CLOSED LOOPS

CREATING CIRCULAR CONSTRUCTION FLOWS

FOR A JUST SOCIAL HOUSING INDUSTRY

OPEN JUSTICE

A VISION AND STRATEGY FOR THE PROVINCE OF SOUTH HOLLAND

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Closed Loops, Open Justice
Creating circular construction flows for a just social housing industry

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Cover: glimpse of the vision (illustration by authors, based on Carles Enrich, 2015)

*All illustrations are made by the authors unless indicated otherwise.

Preface

This report proposes a spatial vision and a development strategy for the province of South Holland for the year of 2050. It has been made during the 10 week courses: “Research and Design Studio: Spatial Strategies for the Global Metropolis” & “Research and Design Methodology” which are part of the Urbanism master track at the Delft Technical University. The course addressed different issues of a circular economy, spatial justice and the densification assignment in the province of South Holland.

This report was created by a team of 4 MSc Urbanism students at the Delft Technical University, each with various international backgrounds;

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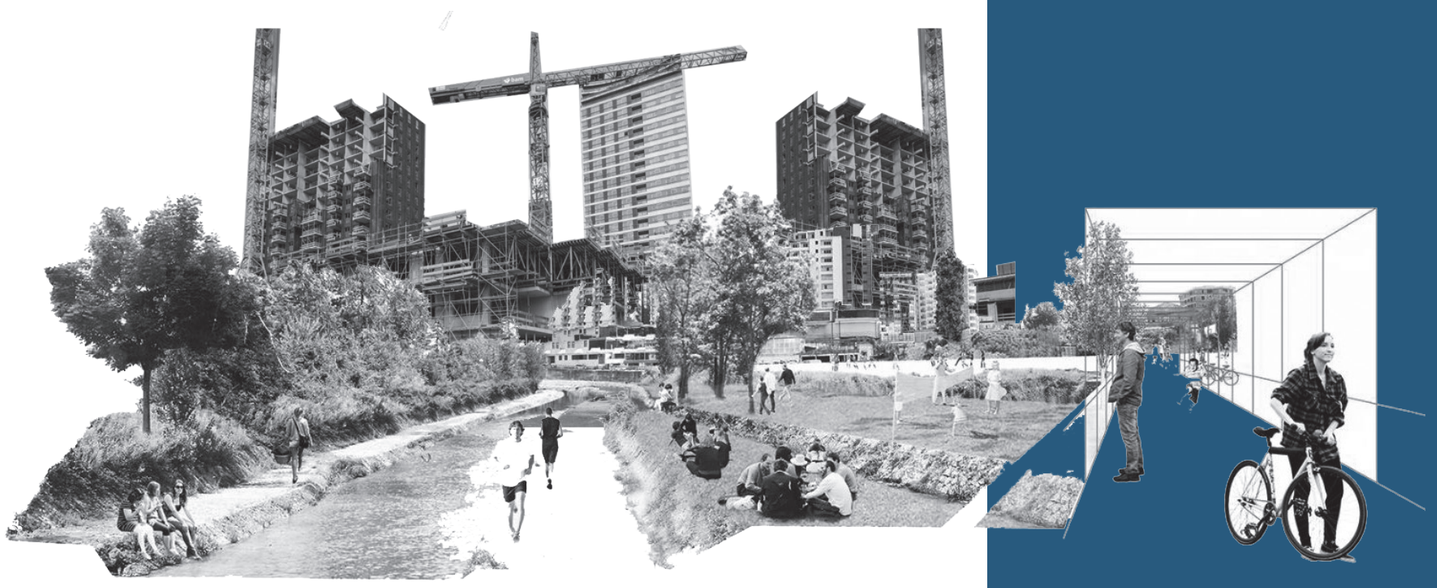


Abstract

In the province of South Holland steps have been taken to create a circular construction industry to mitigate current linear processes. These linear processes include wasteful resource-intensive models that lead to loss of value and depletion of raw materials. However, to achieve a complete circular construction industry, the true social and environmental costs of this transition need to be taken into account. This has shown to increase the initial cost of construction which, if left uncontrolled, would lead to an increasing gap in the provision of affordable social housing.

Therefore, the aim of this research is to provide innovative circular construction solutions for the provision of spatially just social housing in the densification of South Holland.

There is a focus on the current state and trends of the construction industry in relation to the densification and social housing issues. Through literature review and data analysis the current and future issues are identified to create a toolbox of design strategies. The toolbox contains local production, modular and flexible construction, improved infrastructure, digitization, and transformation and restoration.

To explore how a circular construction industry can be deployed in the provision of social housing, our focus is on three different kind of strategic areas: social housing in big cities, social housing in medium-sized cities and (former) industrial areas. The previously mentioned tools will illustrate not only the transition towards a more circular construction industry that supports the provision of social housing, but also shows how it can function as an area that engages people with the transitions towards a circular economy. This will tackles issues of segregation, diversity, equality awareness and participation.

Keywords

circular construction, social housing, socio-environmental costs, densification, south holland

Figure 1 Glimpse of the vision (illustration by authors, based on Carles Enrich, 2015)

Content

1. Introduction

The province of South Holland houses more than 3.5 million inhabitants and roughly covers 3,500 km2. The Dutch Ministry of Interior Affairs and Kingdom Relations assumes a demand for 1 million new homes until 2030 in The Netherlands (Ministerie van BZK, 2018). It is estimated that the province of South Holland will have to house 230,000 of these new homes. The province has formulated guiding principles to guarantee this densification happens in a sustainable way.

An important aspect which need to be taken into consideration when looking at this densification demand is the socio-spatial justice part. One of the core propositions of spatial planning is to mitigate social inequality. While formulating the vision for 'Closed Loops, Open Justice', the concept of spatial justice is considered. This concept emphasizes the need to understand and act upon the spatial dimension of justice and injustice in the city. Not only in terms of allowing citizens to have a voice, but also in terms of fair distribution of public goods in the city. An important example of social (in)justice in the Dutch context is social housing. Social housing covers an important part of the built environment in The Netherlands, but housing corporations have however reduced their engagement in the provision of affordable housing. Only the extremely vulnerable groups are served nowadays. Gentrification, segregation and an unequal access to opportunities are important effects of this development.

In 'Closed Loops, Open Justice' the design is geared towards the provision of affordable just social housing, regardless of the profile of the inhabitants. We do not make a distinction between disadvantaged groups, but instead take a general outlook at the availability and access to existing and future social housing. The proposal creates diversity and accessibility for all society groups and increases spatial justice, especially in the social housing sector.

The construction sector plays an important role in achieving the demand of new homes. This sector generates approximately €13 billion per year, and entails around 33,000 businesses and 105,000 jobs in South Holland (Drift and Metabolic, 2018). Around 40% of all raw material flows are generated by the construction sector. This makes the construction sector, with approximately 4 million tons of waste, the largest waste stream in the region. Products of the construction industry are nowadays mostly burned or downcycled, but recycling is not (yet) a structural part of the process. The province of South Holland therefore strives for a fully circular construction economy in 2050 (Transitieteam Circulaire Bouweconomie, 2018, Ministerie van I&M, 2016).

The transition towards a circular economy goes beyond more than economical and smarter use of raw materials, products and services. It also concerns people, social inclusion and other working methods and processes within and between organizations. Attention is needed for the social dimension of the circular (world) economy in the Netherlands and its effects worldwide (Grondstoffenakkoord, 2017). By analysing the current situation and issues, we concluded that a transition towards a local circular construction industry is needed for a just social housing industry. Our aim is to distribute the socio-environmental costs of circular housing development fairly within social housing units in order to prevent further gentrification and segregation that would arise from the increased cost of a circular transition.

By analyzing the problems of the current construction and social housing industry, and by introducing the vision for a circular South Holland, the research question that emerges is:

> *"How can the integration of circular construction processes contribute to spatial justice of social housing in the densification of South Holland?"*

To answer this research question and its sub-questions, this report will introduce the concept of circular construction flows as a starting point for a just social housing industry.

To explore how a circular construction industry can be deployed in the provision of social housing, a focus is on three different kind of strategic areas: social housing in big cities, social housing in medium-sized cities and (former) industrial areas. In addition, the reports illustrates tools and future scenarios in which these areas can not only facilitate the transition towards a more circular construction industry that supports the provision of social housing, but also shows how it can function as an area that engages people with the transitions towards a circular economy.

Figure 2 Glimpse of the vision (illustration by authors, based on Carles Enrich, 2015)

2. Project Approach

2.1 Problem statement

In the province of South Holland steps have been taken to create a circular economy. The construction in the present urbanisation model consists of linear processes, which include different participant groups. These linear processes are wasteful resource-intensive models which lead to loss of value and depletion of raw materials. To start this transition towards a circular economy, the current trends in the construction industry need to be adjusted.

Additionally, we notice that society is largely unaware of the concept of circularity at a larger scale. This creates a social barrier towards acceptance of the costs and benefits of a circular economy, which makes the transition more complex. To achieve a complete circular construction industry, there is a need to factor in the true social and environmental costs of the transition. This has shown to increase the initial cost of construction which, if left uncontrolled, would lead to an increasing gap in the provision of affordable social housing.

To achieve the goal of creating 230,000 homes in a circular and just way, the smaller linear construction processes need to be integrated into a regional circular economy and the true social and environmental costs of the circular transition need to be adressed in order to realise the provision of just social housing.

2.2 Research Question

"How can the integration of circular construction processes contribute to spatial justice of social housing in the densification of South Holland?"

What are the geographical construction and demolition flows and how can these flows transform in a circular and just way?

What are the true costs for society in the transition to a circular construction industry?

What are the current trends and issues in the densification strategy of South Holland?

What is the current state of social housing in South Holland and how can they be transformed in a circular and just way?

2.3 Methodology Framework

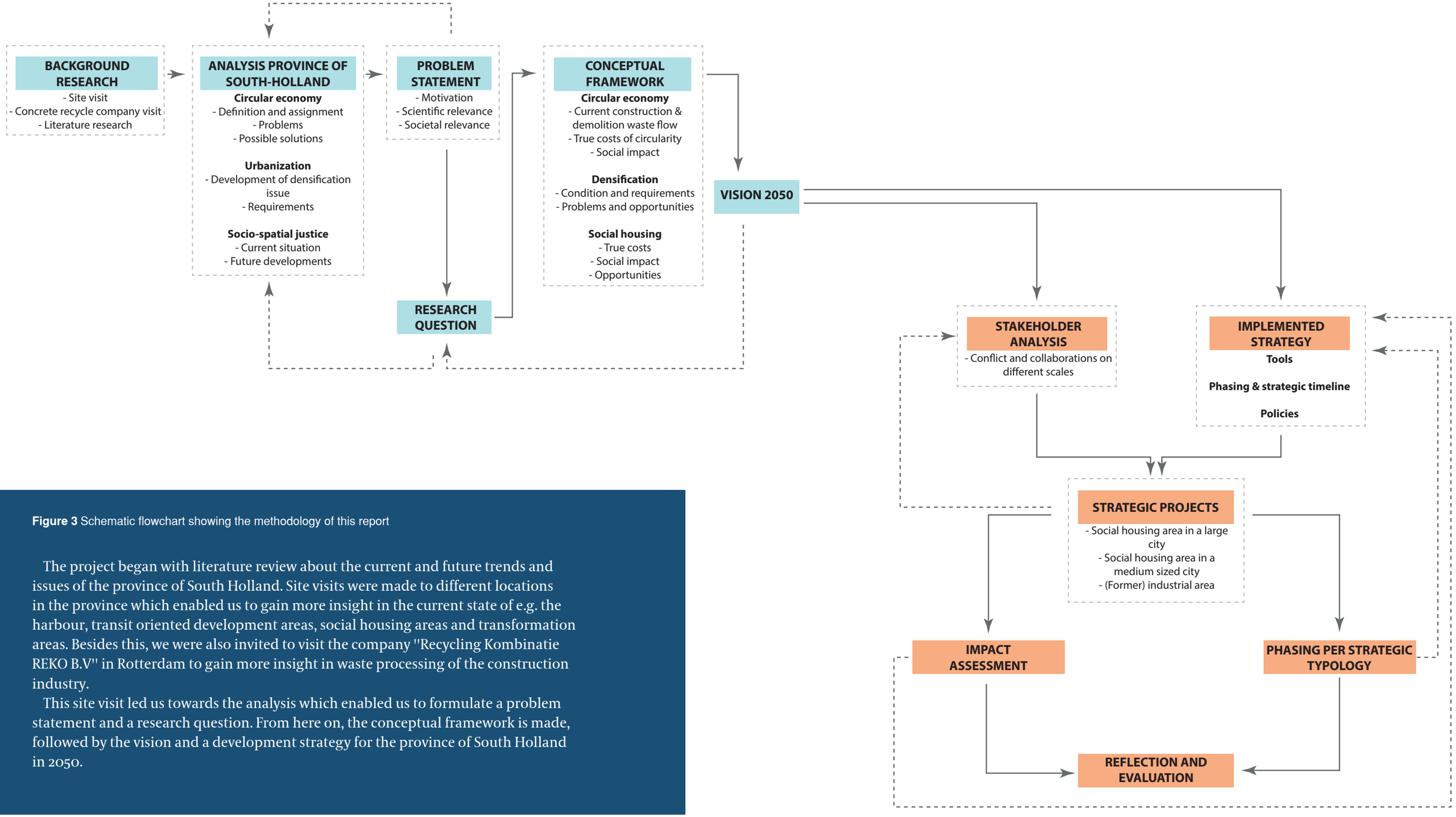


Figure 3 Schematic flowchart showing the methodology of this report

The project began with literature review about the current and future trends and issues of the province of South Holland. Site visits were made to different locations in the province which enabled us to gain more insight in the current state of e.g. the harbour, transit oriented development areas, social housing areas and transformation areas. Besides this, we were also invited to visit the company "Recycling Kombinatie REKO B.V" in Rotterdam to gain more insight in waste processing of the construction industry.

This site visit led us towards the analysis which enabled us to formulate a problem statement and a research question. From here on, the conceptual framework is made, followed by the vision and a development strategy for the province of South Holland in 2050.

3. Conceptual Framework

The “Closed Loops, Open Justice” project is based on three themes: the circular economy, urbanization and spatial justice. Within these themes we aim to address three main topics: true cost of circular construction, densification and social housing. This conceptual framework explains and defines the three topics and how they come together to help achieve the densification challenge set out by the province of South Holland for 230,000 new homes. Our objective with the “Closed loops, Open justice” project is to utilize the benefits of circularity in the construction industry to improve the quality and distribution of social housing within the densification challenge of the province of South Holland. Closing the loops will help mitigate the environmental impact of buildings on the natural environment by dealing with the issue of decreasing scarce resources and the creation of surplus waste. We will then implement the design solutions of circular construction to repurpose and optimize social housing user experience through the creation of inclusive, sustainable housing developments.

The flexible developments are created to meet the diverse and changing needs of all stakeholders within the construction industry, while removing the risk and uncertainty that comes with developing niche housing stock for a single user group. We begin by addressing the issue of the circular economy and construction in the context of South Holland.

Circular Economy

In this section, we will focus on the issues of construction, one of the three topics our project addresses strongly. A circular economy is an economic and industrial system based on the reuse of products and raw materials, and the restorative capacity of natural resources. (Bastein et al., 2013)

However, the current construction industry consists of linear processes. It is a system of “take, make, and dispose” (Lacy & Rutqvist, 2016). The circular economy paradigm is a reaction to the linear approach. A circular economy keeps products and materials in use, giving zero waste and pollution (Ellen MacArthur Foundation, 2017). This has a major effect on the market, customers and resources. According to Lacy & Rutqvist (2016) it is the only large-scale solution for prosperous, green and thriving global growth and human development. A circular economy fits the concept of people, planet and prosperity (Hammond, 2006). Three elements represent the need of a circular economy: the demand for raw material, the dependency to other countries, and climate change (Rijksoverheid, 2016).

As described in the report of the Ellen MacArthur Foundation (2017), the circular economy is based on several key principles, which drive four sources of value creation:

- ‘The power of the inner circle’: the more that hidden costs (such as materials, labour, energy and capital) are retained in a product, the greater will be the savings (or potential benefits). Repairs and maintenance retain much more of a product’s value than recycling its individual component.
- ‘The power of circling longer’: the more often a product re-enters a cycle, or the longer it is used, the higher will be the value created.
- ‘The power of cascaded use’: if materials (as opposed to products) are to be reused (as a result of wear, for example), they can create added value if people look for other, more complex uses for them instead of breaking them down to the level of raw materials.
- ‘The power of pure cycles’, i.e. it is easier to separate inputs and designs: reuse, repair and recycling all benefit if the final phase of the life of a product has been taken into consideration when it is designed, by ensuring, for example, the use of non-toxic components and combinations of materials that are easy to separate. (Ellen MacArthur Foundation, 2017)

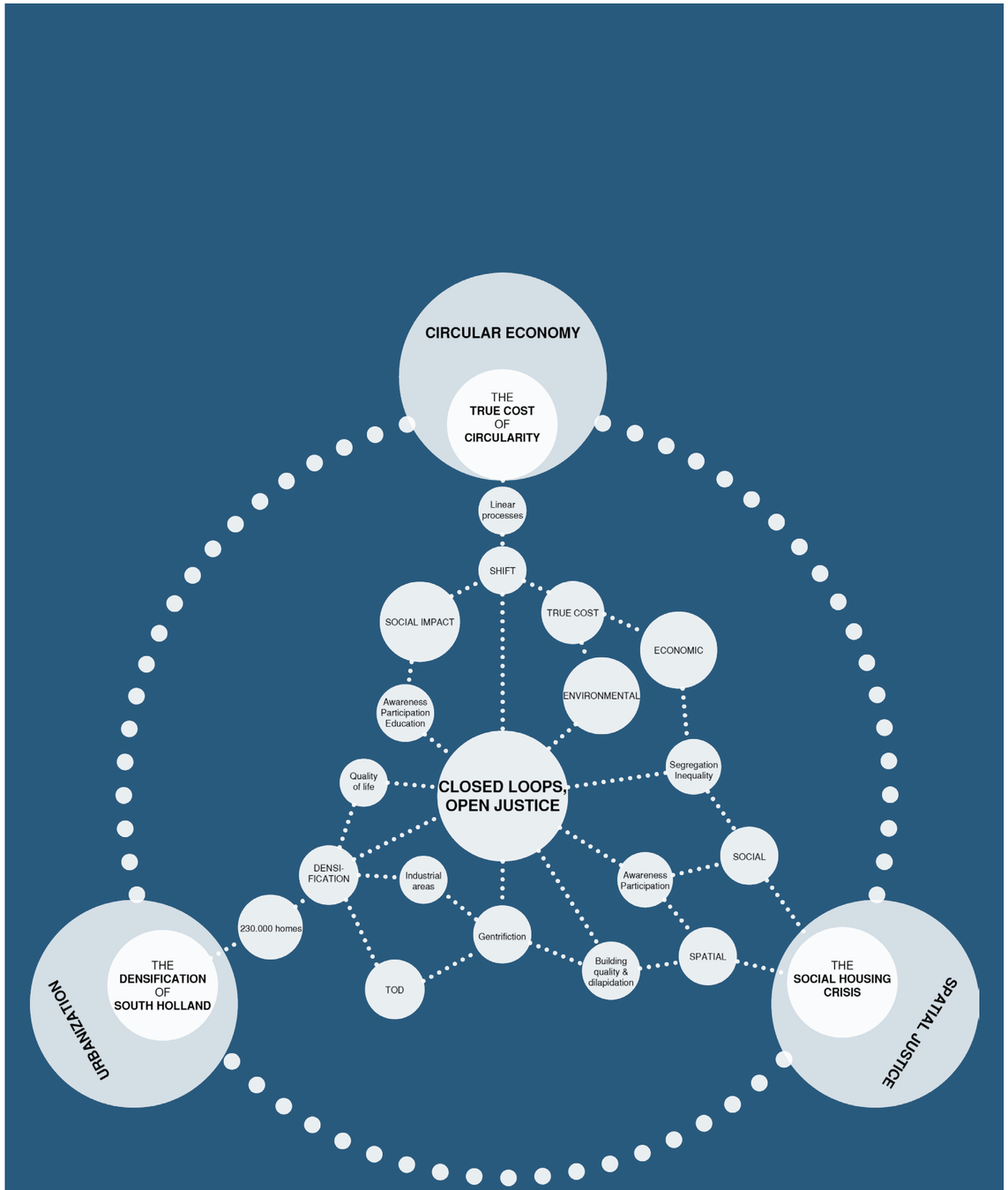


Figure 4 Conceptual Framework

The True Cost of Circularty

"The cost of a transition to a circular economy will to a large extent depend on its estimated potential. This is true, for example, of the costs related to collecting and processing materials, and the investments repair businesses would have to make." (Bastein et al., 2013)

We acknowledge that there has been a growing shift towards circularity in the construction industry, with a lot of emphasis being placed on value retention in the production of buildings. According to the Circular Construction Economy report for the Netherlands in 2018, they define the goal of this circular construction as a system that attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system. These goals match the principles of value creation mentioned in the circular economy section earlier. The Netherlands has made excellent progress in its endeavour to move towards circularity, but at the same time it is necessary to explore other opportunities. We are a long way from our target if our only goal is a high rate of recycling. (Bastein et al., 2013)

This is an indicator that we need to consider other values within the circularity chain if we are to fully achieve true circularity. Looking at the construction sector, we see that focus on impact analyses is mainly in construction products and materials with so- called high embodied energy, the energy linked to the production of construction products and materials from raw materials. This includes the energy used in the extraction of materials, the manufacture of construction products, the construction phase itself and the end-of-life phase, demolition, but not energy used directly during the use phase. (Vtt et al., 2020)

Therefore, if we are to fully embrace a complete and clear transition to a circular construction industry, we must go a step further and address these initial environmental and economic costs as well as user based energy demands. We are already aware that construction is one of the largest sectors of today's global economy, representing 13% of GDP and employing 7% of the world's working age population. Construction and demolition accounts for 25–30% of all waste generated in the EU, while cement and steel production for construction account for close to 10% of global CO_2 emissions (Acharya et al., 2018)

Taking proper account of these environmental impacts in the final products of the built environment will enable actors and stakeholders to make more conscious and sustainable decisions in order to achieve a truly sustainable circular construction industry. However, we note that this will come with extra costs to the construction industry. It is evident from research commissioned by the Ministry of Infrastructure and Environment in 2013, that due to the nature of current construction businesses where benefits and burdens are not evenly distributed along the value chain, it is extremely difficult to businesses to make viable business cases for a circular system if agreements have not been made within the chain to spread the costs. (Bastein et al., 2013) Cultural norms and behavior, especially within construction stakeholders, have in the past proven to be a major barrier to the transition to the circular economy. It is therefore important to engage all stakeholders to agree on a shared network model where the benefits and costs of the transition are clearly defined and embraced.

"It is important for us to emphasize that; the inclusion of real costs is likely to boost the circular transition. However, implementation strategies are required to cope sustainably with potential short-term social costs (e.g., step-by-step implementation). The integration of environmental costs should be coordinated with policies and quality standards regarding Building Reversible Design, as well as materials and their re-use potential." (Capelle et al., 2020)

Consequently, we also embrace that there are other economic costs such as initial capital expenditure costs of new businesses, industries and resources, and repetitive transformation and design for reuse costs. This is due to the current nature of capitalist business models, which are structured to prefer short term gains over long term returns. However, we see that the long term environmental, social and economic benefits of a circular transition, will outweigh the short-term costs if policies and strategies are implemented to facilitate the transition for businesses within the whole construction industry. A transition to circular construction will not only reduce material consumption and waste production but it will also decrease Greenhouse gas emissions. (Vtt et al., 2020)

Social Impact

The transition towards a circular economy goes beyond the economic and prudent use of raw materials, products and services. It also concerns people, their behaviors, participation, and relationships within and between organizations. Attention is needed for the social dimension of the circular (world) economy in the Netherlands and its effects worldwide (Grondstoffenakkoord, 2017), in order to promote social inclusion.

"A circular economy can have a positive impact on employment opportunities, but it is necessary to increase the supply of labor on the long term. Otherwise, there is a partial displacement effect, which attracts employees from existing jobs." (CPB & PBL, 2018)

The shift in job opportunities is caused by the costs and benefits of a circular economy, which are not evenly distributed. On the short term, this transition will possibly lead to a mismatch between supply and demand and the availability and suitability of workers to fill job vacancies. This shift in employment brings social and individual adjustment costs like looking for a new job, retraining or even (temporary) acceptance of a lower wage (TNO, 2019), which might not be acceptable for some households.

Increasing visibility and participation of circular initiatives can lead to possible awareness and a different attitude towards circularity, where circular products can increase in value and possibly be marketed with a higher perceived value. However, the transition towards a circular economy can also lead to less positive attitudes, for example as a result of the previously mentioned job insecurity. This is especially true for employees with jobs in the linear economy where employment is dwindling or in which employees are obliged to receive additional training in order to remain employable. It is therefore necessary to investigate what the true costs of circularity are and how these effects influence the construction industry in South Holland (Heestermans et al., 2019).

The Densification of South Holland

Another important dimension of the transitions towards sustainability is urban form and, within this domain, the issue of densification and sprawl are crucial, because of the impact urban form has on the environment, on production and on households.

One of the main enablers of the urban transition to circularity is densification. A report by ABF Research (2017) stated that by 2030 one million new homes should be built in the Netherlands to cater for future demand. That is why the Province of South Holland strives to promote urban living and to improve the quality of its urban areas through various strategies, including densification.

South Holland densification strategy is mostly geared around Transit Oriented Development, which research has indicated can be a key strategy for improved quality of urban space. Densification is favored because it brings about a high concentration of resources, capital, data, and talent over a small geographic territory.

"This proximity can enable the circular economy in a number of ways. Reverse logistics and material collection cycles could be more efficient due to the geographical proximity of users and producers, creating more opportunities for reuse and collection-based business models. The proximity and concentration of people enables sharing and reuse models (where products or assets are used multiple times by different users, typically within a neighbourhood or smaller geographic unit)." (Ellen MacArthur Foundation, 2017)

Urban areas based on the circular economy hold the promise of prosperity that is restorative and regenerative by design. It is an approach to economic development designed to benefit businesses, society, and the environment. (Ellen MacArthur Foundation, 2017) We therefore fully agree with proposals and strategies put forth by the Province of South Holland in improving this transportation hubs to increase the quality of life for the city dwellers.

However, from the densification strategies employed by the Province of South Holland, we observe that, it is very easy to fall into the trap of gentrification and segregation, by creating high value zones around transit areas and relegating the underserved and underprivileged members of society to the peripheries of urban areas. This would bring about spatial injustice within the densification zones identified for development.

The Social Housing Crisis

Very much connected to the previous topic of urban form, is the issue of housing. Housing is at the centre of urban development, because it touches all aspects of sustainability and has a crucial role in the lives of citizens. Currently in the Netherlands, especially in the large cities, there is a housing crisis, and specifically, a social housing crisis (Julen, 2019) (Ten Teije, 2019). The corporations, who are responsible for building social housing, claim that their landlord tax is too high and their projects are deprioritized by municipalities (Aedes, 2019). The national government, on the other hand, states that corporations have enough profit, which they can use to build more social housing (VTW, 2020 & VVD, 2020). Visions by municipalities (Gemeente Den Haag, 2019) and provinces (Provincie Zuid Holland, 2019) show that the housing stock should be distributed fairly and at least 30% of newly built housing must be in the social housing sector. The individual is the victim of this crisis. Waiting lists can reach up to 9 years and the cost of social and private housing is increasing (CBS, 2020) (RIGO, 2019).

Social justice is defined as 'justice in the distribution of wealth, opportunities, and privileges within a society' (Oxford Dictionaries, 2020).The social housing crisis covers the theme of spatial justice. Spatial justice can be defined as 'social justice in space' (Potter & Novy, 2009). Therefore, the distribution of benefits and burdens in the densification of South Holland will have to be done fairly taking into consideration all users and stakeholders. The role of our project, will be to ensure that despite the increasing advocacy for a transition to a circular construction industry, the Province will put in place, just procedural and distributive process for the communities involved and especially vulnerable groups living in social housing neighborhoods.

Spatial justice has two dimensions: procedural and distributive (Rocco, 2020). A procedural problem in social housing is the lack of influence of the disadvantaged groups. The voices of the elderly, children and physically challenged people are often not heard in urban development. This leads to neglect of their needs and they are consequently disenfranchised from opportunities and wealth. Another procedural issue is that corporations have to pay ten times the tax a private renter pays for the same apartment (Aedes, 2019).

One urgent distributive problem is the current and future location of social housing. Transit oriented development and gentrification are driving social housing out of the city. Areas around city centers and train stations are transformed and gentrified into high-end neighbourhoods for middle and upper class. Social housing areas are not included and therefore have less accessibility to this increase of quality (PDOK, 2020) (Van Gent & Hochstenbach, 2019). Given the fact that the Netherlands wants to reach energy neutrality in 2050 (Rijksoverheid, 2016), improvements to the current social housing stock should also be implemented. Transforming the current housing stock is a major assignment in reaching energy neutrality. Overlaying maps of corporation owned-housing, building type and building age (PDOK, 2020) shows that most social housing are row houses or portico houses dating from 1950 to 1980. The building quality of these post-war houses is relatively low due to the pressure on the housing stock at that time (Blom, Jansen, & Van der Heijden, 2004).

To protect the social housing neighbourhoods from dilapidation, they should be renovated. However, there is the huge concern of causing gentrification. Gentrification would mean that the current tenants could no longer afford the refurbished houses and they would be pushed further away from the city centers. This can increase segregation and inequality (Leidelmeijer et al., 2015). Segregation is caused by dissimilarity. Spatial segregation is mainly caused by dissimilarity in race or income (Whyte, 1983). It can be measured by e.g. the GINI-coefficient (Leidelmeijer et al., 2015). Segregation happens on every scale (Ponds et al., 2015). In case of social housing, it happens mainly on the neighbourhood scale. In large cities, there are social housing-districts (PDOK, 2020). This separation can cause exclusiveness and inequality. This means that people in one district do not have the same opportunities, services or facilities as someone in another district. There is a need to act to ensure inclusiveness and equality in densifying South Holland in a circular way. Since social housing corporations favor inclusiveness and equality, they are ideally suited to implement circular economy business models.

Conclusions

Looking back at the issues addressed we see that there is a growing need for the construction industry to make a complete shift from the current linear value chain models to a circular system. This circular system-closed loops- will serve to reduce the environmental impact by reducing waste surpluses and ensuring that all raw materials used are designed for maximum value retention. Some of the principles and solutions being implemented in circular construction such as flexible construction and local production will be very useful in addressing the renovation and development challenge of social housing stock as they will favour both the end user and the developer. The developer reduces the risk of uncertain future utilization brought about by creating niche housing units, while the clients are assured of easy and flexible quality improvements whenever need arises.

However, we have seen that despite the huge benefits of this shift to a circular construction, there is a need to embrace the true costs associated to it. Current building practices, although linear provide relatively cheaper investment options for developers as compared to circular construction options. Many bottlenecks exist in the shift towards circularity since the benefits and costs are generally spread out unevenly within the construction chain. This makes the shift very expensive for frontrunners who would generally want to make this transition. If on top of this we are to factor in the environmental tax obligations placed by government regulations, it would become hard to make a favorable business case for the transition. However, we acknowledge that the shift is indeed necessary since there is immense pressure from climate change, decreasing raw materials and the need to reduce dependency on other countries.

We have clearly highlighted that there are also major social benefits that the Province will derive from the shift towards a circular economy. This social and environmental benefits far outweigh the initial transitional economic costs. Cultural mindsets and the path dependency have long been major barriers for this transition. The province will therefore need to make a bold move to create policies and incentives for businesses in the construction industry to transition to circularity. The circular economy requires a shift from current linear short-term profit principles to a shared, networked system, where long-term goals are prioritized.

And the social housing sector as highlighted therefore creates a perfect partner for implementing this transition. The social housing sector is driven by values of spatial justice and therefore aligns perfectly with the values of justice in the circular economy. Both overlook short-term gains for long term value creation. The Closed Loops, Open Justice project therefore advocates for the Province of South Holland to create a conducive business environment for social housing to be the frontrunners in this transition to a circular economy and provide a pathway for other stakeholders in the housing industry both nationally and globally to follow in this shift toward a circular economy.

4 Provincial Challenges

The province of South Holland faces four challenges, explained in the problem statement, research question and subquestions. In this chapter, the current state, current issues and future issues of these challenges are analysed. The analysis forms, together with the conceptual framework, the reasoning for the vision and strategy.

Circular Construction
An analysis on the current construction industry. It contains an elaborate research on the current construction flows and stakeholders.

The True Cost of Circularity
The shift from a linear to a circular construction industry has social and environmental effects which are analysed and explained.

Densification of South Holland
An analysis on the Dutch strategy to realise 1 million homes, of which 230.000 in South Holland.

Social Housing Crisis
An analysis on social housing crisis, showing the quantative and qualitative problems.

4.1 The Circular Construction Loop

The current construction industry consists of linear processes. It is a system of “take, make, and dispose” (Lacy & Rutqvist, 2016). The circular economy paradigm is a reaction to the linear approach. A circular economy keeps products and materials in use, giving zero waste and pollution (Ellen MacArthur Foundation, 2017). To reach a circular economy, a circular concrete flow is necessary. This will be the kick-off point of the materials circularity in South Holland.

In the current construction industry sector, an important aspect is the amount of imported and exported goods. According to CBS (2020), 13% of the exported goods are mineral fuels and 2% are steel and iron whereas 16% of the imported goods are mineral fuels and 2% is steel and iron. At the same time a lot of companies are involved in the import and export of goods for the construction industry. Over 15,000 companies export goods, whereas over 25,000 companies import goods (CBS, 2020). In order to make the transition towards a circular economy, it is crucial that these aspects are taken into account since a circular economy requires less raw materials and maintains the materials value as much as possible.

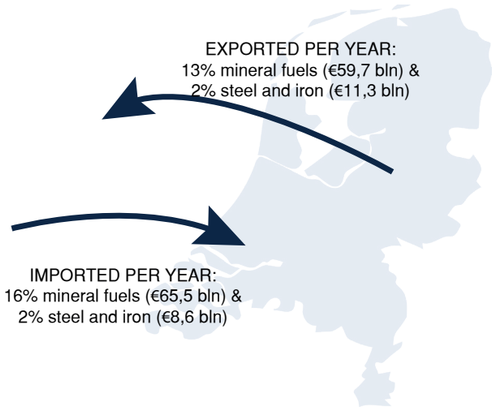


Figure 5
Import and export in the construction industry
(illustration by author, based on CBS, 2020)

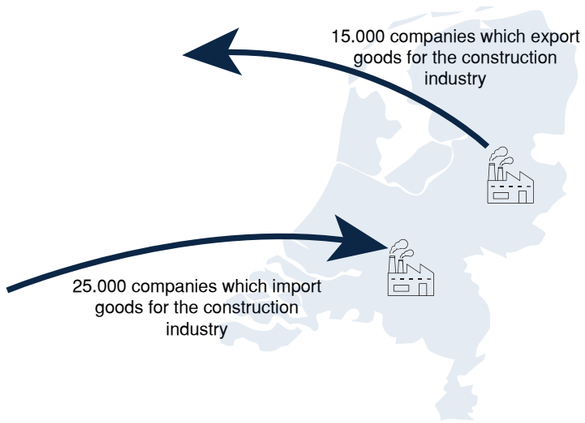
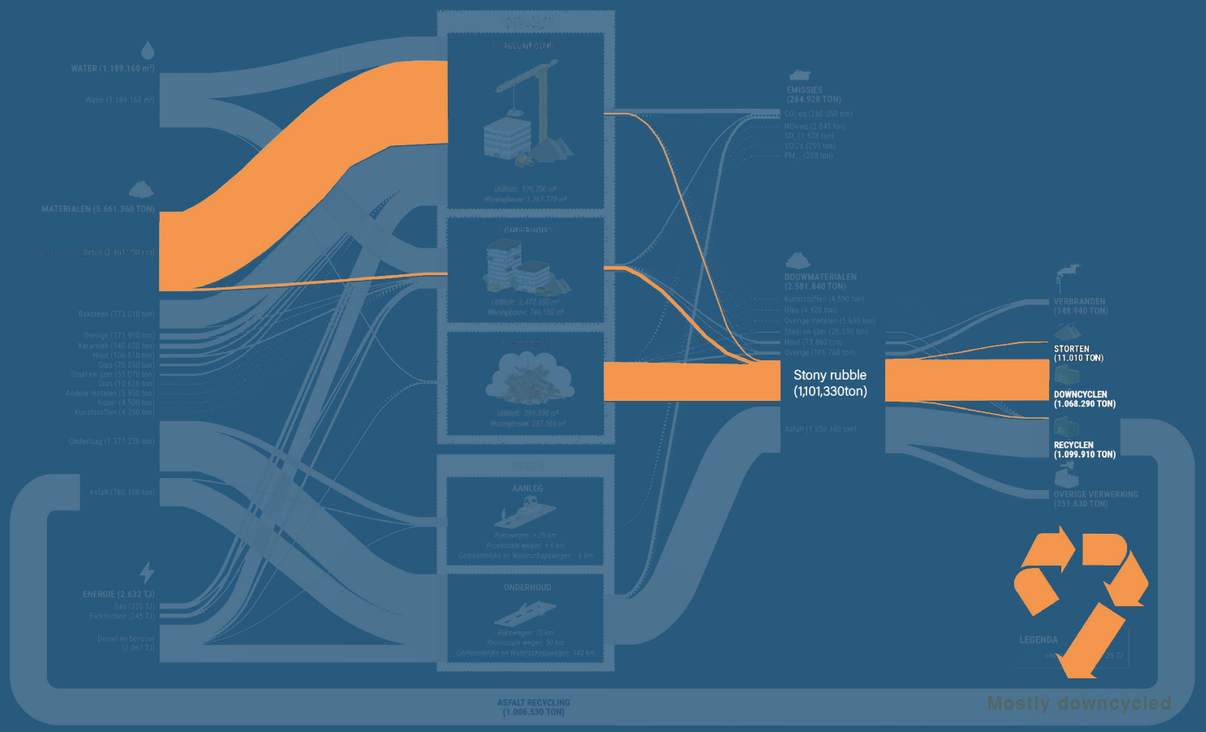


Figure 6
Import and export companies
(illustration by author, based on CBS, 2020)

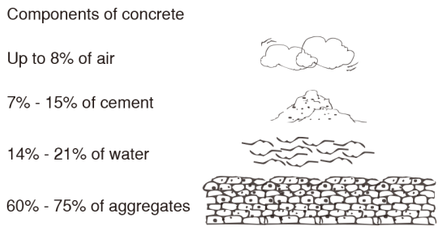


▲ **Figure 7** Concrete flow in South Holland
(adapted from Drift & Metabolic, 2019)

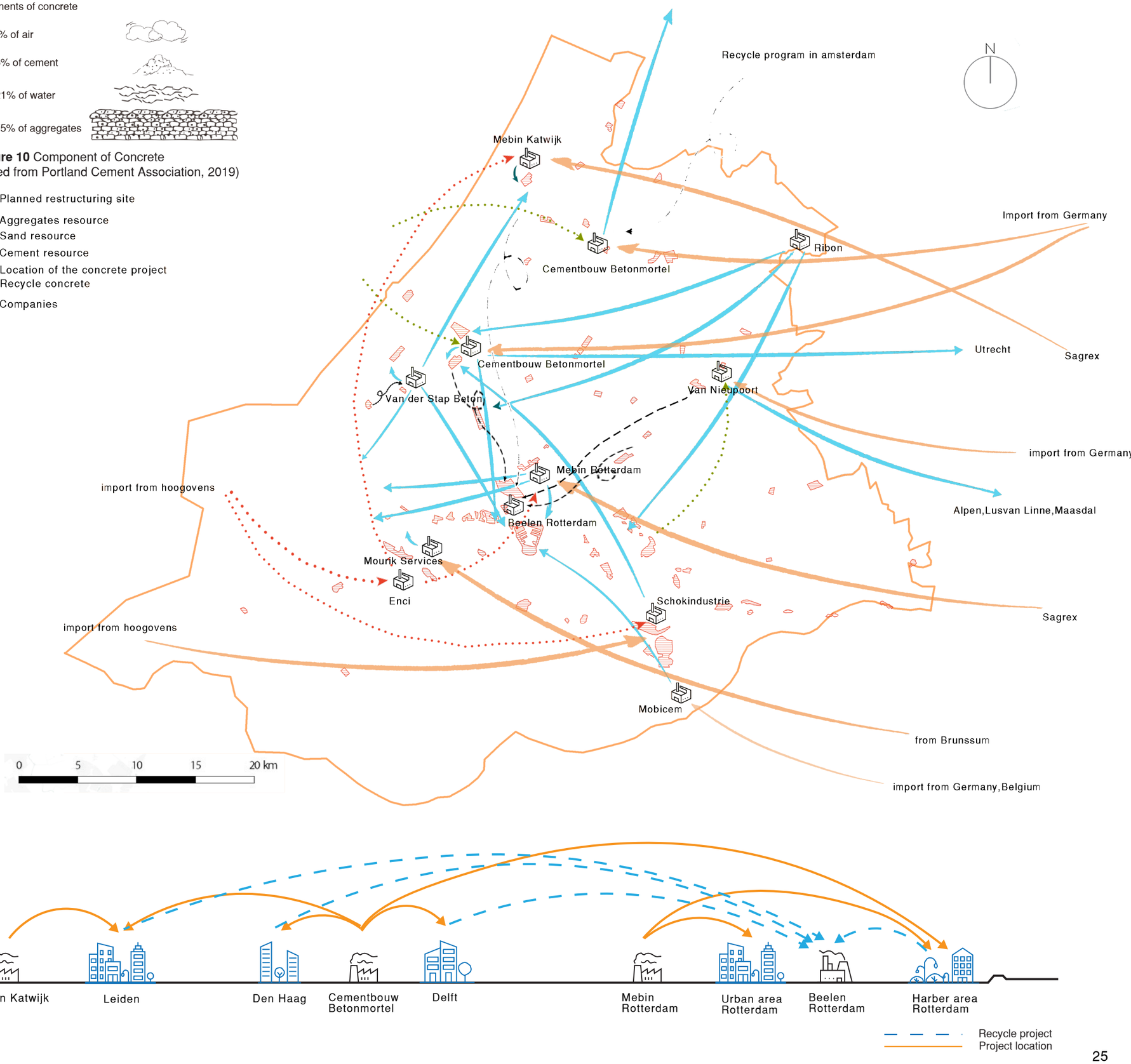
As highlighted in figure 7, the concrete wasteflow in the construction sector is the biggest waste stream where 38% of the materials in construction is concrete. And concrete waste is 1,101,330 tons per year and 1,068,290 downcycled every year. In the demolition of stony rubbles, almost 97% of the concrete waste is downcycled, and still a small part go into landfill. The actually recycled sector is less than 2%, which means there is a big challenge to transform all the concrete linear process into circular construction, but also there is a large opportunity for the concrete construction industry to be much more circularity in the near future(Zuid-holland circular, 2018).

Concrete waste flow

Concrete companies in South Holland rely on the import of raw materials like cement and aggregates from Germany and Belgium. On top of that, they have projects all over the province, even outside the region, which means more emission and attrition from the transportation.
Moreover, most of the concrete companies are able to transform to recycle the construction & demolition waste, but they are not doing it. The few recycling projects currently taking place are not enough to create a circular construction industry in the region.



▲ **Figure 10** Component of Concrete
(adapted from Portland Cement Association, 2019)



▲ **Figure 8**
Concrete Flow Map of South Holland
(illustrated by authors, based on conpany websites of: ENCI; Cementbouw Betonmortel BV Zoeterwoude; Beelen Rotterdam; Vander Stap Beten; Mebin - rotterdam; Mobicem BV; Mourik services BV; Schokindustrie BV; Riboton; Van Nieuwpoort)

▶ **Figure 9**
Concrete Flow Section

Stakeholder analysis

Towards a circular future, the shift in the construction & demolition industry would affect a lot of the stakeholders in this process. We take into account the industrywide perspective of circular economy awareness, challenges and enablers. Generally, a consensus has been reached that circularity need the cooperation with all of them. But there are still some challenges to overcome.

1.Designers lack the circular economy knowledge which leads to that buildings are not circularity designed.

2.Large company regard the transition as a great challenge but are not pushing this forward.

3.Lack of incentive for the clients and designer to make end of life products which can be circular and flexible in the construction and demolition.

4.Manufactures only care about products and they should be more aware of the new materials and knowledge-based factory.

5.There are also common ideas that the current supply chain is fragemented and lacks a holistic approach. Besides, the new technology should be applied to raise the quality of the recycled materials.

In conclusion, the manufacturer and main contractors are more aware of this trend, and they know where the key issues lie (Adams, et al. ,2017). The whole supply chain in the construction & demoliton industry needs an update to become circular without downcycling, landfilling and unnecessary waste. The value of the materials should be maximized (Stahel, 2010) and a solution for them could be enabling them to be within closed material loops.(McDonough and Braungart, 2002)

The legislation, incentive interest, new knowledge and viable business model shall be the trigger factors that accelerates the current linear constructon industry to form a circular loop in the province of South Holland.

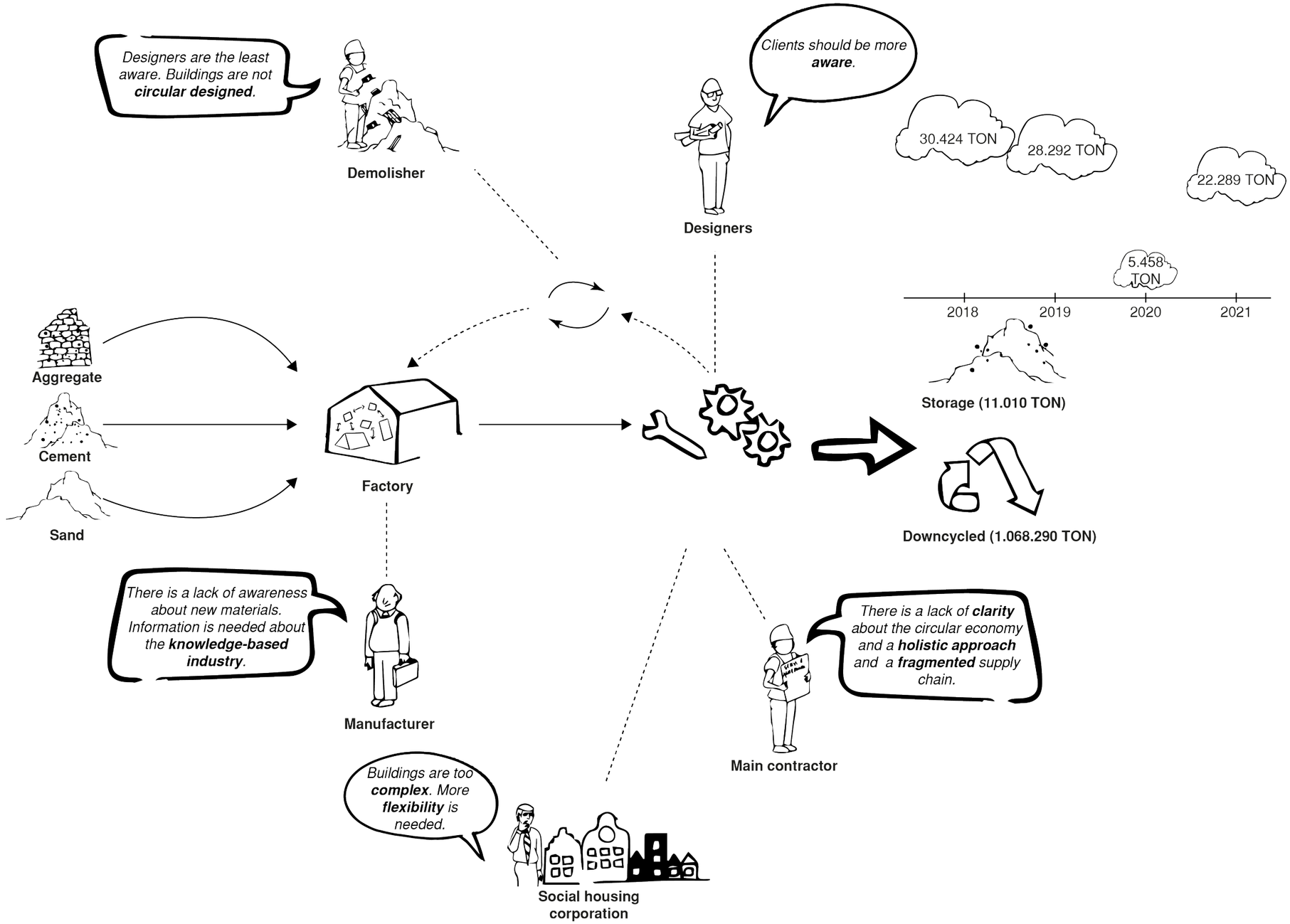


Figure 11 Stakeholders in the construction industry (illustration by authors, based on Adams et al., 2017)

The Transition

Currently the first steps towards a circular construction industry are already made. Changes such as modular construction, flexible construction, material banks and digital databases are being implemented as shown in Figure 12.

Modular constructed buildings consist of repeated sections (modules). It is a construction method which involves constructing away from the site and where the final installation is completed on site.

Flexible construction refers to the easy construction and deconstruction of buildings and homes, which makes it more accessible to changing functions of buildings.

Material banks are databased transition stations that realise the distribution of materials in order to reduce the waste of buildings.

Digital databases are online platforms which include the material passports of materials containing information of quality, function, past uses and maintenance.

However, despite these changes, the transition towards a circular construction industry is not yet complete and achievable. This is probably largely due the true socio-environmental costs which are associated with this transition. The next pages will elaborate further on this.

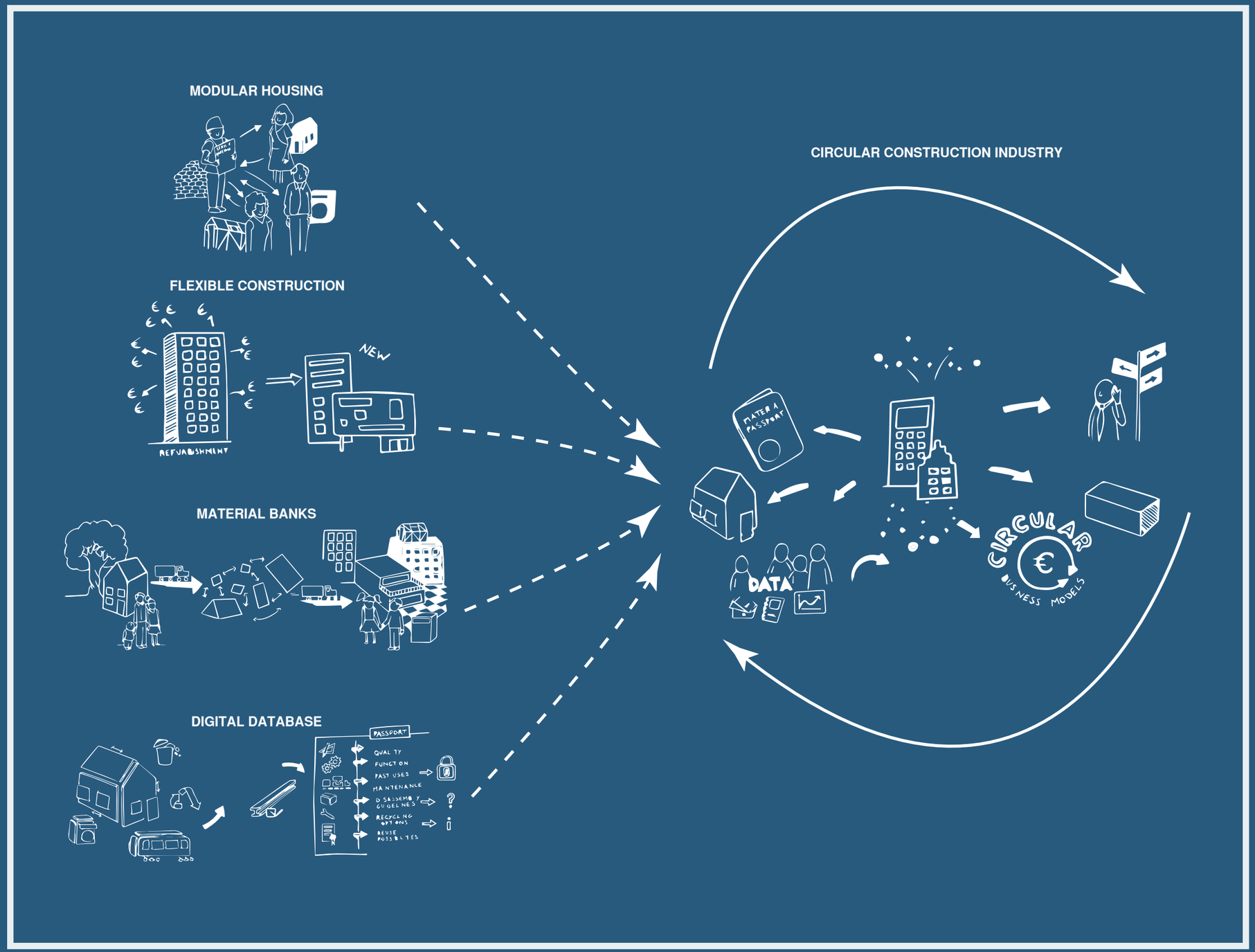


Figure 12 The first steps towards a circular industry

4.2 True costs of circularity

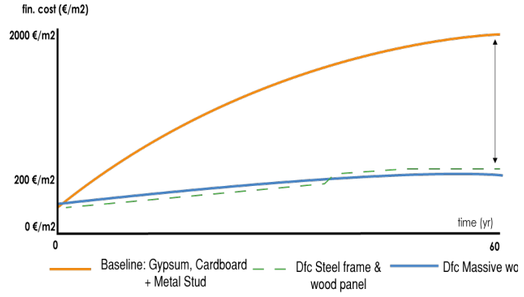
Currently, many bottlenecks hamper the transition to a circular economy in the built environment. These are often linked with past or current building practices. To make an economy truly circular, it is necessary to take additional measures by focusing on the whole lifecycle of construction products in a way that preserves resources and closes the loop.

The GTB Lab team in their research for BAMB (2019) stressed the importance of making circular products competitive through cost reduction and by maintaining a higher value of materials for longer. Identified strategies point out different key aspects such as the optimisation of production process, the rethinking of the logistic strategy, and ownership transformation based on the take back concept. BAMB(2019)

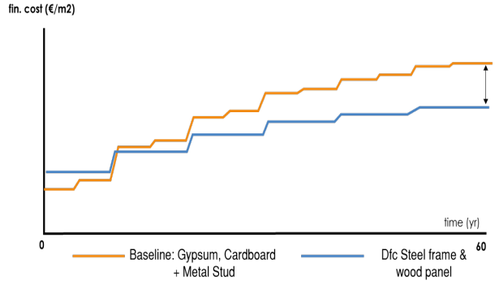
Looking at figure 13 the graphs indicate the difference in costs between a circular interior wall system and a traditional non-circular interior wall from Research carried out by GTL Lab under Bamb (2019). The graphs show the cost of materials where intermediate transformations are done to the building over a period of 60 years to show the cost under situations where the building would need to be transformed either to improve the quality or to meet the changing needs of its users. The blue line indicates the circular wall systems. The graph indicates that; at the point of transformation, there will be a transformation cost for the interior circular wall. However, there would be no extra cost to the material, as it would be designed for deconstruction and repurposing. The other line shows the non-circular material wall. The graph is a smooth curve indicating that the cost of transformation and materials are constant and accumulative.

Therefore, the initial cost of the circular material is relatively higher than that of the non-circular material, but factoring in transformations needed for the changing needs of users and owners, the long-term costs of circular materials would generally be lower. It is therefore a convincing argument that developers in the construction industry should not shy away from this increased capex, as the long-term gains are definitely worth the transition.

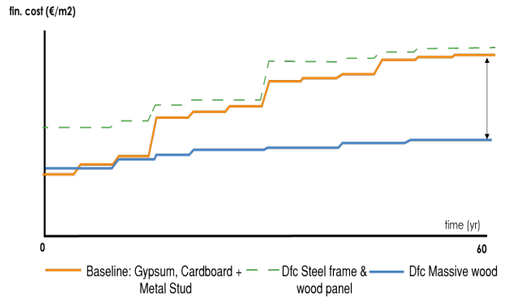
The graph on figure 14 developed by Enkvist and Klevnast (2019) indicates the carbon emissions saving that would be achieved if the construction industry was to shift to circular raw materials. As shown, a shift to circular construction with regard to the two main carbon emitting materials in the construction industry (Cement & Steel) would lead to a 53% reduction in carbon emissions.



Early Transformation

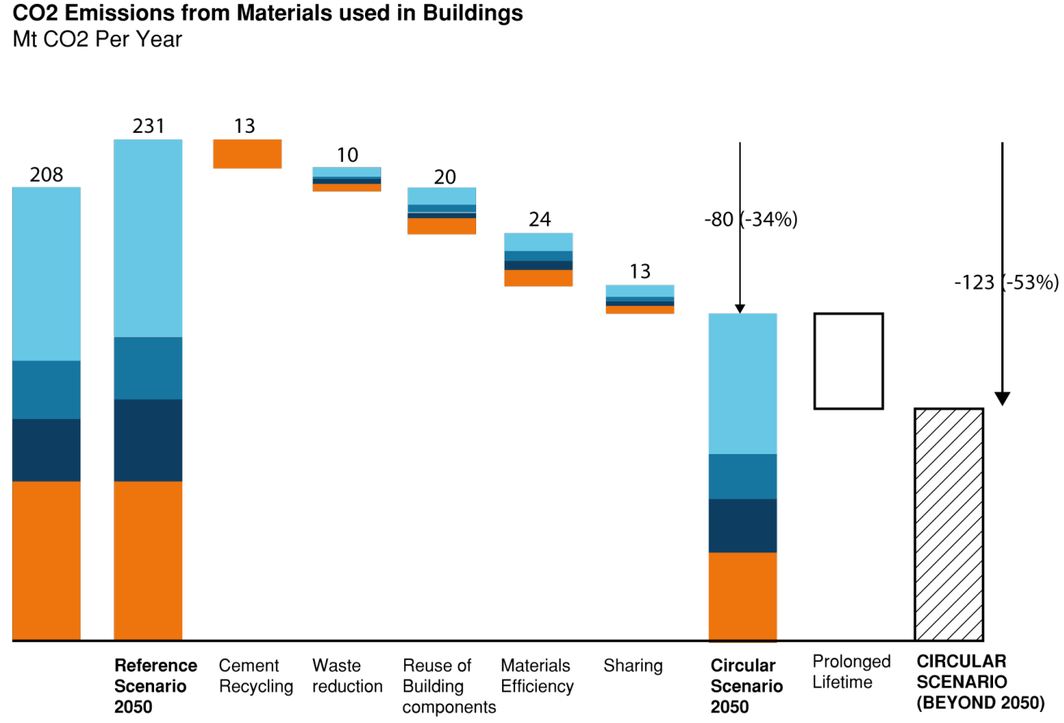


Transformation every 10ys



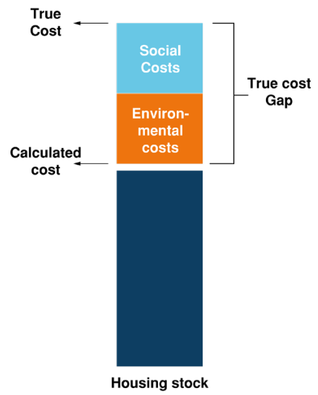
Transformation every 15ys

▲ **Figure 13**
Comparative cost for circular & non-circular materials (BAMB, 2019)



▲ **Figure 14** Projected CO2 saving from a circular Scenario (adapted from Enkvist & Klevnast, 2019)

▼ **Figure 15**
True cost of raw materials (adapted from TruePricing, 2020)



> **A circular scenario reduces CO2 emissions from building materials, millions tonnes of CO2 by 53%.**
> **Enkvist & Klevnast (2019)**

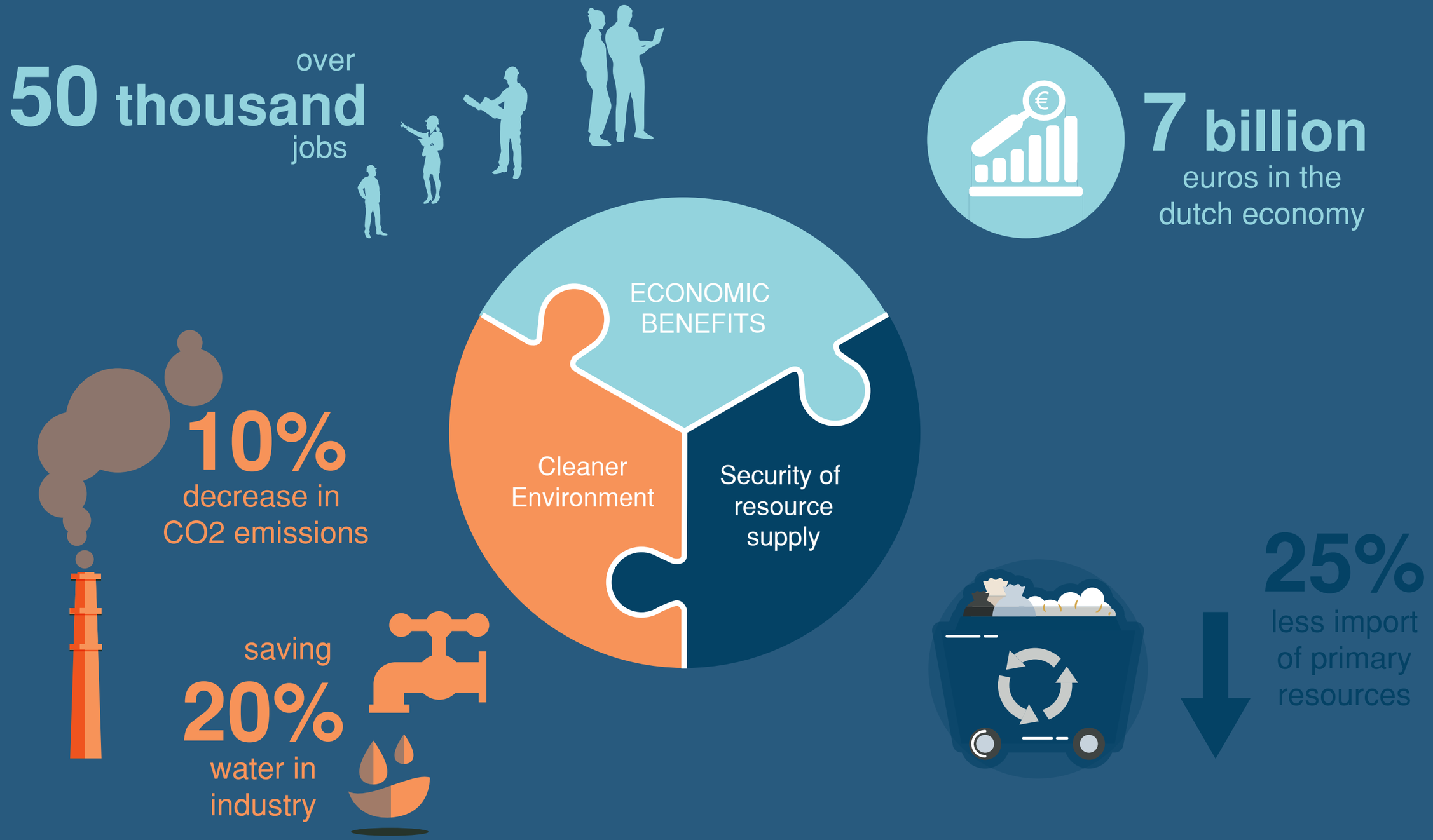
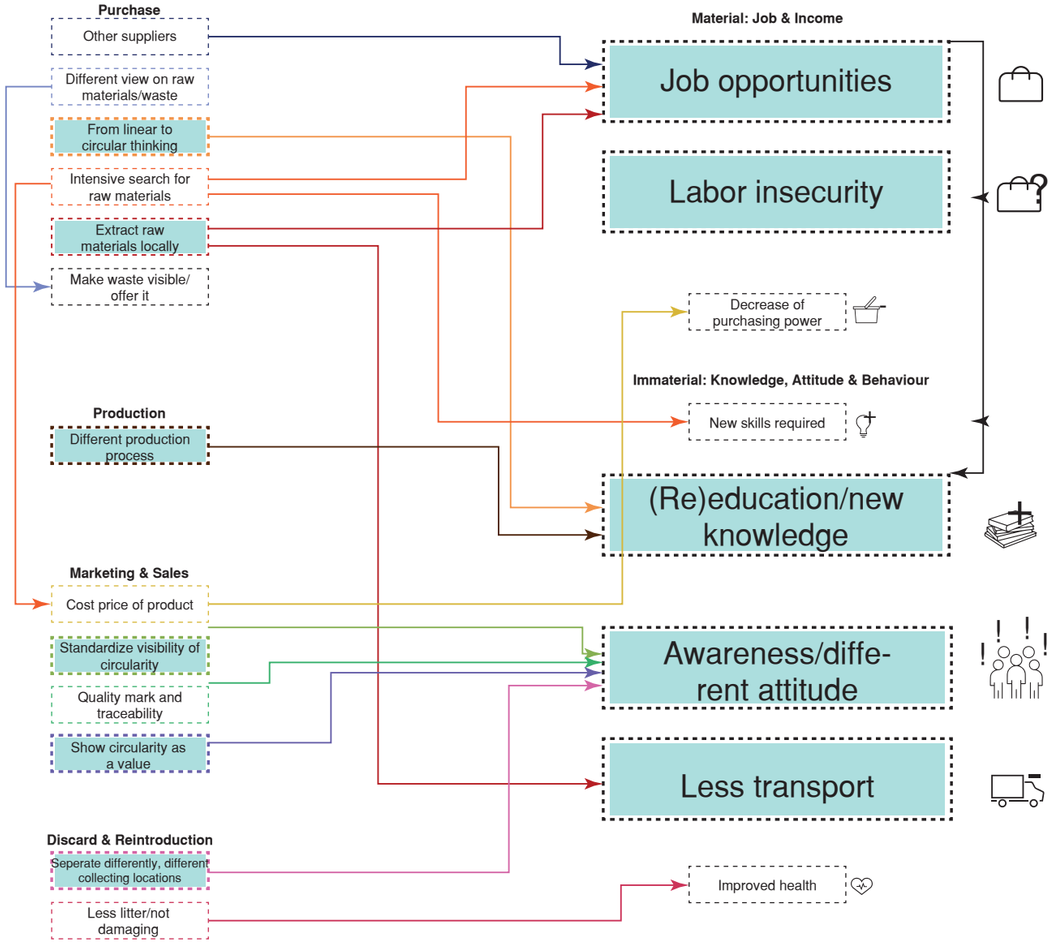


Figure 16
Benefits of the circular economy for the Netherlands
(adapted from illustration of TNO, 2018)

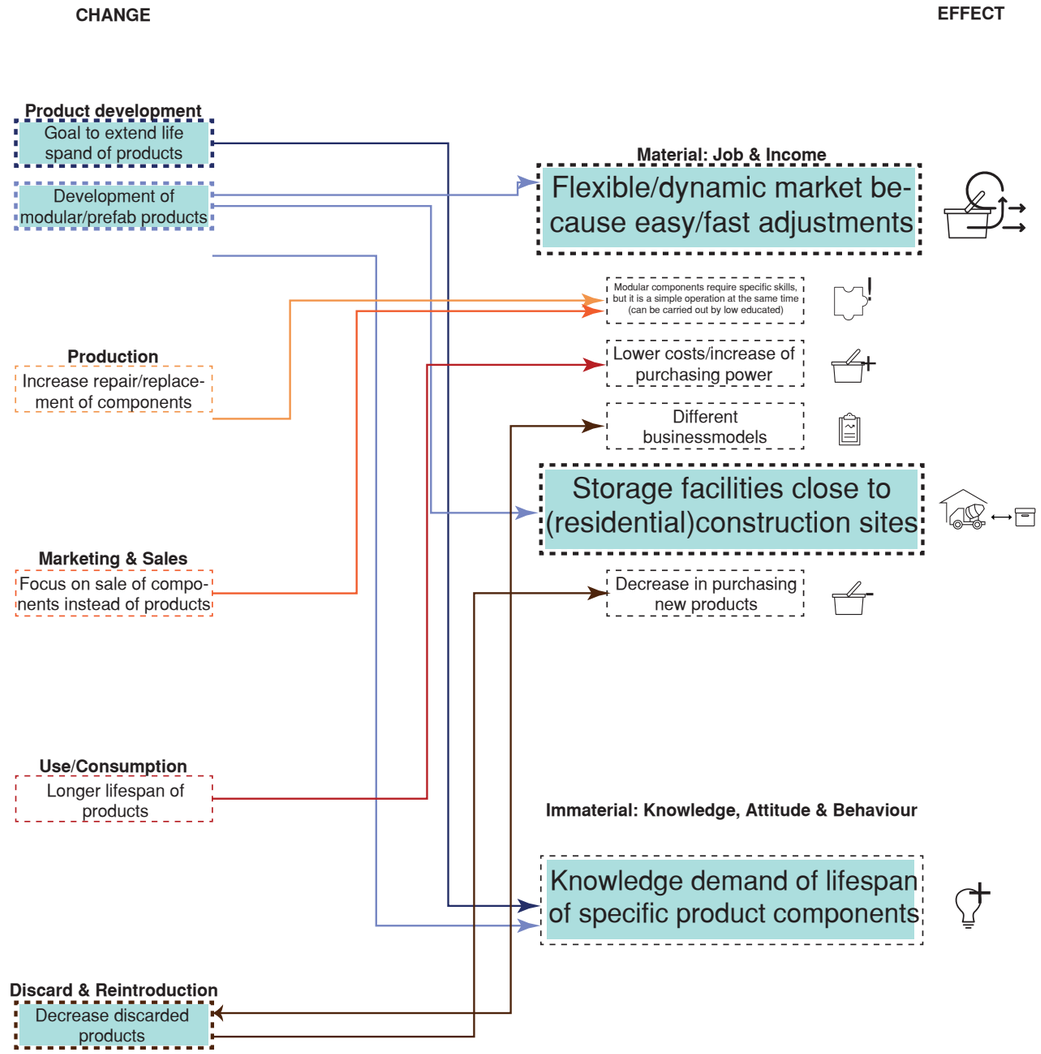
Social Impact

Circular raw materials



▲ **Figure 17** Flowcharts circular raw materials (illustration by authors, based on ECORYS, 2019)

Optimisation of the life span of products



▲ **Figure 18** Flowcharts optimisation of the life-span of products (illustration by authors, based on ECORYS, 2019)

As stated earlier, the change towards a circular construction industry bring about social and environmental costs. In 'Zuid Holland Circulair in 2050', Heestermans et al. (2019) made an exploratory study of the social consequences of the transition towards a circular economy. So far, little is known about these social consequences and the report therefore concerns exploratory first steps. Figures 17 and 18 offer a preparatory overview as the circular economy is not yet a reality. Social consequences are formulated on the basis of discussions about possible consequences and available forecasting research.

Because the focus is on circularity in the construction industry, 'Closed Loops, Open Justice' focuses on the social impact of the introduction of circular raw materials and the optimisation of the lifespan of products. The main effects of the introduction of circular raw materials are the shift in jobs, (re)education and needed participation and awareness.

The shift in job opportunities is caused by the costs and benefits of a circular economy, which are not evenly distributed in the beginning of the transition. This transition will possibly lead to a mismatch between supply and demand and the availability and suitability of workers to fill job vacancies. This shift in employment brings adjustment costs where employment might be disappearing or in which employees are obliged to receive additional training in order to remain employable.
Standardizing the visibility of circularity can lead to possible awareness and a different attitude towards the transition, where circular products can increase in value and possibly be marketed with a higher perceived value.
Modular and prefab construction play an important role in the transition towards a circular construction economy. Products are designed with a lifespan which is as optimal as possible, or where easy and fast adjustment are made possible to re-purpose the goal of a product.

4.3 Densification of South Holland

Current Densification Strategies

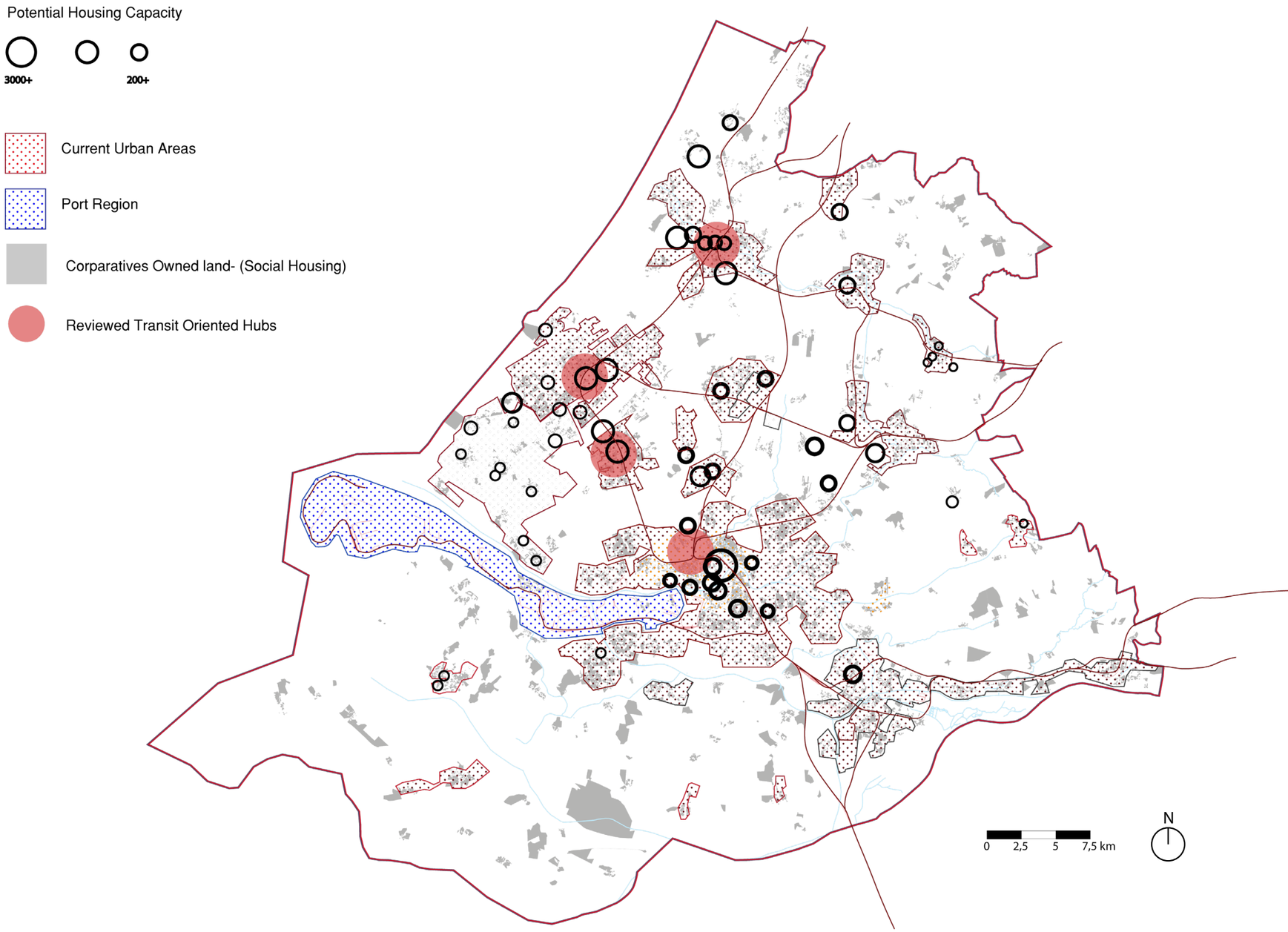


Figure 19 Densification Strategies Map (illustration by authors, based on OpenStreet Map, 2020; PDOK, 2020; & De Zwarte Hond, 2019)

The Province of South Holland has made great strides in trying to address the housing challenge of the Netherlands. The province intends to put up a projected 230,000 homes within the next decade. To do this it has commissioned research from different stakeholders within the construction and planning industry to try and come up with solutions for how to undertake this challenge. The province's main strategy includes, densification within the existing urban area, differentiation of housing stock, building close to public transport hubs, while exploiting potential of water infrastructures and green spaces, among other development strategies.

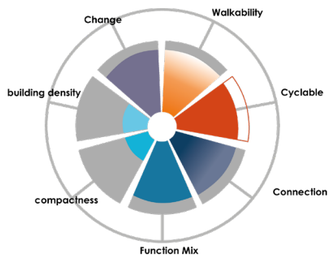
By building housing close to stations (train, metro, light rail and waterbus), public transport networks will be used more effectively and can be further extended. Each station can choose a distinctive profile, thus creating a reason to travel from one place to another. (De Zwarte Hond, 2020)

Figure 19 shows the map of south holland with the identified transport hubs within the region. It indicates the existing urban area extents and the potential housing capacity around each of this transport hubs. Some few areas identified for new developments are located outside the existing urban areas and provide opportunities for new solutions for densification at the edges of this urban areas. However, the main emphasis for densification still lies within the existing transport infrastructure hubs.

To further explore the TOD scenario, the state of South Holland did a study to measure the quality of life around the 67 train stations within South Holland based on ITDP's standard guidelines on Transit Oriented Development. They identified that, the areas around the stations are mostly car-oriented with few homes and amenities, lots of tarmac and parking. The TOD development they envision will therefore seek to redevelop the areas to allow people to make better use of public transport, walking and cycling. The figures below indicate the result of these study using the measuring instruments used, to show the improvements that could be made to these areas in order to improve the quality of life based on space and mobility.

However, from the visualizations charts shown in Figure 21, 23, 25, & 27, it is possible to see the type of projects that developers envision for these areas around transport hubs. This include high end residential and Mixed-use developments that cater to the needs of the middle-class society. When compared to the social housing neighbourhoods that surround this densification projects, there is a concern that if this type of development, if left unchecked, poses the threat of causing gentrification by raising the value of adjacent properties and eventually relegating the vulnerable groups further away from city centres and transport hubs.

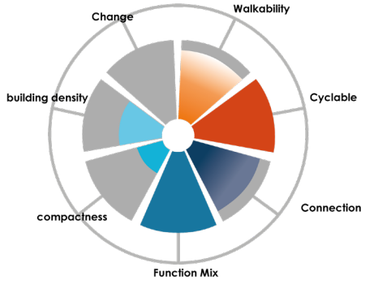
Transit Oriented Development (PZH)
(selected nodes)

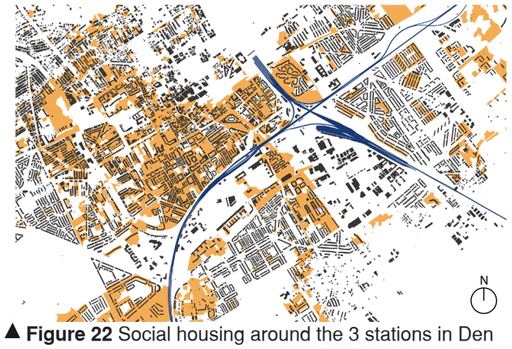


▲ **Figure 20** Social housing around Rotterdam Central Station (based on Open StreetMaps, 2020 & PDOK, 2020)

Figure 20 shows the ratings and improvement suggestions for the transport node of Rotterdam Central Station based on the Province's analysis criteria. However as seen on figure 21 the vision for the areas around this transport node as developed by different architecture firms feature buildings for individuals on the higher side of the income scale.

▲ **Figure 21** The Sax (MVRDV, 2020, Image: MVRDV)

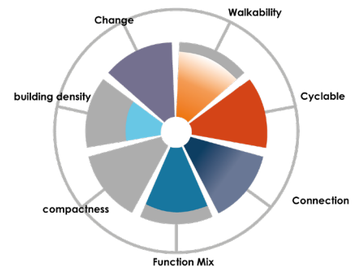




▲ **Figure 22** Social housing around the 3 stations in Den Haag (based on Open StreetMaps, 2020 & PDOK, 2020)

Figure 22 shows the ratings and improvement suggestions for the transport node of Den Haag Central Station based on the Province's analysis criteria. Figure 23 shows visualizations for developments around the this station. We can easily conlude that such buildings would be targeted towards groups on the higher side of the income scale.

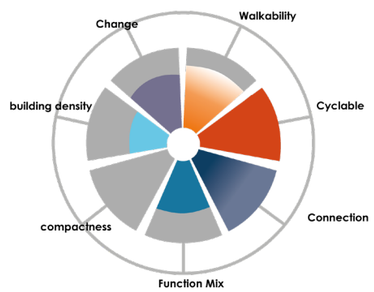
▲ **Figure 23** Future of the Hague
(Gemeente Den Haag, 2020. Image: Gemeente Den Haag)

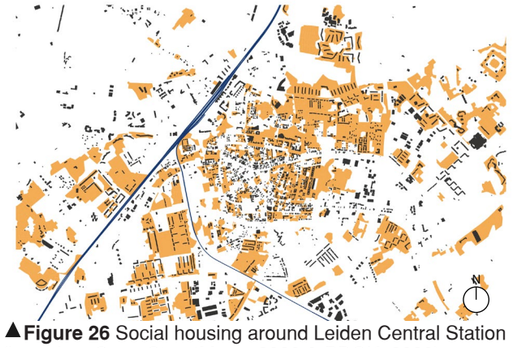


▲ **Figure 24** Social housing around Delft Station based on Open StreetMaps, 2020 & PDOK, 2020)

Figure 24 shows the ratings and improvement suggestions for the transport node of Delft Central Station based on the Province's analysis criteria. Figure 25 shows visualizations for developments within the areas around this station. The target group of such buildings are for income groups on the higher side of the scale.

▲ **Figure 25** Development in Delft (Archdaily, 2020. Image: Van Dongen-Koschuch Architects and Planners, 2020)





▲**Figure 26** Social housing around Leiden Central Station (based on Open StreetMaps, 2020 & PDOK, 2020)

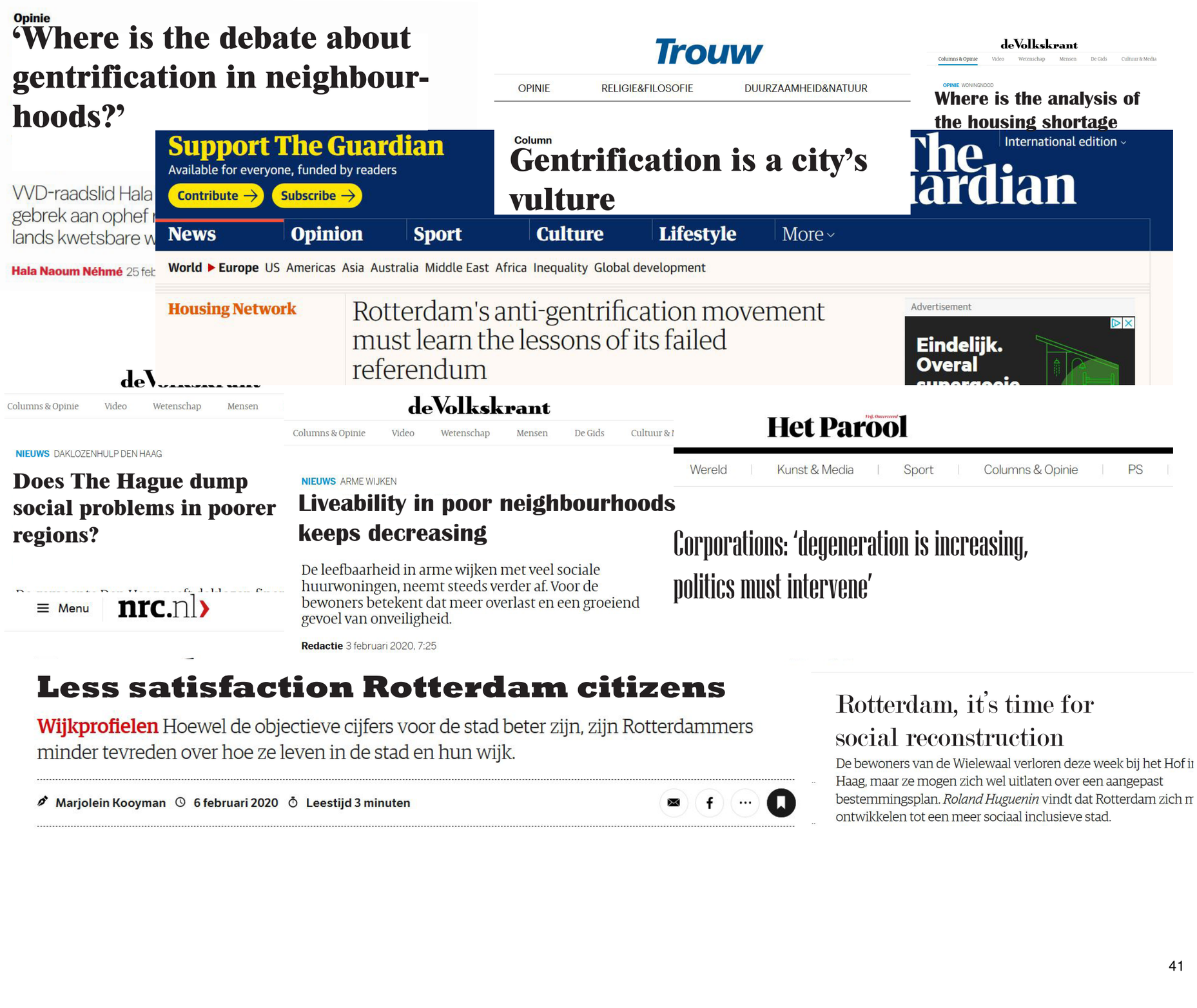
Figure 26 shows the ratings and improvement suggestions for the transport node of Leiden Central Station based on the Province's analysis criteria. Figure 27 shows visualizations for developments within the areas around this station. Similarly, The target group of such buildings indicate that they are for income groups on the higher side of the scale.

▲ **Figure 27** Development in and old factory in Leiden
(De MeelFabriek, 2020. Image: De MeelFabriek)

Social Relevance

Within the current assignment of adding 1 million homes there is an underlaying assignment which is a notable topic in society, as highlighted by the media: the social housing sector. The construction of social housing reached an all time low in 2019 (Julen, 2019). Aedes, the overarching association for social housing corporations, is naming the landlord tax as the main problem of this all time low (Aedes, 2019). Geographer Cody Hochstenbach wrote a column in RTL Z (2019) where he pointed out that the government is purposefully neglecting the social housing sector. The landlord tax is only a part of political actions to limit the sector.
Since 2013 the sector counts 100.000 less dwellings. Waiting lists are increasing and more people fall by the wayside (Ten Teije, 2019). According to Federatie Opvang (2019) even people with a regular job can get homeless. Interviews in several newspapers show people that cannot find a house, even though they have been on waiting lists for 8 years (Ten Teije, 2019)(Start, 2019). Former Aedes-chairman stated that a generation is growing up for whom buying a house will be elitist (Julen, 2019), although there is still an ideology for private owned housing (Hochstenbach, 2019).
Institutions and individuals are calling for action, using the media as signboard.

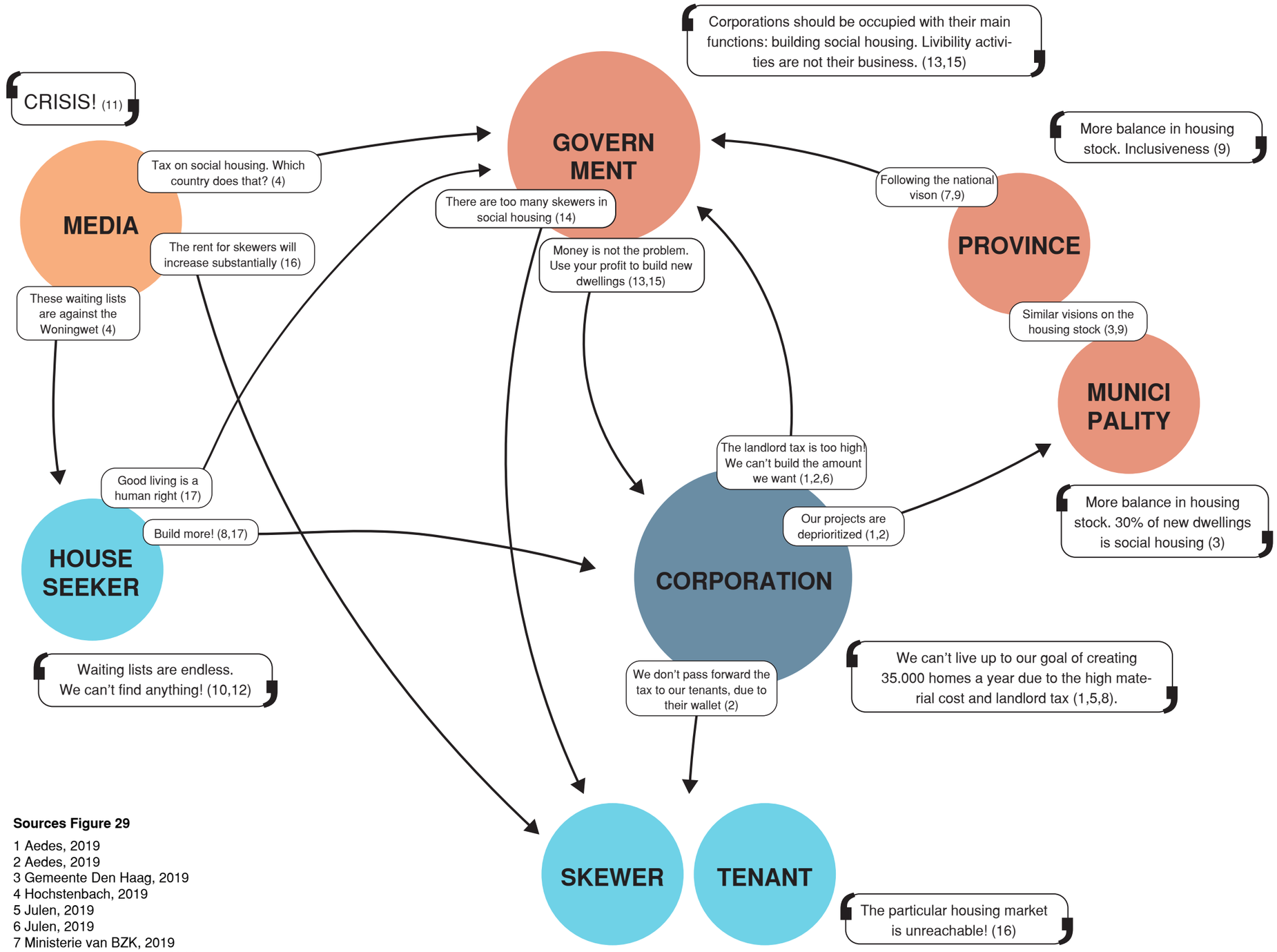
4.4 Social Housing Crisis



▶ **Figure 28**
Headlines on the Social Housing Crisis (illustration by authors, based on Benali, 2018; Bolhuis, 2020; De Volkskrant, 2020; Doucet et al, 2016; Huguenin, 2020; Kooijman, 2020; Winterman, 2020)

Stakeholders & Conflicts

Columns and newspapers gave attention to the social housing crisis. Figure 29 explains the situation of this crisis. It shows the starting points of the stakeholders and the conflicts between them.
In 2013 the government set a landlord tax for corporations. This led to a decrease in the construction of social housing (Aedes, 2019). Corporations asked in a letter to the government to 'stop with this high taxes' because they can not reach their goal of creating 25.000 homes per year (Julen, 2019). The government, on the other hand, claims that the corporations have a profit of 4 billion euros per year they could use to build social housing (VTW, 2020). The statement of the VVD (party in coalition) on corporations is that they should focus on building social housing and not middle class housing and liveability activities (VVD, 2020). On top of that, the VVD states that there are a lot of skewers in social housing, which is unfair (VVD, 2020).
These skewers, as well as regular tenants in social housing report that if they want to leave their house, the free and private sectors are unreachable (Winterman, 2018). Waiting lists can reach up to eight years in cities (RIGO, 2019).
The second problem mentioned by corporations is that they are deprioritized by municipalities (Aedes, 2019). They do not have enough locations to build, although municipalities and provinces want more balance and inclusiveness in the housing stock (Gemeente Den Haag, 2019) (Provincie Zuid-Holland, 2019). The deprioritization is mainly due to the focus on Transit Oriented Development and gentrification of inner city areas (Doucet et al., 2016).



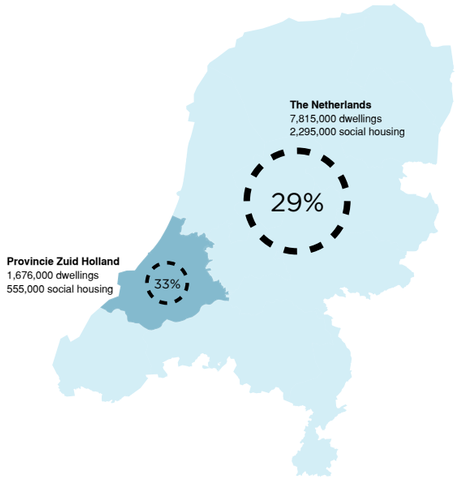
Sources Figure 29

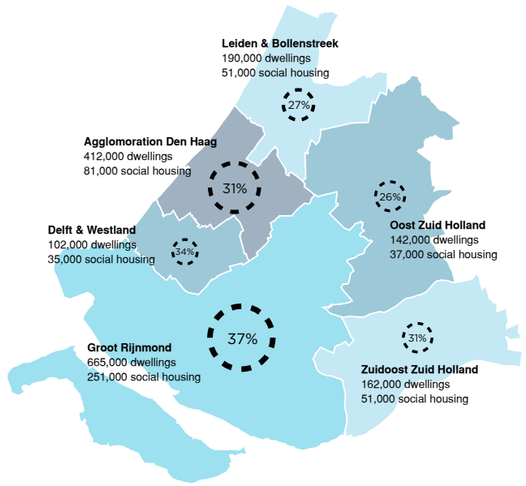
1 Aedes, 2019
2 Aedes, 2019
3 Gemeente Den Haag, 2019
4 Hochstenbach, 2019
5 Julen, 2019
6 Julen, 2019
7 Ministerie van BZK, 2019
8 Provincie Zuid-Holland, 2018
9 Provincie Zuid-Holland, 2019
10 RIGO, 2019
11 Ten Teije, 2019
12 Ten Teije, 2019
13 VTW, 2020
14 VVD, 2020
15 VVD, 2020
16 Winterman, 2018
17 Woonbond, 2020

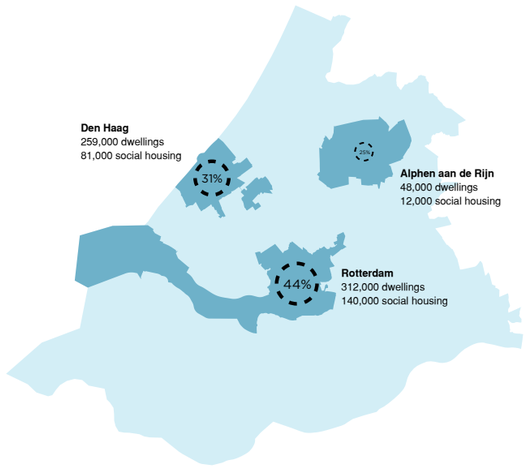
▶ Figure 29
Stakeholders and their conflicts in the social housing crisis (illustration by authors, based on sources numbered bottom left).

Social Housing Percentage

The Netherlands have one of the highest percentage of social housing in Europe (De Jong & Van der Moolen, 2014). The graphs in Figures 30-32 show the percentage of social housing in the total housing stock (CBS, 2019). It represents the size of the social housing crisis: 29% is social housing, which makes 2,3 million dwellings. In South Holland it is even higher with 33%. Rotterdam is the capital of social housing: 140.000 social housing units, which makes 44% of the total stock.







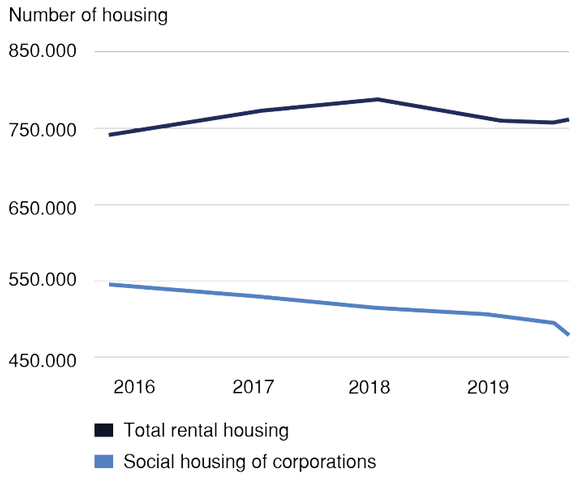
▲ **Figure 30**
Social housing percentage in the Netherlands and South Holland (illustration by authors, based on CBS, 2019)

▶ **Figure 31**
Social housing percentage in the corop-areas in South Holland (illustrations by authors, based on CBS, 2019)

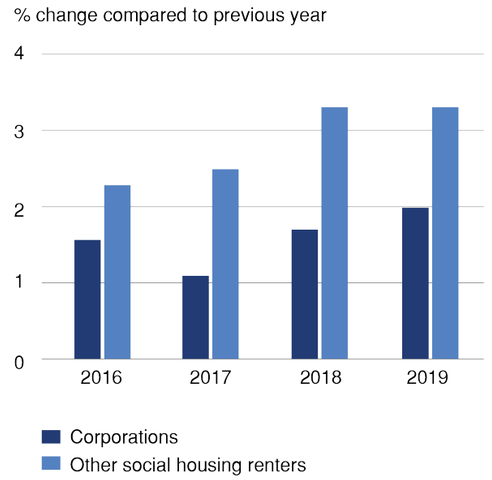
▼ **Figure 32**
Social housing percentage in Rotterdam, Den Haag and Alphen aan de Rijn (illustration by authors, based on CBS, 2019)

Problems in the Social Housing Sector

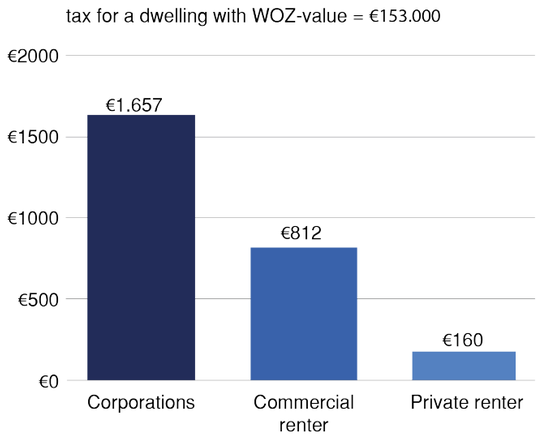
Figure 33 shows the increasing amount of housing, but the decreasing amount of social housing. However, the quantity is not the only problem in the current social housing crisis. The housing prices are rising exponentially, especially the private sector (CBS, 2020). This puts extra pressure on social housing and it is the reason that there are many skewers: people who live in social housing are not able to make the jump to the private sector (Winterman, 2018). On top of that, figure 35 shows the amount of landlord tax different institutions pay for a house with a WOZ-value of 153.000 euro (Aedes, 2019). A corporation pays ten times more than a private renter. Lastly, tenants in social housing are decreasingly satisfied. Where 80% was satisfied in 2006, is only 70% satisfied in 2019 (CBS, 2019). These graphs show the problems in social housing are quantative and qualitative.



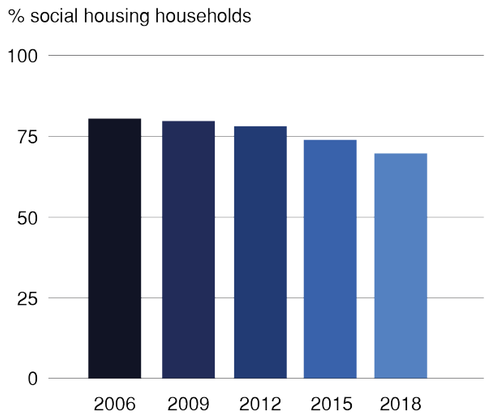
▲ **Figure 33**
Development of the housing stock
(based on CBS, 2020)



▲ **Figure 34**
Percentual change of housing price per year
(based on CBS, 2020)



▲ **Figure 35**
Landlord tax per landlord type
(based on Aedes, 2019)



▲ **Figure 36**
Satisfaction in social housing per household
(based on CBS, 2020)

State of Social Housing

The current state of social housing shows the qualitative side of the social housing crisis. An analysis has been made on the buildings and demographics in social housing areas in South Holland. The complete analysis can be found in the appendix.
South Holland has four types of social housing areas: prewar workers areas, postwar portico areas, postwar rowhouse areas and student housing areas (Blom et al, 2004) (CBS, 2020)(Google Streetview, 2020) (PDOK, 2020).
The focus will be on the postwar areas built between 1945 and 1960, when there was housing shortage. A large amount of housing had to be build what took off quality and craftsmanship (Blom et al., 2004). Several of these social housing areas has been designated as problem areas or 'power areas' which are in need of transformation (Lörzing & Harbers, 2009).
Two example areas are shown: Moerwijk in Den Haag and Haarwijk in Gorinchem. Moerwijk is an examplar project for a postwar area in a large city. It has portico apartment blocks, often with a blind ground floor (Google Streetview, 2020). Two third of the population has a migration background and most households are young families (CBS, 2019). Where the building statistics of Haarwijk are similar to Moerwijk, except for the row houses instead of portico apartments, the demography is completely different. Most residents are native Dutch and all types of households and ages are represented (CBS, 2019).
The concrete structures make it possible to renovate the buildings without removing the construction. A renovation of the facade and installations can improve the sustainability, durability and quality of the buildings.

Figure 37: Moerwijk is dilapidating
(In de Buurt Den Haag, 2019. Photo ANP Valerie Kuypers)

Figure 38: Blind Ground Floors
(Omroep West, 2015. Photo Maarten Brakema)

Moerwijk, Den Haag

age 1950 - 1970
typology portico
energylabel D - E
facade brick, glass, plaster
construction concrete
constraints asbesthos, state

age mainly 0 - 40
migration background 80%
household type mainly families

Figure 39: Ghosttown Haarwijk (AD, 2019. Photo Cor de Kock)

Figure 40: Ghosttown Haarwijk
(BN de Stem, 2019. Photo Jens Verhagen)

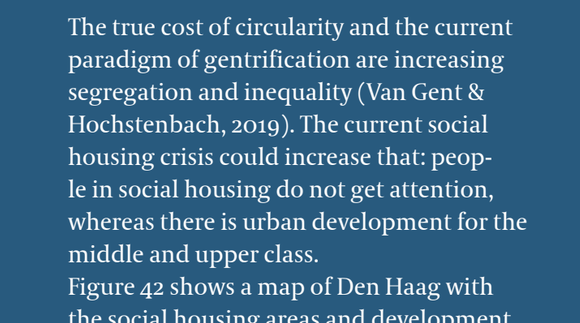
Haarwijk, Gorinchem

age 1950 - 1970
typology row houses
energylabel C - E
facade brick, glass, tiles
construction concrete
constraints asbesthos, state

age all
migration background 15%
household type all

Segregation & Inequality

The true cost of circularity and the current paradigm of gentrification are increasing segregation and inequality (Van Gent & Hochstenbach, 2019). The current social housing crisis could increase that: people in social housing do not get attention, whereas there is urban development for the middle and upper class.
Figure 42 shows a map of Den Haag with the social housing areas and development areas. As we concluded in the current state of social housing, these areas are in need of transformation. Although the municipality of Den Haag wants to balance the housing stock, they are focussing on transit oriented development around the three main train stations (Gemeente Den Haag, 2019). These development areas are outside of the social housing areas.
The Gini-coefficient, a measure for segregation, is already high in Den Haag (Leidelmeijer et al., 2015). Segregation is caused by dissimilarity and it results in inequality. (Whyte, 1983). Increasing segregation will increase inequality, which will increase dissimilarities and thus increase segregation. This negative spiral will cause that social housing areas are driven out of the city.



▲ **Figure 41**
Gentrification is driving social housing out of the city

▶ **Figure 42**
Segregation Map of Den Haag
(based on PDOK, 2020)

Conclusions on the Challenges

From the analysis we can see there is a slow shift towards a circular construction industry. The Netherlands continues to make strides towards a sustainable construction industry while addressing the pressing challenge of creating 1 million homes, of which 230,000 are in the Province of South Holland. However, the construction industry needs to embrace a closed loops approach in order to also address the challenges of climate change and decreasing resources. Despite this positive opportunities we must also recognize that construction businesses ready to be front runners in the shift will require a lot of support through regulations, policies and stakeholder engagement in order for their business models to make economic sense. All stakeholders need to embrace this true cost of the shift which can only be achieved by radically changing our values and business models from short term objectives to long-term value based objectives.

The densification of South Holland has began and a lot of emphasis has been placed on developments around transportation hubs. The Province must however be keen to avoid gentrifying existing social housing neighborhoods in the process of trying to achieve their housing targets. We observe a neglect on the quality of existing social housing stock which are most in need of renovation and transformation in order to improve the quality of life for the vulnerable groups in society. Continued neglect of this sector will only serve to increase social segregation, and wealth disparities. However, due to the nature of social housing corporatives business models, they present the perfect opportunity for all stakeholders in the construction industry, led by urbanists and the Province of South Holland to implement our "Closed Loops, Open Justice" vision to try and address the challenge of densification of the urban form and spatial justice for the vulnerable groups of society.

The use of circular construction models in the provision of just social housing developments will serve as a benchmark for not only other regions of the country but also the entire world.

> **" Social housing corporations are ideally suited to implement circular economy business models since both favour long-term inclusive value above mere financial profits.**
>
> **(Nederland Circulair, 2019)**

5. South Holland in 2050

In 2050, the province of South Holland will provide inclusive and just social housing through integrated circular construction processes. These construction processes, while including the true social and environmental cost of circularity, will provide innovative models for social housing through processes which include local production and flexible construction using recycled and locally produced materials to reduce the environmental impact of new imported materials. The provision of social housing will include integrated systems for participation and awareness to provide knowledge about the benefits and costs of the transition. The social housing will be fairly distributed in urban areas where residents have good accessibility to quality public and -green spaces, services, and infrastructure.

South Holland 2050
This regional vision map shows the main tools to reach circular construction flows and just social housing.

Regional Interventions
In addition to the vision map, this map shows the regional interventions that are made to support the vision.

Rotterdam Heijplaat 2050
This map of Heijplaat shows how the vision translates itself to the local scale. The main tools and locations are shown. Further elaboration on the local interventions will be done in the strategic projects in chapter 7.

Figure 43 Regional Vision Map

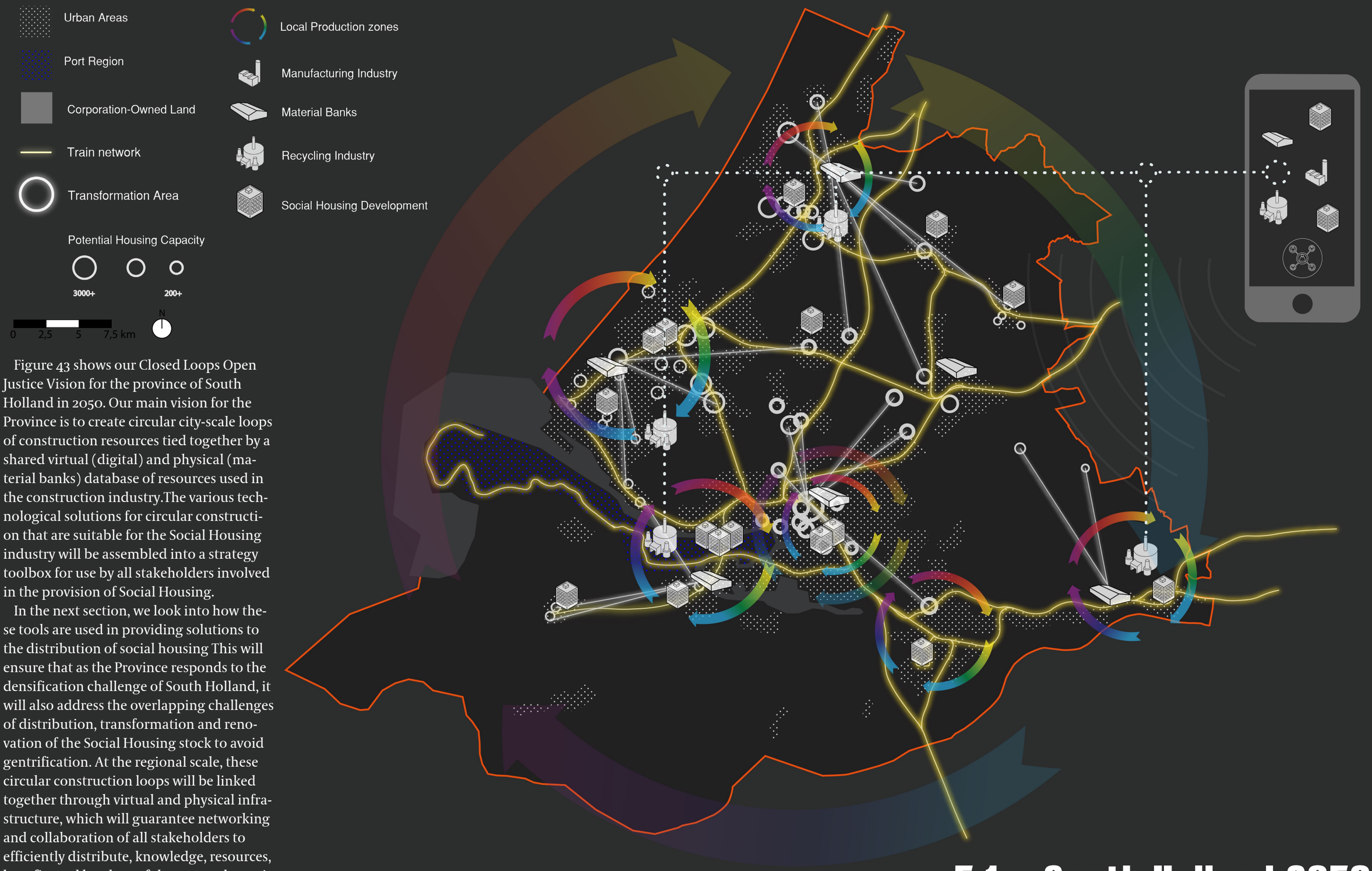


Figure 43 shows our Closed Loops Open Justice Vision for the province of South Holland in 2050. Our main vision for the Province is to create circular city-scale loops of construction resources tied together by a shared virtual (digital) and physical (material banks) database of resources used in the construction industry.The various technological solutions for circular construction that are suitable for the Social Housing industry will be assembled into a strategy toolbox for use by all stakeholders involved in the provision of Social Housing.

In the next section, we look into how these tools are used in providing solutions to the distribution of social housing This will ensure that as the Province responds to the densification challenge of South Holland, it will also address the overlapping challenges of distribution, transformation and renovation of the Social Housing stock to avoid gentrification. At the regional scale, these circular construction loops will be linked together through virtual and physical infrastructure, which will guarantee networking and collaboration of all stakeholders to efficiently distribute, knowledge, resources, benefits and burdens of the new and sustainable circular construction industry.

5.1 South Holland 2050

Figure 44 Regional Interventions Map

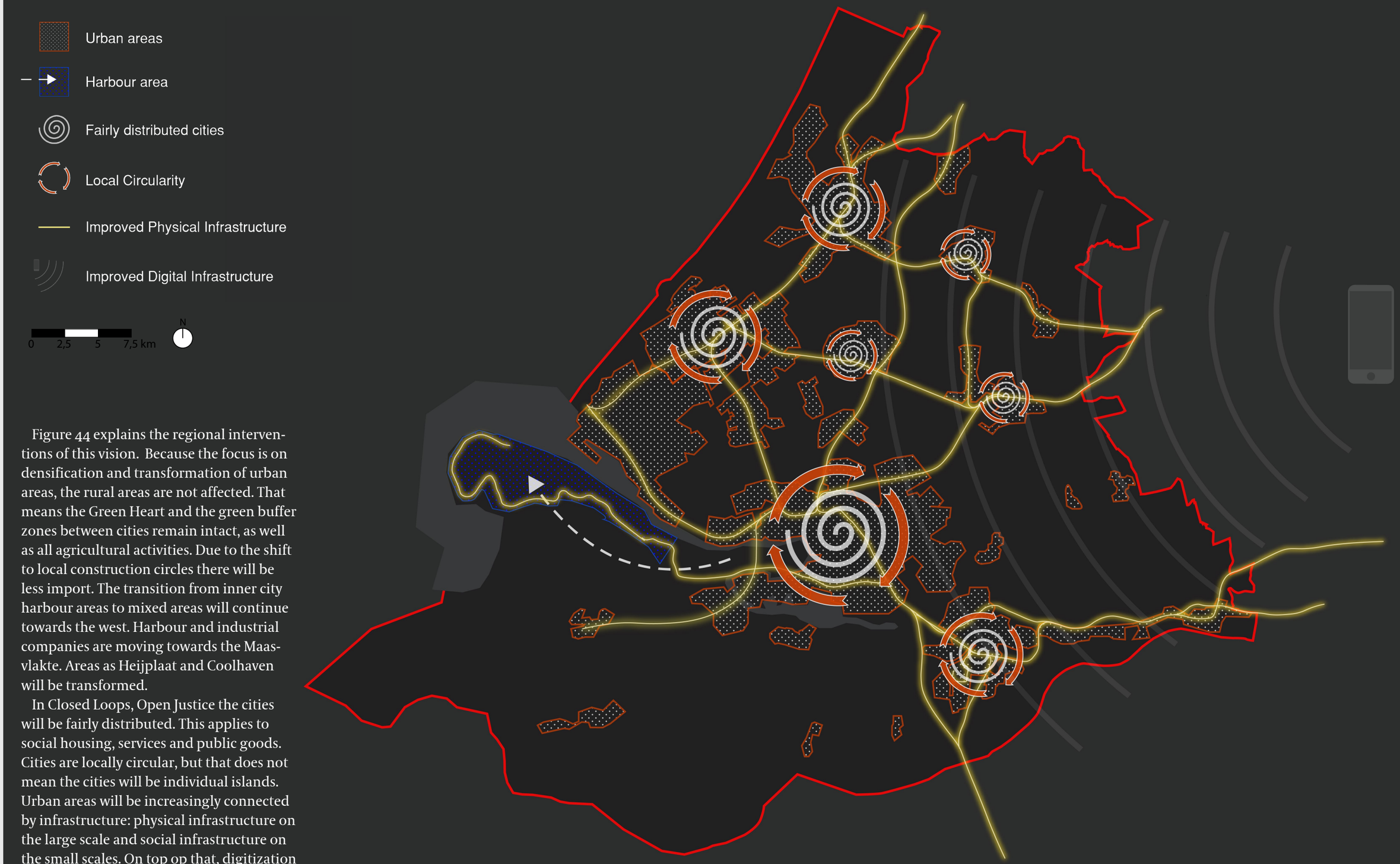
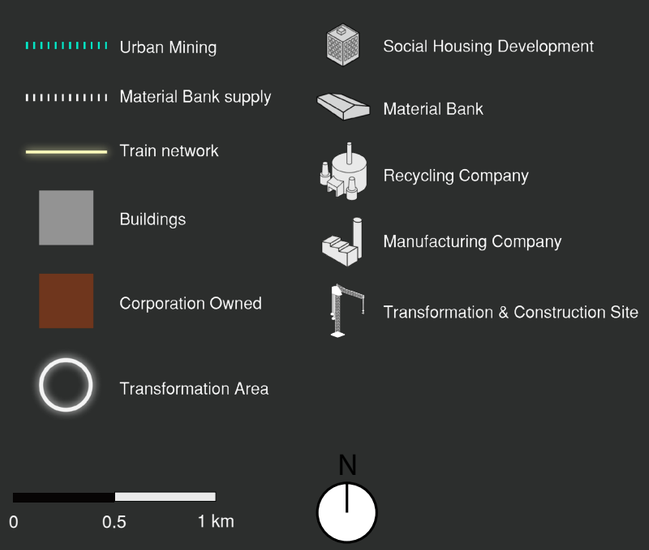


Figure 44 explains the regional interventions of this vision. Because the focus is on densification and transformation of urban areas, the rural areas are not affected. That means the Green Heart and the green buffer zones between cities remain intact, as well as all agricultural activities. Due to the shift to local construction circles there will be less import. The transition from inner city harbour areas to mixed areas will continue towards the west. Harbour and industrial companies are moving towards the Maasvlakte. Areas as Heijplaat and Coolhaven will be transformed.

In Closed Loops, Open Justice the cities will be fairly distributed. This applies to social housing, services and public goods. Cities are locally circular, but that does not mean the cities will be individual islands. Urban areas will be increasingly connected by infrastructure: physical infrastructure on the large scale and social infrastructure on the small scales. On top op that, digitization will also improve the digital infrastructure in and between cities.

5.2 Regional Interventions

Figure 45 Local Vision Map Heijplaat



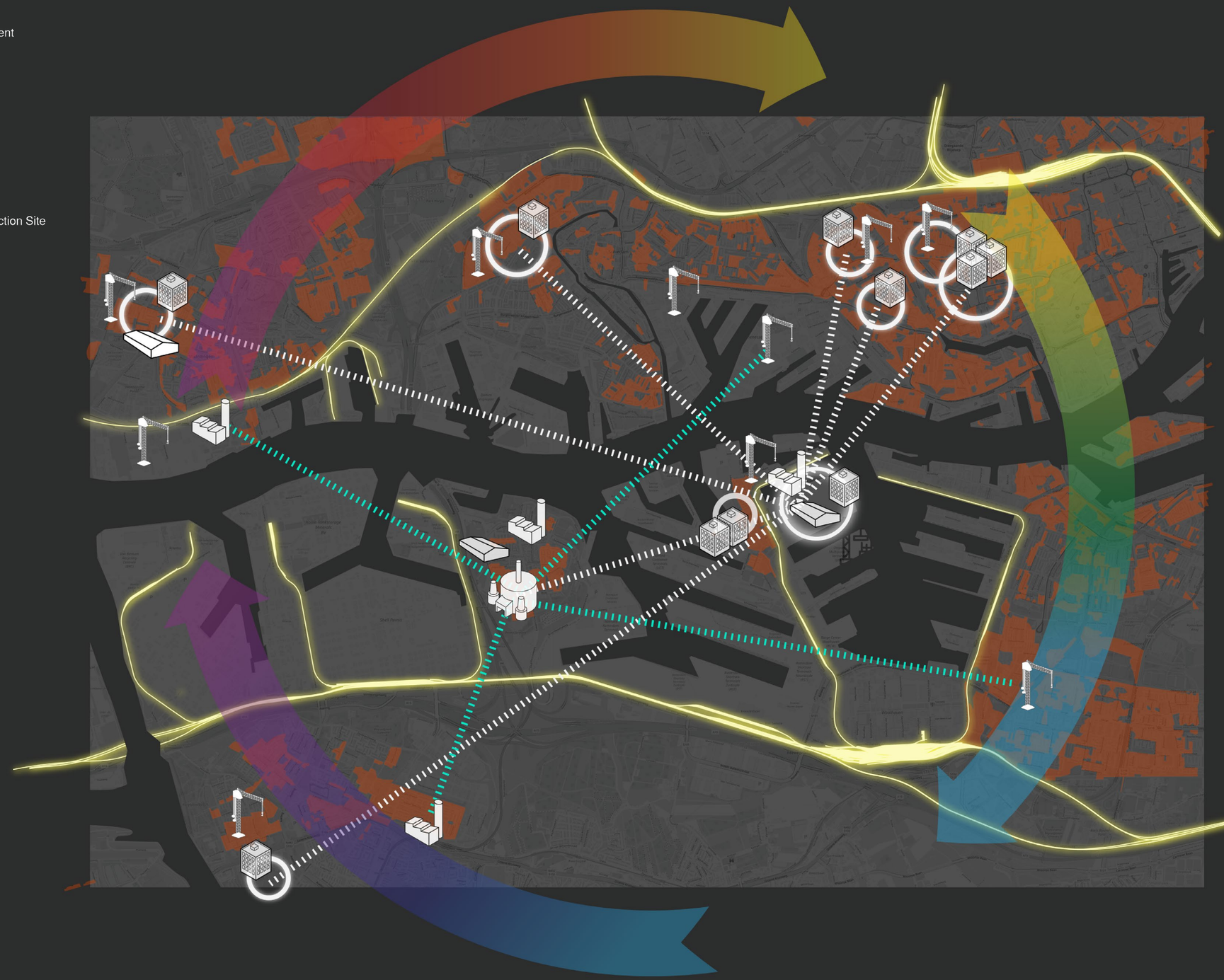


Figure 45 illustrates how we envision the circular construction loops at city-scale. The representative loop of Rotterdam is used in this illustration. The loops will be implemented at City-scale to ensure that densification happens only within the boundaries of the existing urban areas.

With a reduction in importation, the former industrial areas around the port will be used to set up more recycling and manufacturing industries that will process new locally sourced materials through sustainable design and manufacturing technique. These production and recycling centres will then be linked with material banks to ensure that all materials are accounted for in the development process. The building components and materials can then be transported to construction sites across the city or region and used in buildings for the duration required.

When need for transformation of buildings arises, surplus materials can be deposited back to the banks and where necessary recycled and supplied back to the material bank. This will reduce construction waste, where designers can then find new design purposes for available material resources.

5.3 Rotterdam Heijplaat 2050

6. Development Strategy

To create circular construction loops for a just social housing industry, we created a development strategy. A set of design tools and policies are put together. These policies are developed from an in-depth stakeholder analysis. The implications of the tools and policies are shown in strategic projects. The strategy is multiscalar, starting at the region level. The regional interventions map showed the implications on the province of South Holland. Zooming in to the neighbourhood scale, a strategic design is made for three locations in the province: Moerwijk in Den Haag, Haarwijk in Gorinchem, and Heijplaat in Rotterdam. This will be further elaborated in chapter 7 on the strategic projects.

Design Toolbox

To realise the vision a toolbox is put together, consisting five main tools and accessory subtools. These tools will be implemented in the strategic projects, to subsequently be implemented in other areas to a certain extent.

Stakeholder Analysis

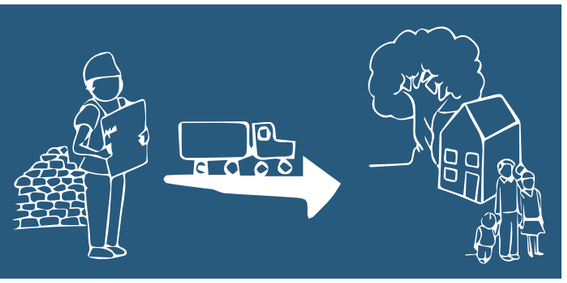
The vision and toolbox will affect stakeholders. The current stakeholders and conflicts between them are mapped. The report suggests a set of policies and engagement strategies to counter conflicts and set up collaborations for the future situation.

Policies

To reach circularity, inclusiveness and equality, a set of essential policies is created.

6.1 Tools

local production



modular/flexible construction

transformation & restoration

infrastructure development

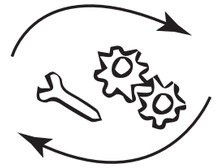
digitization

Local Production

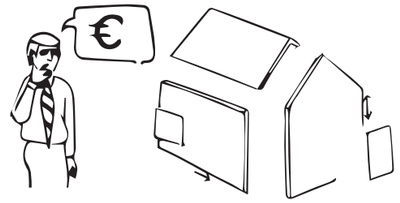
Figure 46 Local Production Collage (illustration by authors, based on Carles Enrich, 2015)

The transition towards a circular economy goes beyond economical and smarter use of raw materials, products and services. It also concerns people, social inclusion and other working methods and processes within and between organizations (Grondstoffenakkoord, 2017). Local production is not only able to focus on the physical changes towards a circular construction industry, but is also a way to include the social changes. In this way local production can be implemented as one of the main tools in order to realise the vision of 'Closed Loops, Open Justice'.

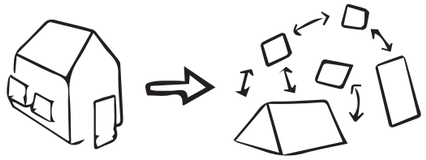
Recycle companies
The focus is on circularity in the construction sector. Current factories will transform into recycle companies to achieve a system that attempts minimizing value destruction in the overall system and to maximize value creation in each link in the system.



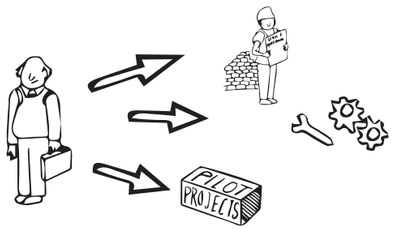
Prefab companies
Prefab companies deal with the process of construction in which materials are made into separate elements in advance, after which they are transported to the construction site and processed there.



Material banks
Material banks are databased transition stations that realise the distribution of materials in order to reduce the waste of buildings.



Regional coordination
The local production is coordinated regionally. In this way local production loops all work together, instead of local loops working separately. This emphasizes the need for local and regional synergies working together in order to achieve a regional circular economy.



Integration of actors
The shift towards a circular economy concerns more than working methods. Synergies and cooperation between people and organizations play an important role in realising the transition towards a circular construction industry.

Integration in society
Integrating the local production in society can increase visibility and participation of circular initiatives which can lead to possible awareness and a different attitude towards circularity, where circular products can increase in value.

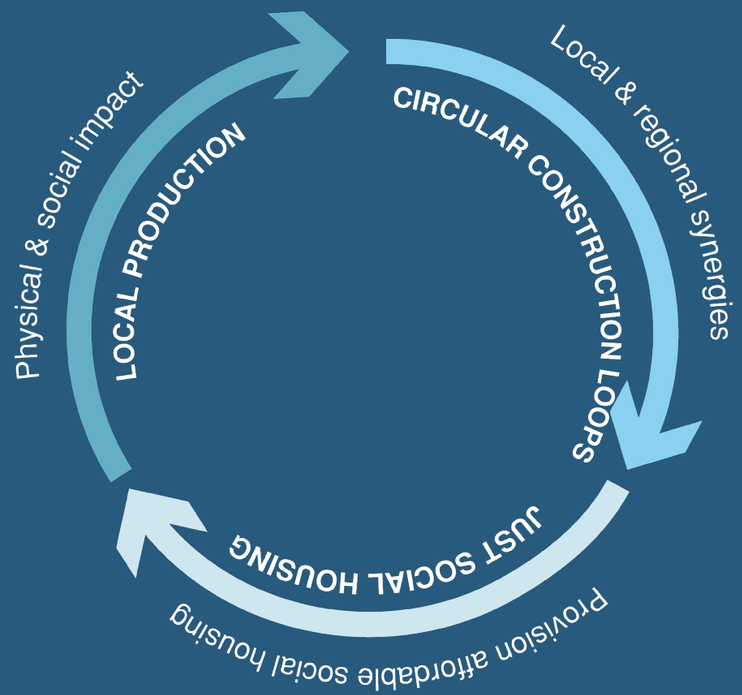
Local production

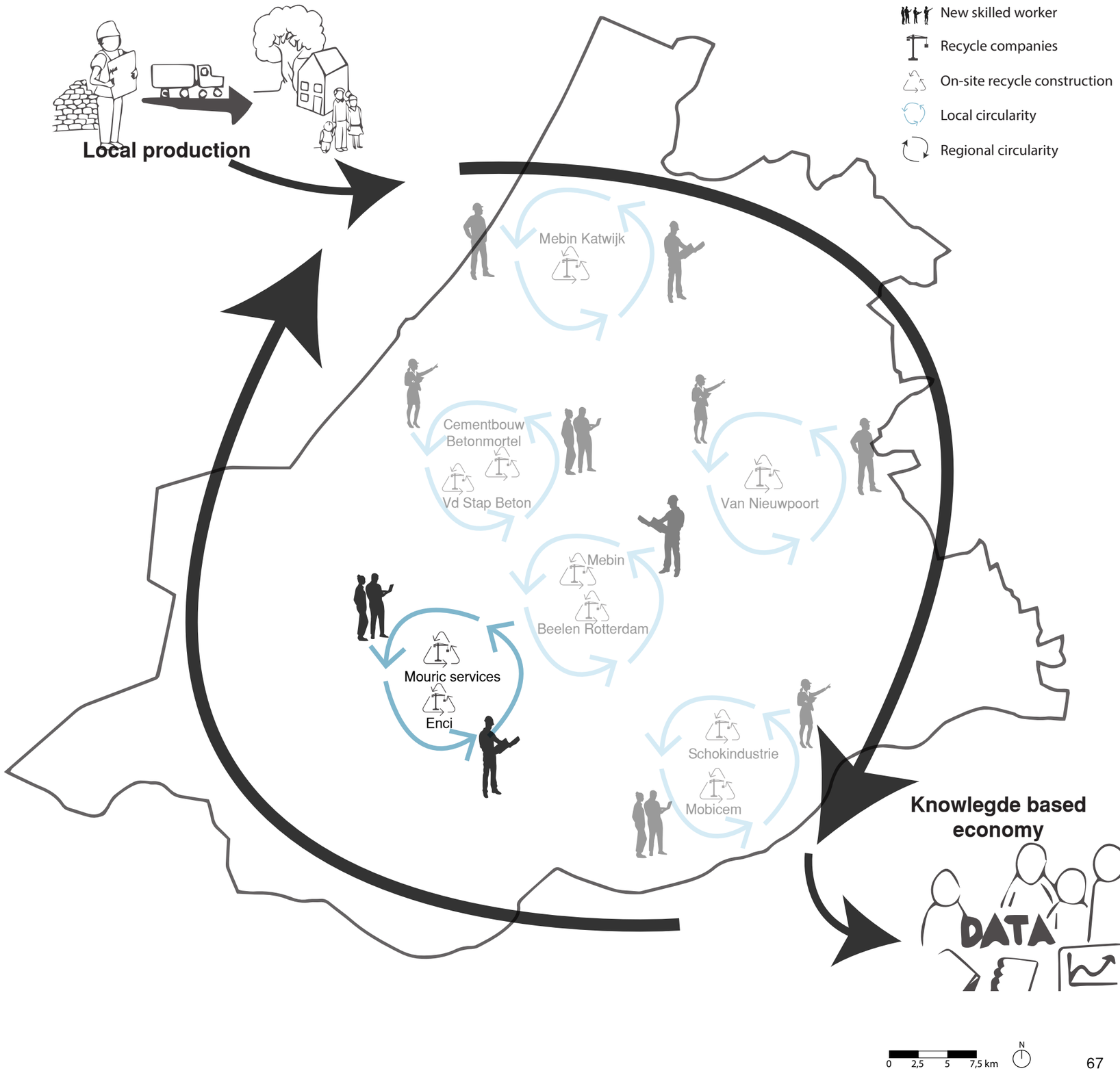
Integrating local production in the construction sector can contribute to achieving a circular just economy as shown in Figure 47. By focussing on closing loops on smaller scales, import and export towards and from The Netherlands is decreased significantly. Recycling- and prefab companies can be included more in the construction process and also material banks are focused on the reuse and recycling of materials.

The shift towards local production makes the (manufacturing) process of construction materials more organized and trackable which increases the visibility of circularity and influences the social impact of the transition towards a circular economy. The social impact is mostly geared towards raising awareness and creating jobs. The transition towards a circular construction economy focuses on a more knowledge based economy. This knowledge based economy can result job opportunities, retraining or (temporary) acceptance of a lower wage (TNO, 2019).

► **Figure 47**
Local production on the regional and local scale (illustration by authors, based on Belussi, 1999)

▼ **Figure 48**
Effects of Local Production





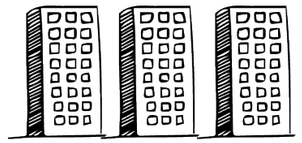
Flexible Construction

Figure 49 Flexible Construction Collage (illustration by authors, based on SuperArchitects, n.d.)

Flexible/Modular construction uses standardized design and prefabrication produced in the factory to make living units off-site. The materials are transported to the construction site and installed into houses. Because of the premade units and materials, it is easily adaptable to meet various on-site demands.

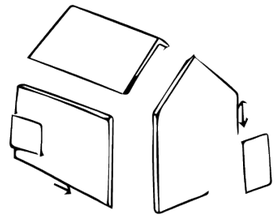
Standardization

Standardized design uses modules and considers modular materials while designing. Fixed size doors, windows, walls and even living units are used in the new flexible construction in order to make it easy to change and reuse.



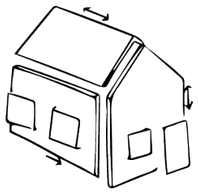
Prefabrication

Prefabrication is important in the flexible modular housing, which makes it possible to install and build more in a short time. Moreover, prefabricated materials produces less waste during the manufacturing and installation period.



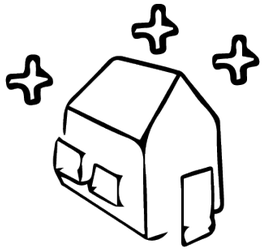
Modular Building

With the standerdized design and prefabrications, living units are put into modular buildings. The size and structure of the modular houses are easily adaptable to meet different inhabitant demands.

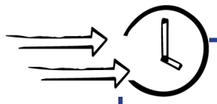


Uptopping

Besides the newly-built houses, modular building can also be applied for topping up the existing urbanized area. Additional modular units take less time, produce less waste and are more flexible to change.

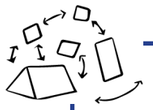


> **Permanent Modular Construction (PMC), as an off-site solution, has marked as a higher quality, faster to market and greener solution than traditional stick built, sitebuilt construction.**
> (Woźniak-Szpakiewicz, 2016)



Time effectiveness

Most of the construction is completed in the factory, which saves time of the on-site operation.

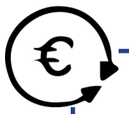


Flexibility

Flexibility and relatability of modular components make them easier to change the style or location to meet different demands.

Sustainability

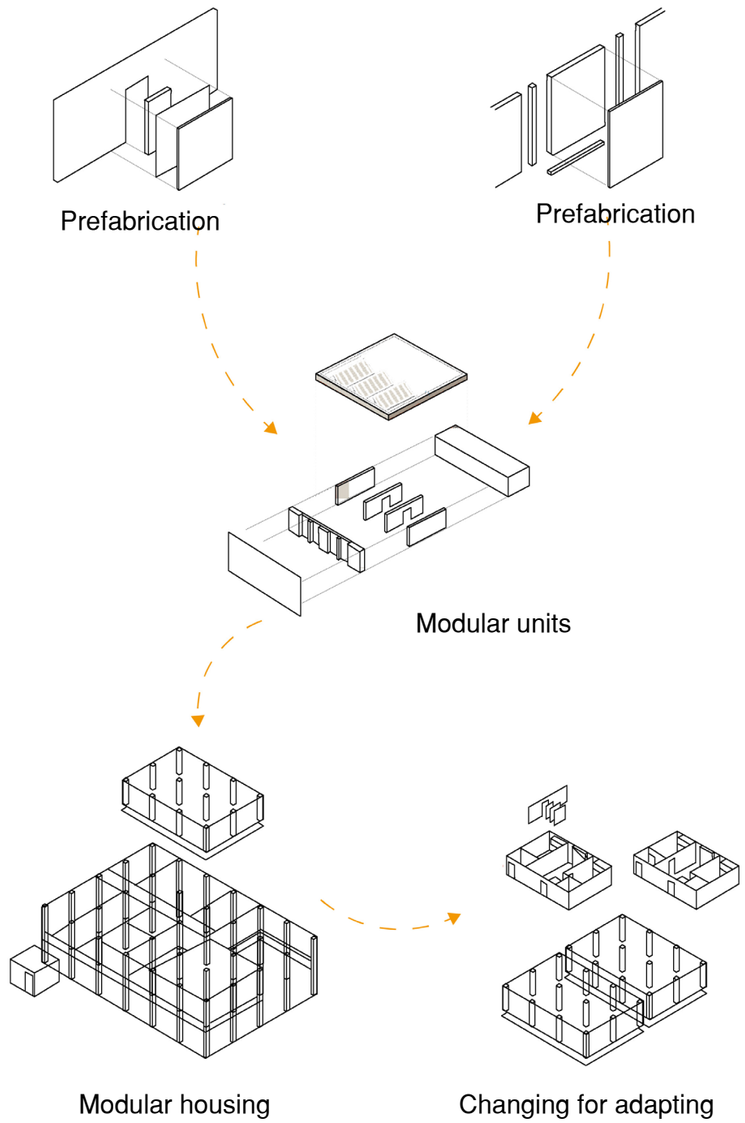
The 100% controlled fabrication producing process results in less waste and reduces the probability of defective on-site products.



Cost effectiveness

Similar prefabrication of the modular housing make it possible to do mass production which results in less material cost.

▲ **Figure 50** Characteristics modular housing (based on DWD Modular, 2020)



▲ **Figure 51** Modular housing (Sidewalk Labs Team, 2019, adapted by author)

Modular social housing

Time saving, flexible, less waste and fewer costs makes modular building very suitable for the social housing construction.

Time is limited in the assignment of building 230,000 new homes in South Holland before 2030. Modular housing can be 30%-50% faster than the traditional construction (Modular Building Institute, 2020). Moreover, modular/ flexible building can be also implemented in the densification of the existing urban areas. Uptopping and building expansion can be achieved by modular units.

Modular building is also flexible which makes it easily adaptable. Combinations of different units creates various possibilities for housing. It can be a single room for single inhabitants, double rooms for young couples, even skip-floor dwelling house for larger families. Except for the privatized social housing, the tenants in the other sector are changing from time to time. The modular housing can follow the tenants' changing needs to making it easier to find suitable social housing in desired locations.

The modular housing also results in less waste as the installation process replaces the on-site construction. The process is more controlled, which obeys the principle of circularity.

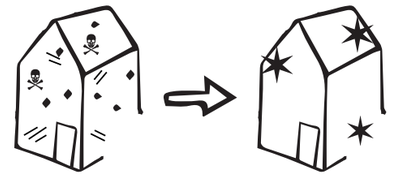
Less cost of the modular housing makes it possible to reduce the rental fee or improve the public service in the community, which means a more inclusive neighborhood.

Transformation & Restoration

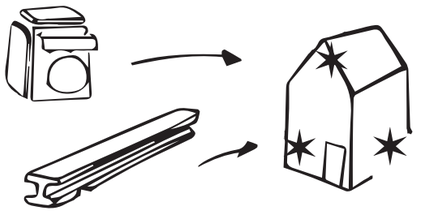
Figure 52 Transformation Collage (illustration by authors, based on World Landscape Architect, n.d.)

A major challenge in reaching a circular economy in 2050 is accomplishing an energy-neutral housing stock. New buildings can be made energyneutral, but most of the current dwellings will need transformation and restoration to live up to the energyneutral standards. Again this challenge is quantative and qualitative. The transformation and restoration of the housing stock can also boost an increase of quality. Especially postwar housing areas, with often a high percentage of social housing, are dilapidating, both buildings and public space. Facades and installations can be improved for climate reasons, but it can improve comfort and aesthetics as well. Most postwar housing areas are dominated by the car, there can be a shift to a domination of public transport and slow traffic. By transforming public space this can shift. Thus, the transformation of the current housing stock is needed to reach energyneutrality, but can in addition improve the comfort and quality of buildings and public space.

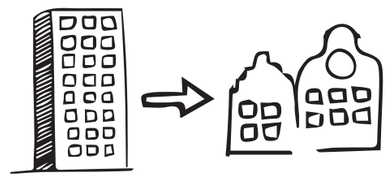
Renovate
When certain elements of a building do not live up to current standards, they can be repaired and renewed. Renovation can be done bottom-up and top-down.



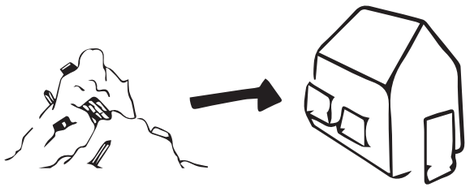
Retrofit
Postwar buildings are suitable for retrofitting. The concrete construction remains, the facade will be replaced by prefab elements to increase quality and sustainability. Installations are updated to live up to current standards. Tenants can stay in their apartment during the retrofitting.



Transform
Empty office and industrial buildings will be transformed to dwellings. When needed, facades, installations, and other elements are renovated. The transformed buildings will consist social and private housing.



Rebuild
When a building or area is in a state that it is not profitable and desirable anymore to renovate, retrofit or transform, it should be deconstructed. New energyneutral buildings or quality public space can be built on this location.



Increase Typologies
To create various streets in existing neighbourhoods, the amount of typologies should increase. The facades and disclosure of buildings can be adapted. This can be done by the four tools named above.

Tranformation & Restoration

The subtools for transformation & restoration are all ways of transforming and restoring the buildings and public space. The scheme below shows the subtools from light to drastic changes: renovate > retrofit > transform > rebuild. This strategy will mainly focus on retrofitting. It is improving sustainability and quality, without gentrifying the neighbourhood and therefore driving social housing out. Retrofitting is a quick and cost-effective way to add value and energy-efficient systems to an existing building, where the residents can stay in their homes.

> **Feasible retrofitting is an optimised combination of cost, downtime, disturbance, technical applicability, and social impact.**
> (Sucuoglu et al., 2006)

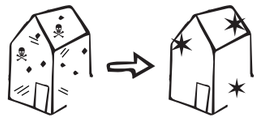
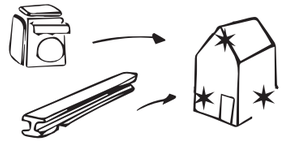
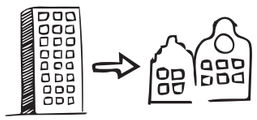
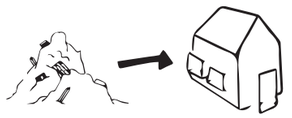
		**Renovate** 	**Retrofit** 	**Transform** 	**Rebuild** 
Buildings	  	Repairing and renewing elements of the buildings: window frames, drainage, installations, kitchen, and bathroom. Increase quality and comfort by bottom-up renovations in the interior, but also on the facade, on balconies, and in the gardens	Replacing current facades by prefabricated facade or roof elements according to the future climate regulations. In row houses it is mainly about replacing the facade and roof. In portico and gallery apartment blocks the concrete construction is maintained, the rest of the building is stripped. The size of the retrofit will decide whether the tenants can stay in their house, have to move out for a short term of have to move out for good. The main goal is that all current residents can keep living in their house.	Transforming office and industrial buildings into housing or mixed-use. The housing will be a diverse mix of social and private housing. If buildings need renovations or retrofitting in the transformation to reach the climate and comfort standards, this will be realised.	Demolishing buildings in a certain state that it is the only possibility. The demolition creates space to built modular housing, where social and private housing can be combined. These buildings will be energyneutral or even energy positive. They can be build with recycled concrete or organic materials. When there is no need for additional dwellings, the location can be used to create qualitative public space or bottom-up initiatives.
Public Space	 	At locations where the public space is dilapidating, it will be renovated. This can be done by adapting and adding crosswalks, repairing pavements, adding greenery or changing viewing green to active and usable green.	Although retrofitting is a term mainly for buildings, it could also be applied to public space, especially on infrastructure. Asphalt can be removed by permeable pavement to reduce heat stress and noise pollution. The median strip can be changed to greenery.	Most social housing areas are dominated by the car. This will be transformed to a dominance for public transport and slow traffic. The road profile will be more safe and pedestrian friendly, improving the last mile connection and social infrastructure.	Dilapidated public spaces where renovation is no option anymore, the public space will be rebuild. The focus will be on improving safety and strengthening the community, creating active public spaces, greenery, and safe infrastructure.

Figure 53 Transportation & restoration table (images Google Streetview, 2020)

Infrastructure

Figure 54 Infrastructure Collage (illustration by authors, based on Carles Enrich, 2015)

There is strong international evidence that infrastructure investment is central both for accelerating growth and for reducing inequality and making growth patterns more pro-poor. (Jones, 2006)

Infrastructure development promotes inclusive growth and reduces poverty by creating additional jobs and economic activities; reducing production and transport costs through improved transport and connectivity; expanding overall production capacity; connecting markets and other economic facilities that may extend beyond the country; and improving access to key facilities such as health, education, and other basic services. It is therefore important to ensure that the social housing areas have an efficient transport system (Rajé, 2018)

> *"Infrastructure is critical to social functioning with direct impact on social wellbeing, earnings, education and health. When infrastructure is inaccessible to any social group, that group is at risk of social exclusion, unable to participate in and contribute to society" (Agarwal and Steele, 2016).*

Improve accessibility

Infrastructure that seperate neighborhoods and creates barriers such as roads, tracks will need to be re-planned for better inclusivity. There is a need to invest in infrastructure that fosters unified neighborhoods without creating barriers.

Improve walkability

There is a need to develop housing units that will consider access between rows of streets. current post war units consist of long linear blocks sometimes upto 90m which reduce transverse accessibility across neighborhoods.

Improve quality

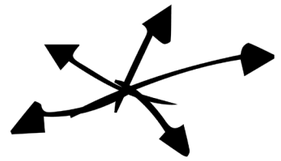
Infrastructure networks within existing neighborhoods will need to cater for alternate transport needs to bridge the gap left by feeder buses within larger municipalities.

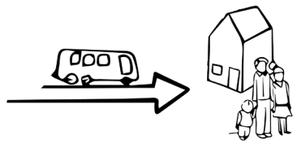
First/last mile connection

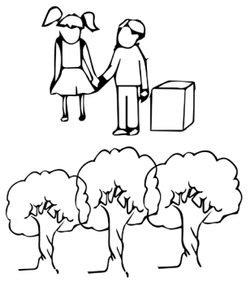
Neighborhoods will need to develop shared mobility infrastructure which acts a more efficient system to replace the overreliance on private cars for neighborhoods and work places that are spread out further from transport hubs.

Social infrastructure

An improvement in social infrastructure leads to an increase in the quality of space and consequently quality of life. social housing developments need to improve the quality of their public spaces, parks, furniture in order to facilitate quality living.







Infrastructure

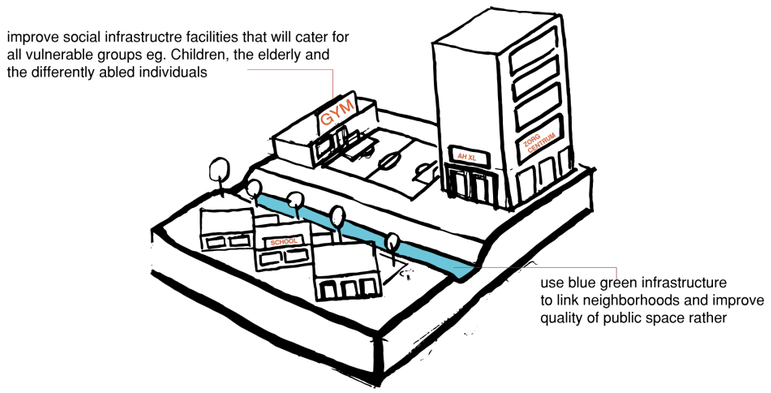
In the Netherlands, Mass transit infrastructure is efficiently developed and distributed. Infrastructure is efficient in creating connections between where people work and where they live. With a total road network of 139,295km, including 2,758 km of expressways, the Netherlands has one of the densest road networks in the world. The country also has a well-developed railway network which connects most major towns and cities, as well as a comprehensive dedicated cycling infrastructure network. (Stead, Meijers, 2015) However, looking at social housing neighbourhoods, there is a need to improve the first/last mile connection between transportation hubs such as train stations, bus stops and waterbus berths to individual's final destinations. This difficulty in connecting the first/last few miles of people's daily commutes, coupled with an efficient road network has a tendency to promote an overreliance on private car transport. Research shows that about half of all trips in the Netherlands are made by car, 25% by bicycle, 20% walking, and 5% by public transport. (Stead, Meijers, 2015)

The infrastructure tool will be used to improve the quality of these neighbourhood transport networks and slow modes of transport, such as shared bicycle systems, car sharing systems and personal rapid transit, in order to cater for the more vulnerable groups of society. These shared, slow-mode mobility solutions will offer innovative solutions that bridge the mobility gap for vulnerable groups such as the poor and the elderly and also reduce the overreliance on private cars for the public.

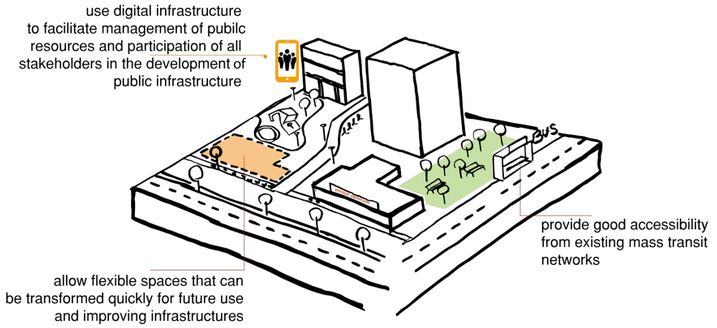
Shared mobility is important because it can extend the catchment area of public transportation, potentially playing a pivotal role in bridging gaps in the existing transportation network and encouraging multimodality for first- and last-mile trips rather than driving alone. While public transit is often constrained by fixed routes, driver availability, and vehicle scheduling, shared mobility's "on demand" access provides the flexibility that travellers need to access or egress from a bus or rail "trunk line." Moreover, shared mobility provides an alternative to costly feeder bus services and land-intensive parking infrastructure. (Shaheen, n.d.)

In situations where infrastructure already exists and serves as barriers or dividing lines between urban areas, there will be a need to remove these barriers. The fragmentation of neighbourhoods by infrastructures such as waterways, dikes, ring roads and train tracks, can lead to increasing social exclusion for underserved or vulnerable groups. There is an urgent need therefore to create social inclusiveness by linking up these fragmented urban areas while improving the quality of public spaces.

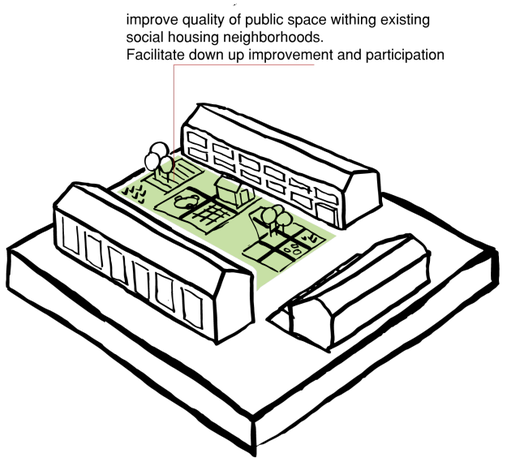
The infrastructure tool also focuses on improvement of social infrastructure such as education facilities for the new circular economy, healthcare and welfare centres, public parks and public spaces. The improvement of social infrastructure aims to provide quality living environments for tenants of social housing while ensuring that there is enhanced interaction between different groups of societies to prevent segregation.



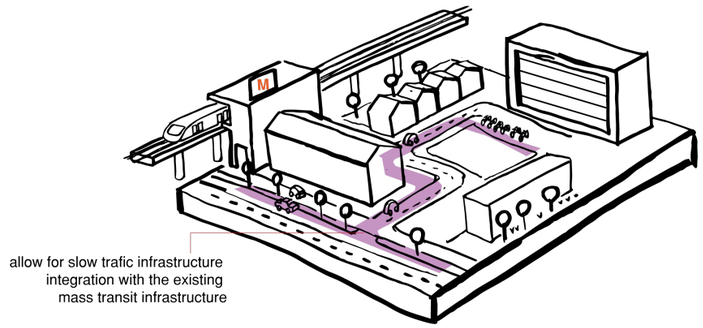
Social Infrastructure
amenities for vulnerable groups



Improved Accessiblity &
Quality Plexible Space for easier transformations



Social Infrastructure
public spaces



Improved Transport Network &
Slow Traffic Infrastructure

Figure 55
Infrastructure tools for neighborhood development
(adapted from TNO,Posad Maxwan, 2014)

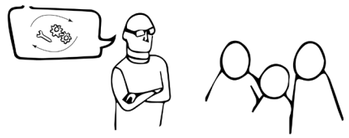
Digitization

Figure 56 Digitization Collage (illustration by authors, based on Carles Enrich, 2015)

Although some innovative business models have already been tested on the market, the construction industry is still at the beginning of the digitalisation journey. (Capelle et al., 2020) There is an increasing shift towards services, away from traditional tangible products that require hard infrastructure and traditional mass production chains. This shift in paradigm, from product- to service-based business models positions the user in the centre of the innovation. It takes into account the transformation in user behaviour and in revenue stream models. Digitization can reduce costs at all stages of the construction value chain. It can be used to: track complex supply chains and manage material flows – material/product traceability, use of:
-BIM and data storage from the use of sensors; design new products (3D) minimising material use, increasing productivity;
-optimise sharing business models;
-automate materials handling and maintenance in construction – for example, use of radio;
-frequency identification (RFID) tags and sensors in material detection and handling, and robot sorting of waste. (Metabolism, 2018)

Re-educate

The digital platform will serve to create data for education purposes where stakeholders can engage, learn and optimize their processes with data collected from other projects.

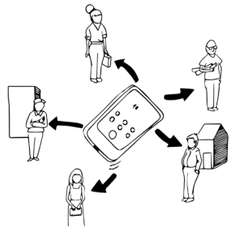


Awareness

By openning access to the end users, these construction database will raise awareness among consumers on what materials and processes go into home construction and engage tehm in making circularity based decisions.

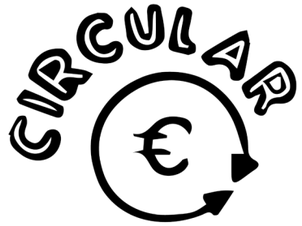
Participation

A digital platform provides stakeholders with opportunities to engage each other openly inorder to even power relations and distribute benefits and burdens within a shared system.



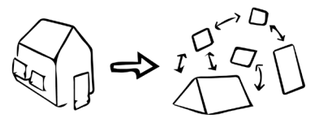
Environmental tax

By keeping track of raw material sources and energy used into processing and manufacturing end products, it will be easier for regulatory bodies to implement strict measures on non-renewable resources to control waste.



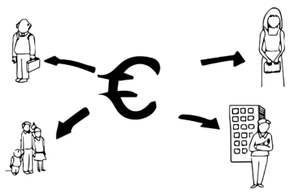
Material banks/passports

Buildings as material banks can only be achieved if there is a digital system keeping track of components, materials and systems that go into the final product. the shift to a digital service system will therefore enhance circularity.



Shared economy

Circularity in the construction industry will only make business sense through service based business models. This will be achieved if all stakeholders agree to join a shared network to create a sharing economy.



6.2 Stakeholder Analysis

Stakeholder negotiations

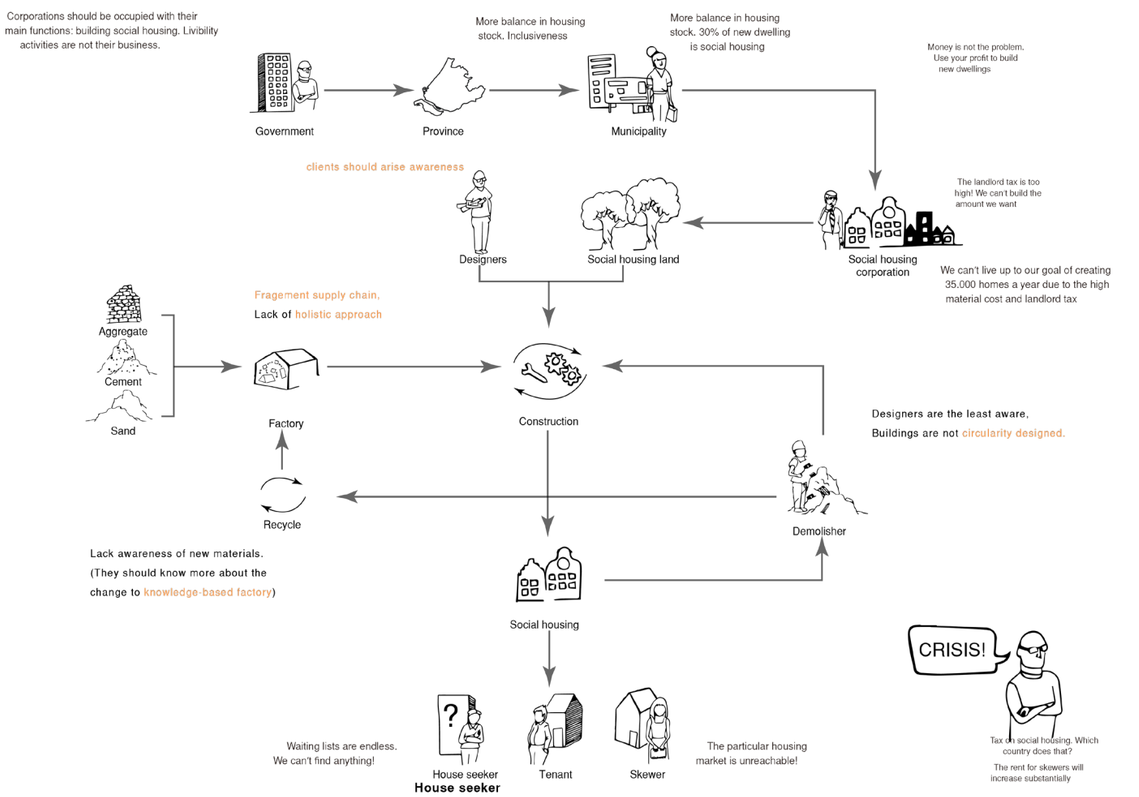


Figure 57 Stakeholders before (illustration by authors, based on Adams et al., 2017)

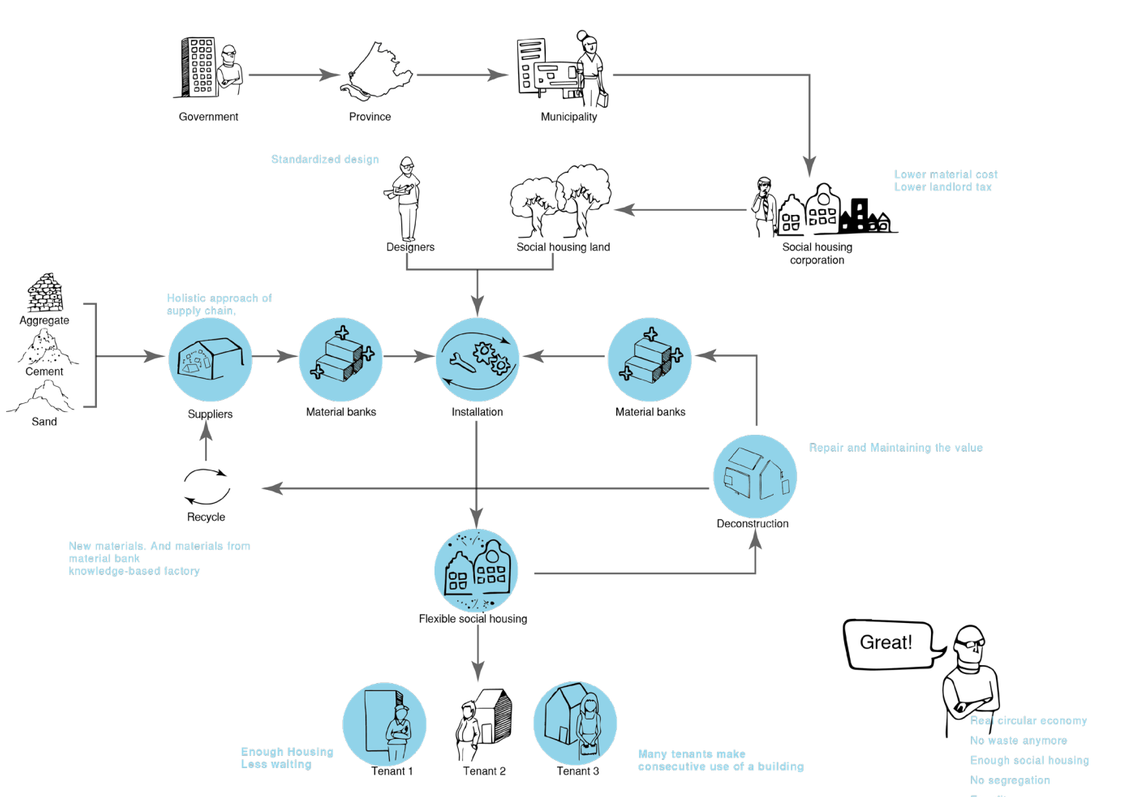


Figure 58 Stakeholders after (illustration by authors, based on Adams et al., 2017)

In the decision making process, governments expect the corporations to build more social housing while corporations are facing the high build & land tax.

Designers are struggling with the new circular design methods.

Meanwhile the current linear construction flow is producing a lot of waste and consuming large quantities of raw materials coming from import.

There is also need for more recycling from demolition. In the end of this flow, house seekers are having difficulty finding a suitable house because of the skewers.

In the future circular construction, there will be a material bank between the suppliers and construction site which is responsible for local distribution, and also making local reuse from deconstruction.

Less waste leads to tax cuts for the corporations.

Prefabrication makes it easier to deconstruct and reuse the materials.

Holistic supply chains enhance the cooperation between the stakeholders in this industry.

There is a yearly check to prevent the skewers in the social housing area.

Stakeholder Conflicts

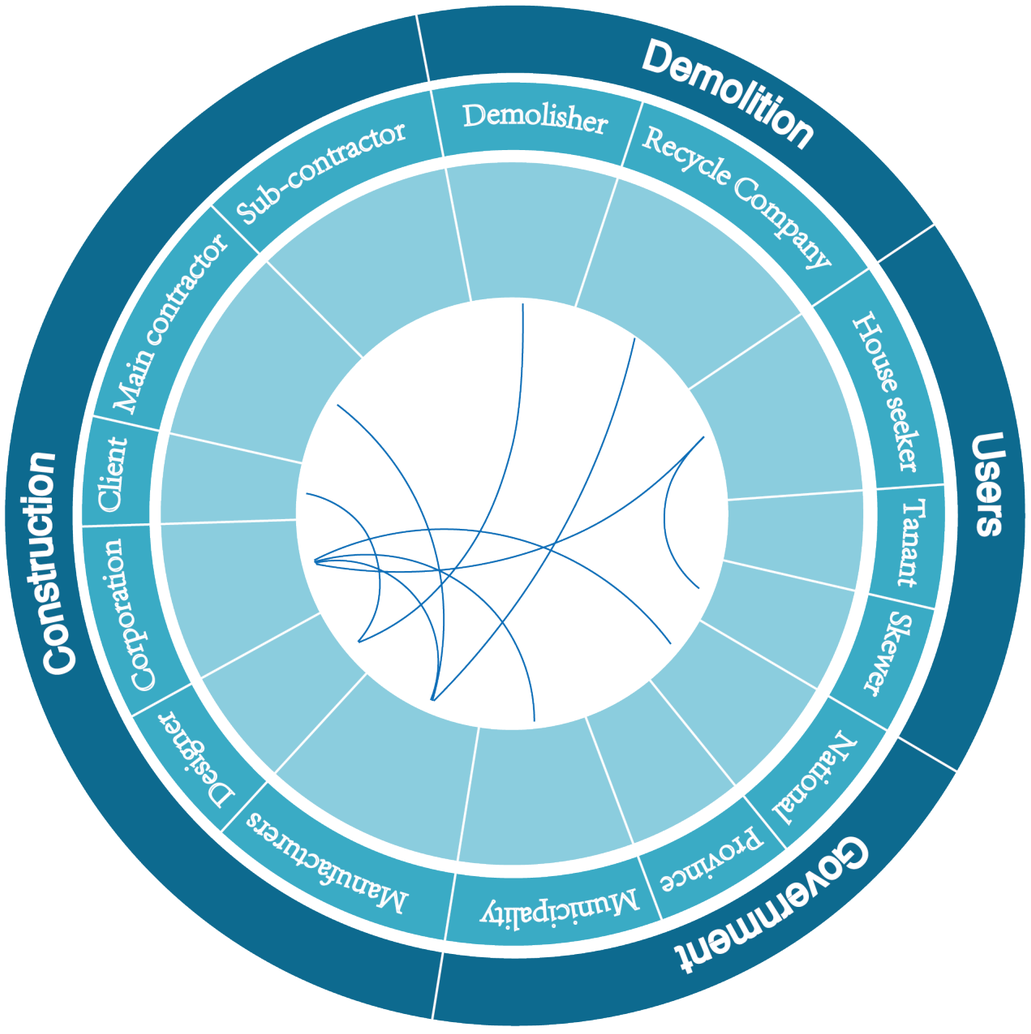


Figure 59 Stakeholder Conflicts

There are conflicts between the stakeholders on multiple levels. In the construction flow, contractors, demolishers and recycle companies are not cooperating well in the shift to circularity. There is also a conflict between government and corporations on the social housing issue. Main contractors and manufacturers hold different views on how to produce less material waste. Lastly, the skewers in the social housing are conflict with tenants. All in all, the media describes it as a crisis.

Stakeholder Collaborations

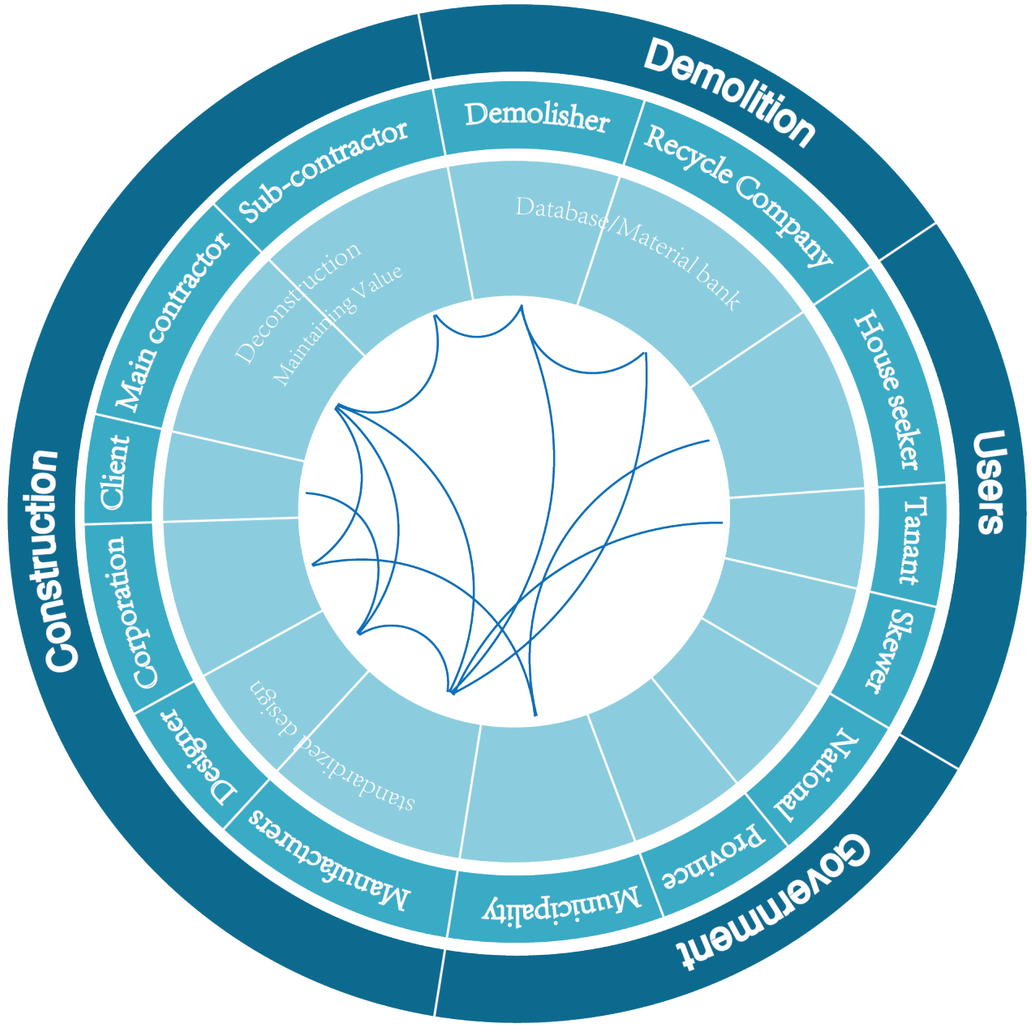


Figure 60 Stakeholder Conflicts

The standardized design from designers, deconstruction from contractors and databased material bank from demolishers consists of a holistic construction & demolition approach which results in less waste and efficient cooperation. Main contractors and subcontractors work together to coordinate the reuse of materials at the local level. Municipality could provide services of social housing for house seekers and tenants and support corporations by offering local regulations and create opportunities in this new circularity.

6.3 Policies

Materials

South Holland is a zero waste region with a circular material flow.

1.Provide tax incentives if materials in newly-build areas are from recycling.

2.All design should be standardized and for reuse, deconstruction, demolition.

3.Waste from construction in South Holland should be recycled as a first priority.

4.Create a regulatory body that determines quality of recycled/reused materials

5.Every construction or demolition area should be linked to a material bank

6.Banks/Financial Institutions repurpose /create special loans for the circular construction industry

7.Implement Environmental tax on all new raw materials for the construction industry

8. Deregulate the use of recycled materials for easier access

Infrastructure

Infrastructure is designed for public and maximum use, and local mobility with less emissions

1.Improve the local cycling and walking infrastructure

2.Public transport can adapt to the future increase of use demand

3.Create better train and tram connection with bigger cities

4. Provide flexible transportation infrastructure that can cater for slow shared modes of transport

Economy

A strong local economy stimulates local entrepreneurship and creats more local job opportunities

1.Ensure local employment is above the regional average

2.Most of the former habitants still live and work in the transformation area

3.The people working in the construction industry before have the priority to gain new knowledge and a new job in circular economy

4.Economic flows are monitored for how much capital is re-invested in the local economy

Social-spatial justice

A better outdoor space and diversity living environment in the new community

1. Streets and public space are lush with vegetation that offers great communication area

2.The public furniture should be flexible and easy to change

3. All the public space are more accessible to everyone

4.Bottom-up design and construction of the public and semi-public space

5.Increase community diversity through socio-spatial justice

6.All the residential area should be merged (No social housing neighbourhood anymore)

7. Strategic Projects

To design and assess our development strategy, we created strategic projects in the province of South Holland. We decided to center ourselves around three types of generic areas, instead of focussing on location dependent places. The generic areas we investigated are: social housing in large cities, social housing in medium-sized cities and (former) industrial areas.

The reasoning behind focussing on generic locations is that these types of areas can be encountered on many different locations in the province of South Holland and each have specific characteristics when looking at buildings and their residents. In this way, not only the feasibility on the small scale, but also on the larger scale can be executed.

Digitization

A fourth, overarching strategic project is digitization. In the toolbox it is introduced, it will be elaborated in this chapter. Digitization will be an essential strategic project to support the vision and strategy.

Phasing

The strategy holds a timeline that suggests a phasing for the goals, policies and projects. In this way we aim to enhance the synergies and feasibility of the regional and the local scale.

Impact Assessment

Lastly the impact of the strategy is assessed on three criteria: place, construction industry and inhabitants.

Generic Areas in South Holland

Figure 61 Generic areas in South Holland (based on Nationaal Georegister, 2019)

Characteristics (based on CBS, 2020)

Social housing area in a large city

age 1950 - 1970
typology portico
energylabel D - E
facade brick, glass, plaster
construction concrete
constraints asbesthos, state

age mainly 0 - 40
migration background 80%
household type mainly families

Social housing area in a medium-sized city

age 1950 - 1970
typology row houses
energylabel C - E
facade brick, glass, tiles
construction concrete
constraints asbesthos, state

age all
migration background 15%
household type all

(Former) industrial area

age 1950 - 1990
typology factories, storages, offices
energylabel C - G
facade brick, aluminium, glass
construction steel
constraints polluted soil, accessibility

Three Strategic Projects

Figure 62 The three chosen strategic areas of this project (based on Nationaal Georegister, 2019)

In this report three locations are investigated further: Heijplaat in Rotterdam, Moerwijk in Den Haag and Haarwijk in Gorinchem. Each of these places is a generic example of the category in which they are placed.

By investigating the current situation and issues, spatial implications for the future are developed which will contribute to realising the vision and development strategy of 'Closed Loops, Open Justice' towards improved social justice in the provision of just social housing.

Stakeholders, and their power and interests, are therefore thoroughly investigated to not only provide in the distributive spatial justice, as Rocco (2020) explains: the justice in the distribution of goods and services, but also in the procedural justice, the justice of the procedures of planning and design. This means by inviting and facilitating vulnerable groups to be more participant in the planning process in the province of South Holland.

Heijplaat

▲ **Figure 63**
Location (based on Nationaal Georegister, 2019)

▲ **Figure 64**
Topview Heijplaat (Google Maps, 2020)

▲ **Figure 65**
Contrast in Heijplaat (Kortenbout, 2019)

Heijplaat is an example of a typical harbour village in Rotterdam which is built approximately 100 years ago. At the present time Heijplaat and RDM, which are part of the Stadshavens, together with Vierhavengebied on the other side of the Nieuwe Maas, are undergoing a complete restructuring which results in a vacant and industrial (look of the) area.
The, almost serene, tranquility of the village contrasts with the activity of the dynamic Rotterdam harbour which is in immediate vicinity, shown in Figure 65. A transition space is required to make this area a mediator of conflict.

Heijplaat is an example where residents are closely involved in the developments of the area. The former Vereniging van Wijkbewoners developed a vision with an explicit view on the sustainable developments of the area.

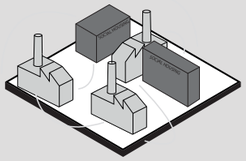
Vierhavengebied is an area in close vicinity to Heijplaat, where companies and startups already developed initiatives focused on the circular economy, where at the same time linear industry is still closeby.

These characteristics are making Heijplaat an ideal location to provide in the need of just social housing. At the same time, a transition towards a circular economy is needed, but the first steps, with inclusion of the residents, are already made.

Why

Close to social housing areas

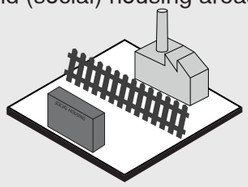
Connect to social housing by application of circularity



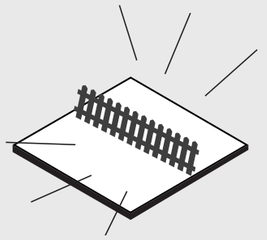
Representative amount of industrial areas in the province of south holland

Current

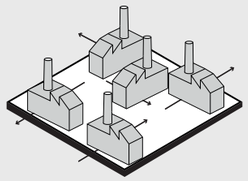
Hard border between industrial areas and (social) housing areas



Empty space around borders

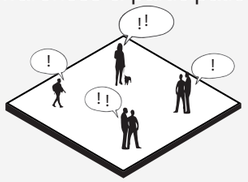


Linear construction industry



Future

Use local production to raise awareness & participation



Create a transition space where sharing of public goods/space and education can take place

Create better infrastructure in the area itself, but also towards the nearby city-centre areas

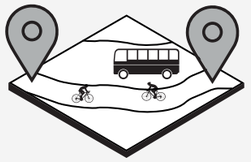


Figure 66 Characteristics of Heijplaat

Heijplaat stakeholders

The municipality of Rotterdam, harbour area and corporation decide together how to transform the harbour area.

Main contractor and designer work on what kind of material can be used in this site, how to make zero waste, how to recycle constrution material and design flexible housing.

Subcontractors and demolition contractors are responsible for the new construction.

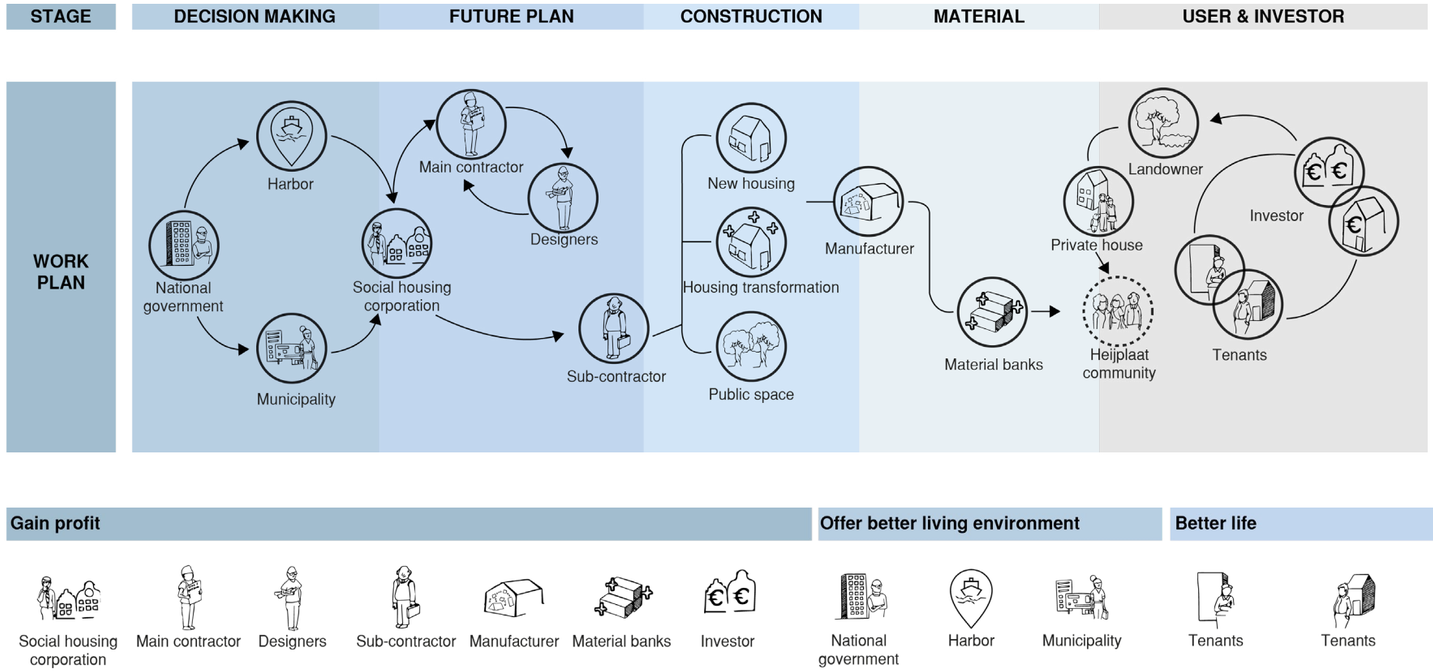
Material banks owned by the manufacturers working towards zero waste during development.

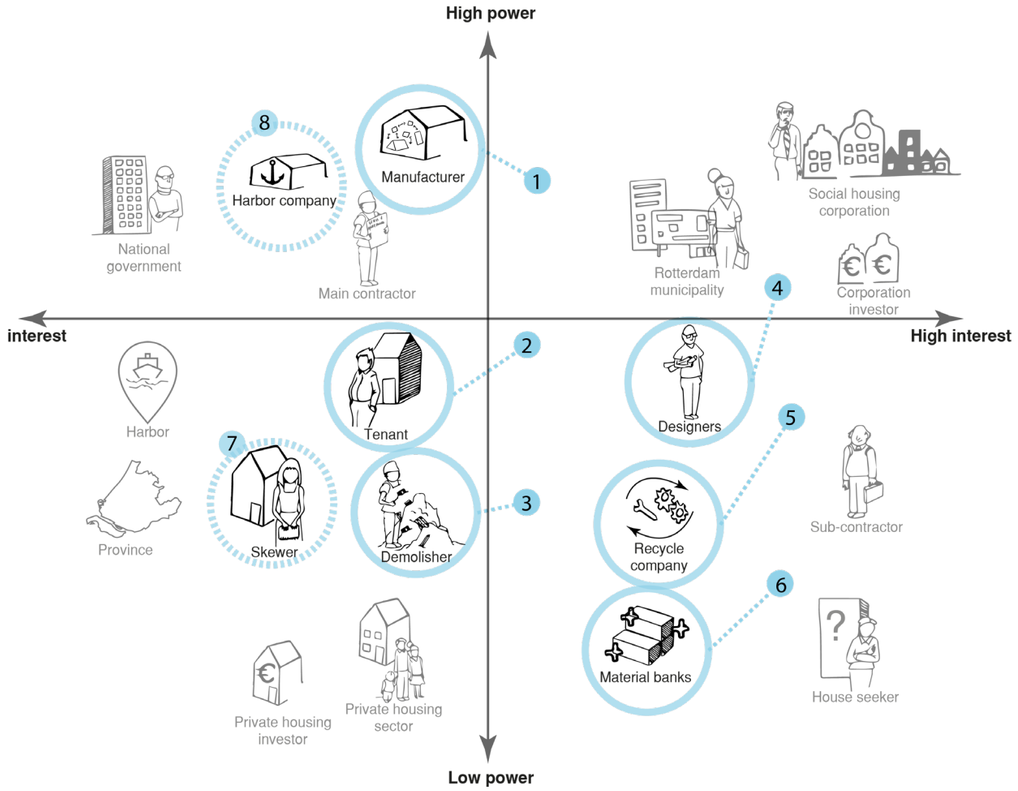
Bottom-up adjustments will be made by tenants.

There are investments for the corporation and service facilities.

Heijplaat policies

1. Circular construction education for manufacturers
   All new social housing area should be flexible in the heijplaat
2. Social housing tenants responsible for semi-public space construction
3. Demolish tax for demolition waste for the first 10 years
   All new housing need to be developed for at least 50% in circular concrete
4. New developed area should be 100% circular construction
5. All construction and demolition waste should be recycled
6. New developed social housing area should have local material bank
   New developed private housing area should be linked to material bank
7. Check yearly to prevent skewers in social housing





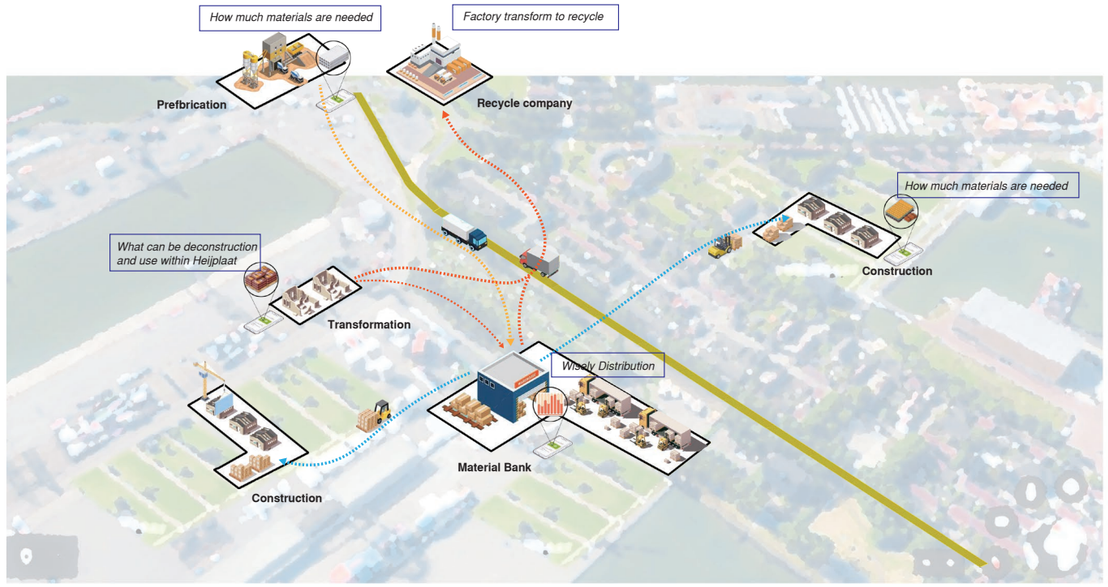
▲ **Figure 67**
Workplan Heijplaat

◀ **Figure 68**
Power-Interest Matrix Heijplaat

The stakeholders in Heijplaat have different position in the power-interest matrix of social housing. In the transformation of the harbour area, some of them shall gain higher power or more interest.
For instance, tenants will gain higher power and interest by participating the design process. Demolisher, recycle company and material banks will get higher power and interest in the circular construction flow. Manufacturer will be less powerful because of the prefabrication, but they will profit more in this shift. The habour companies are moving out and skewers will disappear.

Phasing

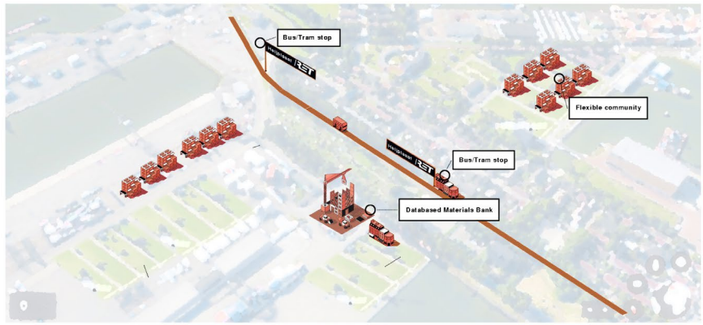
Material Bank Flow



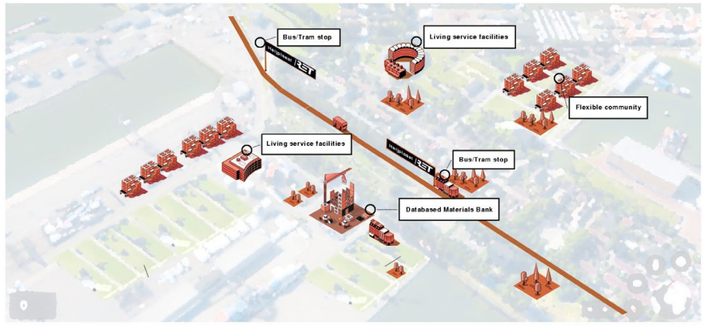
▲ **Figure 69**
Material Bank Flow

Local material bank is built before the transformation takes place. On one hand, it links to the prefabrication manufactory and recycle company. On the other hand links to the transformation and construction site. The Material bank is the data-based transition station to do the wisely distribution to reduce the waste.

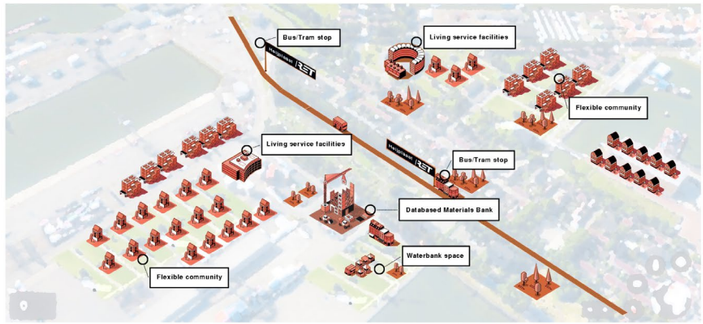
The first step is to make the plan and build the material bank which will be used in the construction and transformation & demolition of the harbour.



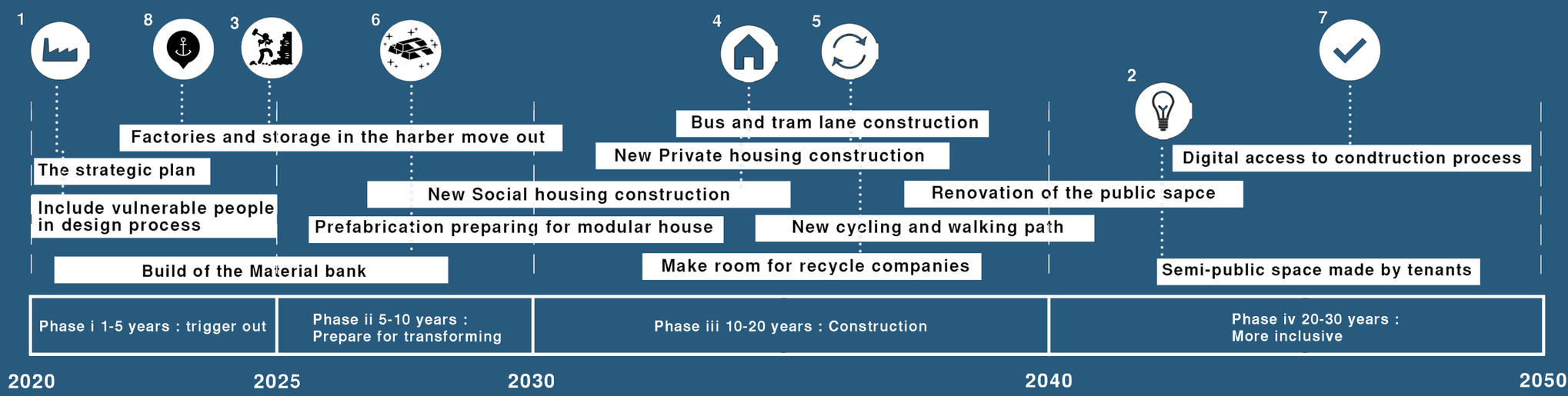
The second step is start building the new houses and some of the service facilities. Municipal public space are being built and also the local infrastructure.



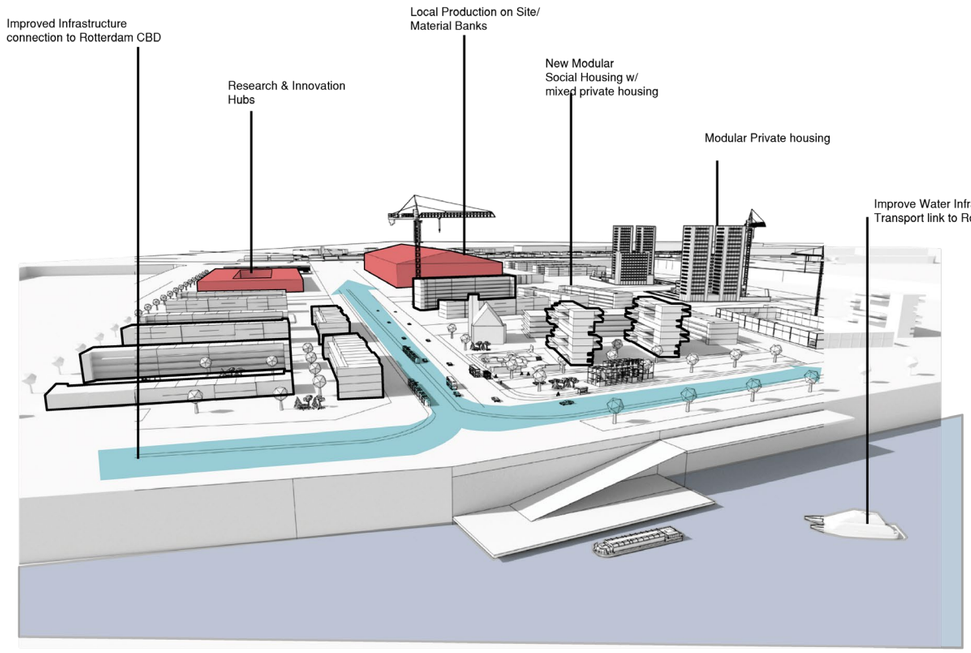
The last step is more houses are built. Bus, tram, cycling and walking lane are finished. Local public spaces will be adjusted by the inhabitants.



▶ **Figure 70**
Phasing Heijplaat



▶ **Figure 71**
Timeline Moerwijk

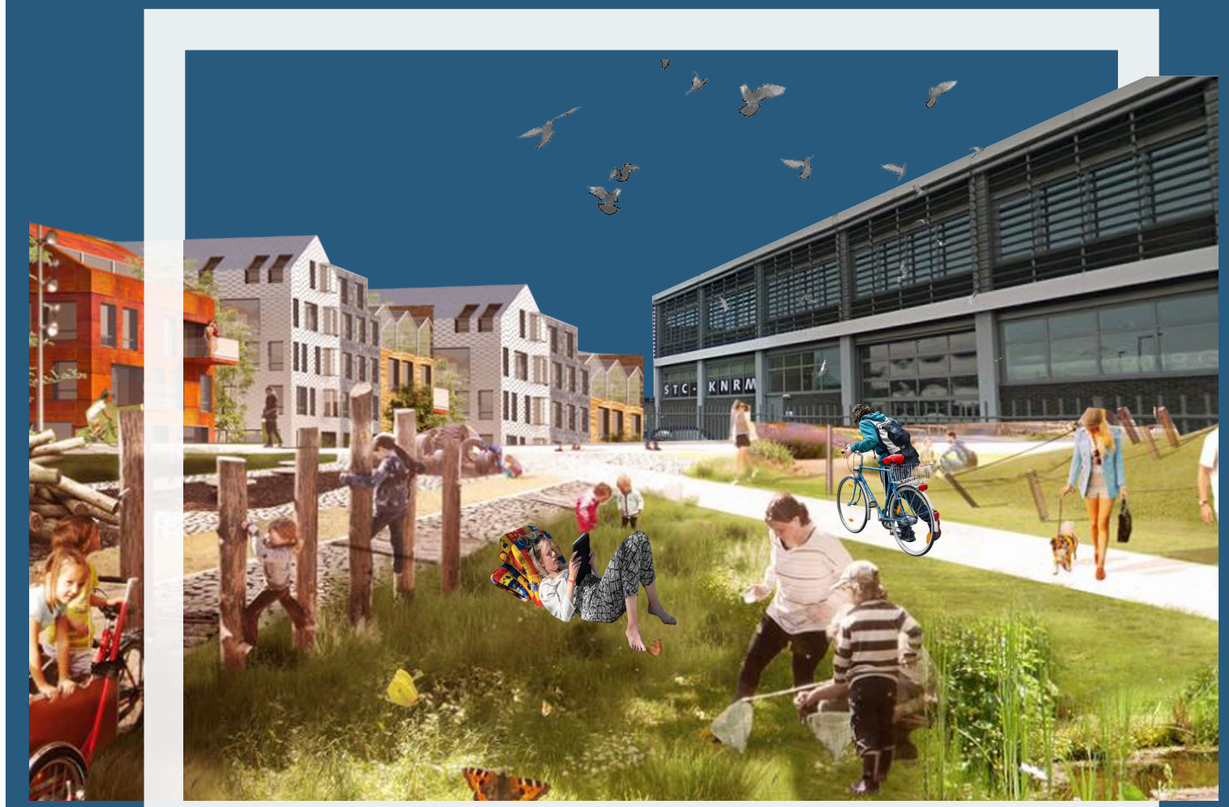


Interventions

From the scenario of Heijplaat, improved infrastructure links the research & innovation hub, local material bank, modular social and private housing and the water infrastructure. Densification is achieved by new modular building and harbour transformation. Research hub is the education center to enhance the circular economy and has impact on a regional level.

▲ **Figure 72**
Interventions in Heijplaat

▶ **Figure 73**
Heijplaat before and after
(illustration by author, based on Kjellander Sjoberg 2013)



Moerwijk

▲ **Figure 74**
Location (based on Nationaal Georegister, 2019)

▲ **Figure 75**
Topview (Google Maps, 2020)

▲ **Figure 76**
Social Housing in Moerwijk (Kuipers, 2019)

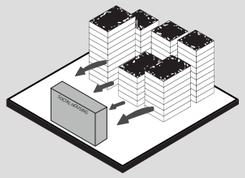
Moerwijk is a neighbourhood in Den Haag and one of the poorest neighbourhoods of The Netherlands (CBS, 2020). With its post war buildings, energylabel D-E and constraints, the houses are in need of transformation.

At the same time, high-end houses for middle- and upper class residents are being built in the city. This mixture results in social segregation and gentrification in the city, where the more vulnerable groups are being pushed out of the bigger cities. Despite this segregation, densification needs to happen within the existing city borders. At the same time, public space and accessibility by public transport need to be taken into consideration when densifying these existing neighbourhoods.

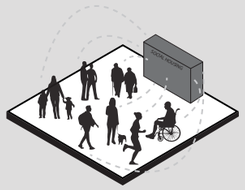
Moerwijk is therefore a suitable example to start with transforming and restoring the current social housing stock, while the social infrastructure is taken into consideration.

Why

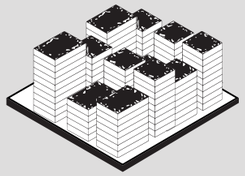
Gentrification, try to prevent the social housing being pushed out of the cities



Amount of social housing decreasing

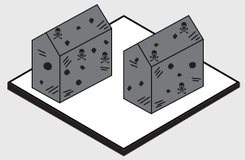


Densification



Current

Quality of social housing is becoming worse and worse

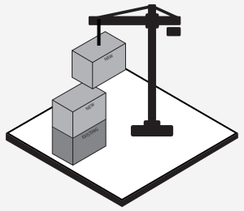


Car dominance

Gentrification & social segregation

Future

Modular and flexible social housing



Pedestrian dominance

Create more social infrastructure for the vulnerable groups of society

Figure 77 Characteristics of Moerwijk

Stakeholders

The municipality of the Hague, Moerwijk community and corporation decide together how to retrofit the neighbourhood.

Main contractor and designer work on what kind of material can be used in retrofitting, how to make zero waste, how to recycle constrution materials and design flexible housing.

Subcontractors and deconstructors are responsible for the retrofitting of the houses.

Recycle companies work towards zero waste while developing.

Bottom-up adjusting will be made by tenants.
There are investment for the corporation and service facilities.

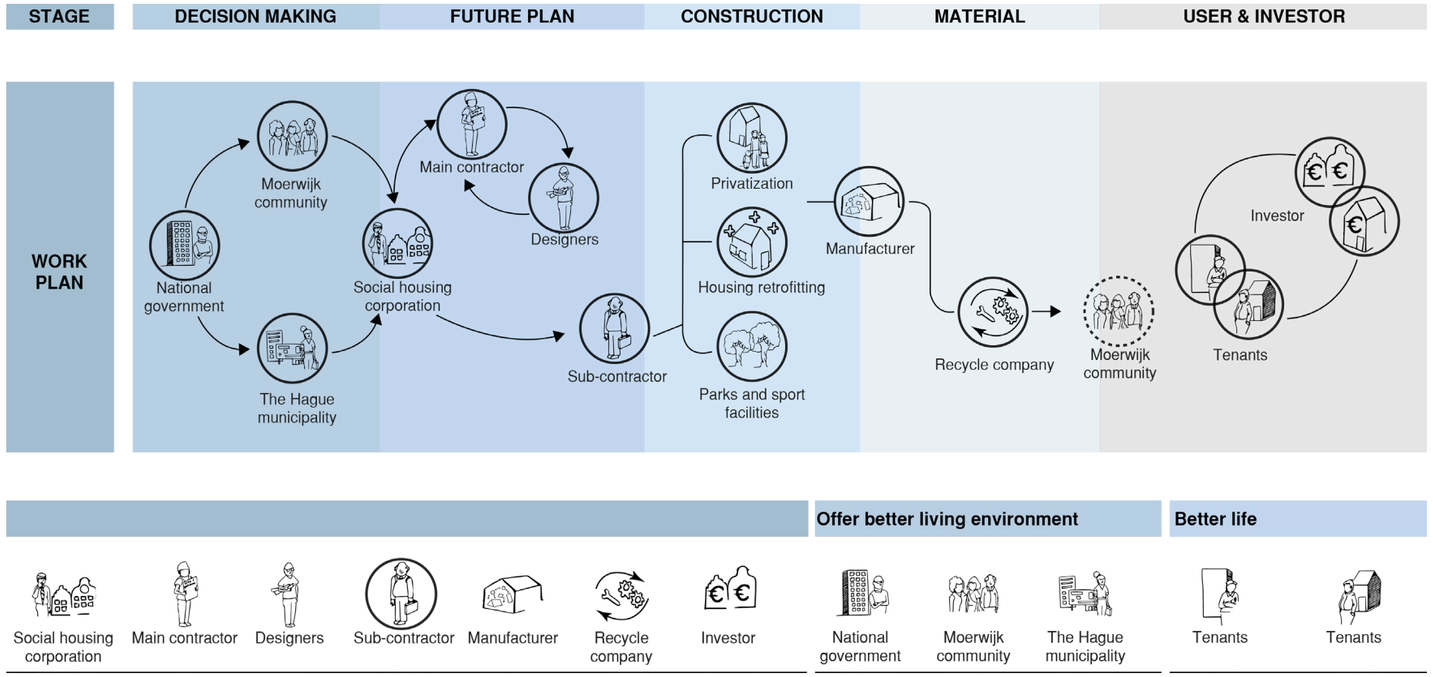
Policies

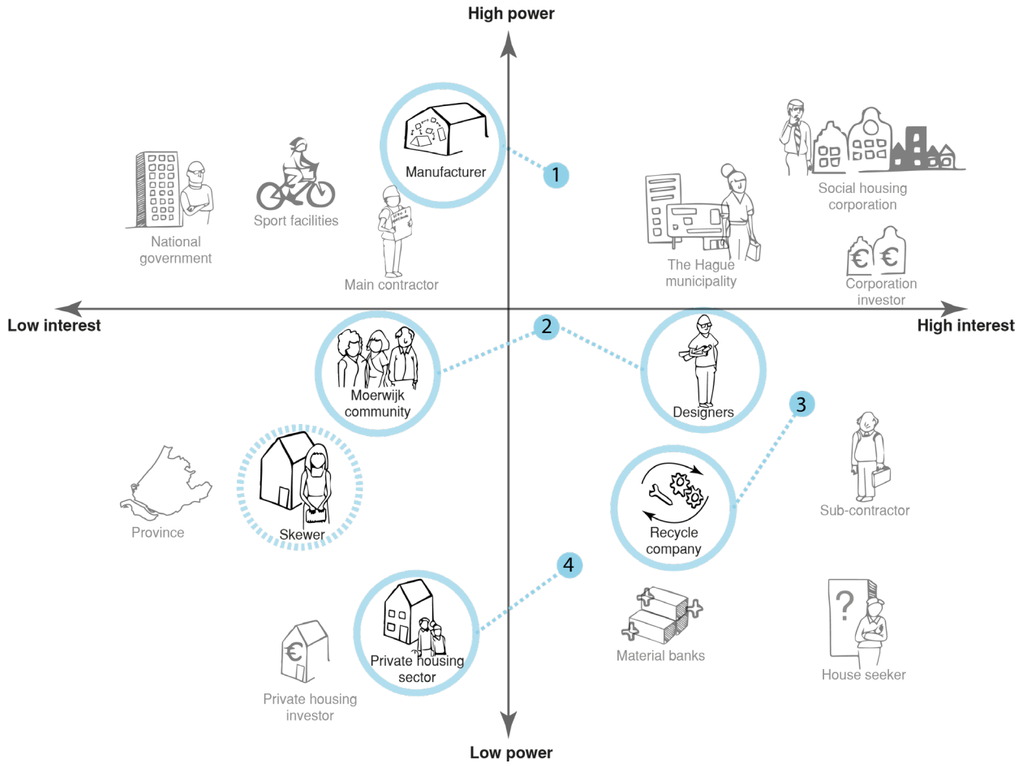
1. All the new materials used in the retofitting or renivation
   should be flexible and recyclable
   50% of the construction material should be from recycling

2. Community has the right to participate in the design process on where and how to renovate the infrastructure
   Tenants of the housing have the right to discuss how to retrofit.

3. All the construction & demolition waste should be recycled and reuse in Moerwijk

4. Private housing rate should be decided together with municipality, social housing tenants and private housing investors





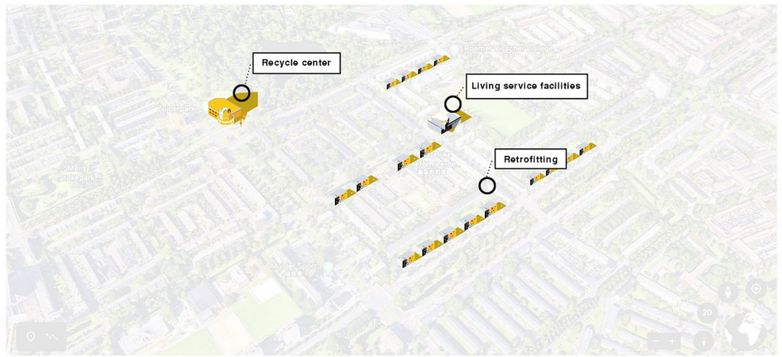
▲ **Figure 78**
Workplan Moerwijk

◀ **Figure 79**
Power-Interest Matrix Moerwijk

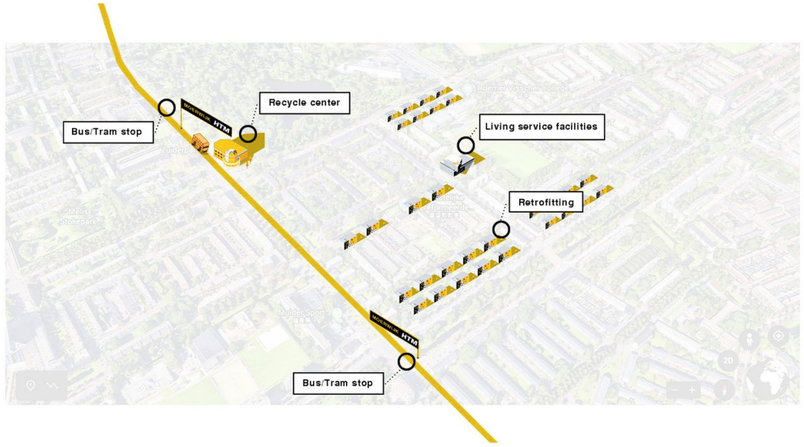
The stakeholders in Moerwijk have different position in the power-interest matrix of social housing. In the retrofitting of the neighbourhood, some of them shall gain higher power or more interest.

For instance, tenants will gain higher power and interest by participating the design process with the designers. Recycle companies will get higher power and interest in the circular construction flow. Manufacturer will be less powerful because of the prefabrication, but they will profit more in this shift. The private housing sector will be an important part of the neighbourhood and skewers will disappear.

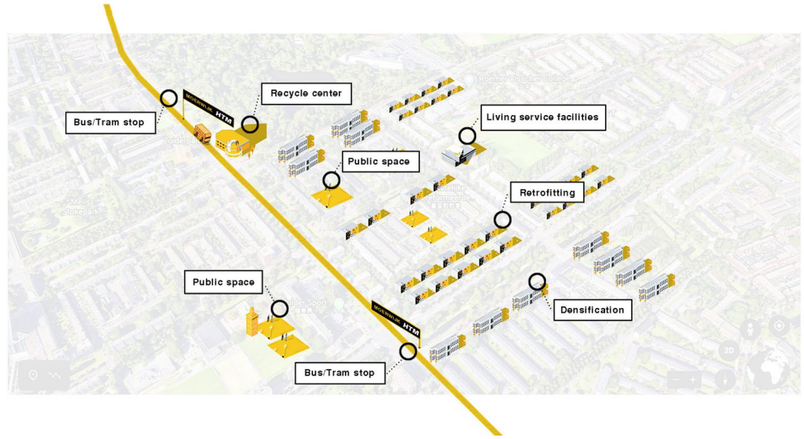
Phasing



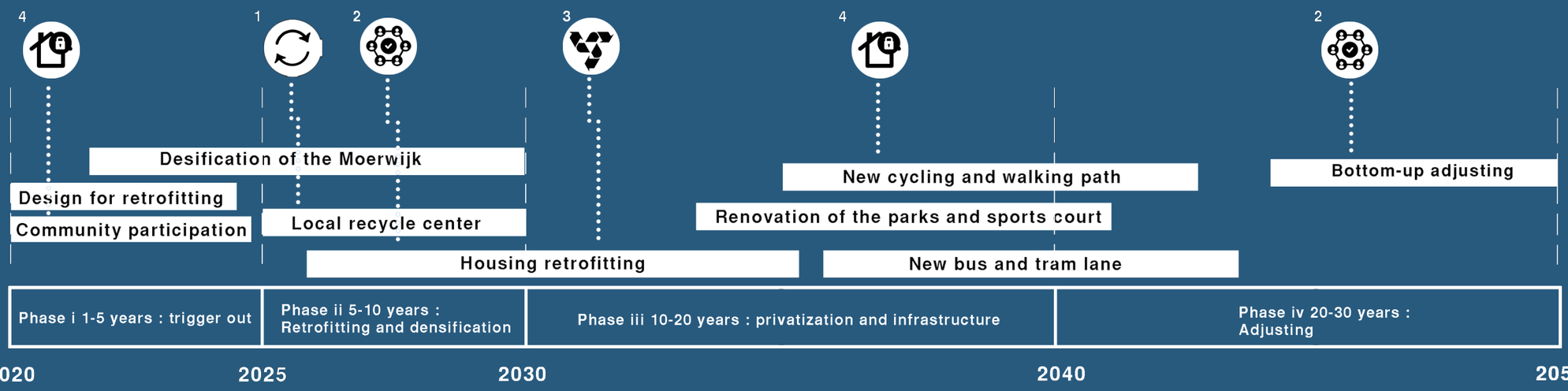
The first step is to make the retrofitting plan and include vulnerable people. Then the densification of this area starts.



The second step is the construction of the local recycle center which will recycle the waste in the following construction & demolition. Also the retrofitting of existing housing kicks off.

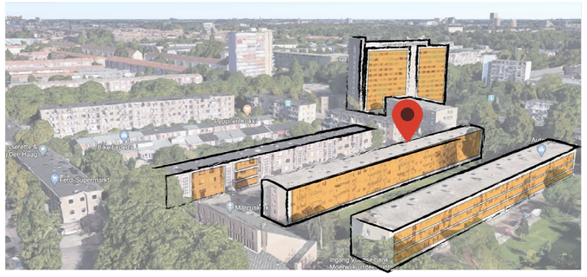


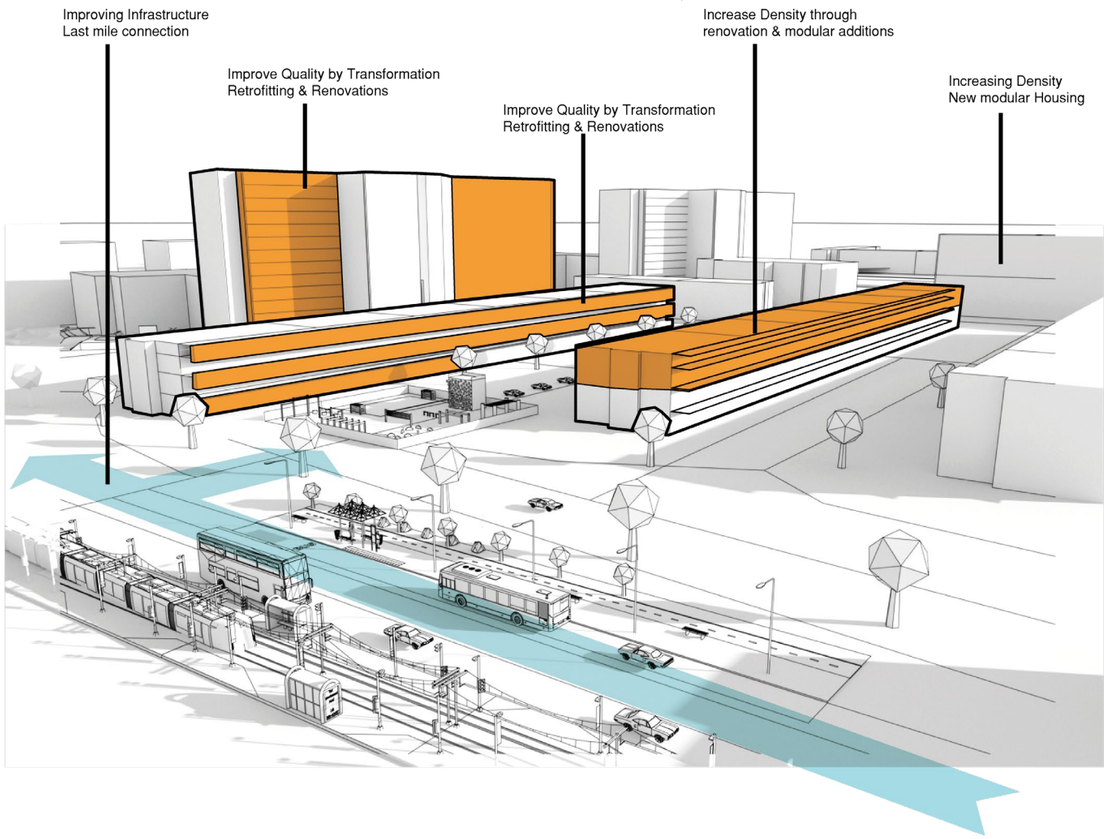
The third period is finishing the housing retrofitting and construction of the infrastructure: cycling, walking and bus tram lanes. Renovation of the parks and sports facilities are done as well.



▲ **Figure 80**
Phasing Moerwijk

▶ **Figure 81**
Timeline Moerwijk



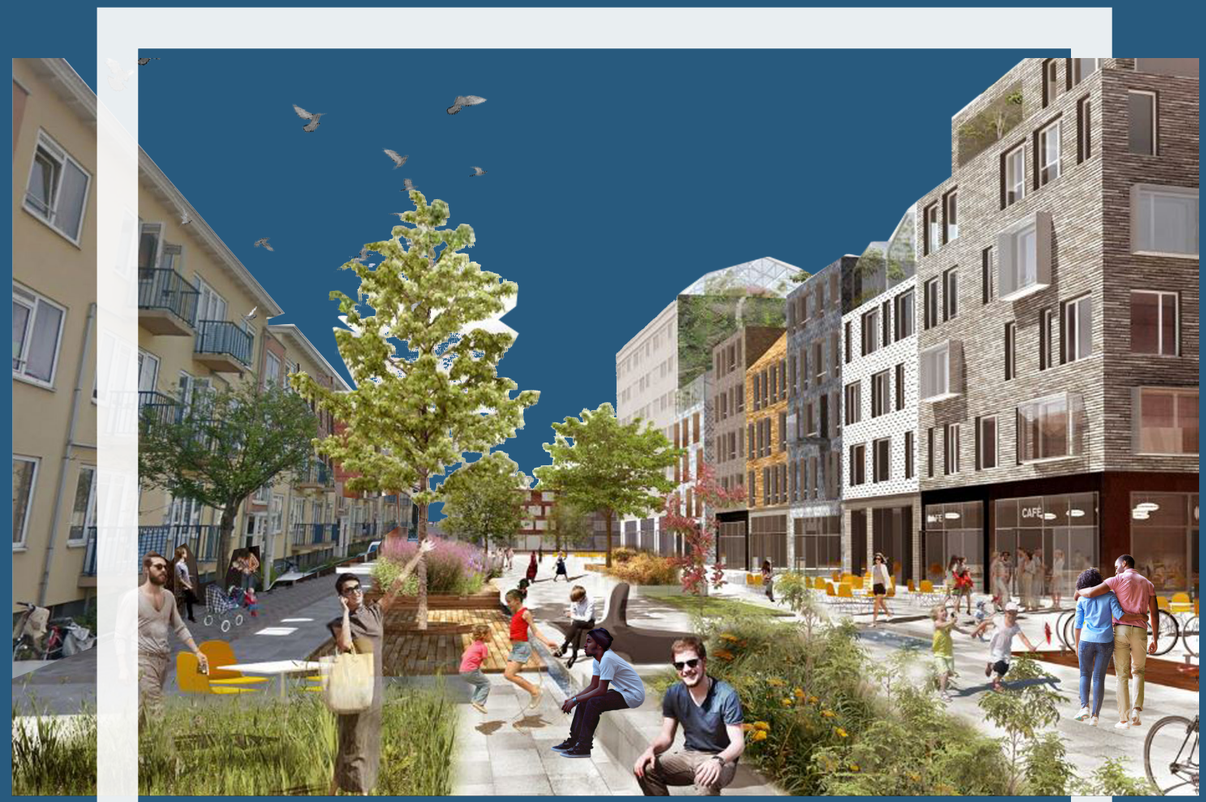


Interventions

The postwar apartment blocks will be transformed and restorated. Portico and gallery blocks with three or four layers can be topped up with an exterior elevator and gallery. The concrete construction and most installations of blocks with five or more layers will maintain, as the rest of the block will be renovated. All facades will be retrofitted to live up to the future standards. Glass fronts and balconies can be added to improve the liveliness. When blocks are in a certain state that rebuilding is the only possibility, modular housing is added to increase in typologies and diversity in the neighbourhood.
Green space will be transformed from viewing green to usable green, e.g. community gardens, also improving the social infrastructure. The dominance of the car will make place for a dominance in public space and walkability, creating new networks to improve the last mile connection.

▲ **Figure 82**
Interventions in Moerwijk

▶ **Figure 83**
Moerwijk before and after
(illustration by author, based on Kjellander Sjoberg 2013)



Haarwijk

▲ **Figure 84**
Location (based on Nationaal Georegister, 2019)

▲ **Figure 85**
Topview Heijplaat (Google Maps, 2020)

▲ **Figure 86**
Abandoned houses in Haarwijk (De Kock, 2019)

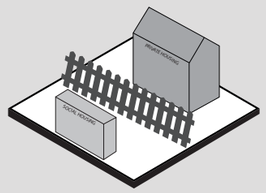
Haarwijk is an example of a social housing neighbourhood in a medium-sized city in the province of South Holland. Because of the increasing housing prices and decreasing availability in social housing in bigger cities, vulnerable groups are pushed towards smaller cities surrounding big urban areas.

At the same time, residents are still leaving the smaller cities for a more vibrant life in the closeby city areas, which results in deferred maintenance or even worse, abandoned areas in the neighbourhood, as shown in Figure 86.

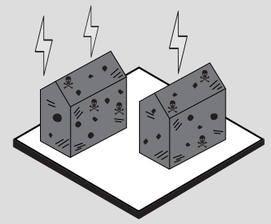
Physical infrastructures, as well as social and public goods, are needed to change these social housing areas in a medium-sized city to become more sustainable and suitable in the future.

Why

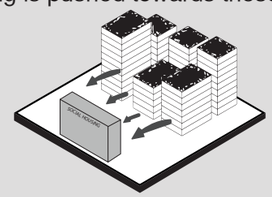
Segregation



Building quality

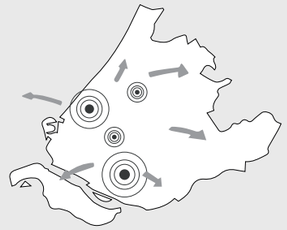


Gentrification in the big cities, social housing is pushed towards these areas



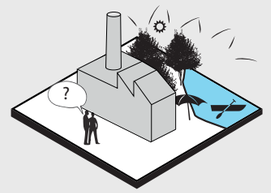
Current

Close to big urban areas



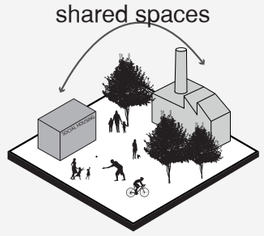
Bad last mile connection

In some cases the industry is blocking the view



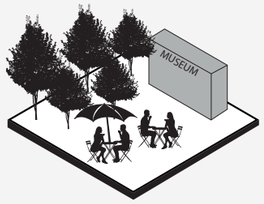
Future

Reduce segregation by making use of shared spaces



More diversity

Accessible public goods



Enhance building quality

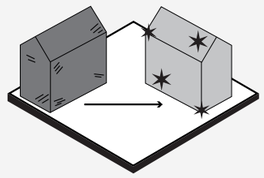


Figure 87 Characteristics of Haarwijk

Stakeholders

The municipality of the Gorinchem, Haarwijk community and corporation decide together how to retrofit the neighbourhood.

Main contractor and designer work on what kind of material can be used in retrofitting, how to make zero waste, how to recycle constrution materials and design flexible housing.

Subcontractors and deconstructors are responsible for the retrofitting of the houses and renovation of the riverbank.

Recycle companies work towards zero waste while developing.

Bottom-up adjusting will be made by tenants.
There are investment for the corporation and service facilities.

Policies

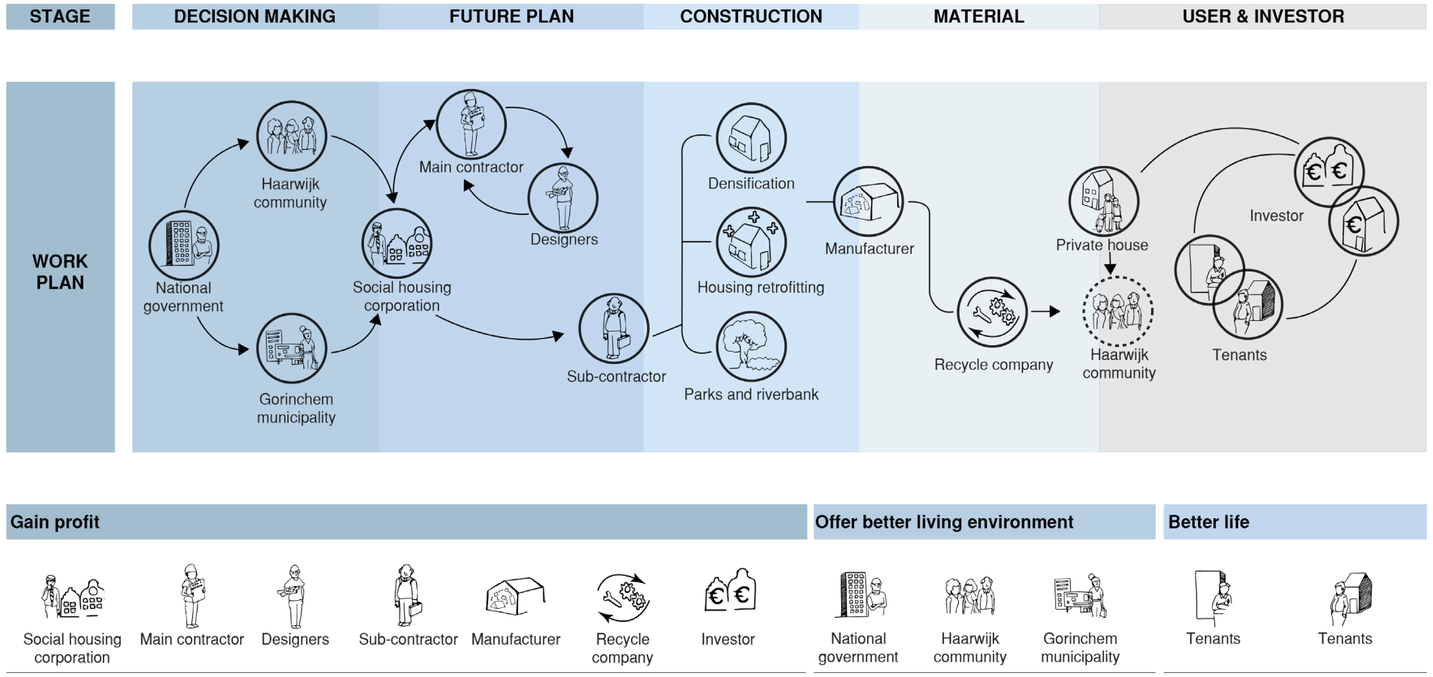
1. All the new materials used in the retofitting or renivation should be premade and recyclable
   50% of the construction material should be from recycling

2. Community has the right to participate in the design process where and how to renovate the infrastructure
   Tenants of the housing have the right to discuss how to retrofit.

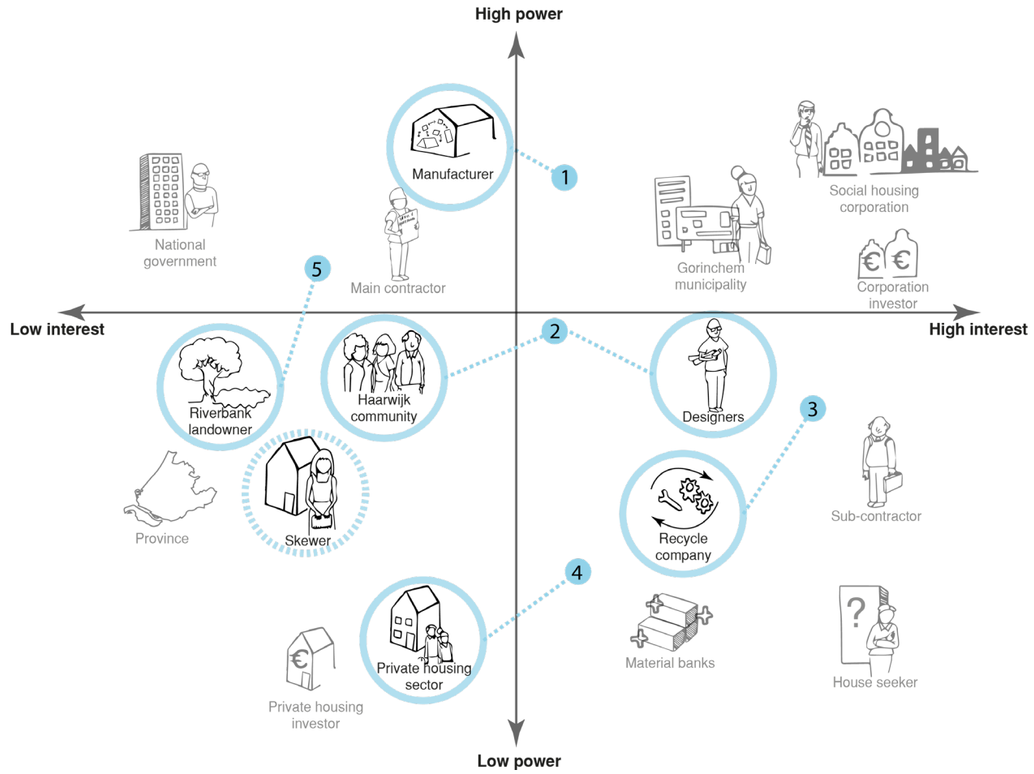
3. All the construction & demolition waste should be recycled and reuse in Haarwijk
   No construction and demolition waste from 2035

4. Private housing rate should be decided together with municipality, social housing tenants and private housing investors

5. Riverbank should be open to everybody and part of it can be used for public commercial



▲ **Figure 88**

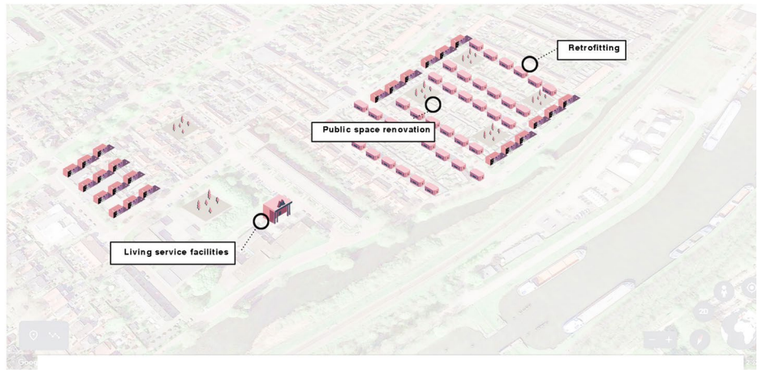


▲ **Figure 88**
Workplan Haarwijk

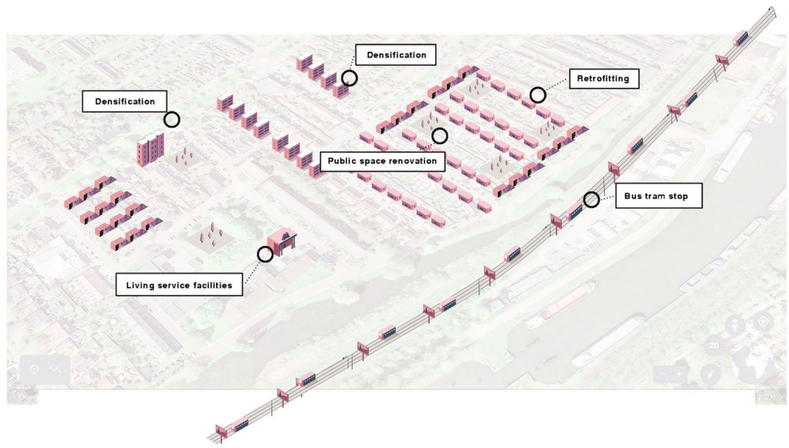
◀ **Figure 89**
Power-Interest Matrix Haarwijk

The stakeholders in Haarwijk have different position in the power-interest matrix of social housing. In the retrofitting of the neighbourhood, some of them shall gain higher power or more interest.
For instance, tenants will gain higher power and interest by taking part in the design process with the designers. Recycle companies will get higher power and interest in the circular construction flow. Manufacturer will be less powerful because of the prefabrication, but they will profit more in this shift. The private housing sector will be an important part of the neighbourhood and skewers will disappear. The riverbank will be a more active public space.

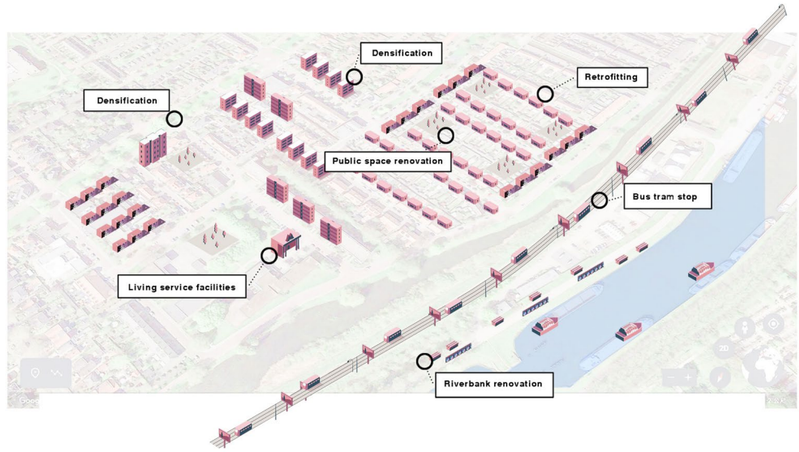
Phasing



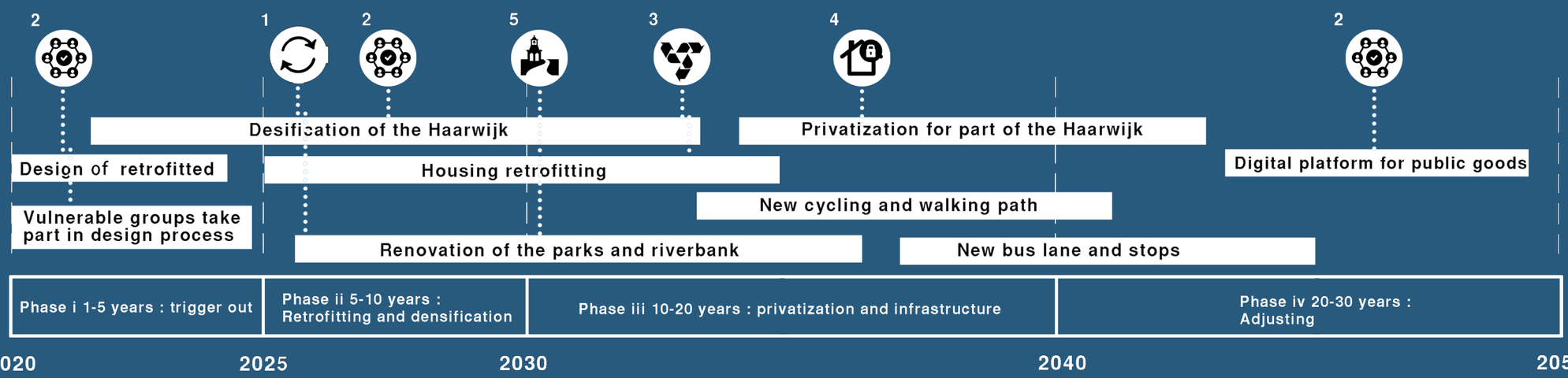
The retrofitting of Haarwijk starts with the inclusive plan and the beginning of the densification. Additionaly, the improvement of public space in the existing community takes place.



The densification should be finished before 2030, as well as more than half of the retrofitting. Start renovate the parks and river bank.

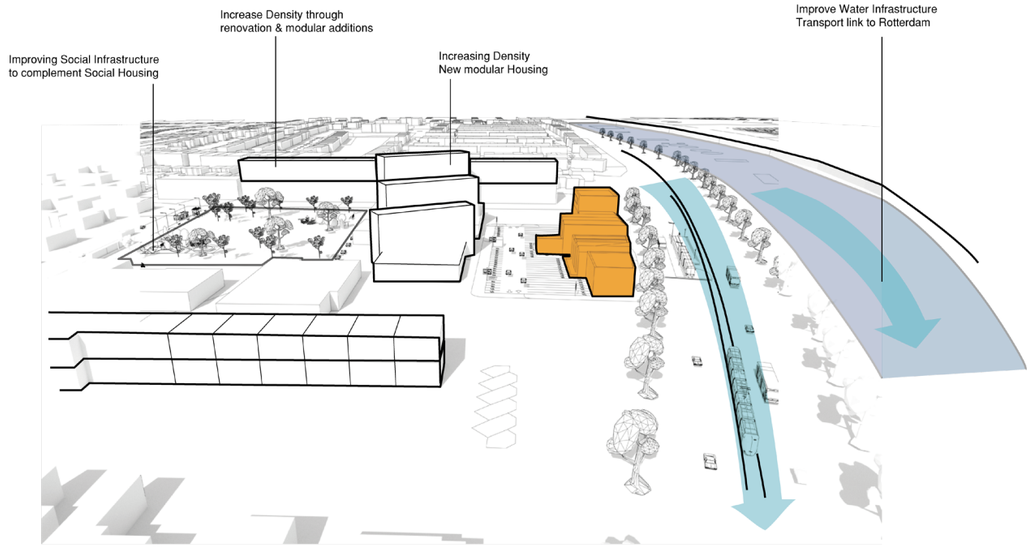


End of the housing retrofitting and riverbank renovation. The building of infrastructure shall take place here.



▲ **Figure 90**
Phasing Haarwijk

▶ **Figure 91**
Timeline Haarwijk



Interventions

The Haarwijk area of Gorinchem will recieve a transformation through renovation and retroffittig existing housing stock. A materials bank and education centre for the re-education and upgrading of circularity skills will be established in the area to serve the region around this center. New modular housing can also be added within the industrial lots along the river bank to transform former small scale industrial sites.

The modular housing will integrate the social housing with a small percent of middle-income housing to create inclusive neighborhoods that create opportunities for all members of society. Figure (xx) shows how these interventions can be implemented. There will also be social infrastructure improvements by improving the quality of public spaces and social amenities.

The physical infrastructure will be improved by providing shared slow traffic options that will serve to bridge the gap left by feeder buses that operate through scheduled timings. The water infrastructure can also be improved inorder to improve the transport of people and goods between Gorinchem and Rotterdam Harbours.

▲ **Figure 92**
Interventions in Haarwijk

▶ **Figure 93**
Haarwijk before and after
(illustration by author, based on Kjellander Sjoberg 2013)

Digitization

In the digitization strategic project, the aim will be to create a database of information for all stakeholders to network and create a shared system. As circular construction covers the entire value chain, in order for the model to fully demonstrate its advantages over linear economic model, it is necessary to involve all stakeholders in mutually benefi cial cooperation. (Bukowski & Fabrycka, 2019)

Figure 94 shows the digital network proposed for the province of South Holland. The main aim of this network will be to provide accurate information to all stakeholders to enable them optimize decisions for sustainable living. The main material producers will provide information about the sources of their materials, their production process and an accurate account of the environmental impact of their extraction and processing. This data will be included in the material passports of the bulding materials produced and consequently in the calculation of the value of the final product.

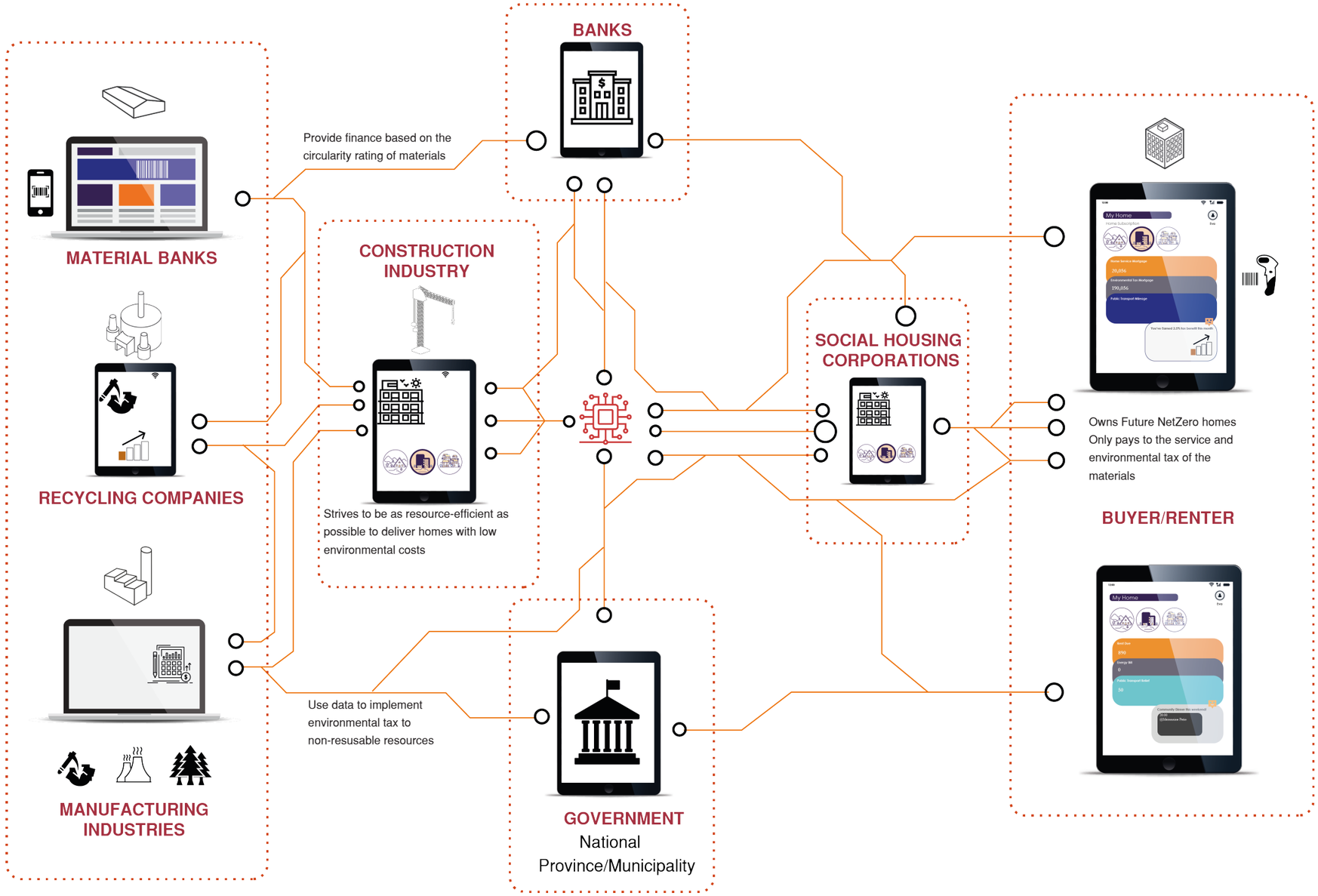
The construction companies are then able to pick materials from material banks which suit their targets for circular development. The financial institutions will also be able to tap into this platform to provide funds to developers and home owners and occupiers who chose to take part in the circular economy industry. Social housing should ensure they take up circularity best practices such as circular tendering. This ease the burden of cost for final home owners and occupiers.

Circular procurement sets out an approach to green public procurement which pays special attention to "the purchase of works, goods or services that seek to contribute to the closed energy and material loops within supply chains, whilst minimising, and in the best case avoiding, negative environmental impacts and waste creation across the whole life-cycle". (European Commission, 2019)

According to Metabolic (2019) there are three key objectives in this process

- To prioritize the circular objectives for a specific location and area, having regard to the varying rolesof the private and public sectors
- To promote innovation rather than imposing restrictions on market actors; prescribe the ends, rather than the means
- To formulate a comprehensive strategy geared to promoting circular building, with the emphasis on materials, and resilience and adaptivity

The objectives of the social housing will be to redevelop and renovate existing stock using circular methods and to develop new stock within the targets of the Province of South Holland. New housing stock should strive to be Energy neutral inorder to reduce the cost burden on the end consumer. With lowered costs, then the consumer can be able to take up any environmental



▲ **Figure 94**
Digitization Framework

costs brought about by the development of their unit. This will raise their awareness as to how the construction industy operates. The end user can then make informed choices on the type of housing they take up based on the production method.

This awareness and participation from the end user is necessary in order to trigger a shift mindset for the whole construction industry. This can create a situation where the value chain shifts from an ownership, short-term profits model to a long-term service based model, where the benefits and burdens of the supply chain are distributed fairly along the whole system.

> "It is fair to say that a circular and reversible builtenvironment can only be supported by a highly interconnected value network. Because of the magnitude of information and variety of stakeholders within the building value network, a digital way of collecting, handling and exchanging data seems indispensable."
>
> (BAMB, 2019)

7.5 Phasing

A timeline is created to examine the process of execution and feasibility of our strategy.
The first part shows the overall process with synthesis of goals, policies and strategic projects, as well as the regulations which are set up nationally for the coming years.
The second part is more detailed and plots the execution of the proposed spatial implications step by step. The timeline is divided in four different phases whereas each phase has its own goals, which are shown on the right.

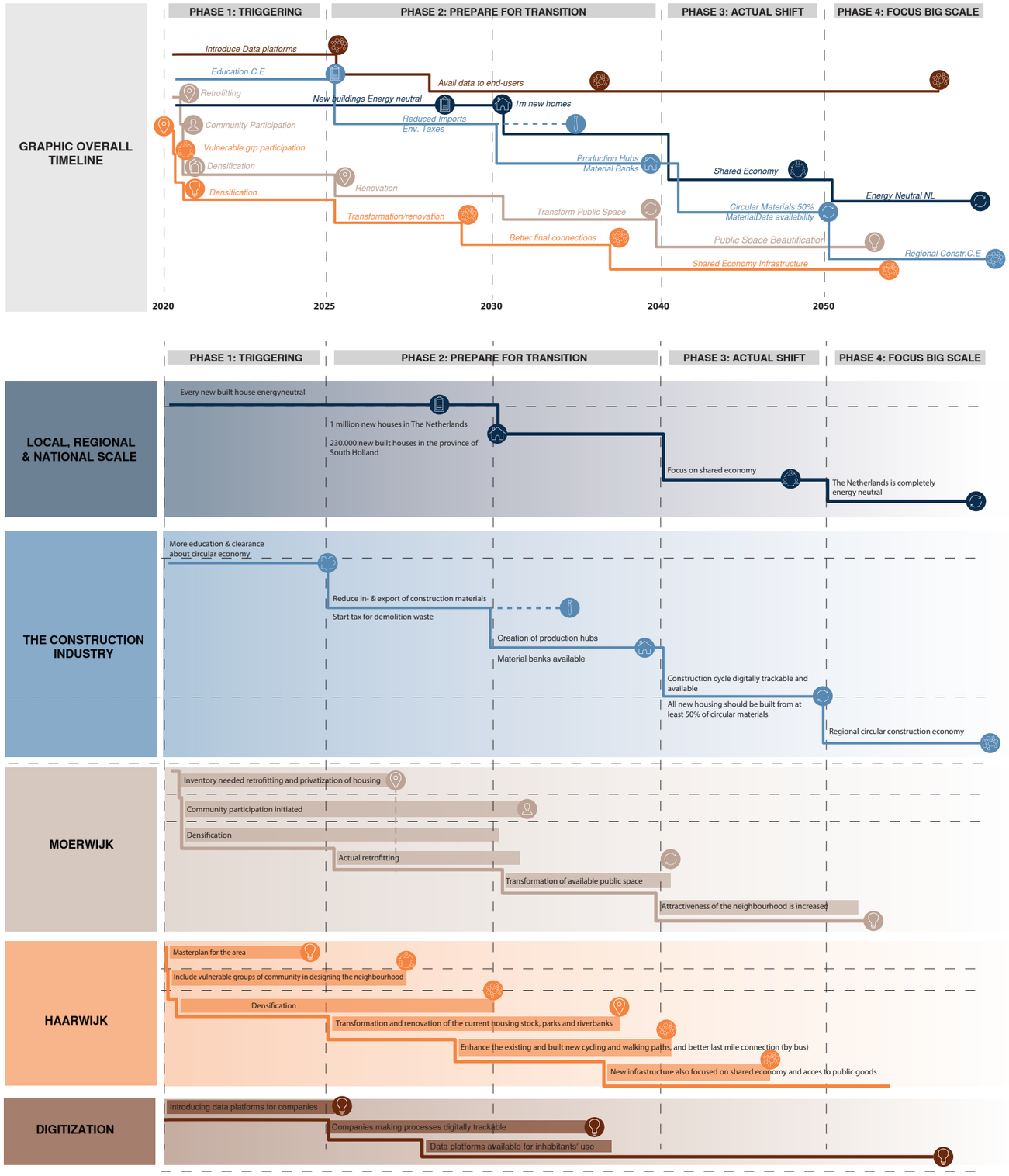


Figure 95
Timeline of the project

GOALS PHASE 1:

- Local interventions & masterplan for projects
- Including vulnerable groups in the design process
- Invest in companies which have ability to recycle and selfcycle in the C&D wasteflow
- Emphasize on education, awareness & participation

GOALS PHASE 2:

- Built new social housing by implementing modular housing
- Offer job opportunities in the circular economy sector
- Use demolished houses when building new (demolishing becomes deconstruction)
- Improve infrastructure and public transport
- More recycle companies instead of linear process companies

GOALS PHASE 3:

- Industrial institutions aim to connect with local public functions
- Further expand of digitalization (processes are trackable)
- New infrastructure aims to connect to shared functions

GOALS PHASE 4:

- Yearly check to prevent skewers in social housing
- Developed strategic areas host a synergy of residential, industrial and shared public functions
- Integrating local cycles into regional circularity
- Fair distribution of social housing

7.6 Assessment Criteria

An assessment criterion is developed, to assess the viability and efficiency of the strategic projects. The assessment will be carried out under three themes of: place, construction industry and stakeholder.

Place

The “place” criterion assesses the effectiveness of the project in developing places which have; an identity, are inclusive and aesthetically enhance the culture and context of the environment they are established in. The quality of the social housing building stock created under these strategic projects and the quality of the public spaces will also be assessed to ensure that they meet the standards set out by national and local policies and authorities.

Construction Industry

Within the construction industry, the projects should strive to fully integrate circular construction techniques, by reducing waste, creating flexible constructions and promoting locally produced materials. The energy ratings of the buildings will also be used as a measure of the quality of the developments and the materials used. Possible shortcomings that should be further researched on and critically addressed will include; how to promote the reduction in raw material imports, against the possible increasing cost of locally produced raw materials.

Stakeholders

Finally, the assessment will take into consideration the contributions of the strategic projects on all stakeholders involved. The projects should be able to raise awareness among all stakeholders involved and promote dialogue and a consensus towards a shared economy in order to fairly distribute the benefits and burdens of future developments through circular construction. Projects will also be assessed based on; the number of jobs they create, their effectiveness in promoting stakeholder participation and the affordability of the housing providing based on household incomes.
We acknowledge however that time constraints and common cultures are among the main barriers to fully implementing these strategic projects. A lot of re-education and training will need to be put in place for all stakeholders within the construction industry and all the end users in order to ensure the viability of all the projects.

PLACE

- Inclusive community
- Better infrastructure
- Identity of a place
- Improved public space

- Not maximizing land value

CONSTRUCTION

- Local circular construction
- Zero waste construction
- Flexible housing
- Awareness of circularity
- Less transportation costs

- Less import
- Higher costs for local production in the beginning
- Possible mismatch supply & demand in the beginning

STAKEHOLDERS

- Job s for inhabitants in local production
- More social housing in the centre of the harbor area
- Life service facilities
- Participation in circular onstruction

- More time needed for design because inclusion of more groups
- Retraining needed

8. Conclusion & Evaluation

In this chapter the vision and strategy are concluded and evaluated.

Conclusion
The final conclusion of the report contains a concluding summary with an answer on the research question, as well as the main aims, goals and findings.

Limitations & Recommendations
After the conclusion, limitations of report are explained, together with recommendations for further research.

Ethical Issues & Societal Relevance
The vision and strategy are assessed on societal values and ethical issues present in the proposal. It contains an explanation of the created public goods and the SDG's that are used.

Group Reflection
Lastly, as a group we reflected on the project, groupwork and the extraordinary circumstances concerning COVID-19.

'The Netherlands setting the trend in social housing development.'

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gebrek aan ophef
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Hala Naoum Néhmé 25 feb

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De leefbaarheid in arme wijken met veel sociale huurwoningen, neemt steeds verder af. Voor de bewoners betekent dat meer overlast en een groeiend gevoel van onveiligheid.

Redactie 3 februari 2020, 7:25

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Menu nrc.nl

Great Satisfaction Leiden Residents

Wijkprofielen Hoewel de objectieve cijfers voor de stad beter zijn, zijn Rotterdammers minder tevreden over hoe ze leven in de stad en hun wijk.

Mariolein Kooyman 6 februari 2020 Leestijd 3 minuten

Rotterdam, it's time for soc

De be

Haag, maar ze mogen zich wel uitlaten ov

bestemmingsplan. *Roland Huguenin* vindt

Figure 96
Positive headlines with Closed Loops, Open Justice (illustration by authors, based on Benali, 2018; Bolhuis, 2020; De Volkskrant, 2020; Doucet et al, 2016; Huguenin, 2020; Kooijman, 2020; Winterman, 2020)

8.1 Conclusions

The ‘Closed Loops, Open Justice’ project sought out to investigate how the circular construction transition can be used in realizing the housing challenge of the Province of South Holland while ensuring a just distribution of social housing.

Through our analysis and site studies we investigated further into the themes of circular construction and its true costs and benefits, the densification agenda of the province of South Holland and the current social housing situation. We found possible conflicting interests between the proposed densification strategies of the province and the development of social housing. In addition to these conflicts there are the burdens of transitioning to a circular construction industry. These are brought about by acknowledging that the true cost of a circular industry will need to factor in environmental and social costs that come with production of scarce raw materials and the technological processes used in the construction of housing. These burdens are aggravated further by continued dependency on the current linear processes of construction and the unsustainable nature of current capitalistic short-sighted, business models. Moving forward into this transition, if these conflicts are to be left unchecked, we foresee a situation where social housing stakeholders continue to be neglected, leading to decreasing housing stock and subsequently, gentrification follows. Vulnerable groups such as the low-income and the elderly, will be pushed out of current city centres to make way for private housing.

Our ‘Closed Loops, Open Justice’ vision for South Holland seeks to address the densification challenge of south holland through representative strategic projects, policies and regulations that can later be scaled up across the region to other similar contexts. The “closed loops” aims to create local sustainable interventions around existing urban areas using tools formulated from the circular construction industry to solve spatial justice issues in the transformation and renovation of social housing neighbhourhoods. The integration of these local closed loops into a regional network of coordinated loops will create a circular system of interaction that enables the province to not only solve densification challenges at a micro scale but also at a macro scale.

Figure 97 Visualisation Moerwijk (illustration by authors, based on Kjellander Sjoberg 2013)

8.2 Limitations

The research of ‘Closed Loops, Open Justice’ is highly dependent on the participation and willingness of people to change from passive to active members in the process of creating a circular economy. Local inhabitants are expected to take part in the decision making process and employees in the construction industry will need retraining and re-education to remain employable. To stimulate this behaviour, several policies and regulations are addressed in this research, where there is a focus on the inclusion of vulnerable groups of society. However, there will always be citizens who are not interested in joining the transition towards a circular economy.

Another limitation focuses on the realization of social housing. Currently, densification is mainly happening around Transit Oriented Developments zones in city centres. This project focused on the densification of just social housing in part of these areas, but did not take into account the financial aspect of creating these homes in an affordable way. This also has to do with another issue of the social crisis, namely on how to integrate social housing and the private housing sector in an equal way in the city. Gentrification and segregation are important issues which are now playing a huge role in the development of big cities and the integration of social- and private housing is therefore an important and sensitive aspect on which further research is needed.

Finally the current concrete flow is one of the subjects which is analysed in this report as a tool towards our vision. However, in order to achieve a complete image of how the current construction industry can be changed into a more circular one, further studies should be done on the remaining flows and the pollution of these flows in the construction and demolition sector. Also issues such as considering new materials from organic waste that can be used in the construction industry, could enhance the content of this research.

Recommendations

As mentioned in the limitations, the research of ‘Closed Loops, Open Justice’ is highly dependent on the participation and willingness of people to change their current lifestyle and behaviour. We made this research through the eyes of an urbanist, while it is recommended to also consider the more social side of how to change people’s behaviours, willingness and participation to deal with the transition towards a circular economy. This could enhance the research that has been done so far.

For future investigation it is also recommended to do more research about the financial aspect of creating just social housing in urbanized areas. This means elaborating on how to create affordable just social housing in between existing city borders. For the issue of integrating social and private housing in the future, it is recommended to do further studies on privatizing social housing, such as the research of Aalbers & Holm (2008) and De Heer & Dignum (2005). According to Aalbers & Holm (2008), privatizing social housing can diversify homeownership and help to stabilize vulnerable areas. De Heer & Dignum emphasize the fact that the sale of social housing can benefit ethnic minorities, moderate-income families, larger families and local inhabitants. Privatization of social housing can therefore be seen as a method in achieving a more diverse and inclusive neighbourhood with stronger local identity, which is applicable to the “open justice” goals we addressed in this research.

Scientific relevance

Through our studies of the construction flows in South Holland, we looked into research about the current linear models of the construction industry. We identified it’s benefits and downsides and through this research we developed our “CLosed Loops Open Justice” vision. The “closed loops” provides a resource management method that emphasizes the importance of achieving circularity within the local level as a first step to waste reduction.

The research of the true cost in this shift is a crucial part of our study, which brings up the socio-spatial justice issue. We note that the initial costs of the transformation, tend to be higher than traditional linear methods, and this increasing cost of the construction industry if passed on to the inhabitants, especially vulnerable groups in the social housing sector, would lead to gentrification. Gentrification, segregation and inequality are on the rise in the social housing sector. Therefore, we develop the concept of “open justice” which will be achieved by merging the spatial benefits of circular construction, improved physical & social infrastructure with policies and regulations for just distribution of housing.

8.3 Ethical Issues & Societal Relevance

The focus of our research lies in the social housing sector and aims for the distribution of spatially just social housing in the transition to a circular construction industry. The design is geared towards the provision of just social housing, regardless of the profile of the inhabitants. We do not make a distinction between disadvantaged groups, but instead take a general outlook at the availability and access to existing and future social housing. The proposal creates diversity and accessibility for all society groups and increases spatial justice, especially in the social housing sector.

Currently there is a pressure on cities as well as on citizens due to the demand for densification, the access to social housing and at the same time the transition towards a circular economy. South Holland densification strategy is mostly geared around Transit Oriented Development. Densification is favored because it brings about a high concentration of resources, capital, data, and talent over a small geographic territory. The Ellen MacArthur Foundation (2017) states that this concentration can enable the circular economy in various ways. However, from the densification strategies employed by the Province of South Holland, we observe that, it is very easy to fall into the trap of gentrification and segregation, by creating high value zones around transit areas and relegating the underserved and underprivileged members of society to the peripheries of urban areas. This would bring about spatial injustice within the densification zones identified for development.

On the other hand, we have clearly highlighted that there are major social benefits that the Province will derive from the shift towards a circular economy. Cultural mindsets and the path dependency have long been major barriers for this transition. The social housing sector is driven by values of spatial justice and therefore aligns perfectly with the values of justice in the circular economy.

It is important to mention the public goods that are provided with the project of 'Closed Loops, Open Justice'. This research aims to find a balance in densifying cities, but also to distribute the socio-environmental costs of circular housing development fairly within social housing units in order to prevent further gentrification and segregation that would arise from the increased cost of a circular transition. The interventions related to creating accessible just social housing not only provide better physical infrastructure as public transport, but also the social infrastructure as an improved public space.

By creating circular construction flows for a just social housing industry, the research aims at addressing frameworks such as the Dutch energy transition strategies, EU Circular Economy Agenda and the Green Deal for Europe. Additionally, the Social Development Goals (SDG's) which are addressed include: 9 (industry, innovation & infrastructure),10 (decrease inequality),11 (sustainable cities and communities), and 12 (responsible production & consumption).

We believe in the role of urbanists to try and intervene in society to represent the disadvantaged members of society in urban development.

8.4 Group Reflection

The circular economy is a great goal towards a more sustainable future. Within the ambition of 100% circularity, there are a lot of aspects that need to be tackled and we, as realistic persons, chose to focus on the most concrete one: the construction and demolition sector. In this category, hundreds of thousands of tons of waste are produced every year. It is definitely a big challenge, but it could also be a great step when circularity can be achieved in this sector.

We analyzed the current concrete flows, went to a concrete recycle company and did literature research. Digital networks, local production and material banks can be used to deal with the issue of a linear construction sector. However, we noticed circularity is great, without a doubt, but we are still critical towards the shift. Big changes are needed which, in the beginning, will lead to increasing costs in the construction industry. Segregation and inequality in the social areas can therefore be a pitfall in the starting years.

One of a planners' duties is to involve the vulnerable groups of society and take care of their public rights. Therefore, we dived into the social housing crisis, with the demand of building 230.000 new homes in the coming 10 years, in the back of our heads. We concentrated on implementing the circular construction methods into the social housing part in order to create just social housing.

As we approach this research as advocacy planners, participation and inclusiveness are important methods used to encourage stakeholders in the construction & demolition sector and the social housing area to accelerate this shift to a just future.

Through the whole research and under the situation of COVID-19, we can conclude the group work was efficient, both in the faculty as well as working from home. Online collaboration is definitely different, and harder, than face to face cooperation, but we managed as a group to adapt pretty fast. We therefore also really appreciated the fast, and as it seemed, easy shift from our tutors in giving us online education, which made the adaption to online working more smooth. We realised online collaboration makes it easier to use digital shared platforms, which might be the style of working with people all over the world in the near future.

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Appendix

Individual Reflections

After the project all group members wrote an individual reflection on a topic discussed in lectures during the project.

Additional Information

This part contains additional data and analysis to support the narrative and reasoning of this report.

Individual reflections

Chen Gao

Regional design is such a complex system when there is a goal to achieve complete circularity in the near future. Start from construction & demolition flows, the social impact, true cost and densification background should be taken into account and be considered across the scales. Through this whole approach, a vision is from principles to concrete and it works in different levels.

In the big picture, we take steps to analyze the current linear process and the demand of being circularity, a desirable future with sustainable development. However, besides the benefits, there is also a true cost of this shift which could be an emerging issue when considering the happening gentrification, segregation, and injustice, especially in the social housing area. It's a planner's duty to give priority to the public interest and let the voices of vulnerable groups be heard. That is when the first idea of a Vision come out: socio-spatial justice is our principle in this transition. Therefore, we chose to focus on construction & demolition flow in the social housing sector. And that leads to our interventions: local production with local jobs, flexible housing which is suitable for social housing, transformation and restoration to improve the building quality, infrastructure for better public transport and digitization for shared information. Then, a vision with closed loop and open justice are referring to real methods in the region.

Regional conceptual interventions need to be implemented into the local level with physical work plans. Three locations are chosen because they are representative and could be an example for the other similar sites to follow. From regional interventions and policies, we have local implementations and regulations. From regional guidance, we have physical circular construction flows. From regional phasing, we have on site timeline. The vision of the region consists of the local approaches. However, these interventions are not a linear pattern form regional to local but continuously working across the scales. For instance, the local material banks are linked to a regional manufactory network and the innovation hub have an impact on the region level. While exploring the specific tools for the strategic projects, I was always referring them back to the regional interventions in the vision and trying to strengthen their mutual influence.

To achieve our vision on both levels, the stakeholders need to be incentivized. The SDS class provided an approach on how to trigger out the stakeholders. In the power-interest matrix, the position changing of the current situation and where they should be in the circular future are reasons for the interventions and policies. The collaborations of the stakeholders are the way to carry out the interventions and reach the region vision in the end. Actually, the vision starts from the demand of the stakeholders and achieves by them as well.

Vision is the desirable future that can be realized with efforts. It's the principle and goals of all the interventions and policies, and the people involved are both participants and beneficiaries.

Jackson Gathanga

Our "Closed loops, Open justice" project seeks to tackle the issue of socio-spatial justice in the densification challenge of South Holland. This provided a good opportunity for me to delve deeper into how socio-spatial justice is addressed in the region of the South Randstad with emphasis on the province of South Holland. We began by looking at the policies and goals set out by the European region on circularity and effective management of construction waste flows. Then we looked at policies and goals set at a national level, before proceeding to address the south holland region. We noted that the governance structures at all scales of this regions have almost similar definitions of their circularity goals in the construction industry. This ensures indistinct boundaries in the policies effected at all levels. Based on this almost unanimous definitions and goals we chose to look at circularity more critically and address the true cost questions brought up by economic, social and environmental activists. Due to the current nature of capitalist businesses, there is a tendency for stakeholders especially in lucrative industries such as the construction industry to maintain rigidity in how they conduct their business while taking limited responsibility of the impact of material extraction and processing at different levels of the value chain. And here the governing bodies at all levels might be willing to overlook the shortcomings of the true costs so as to ensure that the cost of housing remains as low as possible. However, this needs to change moving forward into the transition to circular construction.
We established that, when dealing with social housing, a true circular construction industry requires a shift in not only the way of doing business, but also in the way different stakeholders interact with each other in order to effectively distribute the burdens and costs of a true circular economy. The role of all stakeholders intensifies as there is a need to redefine power relations between them. Good governance will require that these stakeholders are in constant negotiations in order to evenly distribute power among themselves. This is the only way they can commonly agree on profitable business models that will continue to supply affordable and just housing to the end users.
The true cost of circularity coupled with transportation-hub development strategies in the province also enabled us to foresee possible scenarios of gentrification through high-value development projects. This steered us towards our role as advocacy planners. This is a role that requires a keen understanding of power relations between stakeholders, in order to defend the rights of vulnerable groups and common resources in the community. Advocating for the provision of social infrastructures such as social housing and public spaces in South Holland is a huge task. It will require the establishment of new stakeholder networks and structural institutions that protect the rights of vulnerable user groups. As Ostrom points out in the governing of the commons when referring to common pool resources, designing new advocacy institutions is a difficult task, regardless of the homogeneity of the group of stakeholders or how well informed they might be.(Ostrom, 1990)

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Jort van den Broek

The essence of a vision

Regional design is an important discipline dealing with changes in the built environment, especially in a country as the Netherlands, where space is scarce. Regional design covers spatial, social and political topics. Three of these topics form the starting point of our studio: circular economy, urbanization and spatial justice. All three touch spatial, social and political issues. To solve these issues, regional designers create a vision, strategy and design. The vision is essential in this process, it forms a guiding principle for the strategy (Balz, 2020).

vision as a starting point - a vision has an element of envisioning and imagining. A vision is based on current trends and issues, but it can also be formed out of interest. Dialogues in our design team resulted in a common interest within the topics of the studio: a just provision of social housing. Social housing plays an important role in housing the disadvantaged Dutch people.

vision as a connecting element – from this interest, research and analysis is done on the topic and the placement in the bigger picture. The vision is an end product of the research, debate and analysis, but a starting point for the strategy. Our vision of Closed Loops, Open Justice put together a set of principles to reach affordable social housing. The strategy should make sure that these principles are preserved. Therefore, we created a set of tools and policies, which are implemented in the strategic projects. Finally, a timeline and phasing created a structure for the interventions. It also helped to prioritize the principles of our vision again: what is essential and what could be done later? For our design, the vision formed a connecting element between research and design: an end product for the research and a starting point for the design.

vision as an end product – as mentioned above, the vision is an end product of research, debate and analysis, but it is just the start of realization. A vision can also be seen as and end product for inspiration. A vision contains inspirational principles that to a certain extend can be implemented in other vision and strategies. We hope that our vision can be an inspiration for other students, but also for the province of South Holland for the provision of just social housing.

The importance of a vision is shown in these paragraphs. Mainly, a vision is the connecting part between research and design. Additionally, it can form a starting point or end product. Our design team start envisioning just social housing, then researched and created a vision. This vision formed a starting point for the design. This report is an end product that hopefully can be an inspiration to the readers.

COVID-19

This report is made in an extraordinary time. We could work on the university and be physically present until week 5, when the country was in turmoil by COVID-19 and we were forced to work from home. As individual, as design team and as studio we needed to adapt quickly. It normally takes a minimum of 21 days to get used to a rhythm or habit (Lally, 2009), but we did not have time for that. I am happy with the way we all adapted and how it turned out. I think our end result would not have been significantly better without this crisis.

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Roos Jeronimus

'Closed Loops, Open Justice' envisions the province of South Holland to be a global forerunner in the circular construction industry, which balances on the one hand the demand of circular construction flows while at the same time envisions the realisation of 230.000 new homes in South Holland, while taken the just social housing industry into consideration.

The merging of the two previously mentioned fields brings difficulties. Therefore, a development strategy was needed to execute and realise the vision of 'Closed Loops, Open Justice'. As Balz (2020) explains in her lecture 'From Vision to Strategy', a spatial vision for the region and its vicinity promotes a desirable future and guiding principles for development strategies. This associated development strategy consists of a series of spatial interventions, key projects and spatial policies.

The strategy should be graspable on not only the level of the region, but also on city-, neighbourhood- and streetlevel. This means the vision has to be implementable on different scales, so it can therefore be used as a guideline for the development strategy. As Van Raak (2020) described during his lecture 'Circular Economy Challenges for the Province of South Holland from a Transition Perspective', a multilevel vision is required to execute the transition towards a circular economy. In this multi-level perspective Van Raak discusses the macro-, meso- and micro level.

During this course, we tried to implement this multilevel perspective into our vision of 'Closed Loops, Open Justice' in order to create a realistic development strategy for the province of South Holland for 2050. Thinking our vision would enable us to create a feasible planning where interventions become clear at regional and local level. However, during the process I realised we had some difficulties in merging the two fields together on the different scales.

In the beginning this resulted in individuals working on their own theme. Soon we realised that the vision about creating circular construction loops, in order to provide just social housing, needed to facilitate other structural transitions in the construction industry to be implementable on the macro-, meso- and micro level of the social housing industry. What helped us in this case was the focus on generic projects in the development strategy, instead of location-dependent areas. In this way the spatial implications, which connect to the two themes on different scales, were easier to apply throughout the province which made the realisation from vision to development strategy more graspable.

Nevertheless, further work needs to be done to explore the full potential of the vision creating circular construction loops in order to provide justice in the social housing industry. The economic feasibility of our vision towards the development strategy could not be thoroughly examined during this 10 week course. However, this course definitely provided me with tools on how to tackle complex issues related to creating a vision and a development strategy on a regional level.

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Social Housing Analysis

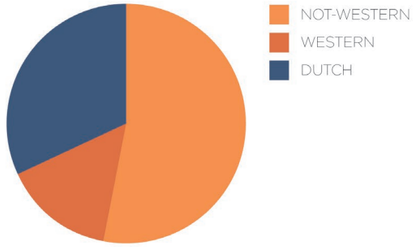
Analysis on the building quality, public space and demography of social housing areas in the province of South Holland.

Sources

CBS (2019)
Google Earth (2020)
Google Streetview (2020)
PDOK (2020)

Demography Moerwijk, Den Haag

MIGRATION BACKGROUND



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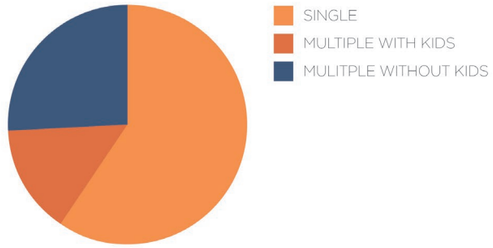

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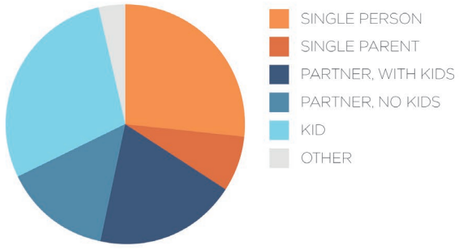

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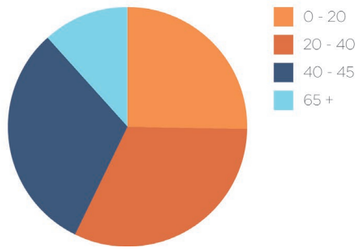
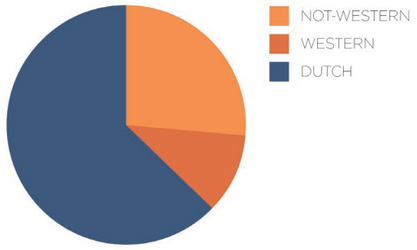


Demography Haarwijk, Gorinchem

MIGRATION BACKGROUND



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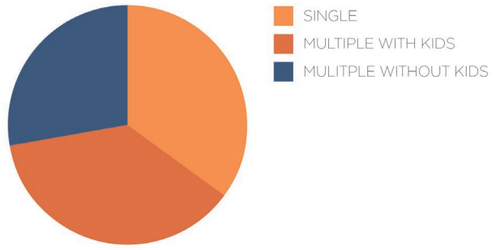

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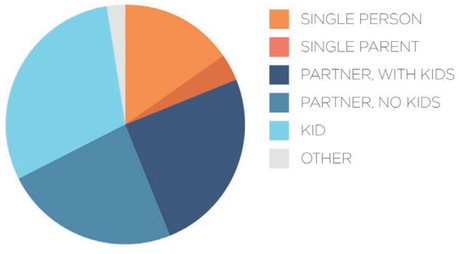

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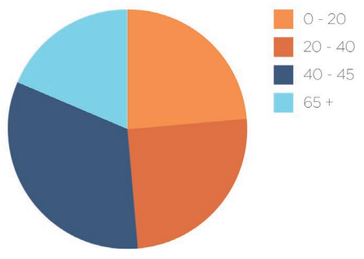


2316
NOORDERKWARTIER
LEIDEN

BUILDINGS
age: 1930s
typology: rowhouses / portico

DEMOGRAPHY
main agegroup: 20-35
main householdtype: single person
migrationbackground: 40%

2401
STROMENBUURT
ALPHEN AAN DE RIJN

BUILDINGS
age: 1970s
typology: rowhouses

DEMOGRAPHY
main agegroup: 30-60
main householdtype: mixed
migrationbackground: 20%

2526
SCHILDERSWIJK
DEN HAAG

BUILDINGS
age: 1980s
typology: portico / rowhouses

DEMOGRAPHY
main agegroup: mixed
main householdtypes: families + single
migrationbackground: 90%

2533
MOERWIJK
DEN HAAG

BUILDINGS
age: 1950s
typology: portico / gallery flats

DEMOGRAPHY
main agegroup: 0-10, 30-40
main householdtypes: young families
migrationbackground: 70%

2628
DELFT CAMPUS
DELFT

BUILDINGS
age: 1980s
typology: apartment blocks / studios

DEMOGRAPHY
main agegroup: 20-30
main householdtype: single person
migrationbackground: 40%

2717
BUYTENWEGH
ZOETERMEER

BUILDINGS
age: 1970s
typology: rowhouses

DEMOGRAPHY
main agegroup: mixed
main householdtype: families
migrationbackground: 40%

3027
SPANGEN
ROTTERDAM

BUILDINGS
age: 1930s
typology: portico

DEMOGRAPHY
main agegroup: 20-35
main householdtypes: families
migrationbackground: 80%

3034
CROOSWIJK
ROTTERDAM

BUILDINGS
age: 1930s / 1980s
typology: portico / rowhouses

DEMOGRAPHY
main agegroup: 20 - 35
main householdtypes: single person
migrationbackground: 60%

3074
HILLESLUIS
ROTTERDAM

BUILDINGS
age: 1930s
typology: portico

DEMOGRAPHY
main agegroup: 20-35
main householdtype: families / single
migrationbackground: 80%

3086
PENDRECHT
ROTTERDAM

BUILDINGS
age: 1950s
typology: portico

DEMOGRAPHY
main agegroup: 25 - 40
main householdtype: families / single
migrationbackground: 40%

3137
HOLY NOORD
VLAARDINGEN

BUILDINGS
age: 1970s
typology: rowhouses / portico

DEMOGRAPHY
main agegroup: 60+
main householdtypes: elderly
migrationbackground: 20%

3142
VERTOBUURT
MAASSLUIS

BUILDINGS
age: 1960s
typology: portico / rowhouses

DEMOGRAPHY
main agegroup: diverse
main householdtypes: diverse
migrationbackground: 30%

3192
ZALMPLAAT
HOOGVLIET

BUILDINGS
age: 1960s
typology: rowhouses / gallery flats

DEMOGRAPHY
main agegroup: diverse
main householdtype: diverse
migrationbackground: 30%

3225
DE KOOISTEE
HELLEVOETSLUIS

BUILDINGS
age: 1980s
typology: rowhouses

DEMOGRAPHY
main agegroup: diverse
main householdtype: diverse
migrationbackground: 20%

3314
NIEUW KRISPIJN
DORDRECHT

BUILDINGS
age: 1950s
typology: portico

DEMOGRAPHY
main agegroup: 20-60
main householdtypes: families
migrationbackground: 40%

4205
HAARWIJK
GORINCHEM

BUILDINGS
age: 1960s
typology: rowhouses / portico

DEMOGRAPHY
main agegroup: diverse
main householdtypes: families
migrationbackground: 30%

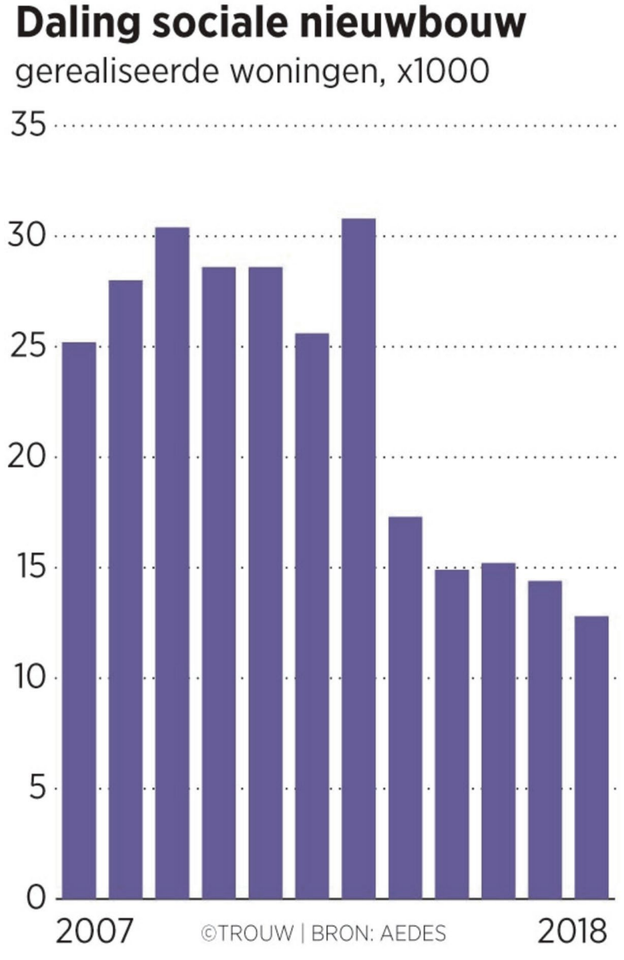
Social Housing Crisis

Data on the social housing crisis: the decrease of construction and waiting lists.

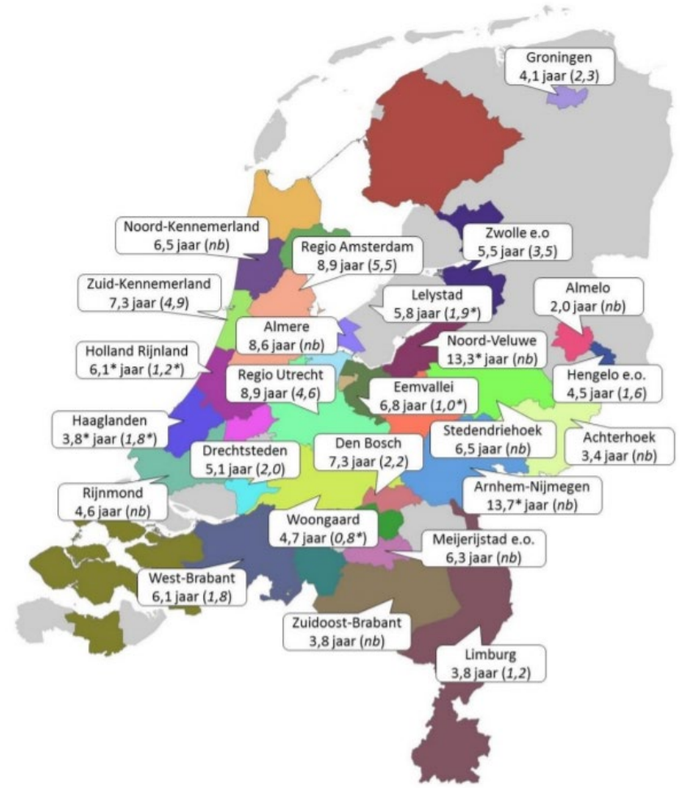
Sources

Aedes (2019)
CBS (2019)
WoningNet (2019)

Decrease in construction of social housing (Aedes, 2019)



figuur 3-1 Wachttijden bij verhuring in het aanbodmodel: gemiddelde inschrijfduur en (tussen haakjes) zoekduur bij verhuring in jaren, per systeem, 2017



Bron: WoningNet en inventarisatie periodieke rapportages, bewerking RIGO

Waiting lists in social housing (WoningNet, 2019)

Construction by corporations reaches all-time low (CBS, 2019)

True Costs

Data and numbers on the true costs of circularity and the circular economy.
Source: BAMB (2029)

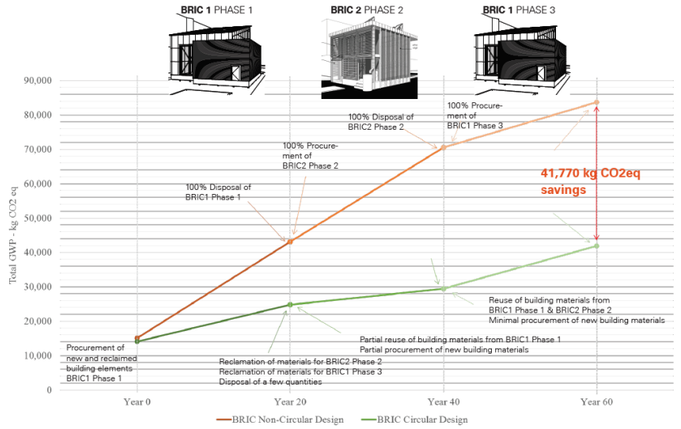
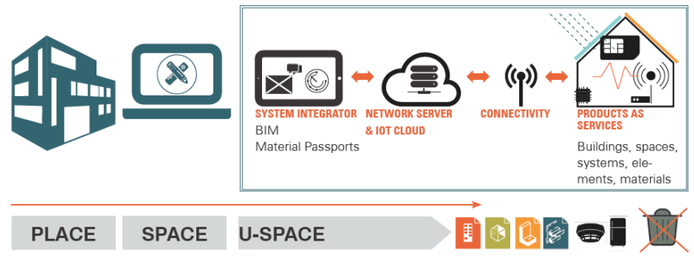


Figure 85: Cumulative Impact over time of BRIC Circular Design vs BRIC Non-Circular Design



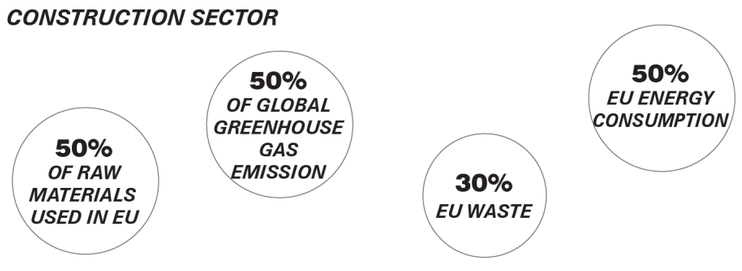
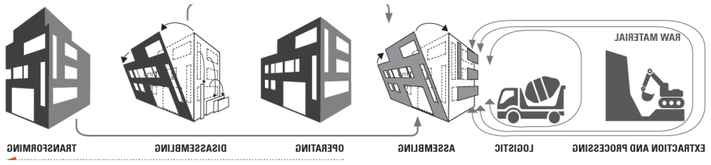
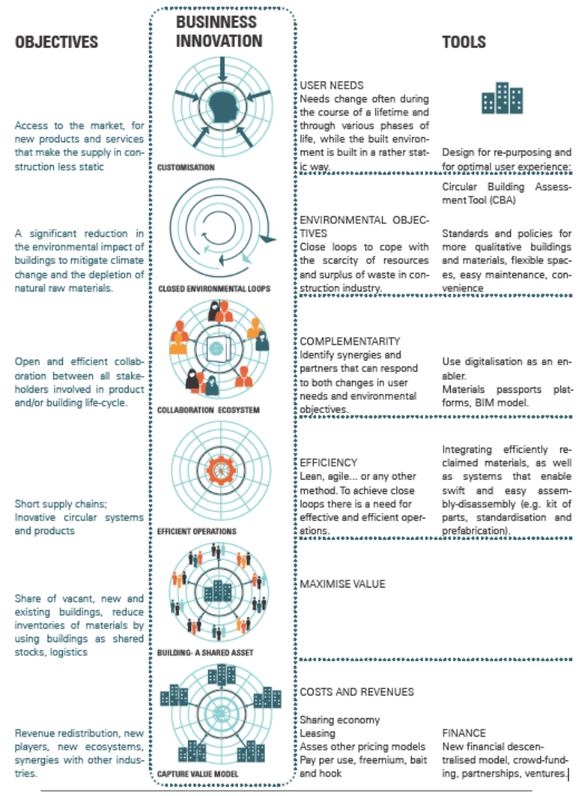


Figure 9: Overview of the construction sector environmental impact [5]





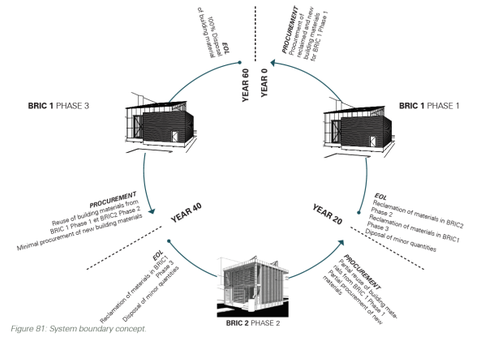


Figure 81: System boundary concept.

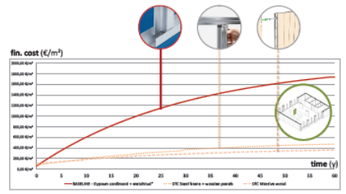


Figure 97: Scenario 1, LCC assessment of three interior wall systems (Geberit and Systimber) compared to a conventional non-reversible wall in case of implementation in a partition wall. (early transformations)

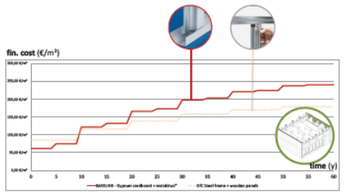


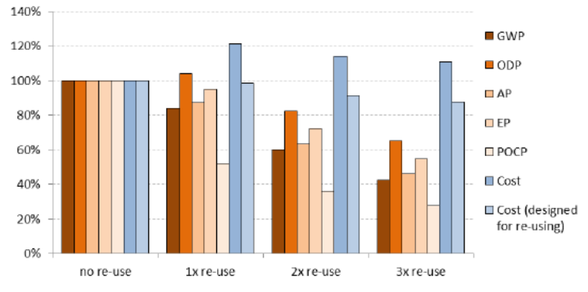
Figure 98: Scenario 2, LCC assessment of the Geberit GIS system compared to a conventional non-reversible wall in case of implementation in a technical wall. (Transformations every 10 years)

x 7.1 The multi-reuse of building products

se: Calculated environmental benefits from reusing a single steel element up to three times.

lifecycle analysis/lifecycle costing illustrated the lifecycle environmental impact and costs of a h led steel beam with welded endplates and bolted connections that can be easily reused in a sim ucture after dismantling from the original one. The results show a clear environmental benefit of reu e study anticipates reduced lifecycle costs by designing for deconstruction. (Hradil, 2014)

LCIA category	units	no re-use	1x re-use	2x re-use	3x re-use
Global warming potential (GWP100)	kg CO_2 eq.	1075	901	642	454
Stratospheric ozone depletion (ODP10)	kg CFC11 eq. x 10^{-5}	4.27	4.44	3.52	2.78
Acidification potential (AP generic)	kg SO_2 eq.	3.33	2.90	2.11	1.53
Eutrophication potential (EP generic)	kg $(PO_4)^{3-}$ eq.	0.293	0.278	0.212	0.160
Photochemical oxidation (POCP high NOx)	kg ethylene eq.	0.089	0.046	0.032	0.025
Cost	€	1149	1394	1312	1270
Cost (designed for re-use)	€	1149	1131	1048	1007



urce: Hradil, P. 2014. Barriers and opportunities of structural elements re-use. Research Report VTT 364-14. VTT, Technical Research Centre of Finland, 2014

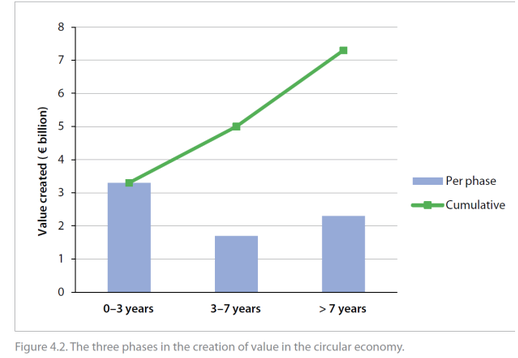


Figure 4.2. The three phases in the creation of value in the circular economy.