Carbon lock-out: Leading the fossil Port of Rotterdam into transition

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Abstract

The port of Rotterdam is a global leader in the fossil fuel economy, with a 50% market share for fossil fuel products in North-Western Europe. Although it is one of the most efficient and innovative ports globally, over the last decade it has seen a gradual increase of pressures on its activities and the need to develop alternative low-carbon strategies.

This paper describes how a turbulent energy context, growing societal pressure and a change in leadership of the Port Authority opened up space for a transition management process. The process impacted the business strategy and the discourse amongst its leaders and contributed to the set-up of a transition unit and a change in investments. It subsequently led to an externally oriented transition arena process with incumbent actors in the port area and actors from outside around the transition pathway to a circular and biobased economy.

By exploring how transition management could support repositioning of incumbent actors in the energy transition, the research contributes to discussions in the transitions literature on regime destabilisation, the role of (incumbent) actors in transitions and large scale energy intensive industries as the next frontier in the energy transition.

Keywords:

Port of Rotterdam, fossil fuels, destabilisation, transition management

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1. Introduction

The Paris climate agreement (UNFCCC, 2015a) put the transition to a sustainable energy system high on the political agenda after decades of debates about energy supply, climate change and the implications of energy production and consumption for a healthy and safe environment. Forecasting studies show that the current pace of innovation and change is not sufficient to bring the 1.5 to 2 degrees warming target within reach, rather the world is on track for 4 – 6 degrees warming by the end of this century (see figure 1).

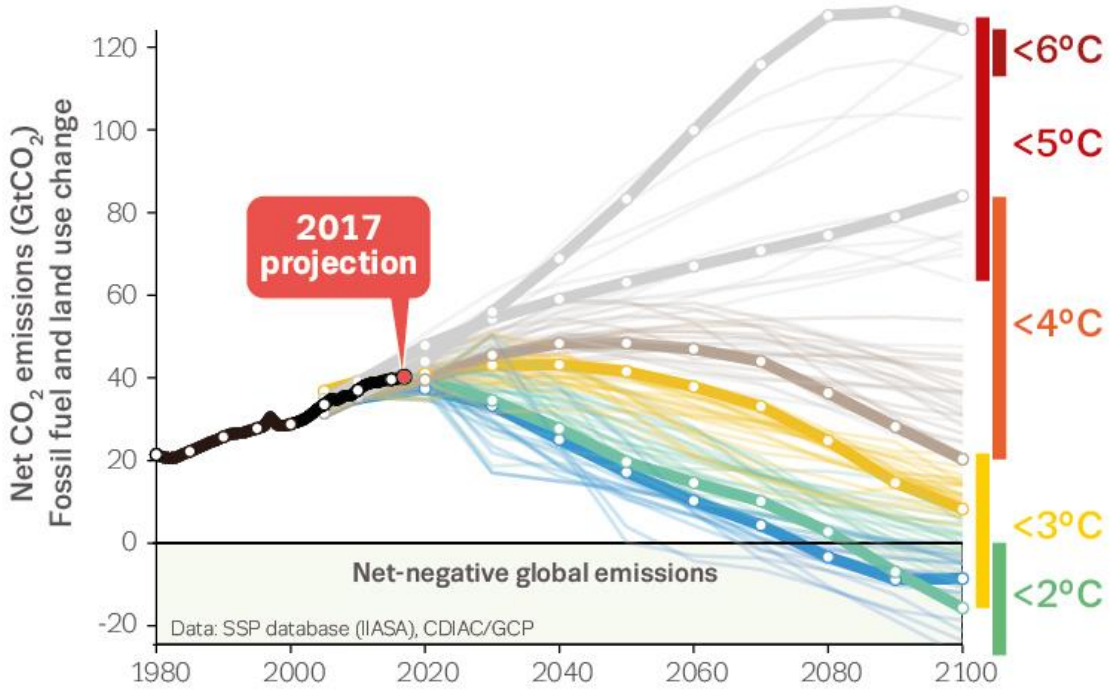

Figure 1 Global carbon emissions projections (Global Carbon Project, 2017)

It is clear beyond reasonable doubt now that the main causes for climate change are manmade greenhouse gas emissions, most prominently carbon dioxide from burning fossil fuels (Pachauri et al., 2014). Recent research finds that if global warming is to remain well below 2°C (and preferably 1.5 degrees) as has been agreed upon in Paris, 82% of currently known coal, 50% of gas, and 33% of oil reserves cannot be burned unabated (McGlade and Ekins 2015). Thus, a shift towards renewable and sustainable energy sources and away from unsustainable fossil fuels is necessary in order to tackle climate change. Since use of fossil fuels is deeply embedded in modern lives and societies, such a shift away from fossil fuels requires tremendous societal change across a wide range of domains and activities.

The academic field of sustainability transitions deals with understanding such fundamental societal change processes. It is rooted in multiple disciplines, including innovation studies, evolutionary economics, institutional theory and complexity theory. A transition is conceptualised as a fundamental change in a regime, the dominant structure, culture and practices in a societal (sub)system that is the result of a co-evolution of economic, technological, institutional, cultural and ecological developments at different scale levels (Rotmans and Loorbach, 2010). Such transitions often cut across a variety of domains and stakeholders and are thus long term (25–50 years), highly complex and contested. Contemporary transitions are often related to sustainability goals in order to resolve a number of persistent problems confronting modern societies (Grin et al., 2010). The growing societal efforts to move away from fossil fuels and resources towards renewable resources, as subsumed under the 'energy transition' (Verbong & Loorbach, 2012), fit neatly to the conceptualisation of a sustainability transition as outlined above.

Transition management has been developed as a new mode of governance for sustainable development (Rotmans et al., 2001; Loorbach, 2007; 2010). While transition research and transition management direct quite some attention towards experimentation and innovation in sustainable niches, to date there is little experience of how decline or break down of existing practices, industries and regimes proceeds and whether transition management can be applied to support change-minded incumbents operating in the context of a destabilising regime.

Our research is based on a transition management process in the Port of Rotterdam stretching out from early 2015 to mid 2017. The Port of Rotterdam is one of the largest fossil fuel hubs in the world: Half of total throughput is related to fossil fuel products, about a quarter of European refining capacity is located in the Port and it supplies in 50% of North-Western Europe's demand for fossil fuels (TNO, 2016). Increasing societal and economic pressure on the Port and a change in leadership of the Port Authority opened up space for a transition management process. At this time, mid 2015, the Paris Climate agreement had not yet been agreed upon and even though climate concerns and sustainability goals were discussed, the Port Authority did not have any strategy including potential phase-out of fossil fuels. The process was commissioned by and carried out in close engagement with the Port Authority, a semi-public organisation responsible for the Port.

Working intensively with and within the Port Authority allowed us to gain a deep understanding of how incumbent actors perceive transitional changes in their context and their role in anticipating this. It also offered an opportunity to develop and test strategies to help incumbent actors navigate such a highly challenging context. The described action research process applied and adapted transition management to this context. At the same time the process helped to gain a

deeper understanding of regime destabilisation, the role of (incumbent) actors in transitions and large scale energy intensive industries as the next frontier in the energy transition.

The article is structured as follows: In section two we present the theoretical underpinnings of our research, building on recent insights in regime destabilisation, we introduce transition management and the adaptations we made to apply it in a destabilising regime context in close cooperation with an incumbent. In section 3 we describe the transition management process including the considerations of applying TM in this context. In section 4 we discuss the effects and implications to which the process contributed. In section 5 we reflect on our findings and relate the insights and lessons learned to transitions literature.

2. Regime destabilisation, agency and transition management

A transition is defined as a radical, structural change of a societal (sub)system that is the result of co-evolution of economic, cultural, technological, ecological, and institutional developments at different scale levels (Rotmans et al. 2001). It comes about through the simultaneous build-up of sustainable alternatives and break-down of existing unsustainable practices (Loorbach et al., 2017). A core concept in transitions research is the *regime*. While it is defined in several ways (Geels, 2002; 2004; 2014; Smith et al., 2010), the different definitions have in common that regimes provide coordination and stability to societal systems that provide a particular societal function. We adopt the following regime definition: the dominant culture, structure and practices within a societal system (De Haan 2010; Rotmans & Loorbach, 2010; van Raak, 2016. As a transition is a structural change of an existing regime into another, it thus implies destabilisation and (partial) reconfiguration of regimes. Such regime destabilization can be caused by external shocks, internal structural problems and bottom up innovations in niches (Grin et al., 2010).

2.1 Regime destabilisation

Based on an elaborate review of historical transition cases, Arranz (2017) shows that different kinds of landscape pressures play a crucial role in regime destabilisation. Building on insights from industrial economics, evolutionary economics, neo-institutional theory, and management studies, and a historical case study of the decline of the British coal industry, Turnheim & Geels (2012; 2013) understand regime destabilisation as resulting from three mutually reinforcing processes:

1. building up of economic and socio-political pressures;
2. performance problems within the regime by undermining resource flows and legitimacy;
3. actors lose commitment to elements of the regime, in turn exacerbating pressures and performance problems.

Karltorp and Sanden (2012) show how diverging actor strategies in the face of transitional pressures can lead to regime fragmentation and destabilization. Bosman et al. (2014; forthcoming) add to this understanding of destabilization from a discursive perspective, analysing how alternative 'storylines in the making' undermine the logic and coherence of the previously hegemonic incumbent discourse. Their study suggests that when incumbents' explanations no longer keep up with new developments, it impairs their legitimacy and provides thrust to alternative storylines supported by actors new or foreign to the incumbent regime.

To our knowledge the first comprehensive venture towards informing destabilisation interventions is by Kivimaa and Kern (2016). According to them the concept of regimes implies "rules, technologies and actor-networks as the main components that can enforce stability or, when they change, create instability of the regime." As such, they propose four regime destabilising functions that policy makers could enact for destabilisation directed at these components:

1. control policies
2. significant changes in regime rules
3. reduced support for dominant regime technologies
4. changes in social networks, replacement of key actors

From a transition governance perspective however, it is not evident that policy makers will deliberately pursue regime destabilisation nor are they automatically in a position to pursue actions towards that end. A key question is therefore what factors could help to create the context within which such policies can emerge or be implemented.

2.3. The role of incumbents in transitions

Recently, attention in transitions literature is shifting from a focus on systems and external shocks as drivers for destabilisation and transitions, towards developing an understanding of the way actors and their agency advance or impede transitions (see e.g. the special issue on this topic by Farla et al., 2012; Avelino & Wittmayer, 2016; de Haan and Rotmans, 2017). However, an ambiguous picture emerges: Smink et al. (2013) find that incumbents tend to hamper change. Geels (2014) even goes so far as to claim that "regime stability is the outcome of active resistance by incumbent actors." (Geels, 2014: 23). Vleuten & Hogselius (2012) in their study of European liberalisation of energy markets provide a different view, by showing that incumbent actors can also drive change. The work of Hengelaar (2017), Hengelaar & Bosman (2017), Bosman et al. (2014) and Karltorp & Sanden (2012) provides a more differentiated view showing that incumbent actors can respond differently to transitional pressures and that these diverging strategies might lead to misalignments in the

regime. Turnheim & Geels (2012; 2013) propose that in regime destabilization actors eventually lose their commitment to elements of the regime. Thus, although it stays implicit in their conceptualisation, Turnheim & Geels (2012) introduce a dynamic view on the position of incumbents: initially their efforts are geared towards maintaining the status quo, while over time they may shift their attention and contribute to accelerating a transition.

2.4. Transition management in context of a destabilising regime

Transition management is a prescriptive and experimental governance approach focused on mobilising and connecting transformative agency to help guide and accelerate sustainability transitions. Transition management asserts that transitions cannot be controlled but aims to stimulate transitions by offering actors insight into transition dynamics, developing guiding and mobilising visions, transition agendas and –experiments. It is based upon the following principles (Loorbach & Rotmans, 2010):

- long-term thinking (at least 25 years) in order to inform short-term action and policies.
- creating space for niches with a focus on frontrunners to promote radical innovation
- (social) learning about different actor perspectives and a variety of options (requiring a wide playing field) as a necessary precondition for change.
- selective participatory decision-making and interaction between stakeholders in order to develop support for policies and to engage actors in reframing problems and solutions through social learning.

An important framework is the Transition Management cycle, whose components are: 1. structure the problem in question and establish and organize the transition arena; 2. develop a transition agenda, images of sustainability and derive the necessary transition paths; 3. establish and carry out transition experiments and mobilize the resulting transition networks; 4. monitor, evaluate and learn lessons from the transition experiments and, based on these, make adjustments in the vision, agenda and coalitions (Loorbach & Rotmans, 2010). A central instrument to implement transition management is the transition arena, a temporary innovation network consisting of a diverse set of frontrunners and change-minded regime players. In a sequence of several sessions, such an arena is "used to develop new substance (ideas, agendas visions); to support a process (of network/coalition building, learning); and to subtly influence existing regimes" (Loorbach & Rotmans, 2010).

Transition management has been developed originally to support frontrunners to more strategically develop their alternatives to incumbent regimes through experimentation and envisioning (Frantzeskaki et al., 2018b). Over time it has been applied in many different contexts and at different levels of scale, but not directly within the context of a regime (organisation). In this

research however, we experimented with applying transition management in an incumbent organisation operating in the context of a destabilising regime. So instead of seeking to destabilise a regime by mobilising niches externally, we experimented with implementing transitions management to contribute to destabilisation from within the regime in order to accelerate the energy transition.

2.5. Transition Management in practice

Action research is central to transition management. While more traditional research efforts take pride in keeping analytical distance to the issues under study, action research holds that the best way to understand how things work, is to engage and try to change them. Action research is distinguished from more traditional research, in the sense that in action researchers do more than just observing, reporting, analyzing, or evaluating. Action research means that we are involved in preparing and organizing meetings, and engage in normative debates on sustainability. Constantly reflecting on the action-reaction dialectic, especially when done together with others that have an interest in the system under study, provides deep understanding and insights that would not have been attainable by staying at a distance. Furthermore, action research allowed us to design the research in such a way that it not only furthers scientific knowledge development, but was also helpful for the participants. For a more specific treatment of action research methodology and the demands it places on researchers, we refer to Greenwood & Levin (1998; 2006), Wittmayer & Schapke (2014) and Wittmayer (2016).

Concretely, the action research activities revolved around strategy work commissioned by and in cooperation with the Port of Rotterdam Authority, taking place between January 2015 and March 2017. The action research efforts provided access to specific documents, interviewees and organizing strategy sessions with employees and relevant contacts within and outside the Port area. As such, data sources include:

- Public documents, including annual reports and studies;
- Internal documents, including strategy documents, working documents and studies under progress, minutes of meetings and e-mail conversations;
- Field notes of participant observation in arena meetings;
- Field notes of informal (telephone) conversations;
- Semi-structured interviews with:
    - respondents at strategic positions within the Port Authority;
    - other organisations in the Port of Rotterdam, which are also involved in the energy transition; and

- organisations outside of the Port, which were identified as interesting sparring partners in the circular and biobased transitions.

With the help of the Port of Rotterdam Authority, potential respondents and participants have been identified. A list of interviews is provided in annex 1. Respondents and participants were selected based on their strategic position within the organization, mostly board level, or from strategy or public affairs departments. Respondents are interviewed on personal title, and personal anonymity is granted in the presentation of results; therefore when using quotes only the organizational context is mentioned. It should be stressed though that the views provided are those of the respondents and not necessarily that of the organization they work for. Processing and analysing of data is a deliberative effort that has taken place throughout the project. Insights from the interviews, desk research, meetings and sessions are constantly discussed, analysed and synthesised within the transition team, with the counterparts at the Port Authority and with the arena participants.

3. Transition management in the Port of Rotterdam

From January to March 2015 the transition management process has been prepared in close cooperation with the strategy department of the Port Authority. Figure 2 provides a timeline of the main steps in the transition management process. The transition team consisted of the authors and two representatives of the Port Authority's strategy department. In cooperation with the Port Authority a long list with respondents and potential arena participants was developed. Interviews with these respondents have been used to select participants and as input for the preparatory system's analysis, which formed the basis for the arena kick-off.

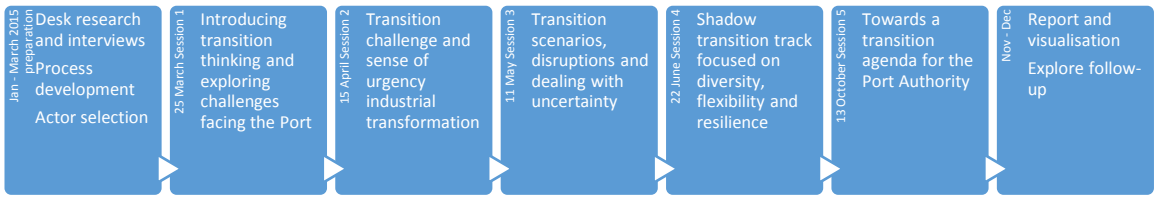

Figure 2 Timeline Port Authority internal transition arena

3.1 System's analysis

The fossil based energy regime in the port of Rotterdam is characterised by its focus on scale and volume and consequent cluster synergies (D'Haese, 2015; van Raak, Bosman & Rotmans, 2016). Through its focus on volume, pride of scale and developing the accompanying infrastructure requirements the port has been able to attract large scale bulk petrochemical production, becoming

a transhipment hub for high volumes of crude petroleum and derivative products, while developing into a large user of fossil fuels itself. Investments in R&D are relatively low compared to the Dutch average (Nijdam, 2010). This is partly explained by the fact that the petrochemical cluster and energy production is constituted by large multinationals whose headquarters and R&D departments are located elsewhere. The decision to invest and innovate in their assets in Rotterdam is part of a strategic consideration also taking into account their operations in other countries and comparing the respective competences and benefits. Furthermore, petrochemical operations are highly capital and infrastructure intensive, involving large investment sums, long depreciation periods and the accompanying risk averse behaviour. On top of that, a large share of activities, such as plant maintenance, have been standardized and outsourced to SME's over time. These SME's then tend to focus on optimizing those standardized activities (interview 12). Added up, these elements lead to investment behaviour that is relatively conservative. The strengths of scale and cluster benefits which have developed over time form the premises for new investments along similar lines, resulting in a path dependent development (D'Haese, 2015).

Landscape pressures

The context of this fossil energy regime in the port of Rotterdam is changing; after several decades of continuing economic growth of international trade the outlooks for the coming decades are much more uncertain. Five landscape developments have been identified that in particular put pressure on the port of Rotterdam (van Raak, Bosman & Rotmans, 2016; Meijknecht et al., 2012; VNCI, 2012; 2013):

1. Demand from Europe is stabilizing, because its market is mature and its population stable and ageing;
2. Refining increasingly takes place closer to the source, for example in the Middle East;
3. The shale gas revolution in the US provides cheap feedstock and energy which increases the competitive position of petrochemical industry across the Atlantic;
4. Increasing geopolitical concerns regarding fossil fuel dependencies, for example on Russia, challenge fossil fuel industries;
5. Increasing environmental concerns, in particular climate change, challenge the future of fossil based industries.

Niche pressures

In response to these landscape trends, niches develop in and outside the port of Rotterdam which might over time challenge and provide an alternative to the existing regime. The most relevant niche

developments are gathered under the umbrellas of the Bio Port initiative (Port of Rotterdam Authority, 2016) and the Rotterdam Climate Initiative (RCI, 2013).

Bio Port

The port of Rotterdam harbours several activities related to the biobased economy. Especially in the production of first generation biofuels the port already plays a leading role. The main players in this area are Abengoa Bioenergy Netherlands, Neste Oil, which operates the world's two largest biorefineries, one of which is located in Rotterdam, Biopetrol Industries and Dutch Biodiesel. The port of Rotterdam is attractive for these producers because of the proximity to the customers, mostly traditional fossil fuel producers which are required to blend biofuels into their petrol and diesel according to the EU fuel directive, and because of the available infrastructure and logistical channels (interview 11). The global biodiesel market totalled about 10 megaton in 2013 (UN, 2015), of which 1.45 megaton is produced in the port of Rotterdam (Port of Rotterdam Authority, 2010). However, this is still only a fraction of the 60 megaton fossil fuel refining capacity in the port.

Rotterdam Climate Initiative (RCI) / Energy Port

The RCI, a joint initiative between the municipality and the Port authority, started in 2007 with the goal to halve the CO_2-emissions of Rotterdam (city and port area) by 2025 compared to 1990 levels. In 2013, RCI presented its energy action plan consisting of seven focus areas of which five relate to the fossil cluster in the port, including the Bio Port already mentioned above. The other four are:

- Deltaplan energy infrastructure, focussing on developing infrastructure to transport and reuse heat, steam and CO_2;
- Setting up of an expert centre for energy efficiency, in which the test facilities for sustainable process technology PlantOne located in the port play an important role;
- Stimulating the use of liquified natural gas (LNG) in water and road transport, reducing its CO_2-footprint compared to traditional fuels;
- CO_2 capture and storage (CCS) from new coal-fired power plants.

However, 10 years into the RCI, we have to conclude that instead of a decrease of CO_2-emissions, the Port of Rotterdam is rather on track towards a 50% increase in 2025, because carbon capture and storage (CCS) which had a large role in the RCI did not materialize.

In addition to the developments gathered under the RCI, the port of Rotterdam boasts several initiatives focussed on developing and attracting wind industry, both on- and offshore and on co-firing biomass in coal-fired plants (Port of Rotterdam Authority, 2012). Next to these alternatives developed within the port, the rise of hybrid and electric vehicles impacts demand for the ports

main petrochemical products (Hill et al., 2013). Table 1 summarizes the landscape and niche-induced pressures on the fossil energy regime in the port of Rotterdam.

Table 1. **Pressures on the fossil energy regime in the port of Rotterdam**

Landscape pressures	**Niche developments**
Stabilizing demand in Europe	Bioport
Increased refining at source	Rotterdam Climate Initiative
U.S. shale gas revolution	Renewable energy
Geopolitical concerns	Electric mobility
Environmental concerns	

Role of the Port of Rotterdam Authority

The Port of Rotterdam Authority is a semi-public organisation that is responsible for the smooth operation of the Port. It takes care of the development, construction, management and operation of the Port industrial complex as well as ensuring the effective, safe and efficient handling of shipping and the offshore approaches to the port. Its objective is to enhance the port's competitive position as a logistics hub and world-class industrial complex (Port of Rotterdam Authority (PoRA), 2018a). Shareholders are the municipality of Rotterdam (70%) and the Dutch government (30%). It had 1150 employees and a turnover of €712 million in 2017 (PoRA, 2018b). The key revenues come from rental income and port dues. Furthermore, the Port of Rotterdam Authority lets port sites, primarily to storage and transhipment companies and to the chemical and petrochemical industries and energy producers. It imposes port dues on ships that make use of the port. It invests in public infrastructure, such as roads in the port area, in customer-specific infrastructure, such as quay walls and jetties, and in the development of new port sites. In order to handle shipping as effectively as possible, it also invests in a traffic management system, patrol vessels and emergency control. (PoRA, 2018a).

From the preparatory interviews at the start of the transition management process a picture emerges of a responsible caretaker. Metaphors of a landlord and shopping mall manager are used to describe its role. The Port Authority takes care of shared infrastructure and a sound investment climate for the industries in the port. It generally does not have an opinion on the organisations and activities that set up shop in the port. Also, respondents are critical of the influence their organisation could exercise in the transition:

> *"Politics should decide the direction, the Port Authority will follow." (…) "We should focus on what we are good at, business case driven, not ideological."* (interview 7)

> *"We can't get too far ahead of the pack, we need to take them along." (…)*

"We could stimulate a bit with harbour dues, but the factories are not ours, so we should not overestimate our influence" (…) Also, it is difficult to say: 'this ship can't come in', because then it will go elsewhere. What we can say is: 'the most sustainable ship receives a discount'." (interview 9)

3.2 Port of Rotterdam Transition Arena

The Port of Rotterdam Transition Arena consisted of a series of five workshops spread out over about a year, with 15 participants from different departments within the organization, from strategy to pilotage, and finance to environmental compliance. The participants were selected based upon their interest in transitions, their specific positions within their departments and a representation of the different specialities within the organisation.

The first session focused on introducing transition thinking and exploring the developments in the environment of the Port, using the multi-level perspective as lens. Based on the preparatory system's analysis we discussed the relevant landscape and niche developments facing the Port and the regime characteristics. This led to insights in the transitional pressures facing the Port and questions about the role of the Port Authority: is it merely a manager, or should it also take a more directive role aimed at a desired future for the port?

The outcomes of the session have been used to sharpen the system's analysis and reflecting on the discussions within the group made us realize that the sense of urgency for transformative change was quite low. It was challenging for the group to think in terms of disruptive change and to envisage a radically different port. With this in mind, we chose to deepen the problem structuring further in the second session.

In the second meeting we translated the outcomes of the first session into a transition challenge for the Port. We confronted the group with an exploration of how other industrial areas, such as the car and steel industry in the US, the mining industry in the South of the Netherlands and imaging company Kodak have transformed or declined in the past. Figure 3 provides a schematic overview of different possible transformation pathways. From this discussion it became clear that there is a real chance that parts of the port of Rotterdam might turn into an industrial wasteland. This resulted in a larger sense of urgency to search for and work on alternatives within the group.

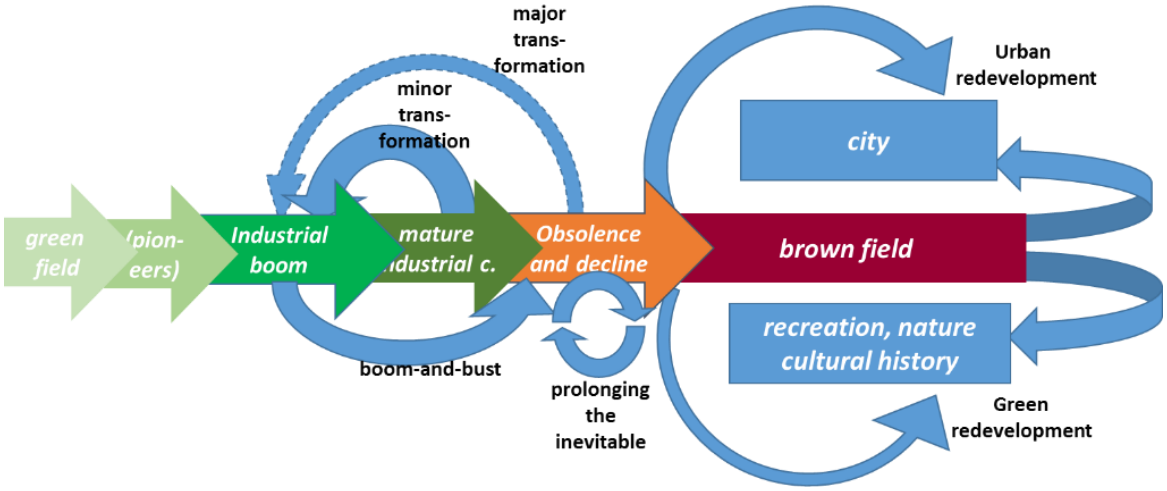

Figure 3 Industrial transformation pathways over time

Based on discussions within the group, the transition challenge was formulated as follows:

> *how to transform from a linear to a circular port economy, from fossil to biobased and from a monoculture based on three isolated pillars (logistics, maritime industry, energy & chemistry) to a diverse and flexible industrial ecosystem?*

Reflecting on the first and second sessions within the transition team, it was time to think about futures for the port. Realizing that it proved difficult to think in radically different alternatives and disruptions, we decided to use the existing energy scenarios of the Port Authority which are familiar to participants and test these scenarios against disruptions and unexpected events.

As such, the third session focused on transition scenarios, disruptions and dealing with uncertainties. We introduced scenarios as a thinking exercise to explore different futures and to see whether the port is prepared for such a future. In a workshop setting we confronted the Port's own scenarios with several disruptions, such as hyper-inflation, a food crisis, a trade boycott with Russia and China, a global climate agreement (this was before Paris!) and the emergence of methane-hydrates as a new energy source, with the question, what do these disruptions mean for the Port? And in which of the existing scenarios are you best prepared to deal with this disruption? Initially, the exercise led to some confusion. The primary responses were that these disruptions were imaginary and unrealistic. But the only relevant question was: imagine something like this happens, are you prepared to deal with it? Once this became clear, intense discussions and creativity emerged. One of the striking findings was that the group could more easily imagine a trade boycott with Russia than a binding global climate agreement. The experiences from the workshop were then used to have a discussion on different types of disruptions and uncertainties, and how to deal with these.

In the fourth session, we consolidated the findings from the previous sessions. Over the course of the workshop series, it became clear to participants that the port is facing existential pressures in all of its traditional pillars. Together we translated this into a more elaborate transition challenge:

> *The Port of Rotterdam forms a fossil monoculture focussing predominantly on mass, volume, scale and technological solutions. Considering a rapidly changing environment, this presents existential risks for the future of the Port. The Port Authority has only a partial and fragmented answer to these challenges. Therefore, a transition track is needed to build a coherent alternative below the radar. Diversity, flexibility and resilience are leading principles in this shadow track and focus shifts to the added economic, social and ecologic value of the activities in the Port.*

Then, we moved on to potential directions to deal with these challenges and the role the port Authority could take in that. Here we again encountered an ambivalent stance: Is the Port Authority a playing ball of these global developments, or is it possible or even necessary to take a more pro-active role? The conclusion was that the Port Authority has no control over those developments, but does have possibilities to create the conditions that enable and accelerate desirable activities or discourage unwanted ones.

We confronted participants with several dilemmas, revolving around the issues floated in previous sessions, to flesh out where the real pain is or might be. These dilemmas made the issues of volume growth vs added value, strengthening the existing monoculture vs promoting diversity and technological vs social innovation tangible and forced participants to take sides. Reflecting with the participants on these dilemmas, it became clear that they were broadly recognized, but that most participants tended to choose familiar options with which they reproduce the traditional focus on mass and volume, scaling and technological solutions. The dilemma exercise helped in making these often implicit preferences explicit to the group.

To conclude the session these insights have then been translated into a transition ‘shadow-track’ for the Port Authority, with new guiding principles *diversity, flexibility and resilience*, as opposed to those of mass, volume and scale. Furthermore, the idea emerged to develop a transition unit, consisting of a team of pioneers that would coordinate and further develop this transition track for the Port.

The fifth and last session in the first stage of the trajectory focussed on further developing the transition agenda for which the foundations were laid in the previous session. This time with a particular focus on the role of the Port Authority. From the discussions it became clear that the Port Authority is a rather traditional, hierarchical organisation. Whereas a diverse, agile and resilient company that is able to nurture the creativity and innovation is needed to lead the transition. This

forms a huge challenge, because the Port Authority itself mirrors the port in terms of a culture that is focussed on volume, growth and optimisation of the existing system, through technological innovation. Given the increased pressure and disruptions facing the port, it is increasingly risky to work on the assumption of an orderly world in which a solid business case for an all-encompassing 'plan A' can be made, based on expected volume growth and scaling. Participants concluded that they collectively had a 'mental vacuum' with regards to imagining futures that were structurally different from how the Port is organized today (see figure 4). In other words: they could envisage biofuels developing to the scale of fossil fuels over decades, but not a future with much less fuels and completely different or a much higher diversity of activities.

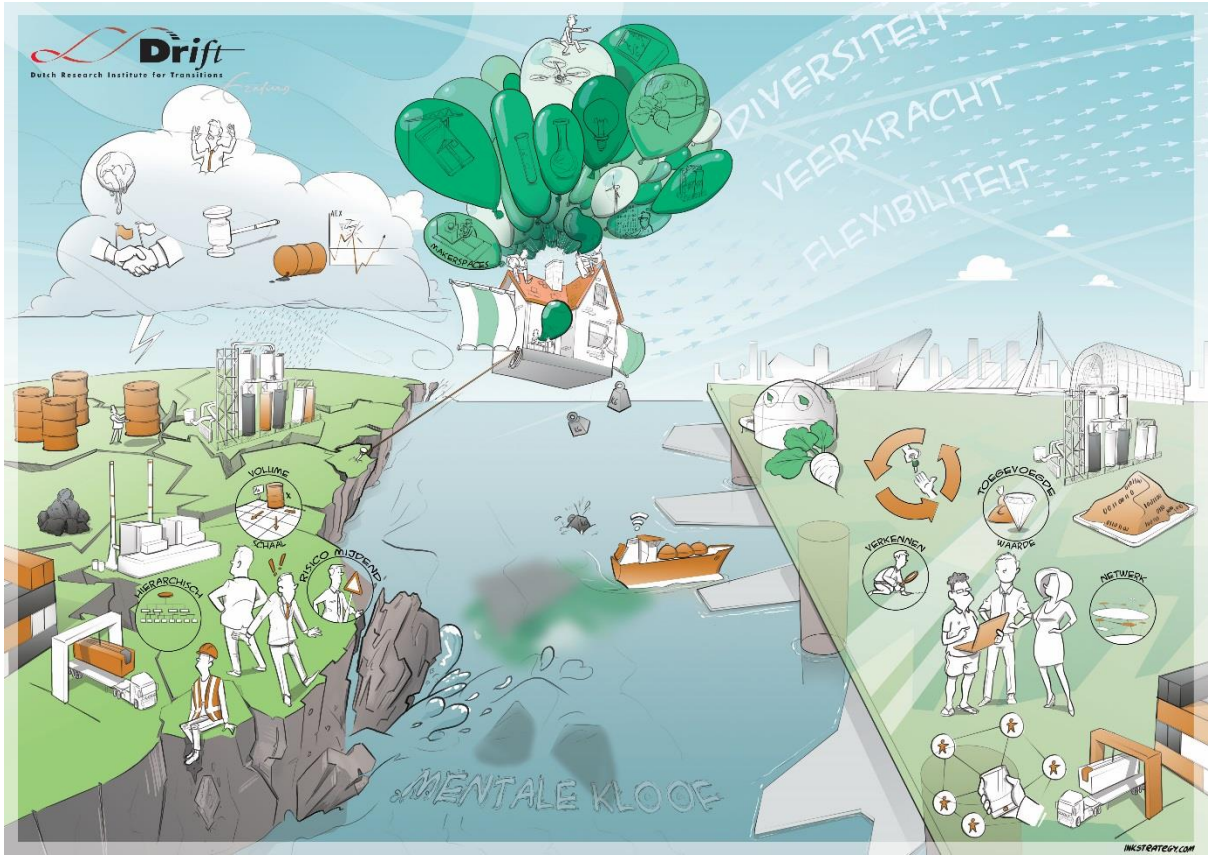

Figure 4 Visualisation of the Transition agenda 'Towards a diverse, flexible and resilient Port of Rotterdam' (in cooperation with: InkStrategy)

The transition arena agreed that developing a shadow track could support both the internal transition within the Port Authority, as well as the transformation of the whole port of Rotterdam (see table 2). Within this track, experimentation can take place on a small scale, to find answers to the challenge laid out above. In the last session, together with the participants we have developed a long list of actions for the Port Authority, categorized in an internal and external broadening agenda and a deepening agenda, and in what is already happening and what needs to happen in future.

Table 2 Transition shadow track towards a diverse, flexible and resilient Port of Rotterdam

Leading principles	Baseline	Direction of solution	Transition track
Diversity	Industrial activities are very dependent on fossil resources	Multiple tracks for industrial activities	Develop and advocate vision for a long term green industrial complex
	Little (cultural, social, professional) diversity of people in the Port	Diversity in employees, languages and cultures	Diverse, multi-cultural transition teams
	Clusters dominated by a handful of large multinationals	Industrial ecosystems of small, medium and large businesses	Five transition 'playgrounds' in which change-minded incumbents cooperate with innovative newcomers to show sustainable innovation
	Closed shop (benefitting existing players)	Attract new entrants and connect to sustainability challenges of existing industries	Flying brigade pro-actively scouting new leads in foreign (to the Port) sectors
	Focus on a small number of large flows	Focus on multiple streams and active development and use of side/waste flows	Make (waste)flows transparent to outsiders
	Port and city have grown apart	Use ports close to city to restore links and exchanges	Work on attractiveness and strategic use of city ports[2]
Flexibility	Developing infrastructure for very long term and for single customer	Phased development of infrastructure aimed at multiple users and uses	Transition backbone for heat, resources, data, electricity and mobility
	Every company has its own machinery, which stands idle for most time	Strategic sharing of hardware	Develop sharing platform for assets including insurance
	Slow and rigid decision making laid out in contracts	Space for flexible contracts and creative use of greater environmental freedom[3]	Substantive vision for the future of the Port guides priorities and leads
	Port Authority is organised in silos	Matrixstructure	Flat organisation with flexible thematic clusters
Resilience	Betting everything on one horse	Having a back-up plan, focused on a broad portfolio of robust solutions	Transition strategy with room for failure and learning; asking clients for their plan B
	'Anything goes' in the Port	Commit and dare to choose	Port Authority has an opinion on activities based on a substantive vision for the future
	Short term profit maximisation	Investing in what is needed for the future	5% of budgets to transition track, without a target for returns to be made
	Narrow focus on volume and growth	Broad focus on added economic, ecologic and social value	Develop transition indicators which are taken into account when investing, e.g.: not fossil; local solidarity; societal value

[2] stadshavens
[3] Milieugebruiksruimte (haven heeft gunstiger milieuvergunningen dan andere plekken, er mag daar meer dan elders)

4. Effects on the Port Authority's strategy and practice

In this section we reflect on the repositioning of the Port Authority over the course of the transition management process. Where initially employees of the Port Authority saw few possibilities for their organization to influence the transition, after completion of the process we see several indications that it is taking a more proactive role in the energy transition. While it is impossible to claim that this repositioning is caused by the transition management process, we will indicate where and how the process had its impact.

4.1 Transition narrative and strategy

After the transition arena, the Port Authority started taking on a much more proactive narrative of "transforming the old and creating space for the new" which has been adopted publicly by the CEO as "the direction of the inevitable transition" (FD, 2016). It is advocating this narrative through different media and at high-level meetings and conferences, including the National Climate Summit, organised by the Dutch government to translate the goals of the Paris agreement to the Netherlands (Rijksoverheid, 2016).

Recently, the narrative has become even tougher, with the CEO of the Port Authority saying "who does not want to join, should leave the Port." (NRC, 2017), leading to tensions with existing fossil based industries in the Port (FD, 2108). Also, the Port Authority has started its own series of conferences to put the issue on the (political) agenda; the Energy in Transition Summit (2018).

4.2 Organisational structure and investments

Next to changing its narrative, the Port Authority decided to invest heavily in terms of personal and financial means. It has developed a transition unit of 50 FTE to pursue businesses and activities that could contribute to making the transition. The team will "offer support with attractive accommodation conditions, connecting infrastructure, support with permit applications and finding financing, etc" (PoRA, 2016).

While most resources had so far been invested in logistical and industrial infrastructure, such as quays and pipelines, more recently it is increasingly focused at opportunities to incentivize social and institutional innovation, including funding for start-up hubs and maker spaces. "When it comes to crucial investments to realise the energy transition, the Port Authority is also prepared to make its own risk-bearing investments or to participate in companies" (PoRA, 2016). Furthermore, specific developments are incentivized with other than monetary means, such as setting aside specific locations for biobased developments and providing infrastructure in a 'plug and play' manner.

4.3 Partnerships and Practices

Where traditionally the existing industries and businesses in the Port where the natural partners, anticipating a transition requires different ways of interacting with stakeholders and engaging new partners. Part of changing the narrative is to position the Port Authority for new partnerships with actors that pursue a similar agenda and to reassess its ongoing cooperations. A concrete example of the new ways in which the Port Authority is interacting with its existing and new stakeholders is the Biobased Port Transition Arena that has been executed as a follow-up from the internal Transition Arena with the same transition team complemented with the Director Energy & Industry of the Port Authority. This transition arena process focussed on co-creating a vision and transition-agenda towards a biobased and circular Port of Rotterdam with actors from within the port and frontrunners from outside of the port (Rotmans et al., 2017). As such, it constituted a mutual searching and learning process to explore alternative futures for the Port, for which the internal arena process laid the foundations.

However, while the changes set out above seem promising, recent developments around coal logistics in the Port show the limits of current ambitions: A research journalist unearthed the fact that a permit for the largest coal transhipment company in Europe, Europees Massagoed Overslag bv (EMO) will expire in the summer of 2018 and that it would like the permit to be renewed (Joosten, 2017). This led to discussions amongst citizens and the municipality, the majority owner of the Port Authority, took on a resolution to phase out coal in the Port. In response, the Port Authority has claimed that it is unable to do anything about renewal of the permit.

In conclusion, we observe that the Port Authority is slowly changing its role, but it is still split between two orientations: it is increasingly stimulating the new economy, diversifying its organisation and setting up a transition team and data department, but has not yet quit supporting the old economy. In the transition arena we positioned the transition strategy in terms of AND / AND, meaning a focus on break-down of the old economy and build-up of new circular and biobased alternatives. Break-down of the old economy in line with the Paris agreement would entail: closing all coal fired power plants and related logistics, halt investments in new refineries or fundamental refurbishing of existing ones and a repurposing of related infrastructure and storage facilities for the bioeconomy. Build up of a circular and biobased port would entail: large scale investments in system innovations, such as anaerobic fermentation for biobased chemistry, hydrogen production and infrastructure and reuse of CO_2. The Port Authority has translated this break-down and build-up strategy foremost into an AND old economy AND new economy strategy. On top of that, the focus seems to be predominantly on system optimisation, for example through carbon capture and storage, instead of on system innovation for sustainable low-carbon production. Also the leadership

is ambiguous, detailing strong ambitions, but when it comes to execution unavoidable pain is postponed rather than confronted, as in the case of EMO.

5. Reflections and conclusions

In this paper we present the results of a transition management process with the Port of Rotterdam. It is the first time transition management has been applied in close cooperation with an incumbent organisation operating in the context of a regime that is increasingly under pressure and destabilizing. Applying transition management in this context shows that transitions thinking and transition management also has something to offer in such a context. Introducing thinking in terms of disruptions and uncertainties has helped the Port Authority to think in alternative futures and disruptions for the Port of Rotterdam and to diversify its actor networks. Furthermore, where the Port Authority initially saw little potential for influencing the energy transition, applying transition management, together with other trajectories running at the Port Authority, has contributed to a change in attitude and diversifying its strategy by opening up new avenues of influence.

Furthermore, while it is not an explicit aim, applying TM with incumbents operating in a regime context draws attention to destabilisation dynamics. It contributed to challenging the existing dominant culture, structure and practices in the Port through:

- bringing in view the transformative challenges facing the Port through co-creating a system's analysis;
- sensitizing participants to potential disruptions and uncertainties facing the Port, through confronting them with wildcard developments, dilemma's, other actors with alternative perspectives and exploring alternative futures;
- explicating underlying assumptions about the raison-de-être of the Port (volume and mass) and the role of the Port Authority, enabling discussion of the applicability of these assumptions in a changing context;
- diversifying existing actor networks and changing its interactions with stakeholders, by inviting actors from other domains and niches to collectively explore alternative futures;
- highlighting relevant niche-developments within and outside the Port to sensitise participants to sustainable alternatives that are already available;
- creating space for open discussion, challenging each other's ideas and assumptions, showing vulnerability and doubt.

Challenging ingrained views and assumptions proved necessary and instrumental in order to allow for more systemic experimentation with sustainable alternatives in a context of decreasing

certainties. As such, transition management has contributed to destabilising the fossil fuel regime in the Port of Rotterdam, while at the same time supporting the Port Authority to take a more pro-active role in the transition. We observe a change in culture and understanding of its role within the Port Authority, that is more pro-actively oriented towards the new economy. Within the Port Authority increasingly there is the perception of two streams, one focussed on the 'old economy' and one on the new, of which the latter gains increasing importance, especially amongst the younger employees.

Furthermore, our action-research in the Port of Rotterdam has contributed to understanding of the inner workings of regimes and the role of agency in their destabilisation. Since this has been an explorative paper based on a single case study, we do not aim to generalise our findings; rather we formulate our insights as propositions that should be verified and further developed in subsequent research:

a. While existing research puts the emphasis on external factors causing regime destabilisation, our research shows that incumbent repositioning is another important driving force, in which external factors play a role, but also by internal ones, such as changes in leadership, cultural change and the influx of a more diverse workforce, including younger people and more women;
b. In response to landscape tensions and niche pressures some incumbent actors are able to change their position vis-a-vis the regime through changing discourse, roles, networks, redirecting of resources and developing new practices;
c. In this repositioning, focussing on build-up is easier or more attractive than on break-down. From a transitions perspective however, break down is also necessary and effective, as a combined focus on build-up and break-down could lead to faster results;
d. Changes in discourse precede those in networks, resources and particularly practices;
e. Incumbent repositioning leads to tensions in existing relations and institutions. And, given that the Port of Rotterdam is still very fossil heavy, the biggest tensions are yet to come.

We conclude that the Port Authority is indeed taking a more proactive role supported by the transition management process, but still has a long way to go to bring the Port of Rotterdam in line with the Paris climate agreement.

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Annex 1 Overview interviews

Stage 1: 12 interviews

	position	organisation	date
1	Director Public Affairs & Communication	ExxonMobil Benelux	28/04/2015 (telephone)
2	Manager Energy Transitions	Shell	15/06/2015
3	Head Government Affairs	BP Netherlands	17/06/2015
4	Director Energy	Akzo Nobel	27/05/2015 (telephone)
5	Managing Director	Neste Oil Netherlands	19/06/2015 (telephone)
6	Manager Corporate Strategy & Responsibility	E.on Benelux	26/05/2015
7	Senior Project Leader PorInt	Port of Rotterdam Authority	19/03/2015
8	General Manager Port Development & Management	Port of Rotterdam Authority	18/03/2015
9	Innovation Manager	Port of Rotterdam Authority	18/03/2015
10	Treasurer	Port of Rotterdam Authority	19/03/2015
11	Business Manager Chemical and Biobased Industry	Port of Rotterdam Authority	17/04/2015 (telephone)
12	Director	iTanks foundation	30/04/2015

Stage 2: 21 interviews

	position	organisation	date
13	General Counsel	Deltalinqs	31/03/2016
14	Public Affairs Manager Energy Transition	Gasunie	22/03/2016
15	Director	Clean Tech Delta	17/03/2016
16	Programme Manager Biobased Economy	Ministry of Economic Affairs	28/04/2016
17	Project manager Strategy & scenarios at Shell	Shell	10/05/2016
18	Director Bio-Industrial Segment	Cargill	21/04/2016
19	CEO	ICO Nitrogen	29/03/2016
20	General Manager	North Seaweed	24/03/2016
21	Programme Manager Bio-Economy	ZLTO	03/05/2016
22	Senior Strategy & innovation adviser	Rabobank Rotterdam	16/03/2016

23	VP Biobased Innovations	Corbion	04/05/2016
24	Managing Director	Neste Oil Netherlands	31/03/2016
25	Founder & CEO	The Better Future Factory	09/03/2016
26	Director (VP) R&D	Suikerunie	15/04/2016
27	Managing Director	Europees Massagoed Overslag	14/04/2016
28	Managing Director	Eneco Business	14/04/2016
29	Innovation Manager Food & Biobased Research	Wageningen University	16/03/2016
30	President	Vopak Nederland	22/03/2016
31	Vice President Fuels	Lyondell Basel	20/04/2016
32	Distinguished Professor Biobased Economy	TU Delft	10/03/2016