

The Effect of Institutional Rules on Collective Action

A comparative analysis using the IAD framework

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Summary

In this research a qualitative comparative case study is conducted between three cases. The research analyses the influence of institutional rules from the IAD framework on collective action. The IAD framework consists of different rules, which can have different rule states and these states can have a negative or positive influence on collective action. The central question that is answered in this study is how these rule states influence collective action regarding subsurface infrastructure projects in the municipality of Groningen and Het Hogeland. The rule states have been identified for each of the cases on the basis of interviews and document analysis. Important rule states that influence collective action for these projects were found. Choice rules, aggregation rules, pay-off rules and scope rules had a different rule state when the project that succeeded in collective action was compared with the projects that did not succeed in collective action. Risk sharing pay-off rules, flexible choice rules and homophily scope rules seem to have a positive influence on collective action. For future similar projects it is advised to apply these rule states during the project to incentivise collective action. A noticeable difference between the conceptual model and the results of the research was the difference between the scope rules. In the theoretical framework, homophily was expected to negatively influence collective action and heterophily was expected to positively influence collective action. However, in the analysis of the three cases this turned out to be the other way around. A factor outside of the IAD framework was found that additionally influences the seizing of collective action. The knowledge about the built environment of the project and upcoming tasks of other sectors seems to be important when the information rule state is unshared, and the boundary rule state is closed. The study is an exploration of the influence of the IAD framework rules on collective action. To fully grasp the influence of these rules on collective action a larger dataset of cases is needed.

1. Introduction

Different infrastructure types are interdependent on each other. This is a phenomenon which is often indicated when one link in a chain of different types of infrastructures does not function anymore. An example of this is a recent power outage in Schiphol which resulted in the failure of the baggage conveyor belt. People were held up in the airport and other types of infrastructure like the roads and railroads had to be closed off to prevent more people from entering Schiphol (Trouw, 2018). This interdependency can be a threat but also an opportunity. Collective action in infrastructure projects is such an opportunity: different infrastructure sectors can work together to tackle difficult problems and these sectors can benefit from each other in multiple ways. This benefit can be in the form of knowledge, but also financially. They can pool their resources. Collective action can be highly beneficial for infrastructural sectors, yet the opportunity is not always seized and it is unclear why. With the increasing need for climate adaptation and the increasing age of the existing infrastructure in the Netherlands, infrastructural renewal projects on roads, sewage and other subsurface infrastructure need to be started in the foreseeable future. These projects are often located in the built environment and interfere with different types of infrastructural sectors. Collective action between these sectors in these projects might result in a benefit for both sides. This applies especially on the municipal level. Municipalities are responsible for the renewal of sewage systems. In this explorative research, projects from the municipality of Groningen and Het Hogeland are investigated.

1.1 Aim of the research

The aim of this research is to explore what influence institutional rules from the IAD framework have on seizing the opportunity of collective action. These institutional rules that are developed by Ostrom & Basurto (2011) can be in different states (Neef et al., forthcoming). In this research, the goal is to see whether different rule states influence the decision to seize an opportunity and thus collective action or not. By examining which of these rules are applied in which way, it may be possible to find out how the different states of institutional rules influence the seizing of collective action. If the influence of the state of the rules on joint investment opportunities are known, then these rules can be applied to enhance further collective action in future projects.

1.2 Research questions

This study compares the sewage renewal of Het Stee Adorp, the road project of the Diepenring and the project of the Yellow stones. For this study, the following research question is constructed:

How do the state of institutional rules from the IAD framework influence collective action opportunities from being seized or not seized in three cases regarding subsurface infrastructure from the municipality of Groningen and Het Hogeland?

Secondary questions are:

- What rule states can be discerned in literature
- In what state are the institutional rules for the cases?

- How do the state of the rules differ from each other between the cases?
- How can the rules from the IAD framework be applied in such a way that decision makers can seize joint investment opportunities more easily?

2. Theoretical framework

2.1 The IAD framework, the framework for data analysis

The IAD framework is the theory that will guide the analysis of the cases. Within this framework there are certain rules that are described to analyse different institutions (Ostrom, 2011). Ostrom and Basurto describe rules as linguistic statements in which must and must not are defined. For these statements to be a rule, sanctions for breaking the rules and monitoring of the rules must exist. (Ostrom and Basurto, 2010). The rules in the IAD framework have different states, the states are to be identified for the research cases. The Rules with their description and possible states are shown in table 1. The IAD framework has been applied for a number of different cases over the years, the framework can be adjusted for a particular research, for each case the IAD framework can have a different purpose. Due to these different interpretations it is important to state how the IAD framework has been used in the research. An example of this are articles by Lestari et al. (2018) and Lu et al. (2016) where a different interpretation of the position rule is used. In these articles the position rule is used to assign actors to positions, which by Ostrom (2011) is described via the boundary rule. When using the IAD framework in this research it is important to establish a clear definition for the different rules to avoid confusion. To clarify the rules from the IAD framework, the table below is used as a guide for the use of the different rules in this study.

Rules	Description	Possible states
Position rules	Define roles of certain actors, roles are a combination of opportunities, preferences, resources and responsibilities.	Similar/Diverse
Boundary rules	Define boundaries on how and at which conditions an actor can enter or leave a position.	Open/Closed
Information rules	Define the handling of information by actors.	Shared/Unshared
Choice rules	Define what actors should or should not do in a certain position at a certain time.	Flexible/Inflexible
Aggregation rules	Define how actors can influence a decision when an action or activity is proposed.	Symmetric/ Non Symmetric
Scope rules	Define the desired outcome this can be a demand, but also a desire, the scope rule may also define what outcome must not occur.	Homophily/ Heterophily
Pay-off rules	Define costs and benefits to be paid or received by actors.	Risk retention/ Risk sharing

Table 1: The different possible states of the rules in the IAD framework. Based on the article by Neef et al. (forthcoming).

As can be seen in table 1, each rule can have different possible states. In table 2, the rule states are further explained.

Rules	Description
Position rules	Similar: There are many similar positions, multiple project members have the same responsibility. Diverse: There are diverse roles in the project, every project member has its own unique responsibility.
Boundary rules	Open: A person can join the project without any boundaries of requirements. Closed: Rules state which requirements need to be fulfilled to join the project. The rule can also be closed when persons can only join the project on invitation.
Information rules	Shared: Every project member can access everyone's work. New information is shared within the project team or is publicly accessible. Unshared: Information is only shared one on one, the information remains unknown for the other project members or is only provided on request.
Choice rules	Flexible: The project team is able to change their original expectation during the project. For example, the planning is adjusted or secondary goals for the project are set. Inflexible: Rigid, the predefined goals or planning for the project are not able to change during the project.
Aggregation rules	Symmetric: Every project member has an equal vote in the decision making process. Non-symmetric: Some project members have a bigger vote or a veto in the decision making process.
Scope rules	Homophily: Project members have a single desired outcome for the project. Heterophily: Project members have multiple different desired outcomes for the project.
Pay-off rules	Risk retention: Extra risk is avoided during the project, project members are not willing to take an extra risk even when there are benefits in taking that extra risk. Risk sharing: When two or more sectors are working together, the extra risk as a cause of working together is shared between the sectors.

Table 2: An explanation of the different rule states and how these states have been recognised during the research.

The rules might have an influence on collective action opportunities being seized or not. One might expect when a boundary rule is open (entry in the project is not difficult), then the

possibility of another sector joining will increase. Yet no article mentions the influence of the rules from the IAD framework on opportunities for collective action. This is also indicated in an article written by Frantzeskaki and Loorbach (2010), where it is pointed out that actors in infrasystem and infrasystem characteristics should be researched to enable innovations in these systems. Opportunities for collective action can be seen as one of these innovations.

2.2 Conceptual model

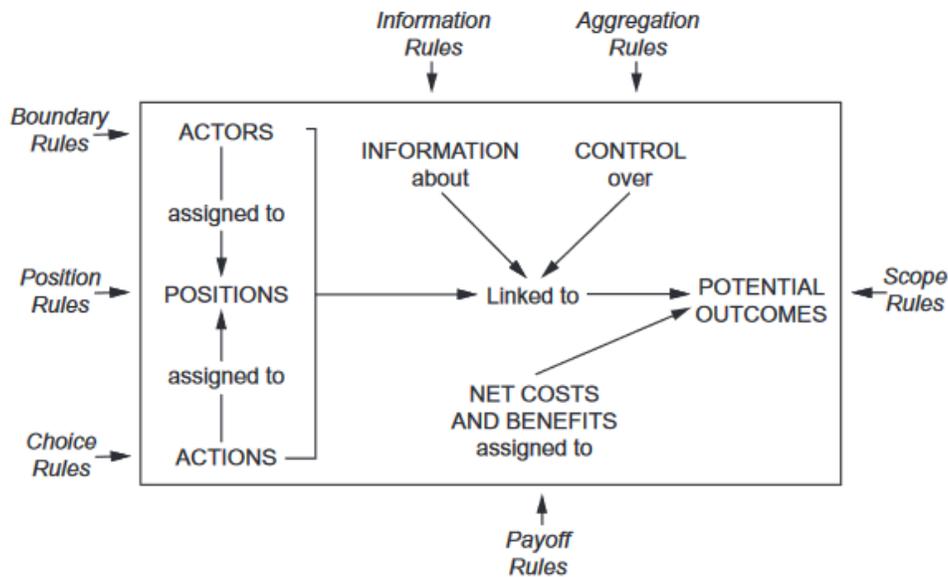


Figure 1: Rules in the IAD framework and in which way they affect elements of an action situation (E. Ostrom, 2011).

Rules from the IAD framework have influence on certain elements from an action situation (figure 1). Boundary rules state which boundaries there are to enter or leave a position and have an influence on the actors that are allowed in a project. Position rules define roles and their resources, opportunities, preferences and responsibilities. Choice rules define what actors should or should not do in a certain position at a certain time. The actors and their actions influence potential outcomes, for example a project with many different actors is expected to have a different outcome than a project with a low number of actors. Information rules define the handling of information by actors. Moreover, it describes which way the information is being shared. The aggregation rules define the control of actors over potential outcomes and actions. Payoff rules define costs and benefits that actors can receive or have to pay. Scope rules define what the outcome must, should or should not be. All the rules from the IAD framework are in a certain way influencing the outcome of an action situation. An example of such an action situation can be the decision to make collective action possible.

The different rules from the IAD framework have different rule states. The different states of the rules in table 1, influence the action situation. The expected effect of the different states that

affect the choice for joint investment is shown in figure 2. During the project, the effect of the state of the rules on the joint investment opportunities will be investigated.

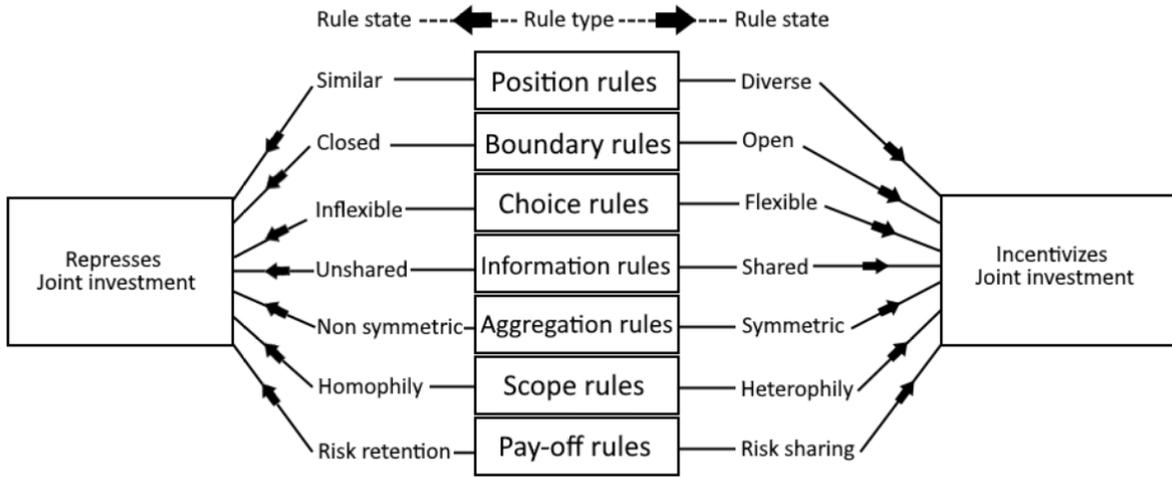


Figure 2: Conceptual model. The different rules from the IAD framework, their possible states and how they are expected to influence joint investment opportunities.

3. Methodology

3.1 Research strategy

For this research, a qualitative comparative case study is used. This type of analysis is useful for explaining why systems (institutions) have certain outcomes (Van Assche et al. 2020). Three cases are included in the case study, one case includes the seizing of a joint investment opportunity and two cases do not seize the opportunity for collective action. If one case would be selected instead of three, the analysis would be less powerful as conclusions from one case with only the best or worst practices do not necessarily have to work in every context (Van Assche et al. 2020). As two cases are organised by the municipality of Groningen, a third case is added to also have a case from a different institutional setting. A comparative case study is used to compare both cases using the IAD framework to see how institutional rules affect the seizing/not seizing of an opportunity for collective action. The goal of the comparison is to explore which rule states influence the seizing of collective action opportunities. The comparative case study is a qualitative approach, each institution is unique and includes small variables. Two cases can have the same rule state. However, within this rule state, small differences between the cases can still be possible. These small variables can hardly be described using numerical data, therefore a qualitative approach is chosen.

Flyvbjerg (2005) describes different strategies for case selection. Cases are selected using information oriented selection, here cases are selected on the expected content of the cases (table 2) If the table of Flyvbjerg is taken into consideration, strategy B.2 is selected, a maximum variation between the cases, with the variation variable being the seizing of collective action opportunities. This strategy is selected because the aim of the research is to identify the circumstances of different organization forms, which incentives collective action.

Strategies for the Selection of Samples and Cases	
Type of Selection	Purpose
A. Random selection	To avoid systematic biases in the sample. The sample's size is decisive for generalization.
1. Random sample	To achieve a representative sample that allows for generalization for the entire population.
2. Stratified sample	To generalize for specially selected subgroups within the population.
B. Information-oriented selection	To maximize the utility of information from small samples and single cases. Cases are selected on the basis of expectations about their information content.
1. Extreme/deviant cases	To obtain information on unusual cases, which can be especially problematic or especially good in a more closely defined sense.
2. Maximum variation cases	To obtain information about the significance of various circumstances for case process and outcome (e.g., three to four cases that are very different on one dimension: size, form of organization, location, budget).
3. Critical cases	To achieve information that permits logical deductions of the type, "If this is (not) valid for this case, then it applies to all (no) cases."
4. Paradigmatic cases	To develop a metaphor or establish a school for the domain that the case concerns.

Figure 3: Strategies for the selection of samples and cases, Flyvbjerg (2005).

3.3 Case selection

Small subsurface infrastructure projects do not often come up in literature or news platforms. On top of that, when a project is described in news articles, it is often hard to determine if collective action has succeeded or that it has not succeeded. In the search for cases to use in this project, project leaders from the municipality of Groningen and project leaders from the municipality of Het Hogeland have been approached. Subsurface infrastructure projects do not often get high publicity. Therefore instead of asking to interview the project leader about a specific project, the project leaders were asked if they had an example of a recently finished project where collective action succeeded, or where it did not succeed. The cases had to be recently finished projects with a focus on subsurface infrastructure. As a result of this approach, three interviews about three cases have been conducted.

3.2 Data collection

For the gathering of data for the three selected cases, interviews and document analysis have been conducted. The interviews and document analysis are conducted to answer the following research question.

How does the state of institutional rules from the IAD framework influence joint investment opportunities from being seized or not seized in three cases regarding subsurface infrastructure from the municipality of Groningen?

Of the three cases, different actors are interviewed, project leaders of the three cases have been interviewed, as they can provide insight in every stage of the case. The method of conducting interviews is chosen because the information that is gathered from actors present at the cases can give in-depth information about how the different IAD framework rules have been applied and in what state they were. To answer the research question, the information about the state of the rules in both cases is valuable.

For the document analysis, internal reports for both cases would be used from the municipality of Groningen and Het Hogeland, to provide more insight into the institutions that were present in these cases. The interviewees were not allowed, or were not willing to share any internal documents about these cases. To provide background information, grey literature has been used, e.g. newspaper articles. Literature from previous studies are not used as they are not written for the cases.

3.3 Data analysis

The data from the interviews is coded in a deductive manner with a structured build up using the IAD framework. The framework is used as a basis to identify the different rule states from the IAD framework for each interview. A combination of inductive coding and deductive coding is used as the IAD framework is the basis of the research (deductive), but with the expectation that certain elements will fall outside the IAD framework and will be added during the coding (inductive). So elements outside of the IAD framework will be included during coding in an inductive way.

As mentioned above, the data from the interviews will be categorized into the different rules of the IAD framework. With the data, the state of the rules will be identified for the three cases. The possible states from the rules in the IAD framework are mentioned in table 1. From the theoretical framework, a coding scheme is developed. Data from the interviews will be categorised using this coding scheme.

Themes	Codes	Subcodes
Rules IAD framework	Position rules	Silmilar Diverse
	Boundary tules	Open Closed
	Information rules	Shared Unshared
	Choice rules	Flexible Inflexible
	Aggregation rules	Symmetric Nonsymmetric
	Scope rules	Homophily Heterophily
	Pay-off rules	Risk retention Risk sharing
Other mentioned points that influence collective action	Knowledge and experience	

Table 3: The coding scheme that will be used to code the interview data.

3.4 Considerations

There are some ethical considerations during this project. The first consideration that needs to be made is that actors from a project that did not seize a joint investment opportunity might be hesitant to talk about the case as they might feel like they have failed. Whereas actors from a case which seized a joint investment opportunity might be too positive of their case. Another ethical consideration is privacy. Some actors might not want to conduct an interview due to personal reasons, it is important to notice that the interviews should be held anonymously, their personal data can not be present in the research. The interviewer should also indicate that the interview will be recorded. To use the data and to record the interview, consent is needed from the interviewee. The recorded data will be stored on a hard drive and a backup external hard drive. The recording will not be uploaded to the cloud. It is also most likely that the interviews will be held online due to the current covid-19 virus, which may cause difficulties in terms of connection and the recorded quality of the interview.

In the interview guide, next to the questions about the different types of rules, preparations before the interview are stated and the permission of the interviewee will be discussed. The interview guide is included in appendix 1.

4. Results

For three cases, collective action was discussed using the IAD framework. For case 1, the collective action succeeded. For case 2 the collective action was tried, but it did not succeed and for case 3 the collective action was not tried and did not succeed. The different rule states from the cases are given in table 3. Below table 3 an explanation for each rule state is given for each case.

	Case 1 Gele steen	Case 2 Diepenring	Case 3 Het Stee, Adorp
Collective action	Yes	No	No
Rules:			
Position	Diverse	Diverse	Diverse
Boundary	Closed	Closed	Closed
Choice	Flexible	Inflexible	Inflexible
Information	Unshared	Unshared	Unshared
Aggregation	Non symmetric	Non symmetric	Symmetric
Scope	Homophily	Heterophily	Heterophily
Pay-off	Risk sharing	Risk retention	Risk retention

Table 4, The rule states for the three different cases.

4.1 Case descriptions and their rule states

Case 1 Project Gele Steen

Yellow stones that have been used as pavement in the city center of Groningen since 1990 became too slippery when the surface was wet, so the stones had to be replaced (Ruimtevoorjou, 2021). In 2015 an experiment was conducted to reuse the old stones and treat them in such a way that the roughness is increased at the surface. The extended life years of the treated stones turned out to be extended by approximately five years. These five years were not enough, so the decision was made to replace the stones. The replacement of the stones started in 2018. A combination has been made with two other companies, Waterbedrijf Groningen and Enexis. The yellow stones are replaced in phases, one street at a time. In this way, the neighbourhood is still accessible when one street is being renewed. The project which will replace 120.000 m² of yellow stones will approximately cost 7.8 million euros (RTV Noord, 2018). Collective action succeeded in this project as during the project other sectors and different companies combined their work with the project. In this way Enexis and Waterbedrijf Groningen experience less costs and the municipality of Groningen delivers less disturbance for the coming years in the city center. As stated by the project manager.

“And we want to make sure we replace the stones last where at least the water and electricity is replaced. In this way the street will not have to be opened for another 15 years.”

To determine the different rule states, an interview has been conducted with the project leader of the case. The position rule in this project is diverse as the 15 project members each have a different role and with each role comes different responsibilities. As can be seen from the quote below.

“Yes, the differences in responsibilities are big. Everyone is responsible for his or her own work. There is a second project leader in the project of the yellow stones. He focuses mostly on the planning business. Furthermore, I have a manager who is financially responsible, so there are many different roles. I am responsible in the end, but there are some sub responsibilities which I discuss with the manager and the second project leader.”

The boundary rule state is closed, people can join during the project but only when that person is invited by the project leader. Other sectors like Enexis and Waterbedrijf Groningen were also invited. Enexis was invited because the project leader had knowledge about the planning from enexis in the city center.

The choice rule is flexible. The planning from the project was adjusted so that the water company could join the work in certain areas. This would then not be the ultimate efficient planning, but extra nuisance was averted, because otherwise some streets would be opened multiple times.

“So we changed the planning there, like hey we can do this street later and then you (Waterbedrijf Groningen) can join later with enough financial means. So by talking to

each other and getting more information from each other step by step, then we can make decisions together about the planning.”

The information rule state in this case is unshared. There is not an open system in which the information can be shared. Information about the project is only shared to all members at project meetings.

The aggregation rule state is non symmetric. The project leaders in this project have a veto over the planning. Approval is needed from the road manager of the municipality of Groningen. If the road manager does not approve of the planning, the project can not continue with that planning. Other companies have no vote in this decision.

The scope rule state is homophily. The expectations and limitations of the different companies were known from the start, in this way the different sectors had the same scope during the project. An example is the tight planning for Enexis, this is known by the municipality of Groningen, therefore the planning could be adjusted to meet the requirements for Enexis to join the project.

Interviewer: “Did your team and the team of the water company have different expectations from the outcome of the project? Or did you have the same expectations?”

Respondent: “No, the expectations were mostly the same. Especially Enexis has a tight planning, they have to replace all the pipes in the inner city before a certain date determined by the SODM. So there is a certain pressure on the planning and you try to accompany that planning as best as possible. We are going to make the deadline for sure.”

The payoff rule state is risk sharing. The municipality of Groningen adjusted the planning in order to let the water company and the electricity company join the project. This is an extra risk for the municipality, but there is less nuisance in the area for the next 15 years. The water and electricity companies share the risk in the planning, they are dependent on each other's work tempo. However these companies profit from the reduced costs with for example digging work or a stakeholder analysis.

“You know, work does not become cheaper by working together, that is what I always say. The difference is that there is a lot less nuisance. Temporarily, now there is more nuisance, but after that we are ready for another 15 years”

Case 2 Project Diepenring

Case 2, project Diepenring is a project where the layout of the Diepenring in Groningen was adjusted. The street was brought back from two car lanes to one car lane with a cycling lane and a wider walking path (Groninger Internet Courant, 2020). The project started in 2017 and ended in 2018. In 2019 Enexis had to work in the area again to replace electric cables (ruimtevoorjou, 2020). Collective action did not occur, both companies Waterbedrijf Groningen and Enexis were contacted at the beginning of the project, and were expected to join the project (Gemeente Groningen, 2016), but the planning for both companies could not be applied to the project of the Diepenring. The municipality of Groningen could not delay the work on the Diepenring as it needed to be finished before work started on another project, Ring Zuid in the south of Groningen. The Diepenring is an important detour route for motorised road vehicles when the work on the other project started. The budget for the project was approximately 1.8 million euros.

To determine the different rule states, an interview has been conducted with the project leader of the case. The position rule in this project is diverse as the 10 project members each have a different role and with that role comes different responsibilities.

The boundary rule has a closed rule state. Members can only join in the project when that person is invited by the project leader.

The choice rule state is inflexible, the planning from the project could not be changed in such a way that the other companies could collaborate in the project. Also Waterbedrijf Groningen did not have the financial means to join the project.

Respondent: "The water company had no means to invest in our area at that time. But also Enexis did not have its plans ready at that moment, they really needed a lot of time for that."

Interviewer: "And the water company could not profit enough from the work you would do during the project so that their prize went down?"

Respondent: "Yeah they could not profit enough."

The information rule state is closed for this case. Most of the information was shared via email from one person to the other.

Respondent: "Most of the information was shared via email."

Interviewer: "Did you also use a central map where multiple people would have access to?"

Respondent: "No we did not have that, everyone is responsible for their own part, drawings are shared between different people, and you save those drawings for yourself. But there is no central map for everyone."

The Scope rule is heterophily, the different companies had other expectations from the project. The different expectations from the project were mostly a result of the different expectations for the planning.

Interviewer: *“Did the expected end result differ between the different sectors which you approached?”*

Respondent: *“Yes, the planning was a point where we had different expectations.”*

Interviewer: *“And did they also expect a different outcome of the project?”*

Respondent: *“Well yes, in the end we all would have liked it if we had worked on the project together, and what you see now, is that every company now still has to do their part.”*

The aggregation rule state is non symmetric. The project leaders in this project have a veto over the planning. Approval is needed from the road manager of the municipality of Groningen. If the road manager does not approve of the planning, the project can not continue with that planning. Other companies have no vote in this decision.

The Pay-off rule state is risk retention. The three different sectors could not share their risks in planning or costs.

Case 3 Het Stee, Adorp

Case 3 the project of Het Stee in Adorp, is a project where a new housing area will be realized on top of an old football field by the municipality Het Hogeland. The project is initiated to provide new housing for starters and young families (Het Hogeland, 2021). The design, planning and contract documents of the project were already finished. In the design, a sewage system was implemented in the new situation underneath the new road for the housing area. The diameter of the new sewage system was calculated based on the new housing area. When the contract documents were already finished, the sewage sector from the municipality Het Hogeland found out that adding the new sewage system to the existing sewage system will increase problems at an already troublesome sewage overflow. This overflow is located just outside of the project area and is the cause of flooding in other areas of Adorp. The problems at the existing overflow could have been resolved when the new sewage system design would be adjusted and the old overflow would be renewed simultaneously. As the new plan has not been executed yet, involvement of the sewage department can still adjust the plans for the sewage system. However due to the fact that this will cause a delay in the project and the sewage department was not involved in the process until after the contract documents had been written, collective action did not succeed for this project.

To determine the different rule states, an interview has been conducted with a member of the case, an expert in sewage of the municipality of Het Hogeland. The position rule in this project is diverse as the 8 project members each have different roles. A project leader, 2 persons from spatial planning and 5 to 6 persons with different work areas are involved (mobility and traffic, roads, sewage, green infrastructure and water). These project members are responsible for the

product they deliver from their own working area. The project leader has the ultimate responsibility.

The boundary rule has a closed rule state. Members can only join in the project when that person is invited by the project leader. The project leader asks people from certain disciplines to join the project, this is not a demand.

The way it goes here at the municipality of Het Hogeland is that we work here on request of the project leader. He asks: "We need this professional discipline, can you work on this project?"

The Choice Rule is inflexible, an indication for this rule state is that an existing sewage pipe is present in one of the lots, but the project team does not want to move the lot border as the area of the lot will then get smaller. However, the costs of moving a piece of the sewer pipeline is highly expensive.

"An extra problem is that the current project team did not see that one of the pipelines towards the sewage overflow is present in a new lot. They had the solution to rearrange the pipeline in another area. The replacement of the lot border is not an option for them as they then have a smaller lot and less ground to sell."

The information rule is closed. Most of the information was shared via email from one person to the other. However, towards the end of the project, a central map was created to share information with. This map is limited to the project members. In meetings, an action list from the previous meeting is discussed to keep people up to date.

"We did share information one on one via email for this project, just now they made a central map for project members who are present in the project. So now it has become a bit more professional."

The Scope rule is Heterophily, the project group for the new housing area had different expectations from the sewage plan than the expert of sewage in the municipality of Het Hogeland. The main difference in the scope rule is the size of the scope, where the project members of the new housing area only look at the specific area of the project, the expert on sewage has its scope set on the entire sewage system in Adorp.

"My expectation of the project was different. I think in the concept of the built environment, so I think in a bigger scope than the project leader who is interested in the small area of his own project. His assignment is to provide a road, a few cables and sewage. That has to fit in the existing environment. That is his scope and he does not have to do more than that. My scope is bigger because I have to look at the entire sewage system of the village."

The aggregation rule state is symmetric. Each team member has their own responsibility and the decision making is done in an informal way.

The Pay-off rule state is risk retention. Risk during the development of the project was minimized by looking at the local scale of the project area.

4.2 Important rule state differences

There are clear differences in the rule states between the three cases. Firstly, the choice rule is flexible in case 1, where collective action succeeded, but the rule is inflexible in case 2 and 3. The way in which a project team is flexible to change due to input from another sector seems to have influence on taking collective action. The expectation was that the symmetric aggregation rule state would incentivise collective action, however in case 1 this rule is non-symmetric. There was a veto regarding the planning, but this veto was not used due to the flexibility to change the planning. In case 3 the aggregation rule state is symmetric, members of the project team were involved in informal decision making, however the right people were not present at the right time to have influence on the decision-making process. This rule state and its outcome indicates that although a rule state can have a positive or negative effect on collective action, other factors can influence this effect towards a different outcome.

The scope rule has a different effect on collective action in comparison with the description in the conceptual model. In the theoretical framework, homophily in the scope rule was indicated as a negative rule state and heterophily was indicated as a positive rule state. Homophily however, seems to incentivize collective action. When each member of the different sectors that are involved in the project have roughly the same expectation from the project, then collaborating between the sectors could be easier. Whereas heterophily, where the different sectors have different expectations, can cause friction between these sectors and negatively impact collective action. The pay-off rule has the same effect in these cases as in the conceptual model. Risk sharing seems to incentivise collective action, whereas risk retention seems to repress collective action. A link can be seen between the choice rule and the pay-off rule, by sharing a risk by for example extending the planning of the project so another sector can join the project one needs to be flexible to change. The position rule, boundary rule and the information rule have the same state for all three cases. No notable differences were found between these rule states, although that does not necessarily mean that the rule states have no influence on collective action. A diverse position rule might influence collective action, but no big difference between the cases has been found for this rule. Collective action was both seized and not seized with the diverse position rule, this again indicates that collective action is not dependent on one rule state, yet it is the combination of the rule states that makes the seizing of collective action possible.

4.3 Important factors outside of the IAD framework

In the interviews, other factors that influence collective action were also indicated. One of these factors is the knowledge and experience of the project leader. Knowledge about the environment of a project has a positive influence on collective action. An example of this factor playing an important role is the knowledge of the project leader of case 1 about the replacement issue of Enexis, who had to replace the old cast iron gas pipes in the inner city. Due to the fact that the project leader knew the task of Enexis, he could contact them to join the project he was provided with. The project leader of case three had no knowledge of the sewage situation in Adorp, therefore there was no necessity to contact the sewage expert for collaboration in the project. This factor is expected to have a link to the closed boundary rule state and the unshared information rule state. Access to the project can be acquired from the project leader for all three cases. However, if the project leader has no knowledge about the environment of his or her project or upcoming tasks from other sectors, he or she will less likely invite other sectors to the project. Moreover, if the information rule is unshared, other sectors have no knowledge about an upcoming project. Due to the fact that these sectors have little knowledge of the project, they are less likely to ask if they can join the project. The invitation of the project leader and therefore the knowledge of the project leader becomes increasingly important.

4.4 Use of the rule states in future projects

As mentioned before, the flexible choice rule, the homophily scope rule and the risk sharing pay-off rule seem to incentivise collective action for these cases. For future subsurface infrastructure projects in a similar setting, it would be advised to use these rule states in this optimal way. Changes in institutions should firstly be aimed towards flexibility, a project team should be able to be open to change and open to priorities of other sectors. Secondly, risk sharing should be encouraged by for example sharing risks in costs or in time. The risk might increase, a project could for example delay due to the time schedule of different sectors, yet by sharing these risks and by discussing possible solutions for these risks, the increased risk can be minimised. By discussing the opportunities and expectations of different sectors, a homophily scope rule can be reached. If different sectors are aware of the different expectations, then these sectors could reach a level where they have similar expectations for the project. With a closed boundary rule and unshared information rule, it is advised to conduct research towards other possible sectors that might have a possible task within the scope of the project. In this way other sectors can still be invited, although the other sectors can hardly join the project on their own initiative. There might be a difference in the level of importance of the different rule states in projects with another scale or background. The projects in this research are executed on a local scale, bigger projects on a national scale might require different rule states to seize collective action.

5. Conclusion

This study is an exploration of the effect of different rules from the IAD framework on collective action. Different rule states contribute to collective action, but do not necessarily determine if collective action is taken or not. A rule state can have a negative impact on collective action in a case, but collective action can still be possible. It is not a single rule state, but the combination of multiple rule states that determine collective action. Differences between the rule states that influence collective action for these projects were found. Choice rules (flexible), pay-off rules (risk sharing) and scope rules (homophily) seem to have a positive influence on seizing collective action in the three cases. A noticeable difference between the conceptual model and the results of the research is the difference between the scope rules. Homophily was expected to negatively influence collective action and heterophily was expected to positively influence collective action. However in the analysis of the three cases this turned out to be the other way around. An explanation for this difference between the theory and the results could be the time in the project where homophily or heterophily is measured. Heterophily is -in theory- viewed as positive. Multiple viewpoints for the project can result in awareness about other sectors that need to work in a project area, this could be a positive factor before the start of the project where multiple different sectors can be asked to join a project. Nevertheless, in the cases in this research, homophily is viewed as a positive factor as it indicates that all involved sectors in a project are able to work towards a single central goal. This is a useful factor when project members need to work together after the project starts, otherwise different expectations of the project could cause friction in the project team. No differences were found between the remaining rules from the IAD framework, however this does not mean that they have no effect on collective action. The diverse position rule for example can still have a positive impact on collective action. The researched cases indicate that for collective action, a diverse position rule needs to be combined with other rule states like for example flexible choice rules or risk sharing pay-off rules.

A factor that was not in the IAD framework, but did have an influence on collective action is the knowledge about the project area and upcoming tasks of other sectors. With this knowledge, other sectors can be asked to join a project.

Multiple factors can influence a single rule state, therefore some rules might be a mix between two rule states, or a rule state changed over time. When this was the case, the rule state that would best fit the situation was chosen. Online documents that were used for the description of the cases and the background information were scarce to find. On top of that, the interviewees were reluctant to share official documents, which made a document analysis hard to execute. This qualitative comparative case study is an exploration on the effect of the institutional rules from the IAD framework on collective action regarding subsurface infrastructure projects. With the help of the analysis of these cases, advice is given on what rule states should be implemented in further projects with a similar background. This advice should be tested in practice to see the effects of the implementation of these effects. Furthermore, some rules showed no difference in the comparison of the cases, but this does not mean they have no influence on collective action. In future research, specific cases could be compared where these

rules are different to see their effect on collective action. With the small dataset of three cases, a difference can be seen, but the effect of these differences in the factors that influence collective action is uncertain. To increase certainty about the effect of all the rule states on collective action, further research should be conducted with a large dataset of cases. In this way, the rule states can be analysed for multiple infrastructure projects, and with the large dataset, a more clear understanding of the effect of the rule states can be determined.

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Appendix 1.

Interview Guide

1. Before the interview

Search background information about the case. If possible, search what type of departments are present.

Bring laptop and recording material or conduct the interview online and test recording material before the interview.

Permission from the interviewee to conduct the interview with (if necessary) applicable covid measures.

2. Introduction

- Ask the interviewee about their day/weather and their current projects, explain the research with the research question and the aim of the research. (explain joint investment opportunities)
- Ask the interviewee permission to record the interview, start the recording.
- explain how the data from the interview will be used and that the interview will be anonymous.

3. General questions about the case

- Ask for a general description of the case, name what you already know about the case.

4. Position rules

- Which actors were involved in the case?
- What responsibilities did they have and what resources could they use?

Indicators:

- similar roles where everyone has the same responsibilities or diverse roles where every actor is responsible for different tasks.

5. Boundary rules

- How could an actor enter a position? where they were invited or could they apply themselves?
- Were there any actors that joined or left during the project?

Indicators:

- Entry of positions is open or closed, an indicator for an open boundary rule can be if a position was added without too much struggle during the project.

6. Information rules

- How was information shared during the project?
- Did this type of information sharing help to provide everyone the information they needed?
- Did any new insights come up after sharing information?

Indicators:

- shared drive, information available for everyone?
- closed, everyone does their job and then it is handed in.

7. Choice rules

- Did any discussions occur regarding the outcome of work of different actors?
- Did some actors change their type of work?

Indicators:

- flexibility to change during the project

8. Aggregation rules

- In what way could a proposed decision be influenced by different actors?

Indicators:

- symmetric/ non symmetric
- If a veto is present, aggregation might be non symmetric
- formal or informal decision making

9. Scope rules

- What was the desired end goal of the project?
- Was there an undesired outcome for the project?
- Did the desired outcome differ between actors?

Indicators:

- Single desired outcome/multiple outcomes

10. Pay-off rules

- Was there a limit in costs during the project? Was one party more at risk regarding investment than another party?
- How did the different actors benefit from the project?

Indicators

- Is there a difference in the amount of risk per actor e.g. risk retention or risk sharing?

11. Closing questions

- During this interview I tried to cover the following themes regarding the seizing of joint investment opportunities. Is there anything you would like to add?
- Thank interviewee for their time
- Mention that the data from this interview will be transcribed and categorized. The data will be used in the IAD framework.
- Are there any other questions or remarks?

Peer review received from Jur Heerink

General	
Is the thesis clearly structured?	Yes, very much so
Is there a clear link between the different parts?	yes
Are the majority of the sources of an academic nature? If not, is there a good reason for this?	yes
Is the literature of a recent date? If not, is there a good reason for this?	Most of it is from 2010 onwards, so yes
Are all the sources used included in the references?	yes
Are the sources correctly cited in the body of the text?	No, 2 small typo's. also a figure is missing a reference
Are the sources correctly referred to in the reference list, in accordance with the Harvard system?	yes
Do the figures and tables clarify the text?	yes
Are the figures and tables numbered correctly and are they referred to in the text?	yes
Is the text clear and readable?	yes
What is the sentence structure like?	Sentences are max 1,5 rule and if longer divided by a comma. Also readability is good.
Are the spelling, grammar and punctuation correct?	yes
Questions/Comments	
<p>There is a reference with only Ostrom, 2010 in 1.1. this should be Ostrom & Basurto or Ostrom 2011.</p> <p>In 2.1. there is a reference R. Lu, which is a typo.</p> <p>Most quotes are in Dutch, but you already let me know that you will translate them.</p>	

Summary	
Are the main aspects of the study discussed?	yes
Are the topic, aim, research questions, methods, results and conclusions summarized?	Yes, apart from the third secondary question
Questions/Comments	
<p>The summary does not really answer your last secondary question, but is a really nice summary of the rest of your research</p>	

Introduction	
Is the topic clearly defined?	yes
Is the relevance of the topic clearly explained?	yes

In your own words, what is the purpose of the research?	To find out why joint investment is not always happening and how joint investment might benefit road and sewage projects.
Are the aim and research questions integrated into the academic literature?	yes
Does the Introduction arouse your interest? If so, how? If not, why not?	Yes, it makes me think about why the opportunities are not always taken, while it is needed in regards to the environment. So the introduction has activated me to think about the topic.
Questions/Comments	

Theoretical framework	
Do the theoretical insights that are discussed constitute a relevant basis for answering the research question(s)?	yes
Are the theoretical insights explained in a comprehensible way?	Yes, very nicely and understandably
Are there references to relevant international academic literature? (articles from academic journals and books)	yes
Is the theoretical framework logically structured?	yes
Does the conceptual model tie in with the research questions and theory?	yes
Questions/Comments	
Theoretical framework is well structured, keeps on to the basics of what this research is about.	

Methodology	
Is the choice of data collection and data analysis methods well explained?	yes
Do the data collection and data analysis methods match the aim and research questions?	yes
Are the questionnaires, observation checklist, etc. included in the appendices?	yes
Does the author clearly explain how he/she set about collecting and analyzing the data?	yes
Is there a reflection on the quality of the data that was collected?	No, there are considerations about the data beforehand, but nothing after the data had been collected. (only in the conclusion)
Is there a satisfactory explanation of the ethical considerations relevant to the research and of how these were dealt with?	yes

Are the Methodology sections logically structured?	yes
Questions/Comments	

Results	
Are the most relevant results discussed?	yes
Are the results thoroughly analyzed (i.e. not just described)?	The interesting ones are, some rule states that aren't as interesting are just described.
Are the results linked to the research questions?	yes
Are the results sections logically structured?	yes
Questions/Comments	
<p>You have written this chapter going from results -> explanation/in depth information. Doing this the other way around might make it easier to agree/harder to disagree with the rule states. Although doing it this way, it is very clear what your results are.</p>	

Conclusion/discussion	
Are the research questions answered?	yes
Are the results placed in a broader theoretical perspective?	yes
Are the results compared with other research results?	No, it says clearly that the dataset is too small for comparison and there is a further need for more research.
Are there recommendations for future research?	Yes, but not specifically. Research about subsurface infrastructure or about general collective action.
Questions/Comments	
<p>Overall the conclusion is good, you bring forward your most important findings. Explain a bit more how the combination of rule states work, can one singular rule state never determine collective action?</p> <p>What about the rule states that are not important? They are not mentioned.</p> <p>Are the rule states that are important all evenly important?</p> <p>Was the scope rule the only noticeable difference between results and framework? -> How did the theory hold up to your results?</p> <p>Document analysis hard to execute -> meaning what?</p> <p>How did the research process go?</p> <p>To have certainty -> it is never 100% certain.</p>	

Based on:

Pain, R. & G. Mowl (1996) Improving geography essay writing using innovative assessment. *Journal of Geography in Higher Education* 20(1): 19-32.

Kennedy-Kalafatis, S. (1996) Encouraging peer dialogue in the geography classroom: Peer editing to improve student writing. *Journal of Geography in Higher Education* 20(3): 323-341.

I was glad with the feedback I got from Jur Heerink, he brought up some points I did not think of before. In the text below I briefly explain what I did with the feedback I was provided with.

As a result of the feedback, the summary has been extended with the answers to the research questions. I tried to reflect on the data collection quality with regard to the document analysis. I did not change the order in which I show the results as Robin Neef urged me to first show the results and then explain how I got to these results. To compare my research with other research is hard to do, because there are not many articles discussing the influence of rule states from the IAD framework on collective action.

For the conclusion I tried to add all the rule states, and talk about the combination of rule states. And explain the points that Jur mentioned a bit more in depth.