plan A are triggers for the next stages.

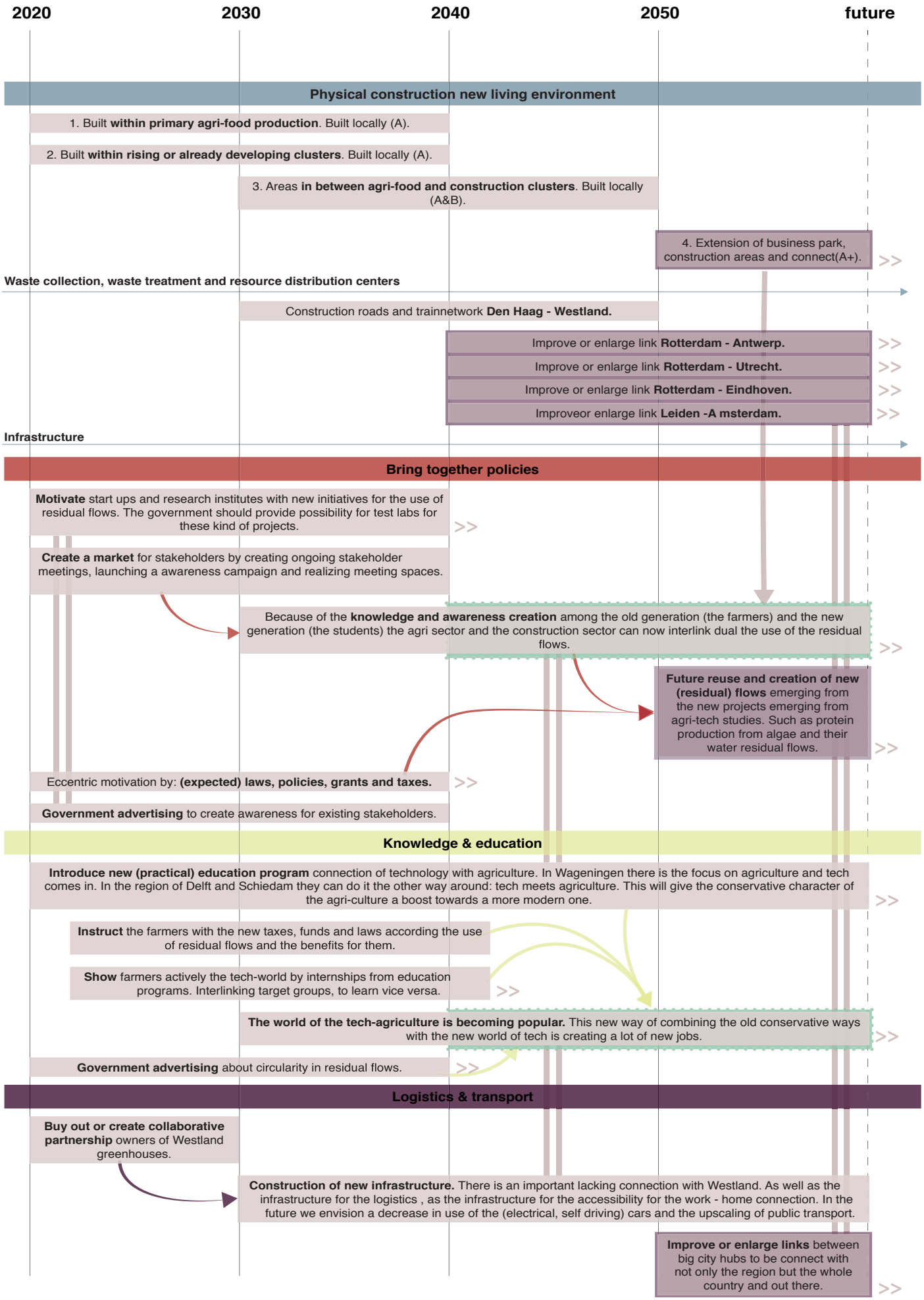
Looking at bringing together the policies it is important to bring knowledge and attractive work conditions for the start up and researchers, just as creating a market for (existing) stakeholders. This can be through intrinsic or eccentric motivation. Influencing big stakeholders, could lead to more knowledge creation around all the employees working in both sectors. Finally, this could lead to the future reuse and creation of new (residual) flows. But, if the knowledge is not created automatically, then the phase of the knowledge and awareness creation shifts to a later stage and in that way also plan A+ is moved to a later stage.

The phasing around the knowledge creation in education is a really important trigger for all the stages. If people are not intrinsically motivated by knowledge, then the chances of a succeeding strategy decreases. It is expected that eccentric motivation doesn't always lead to mindset change, or as least not that quick and good as preferable to reach the final vision. This is an important trigger for the fact that the world of agriculture becomes more popular.

For the logistics and transport phasing, it is clear that the improvement of existing road structures and logistics are needed to take place when plan A is succeeding. If not, then the improvements or enlargements of links has to be phased later.

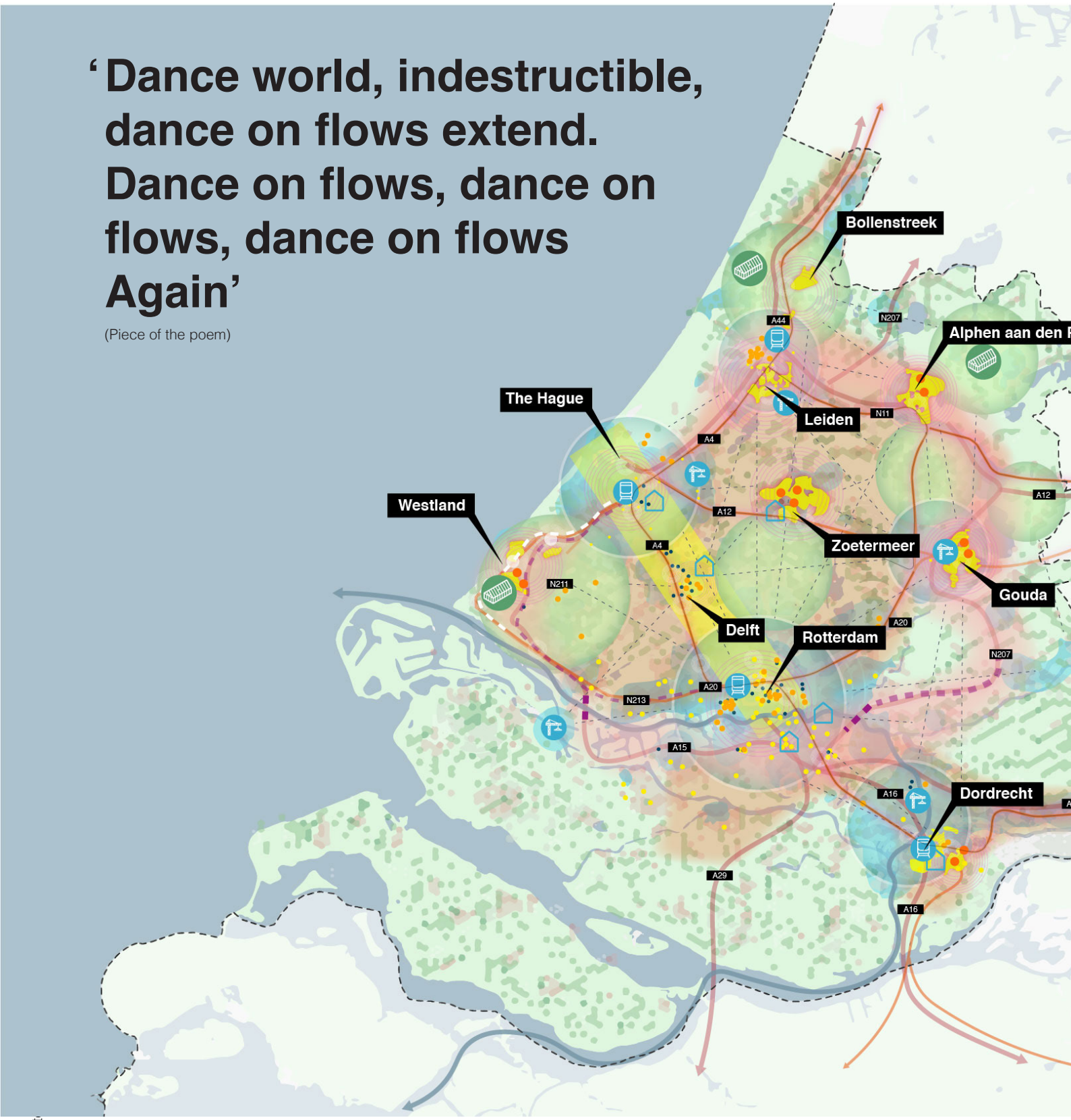
Figure 5.30 | Phasing
(Authors, 2021)




2020
2030
2040
2050
future
Physical construction new living environment
1. Built within primary agri-food production. Built locally (A).
2. Built within rising or already developing clusters. Built locally (A).
3. Areas in between agri-food and construction clusters. Built locally (A&B).
4. Extension of business park, construction areas and connect(A+).
Waste collection, waste treatment and resource distribution centers
Construction roads and trainnetwork Den Haag - Westland.
Improve or enlarge link Rotterdam - Antwerp.
Improve or enlarge link Rotterdam - Utrecht.
Improve or enlarge link Rotterdam - Eindhoven.
Improveor enlarge link Leiden -A msterdam.
Infrastructure
Bring together policies
Motivate start ups and research institutes with new initiatives for the use of residual flows. The government should provide possibility for test labs for these kind of projects.
Create a market for stakeholders by creating ongoing stakeholder meetings, launching a awareness campaign and realizing meeting spaces.
Because of the knowledge and awareness creation among the old generation (the farmers) and the new generation (the students) the agri sector and the construction sector can now interlink dual the use of the residual flows.
Future reuse and creation of new (residual) flows emerging from the new projects emerging from agri-tech studies. Such as protein production from algae and their water residual flows.
Eccentric motivation by: (expected) laws, policies, grants and taxes.
Government advertising to create awareness for existing stakeholders.
Knowledge & education
Introduce new (practical) education program connection of technology with agriculture. In Wageningen there is the focus on agriculture and tech comes in. In the region of Delft and Schiedam they can do it the other way around: tech meets agriculture. This will give the conservative character of the agri-culture a boost towards a more modern one.
Instruct the farmers with the new taxes, funds and laws according the use of residual flows and the benefits for them.
Show farmers actively the tech-world by internships from education programs. Interlinking target groups, to learn vice versa.
The world of the tech-agriculture is becoming popular. This new way of combining the old conservative ways with the new world of tech is creating a lot of new jobs.
Government advertising about circularity in residual flows.
Logistics & transport
Buy out or create collaborative partnership owners of Westland greenhouses.
Construction of new infrastructure. There is an important lacking connection with Westland. As well as the infrastructure for the logistics , as the infrastructure for the accessibility for the work - home connection. In the future we envision a decrease in use of the (electrical, self driving) cars and the upscaling of public transport.
Improve or enlarge links between big city hubs to be connect with not only the region but the whole country and out there.

‘Dance world, indestructible, dance on flows extend. Dance on flows, dance on flows, dance on flows Again’

(Piece of the poem)



Legend

- Agri-food cluster
- Construction cluster
- Greenhouses
- Construction companies
- Transition area’s
- Existing/improved roads
- New roads
- Existing railways
- New lightrail
- Existing railway stop
- New lightrail stops
- Circular cluster
- Existing education
- New education
- Waste treatment companies
- Start-ups
- Resource flows
- Accessibility 15 min.

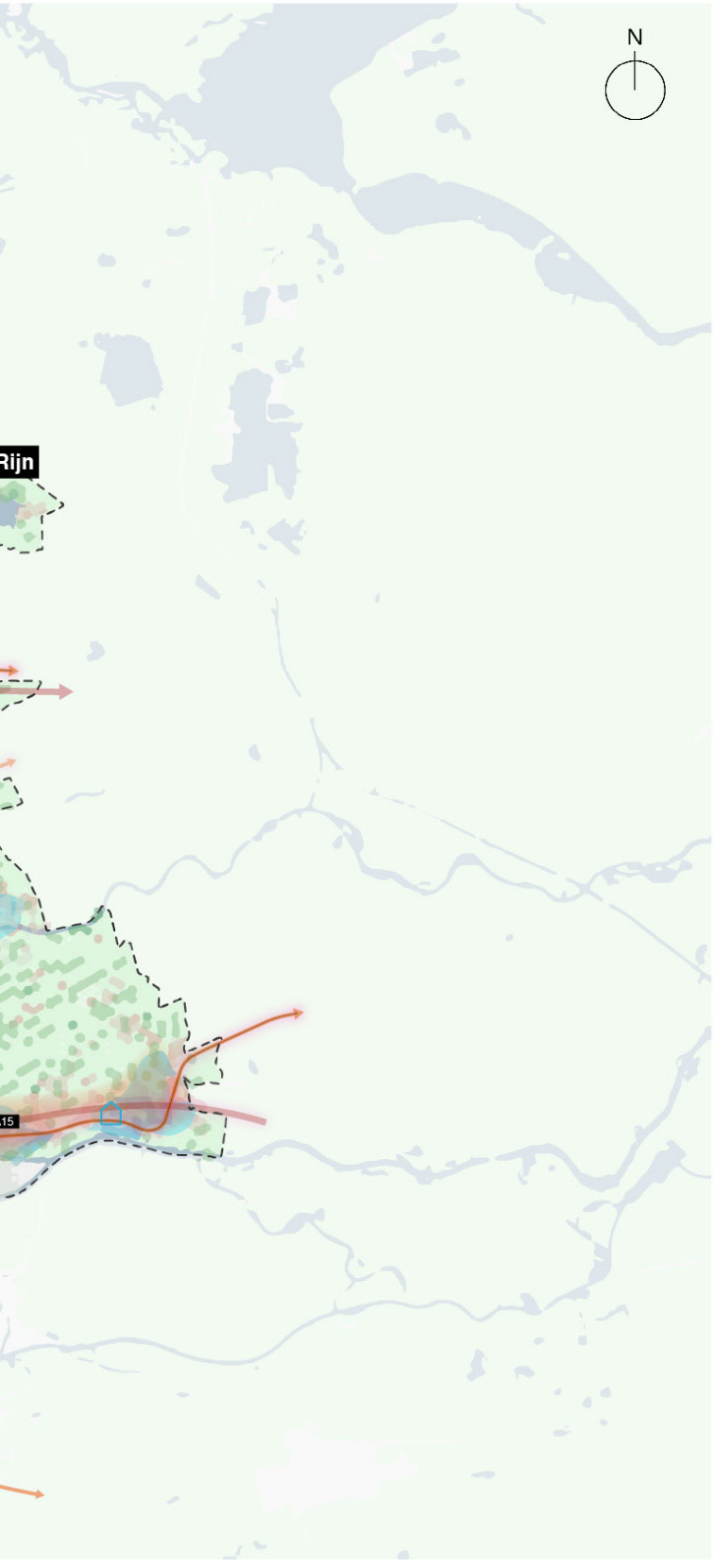


Figure 5.31 | Strategy map
(Authors, 2021)

5.7. Strategy map

With the strategy map, the connection between the the agri-food clusters, the construction clusters, the networks, the transition areas and their functions is visible.

In this paragraph, the most striking interventions sre discussed.
One of the elements are the transition areas. These areas (highlighted in yellow), together with the knowledge axis between the Hague and Rotterdam form the locations of circular activities. Here, the outflows of the agri-food sector are collected and turned in into resources for the construction sector.
Hereby, the location does not only function as distribution and treatment zone, but also as hub for education, start-ups and knowledge institutes.

The transition areas are connected to the optimized road and railtransport. With this, all urban areas of the province are accessible within 15 minutes to make it pleasant to move from the one place to the other.
This is done by adding the lightrail of the Agricultural Westland to the bigger cities. The 4 new stations give people easily access to work and live in this area.
Besides, there are added to new bridges on the roadways in order to connect the nothern part of South Holland better with the southern part.

This continious interplay of networks, places and sectors creates a strong basis for the circular South Holland.

5.8.1. Implications

To create a better understanding of the effects the LandBOUW strategies will have on different dimensions of society, this chapter will discuss its implications. Because the research questions are composed of different themes from the DESTEP-method, similar themes are used to discuss the consequences of the strategy, and the conditions needed to make the strategies work.

5.8.1. Conditions

In order to stimulate interaction between the two sectors, the strategy of LandBOUW wants to create an attractive transition zone, where the exchange of knowledge is stimulated as much as possible. This zone needs to meet certain social, spatial and economic conditions, which are listed in the diagram shown in Figure 5.32.
An example from this diagram is the spatial condition of a good public transport connection. Start-ups can establish themselves in the transition zone, which are focused on the merge of the two sectors. This ensures the exchange of knowledge and in turn stimulates the creation of several new jobs. Such as the LandBOUW product designer, who tries to design the best byproduct by genetic engineering.

These different conditions separately already work towards a successful strategy, but when all conditions of the different themes are right, this will create the most positive outcome in achieving the LandBOUW strategy.

Figure 5.32 | Social, spatial and economic conditions for a successful LandBOUW strategy (Authors, 2021).

The envisionair
looks for future developments in the total interlinked sector

The landBOUW intern
is studying an cross-sector education which combines knowlegde from both sectors

ONDITIONS

ÐGE STIMULATING START UP
MENT

ÐN THAT COMBINES
ÐGE

TERNET NETWORK

ETWORK

ESS ABOUT NEED
NGE

ACTURING

SPATIAL CONDITIONS

GOOD PUBLIC TRANSPORT

ZONES WHERE BOTH SECTORS COME TOGETHER

ATTRACTIVE SETTLEMENT AREA

KNOWLEDGE

RESEARCH CENTERS

EDUCATION

DATA CENTERS

TRANSITION ZONES

AGRI-FOOD
PRIMARY PRODUCTION

High-tech construction farmer
an associate farmer that cares for the best organic 'byproduct'

new public transport
network needed

logistics
work needed

HOUSING

START UPS

ECONOMIC CONDITIONS

COST REDUCTION OF RESOURCES

GOOD LOGISTICS

MORE CROSS-SECTION JOBS

A MARKET FOR SUSTAINABLE BUILDING MATERIALS

GOOD COMPETITION BETWEEN BUSSINESSES TO CREATE THE BEST PRODUCT

The waste manager
connects different businesses with each other and oversees exchanges of waste flows

The foodbank employee
collects and reviews quality of excess food and distributes it to people in need of food

5.8.2. Consequences

After establishing the conditions needed to achieve a successful LandBOUW strategy, we envision it will have many positive effects in the following themes. Because these effects are mostly visible on an environmental, spatial, economic and social level, these will be the four themes discussed. The implications mainly focus on one theme, but also affect some of the others indirectly. Figure 5.33 shows a more exact placement of each consequence in the themes.

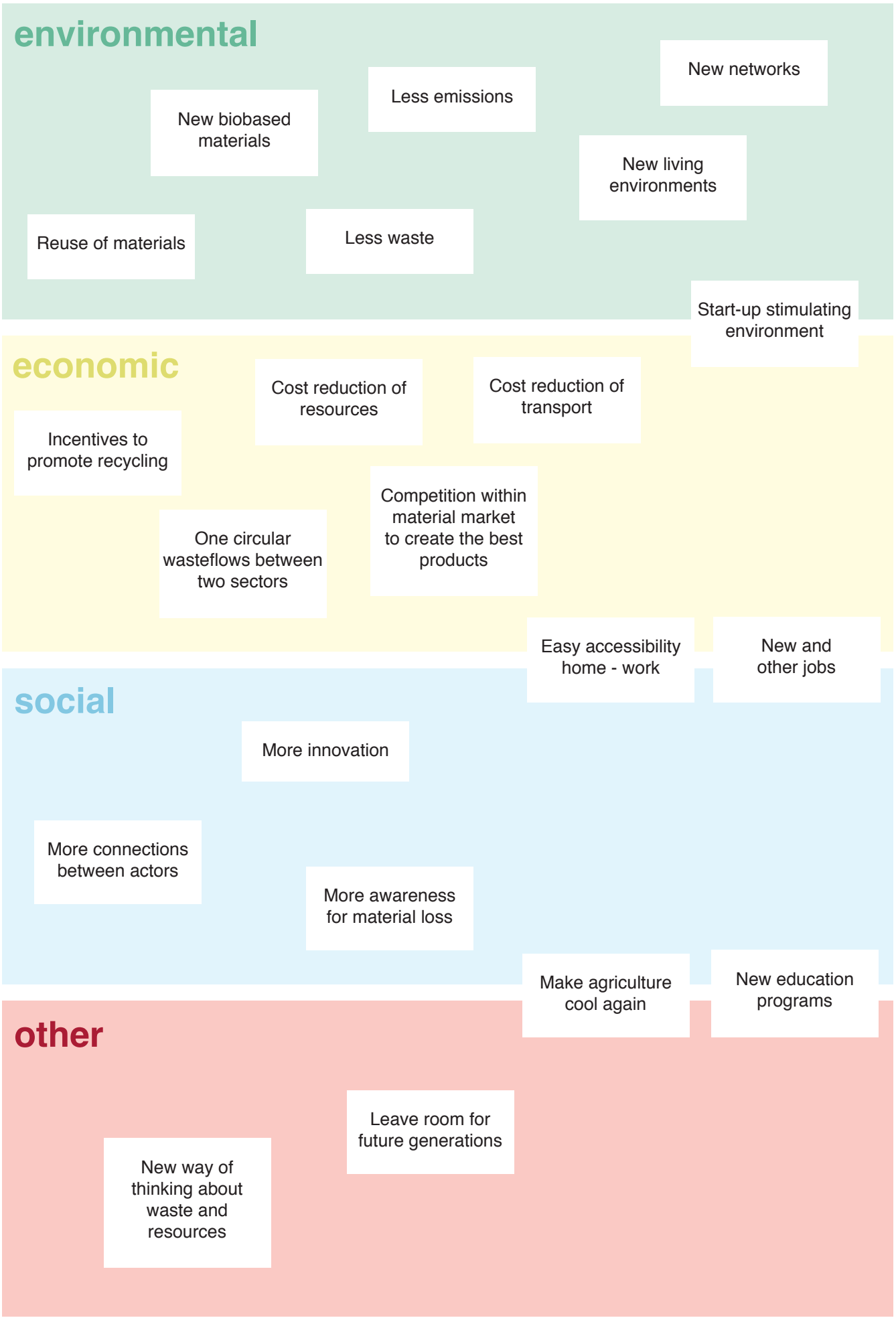
Firstly, since the entire purpose of LandBOUW is to help achieve a fully circular economy in South Holland, the environmental theme naturally benefits from the strategy. Mainly, the LandBOUW strategy stimulates the development of new biobased materials, which will reduce waste that ends up in the environment. It also encourages the increased reuse of building materials, which will do the same for the waste. In turn, this also decreases the need for the production of non-circular building materials, which reduces the emissions created in the process.

On a spatial level, the implications of the strategy are more visible to the residents of the transition areas. These areas namely will change and create new living environments, where people will become more aware of the new strides towards circularity. As was mentioned before, different networks will be expanded to connect the transition areas, which will also affect the spatial plane. The new environment will in turn stimulate the settlement of new start-ups that can encourage competition and innovation in different aspects of the symbiosis.

All of these spatial implications can also indirectly be related to social implications, because they benefit the people surrounding the transition areas. The new living environments will make people more familiar with the idea of circularity, and will give them more awareness on material loss and sustainability. The newly created education programs will do the same, and stimulate the exchange of knowledge in this field. Because of the new course of innovation, new and other jobs will be created, which will also benefit people economically. The new transport networks will make them able to travel between home and work more effectively, and will increase overall accessibility. The bundling of different sectors in the transition areas will stimulate better connections between different actors, which will encourage cross sectoral communication.

Some of the aforementioned social and spatial implications also impact the economy, like the creation of new and other jobs and development of start-up stimulating environments. Besides, creating one circular resource flow between the two sectors also results in some great economic benefits. Each step in the production process of both sectors requires transportation, as was mentioned before, and since more steps of the process are combined in the transition areas, transport costs can be lowered. Because of this, costs can also become lower for the resources, together with the constant stimulation of innovation, which can encourage businesses to compete and create the best and cheapest materials.

Figure 5.33 | Overview of the implications divided in the four themes (Authors, 2021)


environmental
New networks
Less emissions
New biobased materials
New living environments
Reuse of materials
Less waste
Start-up stimulating environment
economic
Cost reduction of resources
Cost reduction of transport
Incentives to promote recycling
Competition within material market to create the best products
One circular wasteflows between two sectors
Easy accessibility home - work
New and other jobs
social
More innovation
More connections between actors
More awareness for material loss
Make agriculture cool again
New education programs
other
Leave room for future generations
New way of thinking about waste and resources

6. ...to conclude

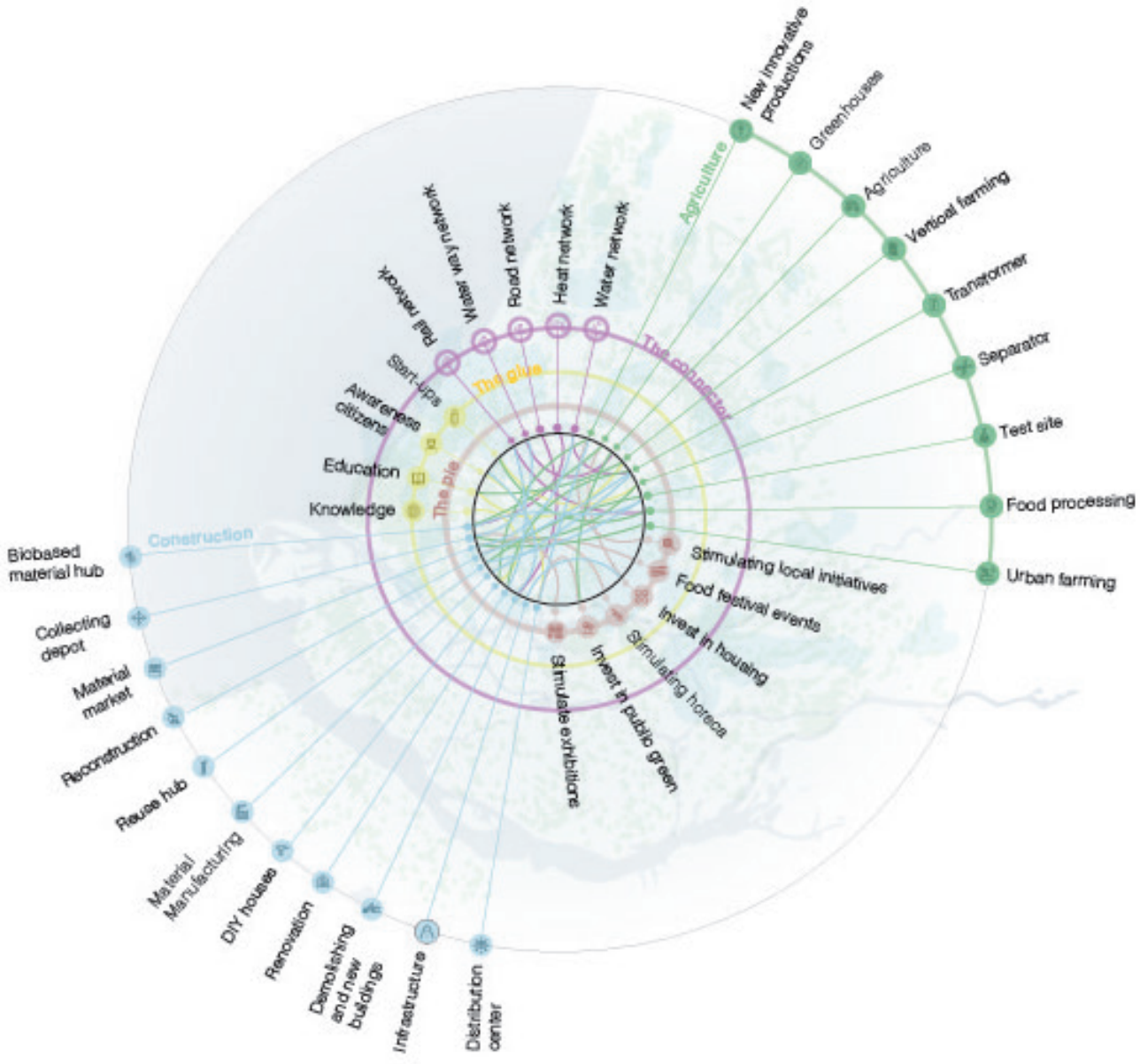


Figure 6.1 | Symbiosis of functions, pillars and sectors (Authors, 2021)

Legend

- Construction related functions
- Agri-food related functions
- Pie related functions
- Glue related functions
- Connector related functions

- Construction flow
- Agri-food flow
- Pie flow
- Glue flow
- Connector flow

6.1. Conclusion

Current developments as drivers for connection
The transition towards a more circular economy in South Holland is done by creating a first link between the agri-food sector and the construction sector. Hereby, an underlying approach of knowledge, spatial connections and policies supports this transition.

Our key driver to start connecting the pillars of the circular economy comes from the existing policies. However, we see that the awareness to become circular appears in governance documents, the connections between sectors only appear at low scale level. This means that circular flows function mostly within their sector and are limited to their own border.

Besides this, the need for housing was also an important factor to create this interlinked relationship. The need for housing directly means need for construction materials and a big change in our living environment. Using the existing biobased materials for the new buildings can be assumed as a weak link because of the limits of availability and the dependent attitude to only look at one source.

The solution has been found in one of the strongest economic sectors of South Holland: The agri-food sector and the construction sector. This sector creates a high amount of residual waste flows and thereby is not circular at all. In contrast to this, we found that the 'waste' of the agri-food sector has high potential to transform in construction materials.
With these developments, we suggest a first in connecting the pillars: Using the 'waste' of the agri-food sector as 'food' for the construction sector.

Finding a symbiosis between the sectors
The connection between the sectors is divided into two parts: 1. The system of flows between the two sectors itself and 2. The underlying concept that supports the transition into a circular economy.

The two sectors
The outflow of the agri-food sector is connected as inflow to the construction sector. This results in a closed loop within the agri-food sector and an extended loop of the construction sector. The use of agri-food products and other biobased products for the construction sector will improve the amount of renewable and reused materials and decrease the amount of loose ends within this sector. Closing the construction loop completely is not possible, because some products used for construction (for example steel and iron) are not feasible or possible to replace at the moment.

The connection of the two sectors is visible in the transition areas. The transition areas are divided into four categories based on their function, development prognosis and strategic location. The first category are the 'Innovative Agri-food areas' placed within the agri-food area. This category focuses on 'waste treatment functions' at the first stage in the LandBOUW process.

The second category are the 'Upcoming Clusters'. These clusters consist of multiple places spreaded over the cities of the Hague, Delft and Rotterdam and change already towards more circular places. The LandBOUW approach is a beneficial addition and supportive system to this places.

The third category the 'Zones In Between'.These locations are in between construction zones and agri-food zones and combine functions of the construction and agri-food sector and generate a lot of new jobs.

The fourth category are the 'Extended Borders' places at the edges of the province or cities. These locations are near construction areas and

former ports or places will become outdated in future. When extending the LandBOUW process further, these locations are suitable and can be the bridge to grow outside the province borders.

The underlying concept

The underlying concept consists of 'the pie', 'the glue' and 'the connector'. 'The pie' is policy oriented and focuses on supporting interventions in the transition. These are, for example, funds for circular oriented companies and opportunities to experiment with materials. The government is hereby a key player at the start of the process. 'The glue' focuses on awareness, education and knowledge. To keep the transition going, there is needed (general) knowledge about circularity. Students and start-ups companies are important stakeholders within this part. Currently, the clusters arise within the axis of the Hague, Delft and Rotterdam, but we also see some rising clusters in Leiden and Dordrecht. In the LandBOUW strategy, we focus on supporting the current clusters and make room for agri-food based education and knowledge companies near agri-food zones. Besides, the 'Zones In Between' are important locations for more general knowledge about agri-food and construction based circularity.

The connector facilitates the spatial network around the transition area's (the places where the connection takes place). The transition is impossible to make if the infrastructural network lacks behind. In order to keep the flows going and to extend over time, a well functioning network is needed. Our biggest intervention is made in Westland. In our strategy, this agri-food zone is connected by a lightrail to the Hague and Rotterdam.

This underlying concept shows a structural base in policies, knowledge and space in order to 1. keep the transition going, 2. extend the transition and 3. create the possibility to have new connected pillars in the circular economy.

Conclusion

The use of agri-food products as construction materials is a first step into connecting different sectors. Hereby, the system closes the loop of the agri-food sector and reduces the loose ends of the construction sector. This connection creates an innovative character for both the agri-food as the construction sector and possible new links in between. By using also other biobased materials, the construction sector is not only relying on the agri-food sector whereby the both sectors are not depending on each other, but benefit from their possible relation. Hereby, the construction and agri-food are leading sectors that show possible relationships. Hereby, South Holland is a leading test site for other urban areas.

6.2. Discussion

> ***'What are things that could have been looked into futher? What are further directions in which to take this research topic?***

To answer this question the practical relevance, unanswered questions and ethics are explained below. This will form the discussion of this project.

6.2.1. Practical relevance

This chapter is about the practical relevance for this strategy. It is about what is useful for society and / or science. Some topics can be distinguished which will be described below.

Succeeding factors or impediments

Discussed in the conceptual framework are the three factors: policy, new technologies and social conditions. The more preferable these factors are designed related to the goals of this strategy, how more likely the strategy succeeds in earlier stages.

Framed sectors

Both sectors, agri-food and construction, are big complex sectors which are changing, growing and innovating everyday. The time we had as a group to do research in these sectors can most probably not meet the full understanding of it. Therefore we could have overlooked some processes, systems or residual flows which could be important for the progress of the strategy. Concluding, for this report a quite general approach is taken to the two sectors.

Also the agri-food sector is a changing sector. Because of the earlier mentioned problems around the nitrogen emissions (Weel, 2020), Co2 emissions (RIVM, 2018) or the big spatial influence, there is a change that the sector will not be there in this capacity. For example greenhouses will be placed vertical in a new concept, named: vertical farming (Marcelis, 2019). With this kind of new concepts also new kinds of systems originate with possibile different residual flows. These kinds of sustainable systems changes are expected to be in the future evenmore at a wide range of systems and activities. However, residual material flows (for one business specific) will always be there.

Other sectors

This research, vision and strategy is based on the residual flows of the agri-food and construction sector. Other sectors have been left out of consideration. Yet, in the phasing is discussed this strategy should be a pilot for other provinces or countries. Likewise, the strategy could be seen as a pilot for showing interlinking sectors gives a good opportunity to create circular use of materials. By interlinking additionally other sectors, such as the chemical sector, even more residual flows can be used as building materials for the construction industry. Earlier on the use of plastic from residual flows from the food industry is discussed, this could even work on a bigger scale with the chemical sector.

The potential use of residual flows

Another point of discussion is the potential of using residual flows. It seems sometimes a little utopian that all the residual flows should flow into other sectors but there is a difficulty with that. For a lot of residual materials it is not immediately clear what kind of new function they could get, because there has been a lack of research into these products or maybe there is really not a new function for them in these existing sectors.

Food waste

The strategy is based on agri-food residual flows. It should be thoroughly investigated whether the residual flow of food can be of added value in the construction sector than, for example, that it can retain its function and be reintroduced as food. Not processing food and giving it directly back to humans or animals is probably more sustainable, than sending it to a waste processing plant and letting the entire recycling and preparation process go on. Thus, it would be good to focus on the reuse of remains from the food and agriculture sector instead of usable food itselfs.

6.3 Ethics

LandBOUW recognizes that the created vision has positive and negative ethical implications.

Better public transport network
LandBOUW has tried to create a better public transport network for all of South Holland. This will make jobs and facilities more accessible for inhabitants of not only the south-west of South Holland but also the north-east of South holland. This improvement in infrastructure means some new road and new light rail connections. Because of this land will have to be bought in some cases. The new/ broader roads will have a slight increase in emissions and noise. While accessing the new network, green structures and biodiversity are taken in consideration to create the best network for the actors.

Education
Education is distributed more evenly in South Holland and is placed inside relevant (production) areas. This places the knowledge where it is needed. In particular for youngsters in practical & theoretical fields., are more opportunities created

Change in market
The LandBOUW vision will have a possible negative impact on the older traditional farmers. These farmers can because of the vision be substituted by new innovative businesses. Also current construction material manufacturers that work with unsustainable resources will have more competition with biobased material manufacturers or be forced to innovate and follow the trends. In the best case scenario these manufactures will not use unsustainable resources at all.

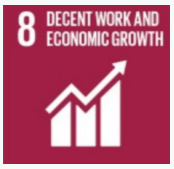
Another stakeholder that will be impacted negatively will be the companies that extract the current unsustainable raw materials. These will have less demand for their product. Nevertheless this change is needed to achieve a circular South Holland.

Transition areas
The transition areas have been chosen because of the strategic location to create the best supply chain for the province of South Holland. The current (surrounding) inhabitants will be impacted by the change. These redesigned spaces will have a big impact on them.

For the future
Another group that has to be taken into account are the future generations LandBOUW focusses on a better future for future generations. Landbouw implies therefore onto nine of the 17 Sustainable Development Goals of the 2030 Agenda for Sustainable Development. (sdgs.un.org, 2015)

Figure 6.2 | Sustainable development goals (sdgs.un.org, 2015)

A just transition: Reducing poverty because of reducing inequalities in accessibility to Education, facilities and existing jobs. & creating jobs



A better (knowledge) infrastructure is created which stimulates economic growth and creates decent work

New biobased materials are created and encouraged to make cities and communities sustainable

A more responsible production of the agri- food sector is created. Also awareness of our consumption and use is raised with all actors.

Air pollution and waste pollution is reduced because of the use of local sustainable resources. While making this change other environmental problems can be tackled simultaneously.

In order to reach the LandBOUW goals new partnership are created between actors and sectors

6.4. Unanswered questions and recommendations

LandBOUW has tried to make a vision towards an optimal use of organic residual materials in a intertwined sector. The main research question has been answered: But because of time restraint, limited resources and efficiency, not all questions about the subjects are answered in debth . Some of the questions that have come up while making LandBOUW that need to be answered are listed below;

1. The Landbouw vision is meant to be a pilot for other sectors. In this document the agri-food sector and construction sector have been taken under a loop. Other sectors need to be looked into more, to determine which sectors can be viewed as nutrition for another sector.

2. Secondly, LandBOUW has mainly focussed on creating exchange in knowledge by physical conditions. More research is needed about the conditions for a digital network.

3. Thirdly, a lot of research is still needed to find agrifood based substitutes for materials like steel. Although this material is more easily reused than concrete, it has a big influence on the environment.

4. Also, the potential of the use of some residual flows is not clear (yet). More research is needed about future use possibilities of these flows. Change in the sector needs to be anticipated for in order to create a sustainable future proof solution.

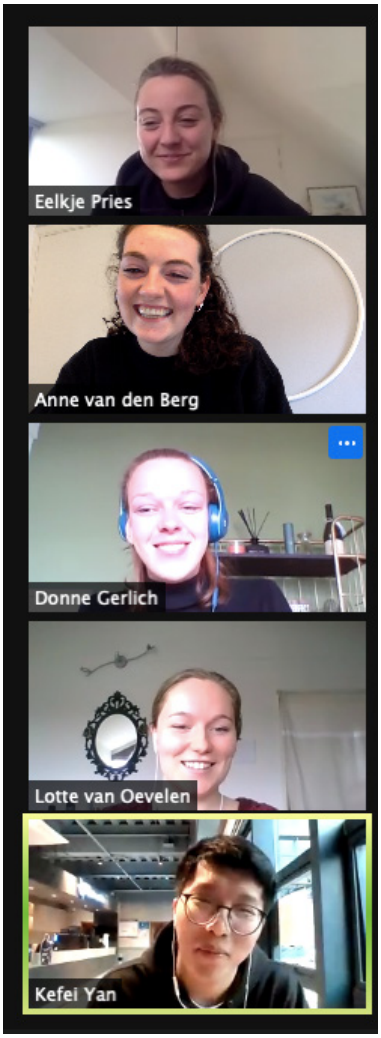
5. Another question that arose while making LandBOUW was: what happens if the need for agri-food based materials outgrows the residual flows of the agrifood sector? By the time the demand for biobased building materials becomes so big that production by only residual materials falls short, the step to the creation of new businesses that produce organic materials for purely construction, needs to be set. This scenario needs to be researched and designed for. But before that, this vision can be a pilot for other sectors, other sectors that can possibly also provide resources for the construction sector. Nevertheless the use of residual organic flows for the food providing businesses will always stay, so this vision will stay to be applicable.

6. The individual transition areas need to be looked at and individual designs need to be made. Social and spatial implications of the new change needs to be accessed more. LandBOUW has made decisions mainly through the eyes of the market and the businesses. While designing for the individual transition zones, extra attention needs to be paid to the view of the (surrounding) inhabitants and the attractiveness of these places. More research is needed in order to identify all transition areas in South Holland, that LandBOUW maybe has overlooked because of time restraints

7. Lastly, it is important to keep engaging stakeholders while realizing LandBOUW. More participation of big stakeholders in South Holland could lead to more appropriate systems and residual flow processing.

Future wish

We hope the LandBOUW strategy created a critical, flexible and open view to residual material flow treatment, creating connections and circularity in itself.
The world we live in can be puzzled in pieces, but should never be broken down. Use 'Land' to 'BOUW' and thereby create a circular future.



Bibliography

Texts

1010 architecture urbanism, Vogel, M., Heijden, R., Boeijenga, J., van der Heijden, R., & Internationale Architectuur Biennale Rotterdam. (2019). Wat heb je nodig? Internationale Architectuur Biennale Rotterdam.

ARUP. (2017). THE URBAN BIO-LOOP GROWING,. MAKING AND REGENERATING. Carra, G., Ilardi, S., Perkins, C., Acharya D. Retrieved 6 April 2021, from https://www.arup.com/perspectives/publications/research/section/the-urban-bio-loop

AHN. (z.d.). *Actueel Hoogtebestand Nederland.* Ahn.nl. Retrieved 25 March 2021, from https://www.ahn.nl/ahn-viewer

Amenta, L., & van Timmeren, A. (2018). *Beyond Wastescapes: Towards Circular Landscapes.* Addressing the Spatial Dimension of Circularity through the Regeneration of Wastescapes. Sustainability, 10(12), 4740. https://doi.org/10.3390/su10124740

Aventus. (n.d.). *Landbouwtechniek* | Aventus. aventus.nl. Retrieved 1 April 2021, from https://www.aventus.nl/richtingen/LandBOUWtechniek

Balz, V. (2021) *FROM VISION TO STRATEGY*. TU Delft. Retrieved 6 April 2021, from https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2099006/View

Balz, V., & Zonneveld, W. (2019, juli). *Regional design in the context of fragments territorial governance: South wing Studio*. (6 Region design). TU Delft. https://doi.org/10.7480/abe.2019.8.3900

Bianchi, F. , Beek, C. van , Winter D., de. Lammers, E. (2020) *Opportunities and barriers of circular agriculture insights from a synthesis study of the Food & Business* Research Programme. Retrieved 2 April 2021, from https://www.nwo.nl/sites/nwo/files/documents/1.%20Circular%20agriculture_full%20paper.pdf

Centraal Bureau voor de Statistiek. (2020a, February 21). *Circulaire economie en materiaalstromen*. https://www.cbs.nl/nl-nl/longread/de-nederlandse-economie/2020/circulaire-economie-in-nederland/2-circulaire-economie-en-materiaalstromen

Centraal Bureau voor de Statistiek. (2020b, May 7). *Landbouw droeg in 2019 evenveel bij aan economie als tien jaar eerder.* Retrieved 1 April 2021, from https://www.cbs.nl/nl-nl/nieuws/2020/19/LandBOUW-droeg-in-2019-evenveel-bij-aan-economie-als-tien-jaar-eerder

Centraal Bureau voor de Statistiek. (2021, January 13). *Geen bedrijfsopvolger voor meer dan 16 duizend boerderijen.* Retrieved 1 April 2021, from https://www.cbs.nl/nl-nl/nieuws/2021/02/geen-bedrijfsopvolger-voor-meer-dan-16-duizend-boerderijen

Circulair Ondernemen. (n.d.). *Subsidies en financiering.* Nederland Circulair. Retrieved 2 April 2021, from https://www.circulairondernemen.nl/subcommunities/overheidsregelingen

CM Web. (2020, August 3). *Overzicht van de nieuwe wet- en regelgeving op het gebied van duurzaamheid*. Retrieved 1 April 2021, from Retrieved 1 April 2021, from https://cmweb.nl/2020/08/overzicht-van-de-nieuwe-wet-en-regelgeving-op-het-gebied-van-duurzaamheid/

Dabrowski, M. (2021, 15 maart). *Stakeholder analysis* [Video]. Brightspace. https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2099059/View

Dam, J., van & Oever, M., van den (2012) Catalogus biobased bouwmaterialen. Het groene bouwen. Wageningen UR Food & biobased research. ISBN 978-94-6173-335-1 Retrieved 6 April 2021, from https://edepot.wur.nl/213602

Delgado, T., Doody, J., Paffenroth, K., Clark, M. T., Conley, A., Dávila, M. T., Doorley, M., French, T., Fulmer, J. B., & Herdt, J. (2015). *Augustine and Social Justice*. Adfo Books.

Delva. (z.d.). *M4H - Toekomst in de maak*. Delva.la. Retrieved 20 March 2021, from https://delva.la/projecten/m4h/

Doménech, T., & Davies, M. (2010). The role of Embeddedness in Industrial Symbiosis Networks: Phases in the Evolution of Industrial Symbiosis Networks. *Business Strategy and Environment*, *20*(05), 1–4. https://doi.org/10.1002/bse.695

Drift & Metabolic. (2018). *Zuid-Holland circulair. Verkenning van Grondstofstromen en Handelingsopties voor de Provincie*. Retrieved 6 March 2021, from https://www.zuid-holland.nl/onderwerpen/economie/circulaire-economie/

DuraVermeer (2020) *IN DOEN VERBINDEN. IN GROEN VOORUIT*. Retrieved 1 April 2021, from https://www.duravermeer.nl/over-dura-vermeer/duurzaamheid/

Europese Commissie. (2019, October 12). *Een Europese Green Deal. Europese Commissie - European Commission.* https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_nl

FABRICations. (2015). *Amsterdam Circulair | FABRICations.* Fabrications.Nl. https://www.fabrications.nl/portfolio-item/amsterdamcirculair/

FMVG. (n.d.). *Onderwijs. Campus Development - TU Delft.* Retrieved 1 April 2021, from https://campusdevelopment.tudelft.nl/thema/onderwijs/

Gemeente Rotterdam. (2019, maart). *Van Zooi naar Mooi.* Programma Rotterdam Circulair 2019–2023.

Gemeente Westland. (2013). *Structuurvisie Westland 2025*. Retrieved 29 March 2021 https://www.gemeentewestland.nl/fileadmin/documenten/wonen_bouwen_en_verhuizen/Struc

tuurvisie_Westland_2025.pdf

Google. (2021). [Google Maps Zuid Holland]. Retrieved 5 March 2021, from https://goo.gl/maps/aFXuDRQmyDvh-QvoA6

Heineken. (2020). Heineken N.V. *Annual Report 2020.* Retrieved 1 April 2021, from https://www.theheinekencompany.com/sites/theheinekencompany/files/Downloads/PDF/AR-2020/heineken-nv-annual-report-2020.pdf

IABR & Keilecollectief. (2019, juni). *Wat heb je nodig voor een circulaire economie?* (IABR-The missing Link). Team 1010.

IABR & UP. (2016). *The productive city* (75b editie, Vol. 2016). Atelier Rotterdam.

King, B. S., Tietyen, J. L., & Vickner, S. S. (2000). *Food and Agriculture: Consumer Trends and Opportunities An Overview.* Retrieved 3 April 2021, from http://www2.ca.uky.edu/agcomm/pubs/ip/ip58a/ip58a.pdf

Lefebvre, H. (1968). *Le droit à la ville*. París: An.

LISA (2016). *Landelijk Informatiesysteem van Arbeidsplaatsen.* Retrieved 5 March 2021, from https://brightspace.tudelft.nl/d2l/le/content/278701/Home

LISA (2018). *Landelijk Informatiesysteem van Arbeidsplaatsen.* Retrieved 5 March 2021, from https://brightspace.tudelft.nl/d2l/le/content/278701/Home

MacArthur, E. (2013). *Towards the circular economy*. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf

Marcelis, L. (2019, August 19). *Is vertical farming de toekomst? - Kassa - BNNVARA*. Kassa. Retrieved 4 April 2021, from https://www.bnnvara.nl/kassa/artikelen/artikel-wat-is-vertical-farming-is-het-de-toekomst

Milgro. (2020). *food.* Retrieved 1 April 2021, from https://www.milgro.eu/sectoren#food

Ministerie van Algemene Zaken. (2020a, June 18). *Afvalstoffenbelasting*. Milieubelastingen | Rijksoverheid.nl. Retrieved 1 April 2021, from https://www.rijksoverheid.nl/onderwerpen/milieubelastingen/afvalstoffenbelasting

Ministerie van Algemene Zaken. (2020b, January 16). *Circulaire economie*. Retrieved 4 April 2021, from Rijksoverheid.nl. https://www.rijksoverheid.nl/onderwerpen/circulaire-economie

Ministerie van Binnenlandse Zaken en Koninkrijksrelaties. (2020, June 15). *Staat van de woningmarkt 2020. Nieuwsbericht | Rijksoverheid.Nl.* https://www.rijksoverheid.nl/actueel/nieuws/2020/06/15/staat-van-de-woningmarkt-2020

Ministerie van Infrastructuur en Waterstaat. (n.d.). *From a linear to a circular economy*. Circular Economy | Government.Nl. Retrieved 4 April 2021, from https://www.government.nl/topics/circular-economy/from-a-linear-to-a-circular-economy

Mot, E., H., S., T., K., Tijm, J., Romijn, G., & Verrips, A. (2018, June 20). *Niet-hernieuwbare grondstoffen voor de circulaire economie.* Centraal Plan Bureau. https://www.cpb.nl/sites/default/files/omnidownload/CPB-Achtergronddocument-Juni2018-Niet-hernieuwbare-grondstoffen-voor-de-circulaire-economie.pdf

Mul, P., Kool, M., Lange, de M., Steman, B. (2017) *Verkenning Circulaire Economie Provincie Zuid-Holland.* Retrieved 22 February 2021, from a2_definitief_verkenning_circulaire_economie_provincie_zuid_holland.pdf

NASA. (n.d.). *Global climate change: Vital Signs of the Planet.* NASA: Climate Change and Global Warming. Retrieved 20 February 2021, from https://climate.nasa.gov/

NASA. (n.d.-b). *The Effects of Climate Change.* Global Climate Change: Vital Signs of the Planet. Retrieved 5 April 2021, from https://climate.nasa.gov/effects/

Nijhuis, S. (2021). Landscape-based strategies for regional design and planning [Online lecture]. Retrieved 6 April 2021, from https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2075227/View

NOS. (2017, June 15). *Waarom we allemaal in de grote stad willen wonen.* https://nos.nl/op3/artikel/2178292-waarom-we-allemaal-in-de-grote-stad-willen-wonen.html

OpenStreetMap (2021). *Map of the Netherlands*. Retrieved 20 March 2021, from https://www.openstreetmap.org/#map=7/52.154/5.295

Platform CB'23 (2019) *Framework Circulair Bouwen Raamwerk voor eenduidig taalgebruik en heldere kaders*. Retrieved 31 March 2021, from https://platformcb23.nl/images/downloads/20190704_PlatformCB23_Framework_Circulair_Bouwen_Versie_1.0.pdf

Platschorre, P. (2020, December 11). *Bouwen gaat door, maar corona zorgt voor 'stroperigheid'.* Cobouw.nl. https://www.cobouw.nl/marktontwikkeling/nieuws/2020/12/bouwen-gaat-door-maar-corona-zorgt-voor-stroperigheid-101291172?_ga=2.227736029.1911380890.1617575448-207981710.1617575448

Port of Rotterdam. (2021, February 19). *Feiten en cijfers.* Haven van Rotterdam. https://www.portofrotterdam.com/nl/onze-haven/feiten-en-cijfers

PricewaterhouseCoopers. (n.d.). *Sustainability*. PwC. Retrieved 27 March 2021, from https://www.pwc.nl/nl/themas/sustainability.html?gclid=CjwKCAjwx6WDBhBQEiwA_dP8rbmPipvv0WsiLOEJeDLY5IFlGPeXqD5ZOinaE3Ibuoa-Pyoss418qrxoCoxAQAvD_BwE

Province of South Holland. (2019). *CIRCULAIR ZUID-HOLLAND Samen versnellen* retrieved. Retrieved 31 March 2021, from https://www.zuid-holland.nl/onderwerpen/economie/circulaire-economie/

Province of South Holland (2020). *De zuid hollandse woningbouw agenda Visie, programma, instrumentarium, en vernieuwing 2021-2025.* 1st publication. Retrieved 2 April 2021, from https://www.google.com/search?q=de+woningbouw+agenda+zuidholland&oq=de+woningbouw+agenda+-zuidholland&aqs=chrome..69i57j69i64.8439j0j7&sourceid=chrome&ie=UTF-8

Van Raak, R. (2021). Circular economy challenges Zuid-Holland/Port of Rotterdam from transition perspective [Online lecture]. Retrieved 6 April 2021, from https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2075219/View

RaboResearch. (2019, November 14). *Woningtekort blijft huizenprijzen stuwen.* RaboResearch - Economisch Onderzoek. https://economie.rabobank.com/publicaties/2019/november/woningtekort-blijft-huizenprijzen-stuwen/

RIVM. (2018). *Greenhouse gas emissions in the Netherlands 1990-2016 RIVM Report 2018-0006.* Bilthoven: Rijksinstituut voor Volksgezondheid en Milieu https://www.rivm.nl/en/Documents_and_publications/Scientific/Reports/2018/mei/Greenhouse_gas_emissions_in_the_Netherlands_1990_2016_National_Inventory_Report_2018

Rijksoverheid. (2020, november). *Ruimte voor Biobased Bouwen.* https://www.rijksoverheid.nl/documenten/rapporten/2020/11/02/rapport-ruimte-voor-biobased-bouwen-strategische-verkenning

Rocco, R., Newton, C., d'Alençon, L. M. V., Watt, A. v. d., Babu, G., Cara-donna, G., Di Gioia, L. Subendran, J., Tellez, N., Pessoa, I. T. (2021). A Manifesto for the Just City. Delft: Delft University of Technology.

Royal FloraHolland (2020) *Sustainable production and marketplace*. Retrieved 1 April 2021, from https://www.royalfloraholland.com/en/about-floraholland/sustainable-healthy-future/sustainable-healthy-future/sustainable-production-and-marketplace

Royal FloraHolland (2020). *SDG12: Responsible production and consumption*. Retrieved 1 April 2021, from https://www.royalfloraholland.com/en/about-floraholland/sustainable-healthy-future/sustainable-healthy-future/sustainable-production-and-marketplace/sdg12-responsible-production-and-consumption

van Schaick, J. (2021, 8 februari). *Shaping (zuid)Holland. Lessons from 25 years of Regional Design in the Southern Randstad*[Video]. Brightspace. https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2071961/View

Sdgs.un.org.(2015) *THE 17 GOALS*. Retrieved 1 April 2021, from from https://sdgs.un.org/goals

Sdgs.un.org.(2015) THE 17 GOALS. Retrieved 1 April 2021, from https://sdgs.un.org/goals

Segerstedt. A. Olofsson, T. (2010).*"Supply chains in the construction industry*", Supply Chain Management: An International Journal, Vol. 15 Iss 5 pp. 347 - 353 http://dx.doi.org/10.1108/13598541011068260. Retrieved 3 April 2021, from https://www.diva-portal.org/smash/get/diva2:1009692/FULLTEXT01.pdf

Socio-economic profile of Zuid-Holland. (n.d.). *European Commission*. Retrieved 5 April 2021, from https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/zuid-holland

Stek, D. (n.d.). *DESTEP-analyse voor het analyseren van je macro-omgeving*. Strategischmarketingplan.com. Retrieved 21 March 2021, from https://www.strategischmarketingplan.com/externe-analyse/destep-analyse/

Taylor, J. & Bjornsson, H. (2021). *CONSTRUCTION SUPPLY CHAIN IMPROVEMENTS THROUGH INTERNET POOLED PROCUREMENT*. Retrieved 3 April 2021, from https://www.researchgate.net/publication/250291896_CONSTRUCTION_SUPPLY_CHAIN_IMPROVEMENTS_THROUGH_INTERNET_POOLED_PROCUREMEN

Thöle, H. (2021, February 8). *An introduction to Zuid Holland* [Slides]. Brightspace. Retrieved from https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2071983/View

TU Delft. (n.d.). *Over TU Delft*. Retrieved 1 April 2021, from https://www.tudelft.nl/over-tu-delft

United nations industrial development organization. (2020). *SHORT FOOD SUPPLY CHAINS FOR PROMOTING LOCAL FOOD ON LOCAL MARKETS*. Department of Trade, Investment and Innovation (TII). Retrieved 3 April 2021, from https://suster.org/wp-content/uploads/2020/06/SHORT-FOOD-SUPPLY-CHAINS.pdf

United Nations Statistics Division. (n.d.). *Goal 12: Ensure sustainable consumption and production patterns. United Nations Sustainable Development Goals.* Retrieved 4 April 2021, from https://unstats.un.org/sdgs/report/2019/goal-12/

Van Raak, R. (2021). *Circular economy challenges Zuid-Holland/Port of Rotterdam from transition perspective* [Online lecture]. Retrieved 6 April 2021, from https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2075219/View

WAAG Society. (z.d.). *All buildings in the Netherlands, shaded by year of construction.*Code.waag.org. Retrieved 10 March 2021, van https://code.waag.org/buildings/

Wandl, A. (2021) environmental technology and design Dep. Urbanism Delft University of Technology. Retrieved 6 March 2021 https://brightspace.tudelft.nl/d2l/le/content/278701/viewContent/2080159/View

Wageningen University & Research. (n.d.-a). H*istorie van Wageningen University & Research*. WUR. Retrieved 1 April 2021, from https://www.wur.nl/nl/Over-Wageningen/Historie.htm

Wageningen University & Research. (n.d.-b). *WUR*. Retrieved 1 April 2021, from https://www.wur.nl/?gclid=CjwKCAjw3pWDBhB3EiwAV1c5rBwnMs0WbOe8zuhnB1VnkYrplQWyy-iWiopet9_GSsYUa8SNEwIeihoC9sUQAvD_BwE

Weel, J. V. V. E. I. (2020, June 30). *Hoe Nederland uitgroeide tot exportreus in de LandBOUW - en nu moet veranderen. Trouw*. Retrieved 2 April 2021, from https://www.trouw.nl/economie/hoe-nederland-uitgroeide-tot-exportreus-in-de-LandBOUW-en-nu-moet-veranderen~b2e65581/

Collages

Collage1 tractor. zf.com Retrieved 24 March 2021, from https://www.zf.com/mobile/en/stories_25024.html

Collage 1 vertical farming Adam Gasson OCTOBER 9, 2019 Retrieved 24 March 2021, from https://www.agritecture.com/blog/2019/10/8/scottish-start-up-plans-to-build-40-vertical-farms-across-uk

Collage 1 vertical farming 2 growhigher.com. Retrieved 24 March 2021, from https://www.growhigher.com/?fbclid=;IwAR0KH2nqcLQ7bfC3W5FTt5Qbivpb43IgmZ_fx4p-fR-maVsJjbFnT_UmCgfc

Collage 1 greenhouses Renske van Dreumel 20 april 2017. Retrieved 24 March 2021, from https://www.hekkelman.nl/blog/agrarischezaken/glastuinbouw-deel-1-afstand-tot-kassen/

Collage 1 vertical farming building Jeremy Floyd JAN 25, 2014. Retrieved 24 March 2021, from https://discover.hubpages.com/food/Vertical-Farming-Feeding-our-future

Collage 1 vertical farming building 2 Fiona Hartley | 17 March 2019 Modular triangular modules form Precht's Farmhouse that connects architecture with agriculture. Retrieved 24 March 2021, from https://www.dezeen.com/tag/vertical-farms/

Collage 1 landscape google maps. Retrieved 25 March 2021, from https://www.google.com/maps/@51.9863799,4.18403,3a,75y,104.37h,84.5t/data=!3m7!1e1!3m5!1sFM7nxPckWBixUS6jqftCAg!2e0!6shttps:%2F%2Fstreetviewpixels-pa.googleapis.com%2Fv1%2Fthumbnail%3Fpanoid%3DFM7nxPckWBixUS6jqftCAg%26cb_client%3Dmaps_sv.tactile.gps%26w%3D203%26h%3D100%26yaw%3D195.62503%26pitch%3D0%26thumbfov%3D100!7i13312!8i6656?hl=nl

Collage 4 biobased building agro-chemie.nl. Retrieved 26 March 2021, from https://www.agro-chemie.nl/nieuws/biosintrum-ooststellingwerf-wordt-biobased-blikvanger/

Collage 2 Asakusa Culture and Tourism Centre, Tokyo, Japan. Kengo Kuma. Retrieved 26 March 2021, from https://www.stedebouwarchitectuur.nl/nieuws/160216/top-10-biobased-gebouwen

Collage 4 waterfront PWL Partnership Landscape Architects 2019. Retrieved 26 March 2021, from http://landezine.com/index.php/2021/02/vancouver-waterfront-park/

Collage 4 park Channel Center Park and Iron Street Park Halvorson Design Partnership, Inc. 2013. Retrieved 26 March 2021, from http://landezine.com/index.php/2014/12/channel-center-park-and-iron-street-park-by-halvorson-design-partnership/

Collage 2 het onderwijsgebouw van Wageningen Universiteit Retrieved 29 March 2021, from https://nl.wikipedia.org/wiki/Wageningen_Campus

Photos

Photo construction workers .nieuwsvoordietisten.nl (2011) Retrieved 29 March 2021, from https://www.nieuwsvoordietisten.nl/20-van-de-bouwvakkers-valt-blijvend-af-met-persoonlijke-leefstijlbegeleiding/

Photo Boss 2018 blog.adecco.be/
Retrieved 29 March 2021, from https://blog.adecco.be/nl/leidinggeven/een-vrouw-als-baas-wie-struikelt-daar-nog/

Photo European Union
Retrieved from https://en.wikipedia.org/wiki/President_of_the_European_Commission at 29-3-2021

Photo United Nations Secretary-General, António Guterres UN Photo/Mark Garten
Retrieved 29 March 2021, from https://www.un.org/sg/en/content/sg/biography

Photo farmer KRO-NCRV
Retrieved 29 March 2021, from https://www.superguide.nl/nieuws/boer-zoekt-vrouw-johan-wil-na-verbroken-relatie-geen-vrouw-meer-tvat

Photo Project developer
Retrieved 31 March 2021, from https://www.vmierlo.nl/vacature-projectontwikkelaar

Appendix

- Symbiosis songs
- Reflections
- Elaborating maps and diagrama
    1. Construction analysis
    2. Urban bioloop systems
    3. New construction materials
    4. Infrastructural accessment
    5. Stakeholder analysis
    6. Background information transition areas

Symbiosis songs

A special of our favorite songs during the project

“Bob de Bouwer” - Bob the Builder
"Banana Pancakes" - Jack Johnson
"Passionfruit" - Drake
“Wrecking Ball” - Miley Cyrus
“We built this City” - Starship
"Strawberry Fields Forever" - The Beatles
"Red Red Wine" - Neil Diamond
“Screaming at a Wall” - Minor Threat
"Bacon"—Nick Jonas and Ty Dolla Sign
“Our House”- Madness
"The Blacker The Berry" - Kendrick Lamar
"Cola" - Lana Del Ray
"Birthday Cake" - Rihanna
‘’Diggin’’ - Kovacs
"Sugar" - Maroon 5
‘’Chocolate" - The 1975
"Junk Food Junkie" - Larry Groce
"Cake By The Ocean" - DNCE
"A Cup Of Coffee, A Sandwich And You" - Gertrude Lawrence
"Cookie Jar" - Gym Class Heroes
"Candyman" - Zedd
“Highway (Under Construction)” - Gorillaz
"30,000 Pounds of Bananas" - Harry Chapin
"Bon Appetit" - Katy Perry and Migos
"Build me up buttercup” - The Foundations
“Brick by Brick” - Arctic Monkeys
“Working Man Blues”- Merle Haggard
“I’m Working on a Building”- Bill Monroe and His Bluegrass Boys
“Working on the Highway” - Bruce Springsteen
“The House That Jack Built” - Aretha Franklin
“If I Were A Carpenter” - Tim Hardin
“Building Bridges” - Brooks & Dunn
“Build Me Up Buttercup” - The Foundations
“Grandpa was a Carpenter” - John Prine
“Oats In the Water” - Ben Howard
“Stir Fry” - Migos
“Hammer and a Nail” - Indigo Girls
“Build” - The Housemartins
‘’Built to last’’ - Mèlée
‘’Built for everything’’ - Rexx life raj
‘’Waste a moment’’ - Kings of Leon
‘’White room’’ - Cream
‘’Glas, concrete and stone’’ - David Byrne

Individual reflections

‘Dancing through scales’

Anne van den Berg

Crossing sectors
With the proposal of LandBOUW, the connection between the agri-food sector and the construction sector has been found by turning waste treatment into resource creation. This strategy states a new regional approach to the ideology of crossing borders of places, policies and flows within the circular transition of South Holland.

Waste to resource
The waste streams of the agri-food sector have led and still lead to negative consequences for the living environment and the climate change. Together with the needed construction activities in order to house new citizens and future companies; these two sectors have great effect on the circular transition.

A new light
The LandBOUW strategy not only suggests to look at waste in a different way, but also proposes a new way of thinking in general. A way to think outside the borders of the sector, the place and the people. The policies play a key role to translate this view to companies, citizens and other (potential) stakeholders.

Creating cohesion
The stakeholders are involved at every scale level. The consequences of the LandBOUW strategy affect them in several ways such as other types of jobs, other ways of working and other ways of living. Therefore, a regional design does not only suggest physical changes, but stimulates responsibilities and planning policies among several stakeholders (Balz, Zonneveld, 2019).

On the other hand, the stakeholders influence the vision and strategy as well. For example, with the redevelopment of the agriculture area in Westland, the farmers have great impact. This both in ownership and approach towards working circular. The willingness of these farmers and financial investment is crucial in order to start the transition of this traditional sector. It is needed to find ways to meet their goals as well and find a way adapt this in the transition (Dawrowski, 2021).

Transition areas
In order to achieve this strategy, strategic locations are needed and thereby suggest physical changes in the built environment. The transition areas chosen have a connection with the agri-food and construction clusters whereby they have a relation with the future redevelopment prognosis. The study of Wastescapes (Amenta, van Timmeren, 2018) contributes this consideration. Wastescapes are (future) left or abandoned environments that are highly potential areas for innovation and circular developments and are therefore crucial in the metropolitan perspective. Hereby van Timmeren and Amenta (2018) state that this solves both the spatial fragmentation and resource scarcity (Amenta, van Timmeren, 2018). With our study, we found out Wastescapes can be found at all scale levels and function as ‘Zones In Between’.

Functions
For the strategy of LandBOUW the concept of ‘Amsterdam circulair’ (FABRICations, 2015) is used to define the functions within the transition areas. The functions give the different transition areas identity and attract different types of stakeholders.
Hereby, the functions also act on different levels. The one function is locally oriented, the other function acts on the national level. Also, this part of the strategy integrates multiple levels.
The LandBOUW strategy is a continuous interplay of streams, places and networks (van Schaick, 2021). Hereby, the poem, written for this strategy, reflects on this:

‘Dance world, indestructible
Dance on flows extend.
Dance on flows, dance on flows,
Dance on flows
Again’

‘Motivation is key’

Eelkje Pries

The difference in designing for a regional design compared to an urban design is most obviously the difference in size of the project. With this difference in scale, there are many more factors to consider. A common thread will have to be decided. From that decision on, it will have to be chosen which subjects should be taken into consideration - and which to a lesser extent. Feeling wise, you can feel bluntly and short minded to approach things generally. Especially when the time given for the research is short. Because of this, it is an art to sort out the most important actors down to a considerable level of detail. This fits with my personal approach for urban design, which is about making an environment better for those who are in need and involved in the spatial change process. These groups, who are in need or involved, are always the common tread in my opinion.

The Capita Selecta lectures and Spatial Development Strategies (SDS)

The thematic exercises of Spatial Development Strategies and the lectures of Capita Selecta gave insight in the different characteristics of a regional design: the continuous re-interpretation of territory and societal challenges based on changing context (local, regional, national, international, global), iteratively ‘dancing’ through spatial scales to develop possible spatial strategies, connecting governance, planning & regional design, and the deconstruct and reconstruct the regional scale through layers(Van Schaick, 2021). Combining these four characteristics shows the difficulty about finding a common thread as mentioned in the first part of this reflection.

This common tread will be decided on the defined problem statement. Existing policy, design or strategy documents sometimes misleads or distracts from the essential designing challenge of today. That is why it is very important to start the research process unbiased, to see for ourselves how we interpreted the data to subsequently revalidate it ourselves. This revalidation of the current situation in combination with the given exercise of creating circularity in South Holland, became the guiding theme for our group design.

In contrast to the design processes on a smaller scale, the regional scale has a design process in which top-down decisions are more likely to apply. It is more about connecting governance, planning & regional design and seeking alliances in a complex context then a commission led plan production (Van Schaick, 2021). It can be controlled from above by means of various tools, for example: laws, funds, or taxes. These instruments enable people to adapt not only through intrinsic motivation, but also through top-down created extrinsic motivation. The ability to turn even more knobs broadens the possibilities for the common tread to be defined, but also to be answered to. It takes the step further in the design by making it possible to tighten the rules.

Methodology Course

The parallel Methodology Course shed a different light on the project. Besides the more systematic and absolute data, the more abstract and re-elevating theories give you some issues to think about. Very important the issue around social and spatial justice(Rocco et al., 2021). Due to the large scale and approach to sustainability, which is often expressed and measured in numbers, the human side of the design is sometimes underexposed.

There never seems to be one truth, an answer always has to do with a context and the relativity of elements and personal interpretations. It is important to realize that for a lot of people the truth is what they know. Therefore an important aspect for creating motivation for the intended target groups in a design, is bringing knowledge. This always remains target group sensitive and a clear outline for this specific target group must be set out. Containing personal preferences and reasons for changing habits. Even though the intention and idea of a design is good, the narrative of how it should be brought to the intended target group is at least as important. That brings us back to the first part of this paragraph, about the fact that for many people truth, which provides motives, is what they know - or understand.

Even though there always seems to exist a hierarchy about who can decide that a change must take place, making agreements between both the 'higher states' in the hierarchy with the 'lower states' is important. An agreement leads to less resistance. Less resistance leads to less wasted energy that could be better put into the design itself and hopefully will eventually lead to a design or decision that everyone can agree with. What is again about social justice.

Spatial Strategies for the Global Metropolis
Concluding, the regional design development process is a process about bringing together many different factors. After establishing the common thread, the idea must test itself against different spatial qualities, but also especially against social consequences. A strategy is about a design that extends over a large area and has not been realized in a few years. The context of this area is constantly changing. By new social or spatial developments, which are driven by technology, for example. Expectations can be outlined for these developments, but real measurement remains difficult. Therefore it is important to realize a flexible and deliberate design.

Phasing as check for the change of success
All elements come together in the phasing. This will always provide an extra check about the ‘how?’ and the ‘why’ of the project. Which forms the important bridge between strategy und realization (Thöle, 2021). The phasing is an excellent kind of summary of the work that has been done and shows interlinked relations in introduced events. Seeing gaps in the phasing, means there are gaps in the design. After determining, you can quickly switch back to the relevant scale, to make a new assessment and to establish new design decisions.

Motivation is key
The why question always ends at the certain point of motivation. “Why would people want a change?” This was the leading topic in the search for an appropriate strategy. The fact that the world should become more sustainable, and therefore should also focus on circularity, is a phenomenon that everyone has heard of. However, the capacity that people agree with this differs greatly. But what differs even more is the knowledge that people know what can be done about it and how people can contribute themselves. For this, a motivation must be created that can be understood by everyone. This aspect of motivation has therefore become the common thread of this strategy. Different types of motivation have been set out in order to reach different target groups and to let them all participate in this design by their own motivation, without feeling directed or forced.

‘Making a strategy’

Lotte van Oevelen

The Capita Selecta lectures and Spatial Development Strategies(SDS)

While working on the assignment to make a regional design for a circulair South Holland, we got supporting workshops and lectures to assist us. These lectures provided knowledge about the region and the assignment itself. Some subjects that were really helpful for us to learn about are listed below:

Regional Design

The lecture about regional design (van Schaick, 2021) was really helpful for me. This course was the first time that we received an assignment on this scale, the province. We learned in this lecture that regional design consists of:
The continuous re-interpretation of territory and of societal challenges based on a changing context.
The continuously switching through spatial scales to develop possible spatial strategies
Trying to connect governance, planning & regional design, to seek alliances in a complex context
It consists of deconstructing and reconstructing the regional scale through layers to discover and develop spatial interventions to find possible spatial programs as a result.
LandBOUW has implemented all these techniques in the report.

Making a strategy

Another helpful lecture was the lecture about making a strategy on the regional scale. A strategy sets goals, talks about society, economy & culture, Includes an abstract design, uses vision & policies, guides toward outcomes and argues for action (Balz, 2021). It creates an argument for the vision that is made. An advice that I had to be reminded of often while making the strategy that was mentioned in the lecture, was that we are building a strategy not implementing a detailed plan.

Material Flow Analyses

A basis for LandBOUW has been the activity Based Spatial Material Flow Analyses (ASMFA) (Wandl, 2021) We learned some helpful methods and tips to analyse material flows. You can analyse this in a system diagram of activities and flows, flow maps and a systemic section. It is important to locate economic activities and actors and to give accurate detailed information while making these diagrams, maps and sections. This information is extra relevant for LandBOUW because the vision is built on the union of the material flows of the agri-food sector to the construction sector.

Research and Design Methodology

The parallel course Research and Design Methodology went deeper into the methodology of writing a regional design report.

Combining research methodology and design

In the courses in the bachelor we made research papers earlier. Nevertheless, this is the first time design and research methodology is truly combined in my eyes. I found this was very interesting. Sometimes this is difficult to combine because design is big and exaggerated, while a scientific research paper is built on facts and doesn’t allow exaggeration and sometimes can be restraining.

Justice and space

In the process, space, especially urban space can increase the chances that the wishes, needs and desires of different groups can be integrated in policy (Rocco et al., 2021). For the result, space can promote the average distribution of the infrastructures, public goods, resources and services. The production of space can be a tool of social justice and the products can provide relatively fair opportunities to different classes. It can plan accessibility of resources or knowledge for everyone and thus make a society more or less democratic (Rocco et al., 2021). Although spatial justice was not a principle in LandBOUW, it has played a role in the vision and strategy. We have tried to create a just space for South Holland. Especially while creating jobs, infrastructure and creating a physical transition area.

Stakeholders

It was very helpful to get an insight of the stakeholders involved in our regional design and are included in the report. The given tools to create a stakeholder analysis have made discussion points visible that otherwise would not have gotten to the light. The existing stakeholders are identified by literature studies. But because of time restraints, more research is needed in order to identify more stakeholders. Another research methodology that is recommended is arranging interviews with already identified stakeholders.

Thank you for the interesting lessons.

‘A new perspective on transitions

Donne Gerlich

During the process of developing the vision and strategy for the LandBOUW project, I first came to the conclusion that the entire project felt like an attempt to plan the transition towards a more circular economy. An interesting first conclusion for me, because Nijhuis (2021) stated in his lecture that regional design is not a blueprint planning, but more based on creating a set of adaptive principles to guide the region in the future. This helped during the process in switching from the mindset of a planner, to more of a transition manager. The theory of transitions and transition management piqued my interest early on in this project, because these concepts especially brought new perspectives, which changed my view on regional design and the goal of the project.

Changes vs. transitions

Changes in society happen constantly, which I first believed means that society is in a constant state of transition and the process of transitioning is never finished. Different transitions have a beginning and an end, but they are less visible, because they take place over longer periods of time. This is obvious, because the scale of regional projects is bigger, which means more and different kinds of influences come from the context, so there is more needed to actually change.

A new perspective on transitions came to me in a theory from van Raak (2021), who states that the specific term ‘transition’ is only used in specific periods of change. His theory explains that most of the time, society is relatively stable, when the fundamental structures are retained and only societal systems are optimized. Real transitions only happen in short periods of rapid change, which he names ‘a slow motion revolution’.

But what’s difficult in this, according to van Raak, is that these periods of rapid change can’t be predicted. And they can’t be planned either, because change in the aforementioned structure is resisted, since it’s rigid and multidimensional. Changing just one thing in the structure to encourage a transition just makes it flip back. This theory really encouraged me to look at different

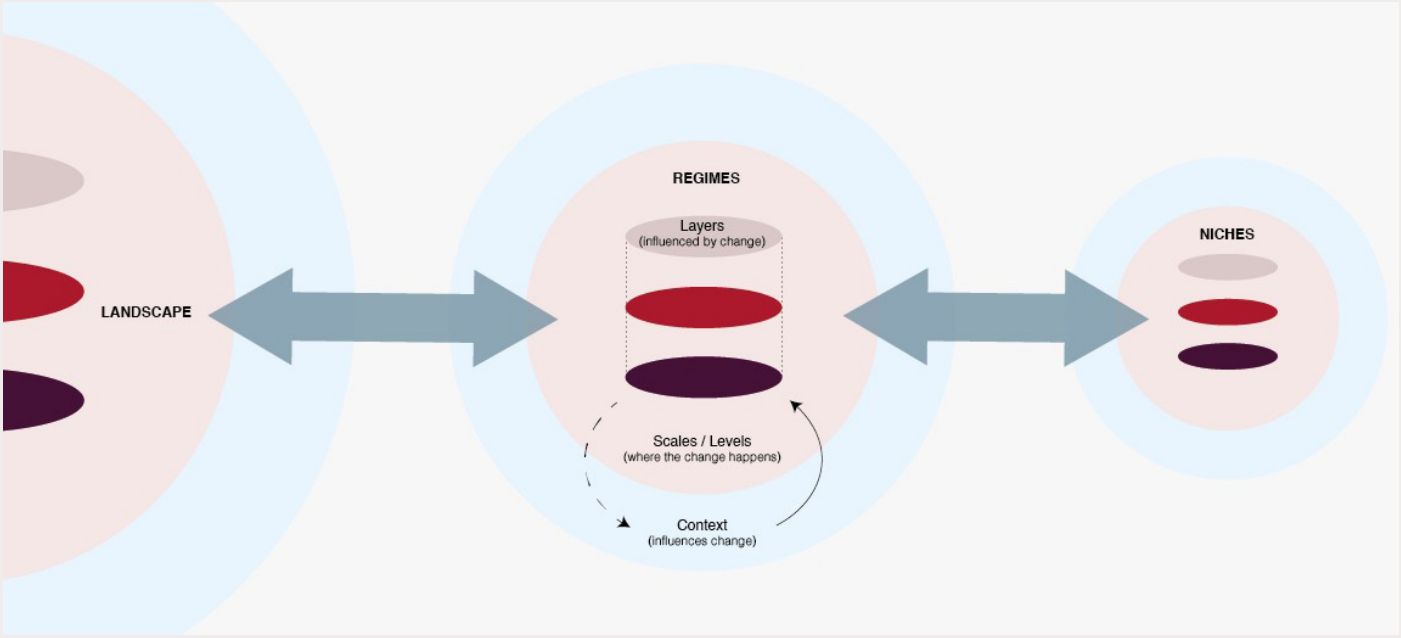


Figure 1 | Diagram of the theory of transitions (Authors, 2021)

aspects of society for the transition of our project, and make sure that all grounds were covered.

Connecting transition theories

Explaining another theory on transition management, van Raak (2021) mentioned that the fundamental structure at the base of society can really be seen as a regime of systems, which is hard to impact. However, if change occurs, he states, interplay happens between 3 levels: the landscape, the regimes and the niches. In Figure 1, these levels were interpreted as scales, because the three levels indicate some size difference between them.

I also found that van Raak's theory on transitions also connects to many of the other lectures, which I didn't expect at first. For example, the constant changes society goes through in his theory relates to the one from van Schaik (2021), who indirectly states how to respond to this problem in practice. Namely, he states that one of the four characteristics of system roles in regional design is a constant re-interpretation of the different aspects that change. Other characteristics he mentions are a 'dancing' through scales, de- and reconstructing of the regional scale through layers and connecting themes in a complex context. The constructed Figure 1 attempts to connect the two theories to indicate where change happens and where influence is impacted. According to van Raak (2021), interplay either comes from outside sources or inside innovation, which is symbolized here by the context outside and the layers inside the levels. The context influences change in the levels, which impacts the different layers inside it. Change in the layers also may in turn impact the context. The different levels also have an impact between each other.

By creating my own theory and diagram consisting of the different theories, the sometimes vague concepts regional design poses are made more explicit for myself. It made me understand that these kinds of projects can't be planned, but include many different factors and require a holistic view. The diagram, together with the different lectures, made me create a more holistic view for myself, by connecting information from all lectures to each other, and by seeing the project and the group as the guides and transition managers of a new set of strategies, guiding a transition from the different levels and layers towards a circular economy.

‘Design as a system’

Kefei Yan

Q3 helped us to consider urban issues and urban development from a more macroscopic and overall scale. There is no doubt that more elements and issues need to weigh than the urban design involved before. How to choose an appropriate entry point among the complicated issues and stakeholders and deepen it into a theme with research significance in limited time is the difficulty in this course and a very important skill I have learned. It also provides a new dimension for my gradually formed design methods and sense of value.

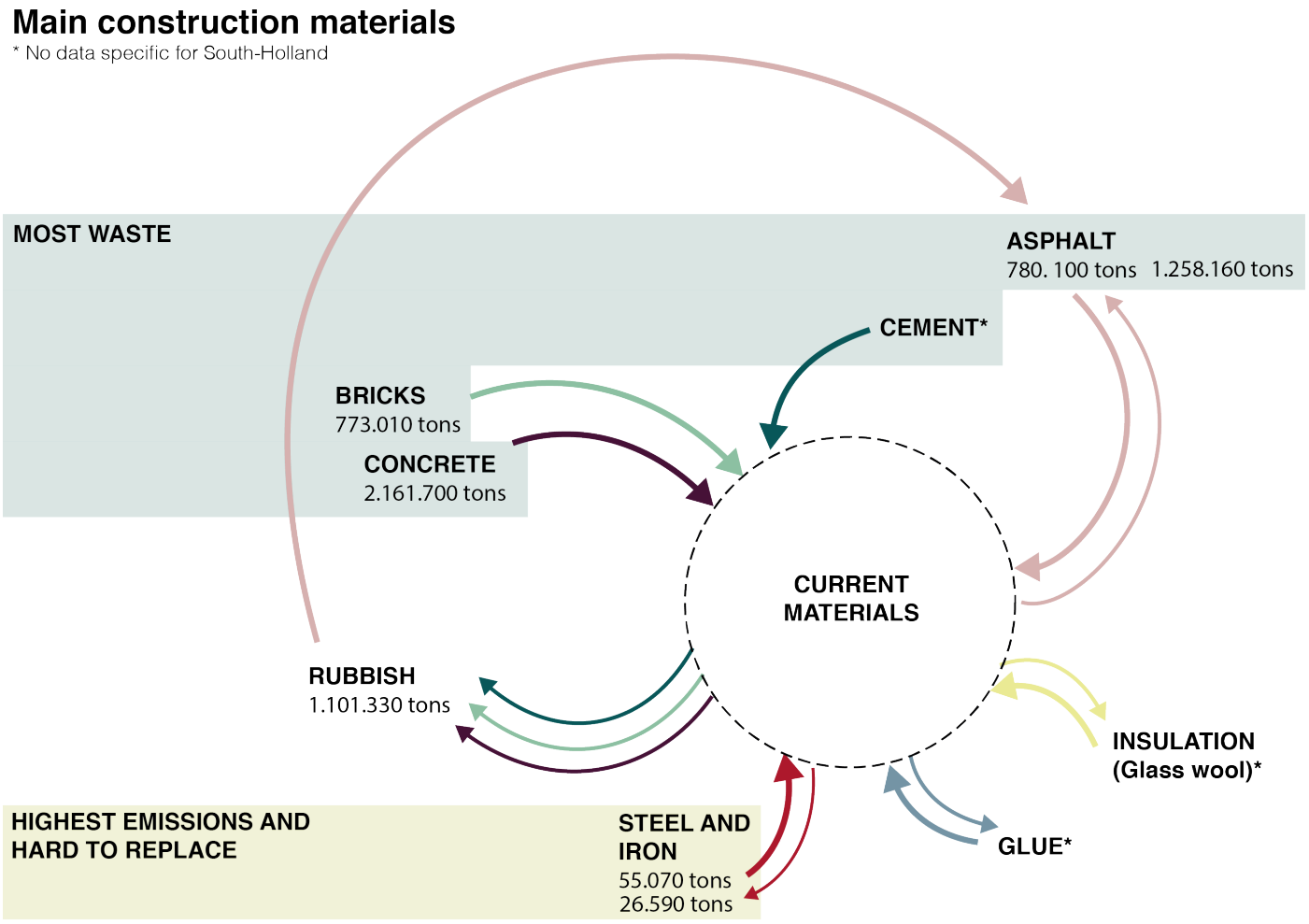
What did the courses bring to me?
The Capita Selecta Lectures and Spatial Development Strategies (SDS) provided a lot of insights and perspectives to view the region and the whole social system. It’s very interesting that in these lectures, researchers, designers and government officials have different views on similar issues based on their roles. Activity-based Spatial Material Flow Analyses (Wandl, 2021) helped us a lot to use different methods to explore and present the connections spatially between industries, providing supporting evidence for our LandBOUW. What Roberto Rocco presented in the Research and Design Methodology also pushed us to think about the motivation of sustainable development, critical thinking about current development and social justice, and how to promote the implementation of a planning. What's more meaningful is that these courses are also training how we build our own methodology in line with our ideology.

What do we focus on?
Starting from the existing shortage of resources and excessive waste, we recommend forming a more comprehensive closed loop as much as possible in the future with more attached value and less waste. The development of high technology provides the platform and opportunities for the possibility of transition and combination. The transition from residual waste to resources, the cohesion of these two sectors or even more sectors and the collaboration of different stakeholders are our main focus.

What approaches do we apply to the main focus?
The direction we chose firstly was the combination of the agri-food sector and construction sector, which reminded me of TENACITY (PinkCloud. dk, 2012) to think about how to create one type of universal intervention as a pilot to develop another way of urbanization. LandBOUW is such a universal system, not only about a transition in construction, but also about a life circle from policy to implementation to engagement. Amsterdam Circulair (FABRICations, 2015) also gave us more insights to develop the local detailed interventions.

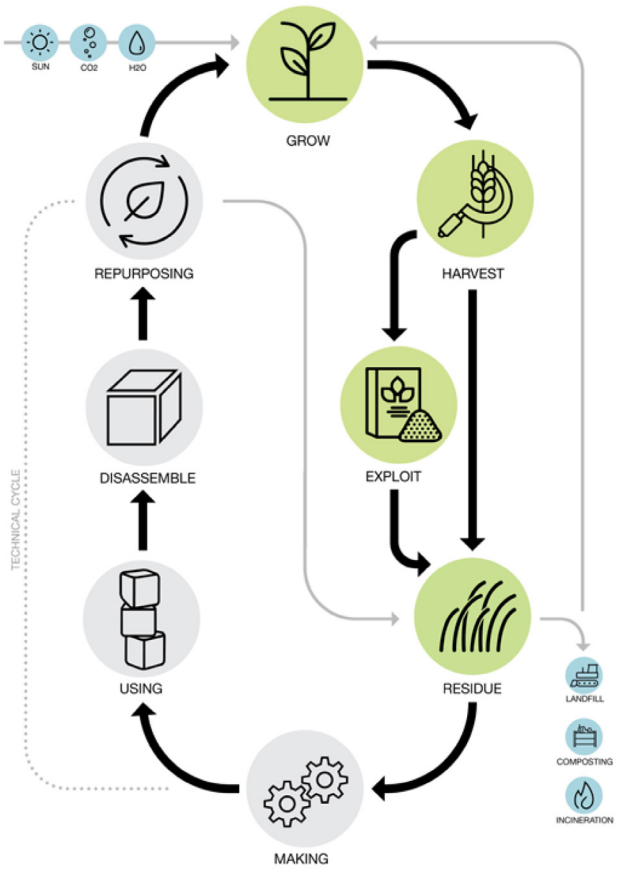
Design a system and design as a system
I find that the whole design of regional scale is more like a mechanism or a system, it can be adjusted according to some variables in the process. LandBOUW is not perfect now but it may be more and more suitable after rounds of assessment. What impressed me a lot in the whole Q3 is that we need to work as an elaborated system that different parts can be connected and coordinated for a better run. Our team is just like a group of designers, citizens, big players, and the tutors are more like the third party. We all design a system as a system to manage to help South Holland embrace a brighter future!

1 Construction analysis

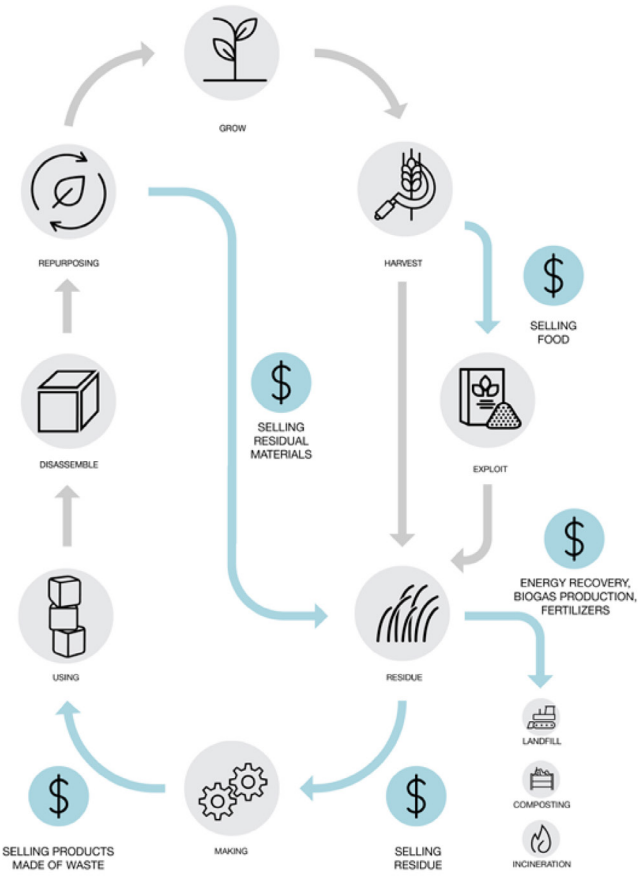


Construction materials

2. Urban bioloop system



Traditional mode
(ARUP,2017, P.17 & P.49)



Alternative mode
(ARUP,2017, P.17 & P.49)

3. New construction materials

Bagasse fiberboard
Bagasse fiberboard is made of a residual product during sugar cane production. (van Dam & van den Oever, 2012) More than 1.2 billion tons of sugar cane is harvested worldwide every year, releasing 0.4 billion tons of bagasse. These fiberboard products are limited available on the Dutch market.

Rice husks
Rice husks are the by-product of rice that remains when preparing the organic rice for human consumption. The rice husk can be used to create insulation material (van Dam & van den Oever, 2012). It is not flammable and is resistant to mold. It also has a moisture-regulating effect, good wall insulation and has a positive effect on the indoor climate.

Seagrass
Seagrass is a common seaweed in the North Sea and the Baltic Sea coast. Seagrass has been used in the past as an insulation material and can be found in historical buildings. It can be used as facade insulation and cavity insulation material. It provides non flammable material. (van Dam & van den Oever, 2012)

Sunflower boards
These boards are made by the repurposing of waste from sunflower harvesting. They can be used for internal use, floors, ceilings and walls (ARUP, 2017) The material has high strength and has low costs.

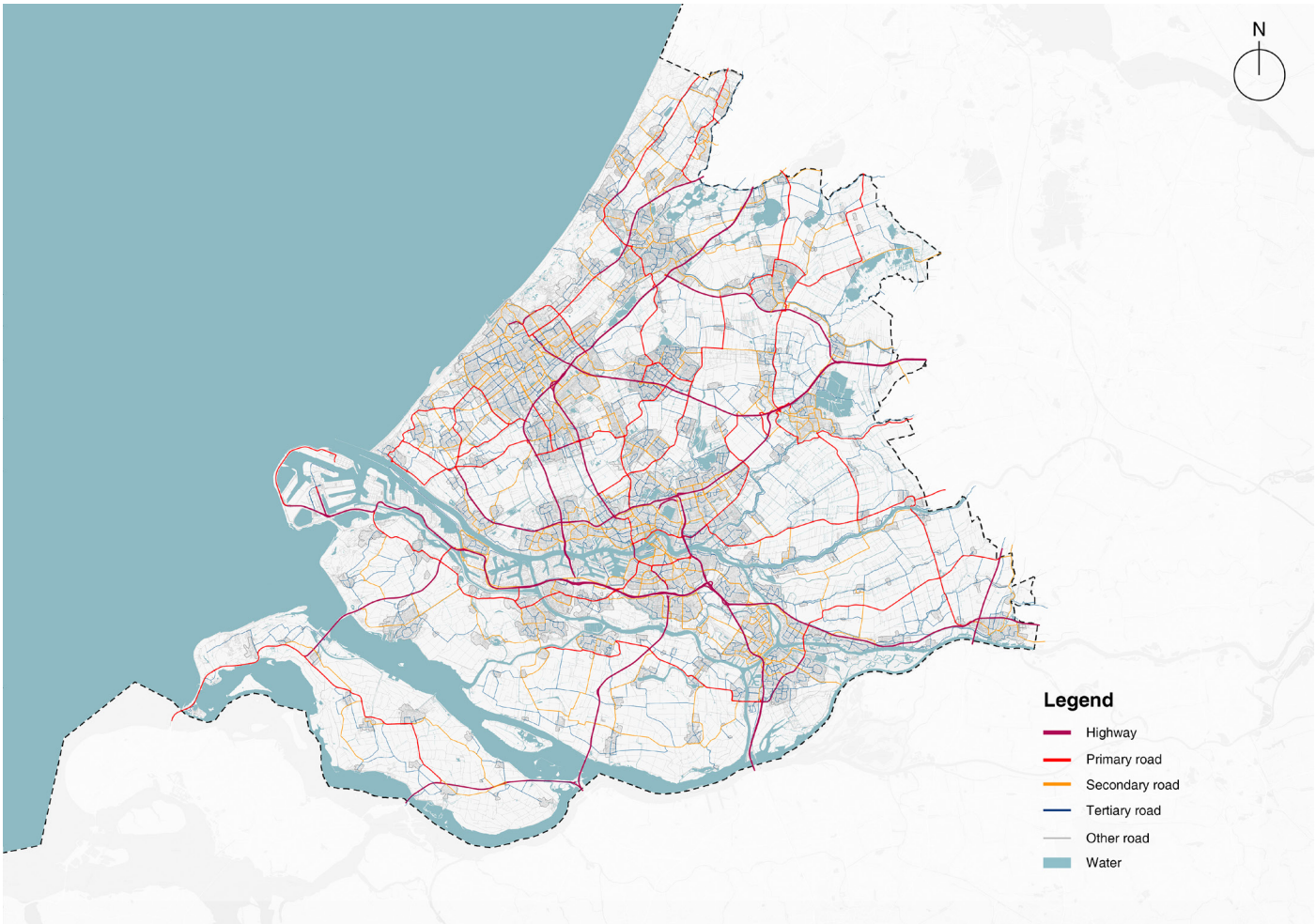
Peanut shell boards
Peanut shells can be repurposed by turning them into particle boards by a hot press procedure and the use of a formaldehyde-free adhesive. These boards are resistant to moisture and flame retardant. They can be used for floors, ceilings, walls and furniture. Peanuts typically only grow in tropical areas but the peanuts used for consumption in the region, can be processed in South Holland (ARUP, 2017)

4. Infrastructure analysis
4.1 Roadways

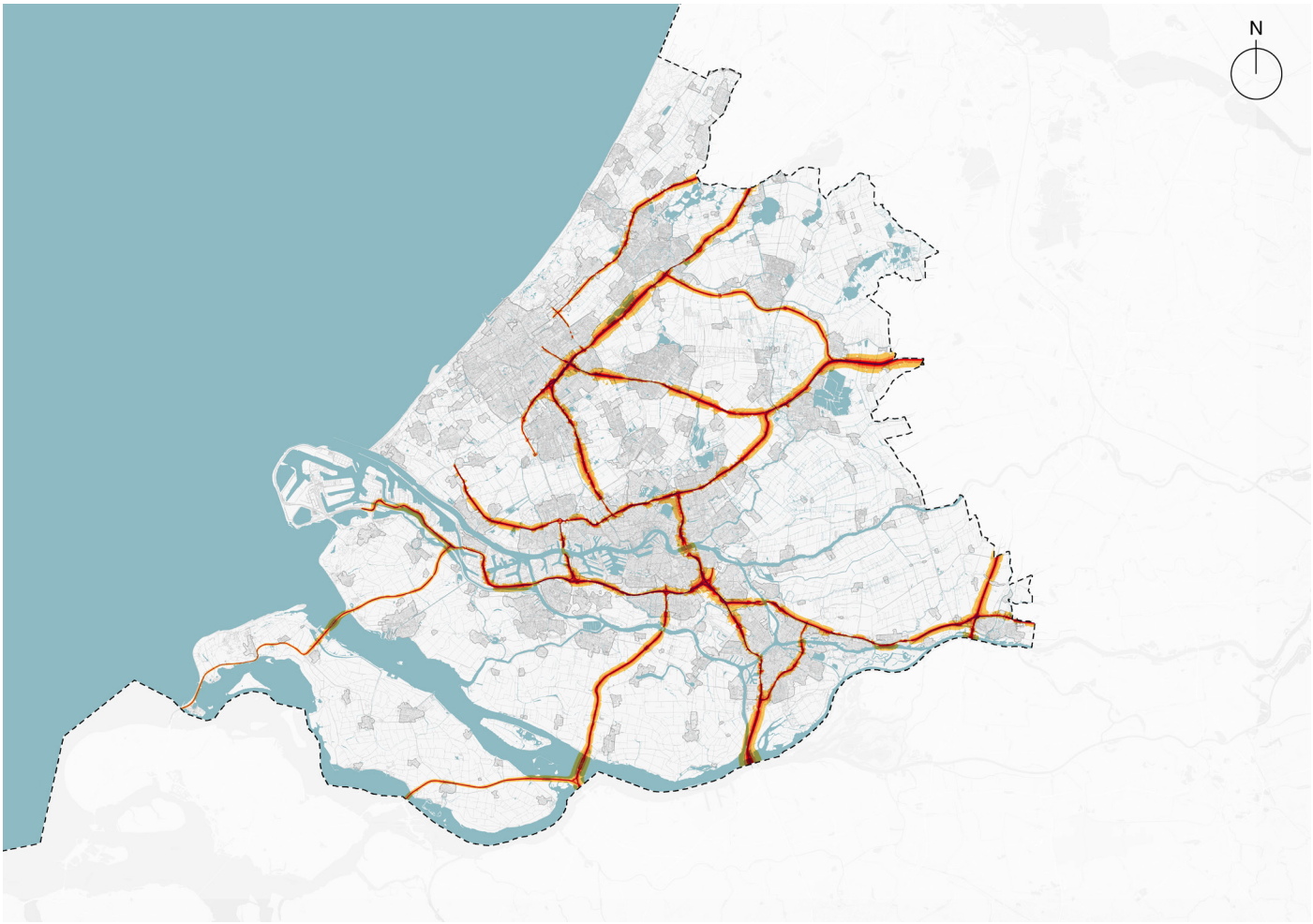
Authors, LISA 2018 ,OSM, 2021 and CBS 2015

Number	Location	Class / Capacity	Node	Environmental influence
1	Bodegraven to Leiden	Highway	————	Low
2	Leiden	Primary road	Leiden	Low
3	Leiden to Wassenaar	Highway	Leiden	Low
4	Wassenaar to Den Haag	Primary road	Den Haag	Low
5	Den Haag	Secondary road	Den Haag	Low
6	Den Haag to Westland	Level up-Primary road	Den Haag	Low
7	Maassluis	Highway	————	Low
8	Maassluis to Rozenburg	New-Highway	————	Middle
9	Rozenburg to Ridderkerk	Highway	Rotterdam	Low
10	Ridderkerk to Krimpen aan den IJssel	New-Highway	Rotterdam	Middle
11	Krimpen aan den Ijssel to Gouda	Level up-Primary road	————	Middle
12	Gouda	Primary road	Gouda	Low
13	Den Haag to Bodegraven	Highway	Den Haag / Gouda	Low
14	Maassluis to Gouda	Highway	Rotterdam / Gouda	Low
15	Leiden to Pernis	Highway	Leiden	Low
16	Rotterdam	Highway	Rotterdam	Low

Accessment

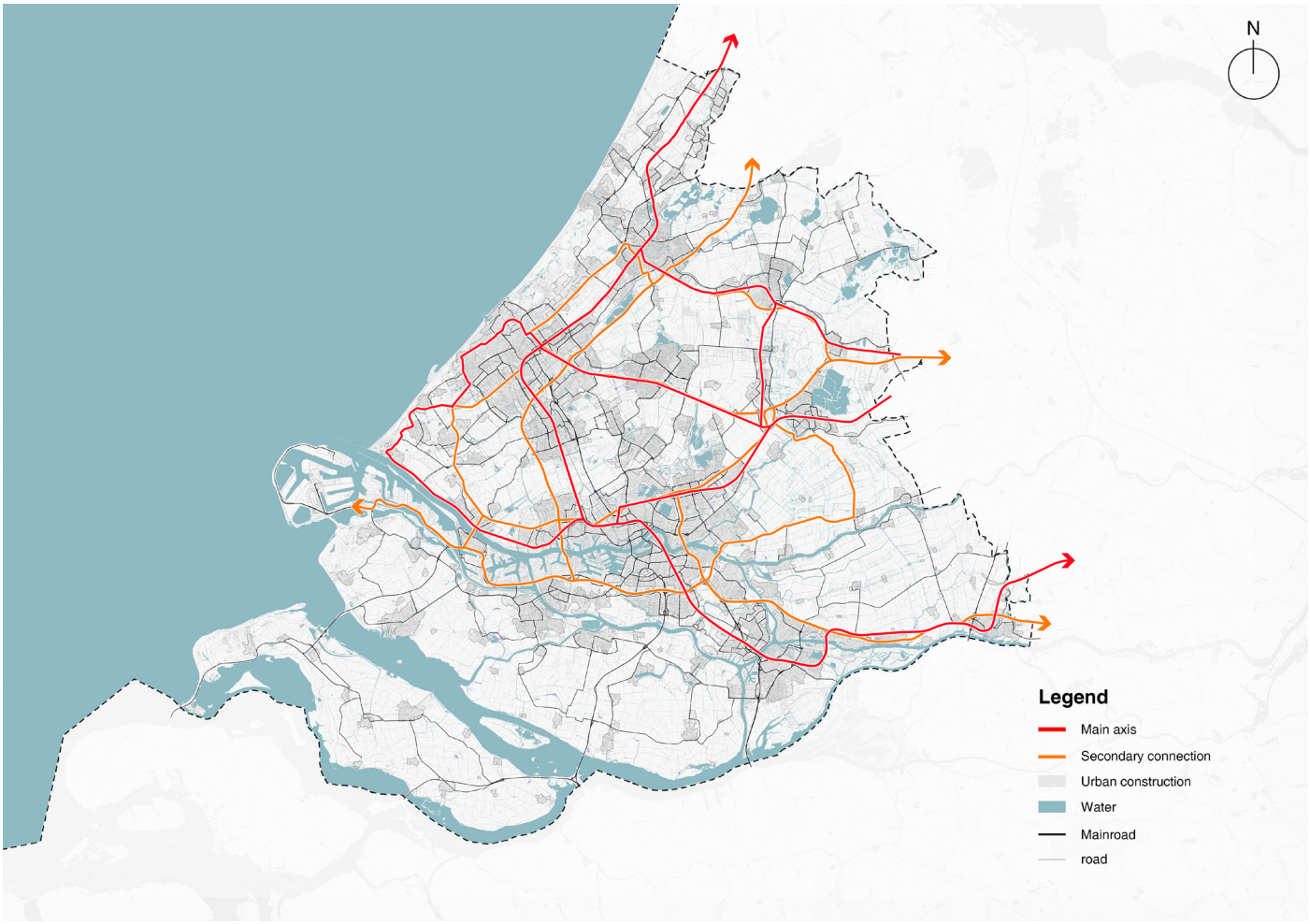


Class roads

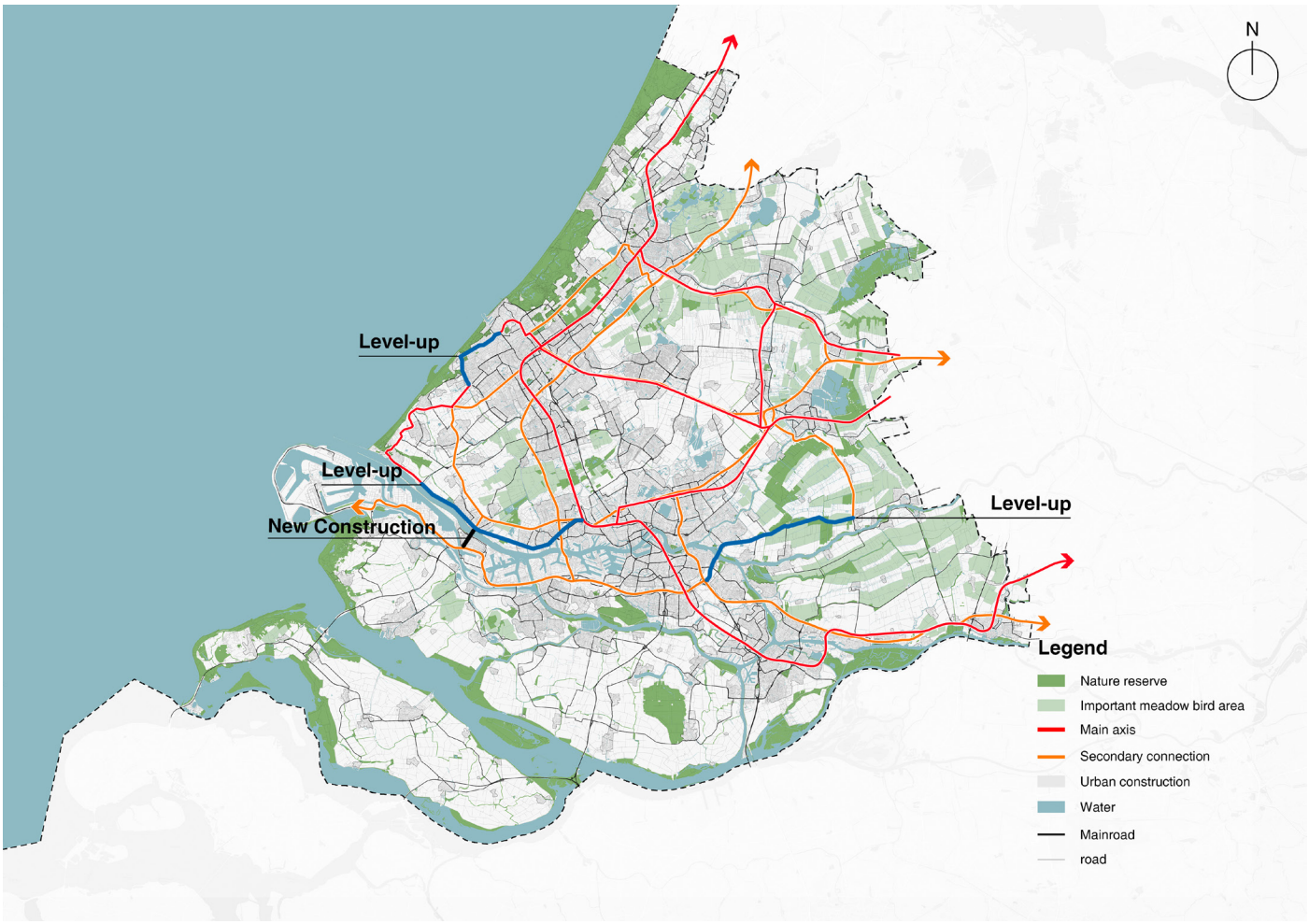


Noise

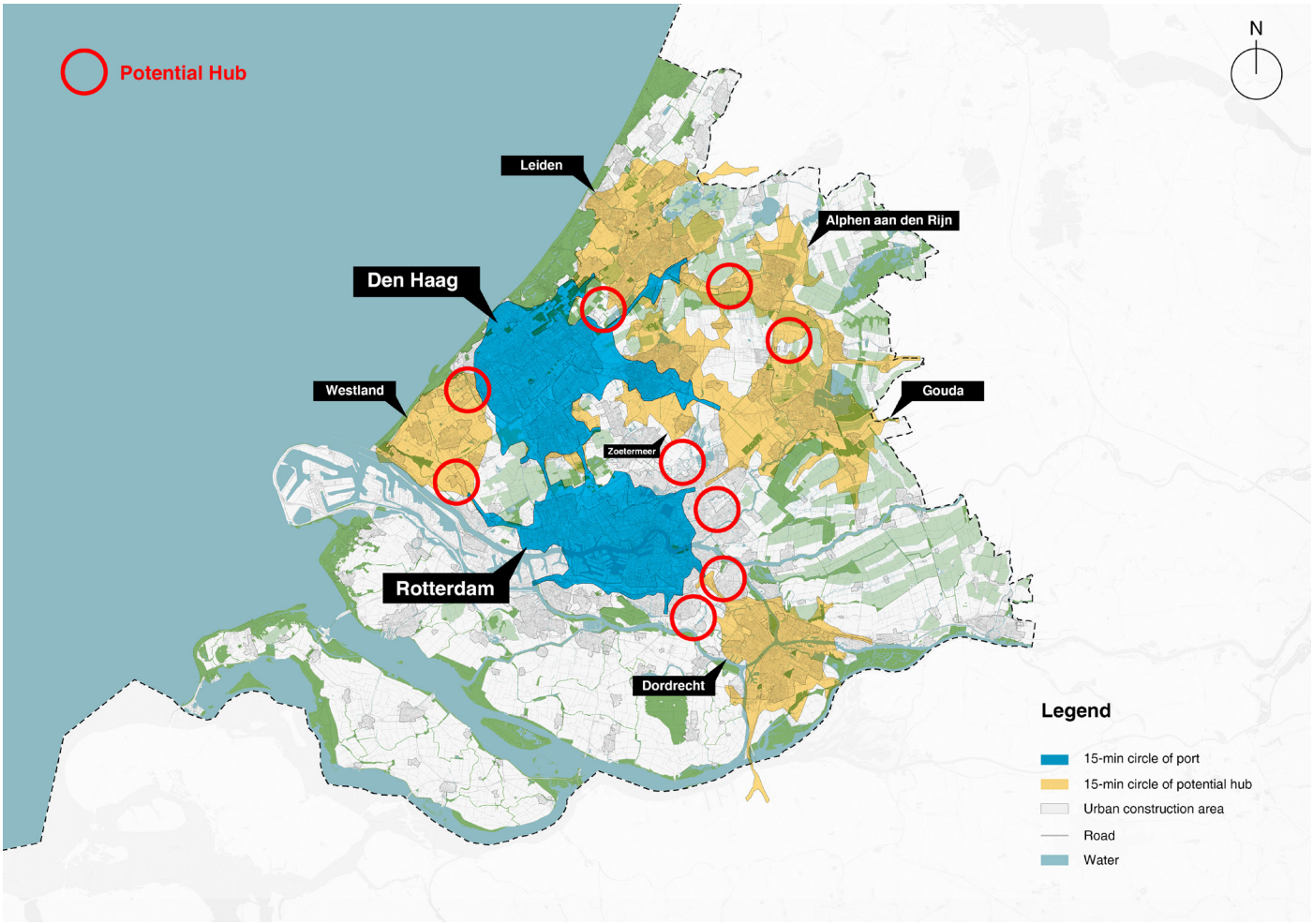
Road cluster



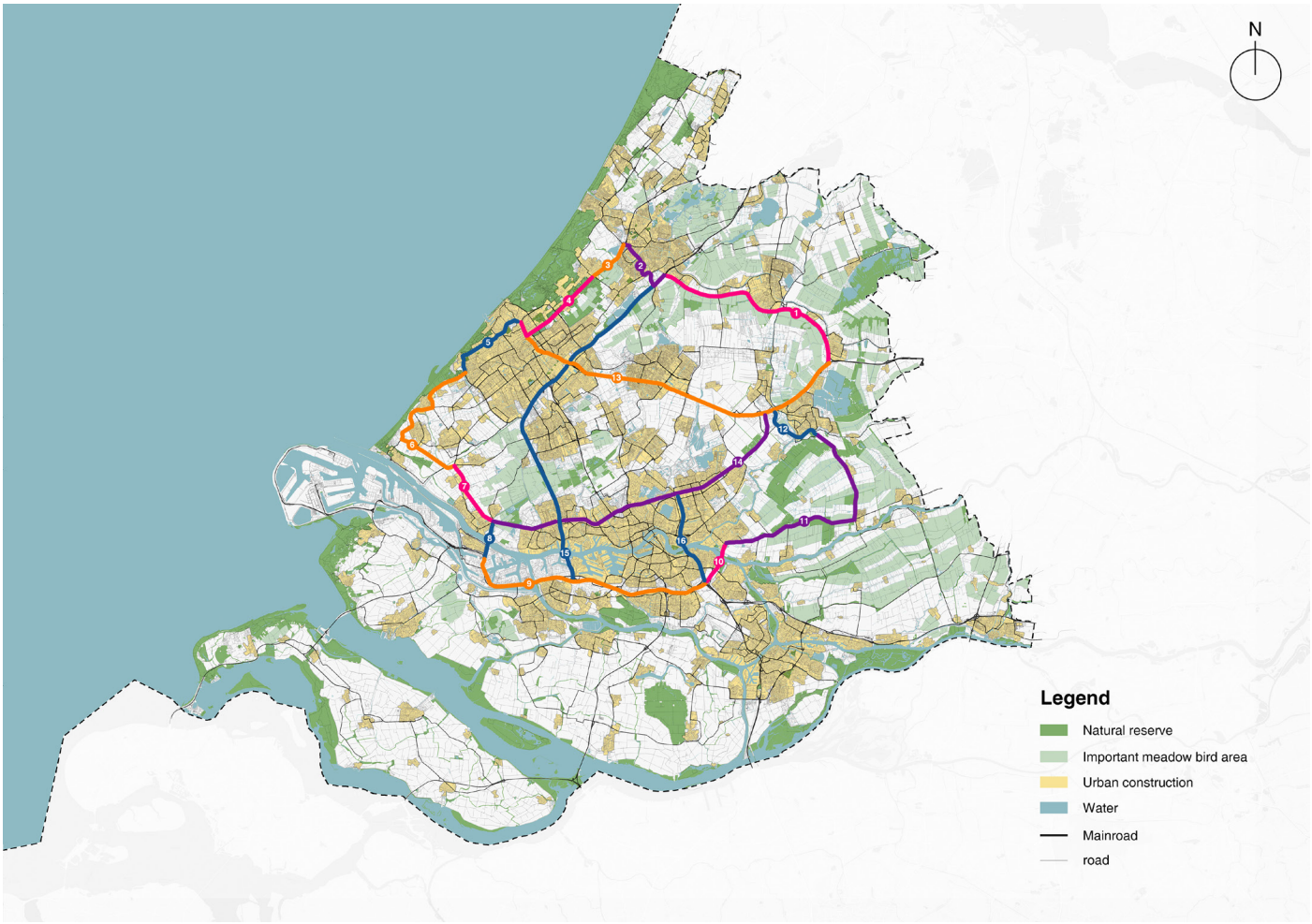
New axis



Natural areas



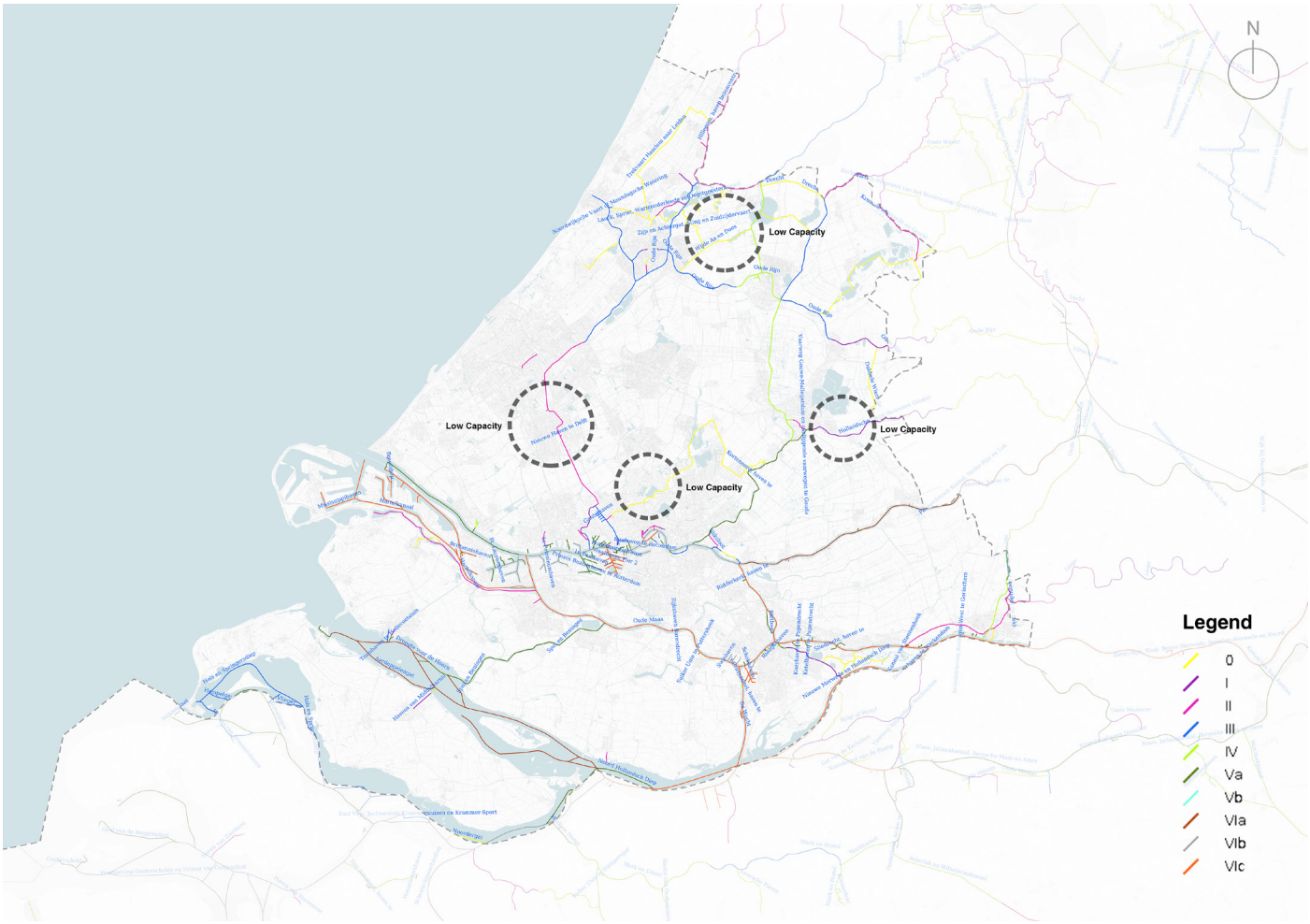
15 min car city



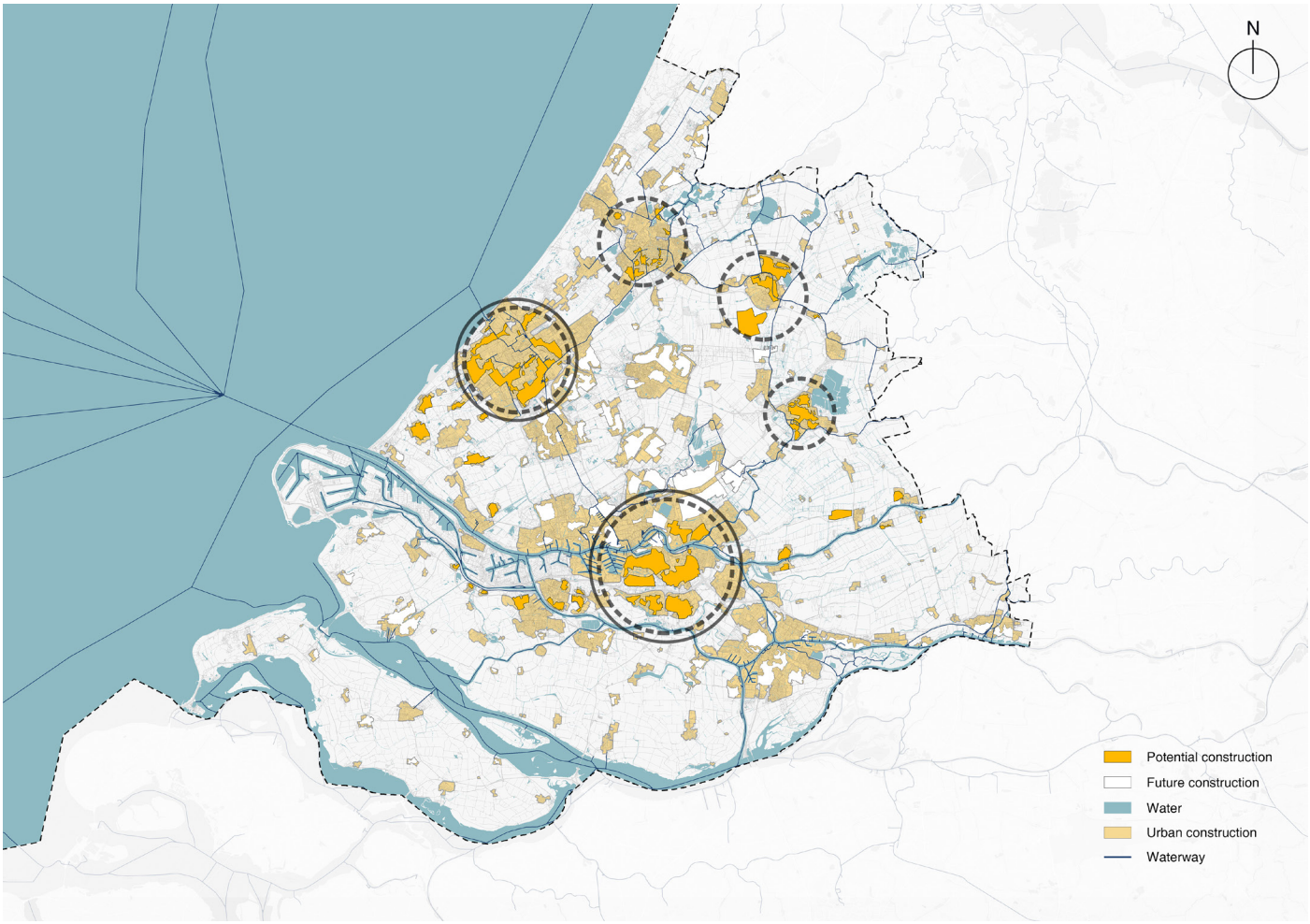
Accessment

4.2 Waterways

Authors, LISA 2018 ,OSM, 2021 and CBS 2015



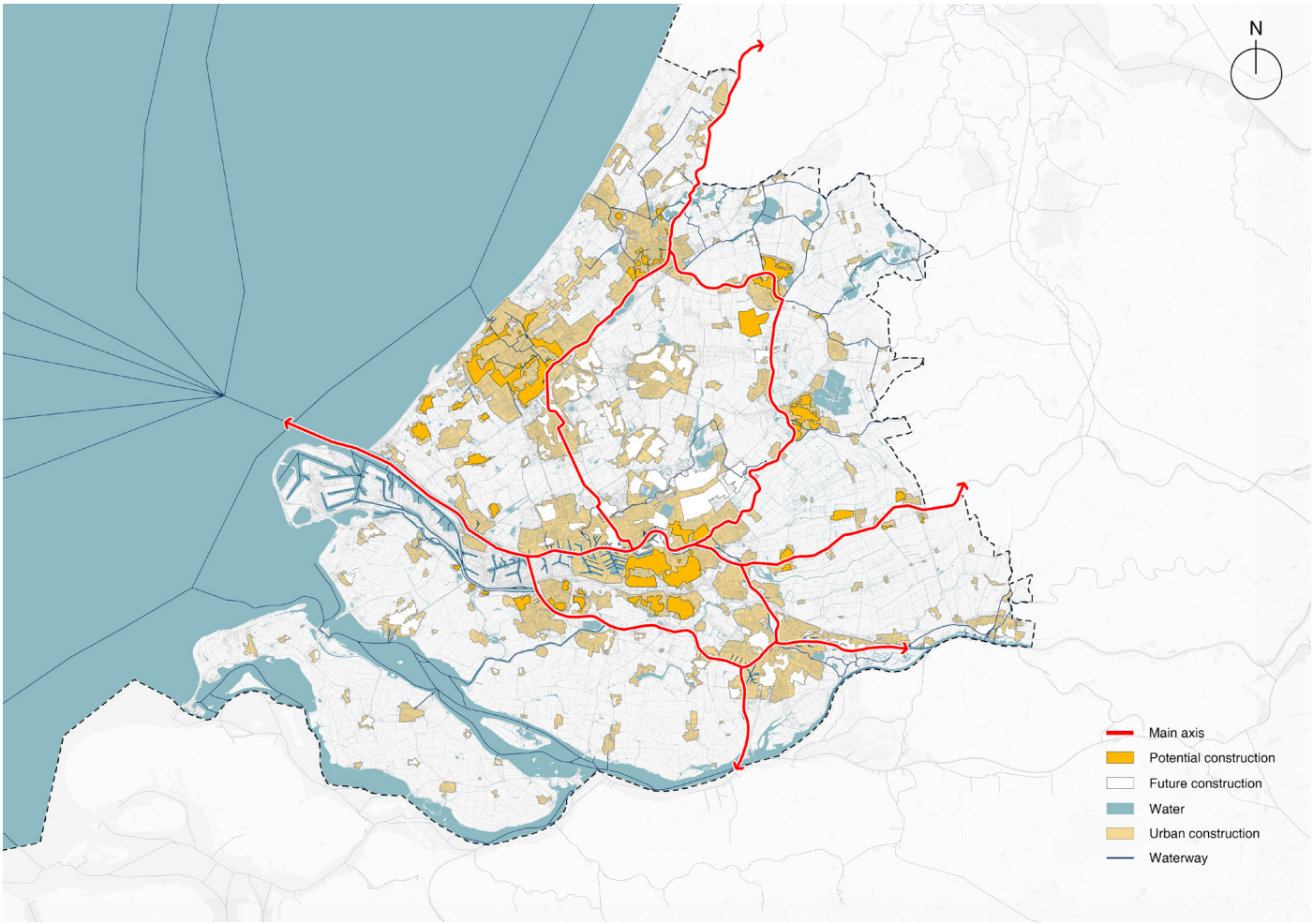
Capacity



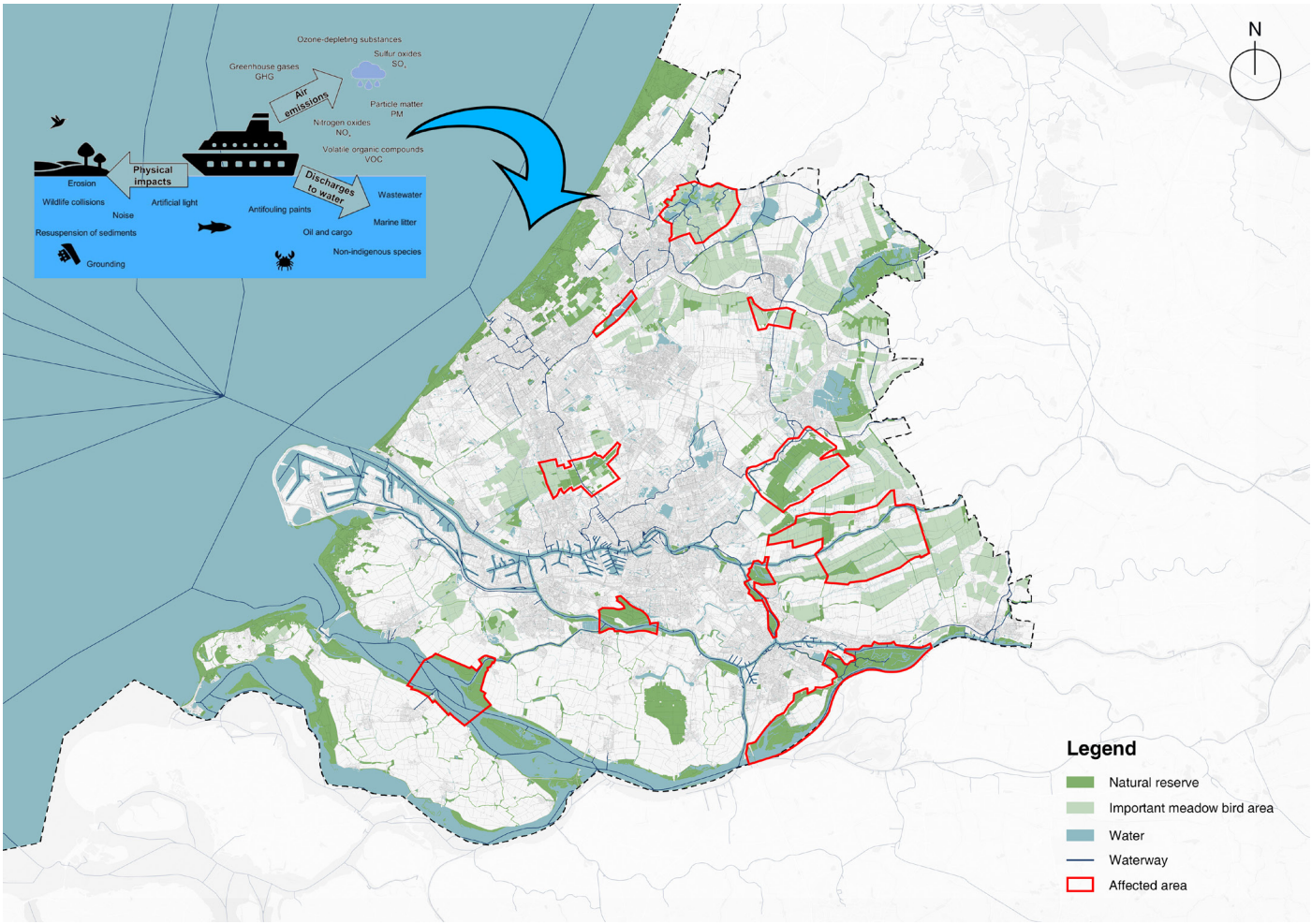
New network

Number	Location	Class / Capacity	Accessibility	Node	Environmental influence
1	Nieuwe Waterweg	Va	———	Maasvlakte Rotterdam	———
2	Nieuwe Maas (Rotterdam)	VIb	———	Rotterdam	———
3	Oude Maas (Dordrecht)	VIc	———	Dordrecht	√
4	Lek	VIa	———	———	———
5	Kortenoord, haven te	Va	———	———	√
6	Stroomkanaal	IV	———	Gonda	√
7	Oude Rijin (Alphen aan den Rijn)	IV	———	———	———
8	Vilet	III	———	———	√
9	Nieuwe Haven te Delft	II	———	Den Haag	√
10	Hollandsche Ijssel (beoosten Gonda)	I	———	———	———
11	Rijin (Nieuwkoop)	0	———	———	———
12	Aarkanaal	III	———	———	———
13	Rijn-Schiekanaal	III	———	Warmond	√
14	Rijin (Leiden)	III	———	———	———

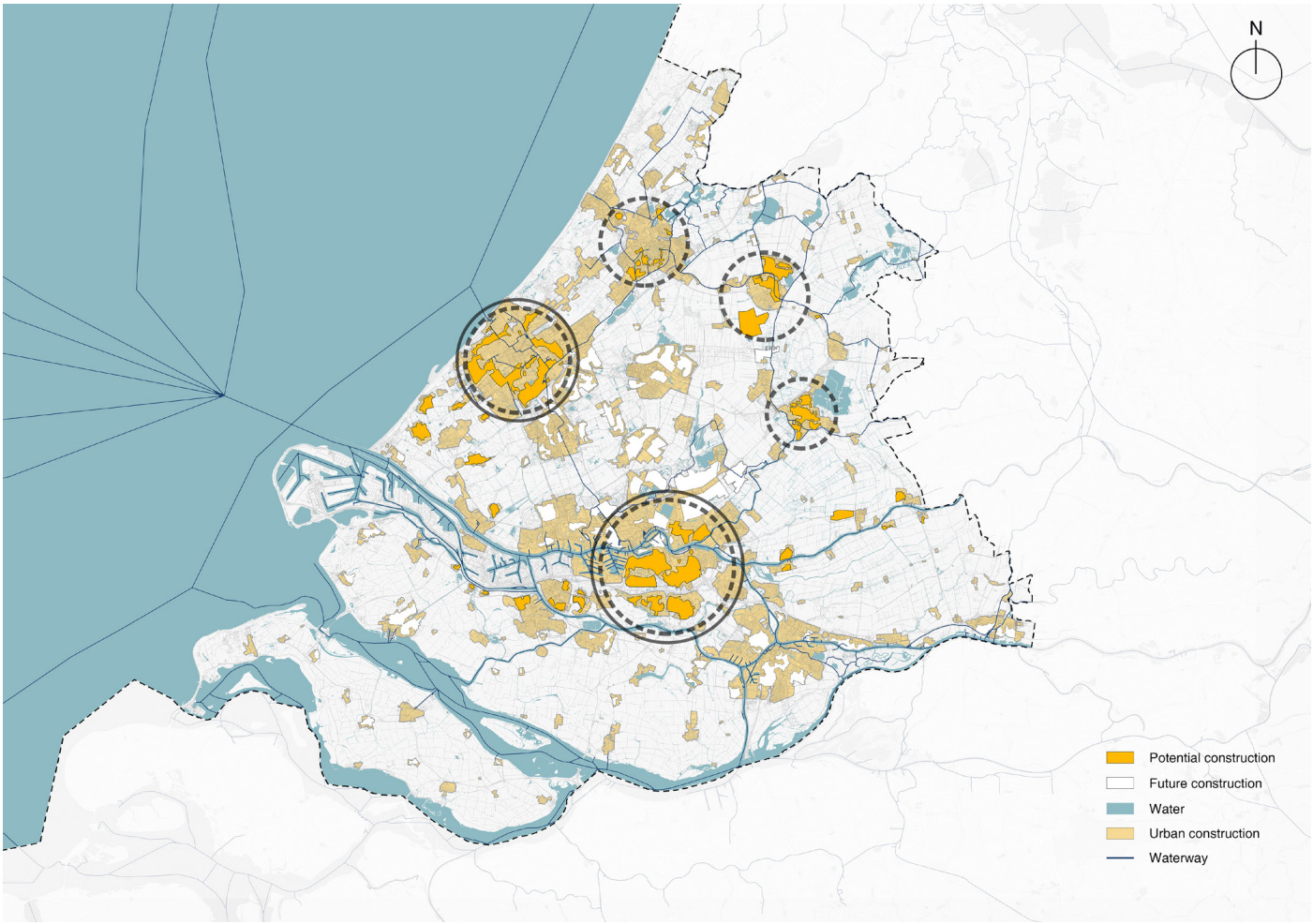
Accessment



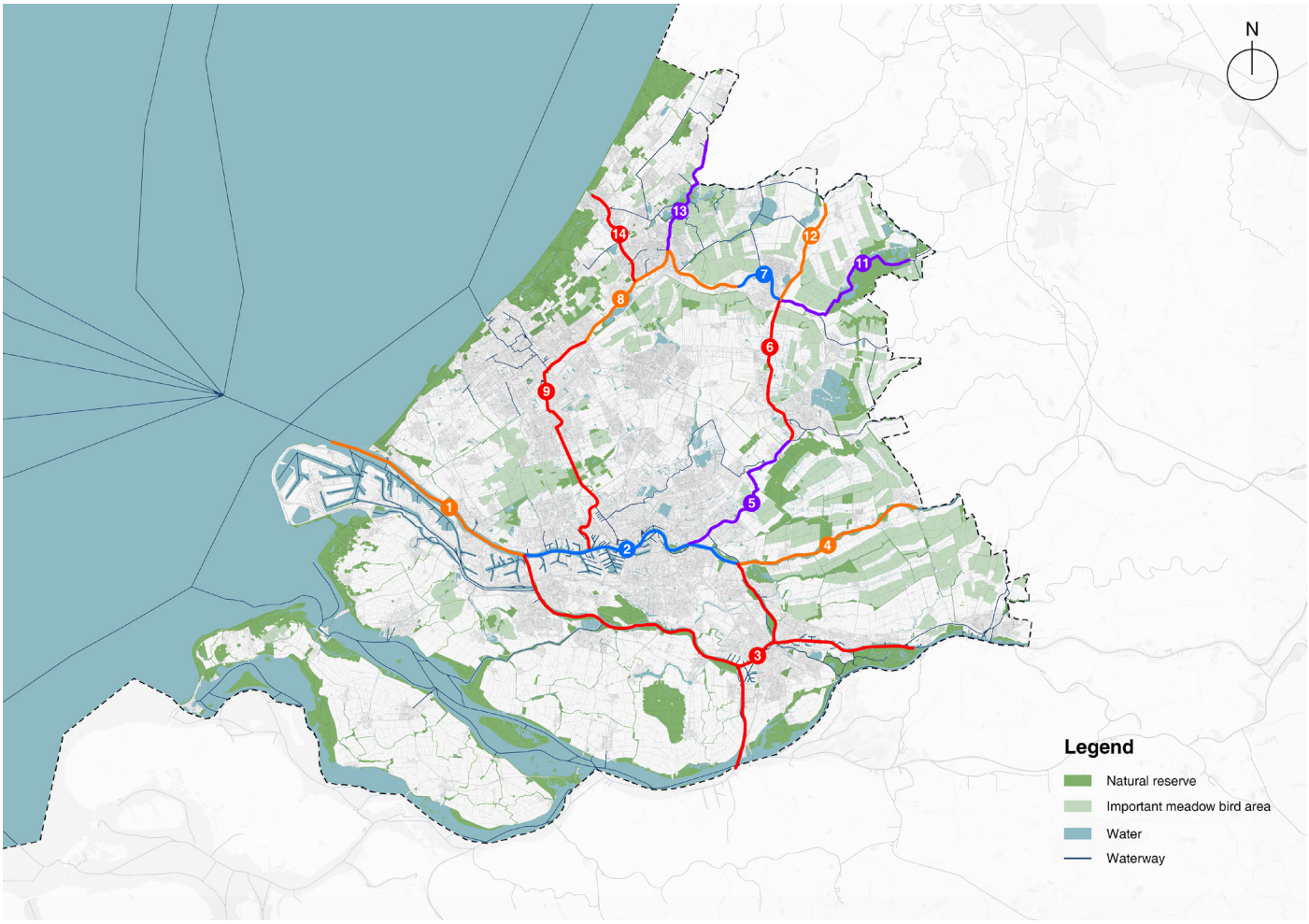
Water axis



Natural zones



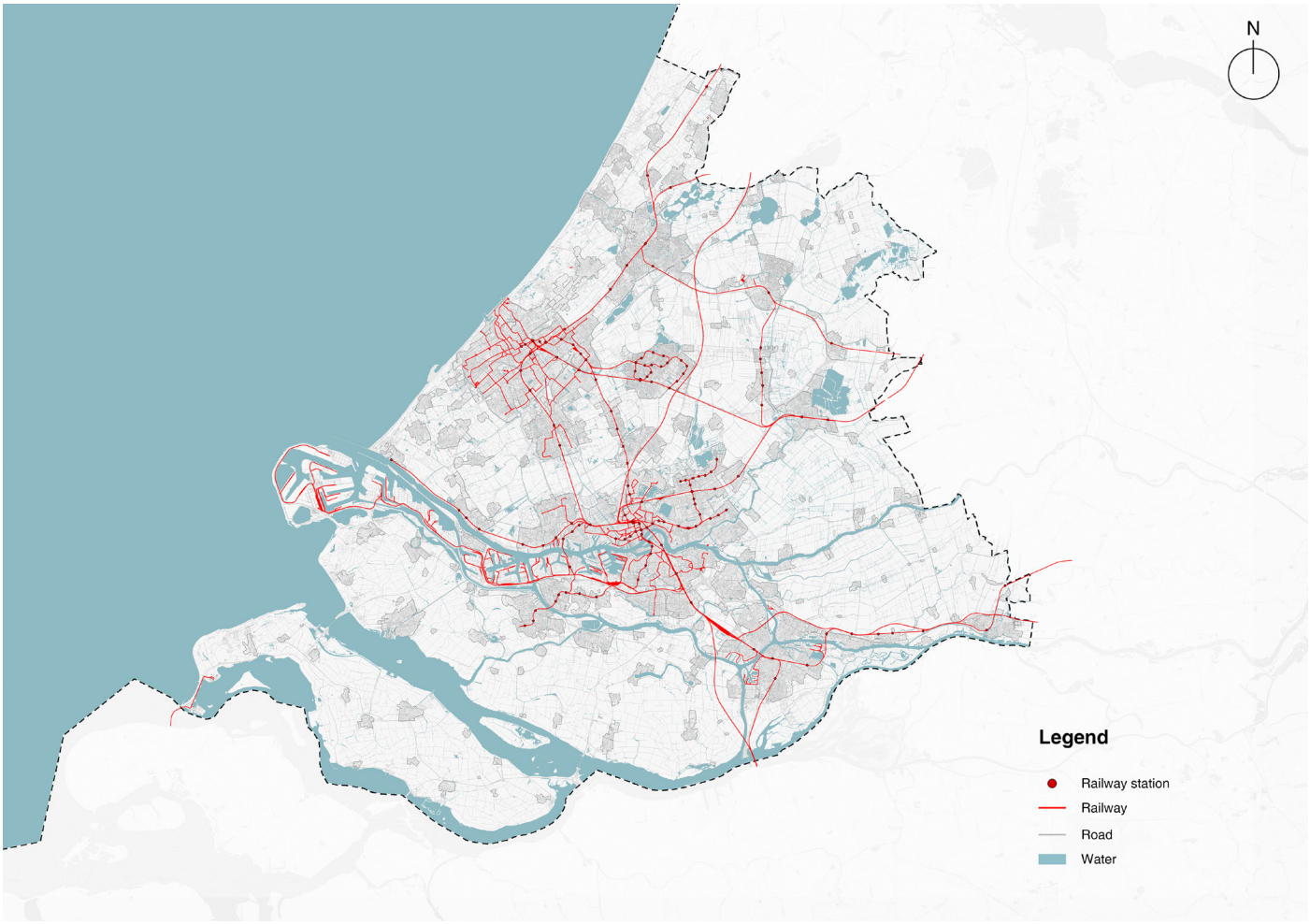
Network new water



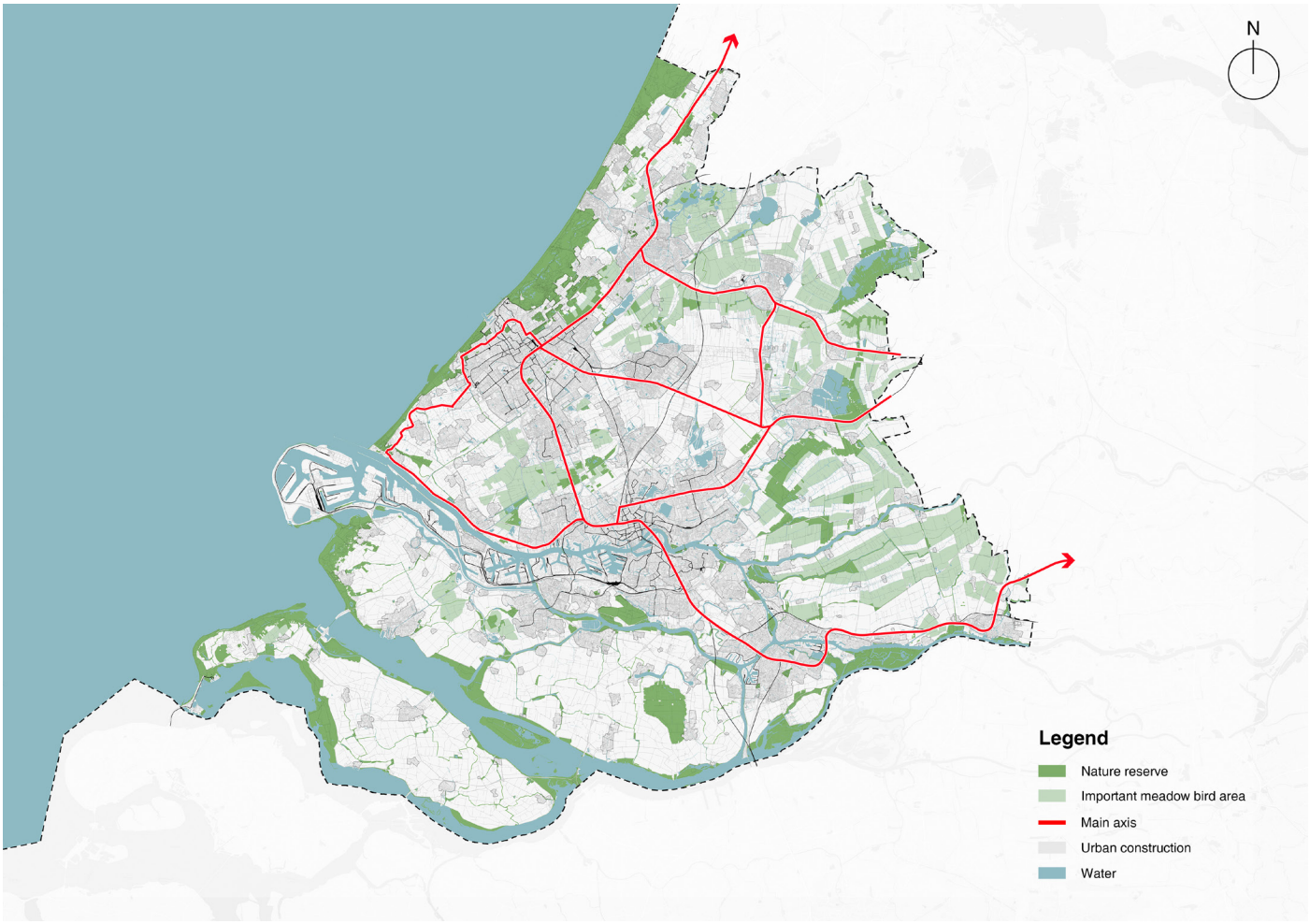
Accessment

4.3 Railways

Authors, LISA 2018 ,OSM, 2021 and CBS 2015



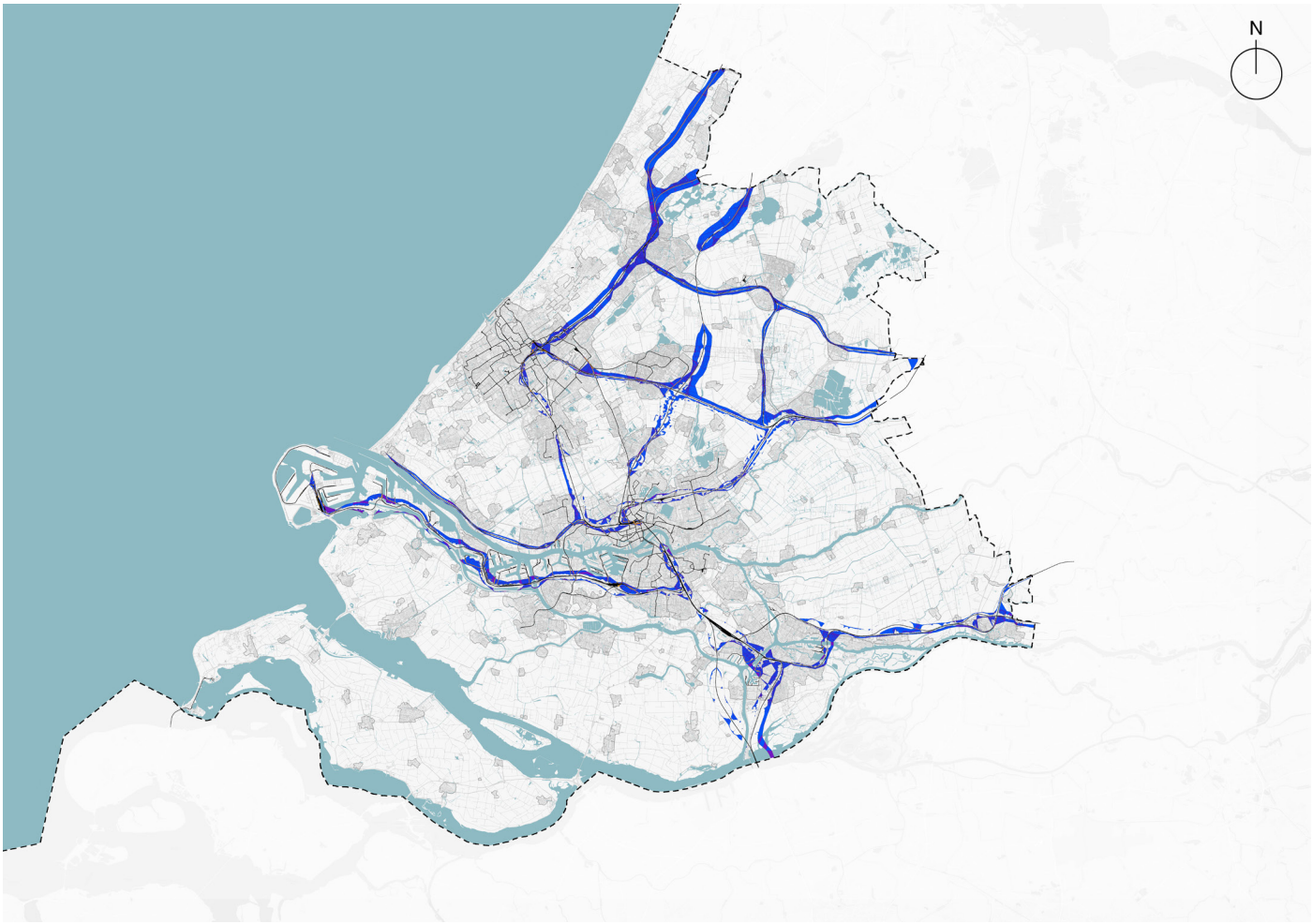
Railway network



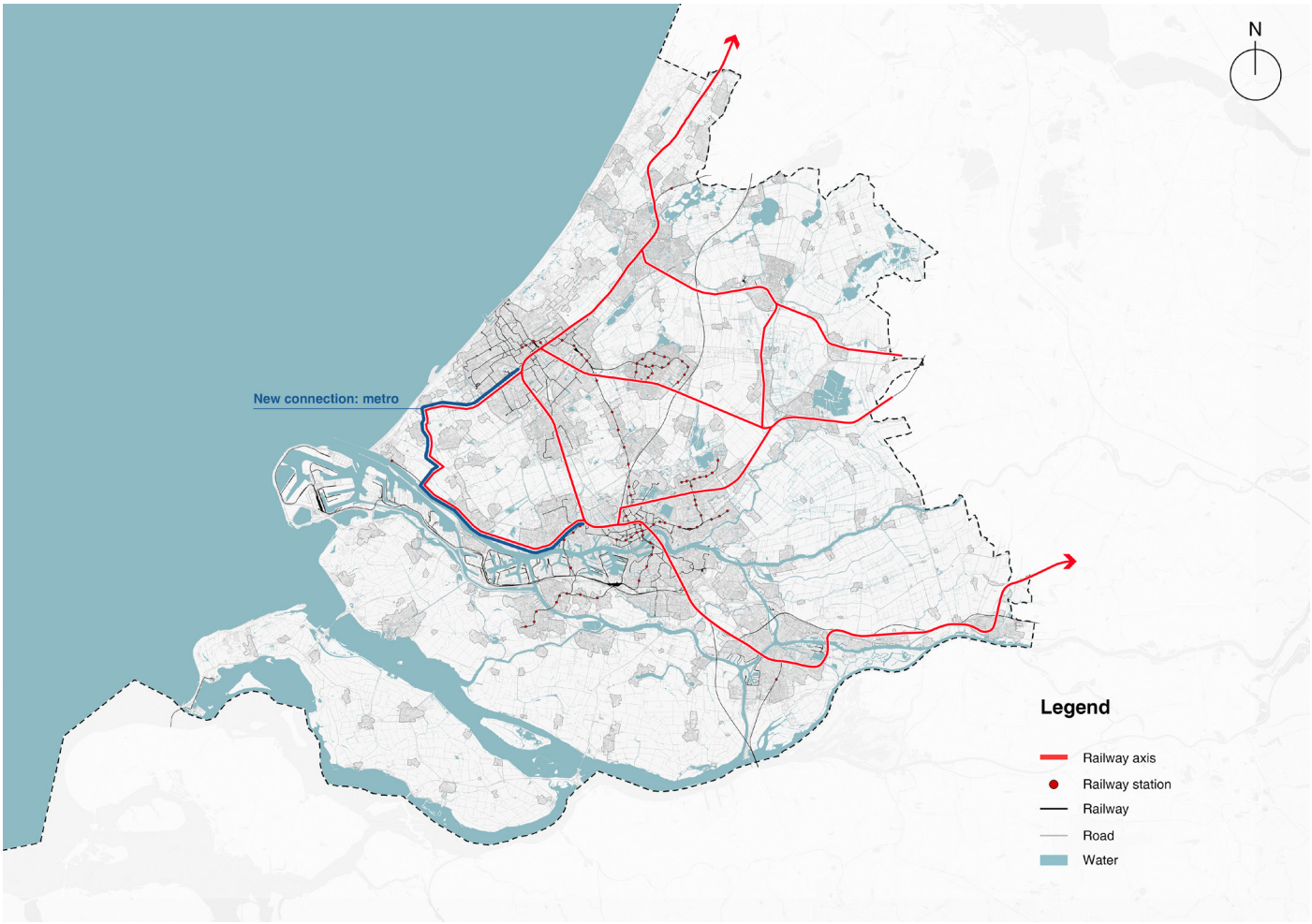
Natural zones

Number	Location	Class / Capacity	Node	Environmental influence
1	Leiden-Den Haag	Rail	Den Haag	Low
2	Den Haag-Rotterdam	Rail	Den Haag / Rotterdam	Low
3	Den Haag-Westland	New-Metro	Den Haag	Middle
4	Westland-Rotterdam	Metro	Rotterdam	Low
5	Rotterdam-Dordrecht	Rail	Rotterdam	Low
6	Rotterdam-Gouda	Rail	Rotterdam	Low
7	Gouda-Utrecht	Rail	————	Low
8	Den Haag-Gouda	Rail	Zoetermeer	Low
9	Alphen aan den Rijn-Leiden	Rail	————	Low
10	Gouda-Alphen aan den Rijn	Rail	————	Low
11	Alphen aan den Rijn-Utrecht	Rail	————	Low

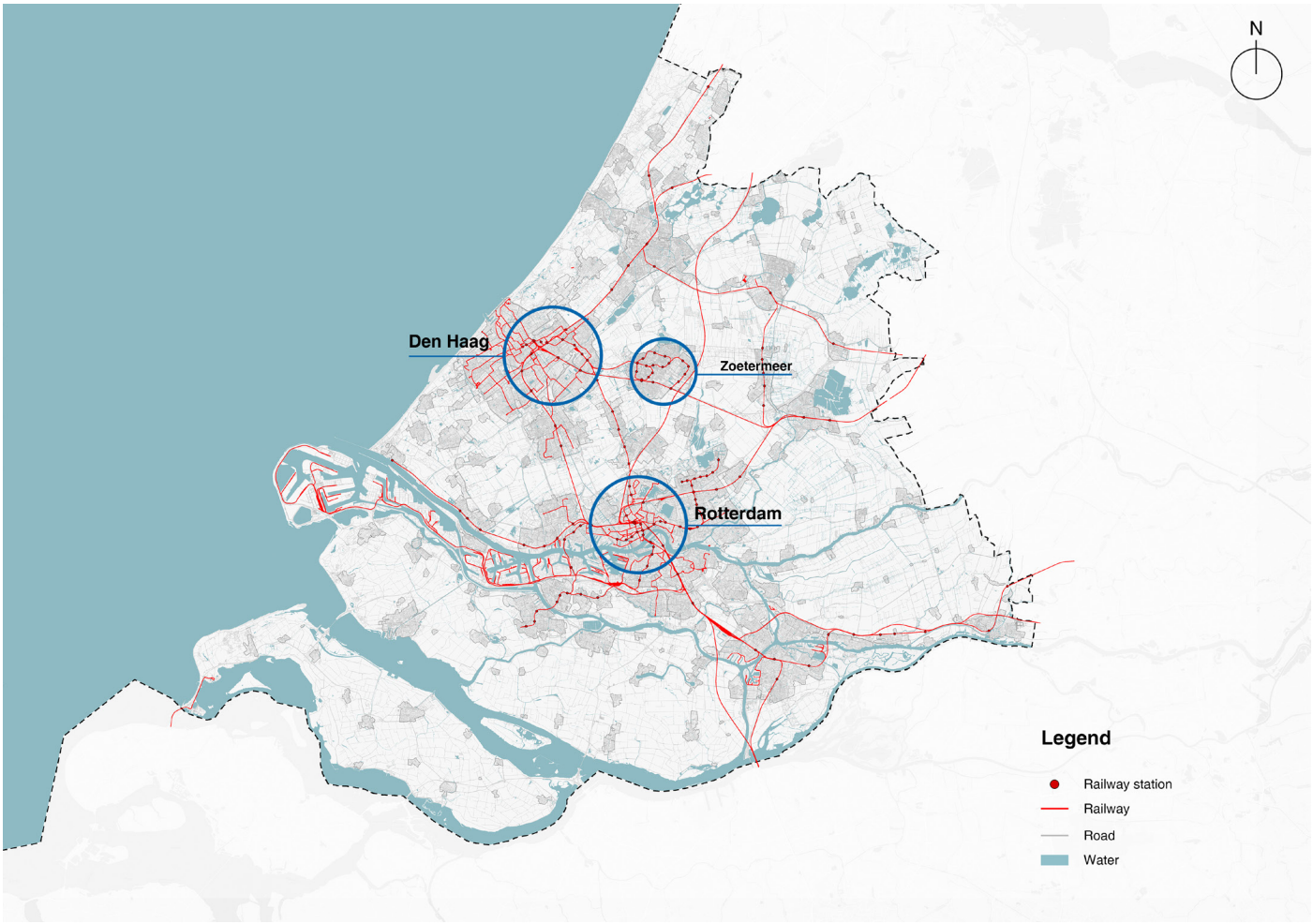
Accessment



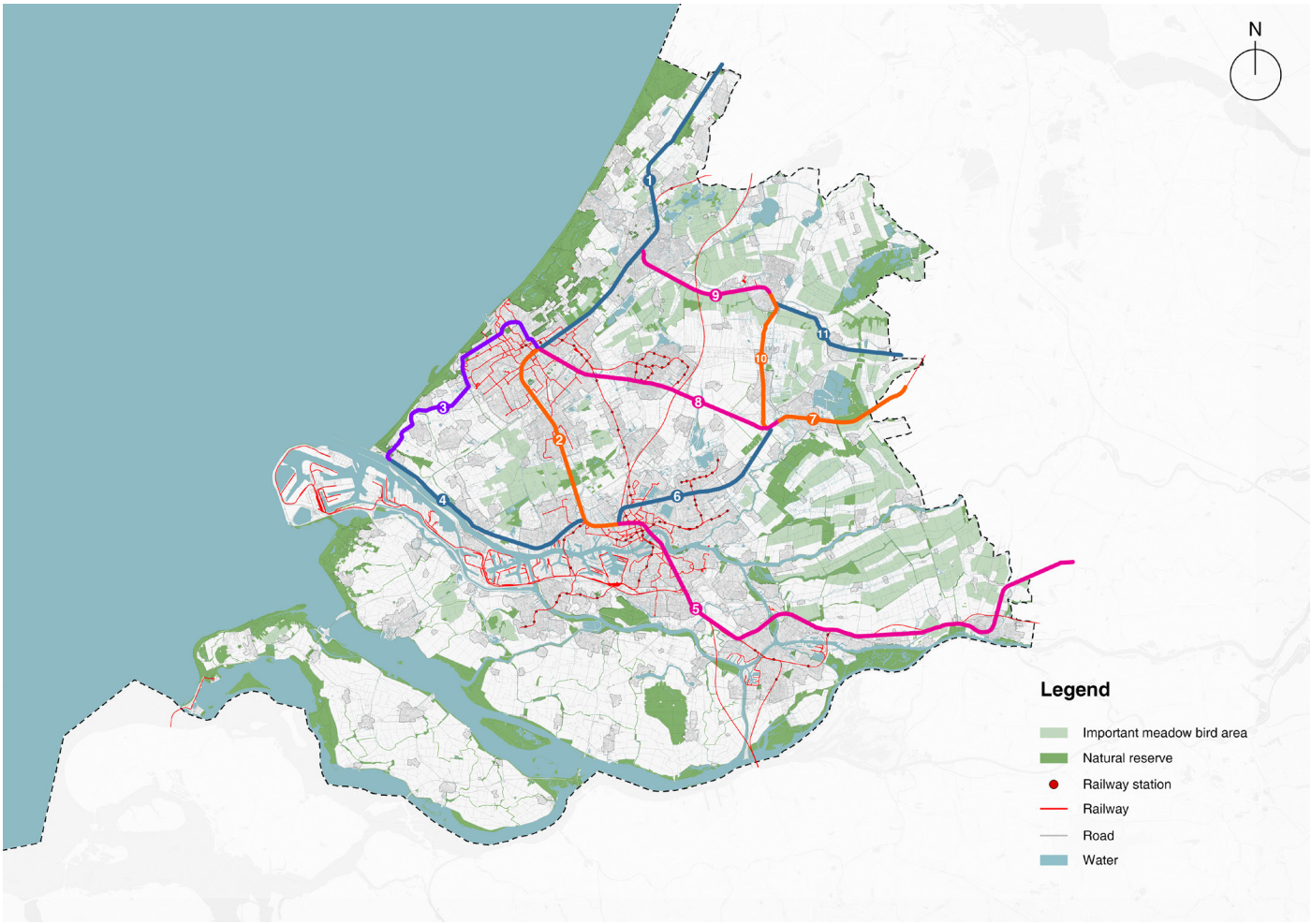
Noise



Railway axis



Nodes



Accessment

5. Stakeholder analysis

Agri-food sector: Critical actor groups

Critical actor:	primary production companies agri-food	processing companies agri-food	supermarket/ market	organic waste collecton companies	agri-food oriented education
interests:	money	money	money, giving the best product for the buyer	money	spreading knowledge, money, innovating
resources:	the biggest material loss, place to produce	the materials	the materials, contact with the buyer	the materials, place to collect	workers, knowledge, inovation
potential problem:	unwilling/unable to give/sell their materials.	unwilling/unable to give/sell their materials.	unwilling/unable to give/sell their materials.	unwilling/unable to give/sell their materials.	unwilling to make a new education program or location is not near location where it is needed.
goals/ how to turn it around?:	1) make it economically interesting for them 2) make it accessable 3) spread awareness about the need	1) make it economically interesting for them 2) make it accessable 3) spread awareness about the need	1) make it economically interesting for them 2) make it accessable 3) spread awareness about the need	1) make it economically interesting for them 2) spread awareness about the need	1) spread awareness about the need 2) place education strategically

Construction sector: Critical actor groups

Critical actor:	raw material extraction companies	existing material manufacturing companies	future biobased manufacturing companies	building companies	construction oriented education
interests:	money	money	money, circular building	money, making the best build environment for the user.	spreading knowledge, money, innovating
resources:	the materials, place to produce	the contact with market	expertise, have to produce it	contact with the user, the market	workers, knowledge, inovation
potential problem:	unhappy that they have less demand for their product	unhappy that they have less demand for their product	unwilling/unable to create sustainable building materials.	unwilling/unable to switch to circular materials	unwilling to make a new education program or location is not near location where it is needed.
goals/ how to turn it around?:	keep them in mind but unrealistic to make them switch from unsustainable raw materials to sustainable material extraction.	1) make it economically interesting for them to switch materials 2) spread awareness about the need	1) make it economically interesting for them 2) make the materials needed accessable 3) spread awareness about the need	1) make it economically interesting for them 2) make the materials needed accessable 3) spread awareness about the need	1) spread awareness about the need 2) place education strategically

Public transport sector: Critical actor groups

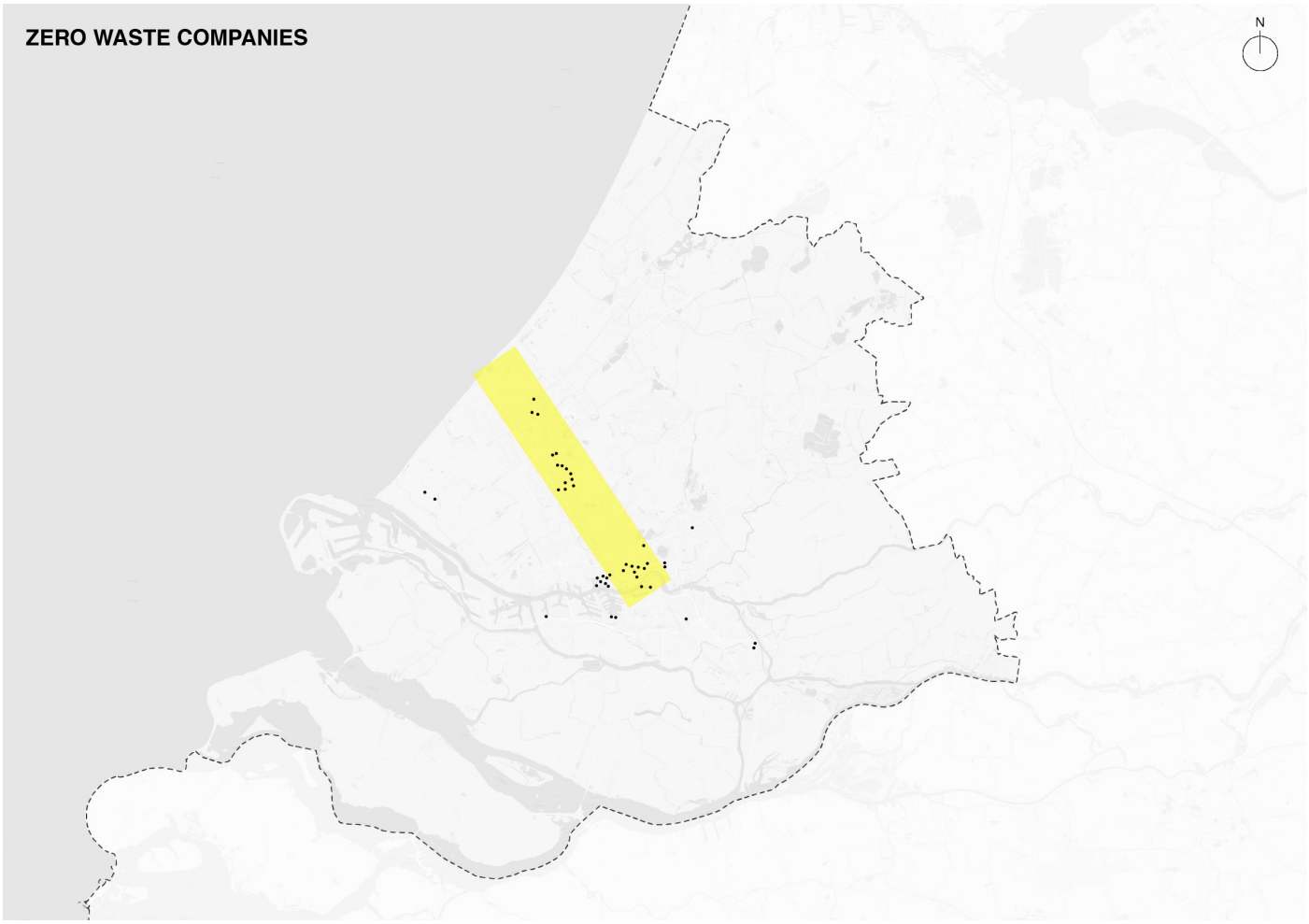
Critical actor:	trainrail companies	bus companies	tram companies
interests:	money, be efficient, be more connected	money, be efficient, be more connected	money, be efficient, be more connected
resources:	existing network, jobs	existing network, jobs	existing network, jobs
potential problem:	unwilling/unable to change.	unwilling/unable to change.	unwilling/unable to change.
goals/ how to turn it around?:	1) make it economically interesting for them 2) spread awareness about the need 3) create a more efficient public transport network	1) make it economically interesting for them 2) spread awareness about the need 3) create a more efficient public transport network	1) make it economically interesting for them 2) spread awareness about the need 3) create a more efficient public transport network

HIgh tech systems and materical sector: Critical actor groups

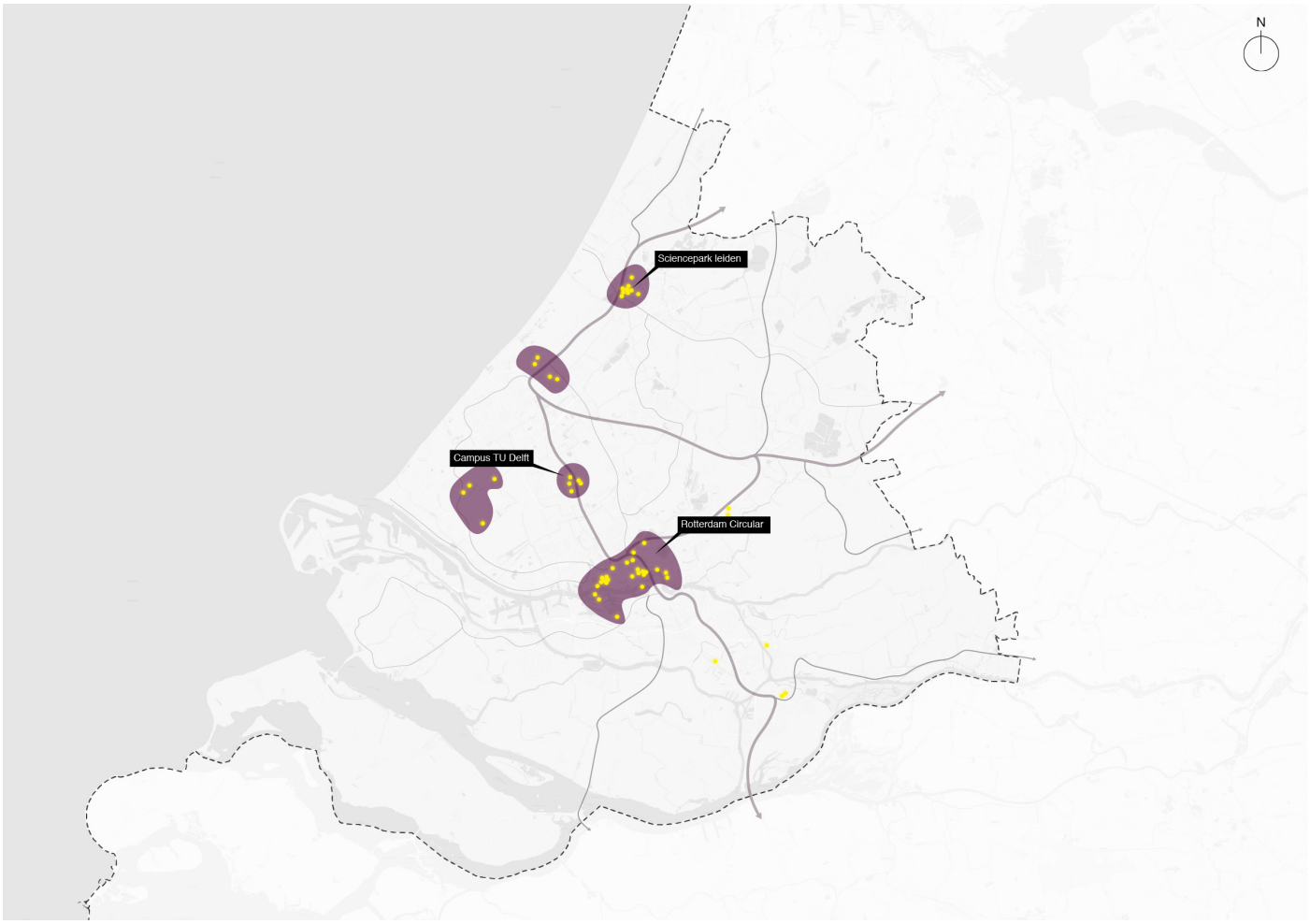
Critical actor:	agricultural technology companies	building technology companies	research centers	technology oriented education
interests:	money	money	spreading knowledge, money, innovating	spreading knowledge, money, innovating
resources:	expertise, necessities to produce instruments	expertise, necessities to produce instruments	workers, knowledge, inovation	workers, knowledge, inovation
potential problem:	no unwilling to change to make the instruments for LandBOUW	unwilling to change to make the instruments for LandBOUW	dont see the need to research, no money to research	unwilling to make a new education program or location is not near location where it is needed.
goals/ how to turn it around?:	1) make it economically interesting for them 2) spread awareness about the need	1) make it economically interesting for them 2) spread awareness about the need	1) spread awareness about the need	1) spread awareness about the need 2) place education strategically

6. Background information transition areas

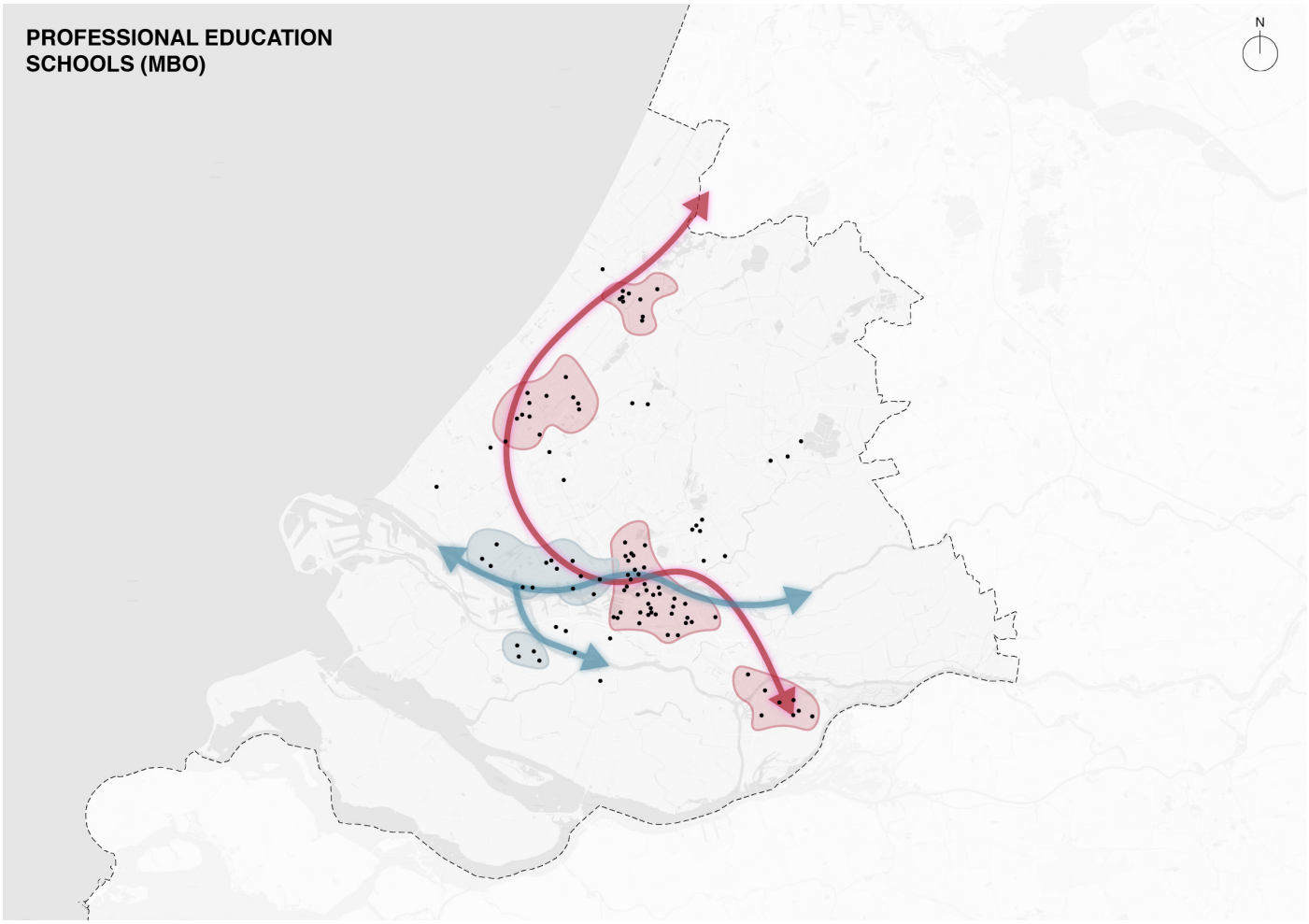
Quality of buildings within the transition areas



Zero waste companies



Circular initiatives



Mbo schools

Land
BOUW
A symbiosis of sectors