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Mapping institutional change: Analysing strategies for institutional design in collective infrastructure renewal

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Abstract

Actors' toolset to affect institutional change by *doing* institutional design is limited because criteria for effective institutional design are often too general and abstract. This paper aims to identify institutional design strategies and explore how they influence institutional change. The theoretical framework builds on Ostrom's Institutional Analysis and Development framework to map institutional change, and it identifies six institutional design strategies: framing, puzzling, powering, network composition, network outcomes, and network interaction. A comparative case study on Dutch infrastructure renewal opportunities – one case's institutional design interventions attained collective renewal, the other did not – maps institutional change in decision-making rounds through institutional directions. Key findings include that institutional change of position, boundary, choice, and information rules first is conducive to collective action. Moreover, mimicry of especially choice rules is pivotal. Furthermore, institutional design strategies have a configurational nature: microlevel strategies have mesolevel consequences, and some configurations

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instigate change, whereas others cause dynamic inertia.

KEYWORDS

decision-making rounds, Dutch infrastructure policy, Institutional Analysis and Development Framework, institutional design strategies, institutional direction

1 | INTRODUCTION

This paper concerns how institutional design may affect institutional change. Institutions can be defined as durable systems of established and embedded humanly-devised *rules* and norms that structure social interactions by informing actors to do X in circumstances Y (Hodgson, 2006; North, 1991). Institutional change is commonly required for achieving collective action and for dealing with institutional fragmentation (De Bruijne & Van Eeten, 2007; Feiock, 2013; Feiock et al., 2017; Fillion & Sanderson, 2011; Heeres et al., 2016; Shrestha et al., 2014). This also applies to the planning and implementation of transport infrastructure. Herrera and MacAskill (2021, p. 13), for example, note that institutional barriers on the one hand are seen as “the most influential underlying factors” hampering adjustment of transport infrastructure, but simultaneously are so common they are referred to as “unsurprising.” Changing institutions may be realized through institutional design, which is both the act and product of designing institutions. We emphasize that design is often redesigned, since actors will rarely operate in an institutional vacuum or from a *tabula rasa*. Hence, institutional design strategies commonly concern the *change* of institutions, rather than establishing an institutional system (Koppenjan & Groenewegen, 2005). However, in literature, there is little insight into how actors *do* institutional design (Bjerregaard & Lauring, 2012; Brousseau et al., 2011).

While recent institutional literature does emphasize actor agency in institutional change (cf. Beunen & Patterson, 2019; Bjerregaard & Lauring, 2012), the questions of *how* actors use *what* specific institutional design strategies remain daunting (cf. Dorado, 2005; Fraune & Knodt, 2017). Two primary reasons exist for the persistence of this knowledge gap. First, institutional design strategies are commonly not concrete and actionable. Literature often provides general or abstract design criteria for effective institutional design, such as Ostrom's design principles, the role of power and legitimacy in institutional change, establishing a goodness-of-fit as a heuristic value, and creating credible commitment (Alexander, 2006; Beckert, 1999; Cox et al., 2010; Healey, 1999; Ostrom, 1990; Ostrom, 1993, p. 199; Schlager et al., 2021). Research based on these criteria revolves around “process descriptions [that] are [...] subordinate to theoretical considerations or empirical findings” (Hermus et al., 2020, p. 28) and tend to “sidestep the intricacies of putting the institutional design into practice” (Glasbergen & Driessen, 2005, p. 266). Second, institutional design strategies are difficult to distinguish from mundane work strategies at the microlevel (Bjerregaard & Lauring, 2012; Klijn & Koppenjan, 2016; Salet, 2018; Spijkerboer et al., 2021). Actors are involved in decision-making processes where their actions are directed to a specific task-at-hand, and their actions, so to say, just happen to have institutional consequences. Basically, people don't talk or act in institutions (Watkins & Westphal, 2016).

In sum, a research gap exists regarding how institutional design strategies may be identified, which, in turn, limits actors' toolset for affecting institutional change. Hence, what is required, is a clear identification of institutional change and detailed accounts of institutional design in that change. To that end, we connect the Institutional Analysis and Development Framework (IAD) of Ostrom (2005) to the rounds model of Teisman (2000). The rounds model is especially appropriate for our purposes because it focuses on deliberate interactions between multiple actors (see Teisman, 2000). By definition, each round is characterized by a specific problem, solution, and most crucial decision for a particular time period. We use the IAD framework to provide insight per round into the direction that the institutional rules-in-use per rule type steer the decision-making process. A change in the direction of rules indicates institutional change. Through an in-depth comparative case study, we then explore the role of institutional design strategies in that institutional change. Accordingly, this paper answers the call to "devote more attention, both theoretical and empirical, to institutional design" (Klijn & Koppenjan, 2006, p. 158).

The aim of this study is, therefore, to explore the concept of institutional design strategies and their relation to institutional change. Our research question is: How do actors use institutional design strategies to affect institutional change? The empirical context of our study is Dutch infrastructure networks. Dutch infrastructure networks require considerable renewal, due to aging assets, network capacity constraints, and stricter qualitative standards including sustainability and climate adaptation requirements. While many infrastructure networks (e.g., road, rail, energy) are increasingly interconnected – that is, multiple networks affect each other's functioning and/or are located in the same area – a collective renewal that employs these interconnections are often not pursued due to the systems' institutional fragmentation (Bornemann, 2017; Heeres et al., 2016; Hiteva & Watson, 2019; Neef et al., 2020; Shrestha et al., 2014; WRR, 2008).

2 | THEORY

In Section 2.1, we elaborate on the concept of institutional directions as the basis for identifying institutional change. In Section 2.2, we elaborate on institutional design generally and institutional design strategies specifically and how they could affect institutional change.

2.1 | Identifying institutional change through institutional directions

The IAD (Ostrom 2005, 2011) systematically studies, identifies, and classifies institutions. The framework assesses four components: the action arena wherein certain activities occur and specific actors act, based on the three exogenous variables of biophysical and material conditions, attributes of community, and rules, that result in specific interactions, and specific outcomes (Ostrom, 2005). Commonly, when assessing spatial planning, the focus of the IAD is on rules because this allows for analysing the complex multiactor decision-making process (Hijdra, 2017; Van Karnenbeek & Janssen-Jansen, 2018; Laeni et al., 2021; Ostrom, 2014).

The IAD employs seven analytical institutional rule types to categorize empirical "rules-in-use," the rules that actually affect behavior in so-called action situations, that is, the "social space where participants with diverse preferences interact, exchange goods and services, solve

problems, dominate one another, or fight” (Ostrom, 2005, p.14). Aggregated, all rules in the use of a single rule type provide a particular direction to the decision-making process (Neef et al., 2022). Focusing on these directions provides a quick and simplified insight into the plethora of rules in use (cf. van Geet et al., 2018; Minkoff, 2013; cf. Spijkerboer et al., 2019; cf. Wu et al., 2018). Changing the direction of rules is of interest to actors because this may imply a change of distributional consequences, that is, the change affects who the winners and losers are in a particular action situation. Hence, a change in the direction, that is, institutional change, may indicate that an institutional design strategy was applied. Below, we describe these directions to empirically use these as identifiers of institutional change, strongly building on Neef et al. (2022).

First, position rules regulate the diversity of positions by increasing or decreasing the diversity of positions, respectively, providing a divergent or a convergent direction to the positions. Positions are particular combinations of resources, opportunities, preferences, and responsibilities as held by actors (McGinnis, 2011; Varughese & Ostrom, 2001). Second, boundary rules either do or do not assign conditions to entry or exit of a position or arena, respectively, providing a closed or open direction (Cole & McGinnis, 2018; Klijn & Koppenjan, 2016). Third-choice rules can either be directed towards flexibility or rigidity. The former allows actors to adapt their institutionalized templates of rules, procedures, and exchanges to the collective action situation and remain legitimate in their actions, whereas the latter obtain legitimacy from adhering to institutionalized templates (Feiock, 2013; Hodgson, 2006). Fourth, information rules may be either facilitative or restrictive. The former directs actors to share and assimilate information, and the latter guard's process continuance by preventing informational and cognitive overload (Schittekatte & Van Hiel, 1996; Stasser et al., 1985; Veenma, 2021). Fifth, aggregation rules can either have a symmetric or nonsymmetric direction, where the former does and the latter does not value the participant's input influence equally on a decision that is jointly affected by multiple actors (Herzberg & Ostrom, 2000; Straffin, 1977). Next, scope rules' directions may be broad or narrow. The former expands the number of possible outcomes hence providing many options for collective action but also providing complexity, whereas the latter delimitates possible outcomes, hence providing more clarity yet possibly excluding certain collective action possibilities (Gerber et al., 2013; Hawkins, 2010). Finally, the payoff rule can be either proximate or distal, with the former directing actors to extend and the latter directing actors to retain their ability to access resources as influenced by earmarks, risks, and rewards (Marwell & Ames, 1979; Oliver, 1980; Skamris & Flyvbjerg, 2001).

2.2 | Institutional design

2.2.1 | Institutional design characteristics

Most broadly, institutional design may be understood as the practice of *doing* institutional design. Institutional design concerns changing the rules of the decision-making game (Ansell & Gash, 2008; Klijn & Koppenjan, 2006). Put most simply, institutional design means designing and crafting institutions (Alexander, 2005; Ostrom, 1993). More specifically, institutional designing is the deliberate, conscious, and ongoing attempts (van Buuren & Klijn, 2006; Klijn & Koppenjan, 2006) to “devising and realization of rules, procedures, and organizational structures that will enable and constrain behavior and action so as to accord with held values,

achieve desired objectives, or, execute given tasks” (Alexander, 2005, p. 213) in “the on-going nature of ‘getting the process right” (Ostrom, 1993, p. 1907). In our study, institutional design is not the same as creating organizations (Filion & Sanderson, 2011; Fung, 2003). Rather, we use *institutional design strategies* as an all-encompassing phrase to cover phrases for ‘doing institutional design’. Institutional design strategies are actions, processes, and instruments that design institutions, where the design includes creation, alteration, deletion acceptance, application, internalization, reinterpretation, including reactivation and noncompliance (Alexander, 2006; van Broekhoven et al., 2015). Examples are devising common resource pool associations (Ostrom, 1990), designing principal–agent relationships (Vining & Weimer, 1998), and employing institutional tools, instruments, and practices (Weimer, 1995). Below, we review literature that provides guidance for *doing* institutional design.

Most generally, institutional design strategies may either affect *one* or *multiple* rules-in-use and rule types – that is, an institutional arrangement – simultaneously. Next, they may either *directly* or *indirectly* intervene in institutions (Klijn & Koppenjan, 2006; Ostrom, 2005). Direct interventions comprise a forthright change to one of the various rules in use. For example, direct intervention in position rules comprises altering the position of an actor; in boundary rules the conditions based on which actors are able to “take a seat at the decision-making table”; in payoff rules by introducing new financial incentives, etc. (cf. Lowndes & Wilson, 2001). Alternatively, indirect interventions comprise “influencing the perceptions and creation of long-term changes in interaction patterns”, including actors changing their strategies which subsequently change institutions (Klijn & Koppenjan, 2006, p. 152). An indirect intervention may affect a rule-in-use of one rule type through another rule-in-use of another rule type rules. Ostrom (2005) provides an example: in an “urban taxi game,” city governments may require a taxicab to display a purchased medallion before it can legally operate. Hence, limits on the number of medallions are boundary rules. However, effectively, strictly limited medallions also imply a large potential financial return. Thus, there are payoff consequences through changing a boundary rule-in-use, making the medallion instrument an indirect institutional design strategy.

Next, some strategies *deliberately intend* institutional change, while other strategies’ institutional change is a *nonintentional byproduct*. The former are formally called institutional design strategies (e.g., Klijn & Koppenjan, 2006), the latter are more ordinary and mundane work strategies at microinteraction level (Beunen & Patterson, 2019; Van Buuren et al., 2016; Spijkerboer et al., 2021). We include both categories in our literature study so as to comprehensively investigate institutional change and the role of institutional design and actors, hence we use the term institutional design strategies for both. We cover six strategies that may affect multiple rules, three of which are the mesolevel intentional institutional design strategies network composition, network outcomes, and network interaction, and three are the microlevel strategies that unintentionally affect institutions being framing, puzzling, and powering. Table 1 summarizes the strategies.

2.2.2 | Institutional design strategies

First, *network composition strategies* influence the composition of the (policy) network (Klijn & Koppenjan, 2006). Network composition strategies distinguish themselves through systemic influences, including promoting network formation, self-regulation, and system modification. An example is the institutional decentralization of energy networks to provide an area-based

delivery of production and consumption of energy (Spijkerboer et al., 2016; Wu et al., 2018). A precondition for these strategies is that actors are centers of power able to modify existing organizational structures (Filion & Sanderson, 2011). These system-wide, meso-oriented strategies may broadly affect all institutional rule types.

Second, Koppenjan and Klijn (2006) discern strategies aimed at *network outcomes*. These strategies intend “to change the pay-off structure (financial or other rewards that are connected to strategies and decisions), to change professional codes (standards by which actors see their professional activities and identities; e.g., good-quality housing) and strategies that are aimed at changing evaluation criteria (standards by which actors judge the achieved outcomes)” (Koppenjan & Klijn 2006, p.150). Hence, these meso-oriented strategies clearly affect the scope and payoff rules.

Third, *network interaction strategies* influence interactions between actors that regulate processes, facilitate interactions, put rules in a framework, or make linkages (Koppenjan & Klijn 2006). They include 1) conflict settlement mechanisms, 2) procedures that fix interaction and decision sequences, 3) certification that attaches quality standards to actor characteristics in relation to other actors, and 4) supervisory relationships. For example, the Dutch Programming, Planning, and Budgeting system for infrastructure planning (the “MIRT”) standardizes the procedures in coming to infrastructure decisions. Changing such standardization can profoundly affect the decision-making game through a change throughout various institutional rule types.

Fourth, a (re)frame strategy is the construction of meaning over ideas, interests, power, and organization to provide guideposts for knowing, analysing, persuading, and acting (Van Buuren et al., 2016; Schon & Rein, 1994). An institutional designer who (re)frames establishes major and sustainable changes in other actors' perceptions, thinking, and strategic behavior so that actors interpret situations differently and adjust their behavior (Brown et al., 2012; Van Buuren et al., 2016; Klijn & Koppenjan, 2006). Accordingly, framing targets specific actors and constitutes a microlevel. Frames explicitly or implicitly address key issues and problem causes, take moral standpoints – for example, appointing “heroes, victims, and villains” – and point towards possible solutions (De Bruijn, 2019). Hence, reframing strategies often combine strategies and affect rules as boundary and scope rules (Van Buuren et al., 2016; Schon & Rein, 1994). For example, framing an issue as a crisis may establish a sense of danger, urgency, and establish support (Van Buuren et al., 2016).

Fifth, *puzzling* focuses on policy analysis, that is, a specific formulation of policy problems as a necessary step to solving them (Van Buuren et al., 2016; Dunn, 2015; Hecló, 1974). Puzzling means to 1) analyse and 2) assess impacts on systems, and 3) explore potential strategies to (preset) policy goals, and calculate consequences of those policies in terms such as robustness, vulnerability, and no-regret (Van Buuren et al., 2016). Puzzling affects institutions through the increase of information: this may either create new insights regarding required actors, actions, incentives, and solutions to solve a policy problem, or may add uncertainty, controversy, and substantial complexity that results in indecisiveness and debate rather than action (Klijn & Koppenjan, 2016). Hence, puzzling commonly complements and intertwines other strategies, and affects information, position, scope, and payoff rules (Arts & Tatenhove, 2004).

Finally, *powering* may be understood as “mobilizing supporters and cold-shouldering opponents” (Van Buuren et al., 2016, p.73). Institutional designers who use powering mobilize bias. Powering is less subtle than framing, despite both intending to generate support for actors' proposals, disarm critics, safeguard the availability of resources, and establish urgency to take

action. An example is agenda setting, maximizing attention for some issues, and minimizing attention for others. More concretely, powering concerns postponing, obstructing, lobbying, deliberating, bargaining, and gatekeeping, which is allowing or restricting participation in an actor coalition (cf. Ansell & Gash, 2008). Hence, powering may affect multiple institutional rule types such as boundary, choice, and payoff rules.

3 | MATERIALS AND METHODS

3.1 | Methodological approach and case selection

We employed a comparative case study to identify institutional change and the institutional design strategies that were used to affect the institutional direction. The in-depth, longitudinal characteristics of case studies are particularly useful for studying institutional design because they allow for a context-sensitive analysis of a complex situation in a dynamic equilibrium rather than a once hard-fought, now static equilibrium (Ostrom, 2005; Theesfeld, 2004). We identified cases through research stays. The research stays enabled exploration of the case study population by being on-site while doing desk research, accompanying meetings regarding infrastructure renewal, and creating serendipitous opportunities to interview infrastructure administrators about contemporary and past collective renewal cases. The stays contributed to *verstehen* (e.g., Babbie, 2013), which is crucial to institutional studies as “obtaining information about rules-in-use requires spending time at a site and learning how to ask non-threatening, context-specific questions about rule configurations” (Ostrom, 1999, p. 53). We selected our cases based on the case outcome: in one case, the Suurhoffbrug, institutional change ultimately did not lead to a change of outcome to collective action, whereas in the other case, the Calandbrug, it did. Selection criteria further included that multiple infrastructure administrations had to invest because of aging infrastructure, presenting the opportunity for collective action (understood as the renewal of infrastructure by multiple infrastructure administrations that join goals and resources). Of our explored cases, the Suurhoffbrug and Calandbrug best fitted these characteristics, and we were able to organize access to the data for these cases. The comparative case study in combination with the research stays enabled us to explore the differences in institutional change and whether different institutional design strategies were employed throughout those changes. The stays were conducted at two major Dutch infrastructure administrations, conducted from November 2019 to March 2020 for approximately 2 days per week each: ProRail and the Port of Rotterdam Authority. ProRail is the government task organization that manages, maintains, develops, and extends the national railway infrastructure. The Port of Rotterdam Authority (hereafter, the Port) is an unlisted public limited company that manages, operates, and develops the Rotterdam port and its industrial complex for safe and smooth handling of all shipping (de Gooyert, 2020). As the Suurhoffbrug carries a stretch of the highway A15, Rijkswaterstaat (hereafter, Road administration), the executive agency of the Dutch Ministry of Infrastructure and Water Management, was also involved, as this agency is responsible for the design, construction, management, and maintenance of the Dutch main road network.

TABLE 1 Institutional design strategies and characteristics

	Actions, instruments, processes	Level (micro, meso)	Directness (direct, indirect)	Intentionality (intentional, unintentional)
<i>Network Composition</i>	Promote network formation; self-regulation; system modification	Meso	Direct	Intentional
<i>Network Outcomes</i>	Influence payoff structure; influence evaluation criteria; influence professional codes	Meso	Direct	Intentional
<i>Network Interactions</i>	Introduce procedures for interaction and decision sequences; change supervisory relations; conflict regulation; certification	Meso	Direct and indirect	Intentional
<i>(Re)Framing</i>	Agenda setting; taking a moral standpoint toward issues and solutions	Micro	Indirect	Unintentional
<i>Puzzling</i>	Analyse systems; explore strategies; assess impacts	Micro	Indirect	Unintentional
<i>Powering</i>	Postpone decision making; obstruct; lobby as bypassing arenas; gatekeep access	Micro	Direct and indirect	Unintentional

3.2 | Data collection and analysis

We collected data through a document study by searching news articles and the internal databases of ProRail and the Port for our cases, and through interviews conducted in July and August 2020. The interviewees, the main decision makers, were identified through the research stays and through snowball sampling. The interviews addressed the institutional rules, their direction, the progression of the case over time, and the role of the actors in progressing these three elements. The interviews were recorded and transcribed. Supporting Information: Appendix A provides an overview of the collected data.

The data were analysed through coding in ATLAS.ti. As codes, we used the institutional directions and the institutional design strategies, where the former served to identify institutional change, and the latter to identify the strategies employed in that change. We applied codes when the data either explicitly or latently reflected the theoretical concepts (Babbie, 2013; Spijkerboer et al., 2019). We described the cases over time by the concept of *rounds* (Teisman, 2000). The rounds model is especially applicable to interactive, complex decision-making processes where multiple decision makers take decisions. Rounds are characterized by a specific problem, solution, and most crucial decision as perceived by the actors as a frame of reference for a particular time period. Hence, different rounds may differentiate central actors, issues, or (type of) decisions. The final round is demarcated by the official signing of a starting document, which is the formal starting point for a Dutch infrastructure project (Ministry of Infrastructure and Water Management, 2018) and which can be characterized as employing or barring collective action. We employ the concept of this temporal round because “if one wants to analyse the effects of institutional design interventions, a close look at the developments within networks and a good reconstruction of the rules and their changes is required” (van Buuren & Klijn, 2006).

Next, we classified the institutional directions per round. Subsequently, we used codes to classify the institutional design strategies employed by the actors in each round. Lastly, by checking whether the data indicated that the co-occurrence of an institutional design strategy and a specific institutional change was related, we analysed what strategies altered which institutional rule types, whether particular strategies were dominantly used in earlier or later rounds, and whether particular institutional directions were dominantly targeted in earlier or later rounds, whether strategies affected single or multiple institutional rule types, whether strategies directly or indirectly affected rule types and what the relation of these strategies to collective action may be. Finally, we compared these aspects between the cases.

4 | RESULTS—CASE DESCRIPTION IN ROUNDS AND INSTITUTIONAL DIRECTIONS

4.1 | Rounds of Suurhoffbrug

The Suurhoffbrug was commissioned in 1974 as a road, and rail bridge in the A15 motorway (administered by the Road administration) and Betuweroute (administered by ProRail). The bridge spans the Hartelchannel (Dutch: Hartelkanaal; administered by the Port). The A15 is the crucial highway for international accessibility of the port to the hinterland. The Betuweroute is the main Dutch-German freightline. The Hartelchannel is an important inland shipping route

from the port toward German steel industry clusters. Supporting Information: Appendix B summarizes the four rounds of the Suurhoffbrug.

Round 1 (2000–2004): Desiring nonaging related renewal. The key problem in this round comprised safety issues of the motorway, and capacity issues of the motorway and the channel. The Road administration and the Port, without ProRail, together explored potential problems and solutions. Elevation of the bridge and simultaneous reduction of the perpendicular bends of the bridge could potentially shape one integrated solution for both of these issues. However, the cost–benefit analysis regarding the costs is disproportional to the benefits of the Road administration and the Port. The infrastructure administrations uphold this institutionalized template, meaning that no action was taken to gather alternative sources of funding. Rather, the Port chose to explore enhancing the shipping capacity of the port through alternative channels, and the Road administration decided to exclude the Suurhoffbrug from their next infrastructure projects.

Round 2 (2008–2015): Desiring aging-related renewal. In early 2008, the key problem changed to civil-technical aging. The Road administration identified that the Suurhoffbrug, amongst other major Dutch bridges, was nearing end-of-life. The renewal was estimated to become necessary by 2020. In this round, however, the infrastructure administrations did not collectively explore both problems and solutions. Rather, the Port was excluded from an arena where the Road administration and ProRail discussed, amongst others, their mutual interests in the Suurhoffbrug, leading the Port to report to feel excluded from decision making. The Road administration postponed the actual renewal of the Suurhoffbrug, to learn from less complex cases first. ProRail also withdrew from renewal, to focus on the merger with the freight rail administrator (Keyrail). Simultaneously, the Port decided to extend the Breddiep channel, which rendered their renewal need in the Suurhoffbrug less urgent.

Round 3 (2015–2016): Conducting intermediate maintenance. The aging-related renewal need became urgent in this round. The road bridge malfunctioned, and rail bridge maintenance had been lacking due to ineffective management of life cycle costs, due to lacking central coordination between ProRail's and the freight rail administrator's various coordinators and engineers. Subsequently, ProRail experienced major budgetary tensions for the bridge. Hence, the Road administration and ProRail made the key decision to coordinate minor maintenance such as fixating the road bridge, without coming to a consensus on the long-term aging problem. Simultaneously, the Port reported they “had to annoyingly put their feet between any door” to be included in the decision making, and ministerial departments of roads and public transit argued over which department is supposed to pay.

Round 4 (2016–2017): Emergence of the temporary bridge. Finally, in this round, the full-scale renovation was deemed impossible, while simultaneously increased crack formation meant that the bascule bridge had to be decommissioned. Accordingly, the Road administration, ProRail, and the Port involved market parties to explore new solutions. Here, the impossibilities for collective renewal were acknowledged, due to the various qualitative conditions of the different administrations' assets. Therefore, at the ministerial board meeting, a temporary road bridge was devised as a solution. In the second half of 2017, this idea was formalized, in part because the ministerial procedure for the renovation of all the involved actors' bridge parts would last well beyond the bridge's lifecycle. For the Port, this meant that the bridge would not be heightened, as the alternative was that no bridge would exist at all.

Concluding, we classify the rounds according to the institutions' directions as indicated in Table 2.

TABLE 2 Institutional directions per decision-making rounds of the Suurhoffbrug (rule direction remaining identical indicated by “=”)

Rule types	Decision-making Round 1	Decision-making Round 2	Decision-making Round 3	Decision-making Round 4
Position	Divergent	Convergent	Divergent	=
Boundary				
Entry	Closed	=	=	=
Exit	Open	=	=	=
Choice	Rigid	=	=	=
Information	Restrictive	=	=	Facilitative
Aggregation	Nonsymmetric	=	=	=
Scope	Narrow	=	=	=
Payoff	Distal	=	=	=

4.2 | Rounds of calandbrug

The Calandbrug was commissioned in 1969 as a rail bridge that frequently opens for sea ships to the port. ProRail manages the freight track, which is the start of the Betuweroute, and the Port administers the functioning of the port and the shipping route. Supporting Information: Appendix C summarizes the three rounds of the Calandbrug.

Round 1 (2009–2010): Identifying first issues. The Calandbrug was first identified as a point of concern for capacity issues in 2009 by ProRail. They signaled that the Calandbridge's openings would significantly disrupt the train traffic after 2020, since an open bridge means no train traffic yet a closed bridge means no shipping traffic, and that an alternative to the bridge was required before 2035. Subsequently, ProRail assessed that immediate action was not necessary. The Port, however, individually decided to continue broad internal explorations into conceivable possibilities surrounding the problems and solutions of the Calandbrug.

Round 2 (2011): Preferring process measures. In 2011, the key issue changed to resource availability for the bottleneck that the Calandbrug poses for the operational capacity of both networks. The Port managed to find support from both the Ministry and ProRail to now collectively explore mutual problems and feasible solutions. In the short term, the only feasible contributions to the bottlenecks were process measures, such as increasing the intensity of train paths elsewhere and improving the planning of the overall infrastructural chain. The Port found this dissatisfactory and took the lead in further exploring problems and solutions.

Round 3 (2012–2013): Preferring infrastructural measures. In 2012, new key issues comprise reliability and aging of the bridge by 2020 and noise pollution at the nearby village of Rozenburg. The aforementioned process measures were unlikely to solve these issues. Rather, a fixed bridge or an alternative route was proposed. The Port initiated a study into four possible infrastructural, physical-spatial solutions. In a follow-up study, they scored the explored solution “Theemswegtrace” as an alternative routing highest of all alternatives. The Ministry, as a funding actor, assigned ProRail and the Port to collectively explore Theemswegtrace as a solution. In 2013, the state secretary took the key decision to reserve €157mln from the Ministry's budget, on the condition that the Port would contribute €80mln.

TABLE 3 Institutional directions per decision-making round of the Calandbrug (rule direction remaining identical indicated by “=”)

Rule types	Decision-making Round 1	Decision-making Round 2	Decision-making Round 3
Position	Convergent	Divergent	=
Boundary			
Entry	Closed	Open	Open
Exit	Open	Open	Closed
Choice	Rigid	Flexible	Rigid
Information	Restrictive	Facilitative	=
Aggregation	Nonsymmetric	Symmetric	=
Scope	Broad	=	Narrow
Payoff	Distal	=	Proximate

Concluding, we classify the rounds according to the institutions' directions as indicated in Table 3.

5 | DISCUSSION—CASE ANALYSIS BY INSTITUTIONAL DESIGN

In this section, we analyse what institutional design strategies were used to affect the institutional direction from one round to another per case, and we compare the cases.

5.1 | Institutional design of Suurhoffbrug

The institutional design strategy that characterizes Round 1 is *puzzling*. The key strategy defining characteristics that we found was that systems, being the bridges in the respective networks of the Road administration and the Port, were explored and impacts (cost–benefits) were assessed. The strategy entailed that multiple actors from multiple disciplines identified different problems and possible solutions regarding safety and capacity. Since Round 1 is the first round, there appears to be no counterfactual that this institutional design strategy affected institutional change from an institutional standard. However, infrastructure planning is commonly characterized by an institutional configuration that empowers the individual actors, that is, an institutional predisposition that disfavors collective action. In this counterfactual, position rules commonly converge diversity of positions. Hence the *puzzling* in the Suurhoffbrug likely served as preparation for altering the position rules' direction.

Two institutional design strategies characterize Round 2. First, ongoing *puzzling* revealed that the new key issue was civil–technical, and therefore mostly civil–technical actors were involved. This meant that the set of involved actors converged to an extent that the Port was not invited to the arena since its involvement was not aging related. Hence, *puzzling* changed the position rules. Second, we identified *powering* based on its characteristics of obstructing access and postponing decision making: While the Port wanted to participate in the Suurhoffbrug

arena, the Road administration and ProRail discussed the Suurhoffbrug in arenas that were inaccessible to the Port. Effectively, the Road administration used powering to cold shoulder the Port by blocking access. Additionally, the Road administration considered the Suurhoffbrug a complex case, so the Road administration wanted to learn from other aging-related renewal needs. In other words, the Road administration maintained individual institutionalized templates for (not) acting. Hence, powering maintained a closed entry boundary rule, maintained a rigid choice rule, and indirectly maintained a narrow scope rule. Powering was used as postponing decision making: indirectly, this caused powering to also affect scope rules, as solution spaces could not be joined due to the combination of closed entry and rigid choice.

Two institutional design strategies characterize Round 3. First, we identified *network interaction* based on its characteristics of introducing interaction procedures: the Road administration and ProRail reached out to one another to align their maintenance processes. Moreover, they involved the Ministry to prepare a long-term solution for the Suurhoffbrug. Hence, the position rules had a diverging direction. However, these new interactions are not sufficiently satisfactory for achieving collective action: departments within the Ministry argued over who is the problem owner, and therefore financially responsible, and the Port indicates still “having to annoyingly put their feet between any door” to be included. Therefore, the cold-shouldering and blocking access characteristic of *powering* continued: the Port still experienced closed entry. Also, the postponing characteristic of powering was found, as the coconducted maintenance further postpones a definitive solution to the Suurhoffbrug – that is, choice rules had a rigid direction – and indirectly a narrow scope direction prevailed.

Finally, in Round 4, we find three institutional design strategies. First, we identified the combination of *puzzling* and *network composition*. We found network composition by its characteristic of promoting network formation sequences: the Road administration officially invited ProRail, the Port, and market parties to a market involvement process. This formation was used to continue puzzling, which we identified based on its characteristic of analysing systems and exploring strategies: the market involvement demonstrated that the procedure for full-scale collective renovation and adding functionality would take too much time before end-of-life is actually reached. Hence, the strategies established the institutional direction that boundary entry is still officially closed since conditions are being attributed by a central actor, but that information sharing is now facilitated. Second, this final round demonstrated the indirect institutional and temporal effect of *powering* – that is, blocking access and postponing decision making. The closed boundary entry and rigid choice in previous rounds established a narrow scope that renders collective action impossible due to too limited time. Lastly, a temporary road bridge as a key decision may be considered another instance of powering, because this bridge cold-shoulders actors looking to reap the benefits of a collective renewal, like heightening the bridge for the Port. This means that powering again reaffirms the rigid choice rule, as the Road administration adheres to its own institutional template.

Concluding, the Suurhoffbrug provides two key insights. First, power can be used as an institutional design strategy to fend off collective action despite actors wanting to achieve collective action through an *institutional indirect effect*. Powering emphasizes one single actor's interests, rather than employing the potential of other actors. This central actor pursued the individual interests by closing the entry boundary and keeping choice rigid, especially through postponing action and fragmenting arenas. However, this *indirectly* and ultimately kept the scope rules narrow and prevented solution spaces from conjoining. Second, we find a particular institutional change map. The directions of just two IAD rule types changed, namely position and information rules. Importantly, payoff and scope rules did not change – more specifically,

these remained unchanged but not unaffected. We find *dynamic inertia*: powering “froze” the narrow scope rule’s direction in place through other rule types. Because of closed boundaries and rigid choices, a narrow scope could not be found. Hence, for effective institutional design towards collective action, the institutional change could follow a path of changing directions of boundary and choice rules first and scope and pay off later.

5.2 | Institutional design of Calandbrug

The first round of the Calandbrug has a similar institutional configuration as the Suurhoffbrug, that is, an institutional predisposition that empowers individual actors. The first strategy we identified is *puzzling* because its characteristic “system exploration” was found in exploring the impacts of disruption and aging on both networks. The Port started changing the institutional predisposition by adapting their own *choice rules* because of *puzzling*: regardless of ProRail indicating not being interested in collective renewal in the Calandbrug, the Port individually dedicated resources to explore other conceptions and possibilities regarding the problems and solutions. By doing so, the Port deviated from the institutional templates from which they draw legitimacy for their actions (since this exploration may be inefficient and unsuccessful given ProRail’s disinterest).

Round 2 is characterized by a combination of *ongoing puzzling*, *network interaction*, and *network composition*. First, the ongoing *puzzling*, that is, the system analysis and strategy exploration of operational capacity bottlenecks and process measures, indicated that both actors’ fiat is necessary to progress a situation where collective action could become a future possibility regardless of the precise key issues. Second and subsequently, we identified a combination of network interaction and network composition strategies. The characteristic of network composition of “promoting network formation” was especially prevalent, as were the network interaction characteristics of “introducing new procedures” and “changing supervisory relations”: the Port constructed a not-strictly-defined arena between ProRail and the Port, in which high managerial positions provided their fiat – that is, the precondition of network composition strategies that centers of power are involved is met. The combination of these strategies *opened* the *boundary* for actors from different administrations and *positions* to continue *puzzling* individually and collectively with access to each other’s *information*. However, and third, these strategies alone do not account for the resultant institutional change. The mimicking behavior of ProRail was key: ProRail mimicked the Port’s institutional change behavior, that is, becoming more flexible in choice, open in boundary, diverse in position, and facilitative in information sharing. The reasons for mimicking were twofold. One, with the Port in the lead, ProRail may benefit from a potential solution at little expense. Two, there is legitimacy to dedicating some institutional resources to the Calandbrug due to the uncertainty of new problems given recently acquired knowledge regarding the Calandbrug. Indirectly, mimicry caused *aggregation* to be *symmetric*, because the decision-making process will now continue rather than be vetoed if just one actor considers the process no longer worthwhile.

Finally, Round 3 contains *ongoing puzzling*, *network outcome*, and *framing* strategies, and has *indirect* effects from the previous round’s *network interaction*. First, ongoing *puzzling* indicated that the key problem had become more urgent: the bridge aged faster than expected, process measures wouldn’t suffice, and no budget was available for the best-evaluated solution. Hence, *puzzling* identified a common solution, that is, altered the *scope rules* direction, and created momentum and urgency worthy of rapid action and public funds, as reflected by the

large numbers of documents produced by the Port, ProRail, and ministry, (sometimes independently, and sometimes in collaboration with one another). Second, to seize the momentum, a network outcome and framing strategy were combined. We identified a network outcome strategy based on the influencing of the payoff structure, and a framing strategy because of its moral standpoint towards the Calandbrug. Essentially, the Port and ProRail employed a “*thin wire*” frame: a well-functioning Calandbrug is crucial to effectively operate the multibillion-euro investment of land extension (the “Tweede Maasvlakte”) in the Port of Rotterdam. This frame invokes the image that a multimillion Euro investment is relatively cheap and that the land extension could have been disinvestment. This frame changed the payoff structure because now funds previously only available to the Ministry also became available to ProRail and the Port. Hence, framing was a concrete example of a network outcome strategy that was successful in changing the *payoff rules’ direction*. Third, the previous rounds’ network interaction strategies got actors acquainted with each other, committed to solving the problems of the Calandbrug, and by extension, committed to each other. Effectively, commitment and trust emerged that ensured that actors stayed and would uphold new institutionalized templates. Hence, the indirect effect of network interaction caused *boundaries to close and choices to rigidify*.

In conclusion, the Calandbrug provides three key insights. First, the rounds show a *temporal, sequential progression* path throughout the IAD. Rounds 1 and 2 affect position, boundary, choice, information, and aggregation rules, whereas the last round affects payoff and scope rules. This may indicate that an institutional change path in the IAD from left to right may help to acquire collective action in later rounds. To this end, first employing network interaction strategies may be especially effective for establishing collective action, since they affect position, boundary, choice, information, and aggregation rules, and network outcome strategies may be especially appropriate later since they affected the scope and payoff rules. Second, *choice rules and mimicry were pivotal* in achieving collective action. In Round 1, the Port chose to be flexible in their choice rules-in-use, that is, deviate from their institutionalized template. Subsequently, in Round 2, ProRail mimicked that choice flexibility. These collective flexible choice rules allowed for the narrow scope and proximate payoff to emerge, that is, for collective action to emerge in Round 3. Additionally, this shows that the same institutional direction, that is, flexible choice rules, can be achieved through different institutional design strategies. Third, the case demonstrates a *configurational nature* of institutional design strategies: network composition built on network interaction, and network outcomes employed framing strategies. Hence, institutional design strategies can be considered in coherence with one another. Moreover, that coherence should take into account the *indirect institutional effects* that were particularly demonstrated by network interaction strategies, causing the rules’ direction to rechange to their original direction over time.

5.3 | Institutional design and comparative analysis

Table 4 summarizes Sections 5.1 and 5.2 by illustrating where an institutional change of rule types coincided with institutional design strategies. The comparison of the cases reveals four main findings: 1) an institutional change path from boundary, choice, and position rules through to payoff rules appear to better promote institutional change and collective action, 2) institutional mimicry can navigate institutional inertia, 3) microlevel strategies can serve as

TABLE 4 Institutional change per rule type as affected by institutional design strategies, where the square brackets indicate indirect effects

	Position	Boundary	Choice	Information	Aggregation	Scope	Payoff
Network composition	X and [x]	x		[x]			
Network outcomes						x	x
Network interaction	x	x and [x]	[x]	x and [x]	[x]		
Puzzling	x		x	x		x	
Framing						x	x
Powering		x	x	x		[x]	

institutional design strategies, and 4) institutional design strategies have a configurational nature. Supporting Information: Appendix D summarizes the key findings discussed below.

First, the cases highlight a particular institutional change *path*, which has been identified as a research gap (e.g., Ostrom, 2014) and as an important source of critique on institutional studies (e.g., Ostrom & Basurto, 2011). While few empirical studies exist (e.g., Buitelaar et al., 2007; Van Karnenbeek & Janssen-Jansen, 2018), our study allows analysing the institutional change path for all rule types, and their *configurational nature* over time.

Illustrating this change, in the collective action case (the Calandbrug), first the position, boundary, choice, and information rule directions were changed. This allowed for an institutional change of the scope and payoff rules later. Especially the choice rules played a dominant role in instigating further institutional change: by deviating from their institutionalized templates of procedures and exchanges, actors invited *mimicry* of choice rules and further institutional change. By choosing to alter the choice rules, opening boundaries and diverging positions became possible. Ultimately, this also changed the scope and payoff rules, despite initially risking inefficiency, illegitimacy, and being unsuccessful. Contrastingly, in the Suurhoffbrug, the boundary and choice rules in particular did not change to more collective action-conducting institutional directions. Rather, the actors stayed in control of their *own* actions by adhering to their legitimized templates of procedures and exchanges, but this rigidity did not allow for further altering of boundary and information rules. Ultimately, this inhibited scope and payoff rules from changing. In conclusion, our study suggests that a specific institutional change path of first changing position, boundary, choice, and information directions may be particularly conducive to further institutional change in the scope and payoff directions.

Second, the cases illustrate the importance of actors *mimicking* each other's behavior to instigate institutional change. Whereas literature has identified *institutional isomorphism through mimicry* (Beckert, 1999; DiMaggio & Powell, 1983; March & Olsen, 1976), to our knowledge, the phenomenon of mimicry has not been identified as a factor in institutional design. Mimicry is demonstrated in the Calandbrug case by the interaction between the Port and ProRail: the Port initiated institutional change behavior (becoming more flexible in choice, open in boundary, diverse in position, and facilitative in information sharing), and ProRail mimicked that behavior. The reasons for mimicking were twofold. One, with the Port in the lead, ProRail may benefit from a potential solution at relatively little expense. Two, there is legitimacy to dedicating some institutional resources to the Calandbrug due to the uncertainty of new problems given recently acquired knowledge. Indirectly, mimicry caused aggregation

rules to become symmetric because the decision-making process will now continue rather than be vetoed if just one actor no longer considers the process worthwhile. Crucially, actors steered the institutional change process in the same direction, ultimately resulting in a change in the scope rules. Contrasting, in the Suurhoffbrug, different actors portrayed different behaviors: whereas the Port tried to access the arena, the Road administration was obstructing access. This meant that actors pulled institutional change in different directions, that is, their behavior had a multidirectional effect on institutional change that ultimately resulted in actors being unable to construct a collective solution, that is, resulted in inert scope rules. Hence, exploring mimicry as a factor in institutional design strategies may be interesting for future research given its key role in progressing the institutional change process. In conclusion, our study suggests that mimicry is a way to further institutional change as opposed to a multiactor multidirectional dynamic that establishes institutional inertia.

Third, our study confirms that people indeed do not talk in institutions (Watkins & Westphal, 2016) as actors stated they were solving a practice-related problem rather than trying to change an institutional structure. This has implications for the theoretical framework. On the one hand, the intentional strategies, that is, network interaction, network composition, and network outcomes (Koppenjan & Klijn, 2006), reflect the mesostructural consequences of actors' actions yet do not reflect actors' self-perceived motivation for their actions; on the other hand, the nonintentional strategies, that is, puzzling, powering, and framing (Van Buuren et al., 2016), reflect the actors' self-perceived motivation for their actions yet do not reflect the mesostructural consequences of actors' actions. Hence, our study demonstrates that microlevel strategies can serve as institutional design strategies. This opens avenues for possible research on how other microlevel strategies may serve as institutional design strategies, thereby contributing to concrete and actionable institutional design, that is, putting the institutional design into practice.

Finally, the cases suggest that the “right” combination of (simultaneous) strategies may be key in instigating institutional change and achieving collective action. As illustrated, puzzling was used throughout the first rounds of both cases. However, in the Suurhoffbrug, the combination of puzzling with powering meant that puzzling occurred rather individually, that is, without actors meeting and building collective rapport (until the market involvement in the final round). Hence, while in early rounds powering allowed the main institutional designer to “stay in control/the lead” of the main problem under scrutiny, powering also excluded the possibility of other actors conjoining their problems, and, in later rounds, solutions. Hence, powering does not seem an appropriate strategy when all actors are needed to participate in decision making generally and puzzling specifically, which is a specific case for infrastructure administrations since they generally are monopolists. By contrast, in the Calandbrug, the combination of puzzling with network composition and network interaction meant that an arena had formed based on mutual managerial support where all actors could meet to progress the puzzling to conjoin problem and solution spaces, that is, to change the directions of scope and payoff rules. Hence, the combination of these strategies seems appropriate to instigate further institutional change for this particular case. The cases, therefore, illustrate that joint-decision making need not be negative or abstract (Scheller & Walker, 2017). Concluding generally, we find that the strategies demonstrate a *configurational nature* in achieving institutional change, just as the rules in the IAD portray a configurational nature.

6 | CONCLUSION

Institutional change is commonly suggested in response to institutional fragmentation, so as to achieve collective action. In this paper, we addressed the knowledge gap about *how* actors use institutional design strategies that affect institutional change. Current literature lacked a commonly accepted framework for concrete, actionable institutional design strategies, has difficulty distinguishing institutional design strategies from microlevel strategies, and has devoted little attention to the temporal complexities of strategies and interacting institutions. Our empirical study into how infrastructure administrations employed institutional design strategies to achieve institutional change for collective action as seizing joint renewal opportunities in aged Dutch infrastructure networks, yielded four main conclusions: institutional change paths are configurational, assess institutional effects of strategies rather than institutional strategies, configurational nature of strategies comprise strategy interrelations and temporal lag, and mimicry has a key role in navigating institutional inertia of choice rules.

First, we mapped institutional change by characterizing the direction of the rules-in-use across several rounds in a decision-making process. This institutional change map showed that institutional design strategies that first change position, boundary, choice, and information rule directions may be particularly conducive to further institutional change of scope and payoff rules. Future research may indicate whether a hierarchy of rules (cf. Van Karnenbeek & Janssen-Jansen, 2018) exists within these particular rule types, which can further inform how institutional design strategies can be effective means to instigate institutional change.

Second, our study demonstrated that mundane, microlevel strategies that do not intentionally establish institutional change – puzzling, powering, and framing – can serve as institutional design strategies, also in addition to intentional mesolevel institutional design strategies – network interactions, network outcomes, and network composition. This finding expands the toolbox that actors have at their disposal to put institutional design into practice: institutional design strategies need not be a separate category of strategies but may be better understood as the institutional effects of (microlevel) strategies. This toolbox may be further developed by future research on the interrelations between microlevel, mesolevel, and other strategies and institutional entrepreneurship. A major contemporary research subject is the endogenous role of actors in institutional change, that is, actor-oriented institutionalism, of which institutional entrepreneurship represents a leading approach. However, it is also criticized for its abstract and ambiguous notion of what institutional entrepreneurs do (Maguire et al., 2004; Biygautane et al., 2019; Hoogstraaten et al., 2020). Exploring the role of these strategies may contribute to this knowledge gap.

Third, our study showed that institutional design strategies have a configurational nature: some combinations of strategies are successful at instigating further institutional change to ultimately achieve collective action – such as puzzling with network interaction – whereas others caused dynamic inertia of scope and payoff rules that ultimately inhibited collective action – such as puzzling with powering. The conclusion is therefore twofold: first, this configurational nature implies that actors should carefully consider the *symbiosis* between strategies they and other actors employ as the institutional design is the playing of a multi-actor decision-making game for institutional change or maintenance. Second, the configurational nature has a *temporal lag*: particular rule types were only able to change or were prevented from changing, due to the combination of the employed strategies earlier in the decision-making process. Hence, the inhibitive effects of ongoing powering and puzzling only became

evident over time. An interesting avenue for future research is exploring the temporal lag of various configurations of strategies.

Finally, our study highlighted the pivotal role of choice rules and mimicry in this symbiosis. The rigidity or flexibility of choice rules respectively inhibited or initiated further institutional change. Both these directions were reinforced through mimicry of that institutional direction by the other actors. If actors wish to navigate institutional inertia caused by institutional fragmentation, they should either mimic the behavior of other actors or adapt the institutional templates from which they draw legitimacy to the task at hand. Since mimicry is contemporarily understood as the main driver of institutional isomorphism; further research into the role of mimicry in actor-oriented institutionalism may contribute to understanding how actors may deliberately use mimicry to fuel (divergent) institutional change processes.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

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