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A transition in the Dutch wastewater system? The struggle between discourses and with lock-ins

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ABSTRACT

Recently, calls have increased for a paradigm shift or transition towards resource recovery and a circular economy in the Dutch wastewater system. However, we have observed diverging interpretations on the nature of the transition. This reflects the political environment of sustainability transitions: political struggle emerges over the definition of problems, futures and strategies to be used. In order to help clarify the emerging debate and identify political choices, we conducted a discourse analysis. We identified three discourses that reveal some of the political choices to be made. One discourse is becoming dominant and focusses on optimising the large-scale infrastructure, market development and legislative changes. The discourse draws on the existing infrastructure and current political-economic institutions, which gives it an advantage in becoming dominant. Our findings also suggest that this discourse shapes a transition pathway that is characterised by lock-in effects and, at most, incremental changes instead of a fundamental shift in the established Dutch wastewater system.

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1. Introduction

The Dutch wastewater system was developed predominantly with a view to improving public health. However, over the last decades, policymakers, researchers and stakeholders have started to focus on its environmental and societal questions. Examples of those questions today include greenhouse gas emissions, energy and maintenance costs, drought and floods, depletion of critical resources and emerging pollutants. Recently, experts and scholars have voiced the need for a 'paradigm shift' (Guest et al., 2009, p. 2; Larsen, Udert, & Lienert, 2013, preface) or 'transition' (ERF, 2014, p. 6; European Water Platform, 2016, p. 3). They aim at the recovery of resources (e.g. nutrients, energy and water) from wastewater and a shift to a circular economy (CE). In general, a CE proposes a reduce-reuse-recycle strategy for waste management, which challenges the negative economic and ecological effects of the linear take-make-dispose system (Ghisellini, Cialani, & Ulgiati, 2016).

However, we see interpretations diverging on a transition towards a CE in the Dutch wastewater system, which we will explore by using discourse analysis. For example, some actors want to optimise the existing large-scale infrastructure and the development of business cases for the recovered resources (e.g. ERF, 2017a). Still others look at citizen awareness and decentralised treatment systems to recover energy and resources from wastewater (e.g. Swart & Palsma, 2013). At the same time, the discussion is expanding on the contamination of surface and drinking water by emerging pollutants (e.g. Vewin, 2017) and on how energy

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and resource recovery may compromise the public health objective of the wastewater system (e.g. Clemens, Palsma, & Swart, 2012, February 10).

These diverging perspectives or discourses shape actions, institutions and power relations and fulfil a key role in processes of change (Fairclough, 2010; Hajer, 2006). The field of sustainability transitions also confirms that discourses influence transition pathways. For instance, the role that discourse plays in environmental policy development (Smith & Kern, 2009), the use of discourse in directing change along specific pathways (Rosenbloom, Berton, & Meadowcroft, 2016) and how incumbents discursively frame transitions (Bosman, Loorbach, Frantzeskaki, & Pistorius, 2014). These examples also demonstrate the political environment of transitions (Avelino, Grin, Pel, & Jhagroe, 2016; Kenis, Bono, & Mathijs, 2016; Paredis, 2013): political struggles take place over what the problems are and how they should be defined, what the future will look like and the strategies to be used in a transition.

Such a transition is a long-term, multi-dimensional process of change through which established socio-technical systems (sectors that supply, for example, water, energy and transportation) shift to more sustainable modes of consumption and production (Markard, Raven, & Truffer, 2012). Some argue that transitions require fundamental shifts in established political-economic institutions (Hopwood, Mellor, & O'Brien, 2005), particularly in the roles of markets, governments, technology and citizens (Scoones, Leach, & Newell, 2015).

A specific discourse or interpretation of a transition pathway can become dominant and leave no opening for alternative pathways (Fairclough, 2010; Hajer, 2006). This may lead to incremental rather than fundamental changes and a lock-in in the established socio-technical system (van den Bergh, Truffer, & Kallis, 2011). More specifically, the characteristics of established systems set the preconditions for the development of new transition pathways (Arapostathis & Pearson, 2019; Klitkou, Bolwig, Hansen, & Wessberg, 2015; Markard, 2011), large technical systems influence discourses and vice versa (Sovacool, Lovell, & Ting, 2018) and transition experiments or platforms are captured by existing networks, markets and infrastructure (Raven, Kern, Verhees, & Smith, 2016; Smith & Kern, 2009). In this way, a new discourse may struggle with lock-ins in an established socio-technical system.

Thus different discourses may give shape to incremental or fundamental changes in the Dutch wastewater system, while a particular discourse can have more power to do so. To analyse these discourses and to avoid a lock-in in the established system, this paper scrutinises the various interpretations of a transition. Two research questions are explored: How do the actors in the Dutch wastewater system interpret a transition? And how can we understand these interpretations from a political perspective on transitions?

After this introduction, we detail the interpretive approach, analytical framework and methods of the paper. In the next section, we first elaborate on a historical context of the wastewater system because it shapes today's interpretations, and then present the results of the discourse analysis. Finally, we discuss the discourses from a political perspective on transitions, with a focus on dominance and lock-ins.

2. Doing discourse analysis

2.1. Interpretive approach

We took an interpretive approach that concentrated on meaning-making to understand social phenomena (Yanow, 2007), particularly on how interpretations shape transition pathways (e.g. Kern & Rogge, 2017; Rosenbloom et al., 2016). Next to ethnographic and narrative methods, one of the methods in the field focusses on discourses or sets of ideas. Generally, a discourse represents aspects of the world that might be represented differently by different actors and their projects of change (Fairclough, 2010). In the study of environmental politics, discourse analysis has also been developed (Feindt & Oels, 2005; Hajer & Versteeg, 2005), and discourse has been defined as 'a specific ensemble of ideas, concepts, and categorisations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities' (Hajer, 1995, p. 44). This power to define not only includes ideas but also excludes specific aspects from the debate, and it influences what is thought, seen and done within a social group. A discourse is thus a factor that shapes transitions.

2.2. Analytical framework

Following Hajer (1995), the analysis focussed on the content of what is being said (i.e. storyline), the context of the statements (i.e. the historical context or roots and the discourse coalition) and the (political) influence (i.e. discourse structuration, institutionalisation and dominance). For the construction and analysis of every discourse, we thus focussed on the roots, storyline, discourse coalition and influence (see Table 1 for an overview).

A storyline is 'a generative sort of narrative that allows actors to draw upon various discursive categories to give meaning to specific physical or social phenomena' (p. 56). It suggests the achievement of discursive closure, not only by defining what the problem is but also by suggesting solutions (Hajer, 1995) and imagining a possible world (Fairclough, 2010). Such a future vision is directly relevant to transitions because they express the objectives and the strategies by which these will be realised (Berkhout, 2006; Konrad & Böhle, 2019). Therefore, next to the problem definition and future vision, we further explored these strategies by scrutinising the role of markets, governments, technology and citizens (Scoones et al., 2015).

Furthermore, a storyline functions as 'discursive cement' (Hajer, 1995, p. 63) for a discourse coalition. The latter is an ensemble of a set of storylines, shared by a particular group of actors and the related practices. The influence of a discourse was analysed by Hajer's two-step procedure: discourse structuration occurs if a particular discourse dominates the way a social unit conceptualises the world, and discourse institutionalisation is relevant if a discourse starts to solidify in institutional arrangements (e.g. new policy, documents, rules and investments) and organisational practices (e.g. restructuring of departments and new commissions or platforms). The two-step procedure specifies that there is a dominant discourse if a coalition succeeds in structuration and institutionalisation; this implies power concentration as well as the strong influence of a specific discourse on a transition pathway (Hajer, 1995, 2006).

2.3. Methods

For the analysis, we inspected the historical context of the wastewater system (Fairclough, 2010; Hajer, 1995) and analysed documents, periodicals, literature, newsletters and videos to gain insight into the interpretations (Hajer, 2006). In addition to these documents, we also relied on twelve in-depth interviews because resource recovery from wastewater is an innovative practice (i.e. lower rate of institutionalisation). Convenience sampling (in a European training network on resource recovery from wastewater) and snowball sampling gave access to Dutch researchers and innovators. The analysed documents were usually referred to in the interviews. Furthermore, multiple events on decentral sanitation, CE, and technology to recover resources from wastewater were visited to complete the analysis. The empirical material was mainly gathered in 2017 (see Appendix 1 for a list of interviews, field observations, documents, videos and newsletters).

The software MAXQDA was used to code the transcripts, field notes and documents. This took place in an abductive manner (Yanow, 2006): prior knowledge about environmental politics and preliminary field observations helped to obtain a rough idea of the different interpretations; during the coding process, we reviewed

Table 1. Overview of the analytical framework.

Roots
Storyline
• Problem • Future • Strategy (markets, government, technology and citizens)
Discourse coalition
Influence
• Structuration • Institutionalisation • Dominance

these assumptions and zoomed in on the different aspects of the analytical framework; and we asked our interviewees for alternative views (Weiss, 1995) to test our assumptions, maximise the range of our samples and construct counter-discourses.

3. The Dutch wastewater system: brief history and current discourses

In this section, we aim to clarify how the actors in the Dutch wastewater system interpret a transition. Before doing so, we first describe three broad shifts in the history of the wastewater system, in which we focus on political struggle and the coproduction of technology and society. The historical overview aims to describe a context for today's interpretations, the influence of history on new discourses, possible lock-ins and interaction with other socio-technical systems. After the overview, we present today's discourses.

3.1. Historical overview

The first shift came at the beginning of the nineteenth century. Around this time, wastewater was disposed on the streets, or (in wealthy households) in cesspools. However, as urbanisation grew, issues started to arise. There were cholera outbreaks, and cesspools overflowed because of the newly emerging piped water supply. Furthermore, liberal ideas that public expenditures should be kept low led authorities to curb investments into solutions. Yet some social groups pointed to alternative solutions and proposed changes to wastewater disposal. The medical community claimed that contaminated drinking water, not stench, was the cause of cholera and therefore argued for disposal outside of the city. As a result, engineers supported large-scale sewer construction. The democratic struggles at the end of the century further stimulated notions of public health and clean water. All these interpretations deviated from official policies but gained in influence and played a role in a shift from cesspools to sewers (Geels, 2006; Rockefeller, 1998; Sedlak, 2014).

Sewers transported wastewater outside of the city, but it remained untreated. As a consequence, water-borne diseases emerged, and downstream communities, fishermen and beaches suffered from water polluted by sewage (Halliday, 2013; Mulder, 2016). This led to a second shift, after multiple discussions on the direction of change. Scientists, for example, refuted the idea of self-purification of water by dilution, and the medical community identified biological organisms (pathogens) as the cause of diseases. The need for sewage treatment became clear, and methods were available as well, but several negative aspects were perceived. Sewage farms were disfavoured because of space requirements, waterlogging and smell; chemical treatment produced too much sludge and failed to remove all pathogens; and artificial fertilisers further discredited treatment systems linked to organic fertilisation (e.g. Liernur's pneumatic sewerage system and barrel collection). In 1913, engineers discovered activated sludge, a biological treatment process that removed pathogens, was odourless, and was low in cost and space requirements. A second shift was coproduced by the sewage infrastructure and political debate linked to public health and drinking water, odour, costs and space requirements. From this moment onwards, wastewater was transported by sewers to large-scale, centralised treatment plants outside of the city (De Korte, 2018; Melosi, 2000; Sedlak, 2014).

A third shift took place from the 1960s onwards: alongside public health, the quality of surface water became more important in the water/wastewater system. The reasons included increased public awareness of environmental issues, driven by Rachel Carson's book The Silent Spring and the report The Limits to Growth. In the European Union, both public health and environmental concerns became institutionalised in, among others, the Urban Waste Water Treatment Directive (1991), the Drinking Water Directive (1998) and the Water Framework Directive (2000) (Lema & Suarez, 2017; Melosi, 2000; Pahl-Wostl, 2015).

Today, public health, water quality and the centralised and large-scale infrastructure can be conceived of as elements of the conventional wastewater system. Massive sewers transport wastewater to large-scale plants outside of the city. After treatment, the water is discharged to surface water which may be used as influent for drinking-water production (Sedlak, 2014). Over time, not much has changed: 'If a water or sanitary engineer from over 100 years ago was to return to the present time […] they would probably marvel that we continue to

use the very same infrastructure that they and their colleagues installed' (Thomas & Ford, 2005, p. 135). In the Netherlands, piped drinking water emerged in the nineteenth century and is now managed by drinking water companies. Sewers were constructed during the first half of the twentieth century, and since the 1950s, wastewater has been treated by the water boards (Langeveld, 2004).

In sum, our historical overview shows how the conventional wastewater system has developed step by step, mostly incrementally, but sometimes in a quite fundamental way, accompanied by political struggles. Previous studies have also highlighted the role of history, lock-ins and incremental changes in the water/wastewater system. For instance, it is captured by a global rationality of the centralised infrastructure (Fuenfschilling & Binz, 2018); sector characteristics such as the large-scale infrastructure, monopolies and high environmental externalities can hinder reforms (Lieberherr & Fuenfschilling, 2016; Meehan, Ormerod, & Moore, 2013); and regulatory, environmental and industrial interests are a powerful 'drive to sewer' (Rockefeller, 1998, p. 12). In this way, the overview provides a foundation for exploring today's discourses, the influence of history and possible lock-ins.

3.2. Three discourses on a transition in the Dutch wastewater system

In this part of the paper, we identify three discourses, for every discourse we discuss the roots, storyline (problems, future and strategy), coalition and influence. We will observe similarities and conflicts, as well as how the three discourses struggle to influence the transition pathway. Whether they succeed in doing so is discussed in the fourth section. A summary of the main results is also presented in a table at the end of this section (see Table 2).

3.2.1. Discourse 1: 'from a technology push towards a market pull'

The first discourse aims at the optimisation of the existing large-scale infrastructure to recover resources from wastewater. Market development ('market pull') and legislative changes are needed to sell the recovered resources. The storyline is narrated mainly by the incumbent actors in the Dutch wastewater system.

3.2.1.1. Roots. Twenty-one water boards are responsible for flood control, water quantity and quality in their designated areas. Since the 1960s, however, there has been a discussion on the raison d'être of the water boards (e.g. Raadschelders & Toonen, 1993). The tarnished reputation of the water boards, societal expectations and high-quality effluent led to the rise of WaterWays (WaterWegen, our translation) in 2008 (Interview 5). In this 'free space', a group of innovators brainstormed possible futures for wastewater and the water boards (Interview 5; WaterWays, 2012). Around the same time, STOWA (the water boards' research institute)[1] published a vision report on Nutrient, Energy and Water (NEWater) recovery in 2030 (2010). A few years later, a more general roadmap for 2030 was published as well (Dutch Water Authorities & Association of Netherlands municipalities, 2012). In 2014, all these ambitions combined in the network and knowledge centre called the Energy & Resource Factory (ERF). The ERF is a joint initiative of all the water boards that 'aims to enable a transition towards resource recovery in the wastewater system' (ERF, 2014, p. 15). Since 2017, the slogan of the ERF has been 'from a technology push towards a market pull', which indicates the necessity of market development for the recovered resources (ERF, 2017a, p. 6; Interview 8).

3.2.1.2. Storyline

3.2.1.2.1. Problems. At least three problems signify the need for a transition. First, the intensive energy use of wastewater transport (pumping) and treatment (aeration) causes greenhouse gas emissions. Second, the maintenance and construction costs of the wastewater system are high. Third, limited resources on earth call for resource recovery (Interviews 5, 7 & 8; STOWA, 2010).

3.2.1.2.2. Future. A CE addresses these problems. Biogas recovery solves the issues of high energy use, emissions and costs, while earth's limited resources such as phosphorus can also be recovered (Interviews 7 & 8). This is reflected in a 'top 5 resources report', where the ERF (2017a) aims to recover and sell phosphorus, cellulose, alginate-like polymers, bioplastics and biomass.

Table 2. Summary of the three discourses.

	'From a technology push towards a market pull'	From a 'sub-optimal system' towards a modernised mixture	Water quality, public health and emerging pollutants
Roots	• Tarnished-reputation water boards • Societal expectations • WaterWays	• Research agenda • 'Certain groups in the Netherlands' • STOWA	• Pyrazole crisis
Storyline: problems	• Energy use transport and treatment • Maintenance and construction costs • Limited resources on earth	• Energy use transport and treatment • Maintenance and construction costs • Flush-and-forget culture • Emerging pollutants • Demographic factors	• Hospitals, industry and agriculture dispose emerging pollutants • Vague priorities of transition
Storyline: future	• Energy and resource recovery • Win-win, business case	• Mix of scales, strategies, technologies, payment systems and decision-making structures	• Integrated approach: industry, agriculture, hospitals, citizens, water boards and drinking water companies • Sharing knowledge, transparency • Who is responsible and who invests
Storyline – strategy: role of markets	• Market pull/development • 'Economic story'	• Limited, a local economy	• Supply clean water
Storyline – strategy: role of governments	• Facilitate market development • Change End-of-Waste regulations • No financial support	• R&D, incentives and change End-of-Waste regulations • Intensified collaboration: municipalities, companies, water boards, project developers and citizens	• Source control, precautionary and polluter pays • Identical standards for wastewater effluent and drinking water influent
Storyline – strategy: role of technology	• Optimisation of large-scale and centralised treatment • Cost-efficient and sustainable • Not a bottleneck, but cooperation of universities, governments and private sector needed	• Mixed central (large-scale) and decentral (small-scale) treatment • Cost-efficient and sustainable • Not a bottleneck	• Spread investments over water cycle • Not a bottleneck
Storyline – strategy: role of citizens	• 'Not feasible' • Passive	• System in interest of citizens • Awareness	• Public awareness
Coalition	• ERF (all water boards), Dutch Water Authorities, STOWA, Delft University of Technology	• LeAF, STOWA, Wageningen University, DeSaH	• Vewin, water/wastewater sector, STOWA, Dutch Water Authorities
Influence	• Structuration and institutionalisation	• No structuration and low institutionalisation	• Structuration and (low) institutionalisation

Business cases provide a win-win situation for the environment and the economy (Interview 7; STOWA, 2010). An interviewee confirms: 'The CE enables the water boards to sell resources, reduce costs and increase revenues to invest in sustainability' (Interview 1). An interviewee from the ERF imagines 'a zero-emission production facility, in which wastewater enters and, at the end of the production line, the recovered resources are sold to green businesses' (Interview 8).

3.2.1.2.3. Strategy. An interviewee underlines the importance of 'a market pull' by saying, 'Systems only change if there is profit to be made' (Interview 1). An interviewee from the Dutch Water Authorities states: 'We create an economic story, and I notice that Brussels talks only about jobs and economic growth. We don't get anywhere if we don't fit our circular economy in that frame' (Interview 7).

The government is not expected to fund such a transition, because the revenues from the recovered resources are sufficient. However, the government needs to play a role in facilitating market development, in combination with changes in the End-of-Waste regulations (Interviews 7 & 8).

The interviewees argue that the optimisation of the large-scale, centralised technology provides economies of scale, sustainability gains and general (cost) efficiency (Interviews 5, 8 & 12). Likewise, the top 5 report describes the efficient recovery of cellulose, alginate-like polymers and phosphorus in large-scale plants (population equivalent of over 200.000) (ERF, 2017a). It is agreed that technology does not form a bottleneck, while R&D cooperation between universities, governments and the private sector is necessary for innovative solutions (Interviews 5 & 8).

Citizens do not play a role in this transition, as 'it is not feasible to involve citizens in technological issues such as Nereda'[2] (Interview 7). Two interviewees argue for the convenience of citizens paying taxes, flushing the toilet and taking showers without having to care about anything else (Interviews 8 & 12). A similar argument is reproduced in NEWater (STOWA, 2010). The top 5 report (ERF, 2017a) and the 2030 roadmap (Dutch water authorities & Association of Netherlands municipalities, 2012) do not elaborate on the role of citizens (and end-users).

3.2.1.3. Discourse coalition. The discourse coalition that narrates the storyline is linked to the incumbent actors in the Dutch wastewater system. For instance, the Dutch Water Authorities (the umbrella organisation of the water boards) initiated WaterWays. The latter combined staff from multiple water boards and their ideas were further developed in what is now the ERF. In the ERF-steering group, the Dutch Water Authorities, STOWA and the managers of several water boards are represented. STOWA has also provided research for the ERF, for example by the publication of a report (2015) on resource recovery that is in line with the top 5 report. Some of the interviewees (e.g. 5 & 12) that (re)produce this discourse are influential wastewater experts who work at the Delft University of Technology and have collaborated with the water boards.

3.2.1.4. Influence. The discourse coalition reiterates the view 'from a technology push towards a market pull', and this interpretation structures the debate about a transition among the incumbent actors in the wastewater system. The storyline is institutionalised by the organisational practices of the ERF, which receives financial support from every water board (which results in a yearly budget of about €500.000) (ERF, 2014). It is also institutionalised by the optimisation of the established infrastructure; 24 out of 314 plants are now trying to recover cellulose, phosphorus or biogas (ERF, 2017b, December 19). Furthermore, it institutionalises in reports and publications of STOWA (e.g. 2010), the ERF (e.g. 2017a) and Dutch wastewater experts (e.g. Guest et al., 2009; van Loosdrecht & Roeleveld, 2015). In sum, the coalition of incumbent actors succeeds in discourse structuration and institutionalisation; whether this also leads to dominance is discussed in the fourth section.

3.2.2. Discourse 2: from a 'sub-optimal system' towards a modernised mixture

The second discourse proposes a mixed – central and decentral – treatment system, focussing less on resource recovery and more on citizen awareness. Some scholars have labelled this system a modernised mixture (e.g. van Vliet, Spaargaren, & Oosterveer, 2010). The storyline is narrated by some scholars (loosely) affiliated with Wageningen University. Over the past decade, a few small-scale treatment projects were realised but the large-scale treatment infrastructure prevails.

3.2.2.1. Roots. In the 1990s, (technological) research emerged on source separation and closing loops at the community level of the wastewater system (e.g. Larsen & Gujer, 1997; Zeeman & Lettinga, 1999). In a book chapter about decentralised (small-scale) treatment in the 2000s, two STOWA affiliates remark that 'certain groups in the Netherlands were becoming dissatisfied with the way in which human wastewater was collected and treated in their country' (Swart & Palsma, 2013, p. 431). In turn, their organisation involved new actors and put wastewater on the agenda by means of research projects, pilots, a coordinating body and a website (sani-wijzer.nl). Today, an interviewee argues for 'a shift from the conventional, sub-optimal, system towards a mixed system' (Interview 4).

3.2.2.2. Storyline

3.2.2.2.1. Problems. The interviewees identify five problems. First, the transport and treatment of diluted wastewater require a great deal of energy, which involves high costs and emissions. Second, expensive optimisation of the conventional wastewater infrastructure is questioned; one says: 'this is the easy way out' (Interview 4). The third problem is the flush-and-forget culture and lack of end-user awareness. Fourth, emerging pollutants end up in the environment as a consequence of effluent disposal and combined sewer overflows. Lastly, over time, there is uncertainty about population growth in some areas, which could render large-scale treatment plants obsolete (Interviews 4 & 9).

3.2.2.2.2. Future. The storyline proposes a mixed system as a solution to the 'sub-optimal' conventional wastewater system. Two interviewees also note that resource recovery should not be the sole focus of a transition because the amount of resources in municipal wastewater is low (excluding energy and water recovery). Along these lines, they describe how decentralised systems solve the aforementioned problems: these reduce the energy and maintenance costs of the conventional system; local embeddedness raises citizen awareness of water use and the flush-and-forget culture; emerging pollutants are effectively tackled in concentrated streams; and the modular design deals with uncertain demographic trends (Interviews 4 & 9).

A modernised mixture consists of 'a mix of scales, strategies, technologies, payment systems and decision-making structures' (van Vliet et al., 2010, p. 5). An interviewee confirms that 'central and decentral systems can co-exist for the next 30 or so years' (Interview 4). The interviewees do not argue for the complete separation of black (faeces), grey (sinks, bathtubs, etc.), yellow (urine) and rainwater pipes straightaway. They state that the first steps would ideally be rainwater harvesting at the household level, the installation of pharma filters in hospitals, the collection of yellow water from urinals in public buildings, and separate black and grey pipes in newly constructed and rural areas (Interviews 4 & 9).

3.2.2.2.3. Strategy. The market has a limited role. One interviewee imagines, for example, a local economy: a farm receives yellow water (fertiliser) from nearby households, and then the latter are partially exempted from treatment taxes (Interview 4).

The interviewees want a government that actively develops a modernised mixture and examines every investment in the conventional wastewater system. Some policy instruments are suggested: changes in the End-of-Waste regulations, increased R&D budgets, space for experiments, (financial) incentives to enable, for example, the installation of decentralised systems and, lastly, an intensified collaboration between municipalities, companies, water boards, project developers and citizens (Interviews 4 & 9).

Technologically, the proposed mixed system departs from the current infrastructure. It ranges from rainwater harvesting, over NoMix toilets and constructed wetlands, to separate pipes for black, grey and yellow water (Interview 4). An interviewee adds, 'Technology does not form a bottleneck; it's not rocket science, you know' (Interview 9). Both interviewees also mention that the technology is cost-efficient and sustainable.

There should be 'a focus on the interests of citizens and what they desire' (Interview 4). Along these lines, an interviewee notes, 'End-users will realise: it is my energy, in my sewer, which is supplied to my house!' (Interview 9). On awareness, one says, 'Citizens are not going to flush whatever they want if they know the toxic stuff is going to end up in the pond next door, where the kids play' (Interview 4).

3.2.2.3. Discourse coalition.

The coalition that narrates this storyline finds its roots at Wageningen University, in the work of, for example, the professors Gatze Lettinga and Grietje Zeeman (e.g. Lens, Zeeman, & Lettinga, 2001). A research institution (LeAF) with which both professors are also associated has facilitated decentralisation projects. STOWA has also (re)produced the storyline, as has a company called DeSaH. LeAF, STOWA and DeSaH have been involved in the development and evaluation of the first and most popular decentralised treatment system in the Netherlands: 'Waterschoon' (in Sneek) (Interview 9; Waterschoon, 2011).

3.2.2.4. Influence.

The coalition realises discourse institutionalisation to a certain degree, but significantly less than the first 'market-pull' discourse. For example, some small-scale treatment projects were realised, such as, notably, about 500 NoMix toilets (see Swart and Palsma (2013) for an overview). Furthermore, the Buiksloterham project in Amsterdam also aims at source separation (Gladek, van Odijk, Theuws, & Herder, 2014),

while DeSaH installed the decentral treatment system in both Waterschoon and Buiksloterham. STOWA, LeAF and some scholars at Wageningen University have published on this topic, and STOWA's saniwijzer.nl keeps track of new developments. The bi-annual STOWA-event on 'New Sanitation' is the most important organisational practice in the Netherlands that (re)produces the storyline. There is thus hardly any discourse structuration and a low rate of institutionalisation, which becomes particularly clear in comparison to how the market-pull discourse (and thus the dominant actors) structures the transition debate and how it is institutionalised by the ERF.

3.2.3. Discourse 3: water quality, public health and emerging pollutants

The third discourse partially shifts the debate away from resource recovery by (re)asserting the importance of public health and water quality (the core objectives of the conventional wastewater system). The storyline is narrated by incumbent actors who are mainly associated with the water/wastewater sector. It has stimulated a debate on how a CE could compromise the public health objective and on emerging pollutants.

3.2.3.1. Roots. An interviewee observes that a lively public debate has developed on emerging pollutants since a pyrazole crisis in 2015[3] (Interview 11). These emerging pollutants can be defined as 'chemicals that are not commonly monitored but have the potential to enter the environment and cause adverse ecological and human health effects' (Geissen et al., 2015, p. 57).

3.2.3.2. Storyline

3.2.3.2.1. Problems. First, Vewin (an association of drinking water companies in the Netherlands) regards the wastewater from hospitals and industry as problematic because it contains emerging pollutants that are not entirely removed by wastewater treatment plants (2017). An interviewee adds, 'The main problem is endocrine disruptors and antibiotics […] most come from agriculture, but this is not dealt with because of the economic value of the sector' (Interview 10). Second, the priorities of a transition towards a CE are still vague. In a press article, for example, a professor and two STOWA associates argue that energy and resource recovery could compromise the public health objective of the wastewater system (Clemens et al., 2012, February 10). Likewise, an interviewee notes that 'the treatment of emerging pollutants is an expense […] while other things might be profitable for the water boards, such as energy recovery'. And he also observes: 'the water boards are concerned about water quality with regard to environmental standards and not to drinking water standards' (Interview 11).

3.2.3.2.2. Future. An interviewee and Vewin argue for an integrated approach, in which sharing knowledge and transparency is of importance. This requires the involvement of stakeholders such as the pharmaceutical and chemical industry, agriculture, hospitals, citizens, water boards and drinking water companies. Moreover, there should be a consensus on what emerging pollutants are, who is responsible for them and who invests in a solution (Interview 11; Vewin, 2017).

3.2.3.2.3. Strategy. Except for the supply of clean drinking water, market dynamics do not play a role in the strategy of this storyline, while the government does. First, the government should be playing a role in enforcing the source control principle, and implement precautionary and polluter-pays principles (Interview 11). In a press statement, the president of the Dutch Water Authorities says, 'The pharmaceutical industry is responsible for pharmaceuticals in water and therefore needs to contribute to additional investments in treatment systems' (2017, December 15). Similarly, an interviewee argues for stricter licensing of who disposes what and how much in sewers (Interview 11). Second, the government should set identical quality standards for disposal of wastewater effluent in surface water, and for the intake of surface water for drinking water production (Interview 11; Vewin, 2017).

The main obstacle is not technology, but rather who among the stakeholders should invest in infrastructure to remove emerging pollutants. Citizens play an important role: public awareness should be raised by, for example, campaigns on emerging pollutants (Interview 11).

3.2.3.3. Discourse coalition. The storyline is narrated by Dutch drinking water companies, Vewin, STOWA and the Dutch Water Authorities. These are all incumbent actors in the Dutch water/wastewater system and they now focus on emerging pollutants. However, especially interesting is that the issue is connected to a transition towards a CE (and the possible trade-offs) by some interviewees and documents, while there are neither organisational practices nor coalitions that (re)produce their storyline.[4]

3.2.3.4. Influence. The storyline highlights public health and water quality, both of which are elements of the conventional wastewater system. Thus they are also present in the two other discourses and are highly institutionalised in, among others, European directives. By contrast, the emerging pollutants are on the agenda and stimulate a lively public debate, but the discourse has not yet been institutionalised. In 2017, the water boards received a one-time subsidy (30 million euros) to initiate additional treatment (H2O, 2017, October 26), and STOWA published a few technical reports about pharmaceuticals in wastewater. Altogether, there is a coalition and discourse structuration on emerging pollutants. However, the rate of institutionalisation is still lower than that of the market-pull discourse (and the second 'modernised-mixture' discourse), particularly regarding the interconnection with resource recovery and a CE. We elaborate on this in the fourth section.

4. Discussion

In the previous sections, we described the emergence of different interpretations on a transition in the Dutch wastewater system, and we aimed to explore the political struggles in such a transition. Therefore, two research questions were formulated. The first question, about how the transition is interpreted, was answered in the previous section by identifying three discourses. The second question was about how to understand the interpretations from a political perspective on transitions. We explore this question in three steps: we argue that the market-pull discourse is becoming dominant, discuss why this is so, and finally, reflect on what this means for a fundamental shift to sustainability in the Dutch wastewater system from a theoretical and empirical perspective.[5]

First, we argue that the market-pull discourse is becoming dominant. The results show that both the market-pull and water-quality coalition (regarding emerging pollutants) succeed in discourse structuration, although they struggle to define exactly what the priorities of a transition are (i.e. resource recovery or water quality). The storyline of the market-pull discourse is also institutionalised more broadly in documents, organisational practices and the optimisation of 24 treatment plants, particularly regarding resource recovery. On the contrary, the modernised-mixture coalition does not succeed in discourse structuration, and the discourse is barely institutionalised. As such, the market-pull discourse is becoming dominant and will most likely shape the future of the Dutch wastewater system, in line with a specific conception of what the problems and solutions are.

Second, the market-pull discourse draws on the existing infrastructure and current political-economic institutions of the Dutch wastewater system, which gives it an advantage in becoming dominant. On the one hand, we have the large-scale infrastructure that consists of sewers and centralised treatment plants (as described in the historical overview). The market-pull discourse chooses to optimise the large-scale plants to recover resources. Thus it is influenced by, and interacts with, the existing infrastructure. In fact, the large-scale infrastructure is taken for granted, becomes performative and exercises power. A choice for optimisation is then easily made, which is typical of large technological systems (Hughes, 1989; Walker, 2000). In this context, an interviewee observes: 'An alternative, possibly more sustainable, solution is nearly impossible because of the current infrastructure' (Interview 8). This suggests a transition pathway characterised by incremental changes and technological lock-ins.

On the other hand, we have the political-economic institutions. Here we also observe that the dominant discourse aims at incremental changes in the existing institutions, particularly if we concentrate on the roles of markets, governments and citizens. With regard to the role of markets, there is a focus on win-win situations, market development for green resources, legislative changes and R&D cooperation. This bears similarities to ecological modernisation (Dryzek, 2005), which has recently been linked to dominant ideas about the CE as well (Gregson, Crang, Fuller, & Holmes, 2015; Hobson & Lynch, 2016; Hofmann, 2019). Of particular interest

is the fact that ecological modernisation has been associated with the status quo and modest reformist strategies (Hopwood et al., 2005). Similarly, there are no fundamental shifts in the role of governing bodies; the same role is played by, for example, STOWA, the Dutch Water Authorities and the water boards. Furthermore, the role of citizens does not change; they remain passive. Stability and incremental changes in existing political-economic institutions suggest lock-ins.

This brings us to a third step in the discussion, focussing on the discrepancy between the increased calls for a transition and our findings on the dominant market-pull discourse, incremental changes and lock-ins. Questions may be raised about the nature of this transition and the different transition pathways to sustainability (Berkhout, Smith, & Stirling, 2004; Geels & Schot, 2007; Klitkou et al., 2015). Geels & Schot differentiate between (among others) so-called 'transformation', 'reconfiguration' and 'substitution' pathways. In our context of lock-in effects, the incumbent actors are, at most, gradually reorienting the established system (known as 'transformation'). This can be interpreted in two ways: over time, the incremental changes may lead to a sequence of transition pathways; a transition then shifts, for example, from 'transformation' to 'reconfiguration' (substantial changes in the economic and power structures), and eventually the 'substitution' of the whole system. However, and by contrast, our findings suggest that the market-pull discourse shapes a transition pathway that is characterised by lock-in effects instead of a fundamental shift in the established system.

Thus the market-pull discourse has an advantage in becoming dominant by drawing on the existing infrastructure and political-economic institutions. Both mechanisms give shape to a lock-in and undermine a fundamental shift in the wastewater system. This is in line with findings in other empirical studies on water/wastewater: the activities in the wastewater system are influenced by a dominant rationality that is characterised by the large-scale infrastructure and technological and economic efficiency (Fuenfschilling & Binz, 2018); and because effluent recovery may disrupt existing practices and ideologies of water management, it requires greater levels of control and thus concentrates on the existing centralised infrastructure, institutions and techno-scientific expertise (Meehan et al., 2013). Furthermore, it is clear that a wastewater transition platform such as the ERF may be constrained and captured by prevailing actors, institutions and infrastructure, which has been observed previously in other sectors (Raven et al., 2016; Shove & Walker, 2007; Smith & Kern, 2009). In this way, our findings indicate that a new discourse in the wastewater system may be conditioned by the past, particularly by the established infrastructure and institutions.

5. Conclusion

There are increasing calls for a transition in the Dutch wastewater system, and our discourse analysis has identified three interpretations of this transition. We have also shown that one discourse ('market-pull' discourse) is becoming dominant. It is most successful in defining what a transition is, according to a specific storyline about the optimisation of the large-scale infrastructure, market development and legislative changes. Subsequently, we argued that this discourse suggests, at most, incremental changes and draws on the existing infrastructure and political-economic institutions. This gives it an advantage in becoming dominant. Our findings also indicated that the discourse shapes a transition pathway that is characterised by lock-in effects that undermine a fundamental shift in the established system. Overall, and in line with recent research on the CE (e.g. Hofmann, 2019; Lazarevic & Valve, 2017; Moreau, Sahakian, van Griethuysen, & Vuille, 2017), the conflicts are not being played out yet and there are choices to be made about a transition towards a CE in the Dutch wastewater system.

Notes

1. STOWA and the Dutch Water Authorities play a role in more than one discourse. Hajer notes, however, that a discourse coalition is 'related to practices in the context of which actors employ story lines […] It thus becomes possible to come to terms with the fact that some actors might utter contradictory statements, or indeed help reproduce different discourse coalitions' (2006, p. 70).
2. This is a new biological and large-scale wastewater treatment technology in which the recovery of alginate-like polymers may be possible.

3. A company discharged a chemical compound (pyrazole) into the Meuse, this was detected by a (downstream) drinking water company which, in turn, filed a lawsuit.
4. It is likely that a similar prevention discourse (and coalitions and practices) may be found in, for example, the broader NGO sector. However, this is out of the scope of this paper.
5. Such a focus implies that the conflict between the content of the different discourses is not discussed in detail here. Nevertheless, the third section and Table 2 do highlight some of these conflicts.

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