UrbanScraps

A local steel cycle for maritime manufacturing in South-Holland by 2050

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AR2U086 R&D Studio | Spatial Strategies for the Global Metropolis
AR2U088 Research and Design Methodology for Urbanism

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Cover image: South-Holland circular, by authors

THE TEAM

The team of Urban Scraps consists of four Urbanism students with diverse backgrounds and qualities. Together we take up the challenge to transition the Province of South-Holland towards a circular economy. Coming from different reasoning and education, we share the interest in the transition in the maritime manufacturing sector. This transition will happen in parallel with a social transition in the region. Our personal interests and ambitions will be described below.

Anna kalligeri Skentzou

I am interested in investigating the possibility of a future manufacturing sector that could adapt to the scarcities of material resources, material flows, by addressing the social transition. More specifically I am interested in exploring the evolution of the existing social structure to this process of transition by focusing mainly on two sectors; firstly, the adaption of the human capital to emerging developments in the nature of work, its facilitation through the establishment of connections in educational and research institutions.

Charlotte Verkleij

I am interested in what a circular port economy will mean in the context of globalisation. A key principle of a circular economy is less import of new materials and products, and reuse and recycle waste-products. My ambition is to close these loops locally, within the province of South Holland. In the theme of social transitions, I am interested in the transport networks in the port area that influence the mental and physical accessibility of (new) jobs in the port.

Manon Speulman

Climate change is a wicked problem of this time. However, the scale of this problem and the seriousness are difficult to comprehend. As a consequence, tackling this issue is far away from people. My goal for South-Holland would be to create a behavioural change in the inhabitants, by creating new spatial qualities and systems that incentify people into more sustainable behaviour considering waste and energy. Nevertheless, this transition should be available and accessible for everyone, through a just design.

Yueqi Zhang

The port of Rotterdam, functioning as an industrial complex, is driving the development of South-Holland. In the context of global change, especially covid and international conflict, a transition toward sustainable and endogenous industry is becoming much more crucial. However, how to strengthen the identity and link it to the citizens of South-Holland so that the industrial port is no more a far-away concept from residents? This is the issue that I want to tackle in the project.

ABSTRACT

Mankind is exhausting natural resources. Therefore, the need to transform the linear material flows towards circular chains is increasing. Steel is a material that is produced and used globally and has high potentials for recycling. However, in the maritime sector, steel is currently barely recycled, let alone reused in a more direct way. Maritime manufacturing is a vital industry in the province of South-Holland, strengthened by a strong knowledge network. The aim of this project is to localise and extend the steel life cycle, to create an environmentally and socially sustainable province in which maritime manufacturing can grow in a responsible way. In order to close the loops, the R-ladder is used as a framework for circular material flows in the manufacturing industry and in the participation of the citizens. A local steel life cycle for maritime manufacturing will be achieved through the connection of the steel using maritime companies in Rotterdam and the Drecht Cities with the steel production company of TATA Steel in IJmuiden. Missing links in the cycle, a secondary steel processing company and ship disassembly companies, will be brought to the province, providing a new purpose to the Port of Rotterdam when fossil fuels phase out. The transition to material circularity will be made possible through innovations in modular shipbuilding and renewable fuels. Innovation centres in the maker's industry will bridge between knowledge and practice. The consumers will be involved in the material transition through community re-hubs in their cities, where they can share, reuse and recycle products. In this strategy, the extensive water network will function as a backbone along which spatial developments will take place. The water backbone will be a connector for both public transport and industrial transport. This strategy for a transition towards circular steel flows in maritime manufacturing, can be an incentive and inspiration for other manufacturing sectors to close their material cycles.

Keywords | *circular economy, maritime manufacturing, R-ladder, urban manufacturing, participation*

CONTENT

1. INTRODUCTION

1.1 INTRODUCTION

Urban Scraps proposes a strategy to achieve a local steel life cycle in the province of South-Holland by 2050, focussing on the maritime manufacturing industry in the Port of Rotterdam. Maritime manufacturing can be defined as 'something made from raw materials by hand or by machinery, relating to navigation or commerce on the sea' (Merriam-Webster, n.d.). The port of Rotterdam, located in the south wing of the Randstad, has had shipbuilding in its identity for centuries. The port has been growing rapidly towards the North-Sea, partially outsourcing the manufacturing sector, while increasing its logistics and petrochemical sectors.

At the same time, climate issues are increasing the need to transition the port and the province towards a circular economy. In the current linear economy, exhaustible raw materials are the input for manufacturing, and at the end waste is the output. The circular economy strives for a closing of the material loops, where waste will be restored as value, through processes of reuse, repair, remanufacture and recycling (Wandl, 2022). This transition will go hand in hand with a social transition, to achieve equity and raise awareness among the residents. Urban Scraps sees value in the steel scraps from the industrial and residential waste and will use scraps of land in the urban network of the port and the region to accommodate the transition.

1.1 Location South-Holland

1.2 PROBLEMATISATION

1.2.1 South-Holland

The Province of South-Holland is located in the economic heart of the Netherlands: the Randstad. Still, the residents of its two major municipalities, Rotterdam and Den Haag, and some of the Drecht Cities have a relatively low income (CBS, 2020).

The net labour participation in these municipalities is also relatively low. The unemployment of people with a non-western migration background is substantially higher than for the people with a Dutch background (CBS, 2022a). This indicates that the current labour market is not very inclusive. There are also clear differences between the levels of education and the rate of labour participation. The unemployment rate is substantially higher for people who only completed primary school than for people who have had higher education (CBS, 2022 b). So, there is a need for further education to match the workforce to the jobs.

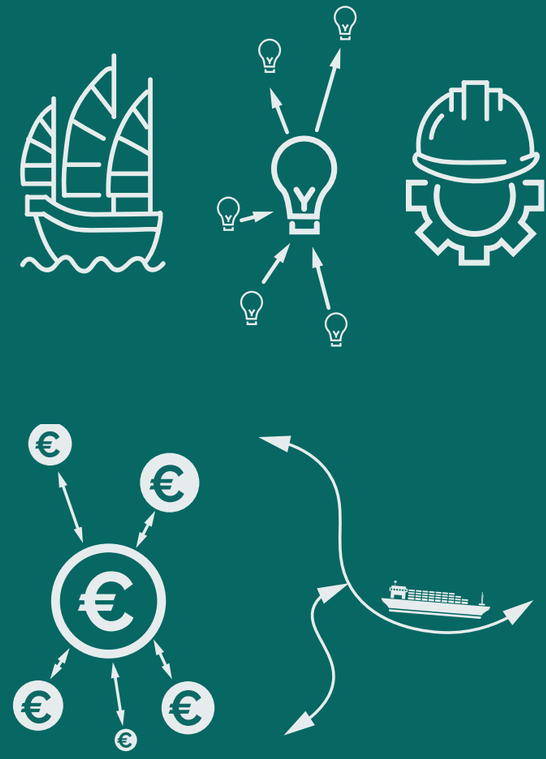
Furthermore, the province is dealing with space scarcity.The Province of South-Holland is the most densely built area in the Netherlands, as shown in the third map. Yet, there is a housing demand of 200.000 new houses until 2030 (Gemeente Rotterdam, 2021b).

In comparison to the rest of the Netherlands, the province of South-Holland has a lot of logistic companies, mostly clustered in the municipalities of Den Haag and Rotterdam, as shown in the fourth map. The cargo from the logistic hubs in the province are partially transported by trucks, using the same road system as the residents, which leads to congestion. The Port of Rotterdam is specialised in logistics, which are mostly fossil fuel based (Van den Berghe, 2022). The use of fossil fuels is polluting and leads to the emission of greenhouse gases. Therefore, the fossil fuels will have to be phased out of the port by 2050 (Port of Rotterdam & Circle Economy, 2019), causing the loss of the current main function of the Port of Rotterdam.

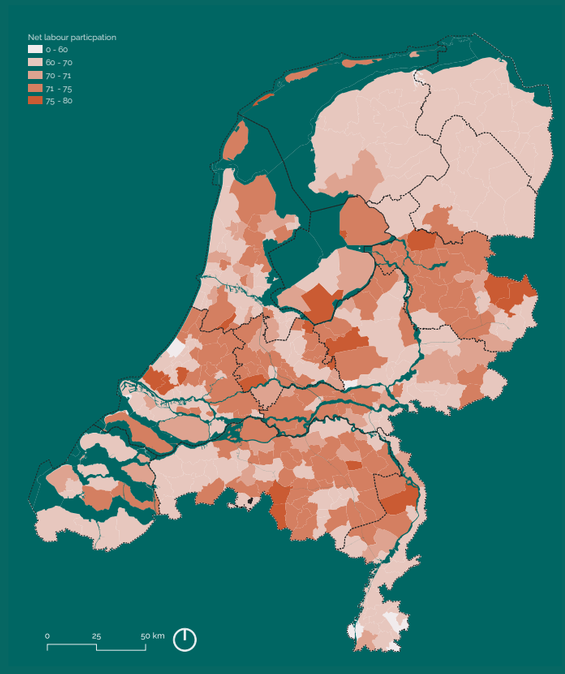
1.2.2 Maritime Manufacturing

The predominant raw material used for maritime manufacturing is steel (Van 't Hoff & Hoezen, 2021), which is an exhaustible material. Steel, like many other metals, can be endlessly recycled without losing its strength (Roest, 2022). Nevertheless, ships and off-shore constructions are currently barely recycled. At the end of their life cycle ships are often transferred to low-wage countries and off-shore oil and gas platforms are abandoned at sea. Next to that, there is a trend of the outsourcing of maritime manufacturing to low-wage countries, mostly in south-east Asia, because labour is cheaper there.

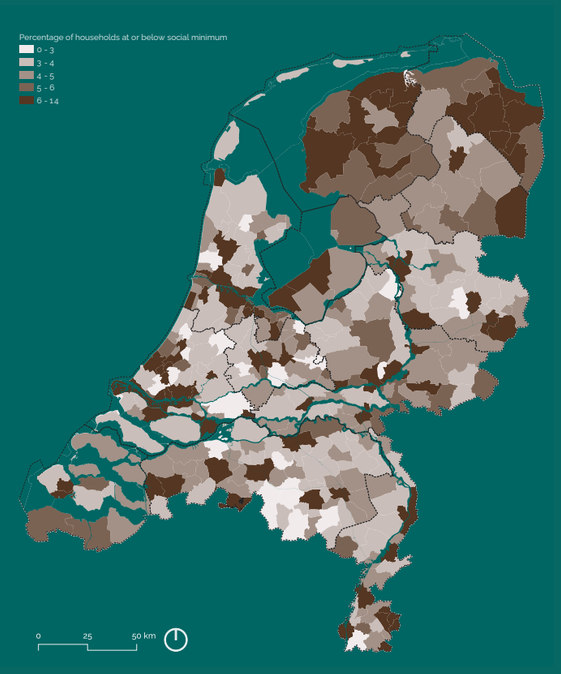
However, it is important to keep the maritime manufacturing sector in the Port of Rotterdam, in South-Holland. First of all, because ship building is in the identity of the Port of Rotterdam. It has been done here for centuries, and thus a body



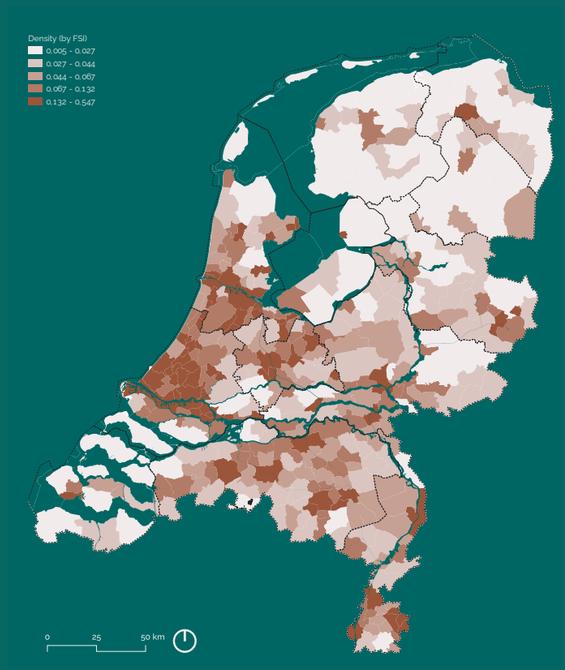
12 Opportunities for South-Holland



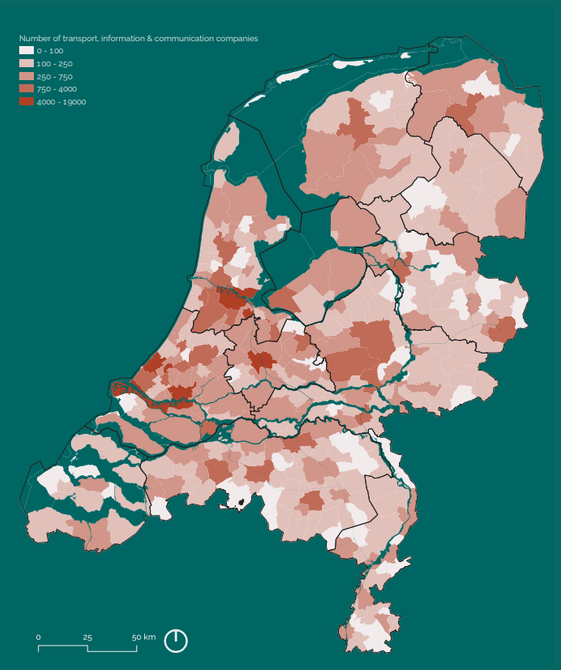
13 Net labour participation (based on CBS, 2020)



14 Precentage of households at or below social minimum (based on CBS, 2020)



15 Density built environment (based on Planbureau voor de Leefomgeving (Rijk), 2019)



16 Number of transport, information & communication companies (based on CBS, 2020)

1.2 PROBLEMATISATION

of knowledge about this sector has been built up. This is strengthened by the knowledge network of education and research institutes available in the region. Keeping, or even scaling up, ship manufacturing will also provide a lot of job opportunities for the residents of the province - and it can give a new identity and purpose to the port, when the petrochemicals will phase out. Currently, the maritime sector is coping with a shortage of skilled labour force, because of the ageing of the employees (OECD, 2022), but the province has many opportunities for high-quality education of personnel. The economical value of the maritime sector is also high, because it is interrelated with many sectors in our economy. Furthermore, the transport sector is based on water, so shipping plays an important role in the region. The waterways form the backbone for the maritime manufacturing industry.

For the import and export of crude steel, steel parts and ships and off-shore constructions, the Port of Rotterdam is dependent on global flows. Therefore, the sector is vulnerable to instabilities in global chains, caused by geopolitical crises. At this moment, we are dealing with the consequences of the war between Russia and Ukraine, resulting in many interruptions in global flows. Actually, there is a local steel production plant in the Netherlands, near the province of South-Holland: TATA Steel. This steel production is not connected to steel used in maritime manufacturing in the province. Moreover, steel production is dependent on fossil fuels, which leads to much pollution and emissions.

Already nine years ago, the European Commision (2013) stressed out the need to take care of the material life cycle in the maritime sector. The different phases of shipping should be executed in an environmentally responsible manner: from the design of the ships, the operation of shipping, up to the dismantling and recycling of the maritime constructions (European Commision, 2013)

STRENGHTS

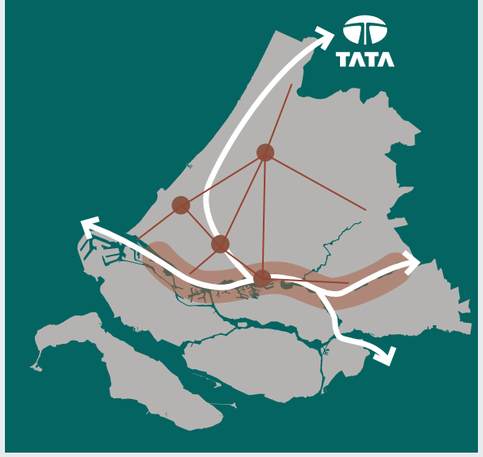
Local steel production

Ship manufacturing clusters

Research and innovation network

Water transport system

Supportive policies



WEAKNESS

Fossil fuel dependency

Missing link of steel production system

Shortage of skilled labour force

Pollution of steel industry

Spatial distance of port and neighbouhood

OPPORTUNITINES

Reuse and renewal of existing offshore platform

High-quality education

Promotion of recycling

THREATS

Material exhaustion

Manufacturing relocation

Dependency on global production chain

1.7 SWOT analysis

1.3 GOALS

1.3.1 Sustainable Development Goals

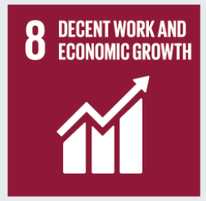
The sustainable development goals (or SDGs) were established by the United Nations in 2015. They are a blueprint for "peace and prosperity, for people and the planet, now and in the future" (United Nations - Department of Economic and Social affairs, n.d.). The 17 goals are meant to activate countries and create a strong global coöperation to end poverty and hardships, while improving healthcare, a healthy environment, education and reducing inequality. This goes together with urging economic growth, while at the same time protecting the ecology of the planet and stopping climate change. To achieve a sustainable and just development, UrbanScraps has set targets for 11 of the 17 goals. Through this the province can become more environmentally and socially sustainable. These 11 SDG's are described below in order of relevance for the UrbanScraps strategy.

The goal from the United Nations (UN) (n.d.) is to ensure inclusivity, safety, resilience and sustainability in all living environments. This includes the access to public transport and public space. Another target is to strengthen connections between cities and surrounding rural areas, in economic, environmental and social ways. An important pillar for sustainable cities is **efficient and just use of resources** (United Nations, n.d.).

The UN (n.d.) has set the goal to establish **responsible consumption and production**. The current society is driven by consumerism, which leads to exhaustion of the planet. The targets for this goal are to reduce all kinds of waste substantially, by refusing, reusing and recycling. Another important pillar for responsible consumption patterns is to raise the awareness of the people about how their 'footprint' affects the planet (United Nations, n.d.).

The UN (n.d.) has set targets to **improve infrastructures, make industry sustainable and encourage innovation**. Accessible infrastructures, from local to global scale, have the potential to reduce poverty. For industries, it is on the one hand important to create inclusive work environments and on the other hand there is an increasing necessity to transition to renewable energy sources and clean production processes. Another pillar for this goal is to support research and development in order to foster innovation (United Nations, n.d.)

The goal from the UN (n.d.) is to provide **high quality education for everyone** and to encourage lifelong learning. The main targets to reach this goal are to create inclusive access to all levels of education and ensure affordability of this. Specifically, the gaining of knowledge and skills about climate issues and sustainable lifestyles has to be promoted (United Nations, n.d.).



The UN (n.d.) has set the goal to let the economy grow in an **environmentally and socially sustainable way**, in which everyone can take part in the labour market. There should be decent work for everyone, regardless of gender and age, to increase the labour participation. Another pillar is to establish a green economy, in which growth does not affect the planet, by responsible resource management (United Nations, n.d.).

1.8 The Sustainable Development Goals (The United Nations Sustainable Development Goals, s.d.)

The goal from the UN (n.d.) is to provide **sustainable energy that is accessible for everyone**. The first pillar is to accelerate the transition to renewable energy, mostly in the transport sector, where globally only 3,4% of the used energy is renewable (in 2018). Secondly, energy efficiency should be improved. A target is set to double the global efficiency by 2030. The infrastructures for clean energy have to be upgraded and expanded, to increase efficiency and to improve accessibility to energy for everyone (United Nations, n.d.).

Because of its urgency, the UN (n.d.) has set a separate goal to fight against climate change and the impact that it has on the **living conditions** on earth. To meet the climate goals set in the Paris Agreement, the way economies are functioning now, has to change drastically. An important target therefore is the integration of climate actions in the policies of national governments. A second pillar is to raise public awareness and improve education on actions to be taken to combat climate issues (United Nations, n.d.).

The UN (n.d.) has set the goal to **end all extreme poverty** in the world by 2030. Important pillars for this goal are to set up systems to protect the poor and make them less vulnerable to for example the impacts of climate change. Everyone should have equal access to basic facilities and economic resources (United Nations, n.d.).

The goal from the UN(n.d.) is to make sure that everyone can live a **healthy, comfortable and happy life**, regardless of their age. Access to good health care services and improvement of hygiene are crucial to reduce the spread of diseases. One of the pillars for this goal is to reduce illness and deaths caused by pollution and contamination (United Nations, n.d.).

The UN (n.d) has set targets to end all inequalities based on gender and **facilitate empowerment of women**. In many countries and cultures, men are still privileged over women. Opportunities and access to education, jobs and other facilities should be equal for all genders. Also, the representation of women in decision-making positions in all levels of governments has to become more equal (United Nations, n.d.).

The goal from the UN (n.d.) is to **conserve all water bodies and to sustainably use them**. Water is rapidly being polluted by plastics and maritime waste. Targets are set to drastically reduce pollution of water bodies and to protect and strengthen the ecosystems of the oceans. This goal also targets to prevent overfishing by big companies and increase the chances for small-scale fishermen (United Nations, n.d.).

1.3 GOALS

1.3.2 The Green Deal

The European Green Deal is a roadmap proposed by the European Commission (2019) for a sustainable and inclusive growth for Europe, as a leading example for the rest of the world. It is a reaction to the rising climate issues and it implements the Sustainable Development Goals of the United Nations. The European Commission strives for an economy that is no longer resource-led and has no more greenhouse emission by 2050. In the policies and measures proposed, participation of the people is an important element, since the transition towards a sustainable economy is asking for a substantial change of the current societal systems (European Commission, 2019). The figure below shows the goals from the European Green Deal. The ones that are most relevant in the UrbanScraps will be described further.

Supplying clean, affordable and secure energy

Energy production is still mostly based on coal and carbon-based gas, resulting in greenhouse gas emissions. The EU aims for a more efficient use of energy and the production of renewable energy. One of the main drivers therefore will be off-shore wind energy. For an energy neutral economy, smart infrastructure is required, including hydrogen networks and energy storage. It is important to prevent energy poverty for households, by helping them to reduce their energy use (European Commission, 2019).

Mobilising industry for a clean and circular economy

The manufacturing industries are still very linear economies. Raw materials are extracted, which is an environmentally unfriendly process, and most products become waste after first hand use. The European Commission has set up an action plan for a circular economy to close material loops within the EU. This includes circular design of products, reducing and reusing before recycling and empowering consumers to choose for sustainable products. The Commission encourages technological innovations, for example to develop a steel production process that is energy neutral by 2030 (European Commission, 2019).

Accelerating the shift to sustainable and smart mobility

The transport sector is emitting a lot of greenhouse gas. The European Commission is aiming for a transition to renewable transport fuels for all different transport modes. The transport of goods by road should mostly change to water-based or rail-based mobility, to increase efficiency. Moreover, there should be affordable, sustainable transport modes for people, in order to change the behaviour of the consumers (European Commission, 2019).

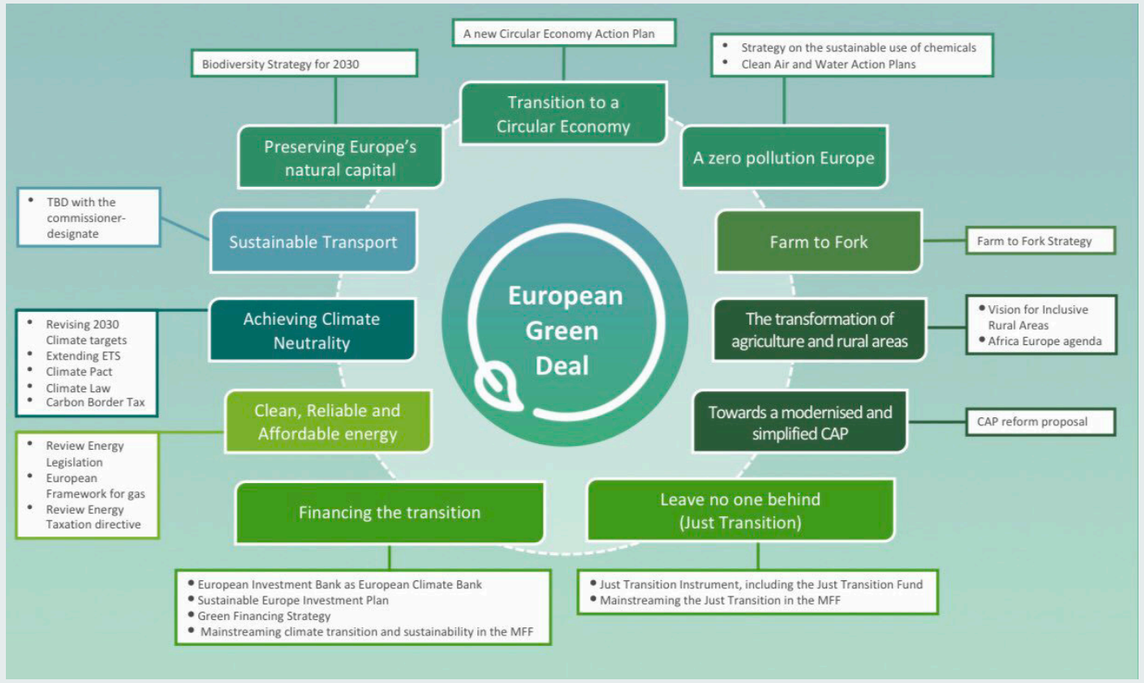
Supporting tools

Mobilising research and fostering innovation

In order to achieve the goals from the European Green Deal, research and innovations are needed on sustainable technologies and the new technologies should be implemented on a large scale. To innovate, experimentation, multidisciplinary collaboration and the involvement of the residents is needed. Furthermore, all research and new technologies should be accessible in a data-base (European Commission, 2019).

Activating education and training

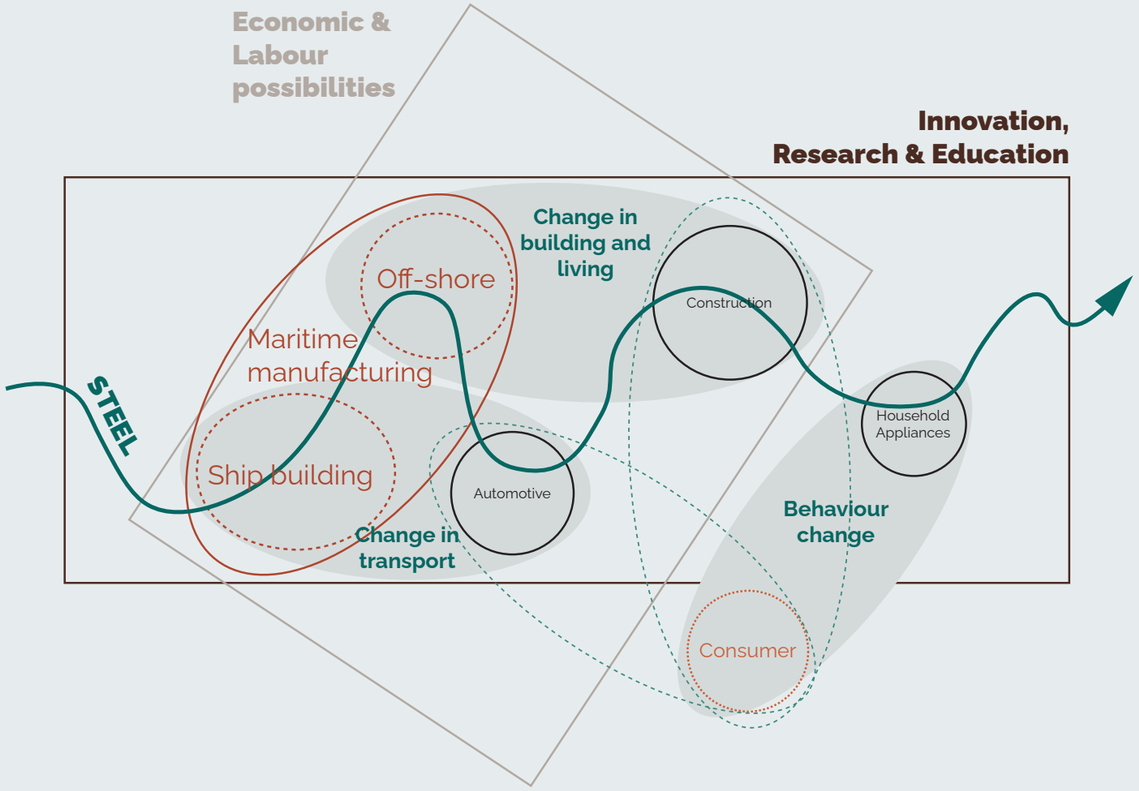
To activate a behaviour change among the European residents, the Commission is working on high quality education for all levels, with a focus on the climate issues and sustainability. The EU will also fund (re-)training programs for the workforce, so that the employees will have the skills to adapt to changing practices in their sector (European Commission, 2019).



1.9 The European Green Deal (De Europese Green Deal, z.d.)

1.3 GOALS

1.3.3 A Purpose



1.10 Targeted changes and interrelations sectors

Although the European Green Deal is presented as a promising solution to the urgent crisis of climate change, it has received strong criticism of 'greenwashing' already existing policies(Varoufakis & Adler, 2020), as it lacks a determined and or argue that it lacks an ambitious systematic change (Gabor, 2020). UrbanScraps aims for an actual change in three steel-related systems, shown in the figure below/above. Radically changing the way steel is used in maritime manufacturing, consisting of shipbuilding and off-shore, will be an incentive for the transition in other steel-using sectors as well. The transition in shipbuilding and automotive manufacturing will lead to a change in transport. On the other hand, reinventing the steel cycle in the off-shore and construction sectors will lead to changes in building and living. Maritime manufacturing does not directly involve the consumer. The automotive and the construction sector are already closely related to the people. Still, a behaviour change of the consumer can be achieved mostly through a transition in the household appliances. For the reinventing of the steel cycle, innovation, education and research need to be supported. At the same time, this transition will come with economic and labour possibilities.

1.4 METHODOLOGY

1.4.1 Research question

HOW CAN THE MATERIAL TRANSITION TOWARDS A MORE ENDOGENOUS SHIPBUILDING PROCESS ESTABLISH A MORE ENVIRONMENTALLY AND SOCIALLY SUSTAINABLE SOUTH-HOLLAND?

HOW CAN THE STEEL MATERIAL FLOW FOR SHIP BUILDING BE CLOSED WITHIN THE REGION?

WHAT IS THE SHIP MANUFACTURING SYSTEM?
WHAT IS THE STEEL PRODUCTION SYSTEM?
HOW CAN THE MISSING LINKS BE BRIDGED?
HOW CAN THE ENERGY TRANSITION AND MARITIME MANUFACTURING SUPPORT EACH OTHER?

HOW CAN INNOVATIONS IN MARITIME MANUFACTURING IMPROVE ENVIRONMENTAL SUSTAINABILITY?

WHAT IS THE INNOVATION SYSTEM?
HOW CAN THE FRAMEWORK OF REFUSE, REUSE AND RECYCLE BE IMPLEMENTED IN SHIPBUILDING?
HOW CAN THEORY AND PRACTICE BE CONNECTED BETTER?

HOW CAN THE CITIZENS BE INCLUDED IN THE TRANSITION TO ACCOMPLISH SOCIAL SUSTAINABILITY?

HOW CAN THE CONSUMER BE INVOLVED TO RAISE AWARENESS?
HOW CAN THE WORKFORCE BE (RE)TRAINED?
HOW CAN THE PHYSICAL AND MENTAL DISTANCE BETWEEN THE PEOPLE AND THE PORT BE BRIDGED?

ASSIGNMENT

circular economy
maritime manufacturing
social transition

Province of South-Holland
Port of Rotterdam

policy documents
> literature review

FIELD TRIP

manufacturing at Drecht cities
> interview recycling company

water based transport
waterbus

makers district M4H & RDM
> tour at RDM campus

PROBLEMATISATION

problem statement
> SWOT analysis

GOALS

SDG'S
European Green Deal

RESEARCH QUESTION

CONCEPTUAL FRAMEWORK

local steel life cycle
innovation
energy transition

ANALYSIS

unravelling the systems
> literature review
> analytical mapping
> data-based mapping (LISA Data + GIS)
> flow analysis

THE CHALLENGE

> TOWS analysis

VISION 2050

A local steel production cycle for the ship manufacturing in South-Holland
> design experiments
> research by design

STRATEGY

Governance
> power & interest
> policy documents

Phasing
dialogue & innovation
attraction & development
integration & expansion

Design objectives
key projects
> design experiments

CONCLUSION

assessment
relevance
reflection

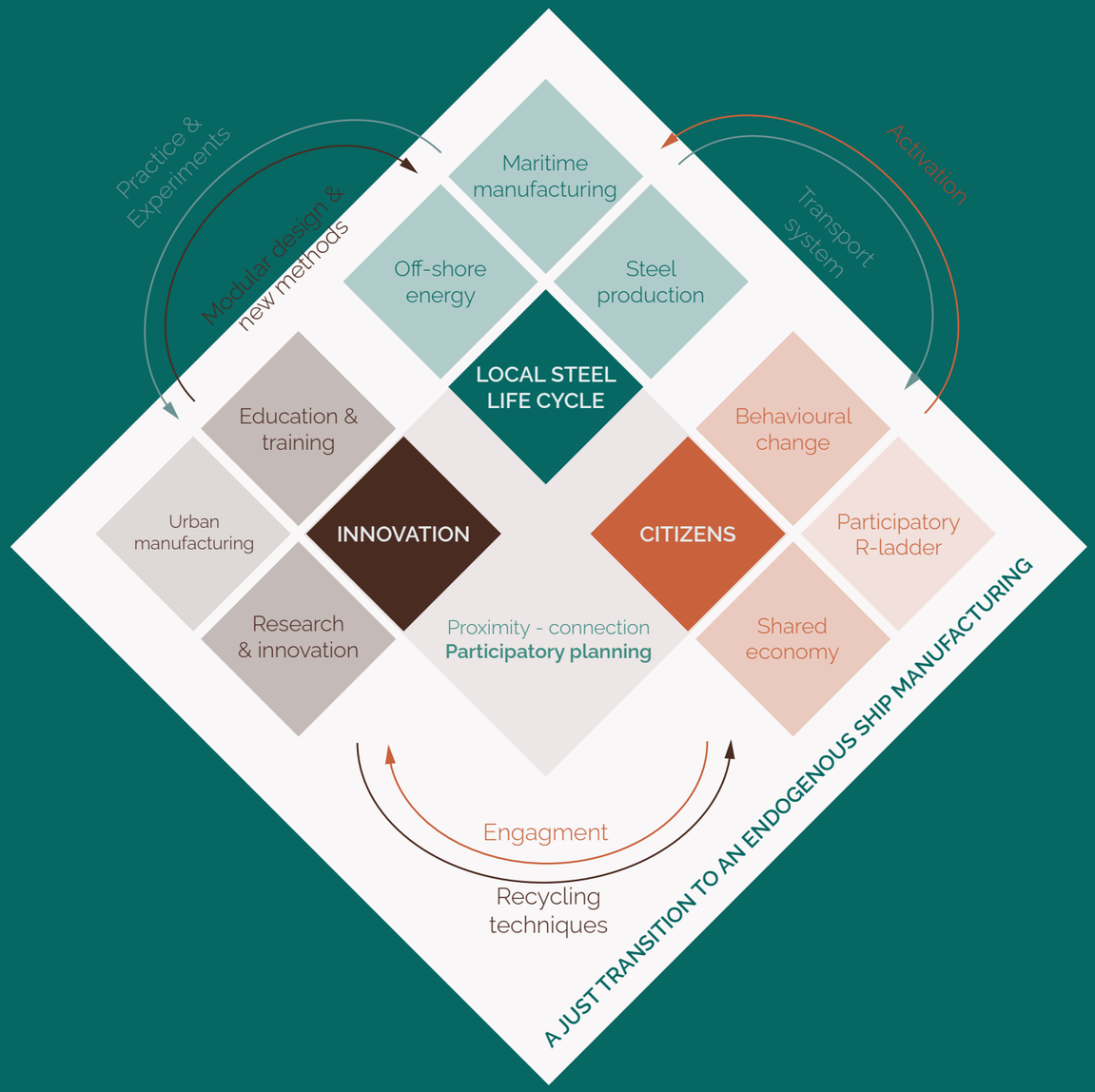
1.11 Methodological framework

1.4.2 Methods

Different methods are used to conduct the research during the different phases of the spatial design project, as showcased in the figure below [methodology scheme]. Since the assignment is about a circular economy in the province of South-Holland, focussing on the Port of Rotterdam, initially the relative policy documents of these main actors are reviewed. Additionally an extensive literature review on the maritime sector and urban manufacturing was conducted, in order to gain an understanding of the sector. During the field trip, interviews were used to gain a better understanding of the processes and some of the stakeholders involved. The strengths - weaknesses - opportunities - threats analysis (SWOT) was used to frame the problematization. For the spatial analysis of the current systems multiple methods were used: literature review, analytical mapping, data-based mapping (using the LISA database in GIS) and a flow analysis. As a conclusion of the analysis phase, an inverted SWOT analysis is done (a TOWS analysis), to specify the challenge. Design experiments and research by design are the methods used to create the vision and the strategic projects. For the analysis of the stakeholders a power-interest diagram and stakeholder interest diagram was made.

1.5 CONCEPTUAL FRAMEWORK

The conceptual framework for the achievement of an endogenous ship manufacturing sector in the Province of South-Holland is shown in the figure below. Taking the local steel life cycle as our lens, we also include innovation and citizens to establish a complete functioning system.



1.12 Conceptual Framework

Local steel life cycle

A local steel life cycle for maritime manufacturing means that the steel material flow will be closed within the region. The linear steel life line, from importing raw materials to exporting waste, will be transitioned towards a local circular process, by linking the production of steel to maritime manufacturing and the other way around. Locally produced steel can then be used in the maritime manufacturing sector and steel waste coming from the maritime sector can be locally recycled at the steel factory. Steel production demands a lot of energy, which is currently based on fossil fuels. The use of renewable energy in the processes of the steel cycle will substantially reduce the greenhouse gas emissions and the pollution. This transition is essential for the achievement of a sustainable manufacturing process in the region. In the other direction, the steel life cycle for maritime manufacturing can also be implemented in the manufacturing of off-shore constructions for renewable energy.

Innovation

The transition into a more endogenous ship manufacturing system and a localised steel material flow requires advancements in the technology that is applied in the sector. Therefore, innovation is a key process that needs to be reinforced. Three specific sectors might facilitate the process of innovation; research, education and urban manufacturing. Particularly, urban manufacturing in makers districts might play an instrumental role in the transition towards a new circular economy by contributing in closing local material loops. By refocusing on local ways of production, introducing innovation and new skills, improving material flows, and working with various stakeholders, urban manufacturing can contribute to sustain a thriving economy, stimulate innovation, address climate change and foster economic and social inclusion (Hill, 2020).

Citizens

The inclusion of the citizens in the process of transition is important to establish a behavioural change. This could be potentially achieved through different strategies; community inclusion to a participatory R-ladder and participation in a shared economy. Firstly, active citizen engagement into a participatory R-ladder could create community incentives and strengthen the local material flows. R-ladder refers to extending material life cycle through the steps of refuse, reuse and recycle (RVO, 2022). By moving up the ladder, behavioural change will happen in social aspects that most of the products are going to enter the circular economy instead of end their life disposed somewhere. Through promotion of the shared economy, the highest step of the R-ladder can be reached: refusing.

Synergies

The transition to an endogenous ship manufacturing process needs to be based on the synergetic relationship between three aforementioned components; material circularity, innovation and citizen engagement. To facilitate these synergies, proximity is crucial.

The creation of a local steel cycle is highly dependent on advancements in the innovation system. Simultaneously, the new methods from research institutions are the basis of industrial upgrading, practice and experiments that can be carried out in urban manufacturing, this also feeds back to innovation.

The development of maritime manufacturing is linked with the transportation system which plays a crucial role in the landing of social participation since the recycling of products largely relies on water transportation. At the same time, social participation also activates the transition of steel production.

The innovation system provides methods of recycling techniques, and the engagement of citizens provides foundations for the workforce and researchers to promote the development.

2. UNRAVELLING THE SYSTEMS

2.1 MARITIME MANUFACTURING

2.1.1 What is Maritime Manufacturing

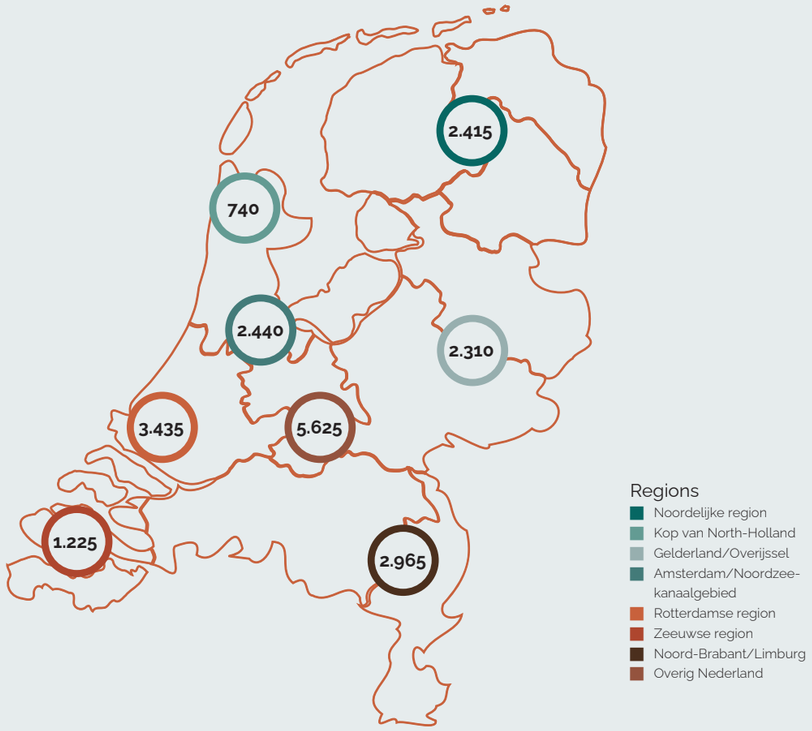
The term maritime manufacturing can be defined by first defining the two words separately. Merriam-Webster (n.d.) gives the following definitions:

- ***Manufacture (noun): something made from raw materials by hand or by machinery***
- ***Maritime (adjective): of or relating to navigation or commerce on the sea***

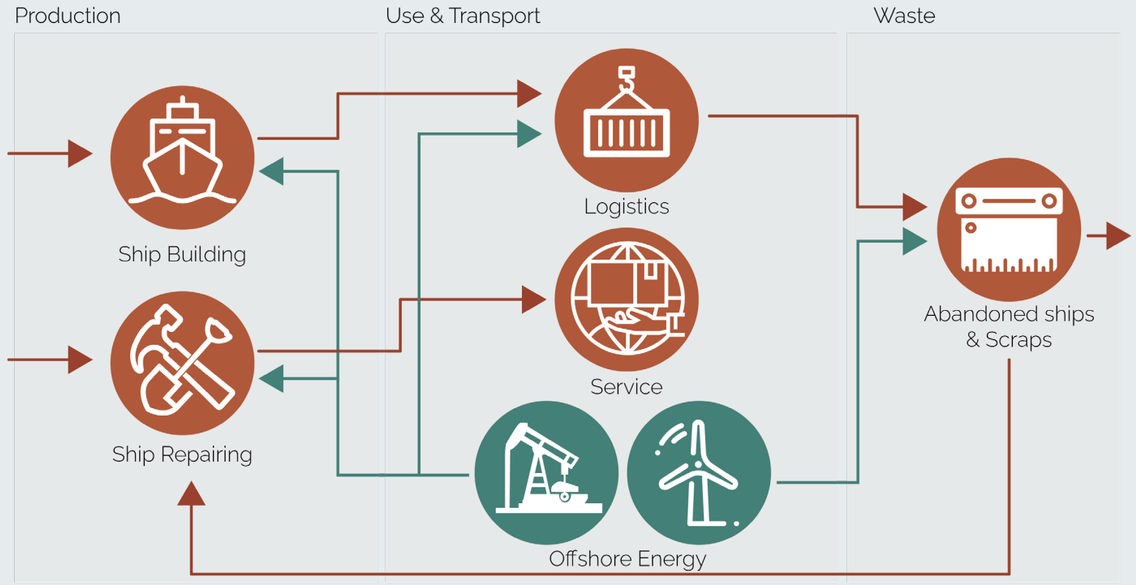
Maritime manufacturing can therefore be defined as the production of navigation or sea related objects, from raw materials. OECD (2022) distinguishes three different sectors within maritime manufacturing: the shipbuilding industry, the offshore industry and the marine equipment suppliers. For all these industries, their life cycle has got three phases: the production, the use & transportation and the waste.

2.1.2 Facts & Figures

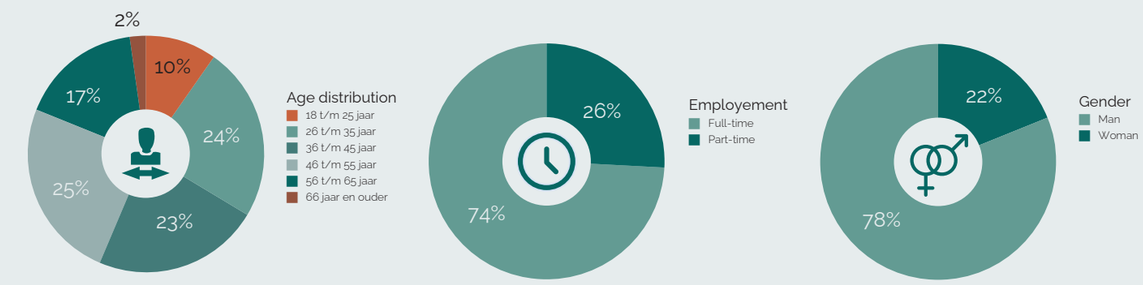
The Netherlands is a maritime region, and thereby maritime manufacturing is an important sector. According to the report of Nederland Maritiem Land (2021) the added value of the maritime sector was 2,9% percent of the Gross Domestic Product in 2020. Approximately 2,8% of the Dutch workforce is directly working in this sector, with the number of employees slightly growing in the past fifteen years. Three quarters of the workforce is employed in a full time job. The age distribution of the employees is quite equal for all age groups, but there is an unequally high percentage of men working in the maritime sector. Finally, the number of maritime companies in the Rotterdam region is relatively high. About 1 of 7 companies is located in this region (Nederland Maritiem Land, 2021)



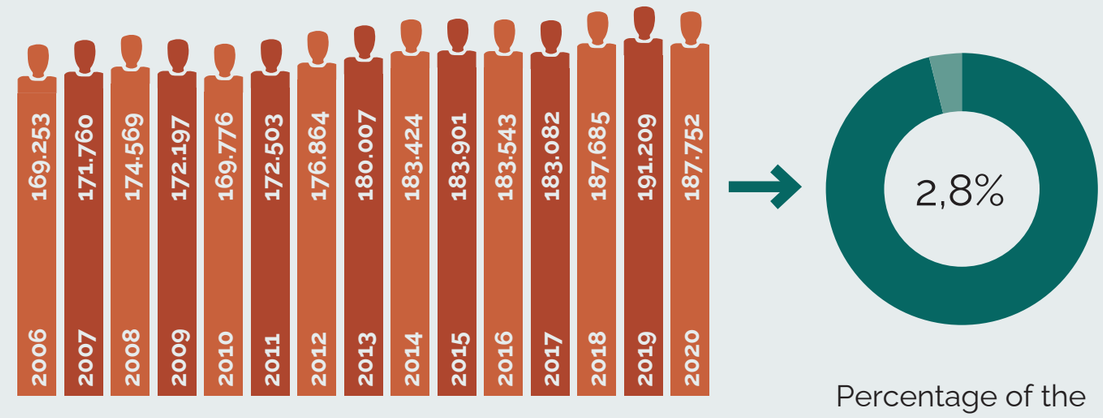
2.1. Regional Distribution of 21.155 establishments (Nederland Maritiem Land, 2021, p.2, Adapted by Authors)



2.2 The proces of Maritme manufacturing



2.3 Facts & Figures of the Maritime sector (Nederland Maritiem Land, 2021, p.2, Adapted by Authors)



In 2020, 266,650 employees were employed directly and indirectly in de maritieme sector.

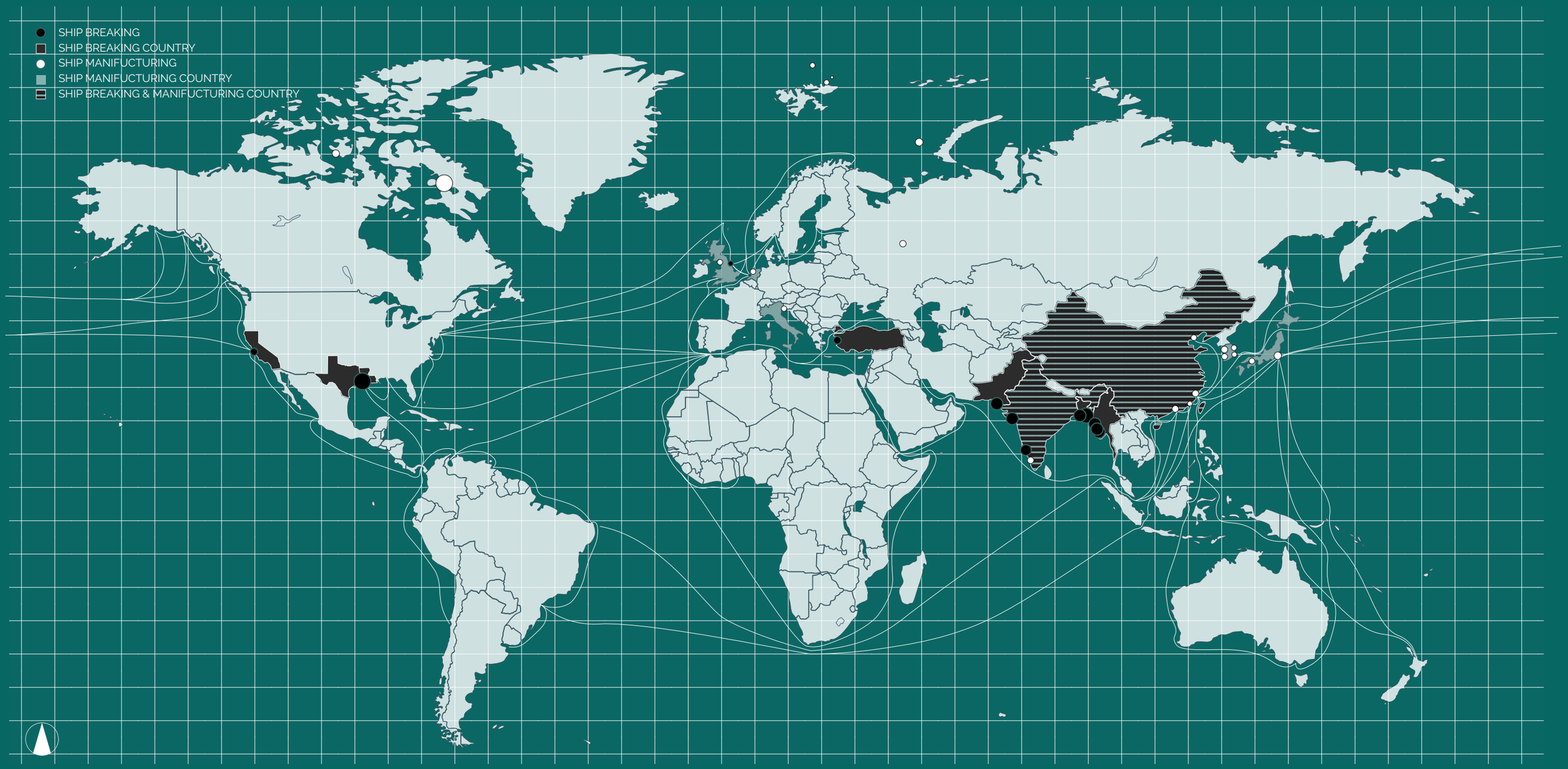
2.4 Direct employement in the Maritime Sector (Nederland Maritiem Land, 2021, p.2, Adapted by Authors)

2.2 SHIP MANUFACTURING

2.2.1 The Global System

Shipbuilding is interlinked to the identity of the Port of Rotterdam. For centuries shipping has been important for international trade (Port of Rotterdam, n.d.-a), but over the past decades there has been an outsourcing of shipbuilding. Manufacturing companies have moved to low-wage countries in mostly South-East Asia. Mass production of ships is happening there, while more specialised vessels are still being manufactured in the Netherlands.

Shipbreaking, when the vessels are out of use, also happens mostly in low-wage countries in South-East Asia and Turkey. Ships from Dutch companies are often dumped at the coast of these developing countries for recycling, which leads to unethical and damaging circumstances.



2.5 global connectino of ship breaking

2.2 SHIP MANUFACTURING

2.2.2 The Need for Disassembly

In the coming decades the amount of ships that will need to be disassembled will substantially increase, as shown in the figure below (Van 't Hoff & Hoezen, 2021). Over the years the global fleet has been growing, not only the number of ships, but also the size of the vessels have increased. When these ships reach the end of their lifetime, there will be a large assignment to recycle them in an environmentally and ethically responsible way (Van 't Hoff & Hoezen, 2021).

Disassembly of EU-flagged vessels has to happen within the European Union, because of the regulations of the Basel Convention (Recycling Product News, 2022). The Basel Convention, adopted by all United Nation member states, regulates waste management. For the shipbuilding industry, the rules will have to prevent low-wage countries from becoming ship dumping yards. Still, 30% of the vessels that are to be recycled in Bangladesh, India or Pakistan under harmful conditions, are coming from European shipping companies. The regulations state that the ships from European companies will have to be disassembled and recycled within the EU. Waste management within the EU is also a goal in the European Green Deal: material flows will have to become circular (Recycling Product News, 2022).

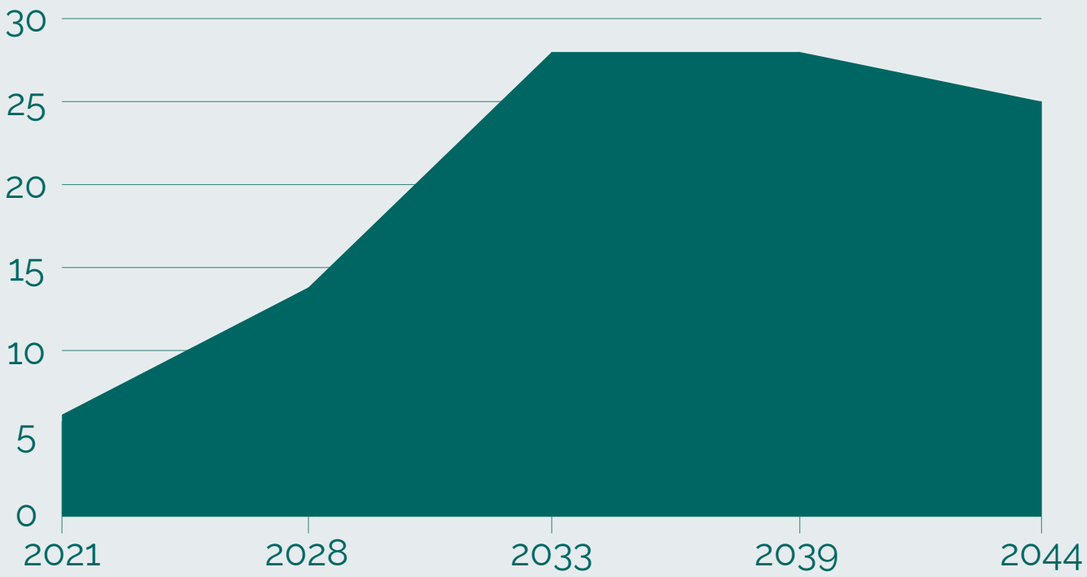
2.2.3 What do we Built

The Dutch shipbuilding mainly consists of specialised vessels, which means a high variation of types and a low amount. Netherlands Maritime Technology (2021) distinguishes three groups of ships: seagoing vessels, inland, fishing & small seagoing vessels and a special type of seagoing vessels: the superyachts, see figure. The superyacht building is relatively large in the Netherlands, with 61 orders in 2020. There is an upcoming trend for these yachts built at the Dutch ship wharfs to become larger (Netherlands Maritime Technology, 2021). The superyacht built for Jeff Bezos at the Oceanco wharf in Alblasserdam is so large that the Hef Bridge in Rotterdam will need to be dismantled for the yacht to pass by (Cooban & Riley, 2022).

The mostly built vessel type at the Dutch wharfs are the dry cargo ships and tankers for inland shipping, with 128 orders in 2020 (Netherlands Maritime Technology (2021). The Netherlands has got important water corridors for inland shipping. Goods that arrive from overseas in the Port of Rotterdam are shipped further towards the hinterland with inland vessels (Baggen & Van Ham, 2019).

Shipbuilding at the Dutch wharfs mostly consists of the assembly of pre-manufactured steel plates. Damen (n.d.) describes the different processes that happen at their ship wharves. The steel plates and profiles are being assembled into panels and subpanels, which are then assembled into a section. A ship is often being manufactured upside down, because the deck is levelled horizontally on the ground. To prevent the steel from rusting (oxidation), the ship is painted with multiple layers. After that, different sections are assembled into a ship. This happens mainly at a dock or a slope, so that the ship can easily be moved in the water afterwards. The finalising step is the 'outfitting', where the interior is fixed in the ship. Next to that, the machines of the ship are tested. After a test run, the ship is delivered to the owner (Damen, n.d.).

In the future, there might be possibilities for new types of ships to be built in the maritime region of South-Holland. For example, the energy transition from fossil fuels to renewable energy will most probably lead to a decreasing demand for tankers. At the same time, the tourism and recreational sector might grow, leading to new types of yachts and ferries.



2.6. Increased need for disassembly (SSI, 2021, p.7, Adapted by Authors)

SEAGOING VESSELS

	CRUISE SHIPS	DRY CARGO SHIPS AND TANKERS	OFFSHORE, WINDFARM SERVICE	DREDGERS	FERRIES	SUPERYACHTS	WORKBOATS, TUGS AND SERVICE VESSELS
Order book*							
Number	-	38	9	7	2	61	12
GT	-	150,963	4,910	38,193	930	99,601	3,487
CGT	-	212,358	18,069	59,512	3,122	245,350	18,044
Million €						5,380	
Delivered							
Number	1	8	2	5	-	16	12
GT	5,937	41,977	18,498	33,595	-	16,791	3,935
CGT	16,538	53,014	22,163	51,877	-	49,969	19,660
Million €						849	
Received orders							
Number	-	12	5	1	2	27	9
GT	-	48,919	3,581	2,333	930	40,290	2,566
CGT	-	66,484	11,372	5,635	3,122	99,784	13,505
Million €						2,150	

INLAND, FISHING & SMALL SEAGOING VESSELS

	PASSENGER VESSELS	DRY CARGO SHIPS AND TANKERS	SERVICE VESSELS	DREDGERS	FERRIES	FISHING VESSELS	TUGS AND PUSHERS
Order book*							
Number	11	123	17	3	21	15	6
GT	24,625	203,575	1,830	1,160	3,012	4,078	569
Million €	235	798	61	18	66	63	16
Delivered							
Number	12	61	25	41	4	9	7
GT	23,000	103,985	3,158	5,951	468	2,379	557
Million €	233	384	51	132	13	34	11
Received orders							
Number	1	98	16	30	19	6	6
GT	2,000	162,290	1,661	5,699	2,230	1,037	346
Million €	-	630	31	109	52	20	7

2.7. Ship building in the Netherlands (Netherlands Maritime Technology, 2020, p.18, Adapted by Authors)

2.2 SHIP MANUFACTURING

2.2.4 The Players

This map shows the ship manufacturing and repair companies in the Province of South-Holland and the maritime region of the Port of Amsterdam. Most of the companies are actually not located in the Port of Rotterdam. The activities in the port are nowadays mostly based on logistics and petrochemicals (Port of Rotterdam, n.d.-a). Maritime manufacturing is generally located in the Drecht Cities. Large shipbuilding companies in this cluster are IHC Holland / Royal IHC, Breko and Damen. More to the north of the province, around the Haarlemmermeerpolder, there are two other large shipbuilding companies located. Royal van Lent and Koninklijke de Vries Scheepsbouw are specialised in the building of superyachts.

Next to shipbuilding, ship repair is an important industry in the Netherlands, for the maintenance, repair of damage and refitting (Netherlands Maritime Technology, 2021). In the maritime region of Rotterdam and the Drecht Cities, there are many rather small repair companies. Damen Repair, located at the Port of Rotterdam is the biggest repair company in the region. Although there are no ship manufacturing companies located in the Port of Amsterdam, there are some repair companies located there. Two of the ship repair facilities in Amsterdam are owned by Damen.

2.2 SHIP MANUFACTURING

2.2.5 The System

The system of ship manufacturing in the province is shown in this map. The most important area where shipbuilding happens is in the cluster along the waterway from Rotterdam to the Drecht Cities. This cluster includes companies for shipbuilding and ship repair. A second cluster can be found further north in the province, around the Haarlemmermeerpolder, where superyachts are manufactured.

Steel panels and profiles are imported and shipped to the ship wharves. There the steel parts and the other equipment are assembled into ships. The constructed ships are used for inland shipping in the province, the rest of the country or in the hinterland or for overseas shipping. When maintenance or repair of damage is needed, the ships can be brought to the repair companies in the ship manufacturing cluster or at the Port of Amsterdam. As soon as the ships are out of service, they are often exported to low-wage countries for the dismantling and recycling.

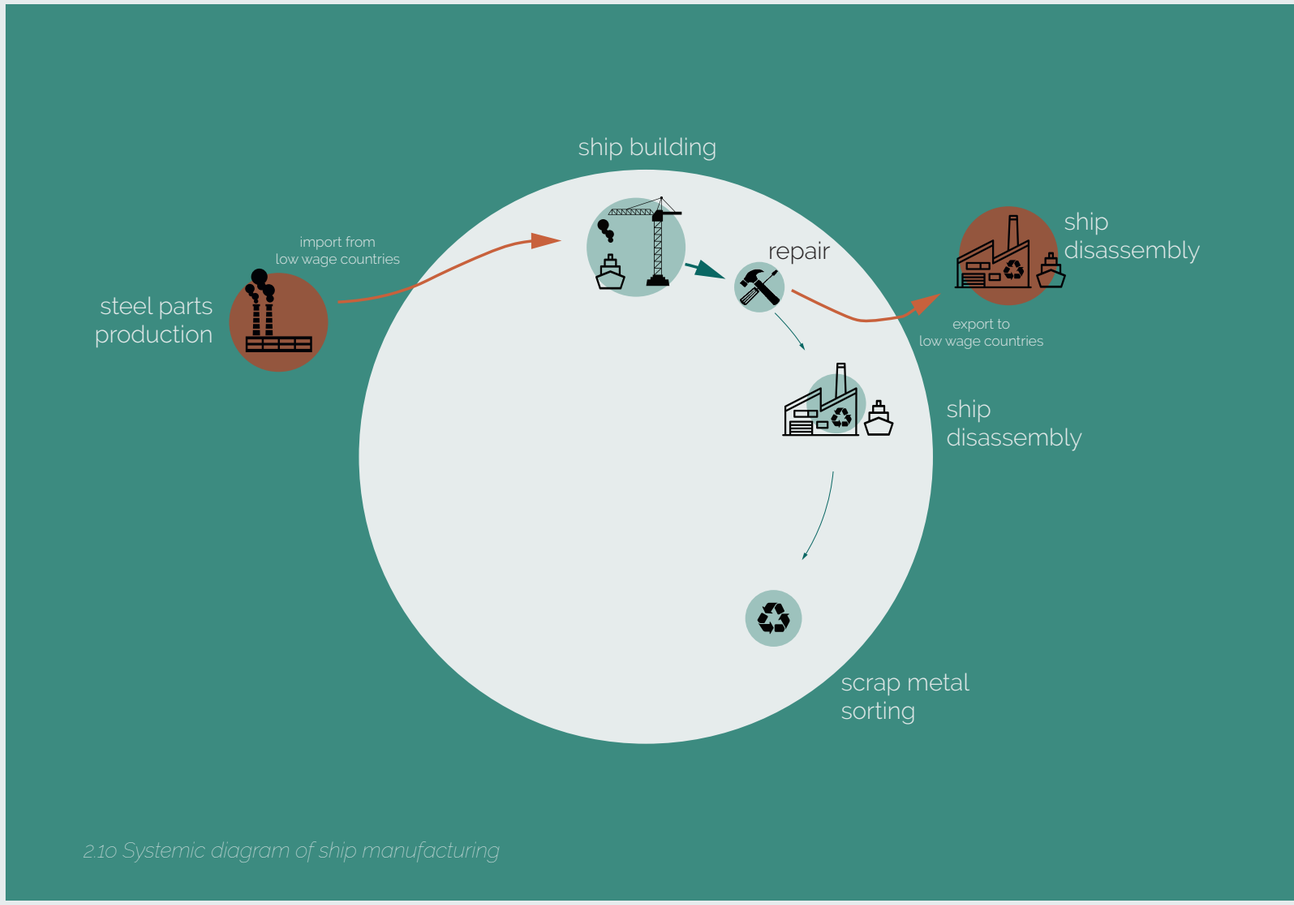
The province of South-Holland has got only one ship disassembly company, located at 's-Gravendeel. At this disassembly wharf, one ship at a time can be dismantled. The waste materials will be sold to recycling companies and the hazardous waste will be managed by waste companies (SSN, n.d.).

2.2 SHIP MANUFACTURING

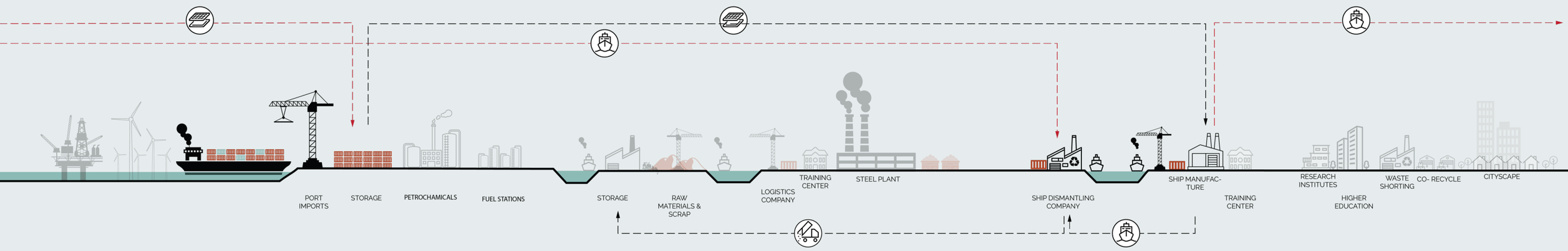
The systemic section and the diagram about ship manufacturing show that this system is currently far from circular or local. The shipbuilding and repair processes do happen within the province of South-Holland, at the shipyards of the companies.

The materials used in ship manufacturing, predominantly steel, are imported to the Port of Rotterdam and from there they are distributed to the shipbuilding companies. The steel is mainly produced and processed in low-wage countries, from raw materials that are leading to the exhaustion of the planet.

At the end of the life cycle of the ships, a few of them can be dismantled locally, after which the scrap metal will be sorted for recycling. Most of the vessels, however, will be exported for the disassembly. The European regulations should make sure that ships owned by EU companies are being disassembled in the EU. Still, a substantial amount will be dumped at the coasts of low-wage countries to be recycled there (Recycling Product News, 2021).



2.10 Systemic diagram of ship manufacturing



2.11 systemic sectino of ship manufacturing

2.3 OFF-SHORE ENERGY

2.3.1 THE SYSTEM

The off-shore industry is part of the maritime manufacturing sector. The off-shore sector can be described as the manufacturing of constructions for the generation of energy at sea (Port of Rotterdam, n.d.-c). This map shows the off-shore constructions and their infrastructures at the North Sea next to the Province of South-Holland.

At the North Sea, there are platforms constructed for the extraction of oil and gas from the seabed. The platforms are connected to the province through an extensive network of pipes. The Port of Rotterdam is connected to a large number of the off-shore platforms through these undersea pipes. Also inside the port, there are many pipelines distributing the oil and gas to the petrochemical companies and to the hinterland (Noordzeeloket, n.d.). Close to the port of Rotterdam, there is a cluster of energy companies that distribute the energy.

The North Sea is also increasingly used for the generation of wind energy at wind farms. The wind farm of Borselle, located 24 km from the coast of the province of Zeeland, is already completely realised. There are a lot more other wind farms planned to be built at the North Sea, of which some small parts are already realised (Noordzeeloket, 2022). So, there is still a lot of off-shore manufacturing needed for this energy transition.

- Distribution of electricity and gas like fuels
- Production of electricity from thermal and nuclear installations
- Production of electricity from windenergy
- Under water oil or gas platform
- Oil or gas platform
- Exploration permit
- Designated wind farms
- Proposed wind energy areas
- Wind farms under construction
- Wind farms in operation
- Anchorages
- Electric & gas infrastructure
- Residential areas
- Industrial Areas
- Ship routes

P 12
Q 10
Q 11
P 15
Q 16
S 3
S 5
S 6
0
7,5
15 km

2.12 Inventarisation off-shore

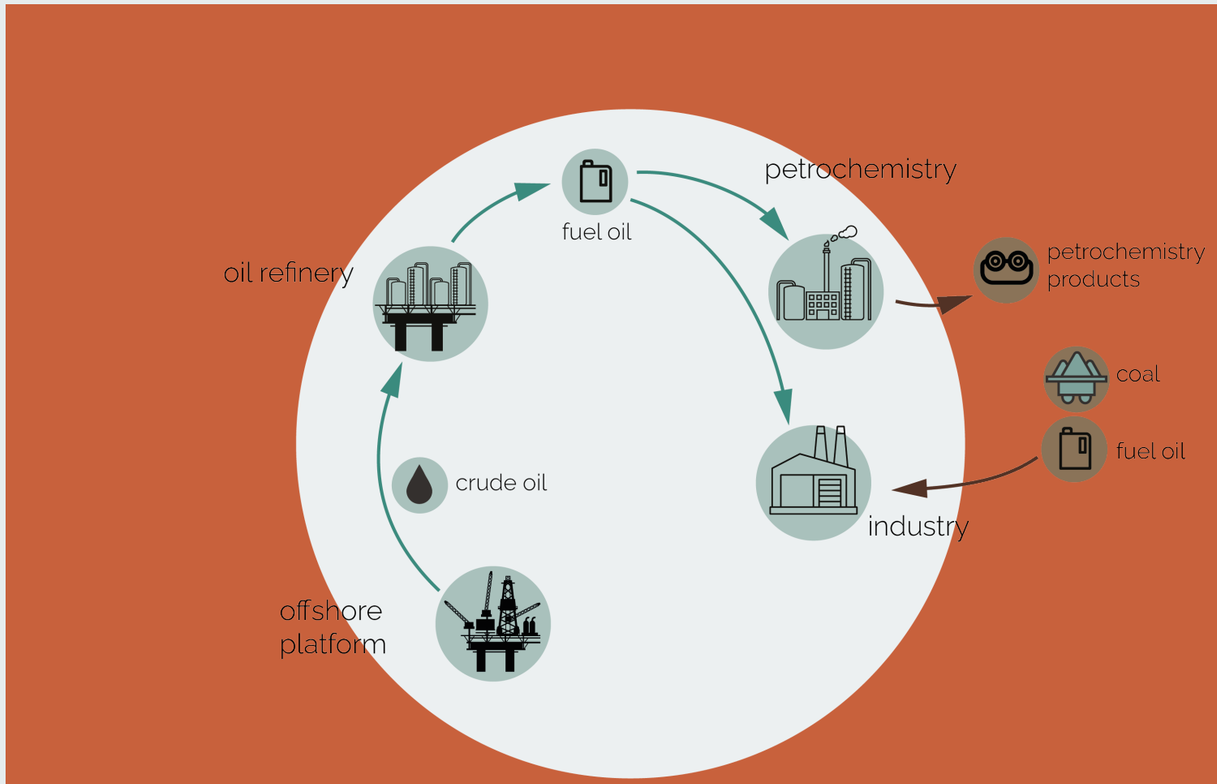
2.3 OFF-SHORE ENERGY

The off-shore system is still mostly fossil fuel based, as visualised in the systemic section and the diagram. The crude oil from the platforms at the North Sea is processed at the oil refineries at the Port of Rotterdam. The fossil fuels are then used in, among others, the maritime sector. The production of steel used in shipbuilding has high energy demands. Also, the ships are using fossil fuels as their energy supply and a substantial part of the goods that are transported from and to the Port of Rotterdam by ships are fossil fuels.

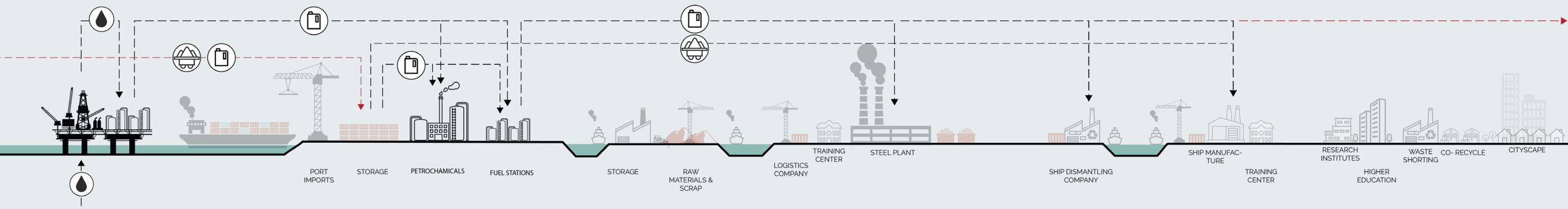
When the oil or gas fields are completely being extracted, the platforms will be out of use and they will often be abandoned at sea. As a result of the ongoing energy transition to renewables, the fossil fuels will phase out. This will lead to a faster abandonment of off-shore platforms. However, in the Dutch North Sea it is forbidden to leave abandoned oil and gas platforms or to sink them to the reef (Basisregistratie Ondergrond, 2021). Maritime manufacturing company Allseas (n.d.) has constructed a very large vessel, the Pioneering Spirits, that can move off-shore platforms towards ports for disassembly and recycling.

The program Basis registration Subsoil (Basisregistratie Ondergrond, 2021) has developed strategies for the reuse of off-shore platforms. The strategy with most potential for Dutch platforms is to reuse them for the production of hydrogen. The electricity produced by wind turbines in off-shore wind farms can be transferred to hydrogen energy. The transportation of hydrogen is more efficient than electricity and it has the potential to be used as an energy source for industrial processes (Basisregistratie Ondergrond, 2021).

In line with the energy transition, the Port of Rotterdam (n.d.-b) has planned to create an off-shore cluster at Maasvlakte 2, where oil and gas platforms can be dismantled and wind turbines can be manufactured. Currently, manufacturing of off-shore constructions is mostly included in shipbuilding companies.



2.13 Sytemic diagram off-shore energy system



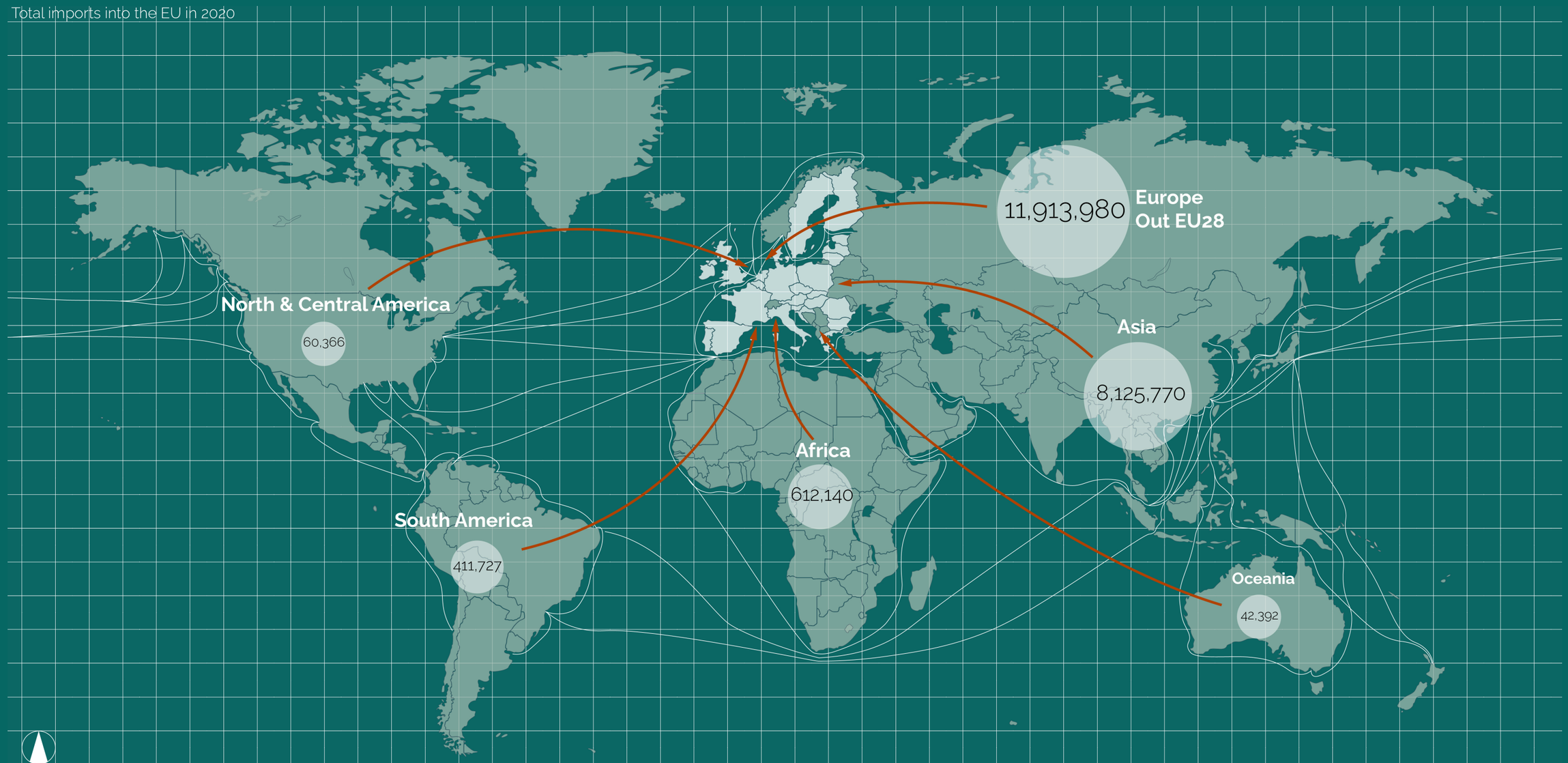
2.14 Systemic section off-shore energy system

2.4 STEEL PRODUCTION

2.4.1 THE GLOBAL SYSTEM

The predominant material used in maritime manufacturing, as revealed in the previous paragraphs, is steel. Despite the fact that steel panels for shipbuilding in South-Holland are imported, the Netherlands has its own steel production company: TATA Steel, located near the Port of Amsterdam. Steel is produced from the raw materials of coal, limestone and iron ore (Van den Berghe, 2018). For these raw materials, there is a global network of import and export, shown in the map below.

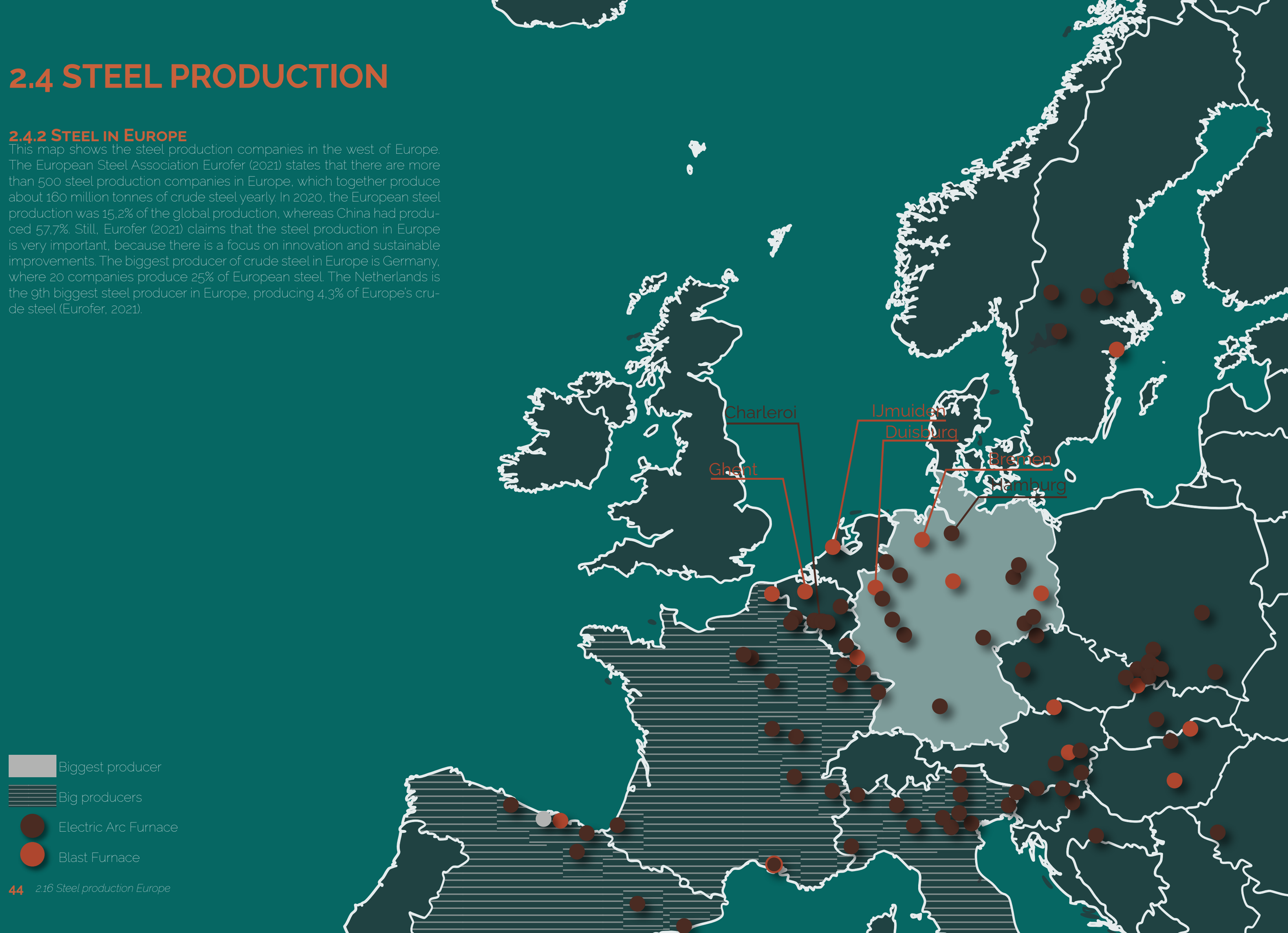
CBS (2018) states that the Netherlands imports coal from mainly Russia, the United States, Colombia and Australia. Yearly, about 50 million tons of coal are imported by the Port of Rotterdam and the Port of Amsterdam quite equally. Two thirds of the coal that arrives in the Dutch ports is exported again to the rest of Europe by inland vessels and by train (CBS, 2018). The iron ore that is imported, is mainly coming from Brazil and Australia. Yearly 10 million tons of iron ore are imported by the Dutch ports, compared to the 1000 million tons that are imported by the biggest importer: China (CBS, 2021).



2.4 STEEL PRODUCTION

2.4.2 Steel in Europe

This map shows the steel production companies in the west of Europe. The European Steel Association Eurofer (2021) states that there are more than 500 steel production companies in Europe, which together produce about 160 million tonnes of crude steel yearly. In 2020, the European steel production was 15,2% of the global production, whereas China had produced 57,7%. Still, Eurofer (2021) claims that the steel production in Europe is very important, because there is a focus on innovation and sustainable improvements. The biggest producer of crude steel in Europe is Germany, where 20 companies produce 25% of European steel. The Netherlands is the 9th biggest steel producer in Europe, producing 4,3% of Europe's crude steel (Eurofer, 2021).



2.4 STEEL PRODUCTION

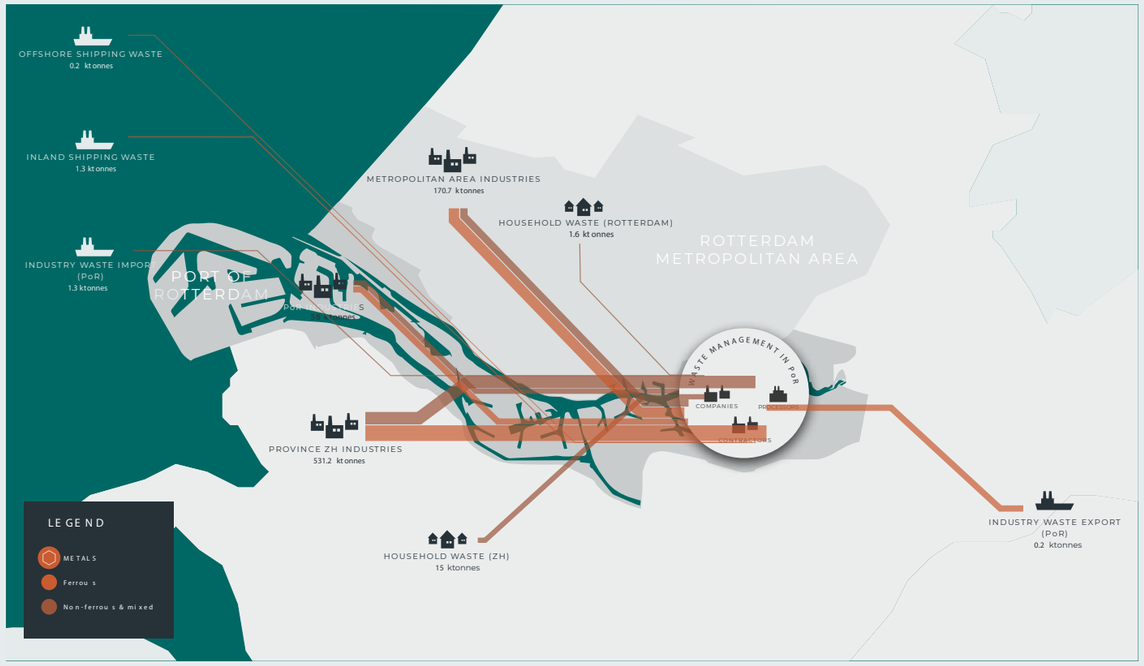
2.4.3 Steel waste

The steel production sector is slowly transitioning from the use of raw materials to the use of scrap metals as their input. Also TATA Steel is using a growing amount of steel waste to produce steel. TATA is connected to three scrap metal companies in the maritime region of Amsterdam: Koster, HKS scrap metals and Rietlanden Terminals (Van den Berghe, 2018). The scrap metal companies import metal waste to sort it and process it in three different ways: with scissors, a press or a shredder (HKS, n.d.).

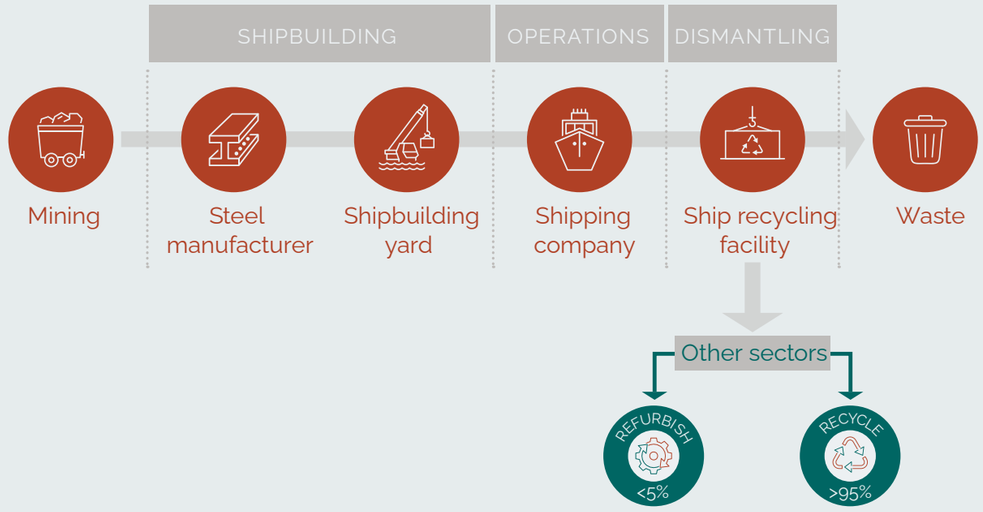
The Port of Rotterdam (2019) is currently functioning as a sorting hub for metal waste, as shown in the figure below. Scrap metals are imported, sorted and cut by companies in the port and then exported outside the region for the actual recycling. The Port of Rotterdam is envisioning a transition towards a metal recycling hub, which requires a factory with a furnaces (Port of Rotterdam, 2019).

2.4.4 Sectors using steel

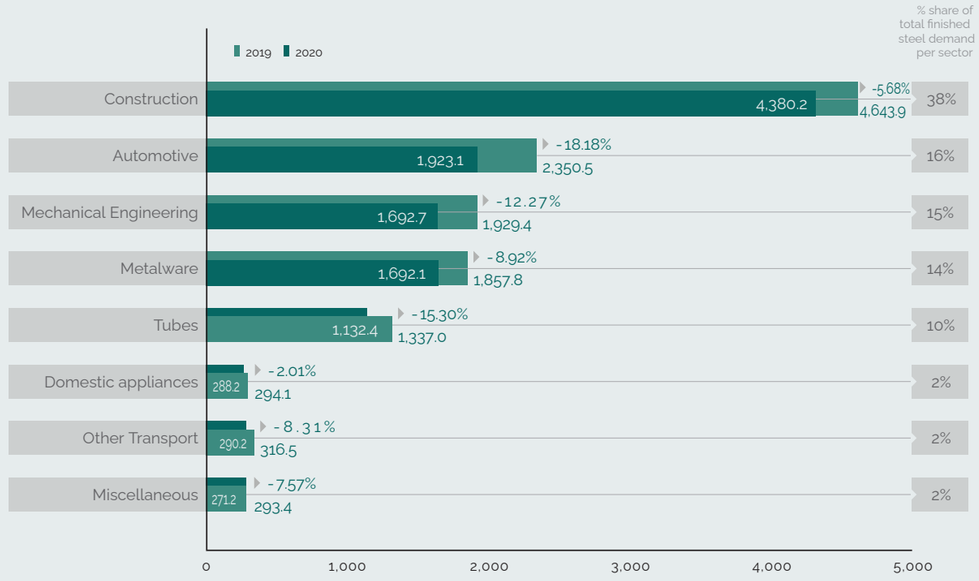
Steel is the main material used in maritime manufacturing, but the maritime sector is not the biggest steel user. The diagram below from Eurofer (2021) shows that the construction sector has foremost the highest steel demand in Europe. The automotive sector, mechanical engineering and the metalware sector also use a substantial amount of steel. To a smaller extent, steel is also used in the manufacturing of domestic appliances, the sector that is most directly related to the consumer. Maritime manufacturing is included in the sector of other transport, which has a relatively small steel demand (Eurofer, 2021).



2.17 Metal waste flows through the port (Port of Rotterdam & Circle Economy, 2019, p.16, adapted by authors)



2.18 Steel in the shipping process (SSI, 2021, p.13, adapted by authors)

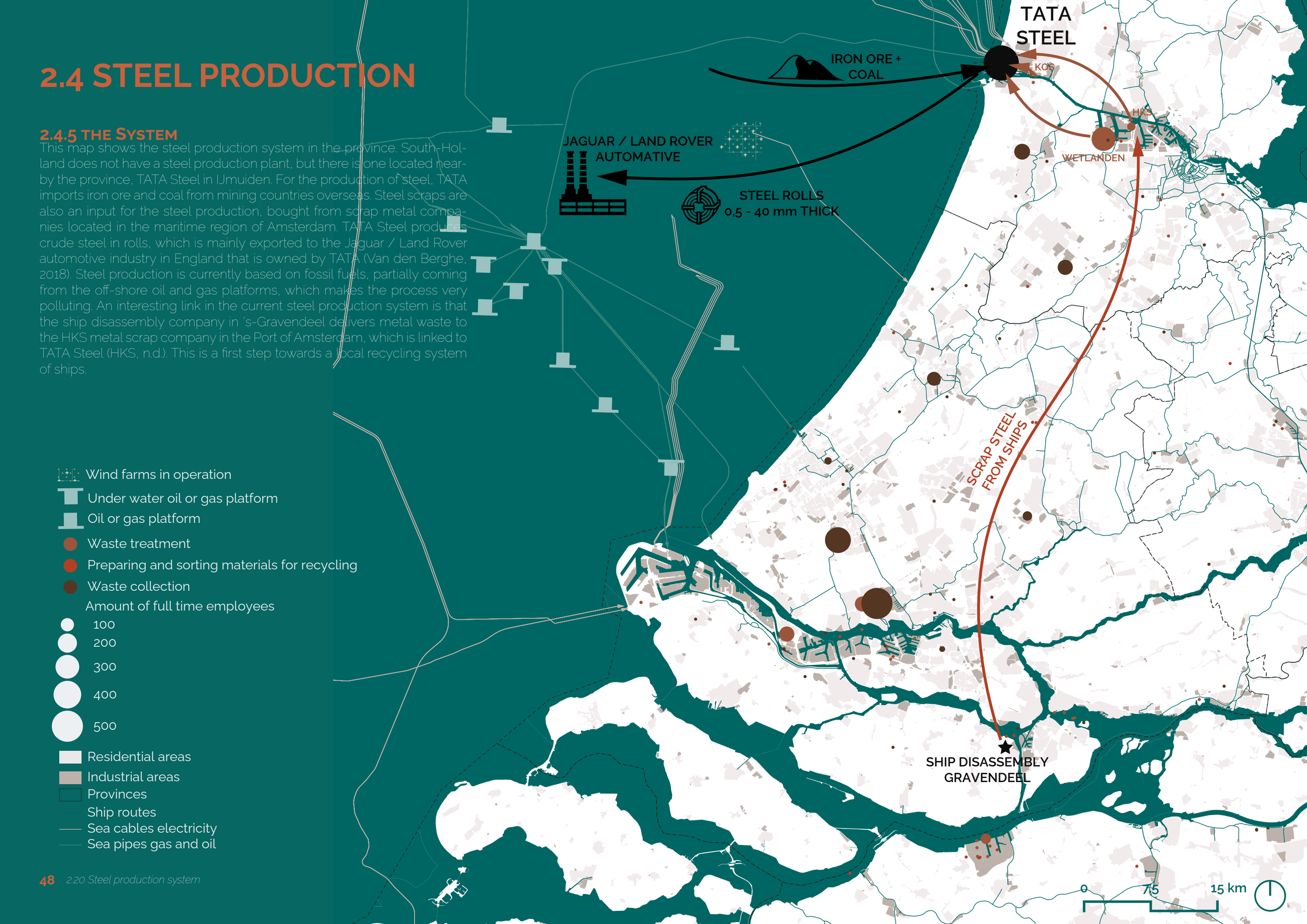


2.19 The different sectors of steel (Eurofer, 2021,p 26, adapted by authors)

2.4 STEEL PRODUCTION

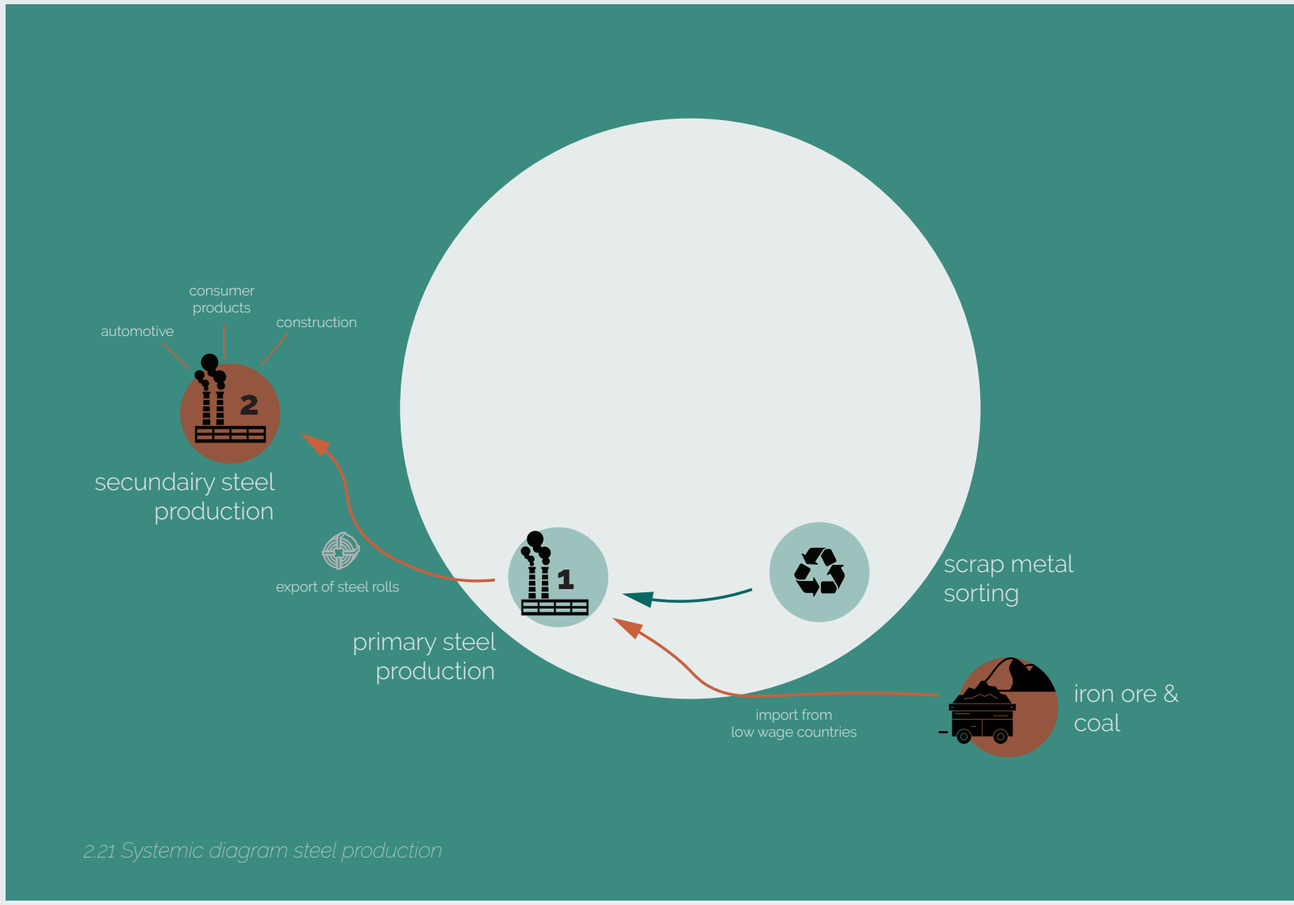
2.4.5 THE SYSTEM

This map shows the steel production system in the province. South-Holland does not have a steel production plant, but there is one located nearby the province, TATA Steel in IJmuiden. For the production of steel, TATA imports iron ore and coal from mining countries overseas. Steel scraps are also an input for the steel production, bought from scrap metal companies located in the maritime region of Amsterdam. TATA Steel produces crude steel in rolls, which is mainly exported to the Jaguar / Land Rover automotive industry in England that is owned by TATA (Van den Berghe, 2018). Steel production is currently based on fossil fuels, partially coming from the off-shore oil and gas platforms, which makes the process very polluting. An interesting link in the current steel production system is that the ship disassembly company in 's-Gravendeel delivers metal waste to the HKS metal scrap company in the Port of Amsterdam, which is linked to TATA Steel (HKS, n.d.). This is a first step towards a local recycling system of ships.

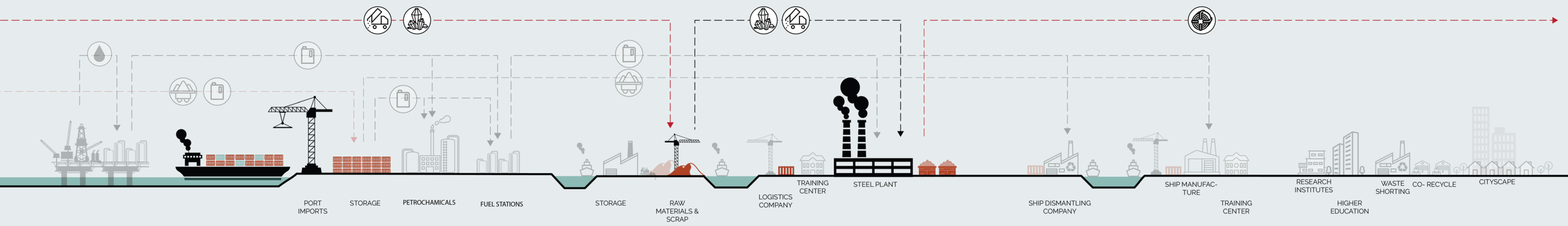


2.4 STEEL PRODUCTION

The systemic section and the diagram show that the steel production in the region is currently not circular nor local. Although steel has a high potential for recycling, there are still a lot of raw materials used for the production of steel. Iron ore is imported from mines in Brazil and Australia and coal is imported from mines in Russia, the United States, Colombia and Australia. TATA Steel also recycles steel waste, delivered by scrap metal sorting companies in the Port of Amsterdam and Beverwijk. Stil, almost all steel waste from the maritime sector is exported for recycling. The only ship disassembly company existing in the Netherlands is actually connected to TATA Steel via HKS scrap metals. However, this link is only for a very small share of the sector. Generally, the steel from ships that are out of service is not (yet) an input for the steel production at TATA Steel. The other way around, steel produced at TATA is also not used for the manufacturing of ships and off-shore constructions in the province of South-Holland. Most of the steel rolls produced are exported to England for the automotive industry that is owned by TATA.



2.21 Systemic diagram steel production



2.22 Systemic section steel production

2.5 RESEARCH, DESIGN & EDUCATION

2.5.1 The Players

The Province of South-Holland has got a strong knowledge network consisting of research, design and education institutes, which together form the basis for innovation. The universities are key players in the network of research and education. In the context of maritime manufacturing, the Technical University of Delft, the University of Leiden and the University of Utrecht are important knowledge institutes. This is supported by a network of HBO's (hogescholen; higher education) and MBO's (practical education).

For the translation of knowledge into practice, innovation centres are important bridging players. Rotterdam has got two innovation hubs: the RDM campus and BlueCity. BlueCity, located in an abandoned tropical swimming pool, functions as an example city for the circular economy. It is a hub for innovative start-ups and it hosts tracks for companies to become circular (BlueCity, n.d.). In relation to maritime manufacturing, there are tracks organised for circularity in the building of superyachts and for circular disassembly of wind turbines (CIRCO, n.d.). In Beverwijk, close to TATA Steel, there is also an innovation centre located: Techport. In this science park, education programs are collaborating with the labour in the steel production sector (Van den Berghe, 2018).

RDM campus

(P. Blokdijk, personal communication, February 17, 2022)

The Rotterdamsche Droogdok Maatschappij (RDM) was one of the biggest shipyards in Europe from 1902 to the 1990's. The shipyard vanished in the 90's because of the manufacturing change: shipyards moved to low-budget countries such as China. From then on the RDM buildings turned into a 'no-go area', they were isolated and semi criminal. That's why the Port of Rotterdam Authority decided to buy the place in 2002 to develop it into a nice and lively area again.

The port of Rotterdam is nowadays mostly based on the petrochemical industry and logistics, which are going to change into more sustainable, environmentally friendly industries. The port of Rotterdam is one of the biggest ports, providing a lot of jobs. However, change is needed to keep this position. To work on the future of the port, the port authority has developed the innovation dock at the RDM site.

At the same time, the Hogeschool of Rotterdam was looking for space for its technical education. One part of the building is dedicated to education and knowledge. The education building has many facilities in different workshops, for wood, 3D printing, etc, which the students of the HBO and MBO can use. Students from the different levels of education can interact with each other in projects they are doing.

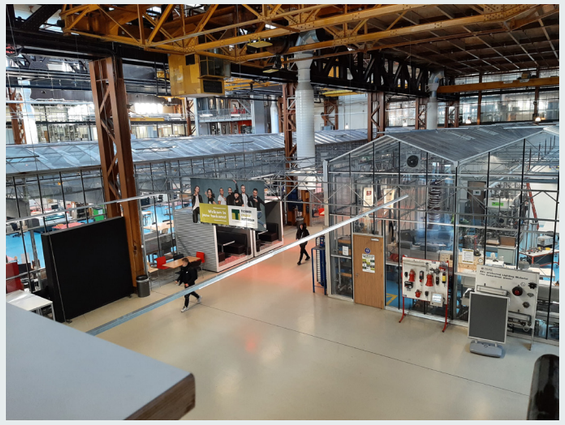
The other part of the building is reserved for innovative manufacturing start-ups. Companies can rent a piece of the RDM hall if they are manufacturing companies, related to the port, focused on a circular economy and they have to be innovative. As a start-up in the RDM campus, you are part of the 'ecosystem': the companies can easily get in touch with each other, they can make use of the shared facilities and the knowledge of the education building and the Port of Rotterdam Authority can help them to get into the bigger network of businesses. At the same time, students can get in contact with the start-ups and do a traineeship with them if it fits their curriculum. So, the RDM campus provides a lot of collaboration within and between the education institute and the innovative manufacturing companies. As soon as the start-ups have grown big enough, the Port Authority will help them to find their one place within the Port of Rotterdam, where the companies can help to build a future for the port.

From the RDM campus, there is a water bus going to the other side of the river, to the Merwevierhavens (M4H). Together the RDM and the M4H from the Makers District of Rotterdam. The M4H was used for the storage of fruit and fruit juices, but these companies are now slowly moving towards the sea. Empty buildings can now be used for other businesses. Perhaps, the RDM campus can grow to the M4H area.

The RDM innovation hub is located in the port, next to the water, because of the vacant buildings that the Port Authority wanted to redevelop. But it is not necessary that the innovation hub is located at the waterside. However, the RDM builds on the future of the port of Rotterdam; proximity is an advantage.

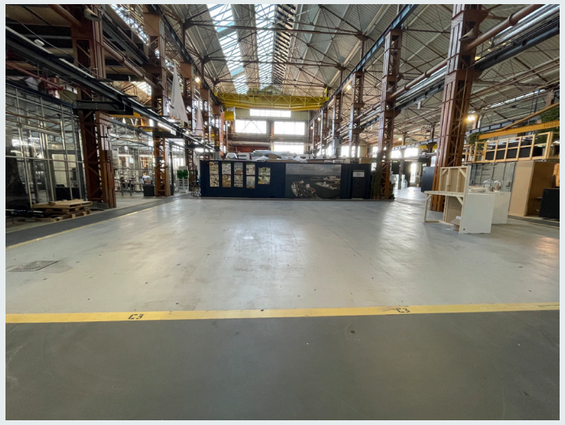
2.5.2 The Makers District

Next to research and education, design and making are also important in the innovation system. Makers districts are areas in the city, often mixed use, where manufacturing takes place (Hausleitner, 2022). Urban manufacturing is beneficial for innovation and for responsible resource management and is therefore stimulating the transition to a circular economy (Hausleitner et al., 2022) Rotterdam is developing a makers district at two urbanising harbours: Merwevierhaven (M4H) and Rotterdamsche Droogdok Maatschappij (RDM). On the one hand, M4H provides spaces for urban manufacturing in the ICT, creative and eco-manufacturing sectors, whereas RDM is focussed more on innovative port-related industries (Jansen et al., 2021). The municipality of Rotterdam and the Port of Rotterdam authority are collaborating to redevelop M4H into a mixed area of urban manufacturing and living (M4H Rotterdam, 2018).



2.23 RDM Shared facilities

2.24 RDM Education



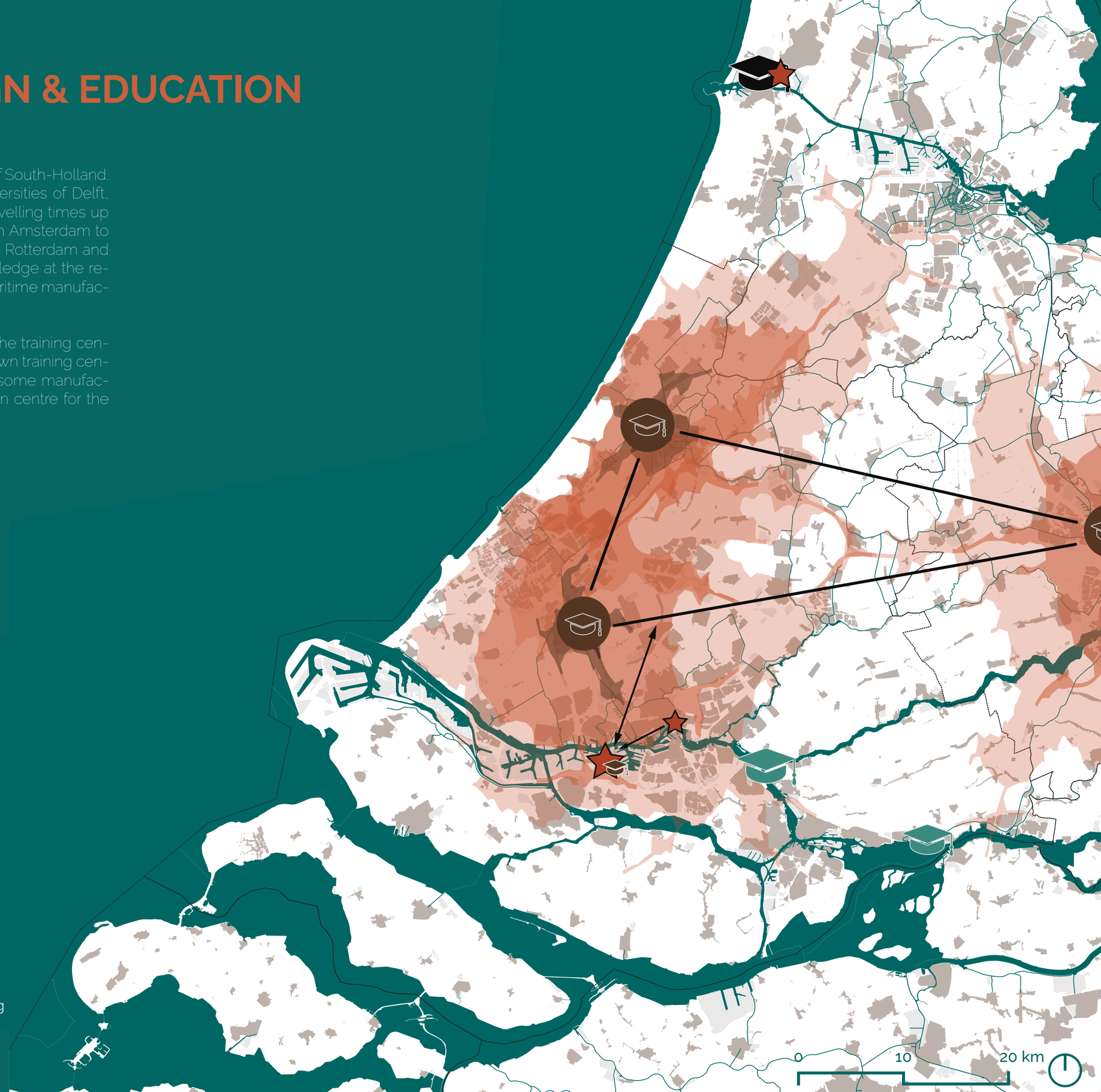
2.25 RDM Space for startups

2.5 RESEARCH, DESIGN & EDUCATION

2.5.3 THE SYSTEM

This map shows the system of innovation in the Province of South-Holland. The main institutes for education and research, the universities of Delft, Leiden and Utrecht, are visualised surrounded by the travelling times up to 30 min by car to reach them. The knowledge axis from Amsterdam to Rotterdam is strongly visible here. The innovation hubs in Rotterdam and Beverwijk function as the connectors between the knowledge at the research and education institutes and the practice at the maritime manufacturing companies and the steel production company.

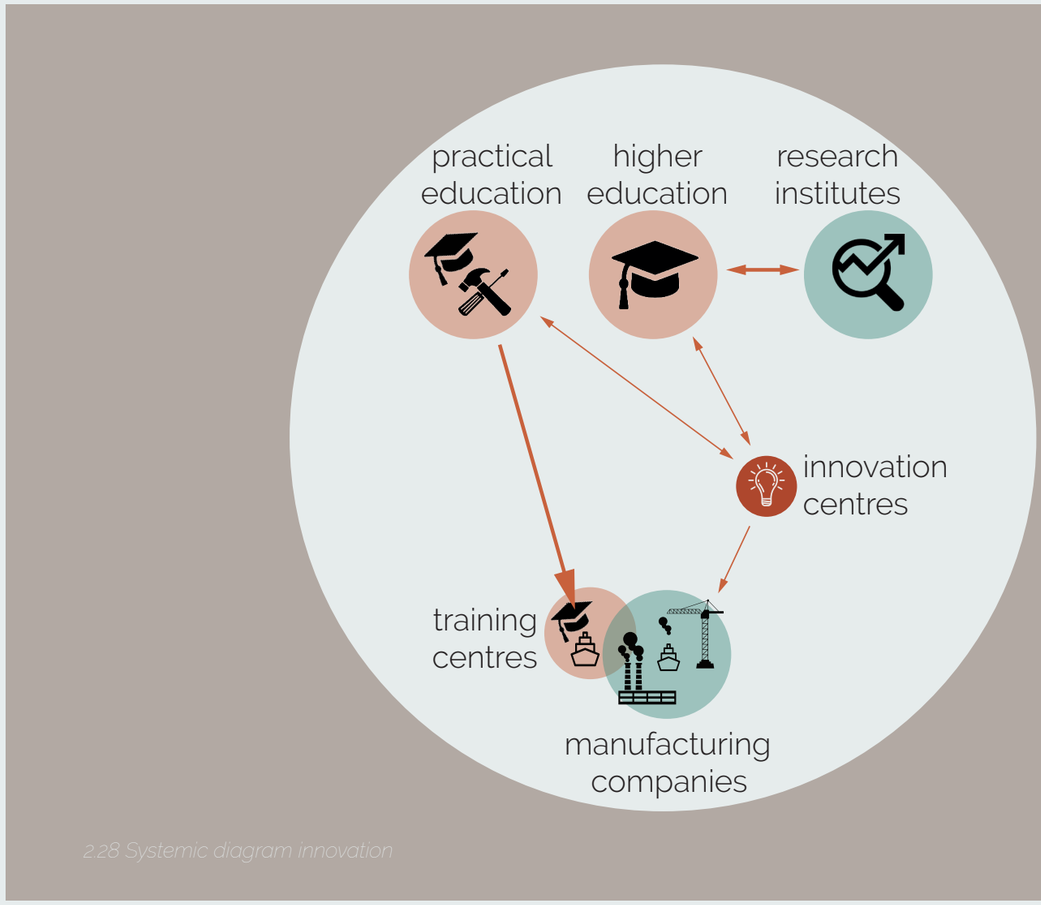
Another important type of education in this network are the training centres for the labour force. For example, TATA Steel has its own training centre to skill the employees (Van den Berghe, 2018). Also, some manufacturing companies, like Damen, have an internal education centre for the training of the personnel.



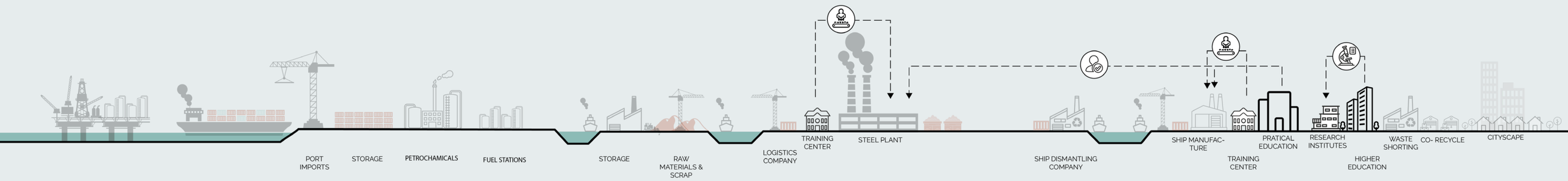
2.5 RESEARCH, DESIGN & EDUCATION

The province of South-Holland has a strong innovation system, as shown in the systemic section and the diagram. There is a lot of exchange of knowledge between higher education and research institutes. Some of the manufacturing companies have their own training centres to train their employees. The practical education institutes are related to the manufacturing companies and their training centres.

A key player in the innovation system is the innovation hub at RDM in Rotterdam, because it provides space for collaboration between higher education (Hogeschool Rotterdam), practical education (MBO Rotterdam) and innovative start-ups in the maker's industry. The new technologies that are developed at RDM can be implemented in the manufacturing processes of the companies that are located in the Port of Rotterdam and the Drecht Cities.



2.28 Systemic diagram innovation



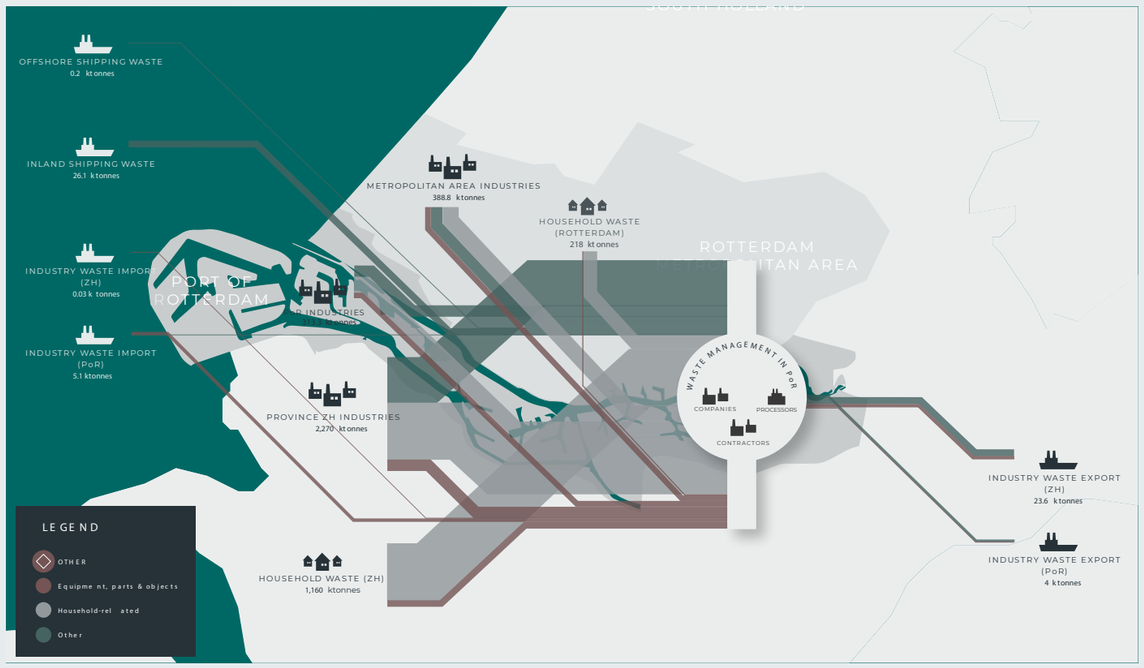
2.29 Systemic diagram innovation

2.6 CONSUMERS & APPLIANCES

The maritime manufacturing industry is not directly related to the residents of the Province of South-Holland. Therefore, a transition in the way steel is used in this sector will not directly involve or impact the residents. A steel using sector that is closely related to the residents is the manufacturing of domestic appliances, including consumer electronics (Eurofer, 2021). Large amounts of household waste flow through the Port of Rotterdam each year, as shown in the figure below (Port of Rotterdam & Circle Economy, 2019). The residents are the consumers of these products and are therefore responsible for the waste management of their appliances. The amount of electronic waste is rapidly growing. Each person produces about 7 kg of electronic waste, but globally less than 25% of the E-waste is properly recycled (United Nations, n.d.).

2.6.1 Milieustraten

Milieustraten are waste collection facilities for consumer waste, managed by the municipalities or by waste collection companies. In the milieustraten waste can be separated in about 30 different containers, including electrical devices, iron and metal (Avalex, n.d.-b). Every municipality has one or more of these waste collection points. Rotterdam, one of the major municipalities of the province, has seven 'milieuparken' scattered around the city (Gemeente Rotterdam, n.d.). The milieustraten are often located at the edge of the cities, which does not make them part of the daily life of the consumers. To raise the awareness about the importance of waste separation, the municipality of Rotterdam has started an initiative for pop-up milieuparken in the neighbourhoods (Gemeente Rotterdam, 2021a).



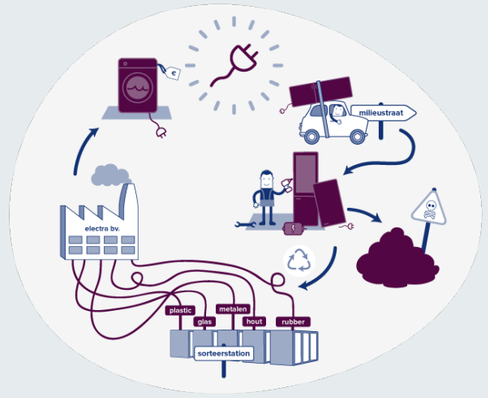
2.30 Household waste flows through the port (Port of Rotterdam & Circle Economy, 2019, p.24, adapted by authors)

2.31 Milieupark Delfshaven, Rotterdam (Gemeente Rotterdam, n.d.)

2.6.2 Recycling Process

After the consumer waste has been collected, the waste will have to be processed and recycled. This does not happen at the milieustraten. As there are about 30 different waste types separated, there will also be almost as many different companies that will manage the consumer waste (Gemeente Rotterdam, n.d.). Often, electrical devices and metal waste are processed by the same recycling company. As shown in the figure [recycling process], the waste will be transported from the milieustraat to the recycling company, where the waste will be cleaned, cut and sorted. Hazardous substances will be separated and recycled by specialised companies. The remaining materials are secondary raw materials that can be used in the manufacturing of new products (Avalex, n.d.-a).

2.32 Pop-up milieupark in neighbourhood Rotterdam (Gemeente Rotterdam, 2021a)

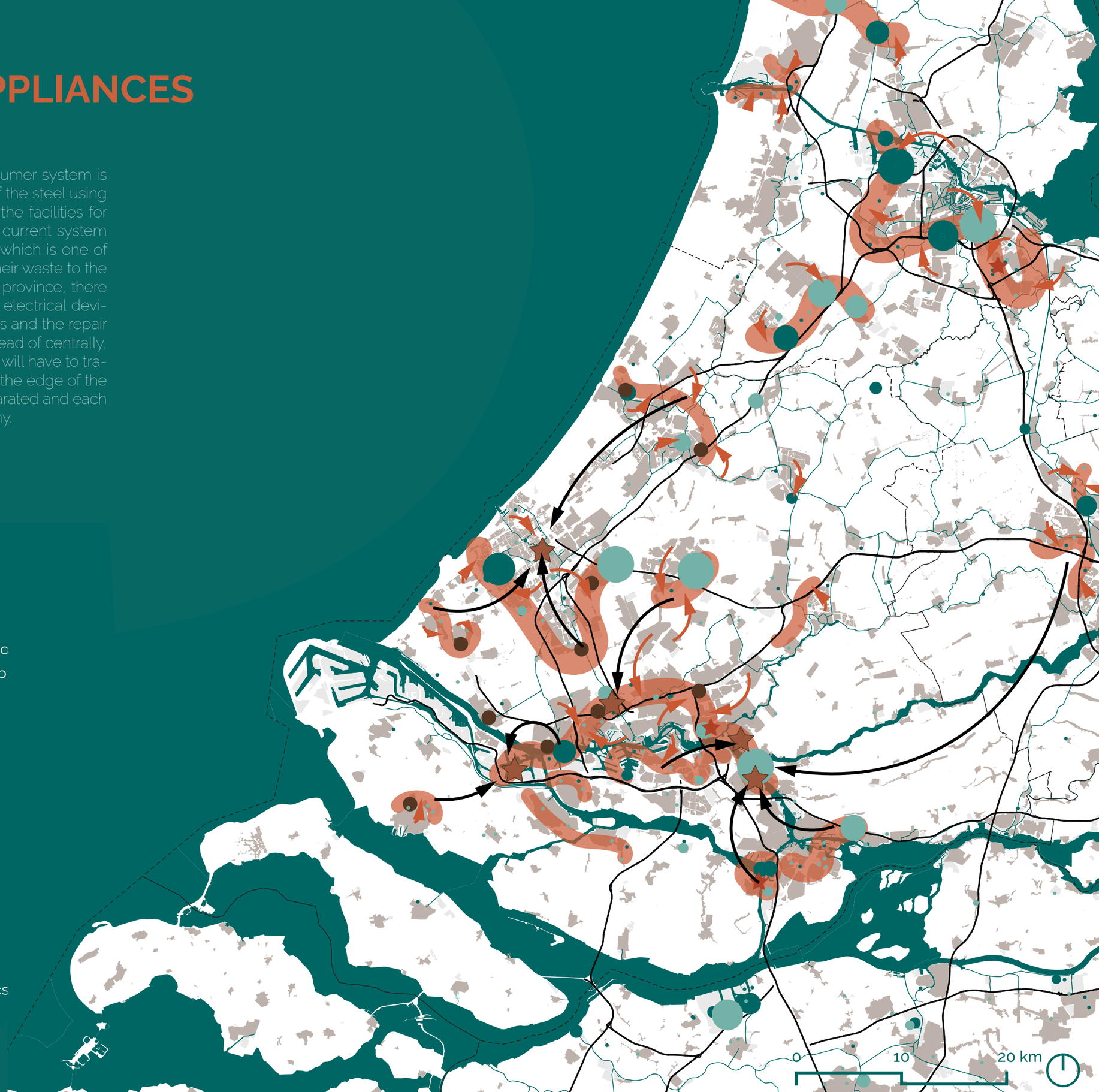


2.33 The recycling process of electrical devices (Avalex, n.d.-a)

2.6 CONSUMERS & APPLIANCES

2.6.3 THE SYSTEM

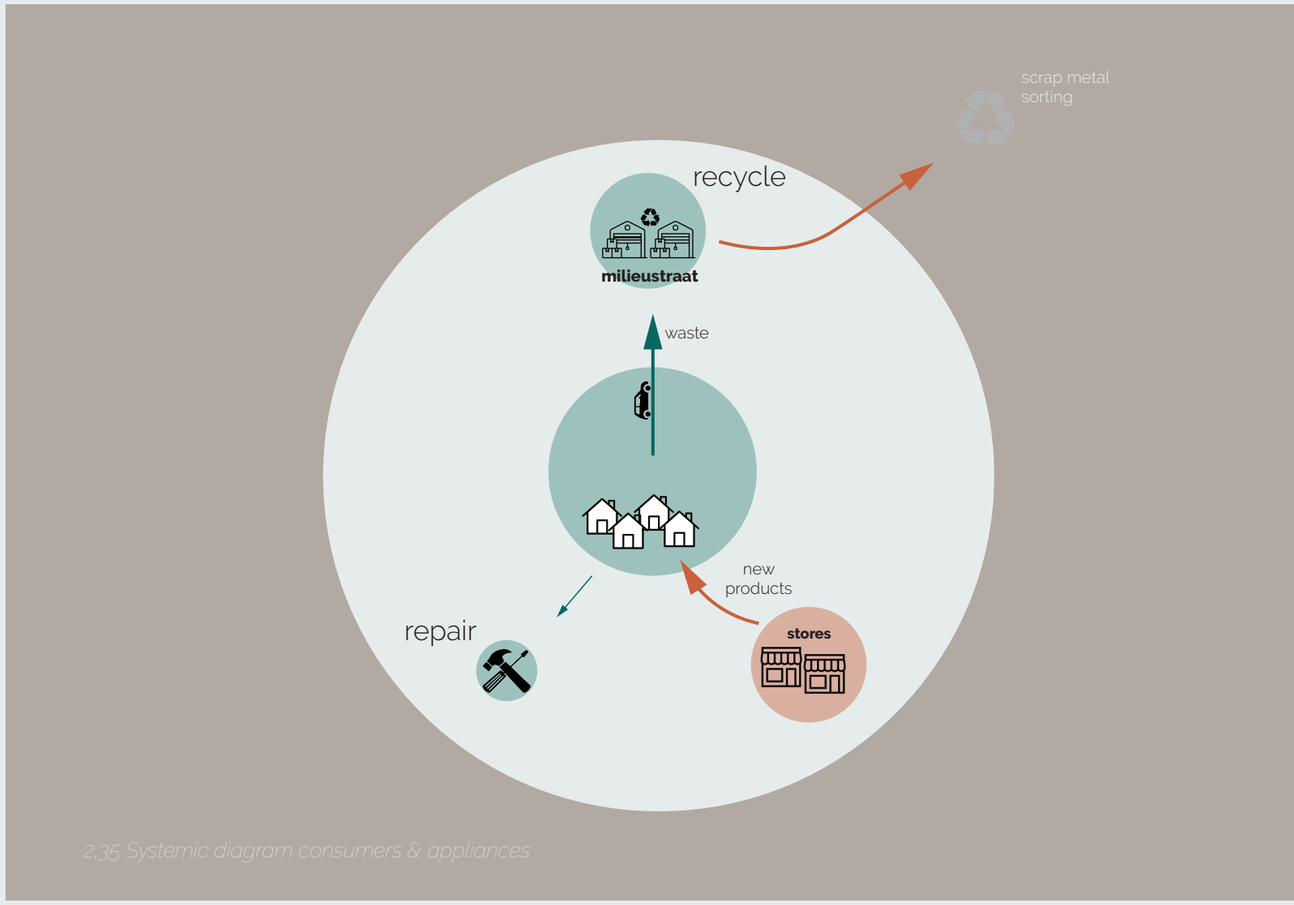
This map shows the system of the consumers. The consumer system is about the life cycle of domestic appliances, as it is one of the steel using sectors. This system is relatively local, because most of the facilities for the consumer system are available per municipality. The current system mainly consists of recycling of the domestic appliances, which is one of the lowest steps on the R-ladder. Consumers can bring their waste to the milieustraten, where waste is separately collected. In the province, there are also some repair companies, for mostly the repair of electrical devices. It is remarkable that both the waste collection facilities and the repair companies are often located at the edge of the cities, instead of centrally, as marked in the 'waste edges' on the map. The residents will have to travel from their neighbourhood to mostly industrial areas at the edge of the city for the disposal of their waste. There, the waste is separated and each waste flow will go to the corresponding recycling company.



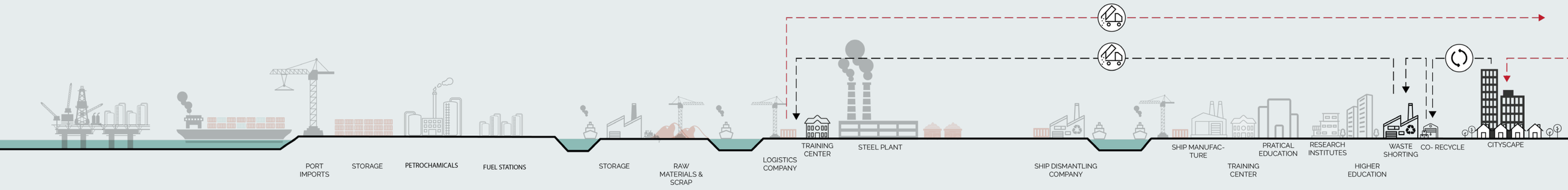
2.6 CONSUMERS & APPLIANCES

The schematic section and the diagram show that the consumer system is not very circular, if assessed with the R-ladder. Repair of products plays a small role for domestic appliances, but the system is mostly based on recycling, which is very low on the R-ladder. From the milieustraten, the steel and other metals from the domestic waste will go into the metal recycling system. Consumerism is still a trend in the system of domestic appliances. Consumers rather buy new products from the stores, than sharing or reusing products.

Compared to the systems of maritime manufacturing and steel production, the consumer system is very local. Stores, repair facilities and milieustraten are located in every municipality. Still, the system might not be local enough for the consumers, because the facilities are located at the edge of cities instead of at central locations within the living areas.



2.35 Systemic diagram consumers & appliances



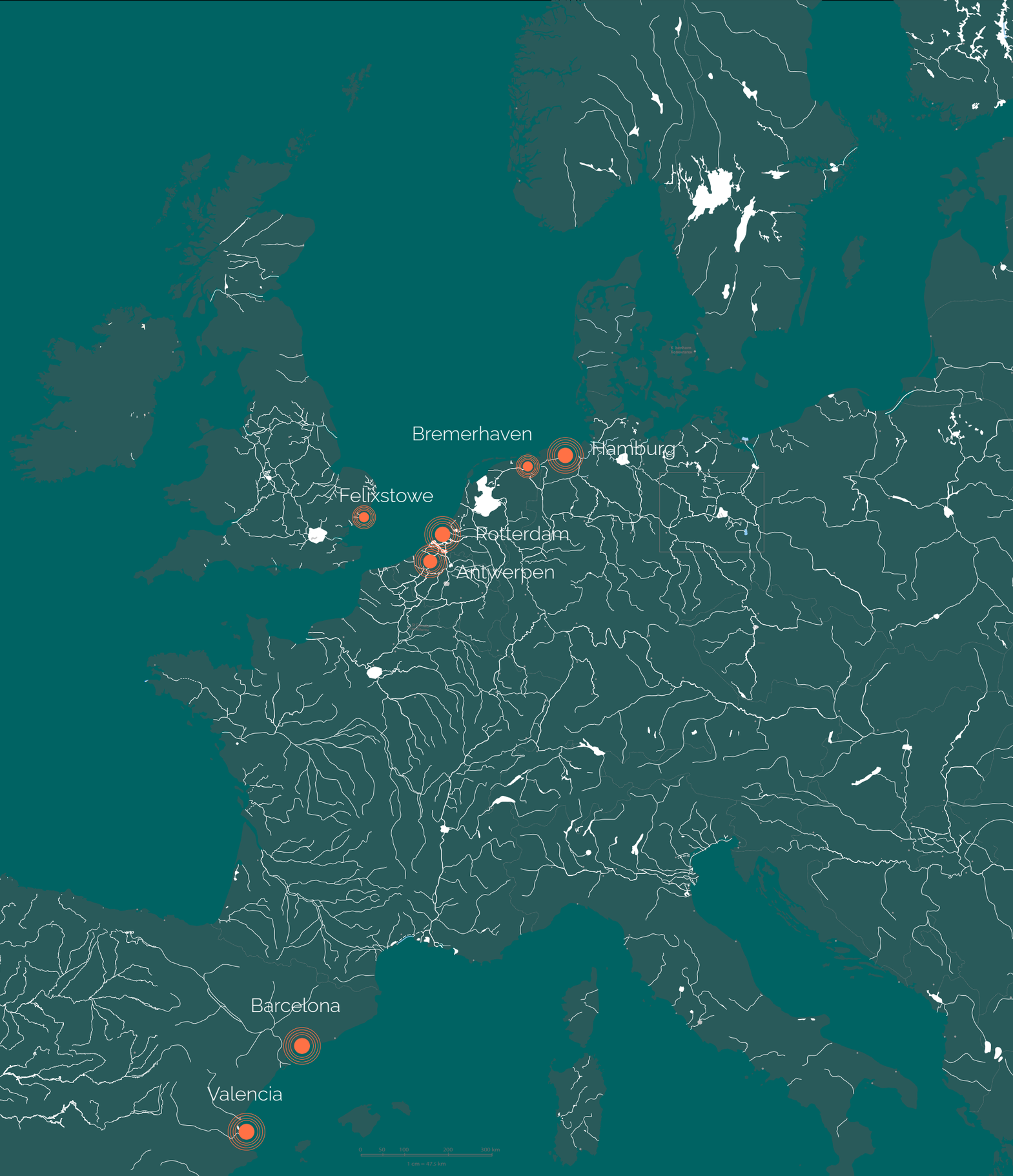
2.36 Systemic section consumers & appliances

2.7 THE WATER BACKBONE

2.7.1 European Connection

The Port of Rotterdam is the biggest port in Europe in handling freight and containers (Eurostat, 2021). The other important ports in the water network of Europe, as shown on this map, are Hamburg, Bremerhaven, Felixstowe, Antwerp, Barcelona and Valencia.

About 50% of the goods transported between Rotterdam's port and destinations in Europe is done by inland shipping, via the rivers of the Rhine and the Maas (Port of Rotterdam, n.d.-b). The organisation Inland Navigation Europe (2021) shows that for all of Europe, only about 6% of freight is transported by inland waterways; three quarters of freight transport is done by trucks and the rest by railway. The Rhine countries are foremost important for inland shipping in the European Union, mainly because of the transport from the Dutch and Belgium ports towards Germany (Inland Navigation Europe, 2021).



Top 10 ports handling containers, 2008-2018

1. Rotterdam(NL)
2. Antwerpen(BE)
3. Hamburg(DE)
4. Bremerhaven(DE)
5. Valencia(ES)
6. Piraeus(EL)
7.Algeciras(ES)
8. Gioia Tauro(IT)
9. Felixstowe(UK)
10. Barcelona(ES)

0 250 500 km

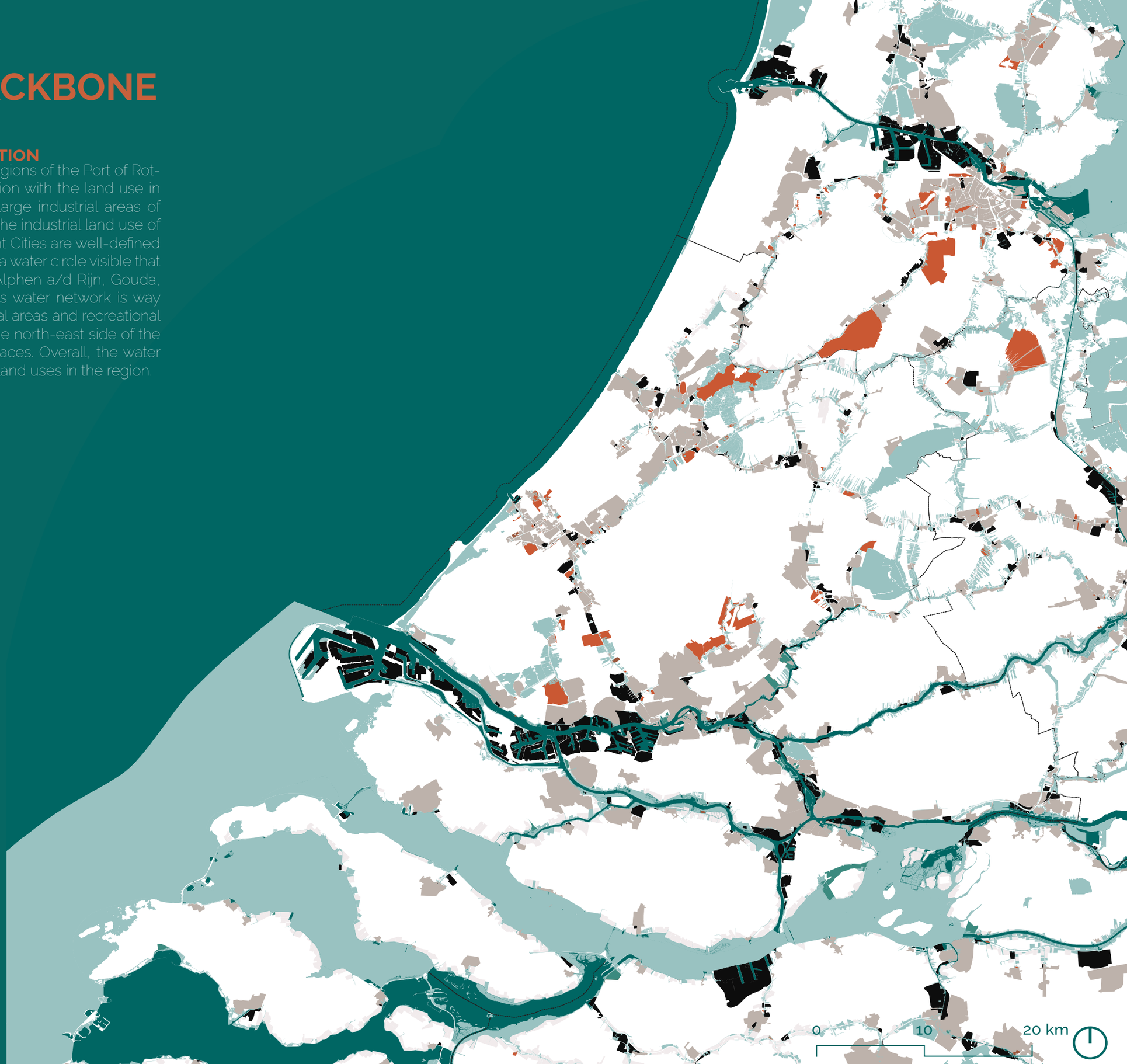
2.37 Water network of Europe

Source: UNECE Inventory of Main Standards and Parameters of the Waterway Network
Eurostat

2.7 THE WATER BACKBONE

2.7.2 The water backbone in function

This map shows the waterways in the maritime regions of the Port of Rotterdam and the Port of Amsterdam, in combination with the land use in the direct surroundings of the waterways. The large industrial areas of the two sea ports are clearly recognisable. Also, the industrial land use of TATA Steel in IJmuiden and the ports in the Drecht Cities are well-defined clusters. In the Province of South-Holland there is a water circle visible that connects Rotterdam, Delft, Den Haag, Leiden, Alphen a/d Rijn, Gouda, and back to Rotterdam.The land use around this water network is way more mixed. Patches of residential areas, industrial areas and recreational and nature areas are alternating. More towards the north-east side of the circle, there are large recreational and nature spaces. Overall, the water backbone is connecting a patchwork of different land uses in the region.



 2.38 Analysis functions surrounding waterbackbone

2.7 THE WATER BACKBONE

2.7.3 The typology of the water backbone

This map shows the different typologies of land use around the water backbone in an abstract visualisation. First of all, there are two global axes, the Port of Amsterdam in the north and the Port of Rotterdam in the south. They connect the region to the European hinterland on the one hand, and to the whole world on the other hand. These axes are characterised by large, monofunctional industrial areas. The two ports are also connected by a waterway.

Secondly, there is a local waterway circle in the Province of South-Holland, that represents a patchwork of different land uses. The left side of the circle can be defined as the knowledge axis, as also shown in the system of innovation. This axis includes the universities and hogescholen of Leiden, Den Haag, Delft and Rotterdam, combined with the other functions that these cities offer.

The right side of the water circle can be defined as the recreational axis. This side is part of the Green Heart, a large nature area between the western part of the Randstad and the city of Utrecht. In this axis, the water is often used for recreation and the land use around the water is mostly residential and natural.

In short, the waterways function as a backbone in the maritime regions of Rotterdam and Amsterdam. They are characterised by different land uses resulting in different types of locations at the water backbone.

0 7,5 15 km

2.39 Typologies around the waterbackbone (Photo's via google streetview)

2.8 THE CHALLENGE

The Province of South-Holland has got a lot of potential to transition to a local steel life cycle for the ship manufacturing sector. The province has a strong shipbuilding and -repair sector with a long history. In the off-shore sector, there are opportunities for the generation of renewable energy. There is even a local steel production company right next to the province, TATA Steel in IJmuiden. Moreover, the province has a strong knowledge network, which can provide circular innovations. Furthermore, the milieustraten, where consumers can dispose of their household waste separately, are a good starting point for the involvement and awareness of the residents in the transition. The extensive water network in the region has the potential to connect all these systems.

2.8.1 Missing links

Still, there are some missing links that need to be solved to make this transition happen, as shown in the systematic section. First of all, there are some gaps in the circle of shipbuilding and steel production. The most important missing link is the connection of TATA Steel to the shipbuilding industry, so that TATA can recycle the steel from old ships and produce steel for new ships. In order to use the scrap steel from a ship that is out of service as an input for the production of steel, the ship needs to be disassembled first. Currently, there is only one ship disassembly company in the Netherlands, which can dismantle one ship at a time. So, the capacity for ship disassembly has to be increased.

On the other side of the circle, from the production of crude steel to the manufacturing of ships, there is another important step missing: steel processing. Steel has to be pressed, cut, formed in the right way to make the panels that can be used in shipbuilding. The Netherlands does not have a steel processing company right now.

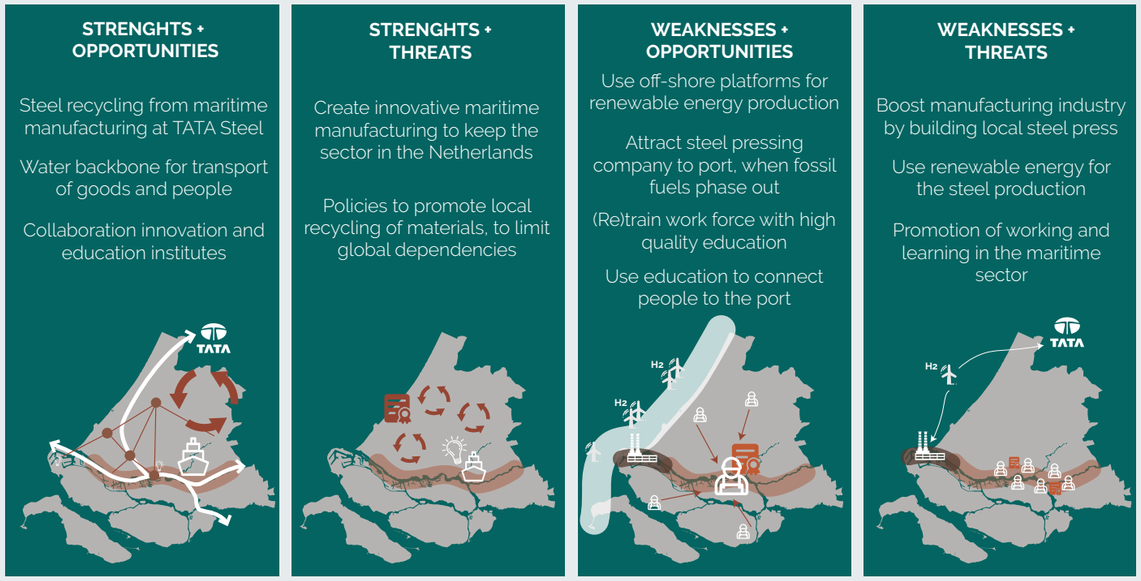
Steel production and ship manufacturing demand a lot of energy and are now based on fossil fuels. In order to make this transition environmentally sustainable, a new form of renewable energy is needed that is dense enough to be used in industrial processes.

For technical innovations in shipbuilding, to make the process more efficient, sustainable and circular, the knowledge from the education and research institutes should be transferred to the actual practice of ship manufacturing. Innovation centres, such as RDM in Rotterdam, function as the bridge in the exchange of knowledge and practice. However, RDM is currently the only innovation hub where such collaboration happens.

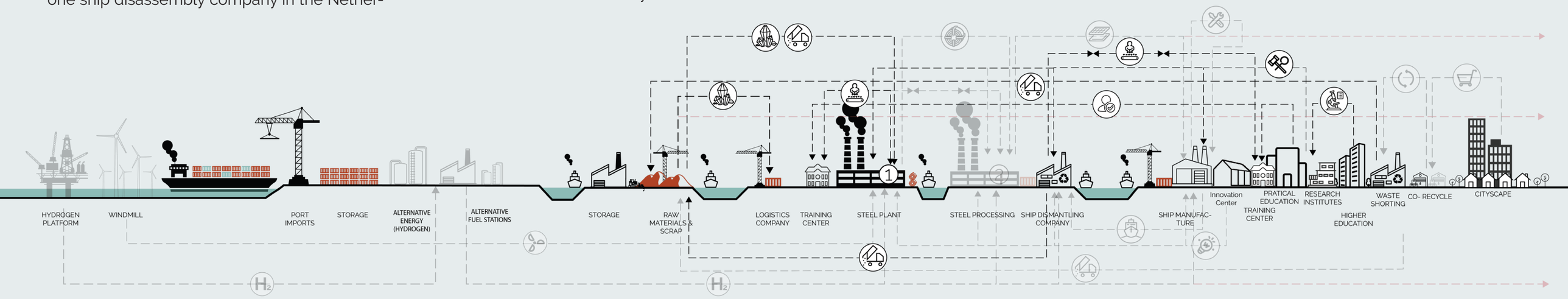
For the achievement of a socially sustainable South-Holland, it is essential to involve the residents in the transition, in the role of the employee as well as the consumer. In the maritime sector, there is a shortage of well-trained personnel and this might even increase when work processes will change as a result of the circular transition. Besides, there is a lack of awareness about the need to transition towards circularity, using the framework of the R-ladder.

2.8.2 Strategic objectives

The figure of the TOWS-analysis shows the strategic objectives that will be used to solve the missing links. The TOWS-analysis is an inverse strengths, weaknesses, opportunities and threats analysis, in which solution directions are searched to maximise opportunities, minimise weaknesses and avoid threats (Dąbrowski, 2022a).



2.40 TWOS analysis



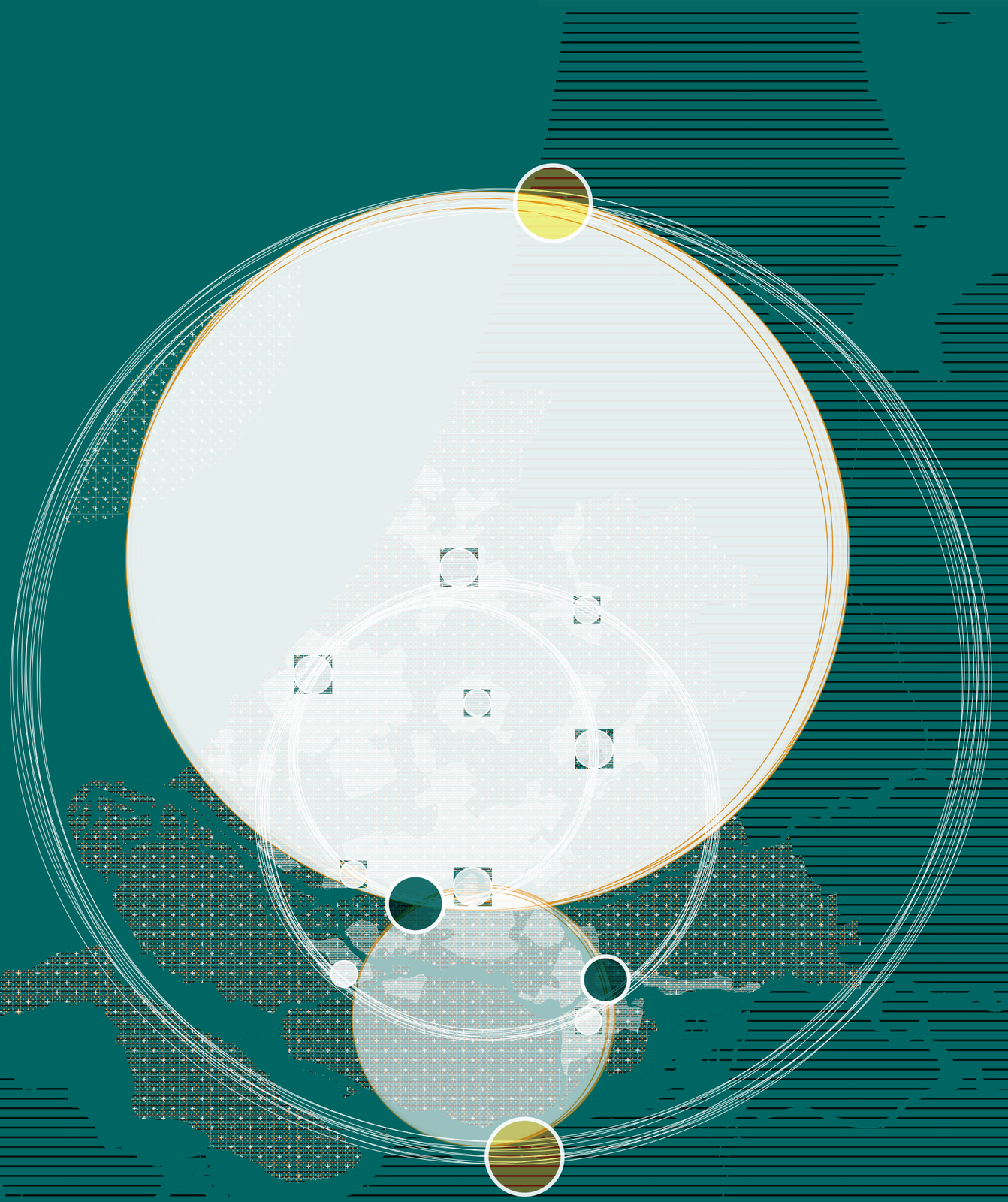
2.41 Systemic section missing links

3. SOUTH HOLLAND CIRCULAR

3.1 VISION STATEMENT

In 2050, South-Holland will have a local steel production cycle for ship manufacturing. No raw materials will be used anymore, and all steel will be reused and recycled within the local chain. The energy needed in the production process will be locally generated renewable energy. The province will have high-quality education and research institutes to stimulate future innovations that will optimise production efficiency and retrain local people to work in the sector. All residents of South-Holland will also be involved in the material life cycle with a strong awareness of the R-ladder: reduce, reuse, repair, refurbish and recycle in the RE-hub in their neighbourhood.

This vision will be achieved by establishing synergies between three sectors: the steel production cycle, knowledge & innovation, and the province's citizens. The manufacturing of ships in the Port of Rotterdam using steel will be connected to the local steel production at TATA Steel. In order to produce steel in an energy-neutral way, wind energy and hydrogen will be generated off-shore. The off-shore constructions will also be manufactured in the Port of Rotterdam. This transition will be possible by innovating the maritime sector through high-quality education and research. Different incentives will attract and enthuse young people to work in this newly defined maritime manufacturing sector. All residents of the province will be encouraged to participate in this transition by sharing, reusing, repairing, and recycling their household products in the RE-hubs. These hubs will be centrally located in the cities to raise awareness and involvement of the consumers.



Windmill farm

Re-hubs

Sorting center

Education Insititution

Innovation Center

3.2 THE LIFE CYCLE OF STEEL

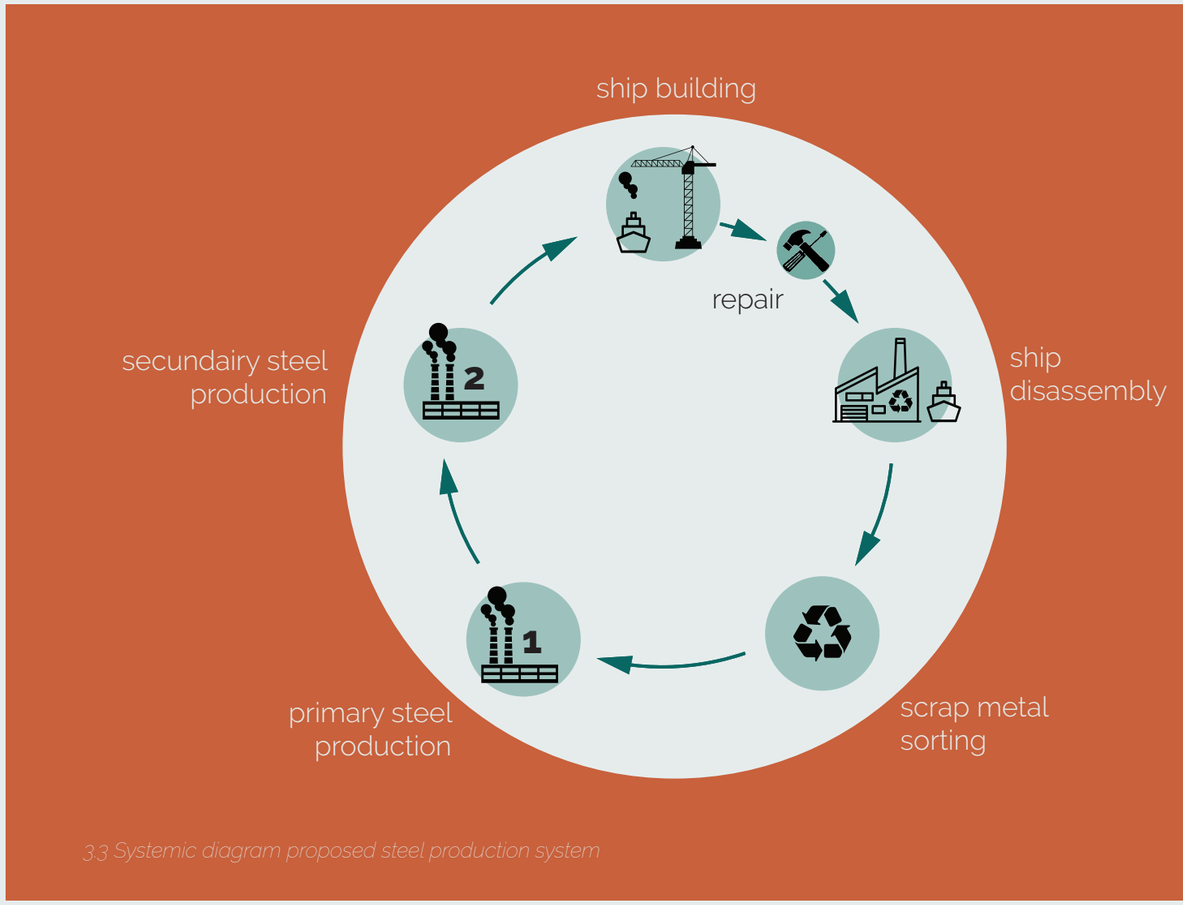
By 2050, the life circle of steel will be closed within the province. As the most significant primary steel processing company, TATA steel will be connected to a new secondary steel processing cluster at the Maasvlakte by the water backbone. The steel produced at Maasvlakte will be the input for ship manufacturing in the Drecht Cities.

At the end of a ship's service, it will be transported to the ship disassembly company, where the ship will be disassembled into steel scrap and other scraps. After that, they will be transported to different sorting centres, and steel scrap will go to TATA steel to enter the life cycle again.

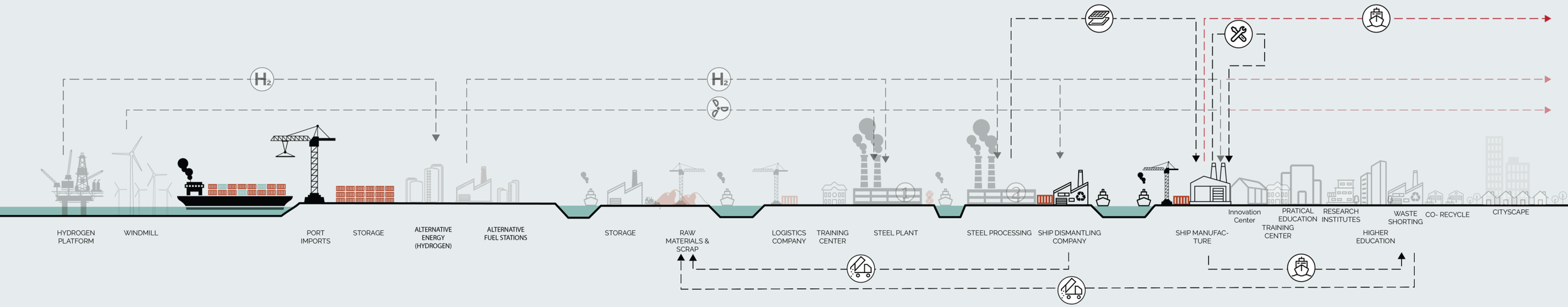
3.2 THE LIFE CYCLE OF STEEL

The systemic section shows how the steel production chain is closed on a provincial scale. Firstly, secondary steel production companies are built so that there will be no need to import steel parts and panels from overseas. Secondly, the ship disassembly sector will be up-scaled, to substantially increase the capacity to locally disassemble ships that are out of service. Disassembly companies will be linked to the existing metal scrap companies. The metal scraps from the sorting centre will be transported to the primary steel production company TATA steel and enter the life cycle again.

Before entering the recycling loop, ships that are out of service will first be sent to ship repairing hubs to see whether there is a chance for them to be repaired or retrofitted so that their service time is extended. The scrapped components will go to disassembly companies for further processing and finally to the scrap sorting centre. By making full use of metal scrap, the import of primary raw materials like iron ore and coal will decrease and finally be entirely replaced by scraps.



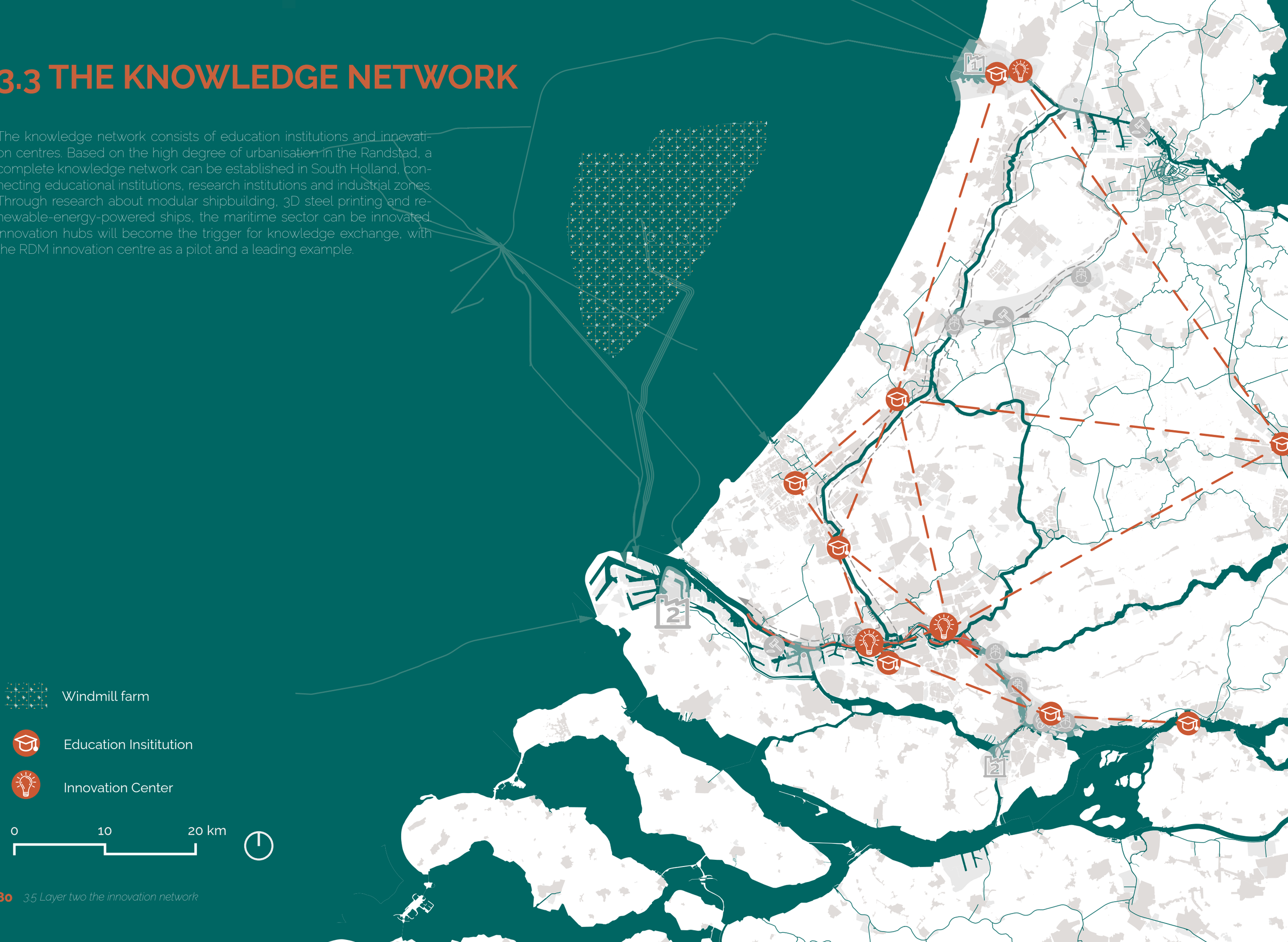
3.3 Systemic diagram proposed steel production system



3.4 Systemic section proposed steel system

3.3 THE KNOWLEDGE NETWORK

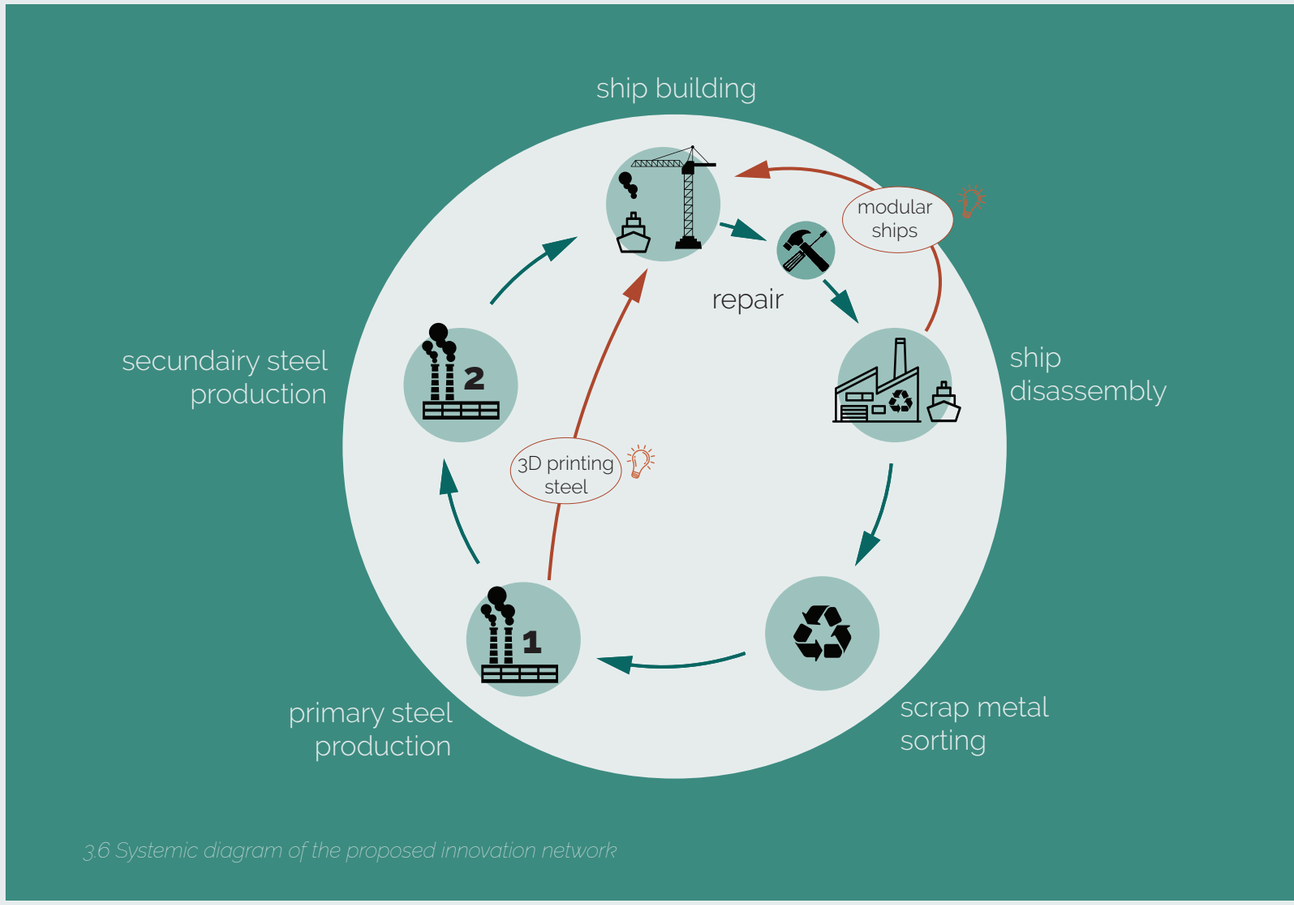
The knowledge network consists of education institutions and innovation centres. Based on the high degree of urbanisation in the Randstad, a complete knowledge network can be established in South Holland, connecting educational institutions, research institutions and industrial zones. Through research about modular shipbuilding, 3D steel printing and renewable-energy-powered ships, the maritime sector can be innovated. Innovation hubs will become the trigger for knowledge exchange, with the RDM innovation centre as a pilot and a leading example.



3.3 THE KNOWLEDGE NETWORK

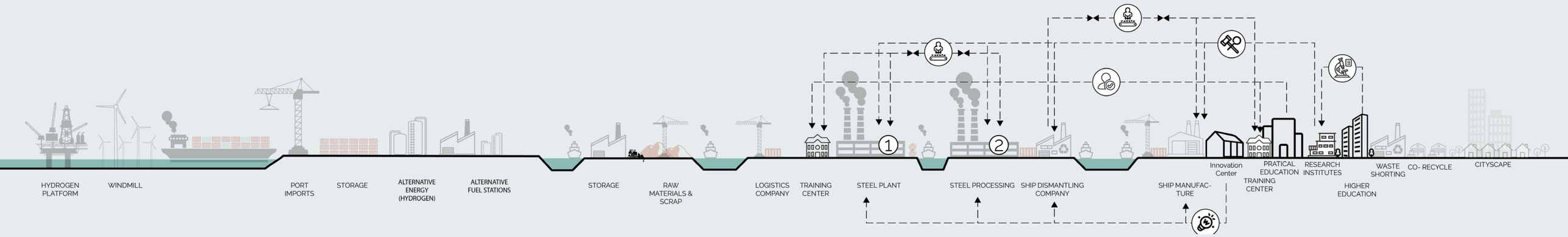
The education system consists of higher education and practical education. Higher education is interlinked with research institutions, aiming at advancing research to promote new technology in the makers' industry. Practical education focuses on training and retraining the workforce to ensure enough educated employees to promote manufacturing.

Innovation centres are the bridges between education institutions and manufacturing. In the innovation centre, students can touch on the actual industry process through school trips and practical exercises to examine whether their knowledge and research results could be implied in the industry. Manufacturers can also keep abreast of cutting-edge research and provide feedback in



3.6 Systemic diagram of the proposed innovation network

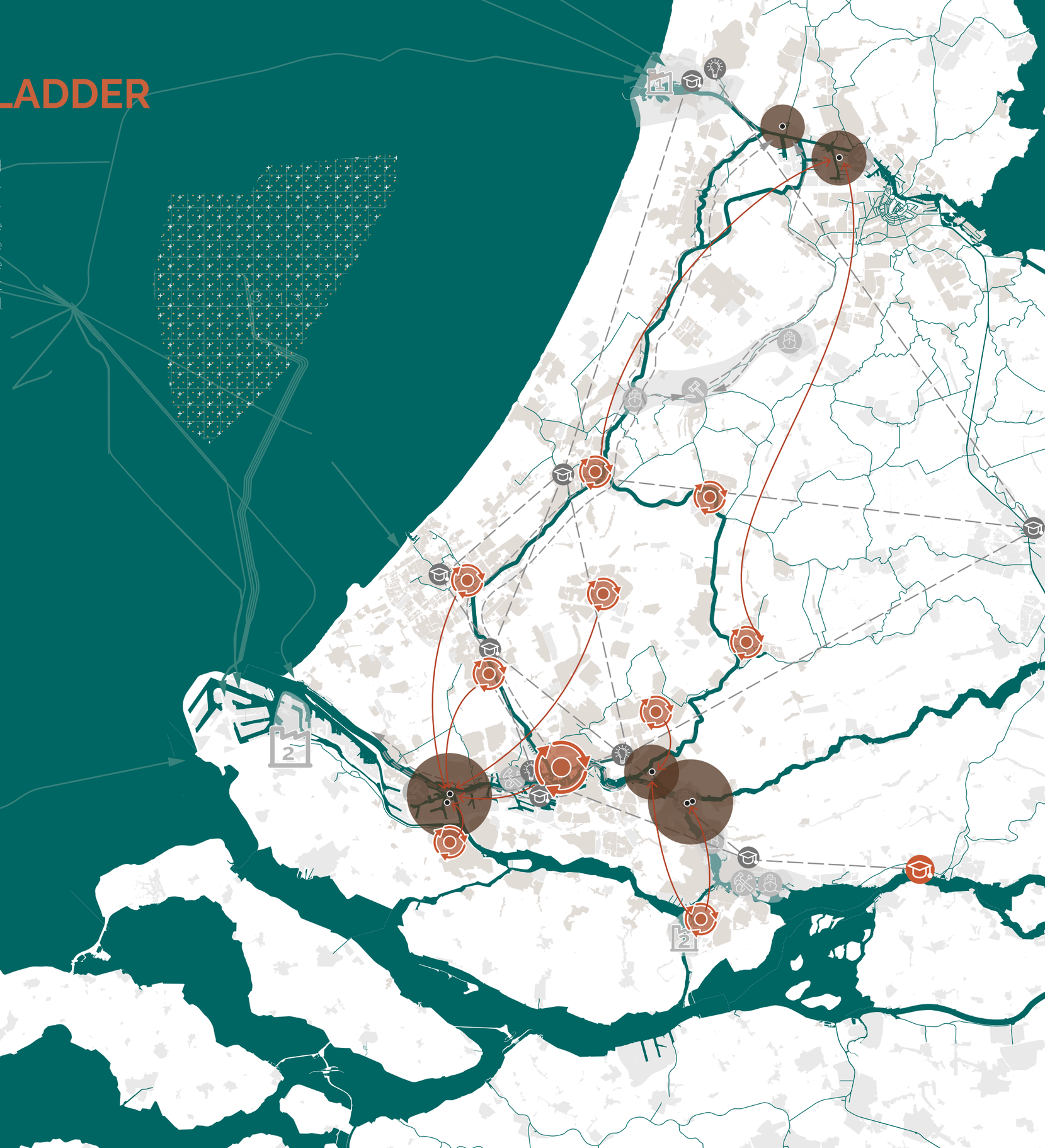
AFTER



3.7 Systemic section of the proposed innovation system

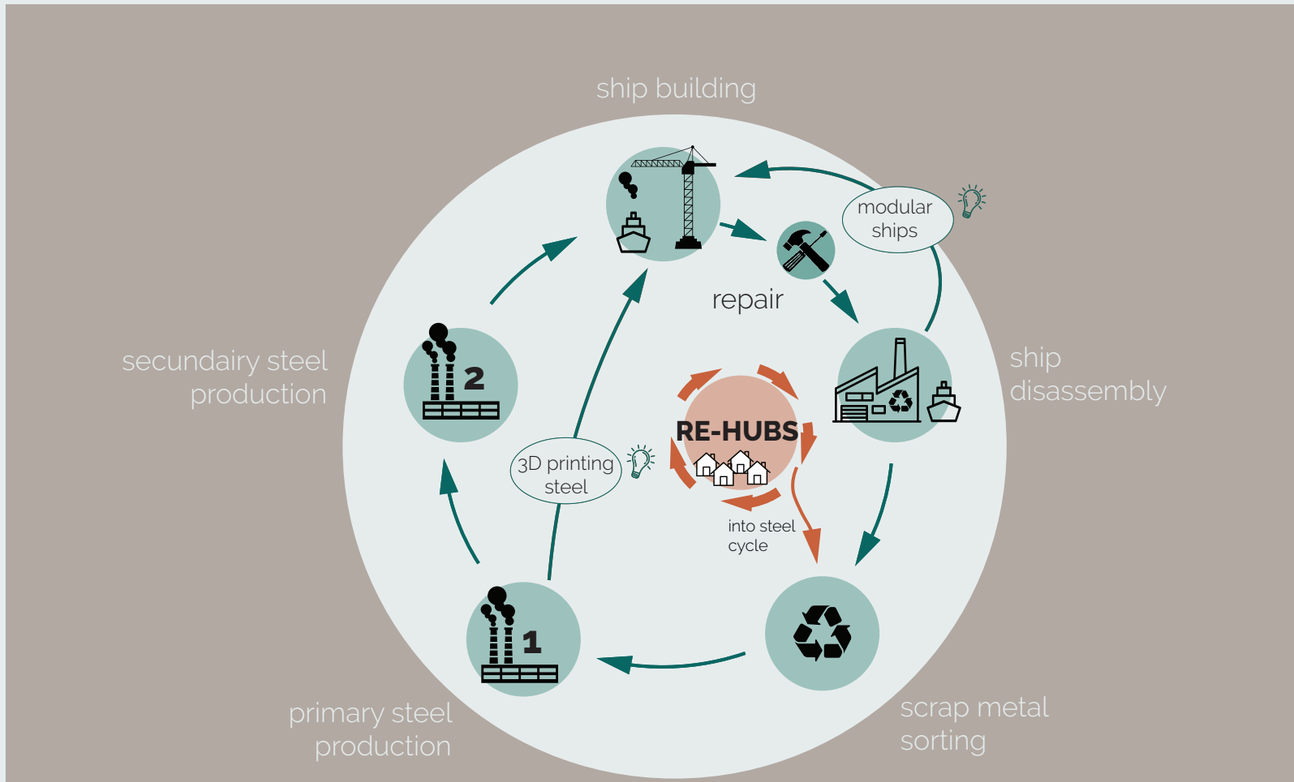
3.4 THE PARTICIPATORY R-LADDER

The Participatory R-ladder includes Reduce, Reuse, Repair, Refurbish and Recycle. Re-hubs will be introduced to build a bridge between the neighbourhood and the recycling centre to raise consumers' awareness. Re-hubs are located centrally in residential areas, where residents can put the products into circular use. When products are disposed for recycling, the last step of the R-ladder, the products are transported to different waste processing centres. Steel waste from consumer products will be sorted at scrap metal companies and in this way they will be put into the local steel cycle. Through this, the participatory R-ladder is built.



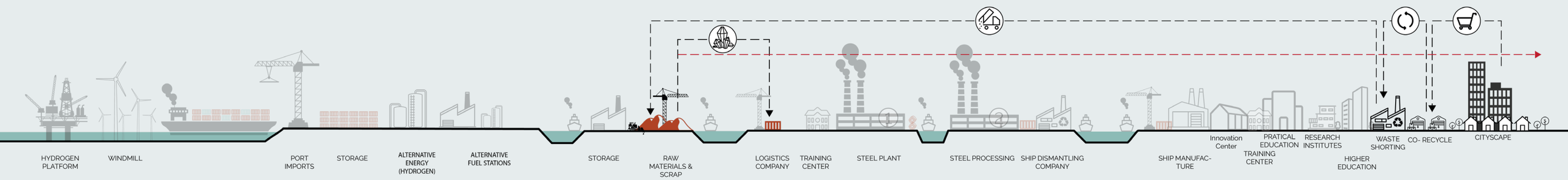
3.4 THE PARTICIPATORY R-LADDER

In the life cycle of steel, the Re-hubs act as a knot connecting the consumer and manufacturing. Although steel use in household appliances takes only 2% of steel products in Europe (Eurofer, 2021), we envision that this would be the chance to include residents in circular manufacturing. The Re-hub is combined with the makers' industry, innovation centre, residential area and waterway. Residents bring the products they need to recycle to the Re-hub in their residential area. If the products are in good condition, they can be sold in second-hand shops. If there is damage, it can be repaired or refurbished; If the product is no longer usable, it goes to the recycling centre for disassembly and processing and is sorted and transported to a different sorting centre. This mixed-use area promotes the R-ladder and stimulates the vitality of the surrounding commercial and residential areas.



3.9 The systemic diagram of the proposed consumer system

AFTER

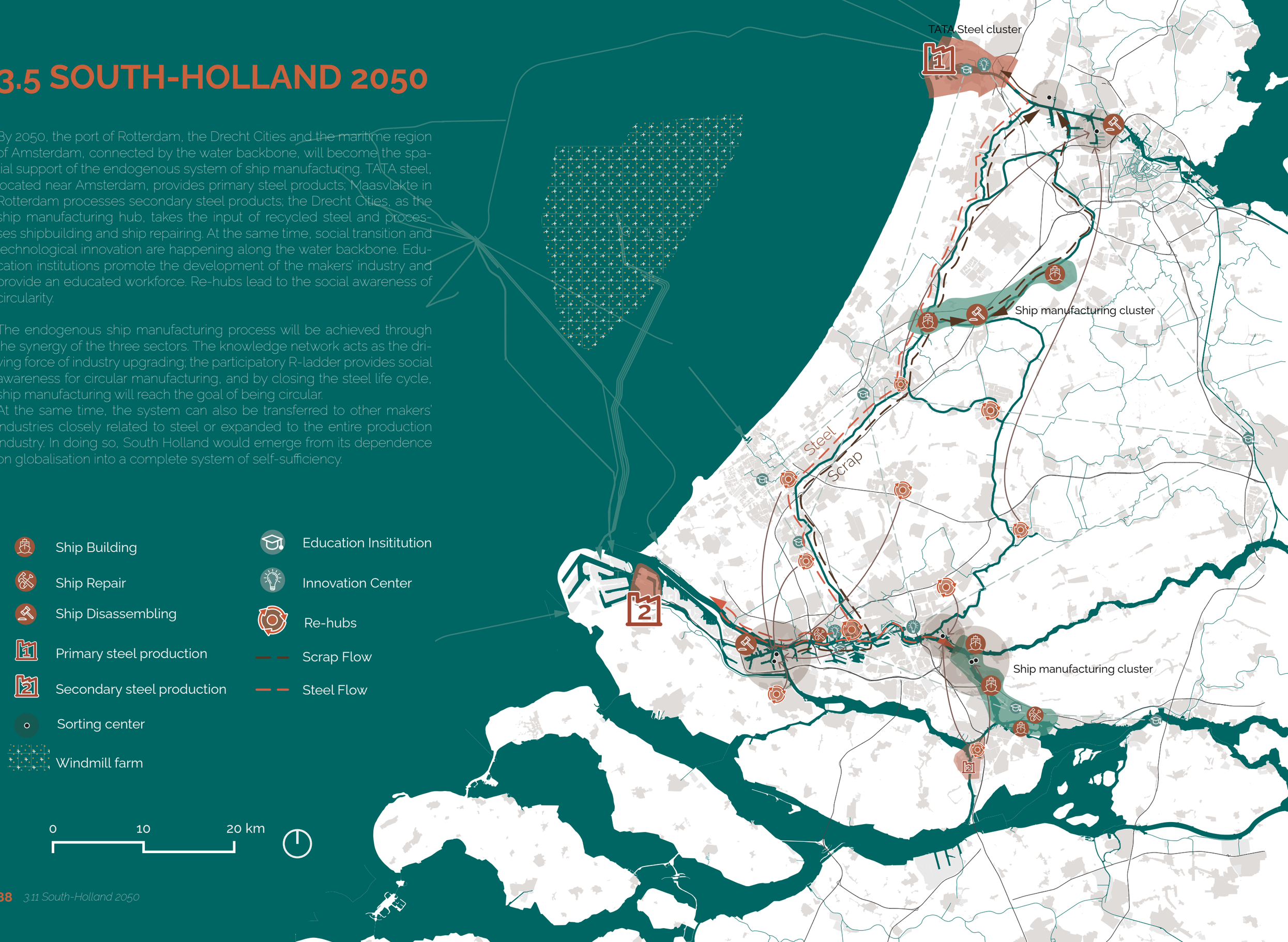


3.10 The systemic section of the proposed consumer system

3.5 SOUTH-HOLLAND 2050

By 2050, the port of Rotterdam, the Drecht Cities and the maritime region of Amsterdam, connected by the water backbone, will become the spatial support of the endogenous system of ship manufacturing. TATA steel, located near Amsterdam, provides primary steel products; Maasvlakte in Rotterdam processes secondary steel products; the Drecht Cities, as the ship manufacturing hub, takes the input of recycled steel and processes shipbuilding and ship repairing. At the same time, social transition and technological innovation are happening along the water backbone. Education institutions promote the development of the makers' industry and provide an educated workforce. Re-hubs lead to the social awareness of circularity.

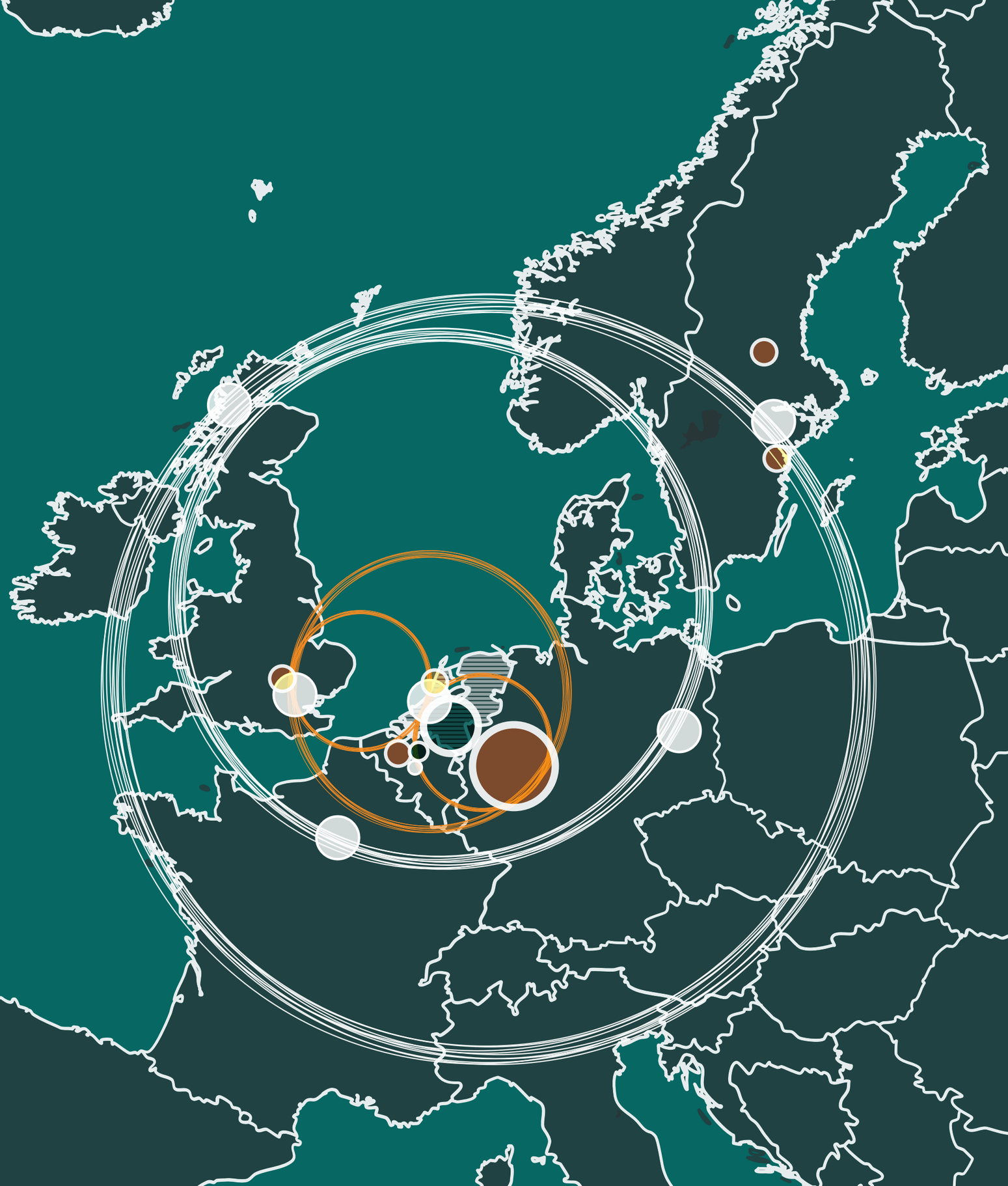
The endogenous ship manufacturing process will be achieved through the synergy of the three sectors. The knowledge network acts as the driving force of industry upgrading; the participatory R-ladder provides social awareness for circular manufacturing, and by closing the steel life cycle, ship manufacturing will reach the goal of being circular.
At the same time, the system can also be transferred to other makers' industries closely related to steel or expanded to the entire production industry. In doing so, South Holland would emerge from its dependence on globalisation into a complete system of self-sufficiency.



3.6 SCALING-UP

By building up the relationship between other steel producers, the province can function as both a recycler and a reuser of steel waste and ships and a solid endogenous maritime manufacturing place. By creating more local circles, we can activate other sectors and keep functioning in the large scale steel loops without our current dependency. Products afterwards can move over the borders and relate to other countries.

Zooming out to the scale of the whole of Europe, we envision that the province can lead the transition towards circular manufacturing in not only the Netherlands but also other countries. This is in line with the goal of the European Green Deal about mobilising industry for a clean and circular economy.



A VIEW OVER SOUTH-HOLLAND

RDM

RE-
HUB

4. TRANSITION STRATEGIES

4.1 GOALS

This chapter gives an illustration on the process of the transition, the different phases of the proposed strategy, the stakeholders involved, and how the vision can be gradually morphed into reality. Initially, the main phases of the strategy and the individual goals for each phase are set up. The different stakeholders involved in the process on a regional scale are identified. Additionally, the process of transition is developed and organised through a process of phasing. Finally, a detailed overview of the actions of different stakeholder groups and necessary policies are unfolded.

The strategic actions that have to take place to execute the vision are divided in three main phases: Dialogue & Innovation, Attraction & Development and Integration & Expansion. In each of the phases, spatial interventions, technological advancements, simultaneously with social-economic changes will happen, supported by policies. For each phase, the goals to be reached will be described.

4.1.1 Dialogue & Innovation

In the first phase, a foundation for the transition will be created. Through dialogue, the private sector and the civil society will be encouraged to take part in the transition. This is also the phase in which research will have to be conducted, to make innovations in the maritime sector possible. For instance, research and design of modular shipbuilding have to be completed before modularity can actually be implemented. Experiments with RE-hubs for consumer involvement will act as initial spatial interventions that will mark the beginning of the transition. Lastly, the first phase is about setting up a stronger network of education for the maritime sector.

4.1.2 Attraction & Development

The second phase is about the execution of the interventions per sector. In this phase, economically attractive locations for manufacturing companies will be developed. New manufacturing companies for the circular economy will then be attracted to these locations in the province. New employees are attracted to work in the maritime sector and students are educated to become the new maritime workforce. In the city centres, the Re-hubs for the consumers will be developed. During this phase, the infrastructure for public water transport will be expanded to improve the accessibility of the labour spaces.

4.1.3 Integration & Expansion

The last phase of the transition is about the integration of circular manufacturing strategies into other steel using sectors and later on into other material flows. Networks of different sectors will be carefully connected, to let them strengthen each other. Also, the behaviour change that has started in the first phase, will be extended to the other sectors, and other provinces. Moreover, this phase will facilitate the maritime manufacturing sector to grow. New types of circular ships can be developed, reacting to new problems or opportunities occurring over time. This phase will be most flexible and adaptive to the needs and desires of that time.

4.2 GOVERNANCE

4.2.1 A Definition

Modern states operate with different types of governance. Based on the level of influence, the different stakeholder groups of the public sector, private sector and civic society exert on the decision making and planning process. These types can be categorised in three main sectors: hierarchic governance, network governance and market governance (Rocco, 2022). The hierarchic governance is based on a top down governmental style, with the enforcement of regulatory rules from formal institutions of the public sector. The network governance is based on the partnership and synergy between different stakeholder groups during the decision making process. Finally, market governance describes a governmental style in which the private sector greatly influences the decision making process. In reality, modern states enforce a combination of these three governance styles, according to differences in culture and economic independence (Rocco, 2022). The process of governance and planning that is envisioned in the strategy of UrbanScraps adapts different elements of governance from all the aforementioned types, with an emphasis on a participatory network governance, stimulating different parts of stakeholders.

By incorporating the ideas of Judith Innes on communicative planning, communication between all the involved stakeholders is crucial for achieving a just and inclusive planning process (Rocco, 2021). Additionally, the recognition of conflicts of interest between different stakeholder groups and their interdependence in achieving their prospective goals might facilitate the synergy between different groups (Rocco, 2021).

Thereby, the identification of all involved stakeholder groups, the tracing of their interest in the transition strategy and the identification of the existing and possible synergies and conflicts is crucial for the planning process.

In addition to their interest, the power of influence of the involved stakeholders is also crucial. In order to understand which of the involved parties exert the greatest influence in the proposed strategy, the stakeholders were placed on a power interest matrix.

4.2.2 Stakeholders

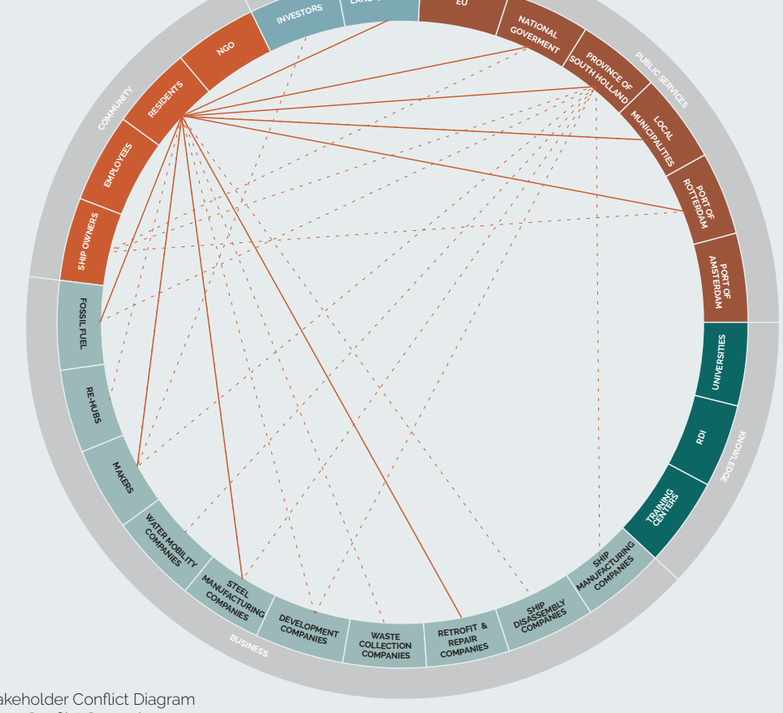
The stakeholders can be divided in 5 five sections, according to the stakeholder classification of the Penta-helix stakeholder map (Hill, 2020, p.214). The first group; public sector, includes governmental institutes like the national government, the Province of south Holland, local municipalities and the Port Authority. This particular group holds the power and controls the stirring tools to stimulate and guide the transition (Hill, 2020).

The second group, the knowledge sector, includes stakeholders that hold the important knowledge for the transition and includes universities, research institutes, technical innovative companies, start-ups and small scale training centres. This group is integral for the realisation of the transition, and must be activated in order to achieve change, however only bigger scale organisations, like universities and innovation centres hold the power and can make determined changes.

The third group; business, includes relevant organisations that can participate in the transitions. This sector includes maritime manufacturing companies, the existing fossil fuel companies of the Port, the steel manufacturing and waste collection companies. This sector generally benefits from the existing market conditions and systematic changes need to be made in some businesses while others need to be gradually phased out.

The fourth group, the community, includes the civic society, residents, employees, small scale businesses and other self-organised non-profit public organisations, which generally hold limited power. This sector needs to adjust to the transition, and even though it holds little power it participates in the transition.

Stakeholder Synergy Diagram
Current Synergies
Potential Synergies



Stakeholder Conflict Diagram
Conflict Synergies
Conflict Synergies

4.2 Relations between Stakeholders

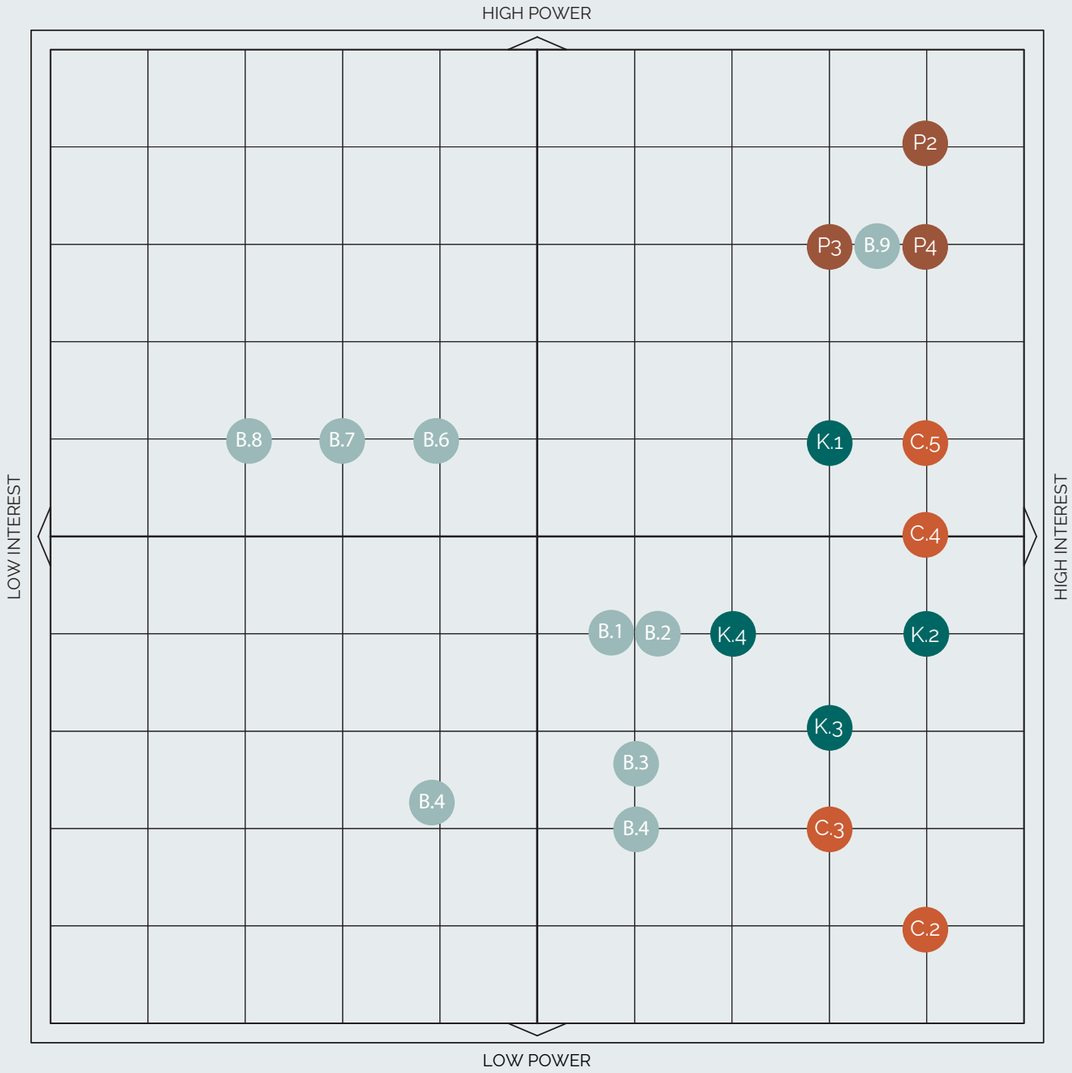
4.2 GOVERNANCE

The last group, finance, includes owners of land, technology and money, like local land owners and investors. This group needs to be stimulated, and incentives need to be created in order for them to take part in the transition.
The transition envisions a strong synergy between the knowledge sector, different domains of the private sector and different domains of the community organised by the public sector. More specifically, the strategy

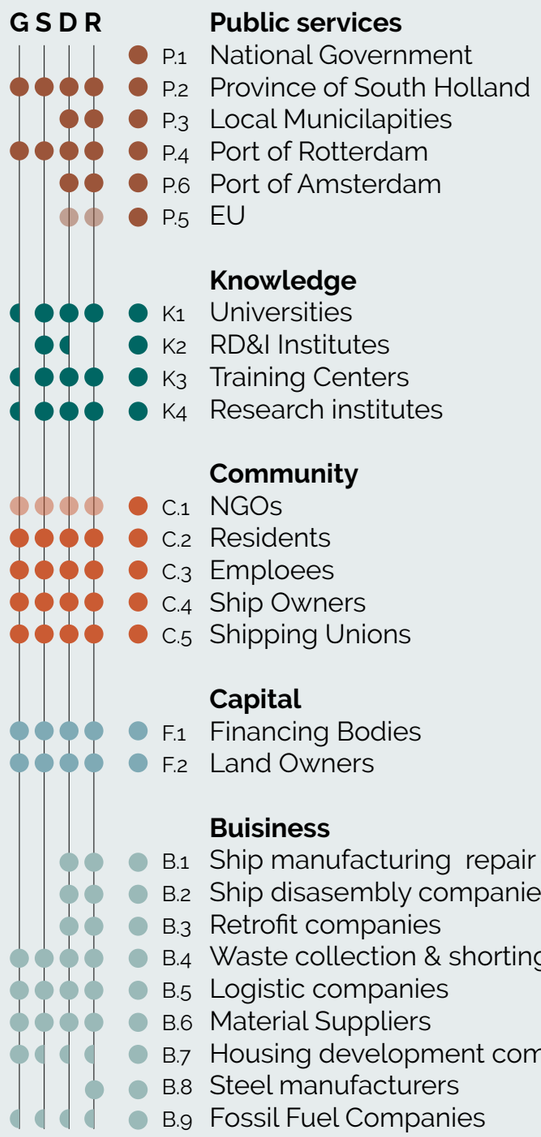
4.2.3 POWER POLICIES

proposes an active collaboration between the existing universities, innovation centres, ship manufacturing companies and the steel sector. The knowledge sector will facilitate the re-education of the existing employees of the ship manufacturing sector. The start-ups will make a smooth transition between crucial developing technologies and the practice of ship manufacturing. Finally, the public sector will facilitate the whole transition, by guiding the different actors through the use of guiding, shaping, capacity building instruments.

Possible conflicts might arise for the process of transition, mostly through the failure of successfully engaging the cooperation of powerful stakeholder groups to policies, for example through the failure of the ship manufacturing companies to work synergistically with the knowledge sector. Additionally, tensions might occur from the failure of the inclusion of low- power vulnerable groups, like citizens and employees, that might be overlooked in the process.



4.3 Power-Interest diagram



4.3 PHASING

4.3.1 TIMELINE

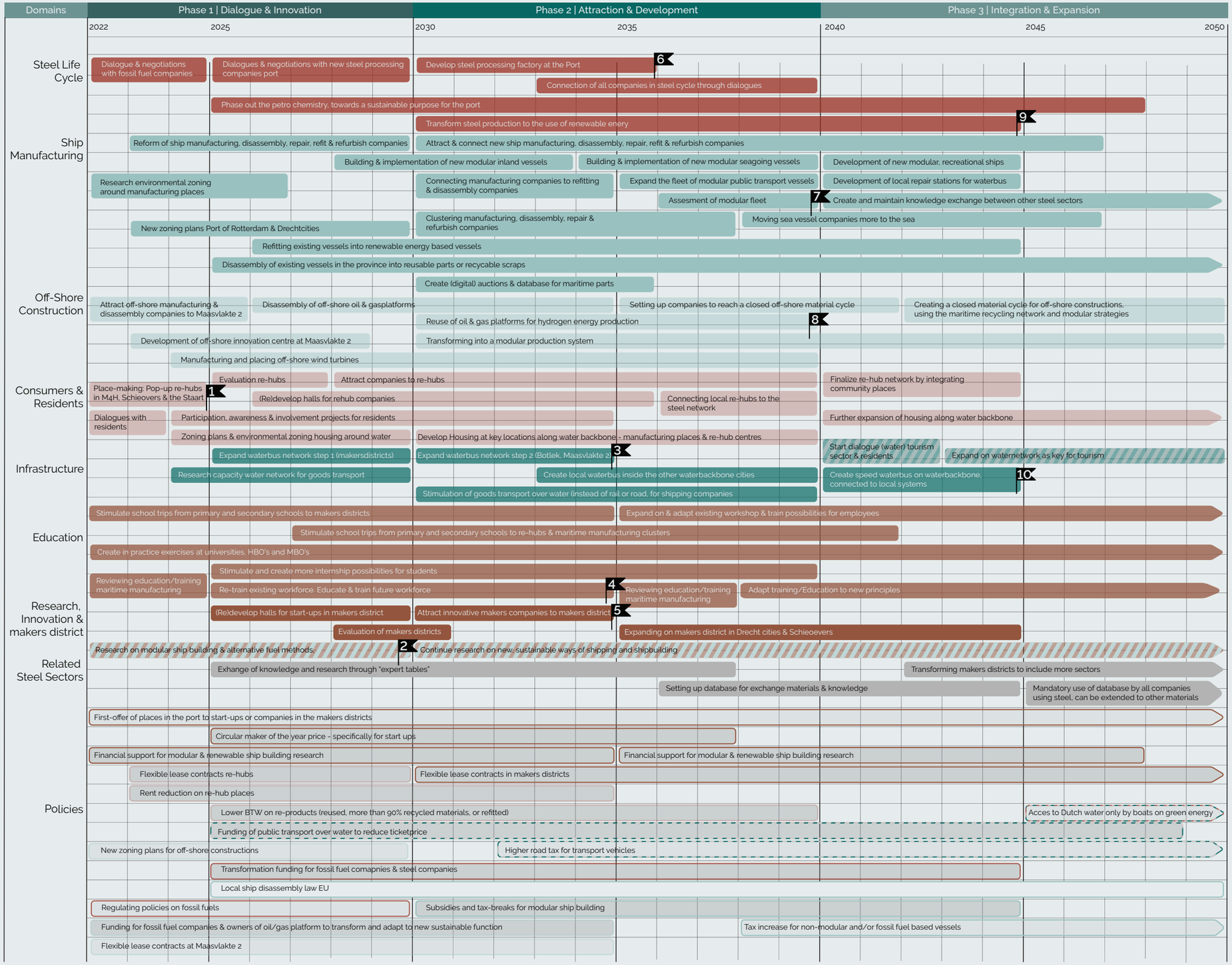
In the phasing of the strategy, the actions are divided over eight domains that are related to the transition: Steel life cycle; ship manufacturing; off-shore construction; consumer & residents; infrastructure; education; research, innovation & design and related steel sectors. Each of the domains will go through the phases of Dialogue & Innovation, Attraction & Development and Integration & Expansion. The policies needed to make the transition happen are also included in the timeline. The outlines of the policies are colour coded to indicate to which domains they are related.

Throughout the three phases, there are some

4.3.2 KEY CHANGES

milestones to be reached for the different domains, marked with the numbered flags in the timeline:

1. Pop-up re-hubs are created and evaluated at key locations.
2. Research on modular shipbuilding is completed. Manufacturing of modular ships is fully functioning. Start implementing alternative fuels for shipping.
3. The waterbus network for the maritime manufacturing port is completed.
4. The workforce is re-educated and re-trained for the disassembly of existing ships, and the manufacturing of modular ships.
5. Innovative maritime makers have settled at the maker's districts. They are connected to the existing companies.
6. The secondary steel processing company in the Port of Rotterdam is in operation.
7. Modular ship building is evaluated and modularity is now the standard practice.
8. All off-shore oil and gas platforms are disassembled and recycled or are reused for hydrogen plants.
9. The steel production in the Netherlands, both the primary production at TATA Steel and the secondary processes, are completely running on renewable energy.
10. The regional public transport network on the water backbone is complete, connecting all cities and main manufacturing clusters.



Policies: Existing Expansion New

4.4 The timeline

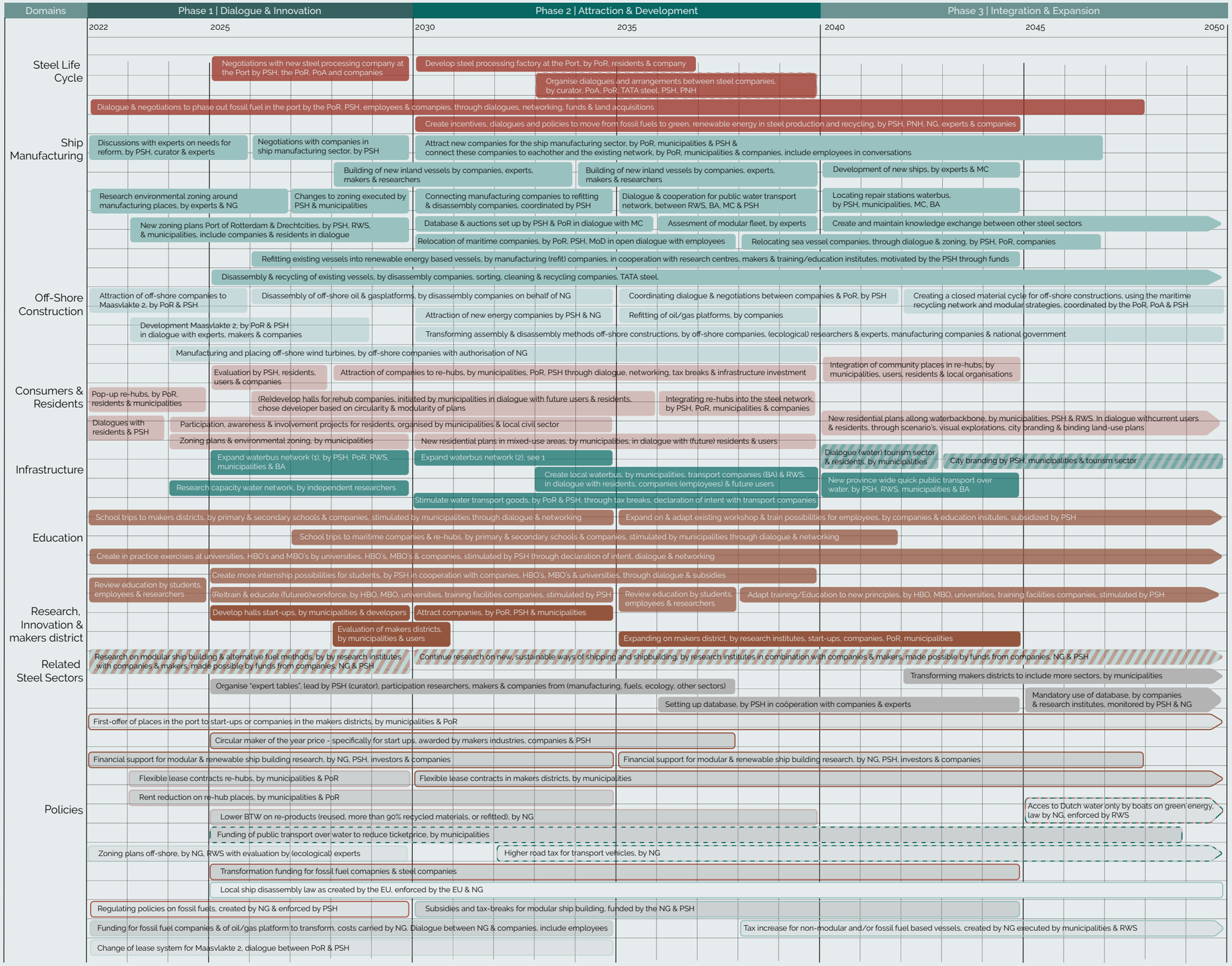
4.3 PHASING

4.3.3 Inviting the stakeholders

In this version of the phasing, the stakeholders are invited in the strategic actions. For each step in the timeline it is described who will take action and how. Some actions can be taken by the local governments, but for most actions the strategy is dependent on the acts of the private sector. There are four types of planning instruments that different levels of governance can use to influence the behaviour of private parties: shaping, regulating, capacity building and stimulating (Hobma, 2022). Capacity building is an important instrument in the strategy of UrbanScraps, as its performance is very much based on networking. Throughout the different domains, relations will be built between companies and experts and dialogues will be held with employees, users and residents.

The policies that are needed to make this transition happen are both regulating and stimulating instruments. Some policies are existing already, but still a lot of new policies have to be developed. Most existing policies related to maritime manufacturing are from the level of the European Union and not on national or regional level. The stimulating policies include lower BTW on re-products; financial support for research on modularity and alternative fuels; flexible lease contracts for re-hubs. Examples of regulating policies needed for the strategy are zoning plans for the industrial, mixed-use and residential areas and a state regulation to prohibit ships on fossil fuels to access Dutch waters.

The most important shaping instrument to make the transition happen - not included in the timeline - is the regional vision presented in chapter 3. Also, the designs of the key locations that will be presented in chapter 5 act as shaping instruments. They will show desirable futures and opportunities to get the stakeholders on board.



Policies: Existing Expansion New

4.5 The timeline of stakeholders

Explanation abbreviations stakeholders:

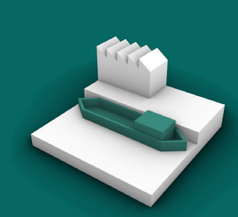
MC - Maritime companies
PSH - Province of South-Holland
PNH - Province North-Holland
PoR - Port of Rotterdam
PoA - Port of Amsterdam
BA - Blue Amigo
NG - National Government
RWS - Rijkswaterstaat

4.4 DESIGN OBJECTIVES

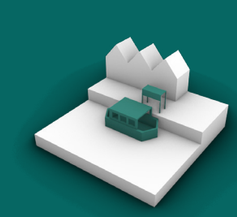
For the spatialisation of the regional strategy, a set of design objectives is developed. They function as spatial principles that can be combined in the design of specific locations in the province, depending on the context and the identity of the location. The design objectives are based on the theory of the pattern language for the Cities of Making (COM) from Croxford et al. (2020). The COM project provides fifty patterns for the planning and design of urban manufacturing (Croxford et al., 2020). For the regional strategy of UrbanScraps these patterns are revised and translated into spatial design objectives that focus on the maritime manufacturing sector, the knowledge network, the participatory R-ladder and the water backbone. The design objectives are used as a bridge between the regional vision and the regional and local strategic designs.

The design objectives are divided in three categories: the Regional Network (R), the Local Program (L) and the Policies & Participation (P).

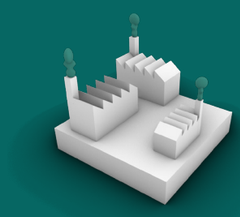
The Regional Network category includes spatial principles that should be implemented on the scale of the region, to form visible and non-visible infrastructures. The objectives from the Local Program can be implemented in the designs on city and neighbourhood scale. In the Policies & Participation category, the stakeholders are involved in the design. Each design objective will be described on the next pages.



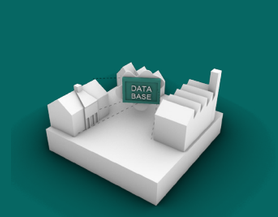
R1 | Efficient transport of goods over water



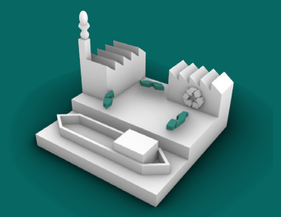
R2 | Fast public transport over water



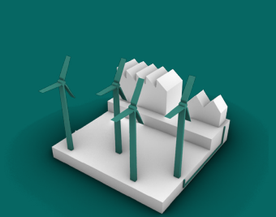
R3 | Industrial clusters



R4 | Database for materials and knowledge

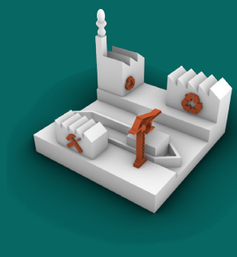


R5 | Forming links in the steel cycle

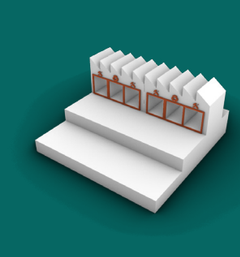


R6 | Off-shore energy production

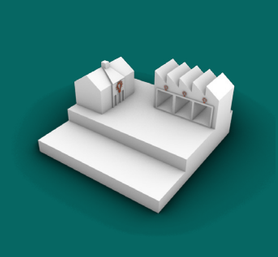
L1 | Proximity to water backbone



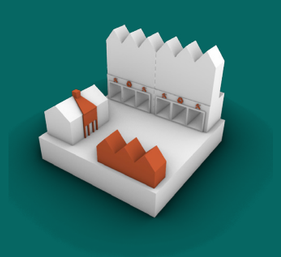
L2 | Network of repair, reuse and recycle for manufacturing



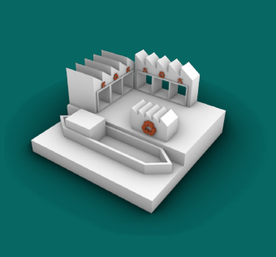
L3 | Makers district: Flexibility and shared spaces



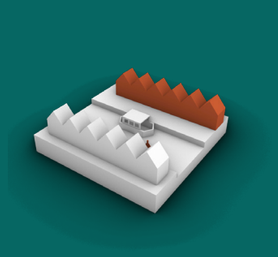
L4 | Innovation dock



L5 | Qualitative mixed use



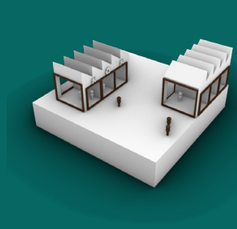
L6 | Community repair, reuse, recycle centres



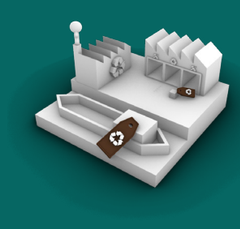
L7 | Residential and recreational waters

L8 | Proximity of education

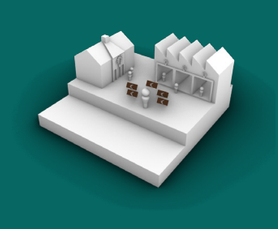
P1 | Company curator



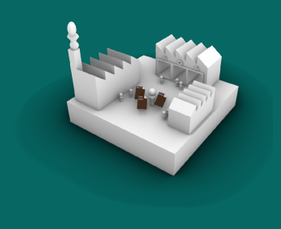
P2 | Transparant making through involvement



P3 | R-ladder product labels



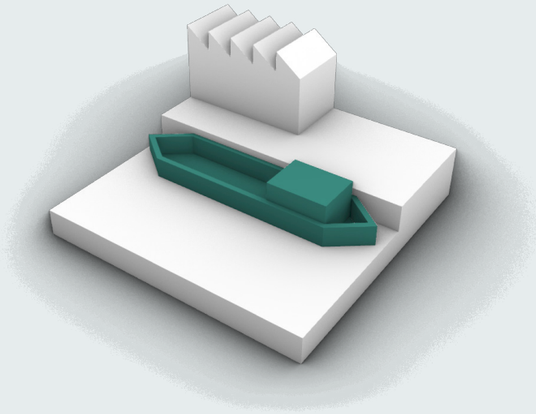
P4 | Incentives for research and development



P5 | Diversity in tenure models: Assurance and Flexibility

4.4 DESIGN OBJECTIVES

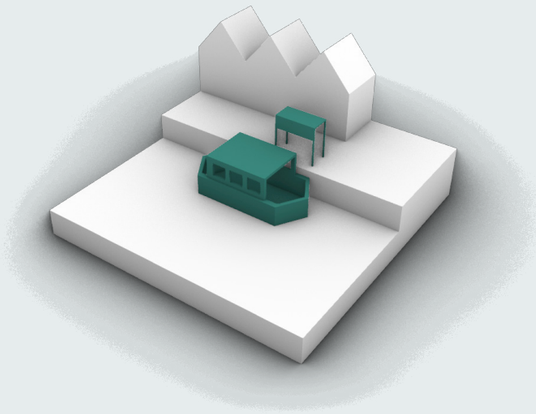
4.4.1 REGIONAL NETWORK



R1 | Efficient transport of goods over water

The Province of South-Holland has an extensive water network, including the Port of Rotterdam, which is the largest sea port of Europe. Most industrial areas in the province are connected to rivers and canals and have their own (small) harbour. Inland shipping is an efficient mode for the transport of goods. In general, one inland vessel can transport as much as 120 trucks, which is equal to 5 km of traffic jam (Inland navigation Europe, 2021).

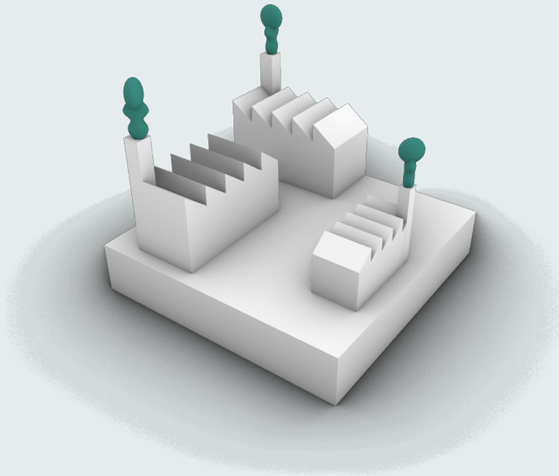
Shifting to mainly water based freight transport will release the pressure on the roads. Increasing the capacity of inland shipping will also strengthen the development around the water backbone, because of the advantages of proximity. As a result, travel times may decrease, leading to a higher efficiency of goods transport.



R2 | Fast public transport over water

Waterways will not only be used for transport of goods, but also for transport of people. The big cities in the Province of South-Holland are all located at rivers and canals. Yet, there is currently only public transport over water in Rotterdam and the Drecht Cities. To let the waterways in the region function as the backbone, the activities of daily life - living, working, education, doing groceries - should all be accessible by water.

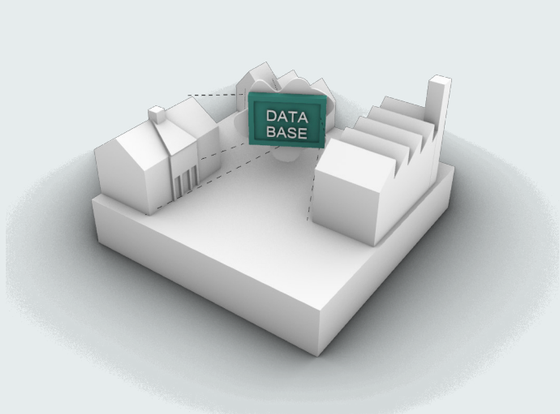
Public water transport is also a way to bridge the distance between the cities and the Port of Rotterdam. Currently, most of the port can only be accessed by personal car, which is not a future proof transport mode, because of its emissions and space demand. The Port of Rotterdam provides a lot of jobs and the transition towards a circular port is expected to provide even more jobs. Therefore, the accessibility of the port for the people who work there, is an important issue. A water based public transport connection between different parts of the port and the city could substantially increase the accessibility.



R3 | Industrial clusters

Over the past decades, there has been a trend of industries in the port moving more towards the sea or even moving out of the Port of Rotterdam. The harbours that become vacant are located close to the city centre and are therefore redeveloped into housing or mixed use areas to meet the demand for new houses. This reduces the possibilities for industries to settle there, because of regulations on nuisance. In the transition towards local circular manufacturing, it is important to keep space for industries that are not so clean. For example, the recycling of metals is quite a dirty process.

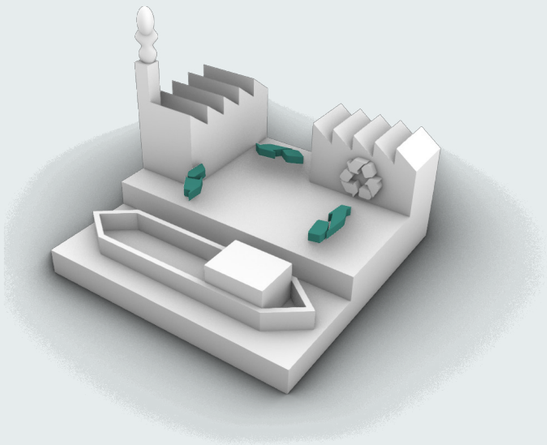
In order to keep nuisance away from residential areas, companies have an environmental category label. Companies in the high environmental category should be located further away from residential areas (Rijkswaterstaat, n.d.). To further reduce the nuisance, polluting or noisy industries should be clustered in areas where a high environmental category is allowed. The Port of Rotterdam has the potential to house industrial clusters when fossil fuels will phase out.



R4 | Database for materials and knowledge

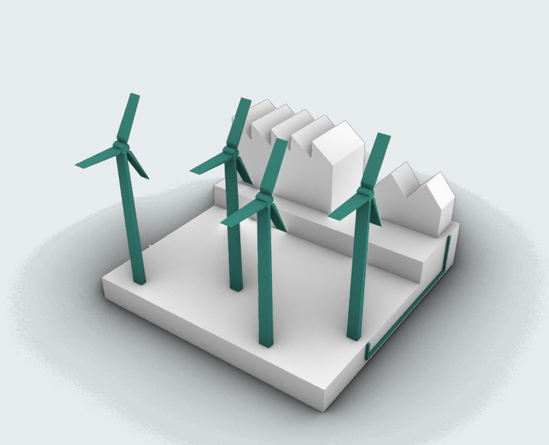
A key aspect in the circular economy is to see waste as value. Manufacturing companies have to collaborate to use the steps of the R-ladder, so they will recycle their waste materials, reuse products and parts and even refuse to buy or produce something new because something can be shared. In order to facilitate local, circular material flows a database should be set up to inventarise which company provides which (waste)materials. Not only materials can be shared like this, but knowledge can be exchanged via the database. In the manufacturing sector, there are a lot of innovations done that support the circular economy. However, new techniques are often patented by the companies that invented them. For the well-functioning of the circular economy, open communication and exchange of knowledge are required.

4.4 DESIGN OBJECTIVES



R5 | Forming links in the steel cycle

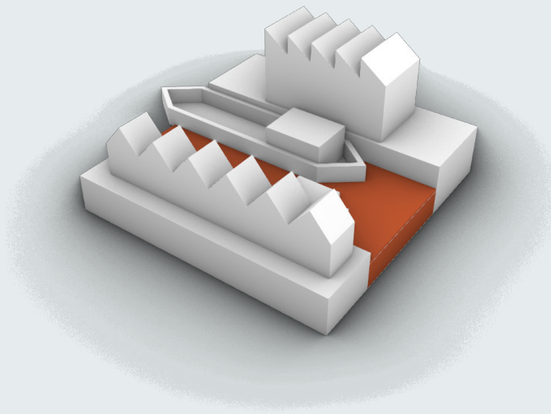
The predominant material in maritime manufacturing is steel. For the creation of a local, circular steel material flow, new links need to be formed. The steel production company TATA Steel and the maritime manufacturing companies are both present in the region, but their systems are not connected. Also, some crucial steps in the steel life cycle for the maritime sector are missing in the province. There is no secondary steel production company and the ship disassembly capacity in the region is far from sufficient. To establish a local steel life cycle, the missing steps in the cycle need to be solved and most importantly, all companies have to be linked to each other.



R6 | Off-shore energy production

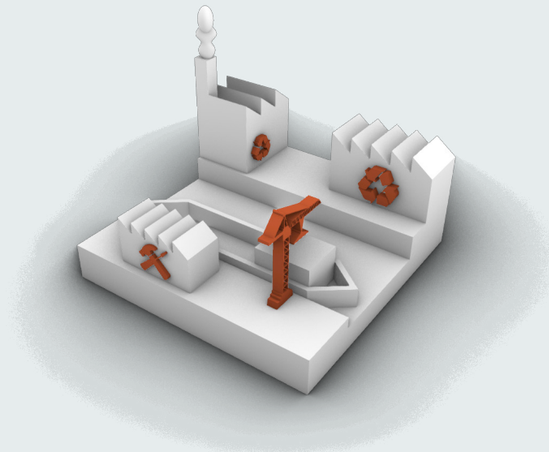
The transition towards a circular economy is only beneficial in combination with the energy transition to renewables. Steel production and maritime manufacturing are currently dependent on fossil fuels, leading to a lot of pollution and greenhouse gas emissions. The North Sea has a lot of potential for the generation of renewable energy. Off-shore renewable energy can be used for circular maritime manufacturing. At the same time, manufacturing of off-shore constructions is one of the subsectors of maritime manufacturing. So, the maritime sector can build the constructions needed to generate off-shore green energy.

4.4.2 POLICIES & PARTICIPATION



L1 | Proximity to water backbone

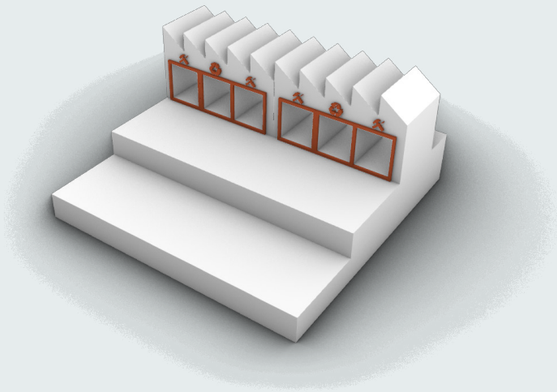
The water backbone will function as a new connector in the region, both for freight transport (R1) and for public transport (R2). The concept of Transit-Oriented Development (TOD) can therefore be applied to the water backbone. TOD is usually focused on developing high density mixed-use around a station for public transport, to create walkable cities (Federal Transit Administration, 2019). In this case, nodes in the water transport networks can function as the stations around which densification will take place. The 200.000 new houses that the Province of South-Holland will have to build until 2030 (Gemeente Rotterdam, 2021b), can therefore be developed around the water backbone. Also for the development of re-hubs, maker spaces and industrial clusters proximity to the water backbone is important.



L2 | Network of repair, reuse and recycle for manufacturing

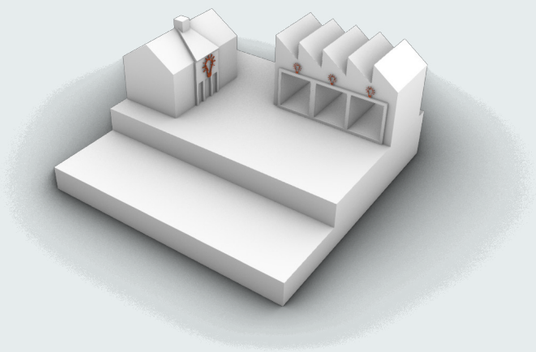
Maritime manufacturing is currently a linear and global system, in which steel parts are imported from low-wage countries and old ships are exported again to low-wage countries for the dismantling. In order to establish local, circular manufacturing, a system should be created for the narrowing, slowing and closing of material loops. A local network should be created where the different steps of the R-ladder are represented by different companies. In addition to the actual manufacturing, there should be a network of repair, reuse and recycling of the materials used in manufacturing.

4.4 DESIGN OBJECTIVES



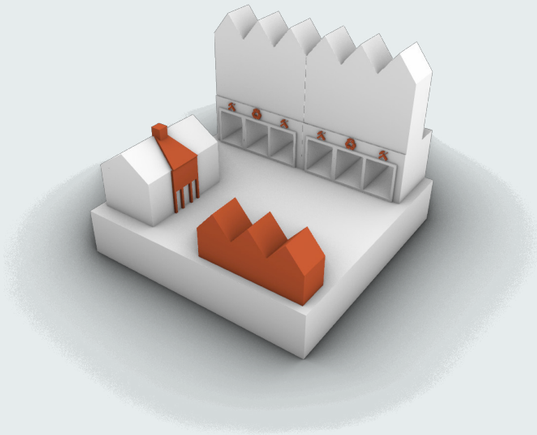
L3 | Makers district: Flexibility and shared spaces

For the development of new technologies for the circular economy, innovative manufacturing companies are essential. The makers district will provide work spaces for manufacturing start-ups and scale-ups in the circular economy. Makers districts are often located at transitional territories, where industry and city meet. These are locations where the industrial program slowly moves out and the urban program slowly moves in. To prevent the buildings and the terrain from being abandoned, flexible work spaces for the makers can be created in the industrial halls. As the makers district mainly houses start-ups with little capital, it is important to provide shared facilities, such as machines and tools or flexible office spaces.



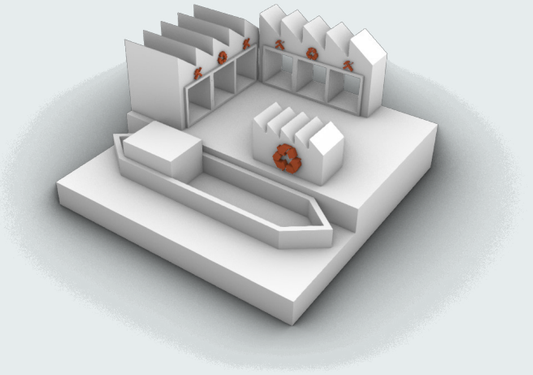
L4 | Innovation dock

In the transition towards a circular manufacturing process, the practice of manufacturing has to be innovated. Herefore, the knowledge gained at the education and research institutes has to be transferred to the manufacturing companies. Innovation centres, such as the innovation dock at RDM in Rotterdam, can form the bridge between knowledge and practice. The innovation dock consists of innovative manufacturing start-ups that collaborate with higher education and practical education to develop new technologies. Subsequently, collaboration with the manufacturing companies will make the actual innovation of the sector possible. The innovation centre should provide affordable work spaces for start-ups to experiment.



L5 | Qualitative mixed use

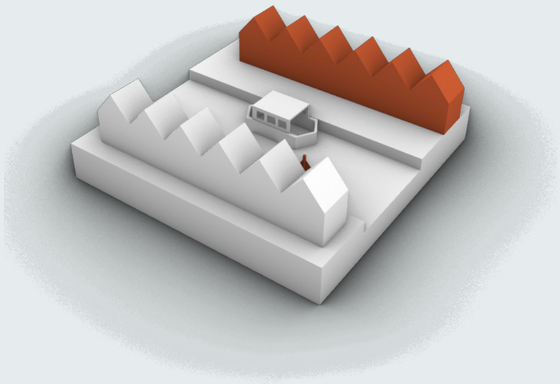
The demand for new housing in the Province of South-Holland is high. At the same time space is needed for urban manufacturing and for heavy industry. Space is scarce in the city and yet there is a desire to densify within the city, to keep green space around the city. Space scarcity asks for a compact city in which different functions are stacked (Gemeente Rotterdam, 2021b). A mixed use area leads to proximity of different functions and strengthens the walkability of the city, but it is important to be careful about mixing manufacturing functions. Clean, innovative companies can be very valuable in an urban area, but mixing companies that create nuisance should be avoided.



L6 | Community repair, reuse, recycle centres

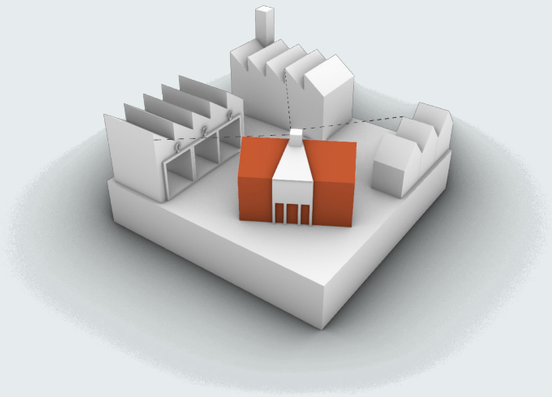
The transition towards a circular economy would not function without a behaviour change of the consumers. The current society is very much based on consumerism, as a result of capitalism, which may threaten the transition. In order to involve the consumer and raise awareness about the circular economy, RE-hubs will be created. RE-hubs are community centres where the different steps of the R-ladder will come together. Retail companies can offer shared products (refuse), second hand shops can facilitate reuse of consumer products, in repair cafés products can be fixed and products can be remanufactured into new products at creative makers companies. Lastly, the products can be recycled when the consumers dispose of them at the co-recycling facility.

4.4 DESIGN OBJECTIVES



L7 | Residential and recreational waters

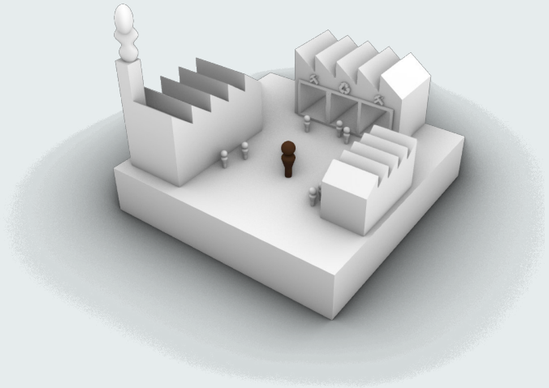
The water backbone will not only be a functional infrastructure. Water is also well appreciated in a living environment. Developing housing next to the waterways will therefore not only be a strength for Transit-Oriented Development, but it will also create qualitative residential areas. Moreover, the water in the Netherlands is often used for recreation. In the province, there are a lot of water sport clubs located next to rivers, canals and lakes. Next to recreational shipping, people can also recreate in natural areas along the water. Recreational waters can also boost tourism in the province. It is important to recognize the quality of having water in urban areas and in rural areas, so this quality can be included in the design.



L8 | Proximity of education

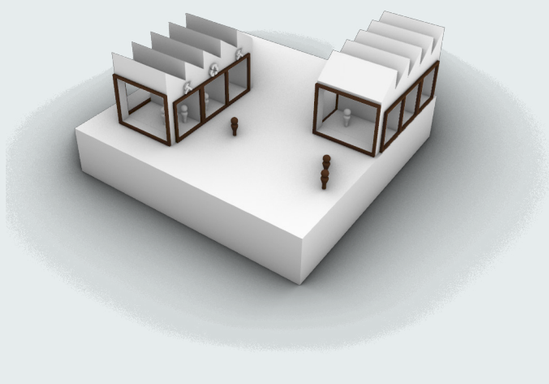
In the transition towards circular manufacturing, education is fundamental in different ways. First of all, higher education in combination with research is needed for the innovation of the sector. Practical education institutes can school scholars towards practical jobs in manufacturing. Collaboration between higher and practical education can link knowledge to practical making. In the maritime manufacturing sector, there is a lack of skilled personnel. Training centres at manufacturing companies can facilitate training of the workforce. Retraining of the personnel will become more important when the manufacturing practice is transitioning to become circular. Proximity of education to innovation centres and mostly to the manufacturing companies is therefore important. For a just transition, it is also crucial that education is accessible for all residents, from all neighbourhoods.

4.4.3 LOCAL PROGRAM



P1 | Company curator

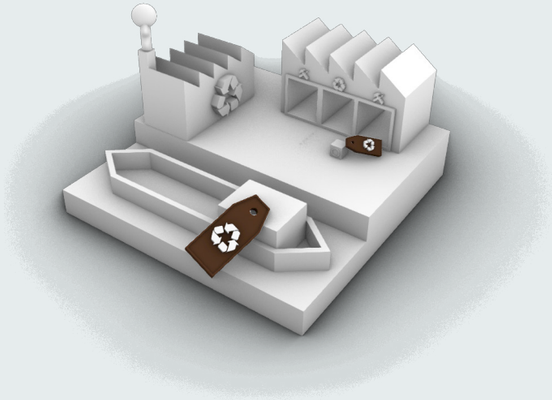
One of the main actions in the transition to circular manufacturing, is linking the different steps in the material life cycle. Many of the needed steps in the cycle are represented by already existing companies in the region. However, most of these companies are often not connected to each other in a local cycle, but function as a step in a global linear chain. In order to connect the companies in a local cycle, coordination is required. A curator can coordinate the alignment and collaboration between companies (Croxford et al., 2020). The curator can be a delegate of the Province of South-Holland, the Port of Rotterdam Authority, or the local municipality, depending on the scale on which companies are desired to be connected.



P2 | Transparant making through involvement

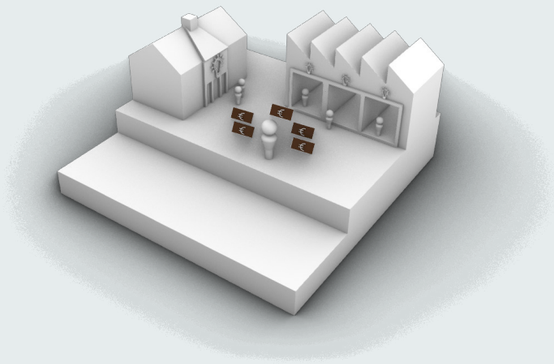
The makers districts will be located in mixed-use areas, where urban manufacturing will be combined with living. This can provide opportunities for interaction, but it can also lead to conflicts in the desires for space use and possible nuisance from the companies. To prevent conflicts between the makers and the residents, it is important that the companies are transparent about what they do. This can be achieved by literally making the manufacturing processes visible through large glass façades and by open communication between the makers and the residents. Involving the local residents in the process of making and 're-making' (using the steps of refuse, reuse, recycle), will make them more likely to accept possible nuisance. In different innovative, maker-related retail facilities, the residents can experience what urban manufacturing can mean for them.

4.4 DESIGN OBJECTIVES



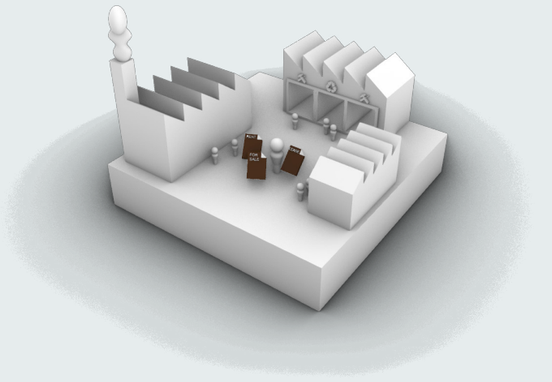
P3 | R-ladder product labels

Although it is generally acknowledged that it is better to manufacture products from reused or recycled materials, still a lot of manufacturing uses primary raw materials, because of the lower costs or the reluctance to change the process. To stimulate companies to produce in a circular way, R-ladder product labels will be created. These labels will indicate whether a product is reused, repaired, refurbished or manufactured from recycled materials. This will result in more transparency about the material use in urban manufacturing and it will encourage manufacturing companies to let their production process rise on the R-ladder. At the same time, these product labels will make the consumer more aware about the circular economy, so they can make a well informed choice about the products they buy.



P4 | Incentives for research and development

For the transition to circular manufacturing, rising on the R-ladder, new innovative technologies have to be developed. For example, to make reuse of material parts possible, the products and constructions have to be well dismountable. Herefore, technologies for modular building have to be developed. To stimulate and facilitate research and development, the national and local governments have to deliver budgets to research and development institutes that focus on circular manufacturing. Besides, it is important that municipalities provide space for research and development. This could be in the form of an innovation dock, where start-ups in manufacturing can collaborate and make use of shared facilities.



P5 | Diversity in tenure models: Assurance and Flexibility

Start-ups in the manufacturing industry are needed to innovate the sector to transition to circular manufacturing. Start-ups are based on experimental business models and have little capital. Currently, the lease contracts for industrial sites are often for long term lease. This will not be feasible for small, innovative companies, as the future of their business is still insecure. Start-ups will therefore benefit from flexible tenure models. On the other hand, it is important to provide assurance of space for companies, so they can start investing in their technologies and hiring personnel. Therefore, it is important that the area managers of industrial areas in the province provide diverse tenure models.

5. STRATEGIC INTERVENTIONS

5.1 TRANSFORMATION OF THE BACKBONE

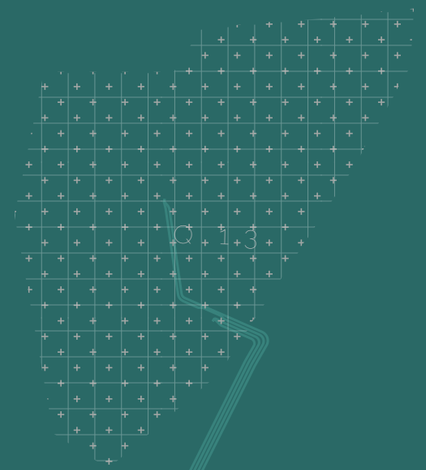
The strategic interventions are landed through the water backbone. Firstly, the waterway supports the building of the transport network. Along the port of Rotterdam and the port of Amsterdam lies the two leading industry clusters, which are connected by the waterway. Secondly, the metropolitan area is developed through the water backbone. The water will function as a core network with nodes around which densification will take place, based on the concept of Transit-Oriented Development. Thirdly, the RE-hubs are located at the riverbank to achieve water mobility. Lastly, steel manufacturing and shipbuilding also highly depend on water transport.

Zooming in on three locations along the water backbone with different identities, will show how the interventions will function on a neighbourhood scale.

- The Schieoevers is a knowledge-based mixed-use neighbourhood. By creating a collective space for both researchers and manufacturers, the space will be activated as an incubation hub for high-tech manufacturing.

-The RDM&M4H houses a pilot innovation centre that builds bridges between makers and education institutions. By clustering the makers' industry adjacent to RDM, there will be more chances to exchange knowledge and experience and promote both the training of the workforce and the development of the makers' industry.

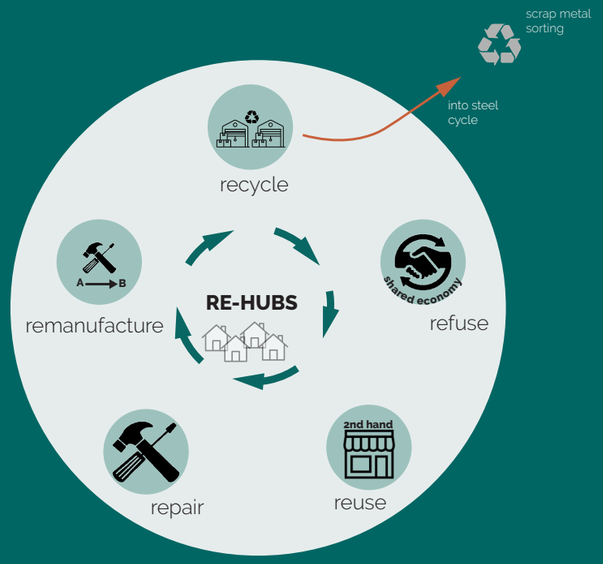
-The Staart is the manufacturing cluster with a strong network connecting upstream and downstream of the industrial shipbuilding chain. Based on the current conditions, it will be maximised to close the life cycle of a ship within the cluster.

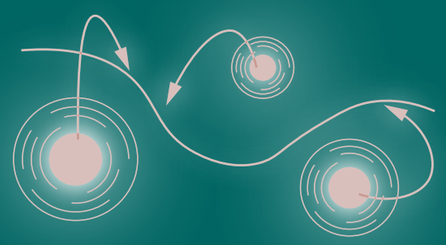


5.2 RE-HUBS IN THE PROVINCE

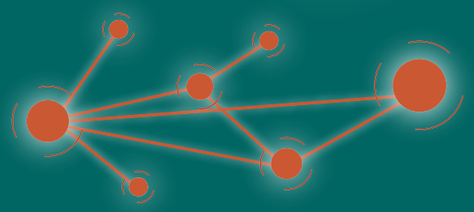
The Re-hub system includes local Re-hubs for consumers and a Re-network for manufacturing. The Re-hubs are located in the centre of the community, aiming to reach as many residents as possible so as to awaken residents' awareness of circulation and create a social atmosphere for the whole society to participate in the circulation. Products that can be directly reused are sent to second-hand stores for sale or repair, while those that cannot be reused will be transported into the industrial Re-network for recycling.

The Re-network includes the steps of the R-ladder in network form instead of in a central hub. Every step will happen on a larger scale at a separate location, so within the network there are separate companies for manufacturing, disassembly, scrap sorting, repair and retrofit. All these steps in the Re-network will happen along the Port of Rotterdam and the Drecht Cities. Finally, the steel scrap will be transported to TATA steel to enter the steel life cycle.





(Local) Re-hubs in the water network



Re-network,the industrial R-ladder

5.3 THE MANUFACTURING PORT

5.3 Changing of the maritime port

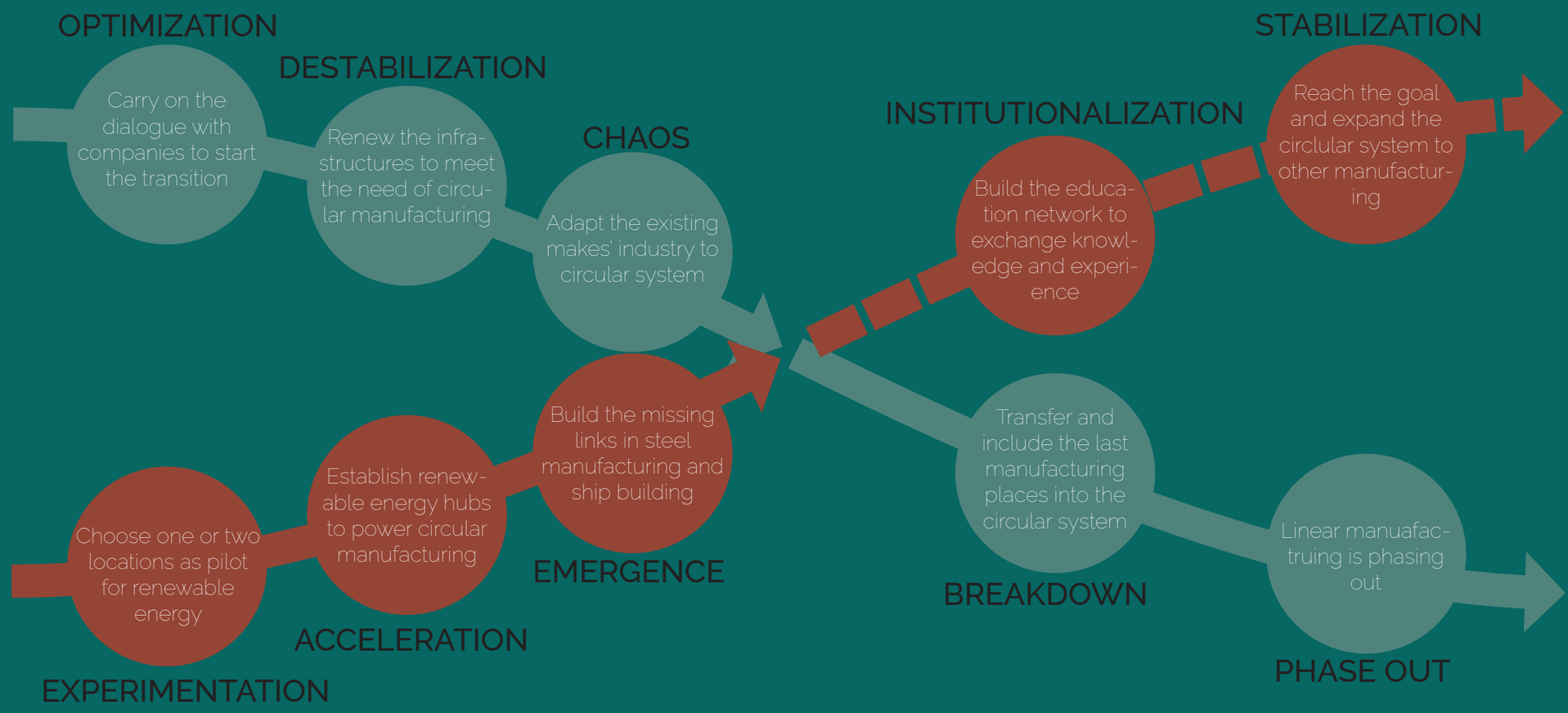
5.3 THE MANUFACTURING PORT

5.3.1 X-curve

Loorbach et al. (2017) explained the process of breaking old regime and building new regime in the X-curve diagram. A series of critical states are highlighted in the process. The optimization state is when experiments are carried out as a pilot. After that, the transition is started. The chaotic state is where the new regimes gradually take the place of the old one, during which a lot of unexpected outcomes and societal changes should be fixed. In the next phase, the transition is partly carried out, and technological research and social innovation produced by civil society take part in contributing to the process.

5.3.2 Phasing In & Out

In the spatial transition of the port of Rotterdam, the first action would be to carry on a dialogue with the stakeholders and establish several renewable energy hubs as a pilot to incent the transition towards a more clean and green port. Then we can introduce the missing links into the port to close the production loop in both material and energy ways. Instead of moving companies out and demolishing existing infrastructures, we want to make full use of the current conditions to minimise the transition's social effect, such as publishing policies to encourage the companies to adapt to a new way of production. After the chaotic phase, social participatory and technology innovation are also included in this transition, and gradually the port will reach its goal of being the circular manufacturing hub of South-Holland.



5.4 The X-curve of the port

5.4 RDM & M4H | ROTTERDAM

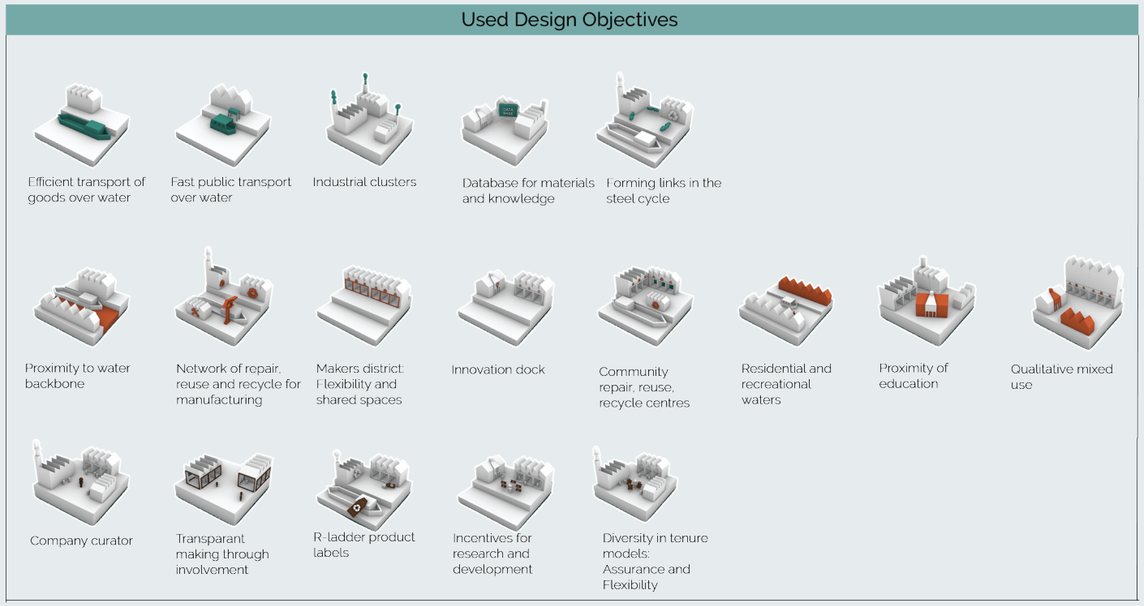
5.4.1 Transformation

As previously mentioned, the Port of Rotterdam will transition into a mixed manufacturing cluster, through incorporating the existing makers district and the expansion of the existing ship manufacturing sector and the RDM campus.

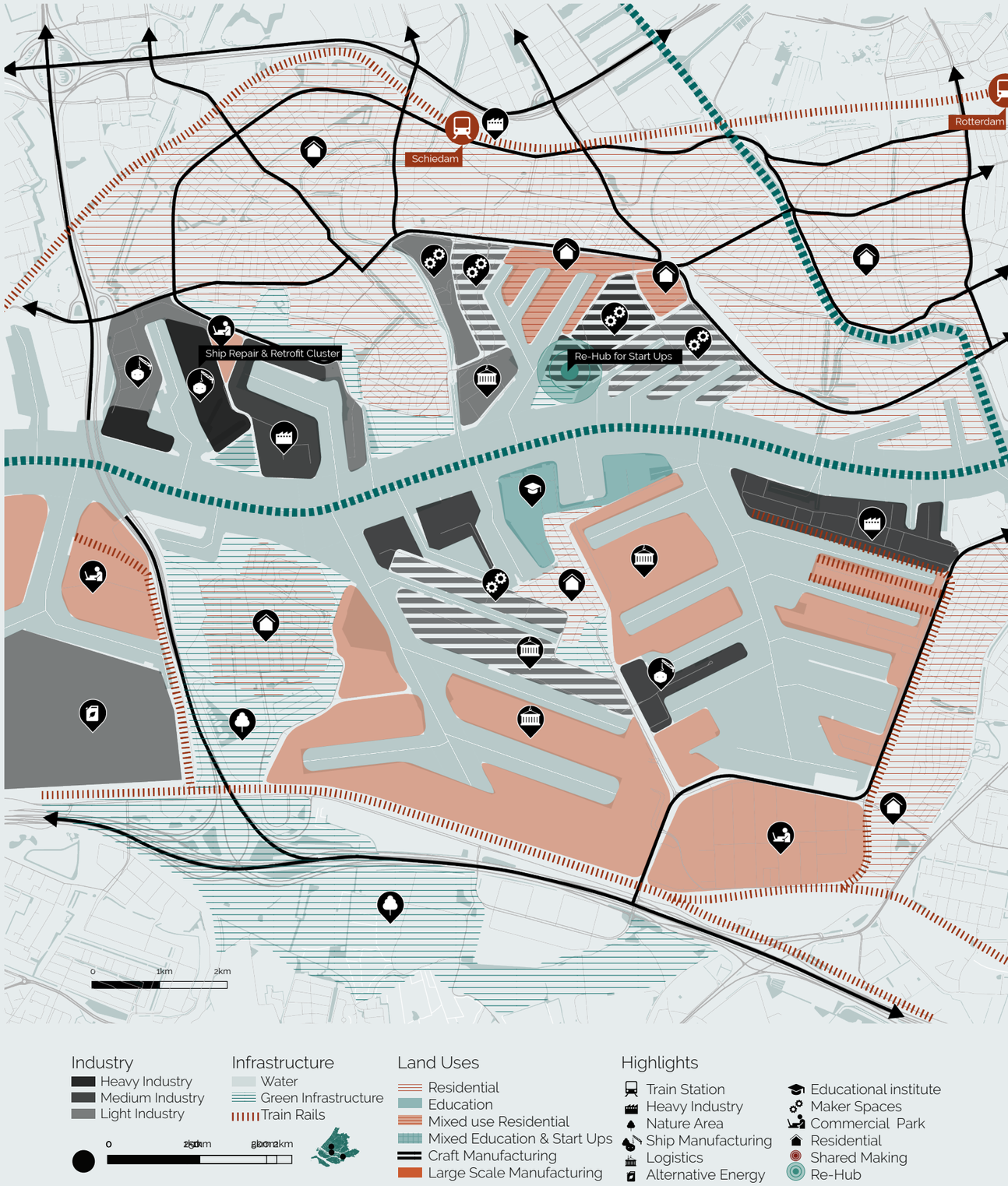
Therefore, the strategy investigates two main spatial objectives; firstly, the incorporation of the material flows of the existing maker and manufacturing activities of MH4 and Waalhaven; secondly the expansion of the ship manufacturing and innovation activity in the area of Waalhaven.

Regarding the manufacturing cluster of M4H, the strategy takes into account the existing development plans for the whole area, and suggests the inclusion of a spatialized Re-hub for steel and metal waste deriving from the manufacturing activities. Regarding the expansion of the ship building in the area, the strategy proposes the expansion of the sector and the incorporation of a repair hub in the Waalhaven. Additionally, through the expansion of RDM Campus, the strategy aims at the increase in implementation of technologies into practice, focused on maritime manufacturing. Thereby, the strategy proposes the expansion of the manufacturing in the Waalhaven, through the introduction of a maritime-oriented innovation start-up space in proximity to the existing campus.

In parallel to this spatial transition, the strategy aims to incorporate values that will promote a social transition, through fair social and economic inclusion. More specifically, the expansion of the ship manufacturing sector will facilitate the creation of diverse employment opportunities, with different entry level positions, from manual labour, to highly spatialized positions. Furthermore, the spatial proximity of these clusters to low income neighbourhoods of the province and the water mobility network will increase the reinforcement of the accessibility of the clusters and enable the employment of vulnerable groups in the area.



5.5 Design objectives in M4H



5.6 Proposed design M4H

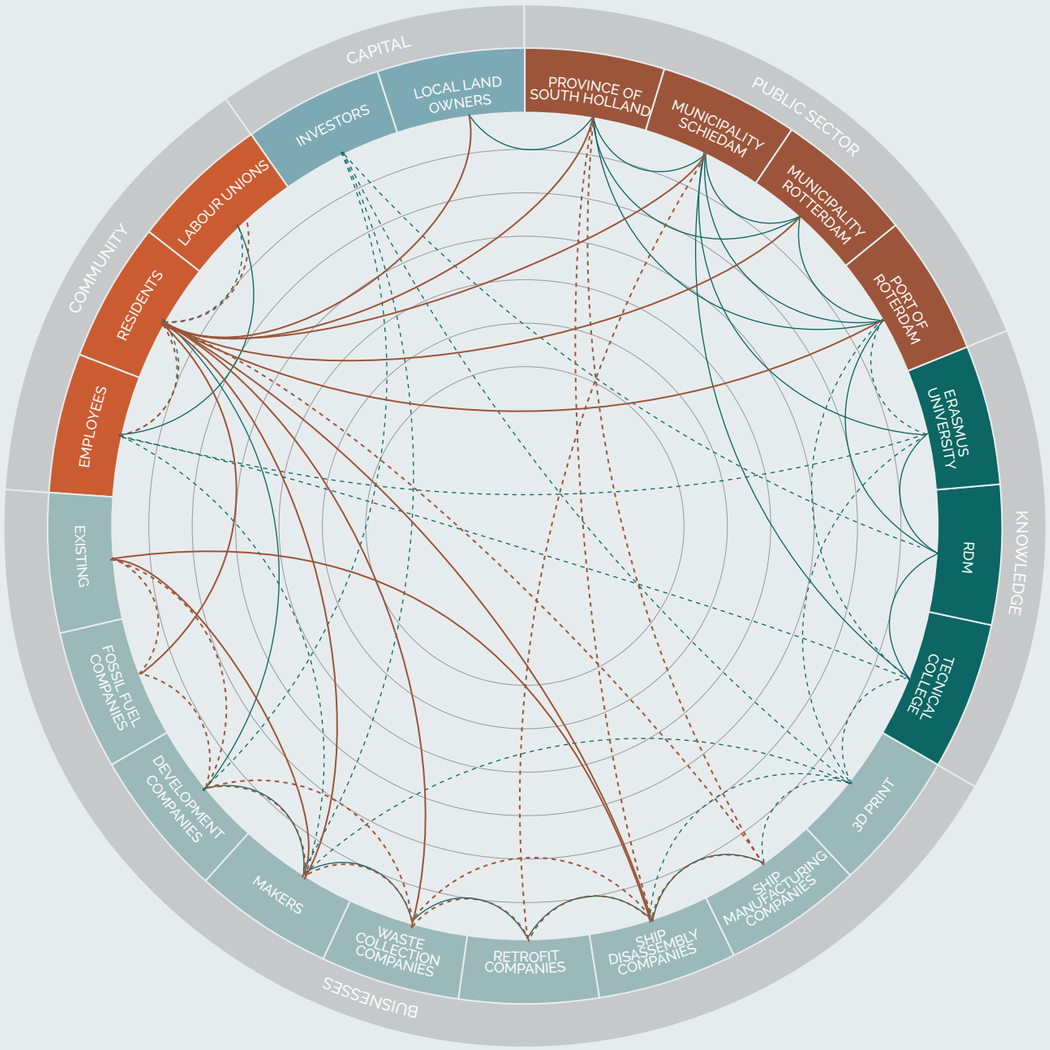
5.4 RDM & M4H | ROTTERDAM

5.4.2 Stakeholders

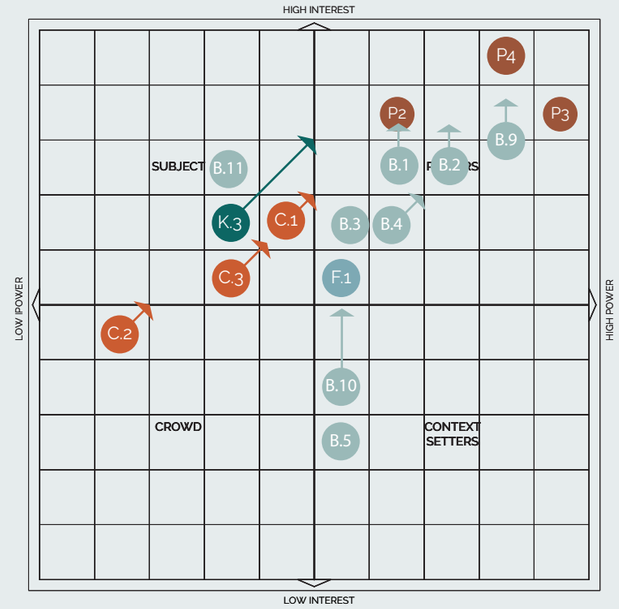
Figure 5.7 shows the existing and projected stakeholder synergies, and the existing and projected stakeholder conflicts.

Evidently, there are already strong synergies between the public sector and the knowledge sector in the area of the port. Specifically, the Port Authorities and the province to the RDM campus authority. In addition, the RDM campus has synergistic relationships with educational institutes, such as Rotterdam Hogeschool and Rotterdam Techniek College. Additionally, the connection between employees of manufacturing companies or makers and education institutes can be strengthened through subsidies and training programs, in order to facilitate the re-training of personnel to jobs connected to circularity.

Finally, conflicts might poetically arise between residents and the new manufacturing companies and factories in the Port, and between existing companies and new companies, due to competition over space. In order to alleviate this, the port and the province can work synergistically with the companies and arrange optimal clustering in order to make use of the existing infrastructure and space characteristics, aiming to minimise nuisances.



5.7 Stakeholder relations M4H



	STAKEHOLDER	TREATMENT	GOAL
P.2	Province of South Holland	Activate	
P.3	Dordrecht Municilapities	Keep Informed	Keep Informed
P.4	Port of Rotterdam	Activate	Activate
K3	Training Center	Keep Informed	Keep Informed
C.1	Labour Unions	Activate	Activate
C.2	Residents	Activate	Activate
C.3	Emploees	Activate, Protect	Activate, Protect
F.2	Land Owners	Involve	Involve
B.1	Buisiness	Monitor	Monitor
B.2	Ship manufacturing companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.3	Ship disasembly companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.4	Retrofit companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.5	Waste collection companies	Monitor	Monitor
B.9	Logistic companies	Monitor	Monitor
B.10	Water Mobility Companies	Monitor	Monitor
B.11	Existing companies	Monitor	Monitor
	Re-hubs	Activate, Monitor, Protect	Activate, Monitor, Protect

5.8 Power-Interest diagram M4H

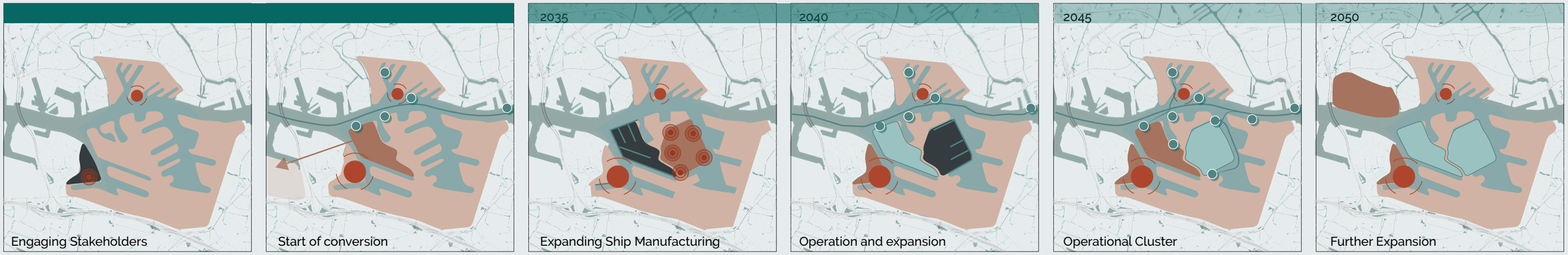
5.4 RDM & M4H | ROTTERDAM

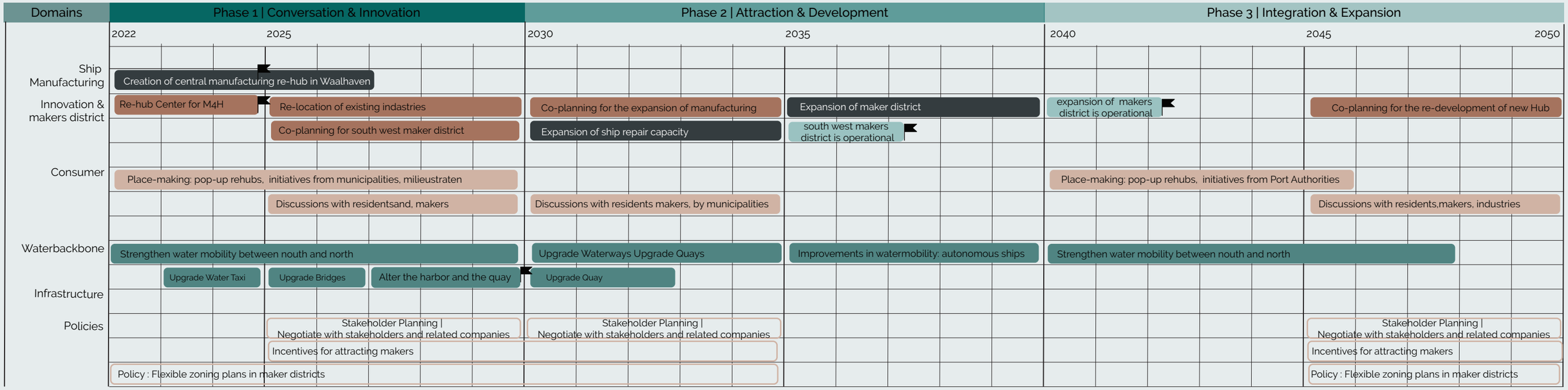
5.4.3 Phasing

The initial phase of the strategy gives emphasis on the engagement of the local stakeholders, and the creation of incentives for the transition of the area. In parallel, incentives are created by the port authorities for the relocation of some of the existing companies. Two manufacturing Re-hubs will be created, one for the area of MH4 and one for the Waalhaven, with the existing infrastructure of this area being utilised for the purposes of the Re-hub. In addition, the RDM campus will expand, in order to increase the space for education.

The second phase of the transition is centred on the expansion of the shipbuilding and manufacturing in the Waalhaven. Processes of participatory planning and place making will initiate changes to facilitate the transition. Incentives for the attraction of spatialized maritime start-ups will be given. The shared facilities for the new manufacturing cluster will make use of the Re-hub. The increased movement of materials and personnel will be facilitated by the expansion of the water mobility network, and the creation of new routes for the water-taxi.

During the final phase of the transition, the Re-hub centres will continue to expand, in order to accommodate the local material flows of the increasing manufacturing activity. Waalhaven will operate as a mixed maker and ship manufacturing cluster, with a specialised re-hub focusing on ship repair. Finally, the spill-over effect into different sectors might require the further expansion of the Re-hub in other areas of Waalhaven.





59 Phasing M4H

L5 | Qualitative mixed use
Combination of manufacturing, housing and sevices, fitting with target groups.

L8 | Proximity of education
From training, to theorethical education on location

L6 | Community re-hub
Place making through repair, reuse, refit & recycle centres
Creating connections through common purposes

P3 | R-ladder product labels

L4 | Innovation dock
Research centres in close relation to practice

P4 | Incentives for research & development

L2 | R-Network
Network of repair, reuse, refit & recycle for manufacturing

L3 | Makers District
Flexible & shared spaces
Places to bring theory into practice

R2 | Transparency
Transparent involving & making

RENT

SWAPFIETS

2ND LIFE

REPAIR CAFÉ

RECYCLE

MAKERS CENTRE

R1 | Transport
Efficient transport of goods over water

R2 | Public transport
fast public transport over water

WATERBUS

L1 | Proximity to water backbone
For transport & living quality

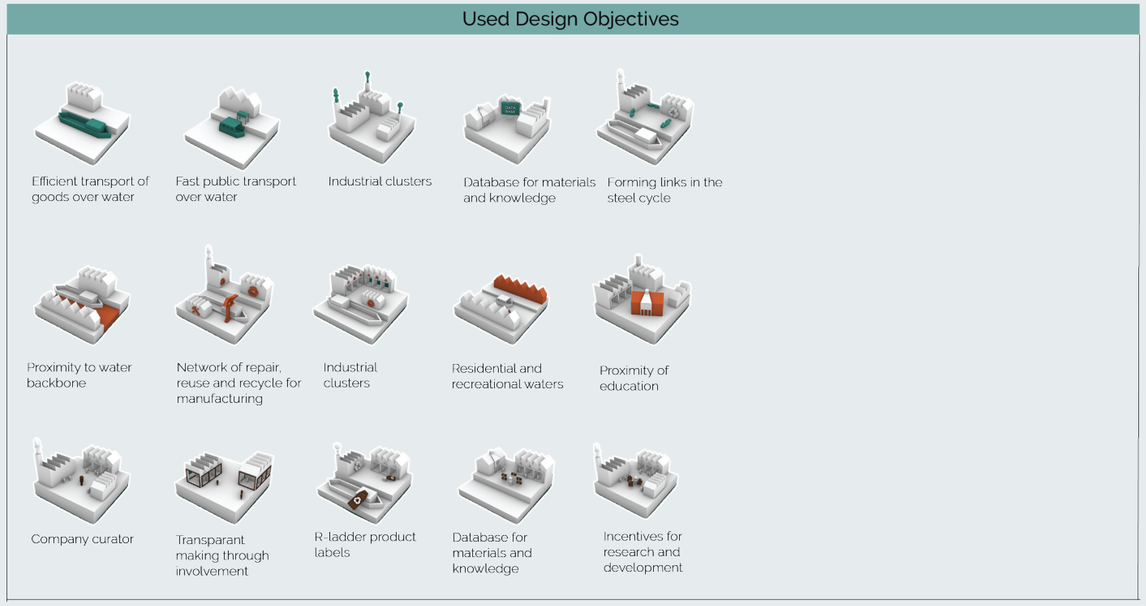
L7 | Residential & recreational waters

5.5 THE STAART | DRECHTCITIES

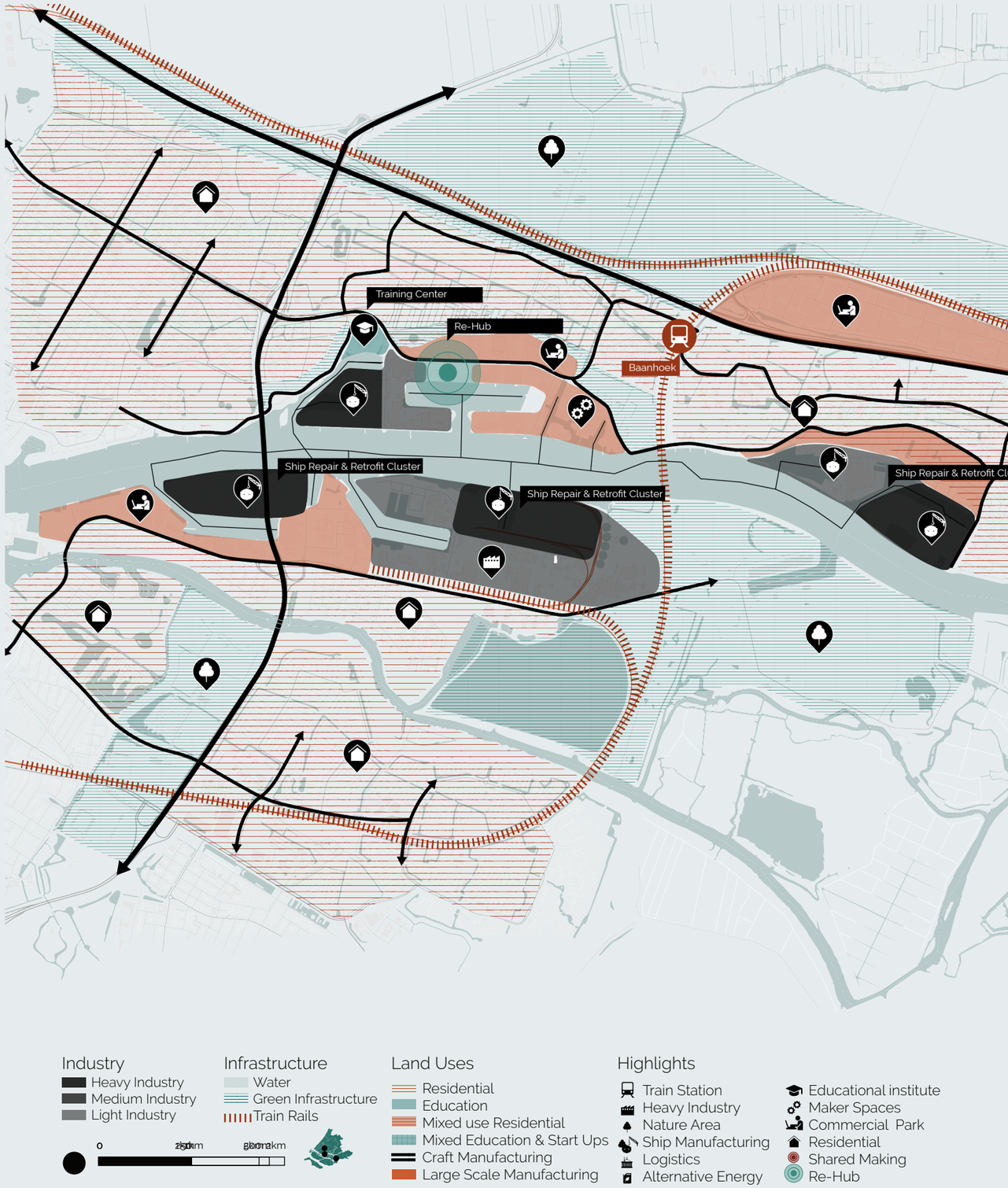
5.5.1 Transformation

As explained earlier, the area of de Staart holds the potential of functioning as a centre in ship retrofit and repair, through the adaptation of the retrofit companies of the already existing ship manufacturing cluster. Thereby, the strategy focuses on two main objectives, the development of repair & retrofit Re-hub and the connection of the existing cluster to a ship manufacturing training centre.

This strategic intervention aims to showcase how the process of adaptation of ship manufacturing can facilitate the social transition through the adaptation of employment to practices focused on circular economy. More specifically, the project utilises clustering of services, the inclusion of educational and training facilities and the connection with the existing manufacturing centres in order to promote this transition. In addition, the project promotes job accessibility through the connection of the manufacturing cluster to the water network.



5.10 Design objectives in the Staart



5.11 Design proposal the Staart

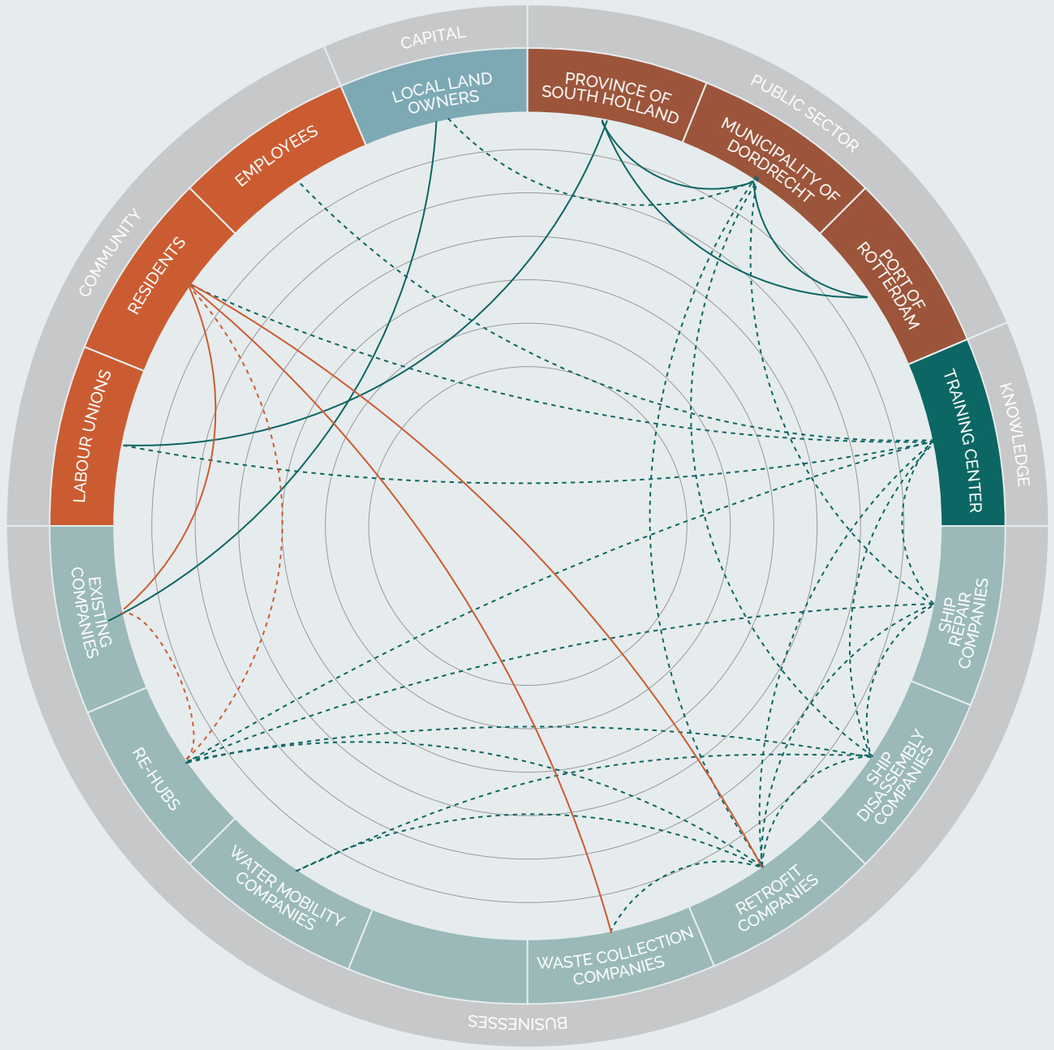
5.5 THE STAART | DRECHTCITIES

5.5.2 Stakeholders

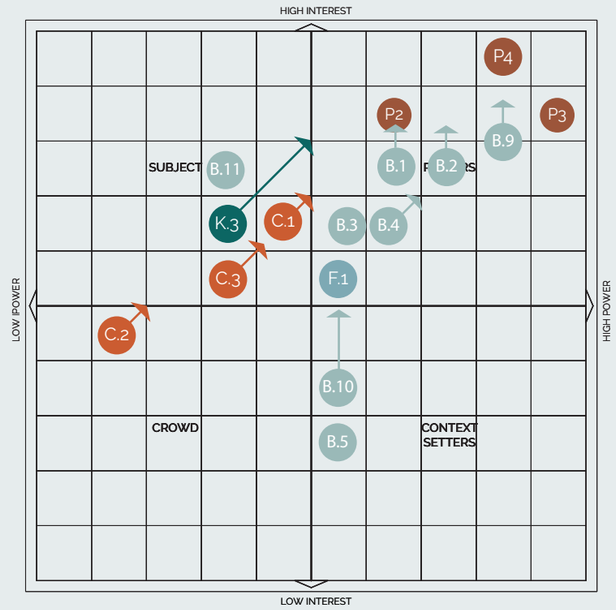
Figure X shows the existing and projected stakeholder synergies, and figure X shows the existing and projected stakeholder conflicts.

Currently, there is limited synergies between the ship repair companies to education institutes or training centres, that spatialize in upgrading repair and retrofit practices. Thereby, a training centre is proposed to upgrade the existing ship repair. Retrofit and breaking practices.

In addition, there are increasing conflicts between the residents and the ship manufacturing and repair companies, owing to competition due to scarcity of space. Thereby, potential conflicts might occur in the future, between landowners and the existing companies, or the public sector bodies, regarding land use. Thereby, the public sector needs to protect the existing manufacturing through legislative and zoning tools.



5.12 Stakeholder relations the Staart



	STAKEHOLDER	TREATMENT	GOAL
P.2	Province of South Holland	Activate	
P.3	Dordrecht Municilapities	Keep Informed	Keep Informed
P.4	Port of Rotterdam	Activate	Activate
K3	Training Center	Keep Informed	Keep Informed
C.1	Labour Unions	Activate	Activate
C.2	Residents	Activate	Activate
C.3	Emploees	Activate, Protect	Activate, Protect
F.2	Land Owners	Involve	Involve
B.1	Buisiness	Monitor	Monitor
B.2	Ship manufacturing companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.3	Ship disasembly companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.4	Retrofit companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.5	Waste collection companies	Monitor	Monitor
B.9	Logistic companies	Monitor	Monitor
B.10	Water Mobility Companies	Monitor	Monitor
B.11	Existing companies	Monitor	Monitor
	Re-hubs	Activate, Monitor, Protect	Activate, Monitor, Protect

5.13 Power-interest diagram the Staart

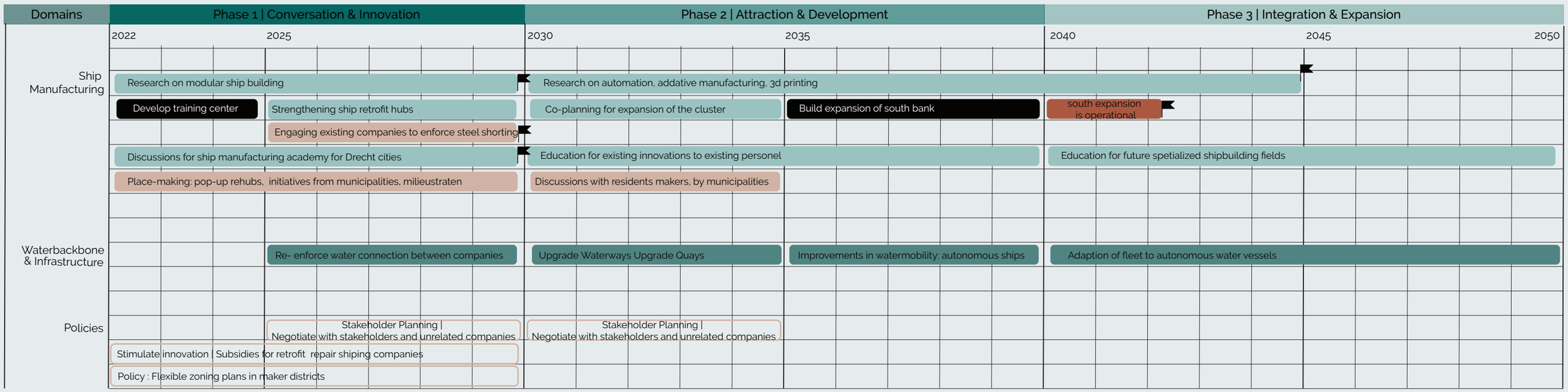
5.5 THE STAART | DRECHTCITIES

5.5.3 Phasing

The initial phase of the strategy is focused on engaging the existing companies and their employees through the creation of incentives for the adaptation to more circular ship breaking and repairing practices. This process will be achieved through the retraining of the existing personnel and the attraction of young, skilled professionals in the field. For this purpose, a small scale training facility will be integrated in the existing cluster, aiming specifically at the re-training of the personnel.

The second phase of the transition is centred in the expansion of the ship breaking and repair activity and capacity of the cluster. More specifically, the existing chemical factory will gradually transition into a ship breaking hub and distribution point for steel and metal waste. The adjacent commercial areas, hosting maritime manufacturing service companies, will remain as buffer zones between the messy manufacturing and the adjacent residential areas. The green infrastructure at the limit of the areas will be reinforced, and extended into the adjacent residential and natural areas, to increase the accessibility of the cluster and improve the working environment.

During the final phase, the area will have transitioned into an efficient repair and retrofit Re-hub, through the adaptation of the existing infrastructure and the re-training of the personnel. The area holds the potential of further expanding towards the east, through the incorporation of high tech repair companies that will have developed in the innovation centre of Schieoevers and RDM.



5.14 Phasing the Staart

L2 | R-Network
Network of repair, reuse, refit & recycle for manufacturing

R5 | Forming links in the steel cycle
Between disassembly and building

R3 | Industrial cluster
Of maritime manufacturing: ship and off-shore building, refitting, repair & disassembly

P4 | Incentives for research & development
For companies as well as research centres

L4 | Innovation dock
Research centres in close relation to practice

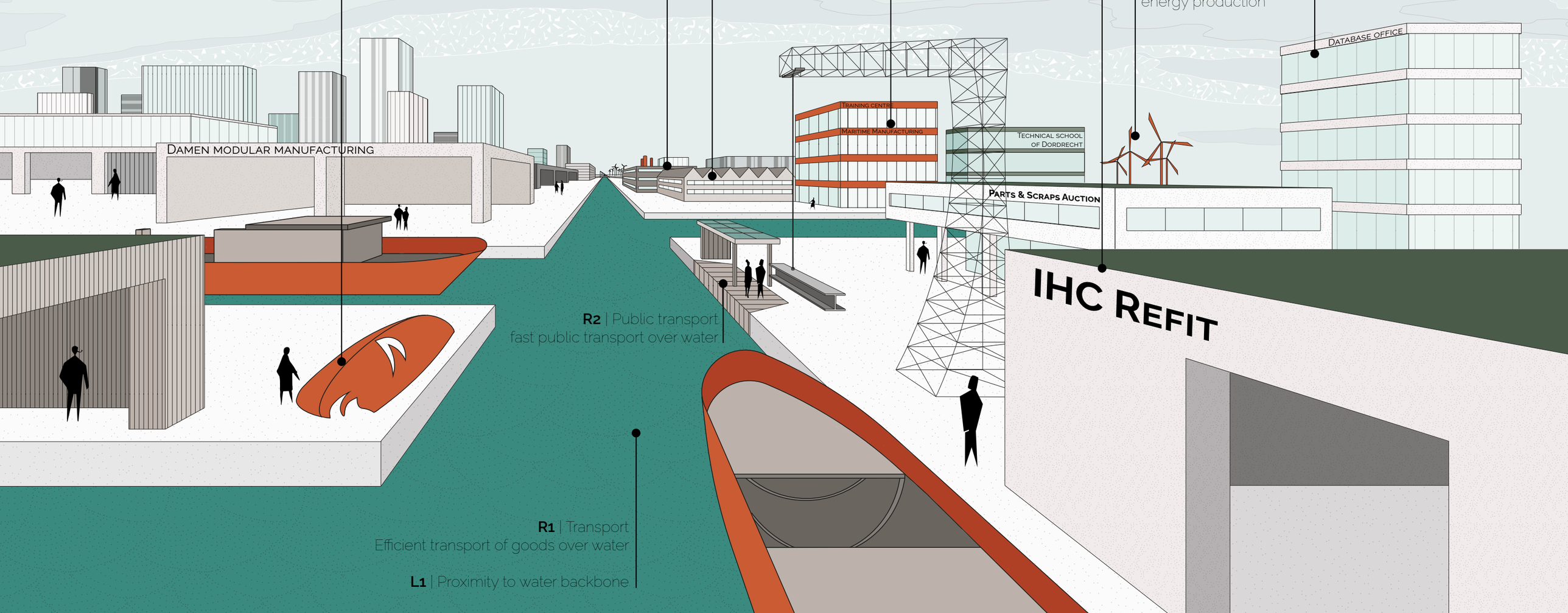
L8 | Proximity of education

L2 | R-Network
Network of repair, reuse, refit & recycle for manufacturing

R6 | Off-shore energy production

R4 | Database for knowledge & materials

P1 | Company curator



R2 | Public transport
fast public transport over water

R1 | Transport
Efficient transport of goods over water

L1 | Proximity to water backbone

5.6 SCHIEOEVERS | DELFT

5.6.1 Transformation

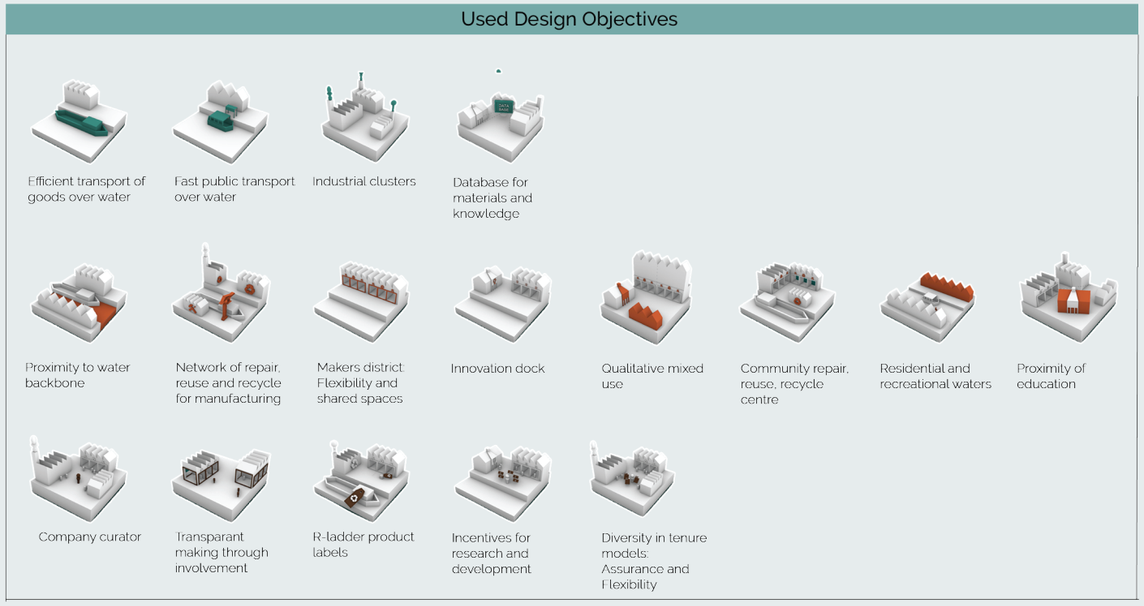
As mentioned above, Schieoevers serves as the example of the integration of knowledge institutes and the scale neighbourhood into the strategy.

Thereby, the strategy focuses on two main objectives; firstly, the re-development of Schieoevers-North into a mixed-use residential area which re-enforces urban mining activities, and secondly, the expansion of TU Delft Campus along the canal through a series of maritime oriented start-up spaces.

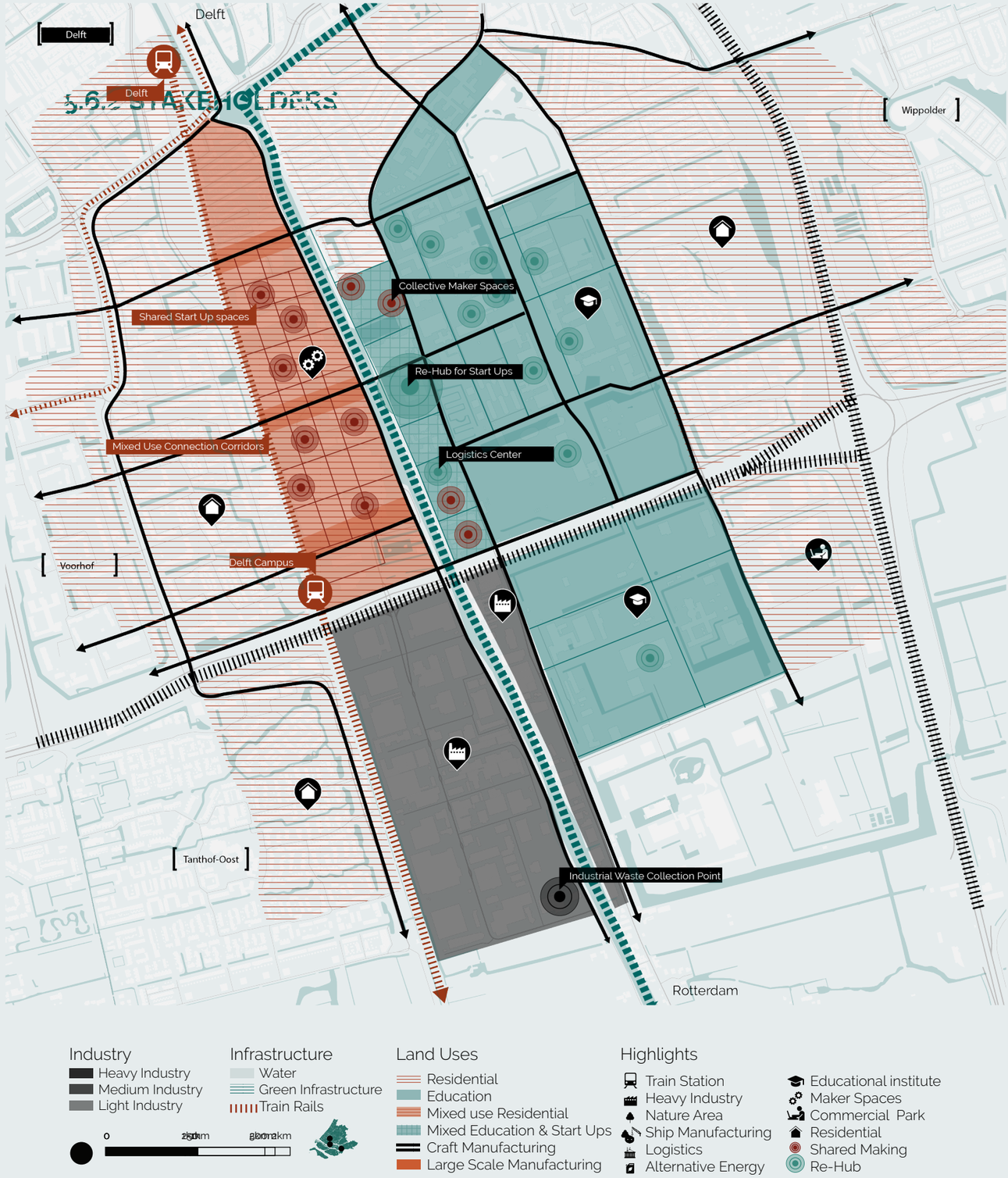
Regarding Schieoevers-North, the strategy aims to expand the existing development plans for the whole area, into a strategy that re-enforces the local identity through co-creation and co-planning practices. More specifically, it aims to strengthen the relationship between the existing neighbourhood, the city of Delft and circular material flows through the incorporation of a consumer oriented Re-hub centre and various spaces of shared creative small-scale making.

Regarding the expansion of TU Delft, the strategy aims at the increase in implementation of developing technologies into practice, focused on high end technologies related to maritime manufacturing, like additive manufacturing. Thereby the strategy proposes the introduction of a marine-oriented Innovation centre with flexible start up spaces for the university.

In addition to these spatial interventions, the strategy aims to facilitate the social transition through the alteration of the existing educational system. This change aims to create a system of education and innovation that will be able to adapt to the transition of the province. It aims to simultaneously provide and transform the existing workforce to spatialization closely related to the technical aspect of the circular economy.



5.15 Design objectives in the Schieoevers



5.16 Design proposal Schieoevers

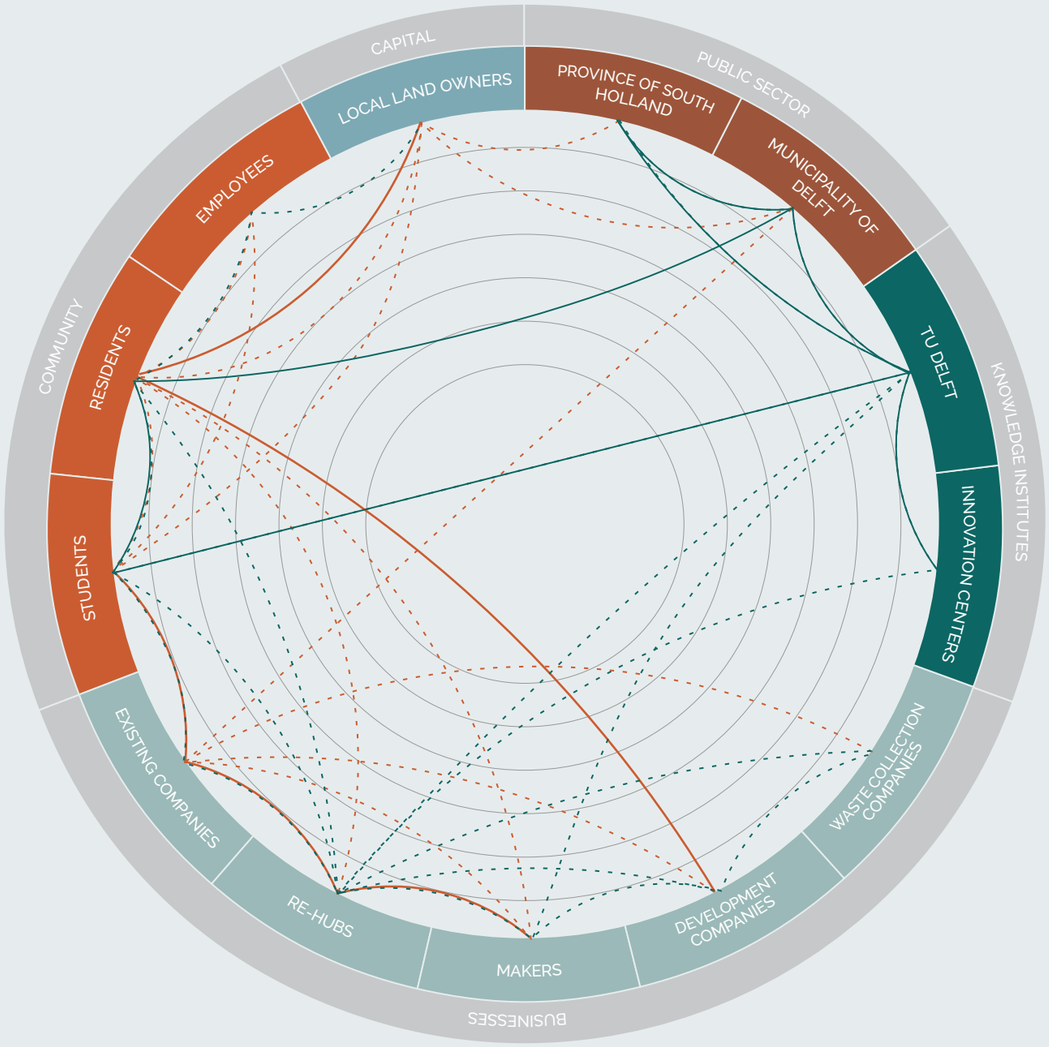
5.6 SCHIEOEVERS | DELFT

5.6.2 Stakeholders

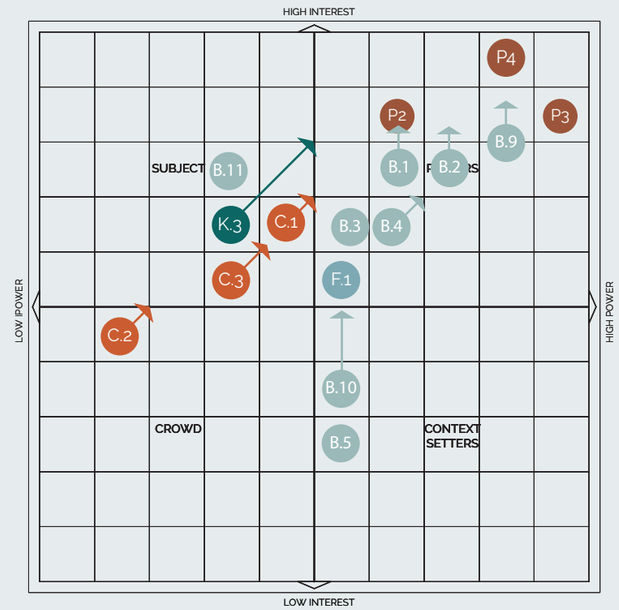
Figure X shows the existing and projected stakeholder synergies, and figure X shows the existing and projected stakeholder conflicts.

Currently, limited co-operation between TU Delft and flexible spaces for startups in the area. This co-operation can be strengthened by providing flexible zoning and spaces. In addition, further collaboration between startups, 3d printing companies, small scale makers can be facilitated through, shared facilities, including shared buildings, machinery, material suppliers, resources and means of transport. New synergies between the RE-HUBs, logistics companies and the newly created companies can be established in order to optimize material flows.

Conflicts can potentially arise between the residents and the new startups and making facilities, because of the scarcity of space and the potential nuisance. In addition, further conflicts might occur between the public sector and the existing companies that need to be relocated.
The RE-HUBS can re-enforce the collaboration between the different stakeholders, as self-organized connection points, by hosting place making events and activities, in order to facilitate the transition and strengthen the common identity for the neighborhood.



5.17 Stakeholder relations Schieoevers



	STAKEHOLDER	TREATMENT	GOAL
P.2	Province of South Holland	Activate	
P.3	Dordrecht Municilapities	Keep Informed	Keep Informed
P.4	Port of Rotterdam	Activate	Activate
K3	Training Center	Keep Informed	Keep Informed
C.1	Labour Unions	Activate	Activate
C.2	Residents	Activate	Activate
C.3	Emploees	Activate, Protect	Activate, Protect
F.2	Land Owners	Involve	Involve
B.1	Buisiness	Monitor	Monitor
B.2	Ship manufacturing companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.3	Ship disasembly companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.4	Retrofit companies	Activate, Monitor, Protect	Activate, Monitor, Protect
B.5	Waste collection companies	Monitor	Monitor
B.9	Logistic companies	Monitor	Monitor
B.10	Water Mobility Companies	Monitor	Monitor
B.11	Existing companies	Monitor	Monitor
	Re-hubs	Activate, Monitor, Protect	Activate, Monitor, Protect

5.18 Power-Interest diagram Stakeholders

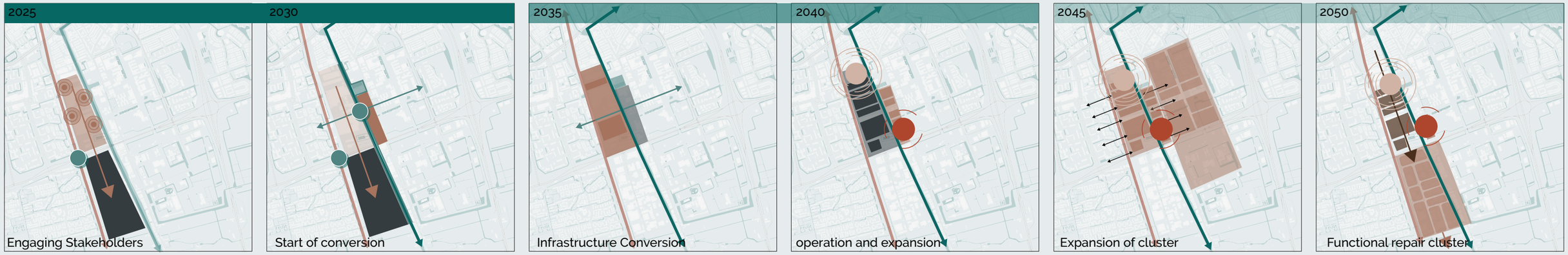
5.6 SCHIEOEVERS | DELFT

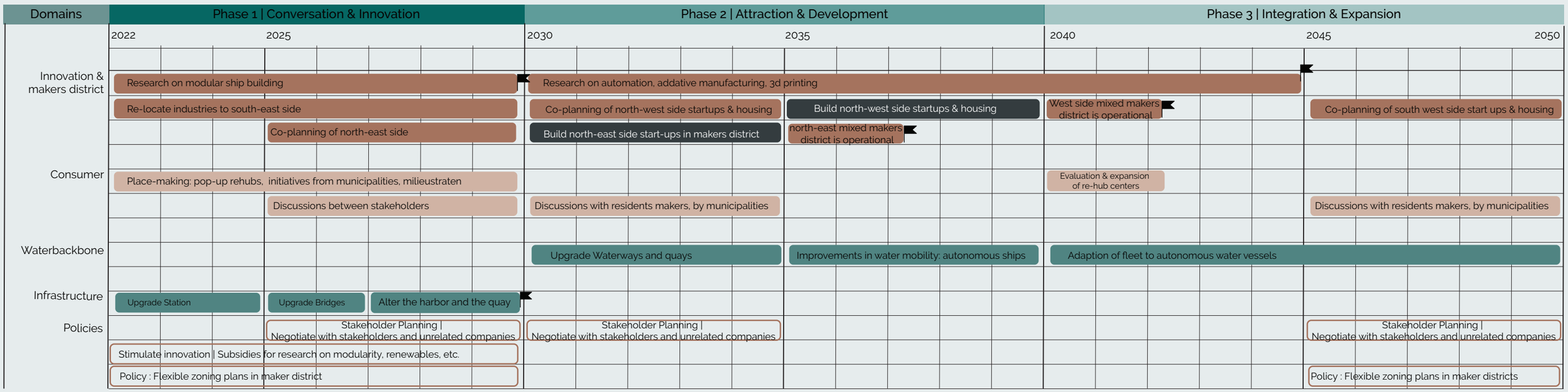
5.6.3 Phasing

During the initial phase of the transition, emphasis is given to participatory planning processes along with improvements in the existing infrastructure, in order to create a context that will facilitate the transition. Initially, discussions are held between involved parties in order to plan the transition of the area. In parallel, incentives are created by the public sector for the gradual re-location of the existing companies. In addition, the civic, green and water infrastructure are altered in order to accommodate the expected flows of material and people.

The second phase of the transition is centred on the operation of the maritime-innovation centre and the startups, through place making activities to attract makers, small scale manufacturers and students. Gradually the space for making, innovation and logistics will increase. A re-hub for innovation can potentially be incorporated in the expansion of TU Delft Campus.

In the final phase of the strategy, Integration & Expansion Phase the neighbourhood of Schieoevers-North will function efficiently in terms of metal circularity, by re- enforcing the material flows, and enabling the residents of Delft to participate in the reinforcement of the R-ladder. In addition, the area connected to high tech maritime manufacturing startups can expand, further south, or relocate to the port (in the RDM expansion), in order for new manufacturing practices to be implemented systematically at a larger scale.





5.19 Phasing Schieoevers

L3 | Makers District
Flexible & shared spaces
Places to bring theory into practice

R2 | Transparency
Transparent involving & making

P5 | Diversity in tenure models

L6 | Community re-hub
Place making through repair, reuse, refit & recycle centres
Creating connections through common purposes

P3 | R-ladder product labels

L2 | R-Network
Network of repair, reuse, refit & recycle for manufacturing

L5 | Qualitative mixed use
Specifically for starters & students

P1 | Company curator

L4 | Innovation dock
Research centres in close relation to practice

R2 | Transparency
Transparent involving & making

P5 | Diversity in tenure models

P4 | Incentives for research & development

R4 | Database for knowledge

L8 | Proximity of education

L1 | Proximity to water backbone
For transport & living quality

L7 | Residential & recreational waters

R2 | Public transport
fast public transport over water

R1 | Transport
Efficient transport of goods over water

MARITIME INNOVATION

START-UP HALL

REPAIR CAFE

RECYCLE POINT

DREAM TEAMS

TU DELFT

High Tech Lab

WATERBUS

THE AUTONOMOUS

6. CONCLUSION

6.1 EVALUATION

The expected ethical performance of the regional strategy of UrbanScraps will be evaluated in this paragraph, starting with an evaluation of spatial justice. The contribution of the strategy to the Sustainable Development Goals from the United Nations and the goals from the European Green Deal, set in chapter 1, will be assessed as well.

6.1.1 Spatial justice

Spatial justice is about the equal distribution of resources over space, through inclusive procedures (Rocco, 2022). In the UrbanScraps strategy, the space balance between nature, humans and industries is critical, especially for the industries that produce a lot of nuisance. Due to the moving and changing of industries, special care has been taken for the quality of living in the surrounding areas. This is done through environmental zoning, and pollution reducing measures, as well as implementing green energy. Next to that, residents are taken into the dialogue to allow them to evaluate the nuisance created by industries as well.

Spatial justice is also reached through equal chances for (personal) development. The strategy does not only focus on higher education, but also on practical education and re-training of the workforce. In this way, UrbanScraps aims to create an inclusive working and learning environment in the maritime sector.

UrbanScraps strives for the inclusion of the citizens in the technological transition, through the creation of community centres for refusing, reusing and recycling products. In this way, all citizens are encouraged to participate in the circular economy and the public awareness will increase.

Another important aspect for the establishment of spatial justice, is accessibility of jobs and other facilities for all citizens. The strategy of UrbanScraps proposes an extensive public transport network over water that connects the living areas in the city with the jobs in the industrial port areas.

Lastly, spatial justice is not only about a just and inclusive transition from the viewpoint of the people, but also from the viewpoint of the planet. UrbanScraps aims to approach the transition from the duty of care for the planet. Reducing, reusing and recycling materials has to stop the exhaustion of the planet. Besides, the material transition will go hand in hand with the transition to renewable energy.

6.1.2 The Green Deal

Supplying clean, affordable and secure energy

The maritime sector is related to energy in three different ways. 1) A lot of energy is used during the production process of steel. 2) The ships use fossil fuel energy ánd they often transport fossil fuels. 3) The off-shore constructions are manufactured to generate energy at sea: oil and gas or wind energy. The goal of UrbanScraps is to transition all these processes towards renewable energy.

Mobilising industry for a clean and circular economy

UrbanScraps is aiming to transition maritime manufacturing towards a circular process, so this goal of the European Green Deal is very relevant. Recycling should be the norm in shipbuilding, instead of material exhaustion and waste dumping outside of the EU. Also, the involvement of the consumer is important to enable a behaviour change.

Accelerating the shift to sustainable and smart mobility

The Province of South-Holland has an extensive water network that could be used more for the transport of goods and people. Then it is also crucial to shift to alternative fuels for ships. UrbanScraps is aiming to use the water network as a backbone for the circular transition.

6.1.3 Sustainable Development Goals

UrbanScraps strives for **sustainable cities and communities** in a resource efficient, resilient and inclusive province. It aims for a more sustainable, accessible and affordable public transport system; A stronger economic, social and environmental link between urban, per-urban and industrial areas; New residential, educational and industrial development focussed on resource efficient living; And a resilient water system that connects and protects natural and cultural heritage.

The aim of this plan is to create **circular production chains** on a local level, while protecting the conditions for the workforce and responsibly handling the environment. Through this, it targets the end of the primary raw materials iron ore, limestone and coal. Next to that, UrbanScraps set the goal to reduce consumerism and promote a behaviour change by creating awareness of the R-ladder, refuse, reduce, reuse and recycle.

UrbanScraps strives to **redevelop the infrastructure** of South-Holland through **new innovations** and a newly developed green, pollution-free and **circular industry**. To achieve this the plan targets renewal of the off-shore energy infrastructure; Incentives for modular maritime manufacturing; Integration of scientific research in maritime manufacturing; And the enhancement of the connection between research institutes and public or private companies to form a positive loop of practice and knowledge.

The economy and labour market need a **strong, qualitative educational basis**. Therefore, UrbanScraps targets opportunities for education and lifelong learning in the province. This will be strengthened by connecting all levels and ages of education to the labour market. In UrbanScraps, more proximity to and mixed use with manufacturing and among others recycling and reuse, should educate inhabitants about these topics to create a more aware society.

The steel flows in the province, and with that multiple sectors, are dependent on other countries and the rapid global changes. This creates instabilities in the economy and labour market. UrbanScraps strives to create a **more resilient maritime and steel structure** which is less dependent on these changes. Through this transformation, the plan aims to create more working possibilities and improve the education needed for this renewed sector.

6.1. The Sustainable Development Goals (The United Nations Sustainable Development Goals, s.d.)

6.1 EVALUATION

The focus on a newly developed maritime manufacturing sector, creates more industries, which leads to pressure on the climate, environment and health of surrounding inhabitants. To prevent this, the plan strives for renewable off-shore energy to sustain the industries and if possible more functions in the province. The aim is to reuse and recycle the existing off-shore constructions to create this **new energy landscape in a material sustainable way.**

Urban Scraps strives to reinvent the maritime manufacturing sector to **reduce pollution and material exhaustion**. It tackles the pollution of industries, new off-shore energy possibilities, modular systems that can be implemented in different sectors and education on the steel life cycle throughout society. The plan strengthens and expands the maritime sector, to make the province more self-maintaining and resilient in case of water related disasters.

In the lower part of South-Holland there is a lower labour participation. On top of that the average income is lower. As a consequence Rotterdam has the highest poverty rate of the Netherlands (in 2017)(Van Hulst & Hoff, 2019). The plan strives to **diminish poverty**, by increasing the job possibilities on all working levels and increasing training for all ages in coöperation with companies.

The **health and wellbeing** of those **working in industries** and **living in its surroundings** are crucial. Therefore, the plan aims to reduce pollution from new and existing industries, while also using zoning to prevent hazardous situations and nuisance. Through a stronger relation with primary education, the plan strives to enlarge the workforce. This will reduce the amount of overtime and create safer and healthier work conditions.

At this moment, there are fewer women participating in the maritime manufacturing sector than men. The plan aims to level the playing field in this regard, by diversifying the labour possibilities and connecting specifically primary and secondary education to create **more enthusiasm among (young) women.**

As the plan focuses on the maritime sector, the existing water ecosystems should not be forgotten. UrbanScraps aims to increase focus on the natural ecosystems at sea in the off-shore energy transformation, by **inviting ecological experts** into the dialogue. The plan promotes a strong relation between research and maritime manufacturing to create more sustainable and less harmful ships and diminish shipyard wastescapes.

6.1. The Sustainable Development Goals (The United Nations Sustainable Development Goals, s.d.)

6.2 DISCUSSION

6.2.1 Limitations

In the development of this regional design, time was limited. Maritime manufacturing is a complex system and touches upon many relevant topics. Therefore, we did not have enough time to research everything. Furthermore, in the vision making process, we have not been able to involve stakeholders in the discussion, which might make it more difficult to execute to understand everyone's viewpoint, especially for a plan that is highly based on commercial stakeholders.

6.2.2 Dependencies

Our intervention is highly dependent on the following topics. Firstly, technical advances are the prerequisite of the whole plan. Without technology as the base of industry upgrading, all our targets would be difficult to realise. Secondly, the plan assumes that the government can provide funding, and companies will be incentivized to invest in innovations. Thirdly, there are dependencies on the national government for the energy transition. Especially in the current situation of Covid and international conflicts, the transition toward endogenous energy production is of great significance for future strategic development.

6.2.3 Relevance

Although the project is based in South-Holland, we also hope the method could be transferred to other places and systems. The transferability of research solutions might be constrained and conditioned according to various policies, social cultures and pre-existing conditions (Temenos & McCann, 2013). We divided the transferability of our project into three different stages: complete solution transferable, elements transferable and reasoning approach methodology transferable (Dąbrowski, 2022b).

The Re-hub is a complete solution that does not have a place-specificity that brings the R-ladder to the consumers and can be a nationwide or global-wide endeavour.

The offshore energy system is an elemental solution that requires a spatial condition of the seashore.

The reasoning approach methodology includes new transport systems, which are the backbone of development and strengthen it as sustainable and accessible transportation for the public, and the R-network, which could be implied to other sectors and other material flows.

6.2.4 Recommendations

For further research, our recommendations would be:

- To research the possibilities of future shipbuilding in types and specialisation, which can help make the maritime cluster grow into a global force.
- To research other material flows and how they can be connected to the Re-network. Based on the shipbuilding industry, the research could start with materials present in maritime manufacturing and expand the system.
- To research the integration of bio-based materials. Currently, the plan only looks into recycling and reusing exhaustible materials. The reuse might make them cheaper, thus more accessible to the public, which might also drive up the overall use. Therefore, research should be done into other bio-based materials that might strengthen the not exhaustible sector and be less dependent on energy.

6.3 CONCLUSION

This report has strived to answer the question:

How can the material transition towards a more endogenous shipbuilding process establish a more environmentally and socially sustainable South-Holland?

To answer this question, we focus on three topics in ship manufacturing: The steel material flow, the innovations of the maritime manufacturing sector, and citizens' involvement.

6.3.1 The Material Flow

Firstly, how can the steel material flow for shipbuilding be closed within the region? The flow is linear and highly dependent on the current system's global chain for raw materials. To transfer it from linear to circular, we linked TATA steel to maritime manufacturing companies and solved the missing links of disassembly of ships and secondary steel processing into the system. At the end of the cycle, investment in clean recycling techniques is required to meet the demand of whittling down material exhaustion. Meanwhile, since offshore takes a large part in maritime manufacturing, including it as an energy transition carrier, it also contributes to cutting down the dependency on the global chain. The offshore sector requires implementing knowledge and technologies to be built sustainably and provide renewable energy for industrial production and transportation. This sector still needs to expand on the existing industries without causing more pollution, environmental harm or endangering the workforce and surrounding residents.

6.3.2 The Innovation Network

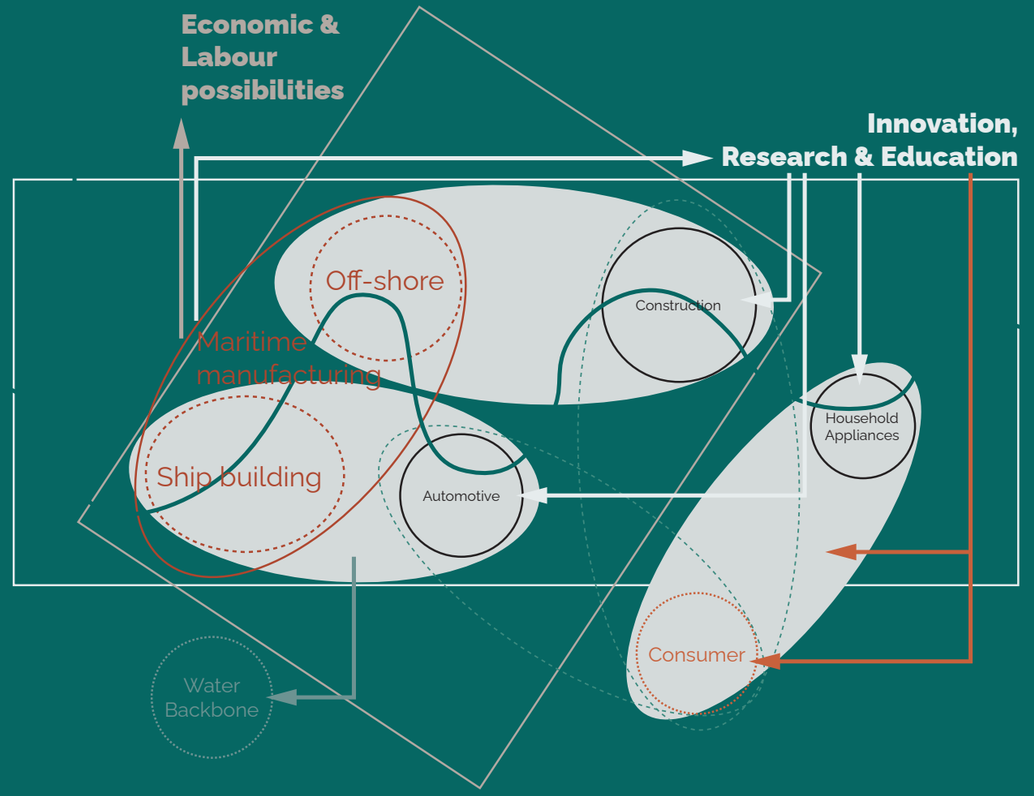
Secondly, how can innovations in maritime manufacturing improve environmental sustainability? To answer this question, we proposed an innovation system to connect all the education and innovation institutions and bridge the gap between theory and practice using new makers districts. The system includes a strong knowledge network, innovation centres, training centres, etc. Furthermore, funding from the government that supports higher usage of the R-ladder, via, for example, modular shipbuilding or 3D printing of steel, incent the moving up from recycling to reuse. Also, we introduced a Material & parts database that connects all sectors, companies, researchers and their flows to make optimal use of the existing parts.

6.3.3 The Citizens' Involvement

Thirdly, how can the citizens be included in the material transition to accomplish social sustainability? This is solved through three aspects: work & education, consumer and public transportation.

In the work & education aspect, we focused on training or retraining the workforce and incent technology innovation in the maritime manufacturing sector. Through (re)training of the workforce, we use combined education from private company academies to public education centres. And by organising incentives in education, the maritime manufacturing sector becomes closer to residents.In the consumer aspect, which involved most citizens, we introduced the Re-hubs to create a participatory R-ladder and raise awareness about waste and material exhaustion. Most citizens are included in this social transition by strengthening the shared economy inside the urban space. In the public transportation aspect, citizens are connected to the port by developing a bigger water transport network as a new public transportation.

By investing in these three layers, intertwining them on a local scale and allowing them to strengthen each other, Urban Scraps strives to create an endogenous ship manufacturing sector. By focusing on the citizens and the duty of care, environmental sustainability and social sustainability are considered. This approach can also be transferred to other systems so that all material flows are possible to be closed within the province scale, and finally, we can reach our goal of being endogenous. We hope this project will be the starting point for a transformation to create a more sustainable, self-sufficient South-Holland in both environmental and social means.



6.2 Influence of maritime manufacturing on other sectors

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8. APPENDIX

8.1 REFLECTION ANNA KALLIGERI SKENTZOU

In the last decades the world has become increasingly urbanised, with approximately 60 % of the world's resources and 50% of the world's waste being attributed to urban regions. The increasing rate of urbanisation and the expected trends will only amplify these figures in the future. Thereby, the management of urbanised regions holds a key role for the transition towards sustainability through more circular pathways for materials and resources (UNEP, 2017). However, the intricate structure of urbanised regions, their interdependence to global systems, and the multiplicity of the embedded social, environmental and economic elements form difficult conditions for their planning and management.

Contextualising this issue in the region of South Holland quickly made us aware of the complexity of the given task. The region is functioning as a polycentric urban region currently in the process of adapting to practices of circular economy (Thole, 2022). This transition to circularity for the Province of South Holland is integrated with a need for social transition (Drift & Metabolic, 2018). Thereby, an interdisciplinary and multiscale approach to the process of regional strategy was important to address the task of regional planning.

During the third quarter, in the studio Spatial Strategies for the Global Metropolis, we were asked to engage a regional design process and develop two interlinked products, a spatial vision and strategy for the Port of Rotterdam and the Province of South Holland. Through the process we approached the subject of the spatial transition of the Province and the Port through a themed lens, in our case maritime manufacturing, utilising elements of the circular economy, that would seek to address the adaption of the region in order to ensure a just social and spatial justice for the civil society. The process was based on a rigorous analysis executed under a short period of time, striving to obtain an efficient understanding of the function of the Port and the Province, the relation of different sectors, material flows and embedded socio economic system.

With our project we aimed to address how the process of a transition to a more endogenous ship manufacturing sector in the Province could potentially facilitate social transition through redefining the identity of the Port and stimulating the relation of the educational system to maritime manufacturing. The project aimed to introduce different types of education models to facilitate the transition of the port from a fossil fuel based to a new active maritime manufacturing ecosystem.

The highly technical nature of our sector posed a great challenge on how to address socio – spatial justice. In this context, the SDS lectures on phasing and governance helped to understand the crucial importance of engagement of all engaged stakeholders in order to ensure an inclusive participatory process. In parallel, the methodology course introduced us to different themes, theories and practices that informed and further clarified the importance of drafting a vision and a strategy. For me, the lectures on governance and stakeholder engagement through visioning, further helped me realise the importance of our task and its relevance to current practices of the field.

As an international student with an architectural background, originating from a neo-liberal country with a top down, market oriented governance style, I had never previously engaged in the development of a regional design vision and a strategy. Initially, I struggled to comprehend the principles and the tools that could be implemented at a project of this scale. Nevertheless, the complementary SDS and Capita Selecta lectures clarified aspects of the process and provided a plethora of tools that could be utilised in order to structure our vision. The steps in the methodology, and the process of analysis and design became more clear and gave some structure to the overall process. Nevertheless, the transition of the research and the analysis to a concrete vision and strategy proved to be a challenge.

In conclusion, thinking back at the beginning of the quarter, I remember being introduced for the first time to – and being overwhelmed by- the terms ``spatial vision" and "strategy". Looking back through our project, ranging from the initial phase of research and analysis to the final strategic intervention, I recognize our collective struggle to execute the given task. Given more time and more guidance, multiple aspects could have been discussed more thoroughly, refined, and planned to a greater extent. All things considered, this quarter has been a challenging and instructive learning period, which enlightened me on the importance and complexity of regional planning.

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8.2 REFLECTION CHARLOTTE VERKLEIJ

"Develop a regional design for the province of South-Holland, with a focus on the Port of Rotterdam, in the context of the circular economy and the social transition, through the lens of maritime manufacturing." The assignment for this quarter was really challenging for me, as I did not have any experience with the regional scale, nor did I have any knowledge about the Port of Rotterdam and the maritime manufacturing sector. 'What is maritime manufacturing?' was therefore a logical question that one of the tutors asked us after we presented our initial approach for the project. It was clear that we were all not so sure about the meaning of this term yet.

As a group, we have learned a lot during the first phase of the regional design: revealing the current systems. We dived into all systems related to maritime manufacturing and mapped the flows in maps and systemic sections, as learned in the workshop of Alexander Wandl (2022) about territorial metabolism. The process of analysing the systems and the problems and creating a vision for the future of the province and the port was very iterative. Every time we found new information, we broadened our scope (diverging), after which we critically reviewed and redefined our approach (converging).

Although the approach of the regional design was constantly adjusted to the new findings from our research, our motive has stayed the same. I have been interested in the geopolitical perspective since the lecture from Karel van den Berghe on the first day of the project, in which he quoted: "What one can reuse, is not longer needed to be imported (again) from a (not so friendly anymore) partner" (Van den Berghe, 2022). Already from week 1, we envisioned a local material cycle for manufacturing within the region of South-Holland. From this visionary future for 2050, the next step is to back-cast this into strategic actions (Van Raak, 2022).

For the strategic actions, we have developed a phasing in which we have invited the stakeholders. It was crucial to realise that most developments are not executed by the governments, but by the private sector (Hobma, 2022). So, to achieve the vision, planning instruments will have to be used to make sure that the transition will actually happen. For the strategic actions in the regional design, we have zoomed in on three locations that will be the activators of the change. It has been a challenge to develop an adaptive strategy, whilst also identifying which actions will definitely need to happen.

Overall, learning by doing has really been the way to go for this project, and I have learned a lot. The regional design process is very complex, because the systems go through a lot of scales, from global to very local, and there are a lot of different stakeholders involved. Therefore, there is no linear road to take to develop a regional design. It is an iterative process, in which you have to diverge and converge the scope. We have experienced this a lot during the process, resulting in some confusion from time to time. By now, I have learned that this is the way to go in the process of regional design, so I think we can be proud of ourselves.

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8.3 REFLECTION YUEQI ZHANG

Turning from landscape architecture to regional planning, the topic of manufacturing made me feel confused at the very beginning. Trying to relate policies, production, energy and other topics that seem not spatial to planning made me feel insecure. We spent much time on information collection and analysis in this research process. Maritime manufacturing is not an isolated concept, but is closely related to energy, social education and other issues. (Nederland Maritiem Land, 2020) Therefore, our research covered a lot of different aspects, which led to our confusion about the working direction in the process.

Fortunately, most of these studies contributed to our project and allowed us to take a more holistic view of the research topic. Zooming out from a design perspective to a planning perspective, I was trying to understand the spatial structure more abstractly.

The methodology course really helped a lot in not only framing our research and organizing the structure but also in understanding urbanism in a societal way. During my Bachelor's time, I was usually focused more on space design, but through the lectures, it also came to me that more invisible influences lie in the social aspect that changes the cities we live in. Urban designers should not only be fascinated by spatial games but also devote themselves to bridging the gap between citizens and governments, as well as building a platform where the voice of all groups can be heard and considered respectfully. (Roberto Rocco,2022)

Looking back on our study process, I realized that we only spent about a third of our time planning and designing. With the limitation of time, we can not really make a detailed study on the function of the port of Rotterdam. If time permits, I will conduct a further study about how to adapt the current function to what we envisioned in infrastructure means, which will make our planning more reasonable as well as a supplement to the network construction of both hard and soft infrastructure. At the same time, it would also be possible to make more detailed designs for the three key locations we chose.

Finally, I must express my great thanks to all my teammates. Feeling so uncertain initially, they were the ones who led me gradually back to the track.

It's only in this course that I was introduced to regional scale planning. With the skills and knowledge I learned, now I am able to understand a city (or a region) in both physical and non-physical ways.

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8.4 REFLECTION MANON SPEULMAN

Over the past years rapid urbanisation has taken place in the Netherlands and the province of South-Holland. From 1950 till 2020 the province moved from multiple different cities to a polycentric urban field. The goal of this region is to operate as a network metropolitan region (Thöle, 2022). For this we need a transition into a circular port economy and a social transition in the region. These two transitions take place through different scales, are interwoven and must be shaped through regional design (Balz, 2022). This is a process with a strong need for cooperation and interdisciplinarity, as it needs to meet the challenges related to the spatial demands. Regional designs are used as a way to generate evidence and to create a platform for collaborative decision making (Balz, 2022). These were the critical characteristics of regional design that I took with me during this project.

During this process I for the first time came across the scale and the complexity of a regional project. The interrelation between all flows and systems allows for endless extensions onto your main topic and research. Therefore, the methodological design approach is even more crucial. As a group we had to work carefully on deepening our research while at the same time specifying our research framework, without losing track of the main narrative.

The complexity of the regional design also created the need for group work. The system is too complex to understand and unravel on your own, which forces you to work together, to rely on your group members and trust in the work that they do. Through the process I was confronted with my own work process in which I like to keep the overview and tend to take up too much work to make sure it happens my way. During this quarter I was forced to trust my group members and their work as it is impossible to do everything. Even though this was confronting at the beginning, I have made steps in this and we worked on the project UrbanScraps as a team.

UrbanScraps focusses on an endogenous ship manufacturing sector in relation to a local circular steel processing system. As these two topics are strongly related to high-environmental class industries, they are far away from "the people" (van den Berghe, 2022). However, a circular steel system without "leaks" needs the input of all steel sectors in the Netherlands as well as the (high-tech) appliances of residents. As a consequence, we needed to create a spatial development that supported a behavioural change into a shared economy and the use of a participatory R-ladder. This was the first bridge between urban space and industries. The second bridge is that of innovation. As a consequence, makers districts became interesting places. These were our places where manufacturing and urban space meet (Hausleitner, 2022). By zooming in on these locations, we could learn the effects of our strategies and spatialize. This lead to new discoveries that could be implemented on higher scales, creating an iterative process between scales

I learned through this that in regional design, it is not only about flows, system and network or how they can change. It is about how we can relate or intertwine them to find those that can strengthen each other. It is looking at the places where scales and systems meet, to disentangle and unravel or connect and merge. Regional design is a process in which different stakeholders need to be included through dialogue, but where we also need to accept that there is not one perfect solution for everyone. In the design is a prioritisation that can only be accepted if it is research based and clearly communicated. In this argumentation we need to look further than the direct consequences of interventions, there are also unexpected and indirect consequences, which might counteract a strategy or vision. Therefore, we need to create transdisciplinary regional design processes in which we open up the dialogue to stakeholders, not only for critique, but also to learn from them and improve upon. Only through this, can we create a just regional design.

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