Shifting from Government to Governance in Water Management: Analysis of the Social Ego Network of Dutch Water Authority, Extracted from News Articles

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Summary

This study aims to determine whether water management in the Netherlands has shifted the last two decades, from hierarchical central government towards collaborative governance, where the state collaborates with non-governmental stakeholders/organisations. Water management in the Netherlands was centralised with the foundation of Rijkswaterstaat in 1798, a governmental organisation that has water management as one of its main tasks. To see whether there is indeed a shift in the governance of water, this study analyses changes in the social ego network of Rijkswaterstaat. This social ego network is extracted from roughly 4000 news articles in 31 Dutch local newspapers, covering the period between 1995 and 2015. The co-occurrence statistics of Rijkswaterstaat with other organisations in these news articles are analysed. These organisations include governmental organisations, like Dutch municipalities, governmental services and water boards, and non-governmental organisations, like private companies, NGO's, nature organisations and research institutes.

In the news articles, the relative amount of mentions of non-governmental organisations with Rijkswaterstaat is increasing compared to governmental organisations. In 1995, roughly one out of three organisations that were mentioned in news articles were non-governmental, whereas this was one out of two in 2015. This indicates that relationships with non-governmental organisations have increased in the past few decades.

When using the social ego network as an indicator for the collaborative ego network of Rijkswaterstaat, it follows that Rijkswaterstaat increased collaboration with non-governmental organisations between 1995 and 2015. Thus water management in the Netherlands has indeed shifted in that period, from hierarchical central government towards more collaborative governance. In order to actually make this step from the social ego network to the collaborative ego network, sentiment analysis on the news articles is recommended.

Preface

This study started when I expressed my interest in flood management and Rijkswaterstaat. This was overheard by Jan Fliervoet, who was searching for someone to develop a method to extract the social ego network of Rijkswaterstaat from news articles. With my interest in Rijkswaterstaat and (very basic) experience with programming, this seemed like a perfect project for me. It has indeed been a fun project, and with so many people making this a positive experience for me, some thanks are in order.

I would like to thank Jan Fliervoet and Gertjan Geerling for supervising me during this project, and being so understandable, helpful and incredibly positive during the process. This really helped me, especially at the moments when I did not know how to proceed. I want to thank Rijkswaterstaat for letting me be an intern at their organisation, and specifically Astrid Bout, my supervisor at Rijkswaterstaat. My thanks also go to Riyan van den Born and Wieb Bosma, for being my second reader and science specialist respectively. Last but not least, my thanks go to Lorena van Duuren, who supported and motivated me, even during her own difficult moments.

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Contents

1 Introduction

The past few centuries, water management in the Netherlands and many other countries were mainly organised centrally by the government. Private companies, civilians and other local actors were usually not included in the process of decision-making. However, researchers indicate that the influence of non-governmental stakeholders in policy making has increased in the past few decades (Benson, Jordan, & Smith, 2013). Including these non-governmental actors in policy making is how collaborative governance is defined in this study.

1.1 From government to collaborative governance

There are multiple reasons to increase cooperation with non-governmental organisations. With the increasing complexity and existing expertise in water management it becomes harder and more expensive for the government to own all the information and expertise needed (Gray, 1989). By collaborating with other organisations, the government is no longer limited by its own expertise and resources, because they can use those of others as well (Huxham & Vangen, 2005). This is more efficient and less expensive than developing the expertise and resources by themselves. Another characteristic of a central, hierarchical government is that decisions are made top-down. This can lead to smaller, local problems being ignored and losing support of the public. By including multiple parties, conflicts and opposition can be avoided and implementation improved (Fliervoet, Geerling, Mostert, & Smits, 2016). However, this does not always have to be the case. Actors might only have their own interests at heart, instead of desiring to contribute towards finding a solution that is best for everyone. This can result in the collaboration not having a useful outcome, for instance a symbolic outcome like a wish list, or even no outcome at all (Bodin, 2017).

Some research has been done on the shift from government to collaborative governance in countries all around the world, such as the United States of America, Australia and England (Benson et al., 2013; Hardy & Koontz, 2009). Benson et al. (2013) argued that in all of these countries water management did indeed shift to collaborative governance, though in different ways and degrees. A clear example of a shift to collaborative governance can be observed in the Water Framework Directive (WFD)[1], introduced by the European Union in 2000. Purpose of the WFD was “to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater” (WFD, Article 1, purpose). Though

[1] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000: establishing a framework for Community action in the field of water policy

more collaboration was not the prime purpose of the WFD, it is considered as an important factor to achieve the goals of the WFD. In Article 14, the member states are told to "encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans". The river basin management plans for the four river basins in the Netherlands, as described in the WFD, all pay attention to collaborating more, mainly with the public and NGOs.

1.2 Rijkswaterstaat

As Benson et al. (2013) point out, empirical research on the extent of the shift to collaborative governance in water management is scarce. This study aims to do this by analysing the social ego network of Rijkswaterstaat, the executive bureau of the Dutch Ministry of Infrastructure and the Environment. All operational management tasks in water management in the Netherlands fall under their responsibility. They describe their mission as follows: 'We manage and develop the roads, waterways and waters of the state and bet on a sustainable environment. Together with others we work on a country protected against floods. Where there is enough green and clean water. And where you can go quickly and safely from A to B. Working together on a safe, liveable and accessible Netherlands. That is Rijkswaterstaat.'[2]. They already included working together in this statement, implying they intend to be more collaborative. The fact that they emphasize working together does not necessarily mean that this is actually happening. An example of this is water management in England, which got more centralised in the past few decades (Watson, Deeming, & Treffny, 2009). This study aims to see whether Rijkswaterstaat, in the area of water management, is actually working together more or not.

1.3 Social Network Analysis

To see whether the collaborative ego network of Rijkswaterstaat has changed over the years, the social ego network of Rijkswaterstaat will be analysed. A social network is a graph, which consists of nodes and ties. The nodes represent certain actors, and the ties represent the relationships between those actors. Various properties can be derived from such a network, such as the strength and centrality of a network. A social ego network is a subgraph of a social network, and consists of:

- A node that is considered the 'ego'
- The nodes that the ego is connected to, called the 'alters'
- The ties between the 'ego' and the 'alters'
- Usually, but not necessarily, the ties between the 'alters'

[2] Translated from: https://www.rijkswaterstaat.nl/over-ons/onze-organisatie/onze-missie/index.aspx

The study of social structures, represented by networks or graphs, is called Social Network Analysis (SNA). How a social network is structured, and what kind of relational ties there are between actors, can give an indication of how much collaboration there is (Chaffin, Garmestani, Gosnell, & Craig, 2016). An example of SNA being used in water management is given by Lienert et al. (2013), who did a stakeholder analysis and social network analysis to gain insight in the process of infrastructure planning in the Swiss water sector (Lienert, Schnetzer, & Ingold, 2013).

1.4 Research goal and questions

The goal of this research is to investigate whether water management in the Netherlands has shifted from hierarchical government to a more collaborative governance. This will be researched by doing a case study on the social ego network of Rijkswaterstaat in the period from 1995 till 2015. This social ego network will be extracted from newspapers, from which objective measures on the network can be obtained (Diani, 2002). The main research question and sub questions are stated below.

Main research question:

> To what extent is there a shift from hierarchical government towards collaborative governance in the collaborative ego network of Rijkswaterstaat, based on newspapers between 1995 and 2015?

Sub questions:

1. How can we extract the collaborative ego network of Rijkswaterstaat over the period 1995 till 2015 by making use of newspapers?
2. How have the collaborative relationships of Rijkswaterstaat changed in the period between 1995 and 2015 with regard to degree centrality (number of ties)?
3. To what categories do the organisations mentioned with Rijkswaterstaat belong, and how does this change in the period between 1995 and 2015?
4. Which (group of) organisations play a dominant role in the social ego network over time?
5. What do changes in the social ego network mean for the transition to collaborative governance?

2 Theoretical Framework

2.1 Collaboration

In literature, collaboration has been defined in many ways (Benson et al., 2013). An early definition was given by (Gray, 1989) who defined collaboration as a process where multiple parties could explore their differences and come to a solution. Other definitions include that power and responsibility should be shared between stakeholders (Selin & Chavez, 1995), multi-party relationships should be voluntary (Yaffee & Wondolleck, 2000) and that there should be some rules that guarantee decisions made are with relative consensus (Hannum, 2006). From all these definitions, universal indicators of collaboration can be extracted (Benson et al., 2013). The first is the amount, and what kind of stakeholders are involved in the process. This goes from only state agencies, corresponding to a central control, to multiple and various stakeholders, corresponding to collaborative governance. Secondly, there is the way of decision-making. In collaborative governance the stakeholders try to reach some consensus by negotiating, where in central control decision are made centrally. Thirdly, the rules of collaboration are important. Which stakeholders interact with each other, and how (Hardy & Koontz, 2009). These rules can be established together, or just centrally by the government. Finally, there is the scale of interaction and exercise of power. Central control usually implements decisions on a national level, where collaborative governance can decide to implement decisions only on the problem itself, sometimes even going against national jurisdictions (Karkkainen, 2004).

2.2 Collaboration in the EU through time

In the past few decades there has been a shift, in the European Union, to collaborative governance. According to Huitema & Meijerink (2014), this started in the 1980s. Benson et al. (2013) even state that it started in the 1970s, with the rise of transboundary water-pollution problems. This increase in collaboration was mainly between members of the EU. The EU imposed standards on water quality and environment, forcing actors in water management to work with stakeholders in environment as well. Policy making still remained in central control and was ignoring the public, since this was easier (Benson et al., 2013). The water framework directive, implemented in 2000, tried to change this. As explained in the introduction, the WFD encouraged collaboration in water management with all interested stakeholders. The use of transboundary river basins also meant some members of the EU had to work together when they shared one or more river basins. To see whether stakeholder participation was indeed increased in the EU, Jager et al. (2016) examined 13 member states over the period 2000-2009. These states were: Austria, Czechia, Denmark, England and Wales, France, Germany, Hungary, Ireland, the

Netherlands, Poland, Scotland, Spain, and Sweden. Their results showed that in every state, except for Denmark, stakeholder participation was increased. In the Netherlands this increase was not very high, but this might have been because stakeholder participation was already quite high to begin with. Despite collaboration seemingly high in Dutch water management, Fliervoet et al. (2016) concluded that the governmental organisations still have a dominant and controlling role, based on a social network analysis in the context of maintaining Dutch floodplains.

2.3 Measures on social ego networks

As explained in the introduction, social ego networks are subgraphs of a social network. An example of a social ego network would be that of someone on Facebook. That person would be the ego, his or her friends the alters with which he or she is connected, and connections between those friends the ties between alters. The different sorts of measures in table 1 can be used when the alter attributes are known, even when the social ego network only consists of ego-alter ties and there are no alter-alter ties (Borgatti, Everett, & Johnson, 2013).

Table 1: Different sorts of measures used on social ego networks

Measure	**Explanation**
Tie analysis: central tendency	Counting the number or proportion of ties of a given type.
Tie analysis: dispersion	Dispersion refers to how evenly ego's ties are distributed across tie catergories.
Alter analysis: central tendency	Counts or proportions of number of alters in each category.
Alter analysis: dispersion or heterogeneity	Dispersion refers to how evenly alters are distributed across categories.
Ego-alter similarity	Ego-alter similarity refers to how similar the ego is to its alters.

2.4 Finding social (ego) networks

Finding good and effective methods to analyse collaboration in water management is very challenging, but SNA can be used to do this at least partly (Stein, Ernstson, & Barron, 2011). A network can be found by simply asking every actor whether they have a relationship to the other actors (Fliervoet et al., 2016; Stein et al., 2011) or by finding the relationship between actors in a different way (Chaffin et al., 2016). This first method gives the social network at a certain point in time. However, social networks evolve through time (Calastri, Hess, Daly, Carrasco, & Choudhury, 2018). When looking at the social network in the past, a problem arises with this method of simply asking the actors. It relies on the memory of the actors, which is not always perfect. This problem becomes bigger when looking back in time further. A different source of data to extract a social network from are newspapers (van Atteveldt, Kleinnijenhuis, & Ruigrok, 2008). The existence of relationships between actors can be determined by simply looking at co-occurrence statistics. To derive qualified relationships (such as collaborations), linguistic patterns have to be analysed as well (Pouliquen, Tanev, & Atkinson, 2008). In both cases, computer content analysis makes it possible to analyse large sets of texts quickly and efficiently. This has been particularly successful for co-occurrence counts (van Atteveldt et al., 2008), which will also be done in this study.

3 Methodology

To see whether, in water management in the Netherlands, there is a shift from central hierarchical government to a more collaborative governance, this study will look at the collaborative ego network of Rijkswaterstaat. This Dutch agency is responsible for, among other things, water management in the Netherlands. The next section provides some more information about Rijkswaterstaat, why it is suitable for this research and how this research was done.

3.1 Rijkswaterstaat

As the executive agency of the Ministry of Infrastructure and Water Management, Rijkswaterstaat is responsible for the Dutch main road network, the main waterway network, the main water systems, and the environment in which they are embedded[3]. The agency was founded in 1798 as a response to the bad state of flood protection in the Netherlands[4]. In the 19th century, Rijkswaterstaat was also tasked with maintenance and development of roads, bridges and the train track network. In the 20th century improvements in technology allowed for greater projects. The most notable ones are the Afsluitdijk and the Delta Works. The first one is a major dam (and causeway) that turned a saltwater inlet of the North Sea, known as Zuiderzee, into a lake, now known as IJsselmeer. The second one is a large series of construction projects that were made to protect the South West of the Netherlands against floods, as a reaction to the North Sea flood of 1953. On the website of Rijkswaterstaat they claim that, since 1970, they have been collaborating more with the market and civilians.

The choice of Rijkswaterstaat for this case study was made because they are responsible for river management and flood protection in the Netherlands. They have, because of their authority given by the government, a central role in water management in the Netherlands. This central role is illustrated by the results of Fliervoet et al. (2016), in which Rijkswaterstaat was acknowledged as a partner by a large number of the organisations in their study.

3.2 Social Network Analysis

In 2015, an analysis was done by Fliervoet et al. (2016) on the social network including the organisations involved with maintenance of the floodplains of the river Waal. One of these organisations was Rijkswaterstaat. The ties between organisations were determined based on questionnaires send to each

[3] https://www.government.nl/ministries/ministry-of-infrastructure-and-water-management/organisation
[4] https://www.rijkswaterstaat.nl/over-ons/onze-organisatie/onze-historie/index.aspx

of these organisations. This way, the social network of the organisations involved was determined. However, this method is not suitable for determining how the social network was in the past.

This study focusses on changes in the social ego network of Rijkswaterstaat. The data used to determine these changes was extracted from Dutch newspapers. The organisations that Rijkswaterstaat had a relationship with were clustered into nine different groups. The clustering was done by distinguishing the different main tasks or functions these organisations have. This resulted in the following groups: government (local), government (national), political, water boards, private companies, NGO's, research institutes, nature organisations and other.

3.3 Data Collection

To analyse changes in the social ego network of Rijkswaterstaat, articles from Dutch regional newspapers in LexisNexis were used. LexisNexis is a digital database that consists of articles from regional, national and international newspapers and journals. The first Dutch newspapers and journals have been added to the database in 1990 and their amount has been growing since then. This study uses the newspapers classified by LexisNexis as local newspapers. LexisNexis had no option to download national and local newspapers at the same time, so a choice was made between the two. The choice for local newspapers was made because these describe relationships on both a regional and national level, whereas most relationships on a regional level are likely not visible in national newspapers. Changes in the number of newspapers were analysed by checking for every newspaper that LexisNexis listed as local newspaper, when that newspaper was added to the database and, in some cases, when they were removed.

Since this study only focusses on the relationships of Rijkswaterstaat concerning water management, only water management themed articles that included Rijkswaterstaat were needed. One way to do this is by classifying all articles that included Rijkswaterstaat by hand, and only take the ones that were about water management. This is a lot of work and not very suitable for analysing large amounts of news articles, something this study does aim to do. Therefore, an appropriate search term was developed. For each article in the month of June 2010 that contained the name 'Rijkswaterstaat', it was determined whether that article water management related or not. Different search terms were done and the amount of false positives (articles found that were not water management related) and false negatives (articles that were water management related, but not found with that search term) were compared. The best search term was chosen, which was:

Rijkswaterstaat AND (water! OR rivier! OR dijk! OR IJssel OR Maas OR Waal OR Rijn) AND NOT (water/ZON/MAAN OR brug OR bruggen OR sluis OR sluizen OR ongeluk OR verkeer OR snelweg! OR file OR wrak OR haven OR parkeer!) AND NOT (A1 OR A2 OR A3 OR A4 OR A5 OR A6 OR A7 OR A8 OR A9 OR A10 OR A11 OR A12 OR A13 OR A14 OR A15 OR A16 OR A17 OR A18 OR A19 OR A20 OR A21 OR A22 OR A23 OR A24 OR A25 OR A26 OR A27 OR A28 OR A29 OR A30 OR A31 OR A32 OR A35 OR A37 OR A38 OR A44 OR A50 OR A58 OR A59 OR A65 OR A67 OR A73 OR A74 OR A76 OR A77 OR A79 OR A200 OR A208 OR A256 OR A270 OR A325 A326 OR A348 OR A783) AND NOT (N1! OR N2! OR N3! OR N4! OR N5! OR N6! OR N7! OR N8! OR N9!)

This search term was used within local newspapers in the years 1995, 2000, 2005, 2010 and 2015. From LexisNexis, the comma separated file was downloaded, which contained the following data for each article: author, date, headline, amount of words and which newspaper it was in. An extra column was later added to the file, containing the text of the article. Double articles and adjusted articles were filtered out by a script that compared every title with the 20 titles that came before that. Since the articles are in chronological order of publication, articles that were published in multiple newspapers or got adjusted were filtered out. This mainly happened with the Stentor and AD, two newspapers that have local newspapers in different places, but sometimes use one article in multiple of those local newspapers.

3.4 Frog

To find the organisations in the articles, a program called Frog[5] (formerly known as Tadpole, and MB-TALPA before that) was used. It is an integration of memory-based natural language processing modules that were developed for the Dutch language (Van den Bosch, Busser, Daelemans, & Canisius, 2007). These modules were created with a memory-based learning software package of the Tilburg University, called Timbl. For this study, the named entity recogniser of Frog was used to find organisations. This named entity recogniser determines whether a word is a named entity or not. If it is, it also determines whether it is a location, person, organisation, product, event or miscellaneous. The named entities that were labelled as organisations were checked by the researcher and then divided into the groups named in section 3.2.

3.5 Data analysis

To analyse changes in the social ego network, this study uses the metrics of table 2. Metric a measures the number of unique organisations in a group. Metric b does the same, but relative to the total number

[5] Further details and a manual can be found here: https://languagemachines.github.io/frog/

of unique organisations. Metric c measures the number of articles an organisation is mentioned in. This is important to determine the intensity of the relationship between Rijkswaterstaat and that organisation. Metric d takes the sum of $c(x)$ over all organisations x in a group, and metric e does the same, but relative to the sum over all groups. All these measures fall under 'alter analysis: central tendency' as described in table 1. Metrics b and e both give a good indication how the focus of Rijkswaterstaat in relationships with other organisations changed. The latter takes into account how intensive relationships with some organisations were and is therefore preferred to the other one.

Table 2: Metrics to measure co-occurrence statistics of Rijkswaterstaat with other organisations

Metric	Definition and explanation
$\boldsymbol{a(S)}$	Number of unique organisations in group S: For the group S the number of different organisations that are mentioned is determined.
$\boldsymbol{b(S) = \frac{a(S)}{\sum_X a(X)}}$	Relative amount of unique organisations in group S: $a(S)$ divided by the total number of unique organisations.
$\boldsymbol{c(x)}$	Number of articles organisation x is mentioned in: For an organisation x, the number of different articles it is mentioned in is counted. It does not matter how many times the organisation is mentioned in an article, only whether it is mentioned or not.
$\boldsymbol{d(S) = \sum_{x \in S} c(x)}$	Sum of number of articles that every organisation in group S are mentioned in: Over every organisation x that is in group S, the number of articles organisation x is mentioned in ($c(x)$) is summed.
$\boldsymbol{e(S) = \frac{d(S)}{\sum_X d(X)}}$	Relative sum of amount of articles that every organisation in group S is mentioned in: The sum of number of articles that every organisation in group S is mentioned in ($d(S)$), divided by the sum of number of articles that every organisation in every group is mentioned in.

4 Results

In this chapter the results will be presented and analysed. The number of articles and newspapers that were included in the search will be the starting point. After this, the organisations that were found are divided into groups and counted per group. The difference in government- and non-government-organisations will be discussed and finally which organisations were mentioned the most with Rijkswaterstaat.

4.1 Number of articles

To get some perspective on the results, the number of articles will be discussed where both Rijkswaterstaat was mentioned and the subject was about water management. Table 3 shows that this number increases considerably between 1995 and 2015; from 361 to 1229. The largest increase takes place between 2000 and 2005, which is when the number of newspapers included in the search also increases considerably. The reason for this is that, in de period from 2002 and 2004, there were 15 new regional Dutch newspapers added to LexisNexis. The average number of articles per newspaper in the search stay roughly the same between 2000 and 2010. It goes significantly down from 40.11 to 35.83 between 1995 and 2000, and significantly up from 35.19 to 42.38 between 2010 and 2015, as can be seen in table 3.

Table 3: Number of articles and newspapers

	1995	2000	2005	2010	2015
Articles	361	430	904	1091	1229
Newspapers	9	12	27	31	29
Average number of articles per newspaper	40.11	35.83	33.48	35.19	42.38

4.2 Groups of organisations

There are multiple kinds of organisations that Rijkswaterstaat was mentioned with. To be able to analyse the results, the organisations were divided into different groups. This makes it possible to see changes and patterns in with who Rijkswaterstaat was mentioned as time progresses. The groups are described in table 4. The first four groups are related to the government, because they are part of or have gotten authority from the government. The other five groups are not related to the government.

Table 4: Different groups of organisations

Groups	Description
Government (local)	Government authorities on a local level. Examples: *municipalities, provinces.*
Government (national)	Government authorities on a national or international level. Examples: *ministries, European Union, police.*
Political	Any organisation that is political but has no actual authority on its own. Examples: *political parties (local and national)*
Water boards	Water boards are local government authorities that are responsible for water safety and water quality in their region.
Private companies	Organisations that aim to make a profit. Examples: *banks, energy companies, law firms.*
NGO's	Non-government organisations that are non-profit. Examples: *trade unions, residents committees, charities.*
Research institutes	Institutes used for research or preserving knowledge/data. Examples: *universities, national institutes, private research institutes.*
Nature organisations	Organisations whose primary aim is to protect or preserve nature. Examples: *WNF, Greenpeace, committees for protection of certain parts of nature.*
Other	All kinds of organisations that do not fit at the above groups. Examples: *sport clubs, educational institutes.*

4.3 Number of organisations

Table 5 uses metric b from table 2 to show the number of different organisations that were found in the articles, divided in separate groups. For instance, in 1995 there were 91 different organisations that belonged to the government (local) group. Note that this gives no indication in how many articles these different organisations were found, because some organisations could have been found in multiple articles.

Table 5: Number of different organisations per group (metric b from table 2)

	1995	2000	2005	2010	2015
Government (Local)	91	87	131	144	125
Government (National)	21	26	44	31	42
Political	18	15	23	22	24
Water Boards	9	13	8	4	6
Private Companies	41	28	64	67	88
NGO's	38	50	71	68	98
Research Institutes	12	23	38	36	43
Nature Organisations	7	7	12	16	27
Other	6	10	38	29	43
Total	243	259	429	417	496

Between 1995 and 2015 the total number of different organisations more than doubles, from 243 to 496. The largest increase takes place between 2000 and 2005. This is also the moment when the dataset becomes larger, as shown in table 3. In every year, the government (local) group has by far the most organisations, followed on a distance by NGO's and private companies. The group with water boards declines after 2000, even though that is the moment is when the total number of organisations increases significantly. Private companies on the other hand increases after 2000, after a decrease between 1995 and 2000. The groups with research institutes and nature organisations both almost quadruple over the entire time period.

4.4 Number of mentions with Rijkswaterstaat

The results above are about with how many different organisations in a group Rijkswaterstaat was mentioned. However, this data completely ignores in how many different articles an organisation was mentioned with Rijkswaterstaat. Metric b takes this into account, giving a better indicator for the intensity of the relationship of Rijkswaterstaat with a group of organisations. Note that here the assumption is made that the number of articles an organisation is mentioned in is an indicator on the intensity of the relation between Rijkswaterstaat and that organisation. Table 6 shows, for each group, the sum of the number of articles that organisations from that group were mentioned in.

Table 6: Sum of number of articles that organisations from a group were mentioned in (metric d from table 2)

	1995	2000	2005	2010	2015
Government (Local)	191	173	371	319	341
Government (National)	24	44	125	105	70
Political	40	41	162	105	131
Water Boards	17	18	15	18	20
Private Companies	54	33	101	107	132
NGO's	53	75	117	145	182
Research Institutes	20	45	75	69	75
Nature Organisations	10	12	24	35	84
Other	6	11	50	41	54
Total	415	452	1040	944	1089

Between 2000 and 2005 the total increases from 452 to 1040, again because there are considerably more newspapers in the database in 2005 (table 3). This increase in data increases reliability of the results, but also makes it harder to see patterns or changes in the data. To be able to see changes in relationships with

the different groups, the total number of relationships should be taken into account. Table 7 shows for every group, how much of the total number of relationships was with that group. For example, in 1995, 13% of all relationships of Rijkswaterstaat were with the group Private Companies.

Table 7: Relative sum of number of articles that organisations from a group were mentioned in (metric e from table 2)

	1995	2000	2005	2010	2015
Government (Local)	46%	38%	36%	34%	31%
Government (National)	6%	10%	12%	11%	6%
Political	10%	9%	16%	11%	12%
Water Boards	4%	4%	1%	2%	2%
Private Companies	13%	7%	10%	11%	12%
NGO's	13%	17%	11%	15%	17%
Research Institutes	5%	10%	7%	7%	7%
Nature Organisations	2%	3%	2%	4%	8%
Other	1%	2%	5%	4%	5%
Total	100%	100%	100%	100%	100%

Figure 1 depicts table 7, and shows how the relationships with organisations from different groups changed over time. The relative amount of relationships with local governments decreases over the entire period, from almost half of all relationships to less than a third of all relationships. The other groups are relatively small, but change quite a lot over time. Government (national) doubles between 1995 and 2005, but then goes back to its starting level between the years 2005 and 2015. Water boards decreases a lot after 2000, from 4% to 1-2%. Relationships with private companies decreased from 13% to 7% between 1995 and 2000, but has been increasing since then. Similarly the relative amount of relationships with NGO's seem to be increasing every 5 year, except between 2000 and 2005. The group research institutes has been stable since 2005, after it first increased significantly between 1995 and 2000 and decreasing (a bit less) between 2000 and 2005. Relationships with nature organisations has taken off in the last 10 years, from 2-3% between 1995 and 2005 till 8% in 2015.

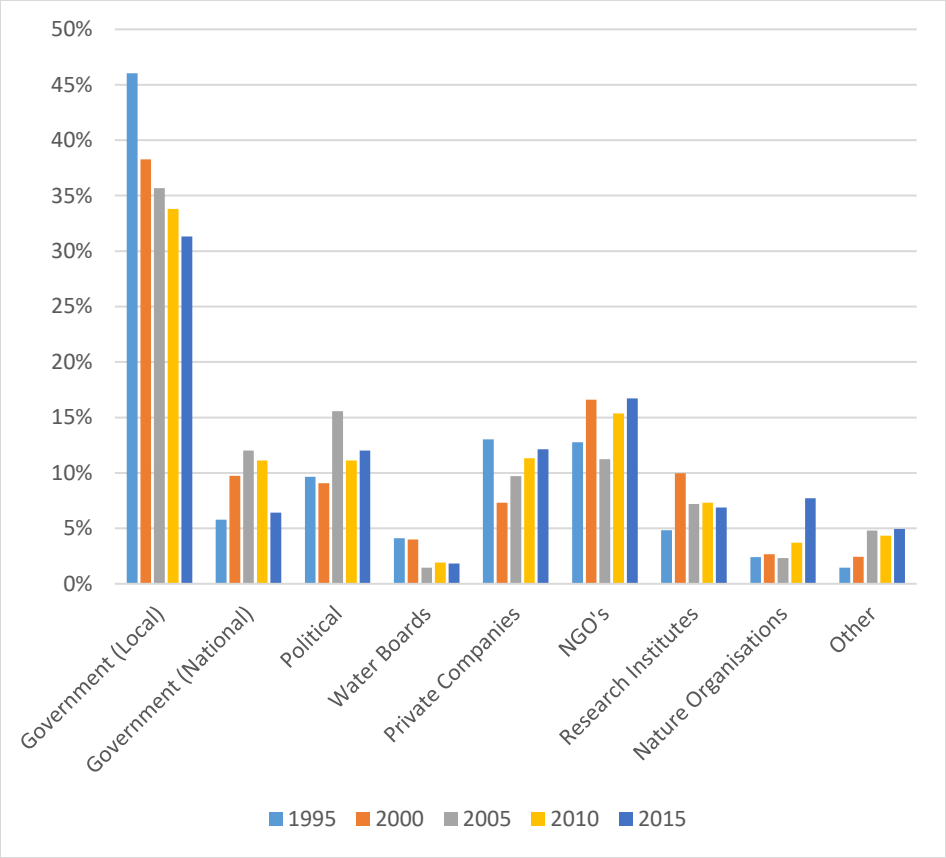

Figure 1: Relative sum of number of articles that organisations from a group were mentioned in (metric e from table 2)

4.5 Government vs Non-Government

To see whether Rijkswaterstaat is being mentioned more with non-governmental organisations, the groups are grouped into government and non-government. The government group consist of the organisations that were in these previous groups: government (local), government (national) and water boards. The non-government group consist of these previous groups: private companies, NGO's, research institutes and nature organisations. Note that the groups 'political' and 'other' are omitted. This is because for these groups it was judged that in most cases there was no direct contact between Rijkswaterstaat and the organisations from that group.

Figure 2 uses metric d from table 2 to show how often organisations from the government and non-government groups were mentioned with Rijkswaterstaat. The data belonging to this figure can be found in the supplementary data, table SD1. The non-government group has been increasing every 5 years from 1995 to 2015, whereas the government group has been decreasing since 2005. Most notable is that in 2015, non-governmental organisations were mentioned with Rijkswaterstaat more often than governmental organisations for the first time.

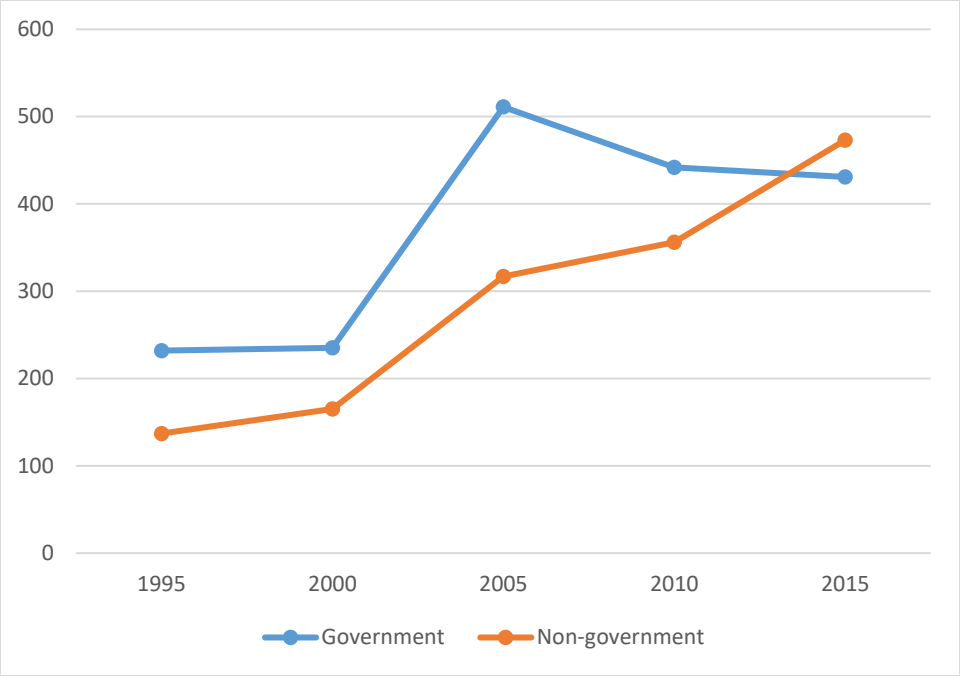

Figure 2: Sum of number of articles that organisations from the two groups were mentioned in (metric d from table 2)

To be able to look at the changes and patterns in the social ego network of Rijkswaterstaat, it is again better to look at how the number of mentions with organisations from a certain group holds against the total number of mentions in that year. This is depicted in figure 3, of which the corresponding data can be found in the supplementary data, table SD2.

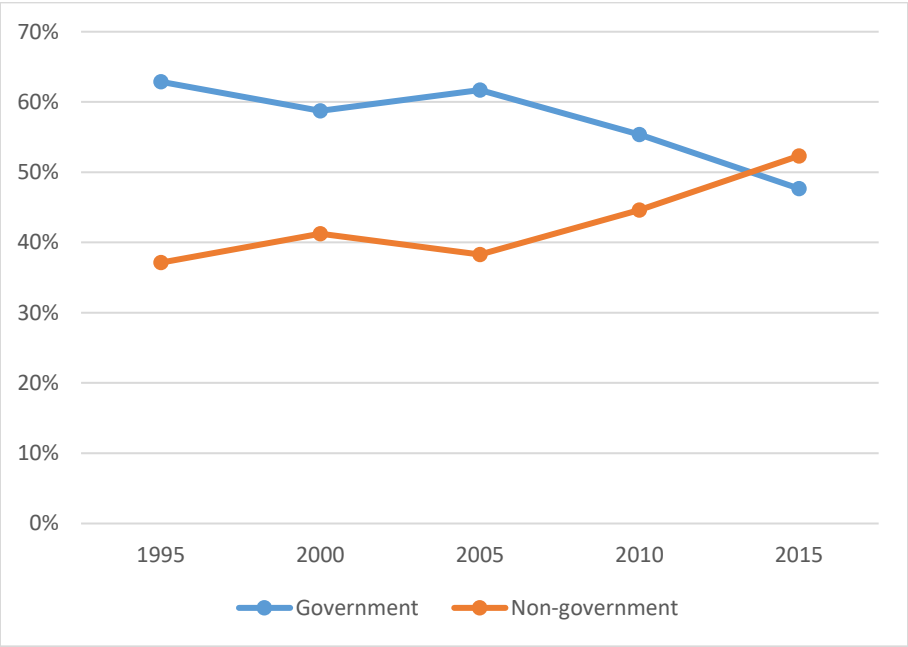

Figure 3: Relative sum of number of articles that organisations from the two groups were mentioned in (metric e from table 2)

In figure 3 it is shown that in 1995, 63% of all organisations that were mentioned were organisations from the government group and only 37% were organisations from the non-government group. These two numbers have become more close to each other, with as final result that in 2015, 48% of all mentions were with organisations in the government group and 52% with the non-government group. There has been only one period where mentions with the government group increased, namely between 2000 and 2005. As shown in table 3, this was the period where more newspapers were added to the dataset. This could have had an effect on the results.

4.6 Common organisations

In this paragraph, the organisations that were mentioned the most, or most consistently, will be discussed. A short overview is given in table 8, which shows the most common organisations per group.

In the government (local) group there are a lot of organisations, mainly municipalities and provinces, which occur in multiple years. In every year however, the organisation that appears the most is the province of Gelderland. Through this province, which is in the south east of the Netherlands, run the rivers IJssel, Waal and Rhine. Another river, the Maas, forms the border with the province North Brabant. Within the government (national) group, Rijkswaterstaat is often mentioned with the State Forestry Service (in Dutch: Staatsbosbeheer) and Government Service for Land and Water Management (in Dutch: Dienst Landelijk Gebied). The State Forestry Service is an organisation that, on behalf of the Dutch government, manages the forests and nature reserves in the Netherlands. The Government Service for Land and Water Management was a part of the Ministry of Economic Affairs and was responsible for the development of rural areas. As of March 2015, the Government Service for Land and Water Management is disbanded. Of the private companies, only NS and Heijmans are consistently mentioned with Rijkswaterstaat, though not very intensively. NS (Dutch Railroads) is the organisation that is doing the exploitation of (a large part of) the Dutch railroad network, and Heijmans is a large construction-service business. Commonly mentioned NGO's are the Royal Dutch Touring Club (In Dutch: ANWB), the Royal Netherlands Meteorological Institute (in Dutch: KNMI) and the Southern Agriculture and Horticulture Organisation (in Dutch: ZLTO). Table 8 also states that the society for preservation of nature monuments in the Netherlands (in Dutch: Natuurmonumenten) was a commonly mentioned organisation. Except for in 2005, they were the nature organisation that was mentioned the most with Rijkswaterstaat. In 2015 they were even mentioned in 41 different articles. From 1995 to 2005 there were relationships with the Royal Institute for Coast and Sea (in Dutch: Rijksinstituut voor Kust en Zee), but this research institute was disbanded in 2007. From 2000 to 2015, the Dutch Organisation for Applied Scientific Research (in Dutch:

Nederlandse organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek) was mentioned a lot. Since 2010, some more private research organisations are mentioned, like Deltares and Imares. The group with water boards and the 'others' group do not have organisations that were mentioned very often. The first group is rather small, and the latter is very diverse.

Table 8: Most common organisations per group

Group	Most common organisation(s)
Government (local)	Province of Gelderland
Government (national)	State Forestry Service, Government Service for Land and Water Management (DLG)
Water boards	-
Private companies	NS, Heijmans
NGO's	Royal Dutch Touring Club (ANWB), Royal Netherlands Meteorological Institute (KNMI), KNRM, Southern Agriculture and Horticulture Organisation (ZLTO)
Research institutes	Royal Institute for Coast and Sea (RIKZ), Dutch Organisation for Applied Scientific Research (TNO), Deltares
Nature organisations	Society for preservation of nature monuments in the Netherlands (Stichting Natuurmonumenten)

4.7 Organisations found by Fliervoet et al. (2016)

In 2015, Fliervoet et al. (2016) conducted a questionnaire among organisations that cooperated in the 'WaalWeelde' (in English: 'Wealthy Waal') program. This program was an experiment that aimed to connect public, private, and societal organisations and involve them in the planning and implementation of river management among the river Waal (Smits, 2009).

The network that was built using this questionnaire, shows that Rijkswaterstaat had reciprocal ties with five organisations or actors, where both Rijkswaterstaat and the other organisation/actor indicated that they had at least monthly contact with each other. These actors can be found in table 9.

Table 9: Organisations in Fliervoet et al. (2016) that had reciprocal monthly ties with Rijkswaterstaat

Organisation	**Number of articles it was mentioned in (2015)**
Delta Program	0
Deltares	5
Government Service for Land and Water Management	0
Province of Gelderland: WaalWeelde program	21 (as Province of Gelderland)
State Forestry Service: Region East	18 (as State Forestry Service)

From these five organisations, three were extracted from the news articles as well. One of the other two, 'Delta Program', was not regarded as an organisation by the Frog program. Therefore, it also did not appear in the results. The other organisation, the Government Service for Land and Water Management, was disbanded on March 1st, 2015. So, it is not surprising that this organisation was not mentioned with Rijkswaterstaat in news articles in 2015. It is worth noticing that they did appear in the results of 2000, 2005 and 2010 (in 7, 11 and 5 articles respectively). It seems that the method used in this study was at least able to find the organisations (that took part in the questionnaire) which had the most contact with Rijkswaterstaat.

The Society for preservation of nature monuments in the Netherlands was mentioned 41 times, so a relationship with Rijkswaterstaat would be expected. In the questionnaire conducted by Fliervoet et al. (2016) this organisation indicated they only had quarterly contact with Rijkswaterstaat, whereas Rijkswaterstaat indicated they had monthly contact with the Society for preservation of nature monuments in the Netherlands. Other commonly mentioned organisations in 2015, like the Dutch Railroads (NS), the Southern Agriculture and Horticulture Organisation (ZLTO), the Royal Dutch Touring Club (ANWB), the Royal Netherlands Meteorological Institute (KNMI) and Dutch municipalities outside of the floodplain area studied by Fliervoet et al. (2016), did not take part in the questionnaire.

5 Discussion

Here the results and method will be discussed and compared with previous literature. First the implications of the results will be analysed. Changes in the number of mentions with the governmental and non-governmental groups are used to discuss whether water management in the Netherlands is shifting towards collaborative governance or not. Finally, the method and its limitations are discussed and recommendations for the future are given.

5.1 Governmental organisations

Table 7 shows that the relative amount of mentions of the largest group, government (local), has decreased from 46% to 31% between 1995 and 2015. This implies that Rijkswaterstaat has relatively less relationships with organisations from that group than before. However, part of this decrease could be explained by mergers between municipalities that have taken place since 1995. Suppose that two municipalities were both mentioned with Rijkswaterstaat in the same article in 1995. Then they were counted as two organisations that Rijkswaterstaat had a relationship with. However, if those two municipalities merged with each other after 1995 and the article would have been written after that, then it would have counted as only one organisation that Rijkswaterstaat had a relationship with. Because of this, some decrease in the government (local) group would be expected. Since the municipalities take up a large part of the government (local) group, varying from 50,8% to 64,6% (table SD3), the effect might be significant. In 2015, there were only 393 municipalities left, against 633 in 1995.

The same issue rises with the water boards. In 1995 there were more than 80 water boards in the Netherlands, whereas in 2005 there were only 26 left. Since then there have been only a few more mergers, with as result that in 2015, the number of water boards was 24. This decline can also be seen in table 7, where mentions of water boards decline significantly after 2000 and then stay stable.

In contrast to the previous two governmental groups, the relative amount of mentions of the government (national) group increased in the first few years. In 2000, 2005 and 2010 this group makes up more than 10% of all mentions of organisations with Rijkswaterstaat. These are also the first years that the Water Framework Directive (WFD) was being implemented by the European Union, starting in the year 2000. The effect of the WFD was expected to be that relationships with non-governmental organisations would rise, but the first increase of mentions of the governmental (national) group could also be related to this, since it was implemented by the EU and Dutch government. After 2005 this group has been declining

again, and could have been even lower in 2010 if the National Police Services Agency (Dutch: KLPD) would not have been so present that year with 28 mentions.

5.2 Non-governmental organisations

The increasing complexity and existing expertise in water management makes it harder and more expensive for the government to have all the information and expertise needed (Gray, 1989). However, relationships with research institutes have not increased that much between 1995 and 2015, based on the regional newspapers that were analysed. There was a large increase in the first 5 years, from 5% to 10%, but after 2000 this went back down to 7% and remained there until 2015. A possible explanation for this could be that research is usually only covered in the news when there are results that are interesting to the public.

Where the group with research institutes stayed around 7% between 2005 and 2015, mentions of Rijkswaterstaat with nature organisations has risen from 2% to 8% in that period. It would make sense if they had contact with nature organisations more often, because attention for environmental topics has been rising. More specifically, the "Plan Stork" (Bruin et al., 1987) has brought more attention to the biodiversity of the floodplains in the Netherlands (Fliervoet, Van den Born, Smits, & Knippenberg, 2013). This rise in attention could very well lead to nature organisations being mentioned more often in newspapers.

For group with private companies, an increase in relationships was expected. Private companies can have expertise and resources that Rijkswaterstaat does not have, making it necessary to increase relations with these private companies. This increase indeed took place between 2000 and 2015, but not between 1995 and 2000, when the relative amount of mentions almost halved from 13% to 7%.

The group with NGO's consist largely of interest groups. According to Jager et al. (2016), stakeholder involvement in water management in the Netherlands has somewhat increased in the period from 2000 till 2009, so an increase in relationships with NGO's was expected. However, between 2000 and 2005, the relative amount of mentions of this group actually decreased, from 17% to 11%. In the periods from 1995 to 2000, and 2005 to 2015, it was increasing again.

5.3 Non-governmental groups vs. governmental groups

From the nine groups that were made, there are two that are not interesting for the research question. The political group consists of political parties, which have no direct collaborative contact with Rijkswaterstaat. The same holds for the 'other' group, which largely consists of organisations like

educational institutes, sport clubs and other organisations that do not (directly) work together with Rijkswaterstaat. The other seven groups were divided into governmental groups (government (local), government (national) and water boards) and non-governmental groups (private companies, NGO's, research institutes and nature organisations). The ratio 'governmental : non-governmental' has changed from 63 : 37 in 1995, to 48 : 52 in 2015. Thus, when discarding the political and 'other' group, in 1995 around two out of three organisations that were mentioned with Rijkswaterstaat were governmental organisations, against one out of two in 2015. This underlines the results found in other articles, which describe a shift from hierarchical government towards collaborative governance in water management (Benson et al., 2013; Huitema & Meijerink, 2014; Jager, Challies, Kochskämper, Newig, & Benson, 2016).

5.4 Limitations & Recommendations

In this study, a first step towards the development of a good method to extract social ego networks from news articles was made. The researcher had searched for other methods, but could not find any methods where the actors were not known beforehand, as is the case in this study. There are still a lot of limitations, which will be discussed in this paragraph, alongside with some recommendations. There were two metrics that were not used in the results because of these limitations, which are shown in table 10. Why these were not used will be explained in this paragraph.

Table 10: Unused but potential useful metrics

Metric	Definition
$f(S) = \frac{d(S)}{\{total\ amount\ of\ articles\}}$	Average number of organisations in group S that is mentioned per article
$g(S) = \frac{d(S)}{\{total\ amount\ of\ newspapers\}}$	Average number of organisations in group S that is mentioned per newspaper

5.4.1 Merging actors

As discussed, there have been multiple mergers between municipalities in the Netherlands in the period from 1995 until 2015. In general, merging organisations can be problematic when analysing the results using metric d. Suppose that, for example, an article was written in 1995, where Rijkswaterstaat was mentioned with the two municipalities Kampen and IJsselmuiden. That article would then be counted twice when using the metric d. However, if exactly the same article was written in 2015, there would only be a mention of the municipality Kampen, since the two municipalities merged in 2001. Then the same

article would only be counted once by metric d. And since this metric is also used in metrics e, f and g, it also effects those metrics. A good way to deal with merging organisations would be to investigate which organisations merged, and treat organisations that merged together as one organisation from the start. In the example with the two municipalities Kampen and IJsselmuiden, this would mean that they would both be treated as the same organisation, so that the article is counted only once when using metric d.

5.4.2 Changing number of newspapers

Table 3 shows that the number of Dutch regional newspapers in LexisNexis changes a lot between 1995 and 2015. In that case, metric g is only suitable for analysis when there is the assumption that every newspaper publishes roughly the same number of articles and with comparable focus of subjects. This study has not done any research on this assumption, so it cannot be validated. Therefore, metric g was not used. On the metrics d and e it can have some effect as well, though less significant. This effect only arises when the focus of added/disappearing newspapers is different from the rest. Between 2000 and 2005 the number of newspapers increases significantly, and this is also the only period where the two lines in figure 3 are moving away from each other, instead of to each other. To avoid these issues, it is recommended to use the same set of newspapers in every year. Unfortunately, this would have led to a considerable decrease of available data in this study.

5.4.3 Focus of newspapers

The fact that different newspapers can have a different focus is not an issue when using the newspapers in each year. However, some newspapers might change their focus over the years. The attention for environmental issues, for example, has increased in the last decades. When there are more articles about the environment, more mentions of nature organisations could also be expected. A study on the focus of Dutch newspapers would be required to be able to say something about the impact of changing focus by newspapers.

5.4.4 Performance of Frog

In this study, the performance of the named entity recogniser of Frog has not been evaluated. A way to do this can be found in the article of van Atteveldt et al. (2008), where the concepts of precision, recall and F1-score are described. The equations to calculate these are given below:

$$Precision = \frac{True\ positives}{True\ positives + False\ positives}$$

$$Recall = \frac{True\ positives}{True\ positives + False\ negatives}$$

$$F1\ score = \frac{2 * Precision * Recall}{Precision + Recall}$$

Precision gives insight in how many of the words that Frog sees as organisations, are actually organisations. A high score indicates that words that are not organisations, are also usually not recognised by Frog as an organisation. Recall is a way to measure how well Frog finds all organisations. A high score means that Frog finds most of the organisations that were mentioned. The F1 score gives an overall estimate of performance of Frog, by looking at the harmonic average of precision and recall (van Atteveldt et al., 2008). The precision was around 0.5 each year, but since the organisations had to be divided into groups by hand, the false positives were removed from the results. So for the entire process, the precision should be 1, provided that no human errors occurred.

5.4.5 Future option: sentiment analysis

Using news articles, the existence of relationships between persons can be determined by simple co-occurrence statistics (Pouliquen et al., 2008). The same can be said for organisations. News articles usually cover a single event and when two organisations are mentioned in that article, there is usually some relationship between the two. However, the nature of this relationship can vary and cannot be extracted from co-occurrence statistics only. This study has used co-occurrence statistics only, so it is hard to say something definite about the collaborative ego network of Rijkswaterstaat. To qualify a relationship between two organisations, linguistic patterns can be used (Pouliquen et al., 2008). In the field of computational linguistics, sentiment analysis has been researched and used, but mainly on English texts. To do this for Dutch texts is outside of the scope of this study, but it is highly recommended to develop some way to qualify relationships between organisations in newspapers. Some work on this has been done by van Atteveldt et al (2008).

6 Conclusion

This study tried to determine to what extent water management in the Netherlands shifted from hierarchical government towards collaborative governance, from 1995 until 2015. The social ego network of Rijkswaterstaat, the governmental organisation responsible for water management in the Netherlands, was extracted from news articles in regional newspapers from that period. Changes in the social ego network were analysed, using co-occurrence statistics of organisations in news articles that mentioned Rijkswaterstaat and had a subject related to water management. From these co-occurrence statistics, the existence and intensity of relationships between Rijkswaterstaat and other organisations were determined. Between 1995 and 2015, a decrease took place in the relative amount of relationships with governmental organisations, especially with local governments. In 1995, two out of every three organisations that Rijkswaterstaat had relationships with were governmental, whereas in 2015 this was decreased to one out of two. The fact that contact with non-governmental organisations increased relative to governmental organisations, implies that collaboration with non-governmental organisations has increased as well. This would mean that there has indeed been a shift from hierarchical government towards collaborative governance in the past two decades. Because of the limitations of the method used in this study, this conclusion is not very strong, and further research is needed on the subject. The method that was used did show promising results, and further development of the method is strongly recommended.

References

Benson, D., Jordan, A., & Smith, L. (2013). Is Environmental Management Really More Collaborative? A Comparative Analysis of Putative 'Paradigm Shifts' in Europe, Australia, and the United States. *Environment and Planning A: Economy and Space, 45*(7), 1695-1712. doi:10.1068/a45378

Bodin, O. (2017). Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science, 357*(6352). doi:10.1126/science.aan1114

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing Social Networks* (1 ed.): SAGE Publications.

Bruin, D. d., Hamhuis, D., Nieuwenhuijze, L. v., Overmars, W., Sijmons, D., & Vera, F. (1987). Ooievaar: de toekomst van het rivierengebied. *Stichting Gelderse Milieufederatie, Arnhem*, 29-40.

Calastri, C., Hess, S., Daly, A., Carrasco, J. A., & Choudhury, C. (2018). Modelling the loss and retention of contacts in social networks: The role of dyad-level heterogeneity and tie strength. *Journal of Choice Modelling, 29*, 63-77. doi:10.1016/j.jocm.2018.03.004

Chaffin, B. C., Garmestani, A. S., Gosnell, H., & Craig, R. K. (2016). Institutional networks and adaptive water governance in the Klamath River Basin, USA. *Environmental Science & Policy, 57*, 112-121. doi:10.1016/j.envsci.2015.11.008

Diani, M. (2002). Network Analysis. In B. Klandermans & S. Staggenborg (Eds.), *Methods of Social Movement Research*: University of Minnesota Press.

Fliervoet, J. M., Geerling, G. W., Mostert, E., & Smits, A. J. (2016). Analyzing Collaborative Governance Through Social Network Analysis: A Case Study of River Management Along the Waal River in The Netherlands. *Environmental Management, 57*(2), 355-367. doi:10.1007/s00267-015-0606-x

Fliervoet, J. M., Van den Born, R. J., Smits, A. J., & Knippenberg, L. (2013). Combining safety and nature: a multi-stakeholder perspective on integrated floodplain management. *J Environ Manage, 128*, 1033-1042. doi:10.1016/j.jenvman.2013.06.023

Gray, B. (1989). Collaborating: Finding Common Ground for Multiparty Problems.

Hannum, R. (2006). Swimming Upstream: Collaborative Approaches to Watershed Management Edited by Paul Sabatier, Will Focht, Mark Lubell, Zev Trachtenberg, Arnold Vedlitz and Marty Matlock. *Natural Resources Forum, 30*(2), 173-174. doi:10.1111/j.1477-8947.2006.170_2.x

Hardy, S. D., & Koontz, T. M. (2009). Rules for Collaboration: Institutional Analysis of Group Membership and Levels of Action in Watershed Partnerships. *Policy Studies Journal, 37*(3), 393-414. doi:10.1111/j.1541-0072.2009.00320.x

Huitema, D., & Meijerink, S. (2014). The politics of river basin organizations: institutional design choices, coalitions and consequences. *The politics of river basin organizations: coalitions, institutional design choices and consequences*, 1-37. doi:https://doi.org/10.5751/ES-09409-220242

Huxham, C., & Vangen, S. (2005). *Managing to collaborate: the theory and practice of collaborative advantage*. London, New York: Routledge.

Jager, N. W., Challies, E., Kochskämper, E., Newig, J., & Benson, D. (2016). Transforming European Water Governance? Participation and River Basin Management under the EU Water Framework Directive in 13 Member States. *Water*. doi:10.3390/w8040156

Karkkainen, B. C. (2004). Post-Sovereign Environmental Governance. *Global Environmental Politics, 4*(1), 72-96.

Lienert, J., Schnetzer, F., & Ingold, K. (2013). Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. *J Environ Manage, 125*, 134-148. doi:10.1016/j.jenvman.2013.03.052

Pouliquen, B., Tanev, H., & Atkinson, M. (2008). Extracting and Learning Social Networks out of Multilingual News.

Selin, S., & Chavez, D. (1995). Developing a Collaborative Model for Environmental-Planning and Management. *Environmental Management, 19*(2), 189-195. doi:10.1007/Bf02471990

Smits, A. J. M. (2009). 'WaalWeelde': van onderaf werken aan ruimtelijke kwaliteit en duurzame veiligheid. *Vakblad Natuur Bos en Landschap, 6*, 6-8.

Stein, C., Ernstson, H., & Barron, J. (2011). A social network approach to analyzing water governance: The case of the Mkindo catchment, Tanzania. *Physics and Chemistry of the Earth, 36*(14-15), 1085-1092. doi:10.1016/j.pce.2011.07.083

van Atteveldt, W., Kleinnijenhuis, J., & Ruigrok, N. (2008). Parsing, Semantic Networks, and Political Authority Using Syntatic Analysis to Extract Semantic Relations from Dutch Newspaper Articles. *Political Analysis, 16*(4), 428-446. doi:10.1093/pan/mpn006

Van den Bosch, A., Busser, G. J., Daelemans, W., & Canisius, S. (2007). An efficient memory-based morphosyntactic tagger and parser for Dutch. *Selected Papers of the 17th Computational Linguistics in the Netherlands Meeting, Leuven, Belgium*, 99-114.

Watson, N., Deeming, H., & Treffny, R. (2009). Beyond Bureaucracy? Assessing Institutional Change in the Governance of Water in England. *Water Alternatives, 2*(3), 448-460.

Yaffee, S. L., & Wondolleck, J. M. (2000). Making Collaboration Work: Lessons from a comprehensive assessment of over 200 wideranging cases of collaboration in environmental management. *Conservation in Practice, 1*(1), 17-24. doi:10.1111/j.1526-4629.2000.tb00156.x

Supplementary Data

Table SD1: Number of collaborations with Government and Non-Government organisations

	1995	2000	2005	2010	2015
Government	232	235	511	442	431
Non-Government	137	165	317	356	473
Total (- political & other)	369	400	828	798	904

Table SD2: Relative amount of collaborations with Government and Non-Government organisations

	1995	2000	2005	2010	2015
Government	63%	59%	62%	55%	48%
Non-Government	37%	41%	38%	45%	52%

Table SD3: Amount of municipalities in the government (local) group and number of municipalities in the Netherlands

Year	**1995**	**2000**	**2005**	**2010**	**2015**
Part of the government (local) group that consists of municipalities	50,8% (97/191)	56,6% (98/173)	51,5% (191/371)	64,6% (206/319)	61,9% (211/341)
Number of municipalities in the Netherlands	633	537	467	431	393