



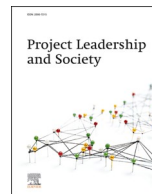
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Empirical Research Paper

“I can say things I wouldn’t normally say”: Changing project delivery implementation and social networks as drivers of institutional change in Nordic infrastructure projects

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ABSTRACT

The implementation of collaborative project delivery models introduces new ways of working, changing processes and behaviours, and influencing network structures, especially in major inter-organisational projects. The ongoing standardisation thereof helps align the industry and change infrastructure institutions while the formation of network ties in a specific project can in turn guide the implementation of the models. We study how this deliberate change of governance structures impact project institutions through two Nordic infrastructure projects, which show how different project networks result in either a successfully implemented change or a return to traditional behaviours. Our findings show first, how inter-organisational projects with a collaborative approach can change institutions through the interaction of institutional levels and second, that network ties helps changing the institutional context, role behaviours and project processes. The findings contribute to the discussion on institutional change and give empirical evidence of how project networks help explain the success or failure of institutional change initiatives.

1. Introduction

To combat the adversity and conflict typical of construction projects (Kadefors, 1995; Hansen-Addy and Nunoo, 2014), infrastructure project clients have recently started to use collaborative project delivery models (CPDM) to combat and to improve project outcomes (Lahdenperä, 2012; Chen et al., 2018; Bygballe and Swärd, 2019).

Clients can thus be said to use CPDM to introduce deliberate change in the construction industry through individual, temporary projects where the models are tested, without committing to permanent changes before the models have been verified (Holti, 2011; Tukiainen and Granqvist, 2016; Winch et al., 2023). Practitioners and service providers, as well as the clients themselves, then need to adapt to the new ways of working, new roles and new practices introduced by these models, and the increasing use of relational governance has both led to increasing numbers of organizations creating offerings related to alliances, partnering, or other forms of collaborative and relational models as well as to the creation of new standards, such as the ISO 44001.

Although the interaction between relational and contractual governance has been long discussed (Poppo and Zenger, 2002; Bygballe et al., 2015; Cao and Lumineau, 2015; Chen et al., 2018) and collaborative

models have been used in the construction industry since the oil field projects of the 1990s (Lahdenperä, 2012), the application of CPDM in the infrastructure sector is a recent development. This change is especially visible in the Nordic countries, where relational governance has become very popular in the last decade (Kadefors et al., 2023). These collaborative models have a strong focus on relational governance and social interaction, as well as shared resources, tools, and processes. Although CPDM has increased in popularity in infrastructure delivery during the last decade (Lahdenperä, 2012; Bygballe and Swärd, 2019), the aforementioned recent efforts at standardisation indicates an ongoing institutionalization of the concept (Hall and Scott, 2019).

Institutional change is an ongoing process, where permanent structures shape temporary actions but temporality simultaneously changes the permanence as new experiences are evaluated, observed and accepted into canon or rejected. Infrastructure projects, long-term and large-scale, include multiple stakeholders and have a significant societal impact (Eriksson, 2015; Chen et al., 2018). As such projects exist in the borderland between permanent home organizations and temporal project organizations, they are an optimal testing ground for new ideas, practices, and organisational modes (Söderlund and Sydow, 2019). This interplay between temporal and permanent is of central interest in

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project studies (Tukiainen and Granqvist, 2016), which, coupled with an increased focus on institutional theory in relation to project organizing (Söderlund et al., 2017; Biesenthal et al., 2018; Winch and Maytorena-Sanchez, 2020), emphasizes the way projects interact with their context, both being shaped by and being in the process of shaping it (Michaud and Lessard, 2001; Manning, 2008; Dille and Söderlund, 2011; Morris and Gerdali, 2011; Tukiainen and Granqvist, 2016; Winch and Maytorena-Sanchez, 2020).

Studies have looked at how informal and formal institutional forces drive field-wide development (Wang et al., 2018), how projects are used to both consciously enact institutional change (Michaud and Lessard, 2001; Tukiainen and Granqvist, 2016) as well as establish new project delivery models (Hall and Scott, 2019) and how these new models are then institutionalized in practice (Bygballé and Swärd, 2019). The increased focus on relational structures introduced by new types of delivery models can influence changes in regulative, normative, and cultural rules (Javernick-Will and Scott, 2010; Scott et al., 2011), which are often institutionalized for major endeavors such as infrastructure construction projects. These rules help establish the project organization and thus the social network that is created in a project (Adami and Verschoore, 2018), which in turn facilitate in information and awareness dispersal (Battilana and Casciaro, 2012). Projects thus act as a nexus of institutional exchange which lead to institutional conflict and complexity (Raynard, 2016).

The change in project delivery models has prompted increased interest in procurement (Scheepbouwer and Humphries, 2011), governance (Denicol et al., 2021) and multi-level changes (Matinheikki et al., 2019) in infrastructure delivery (Qiu and Chen 2022). Furthermore, although recent research has focused on the institutionalization of these models (Hall and Scott, 2019), little is known of the change in actor behavior (Nwajei et al., 2022) and ties between the actors: how actors within projects adopting these new models change their way of working, how they align with others in the project network and what challenges they face in the intersection of project and home organization. Moreover, Tukiainen and Granqvist (2016) point out a lack of insight into the drivers of institutional change, which could be remedied by focusing on the activities within a project.

Taking a network perspective can help us understand changes in the institutional project logics by providing a deeper insight into the interaction between the social and institutional sphere (Pryke, 2012; Powell and Oberg, 2018). How networks can drive institutional change is however under-researched (Qiu and Chen, 2022). Coupled with an institutional lens, the common perception of the project and its context rises to the forefront, necessitating a view of both institutional levels and project dynamics which includes multiple actors and levels of the project and project networks, actors and the ties connecting them. Answering calls for research into collaborative practices and how project networks influence the process of institutionalization (Matinheikki et al., 2019; Söderlund and Sydow, 2019) and further insight into social interaction and ties in projects (Jones and Lichtenstein, 2008; Morris and Gerdali, 2011; Matinheikki et al., 2019) our study focuses on the interplay between social networks in inter-organizational projects (IOPs) and institutional change.

We answer the following research question: *How do IOPs with a collaborative approach influence change in terms of ties and behaviour?* We contribute to the current stream of research on the interaction of institutions and network dynamics, ties, and project-based inter-organizational governance (Jones and Lichtenstein, 2008; Morris and Gerdali, 2011; Matinheikki et al., 2019; Söderlund and Sydow, 2019) and give empirical support to the discussion on institutional change.

The paper is structured as follows: We first give an overview of relational and contractual governance, the construction project delivery institutions, institutional change, and a social network approach, after which we present our methods and findings. Finally, we discuss implications thereof and present directions for further studies.

2. Theoretical background

2.1. Relational and contractual governance

An answer to the adversity found in the construction industry has been sought in collaborative project delivery models building on relational governance, rather than the traditional transaction-based contractual models (Chen et al., 2018; Lahdenperä, 2012; Qiu et al., 2019; Wang et al., 2018), as noncontractual drivers increasingly are seen as a key incentives of project performance and delivery (Chen et al., 2018; Nwajei, 2021). Governance is, nevertheless, a mix of contractual and noncontractual aspects (Bosch-Sijtsema and Postma, 2009; Chen et al., 2018). Contractual aspects include the division of responsibilities and risks, sometimes including the formal project organization structure, while noncontractual aspects cover leadership, project culture, and project organization (Papadonikolaki et al., 2017; Chen et al., 2018), comprising the informal project organization and forming the basis of the social network of the project (Hellgren and Stjernberg, 1995, Adami and Verschoore, 2018). Since formal structures define the expected normative behavior, it is the informal structures that shape the cognitive-behavioral aspects of the project organization (Benítez-Ávila et al., 2018; Powell and Oberg, 2018).

The collective understanding of the governance model is however fragmented in multi-party contexts (Chen et al., 2018) while formal contracts can be seen as a mark of distrust (Poppo and Zenger, 2002). These aspects are not necessarily detrimental to the success of relational governance, since relational and contractual governance complement each other, as relational elements enable flexibility and swift adaptation while contractual governance facilitates trust building (Poppo and Zenger, 2002; Benítez-Ávila et al., 2018).

2.2. Construction project delivery institutions

The construction industry has its own institutions, or formalized and widely used practices and social norms which reflect a common understanding of the world (Meyer and Rowan, 1977; Lawrence et al., 2002; Scott et al., 2011; Scott, 2014). Construction work, project-based (Lundin et al., 2015) and inter-organisational (Jones and Lichtenstein, 2008), standardised organizing models, ways of managing material inputs as well as commonly accepted processes and skill credentials (Kadefors, 1995; Holti, 2011) help coordinate the large number of participating organizations, simultaneously reducing the need for communication since actors can anticipate each other's behaviour (Kadefors, 1995). Today, construction work, such as infrastructure, is delivered through inter-organizational projects both shaped by the institutional environment of said organizations (Morris and Gerdali, 2011; Matinheikki et al., 2019) but also shaping the institutional forces surrounding it (Hetemi et al., 2021). In the case of infrastructure projects, usually delivered for a public client (Denicol et al., 2021), especially the political and public environment (Dille and Söderlund, 2011) plays a major role, as do professional norms and cultural-cognitive prejudices (Scott, 2014).

Regulations and legislation concerning the construction industry are both global and local (Kadefors, 1995). International standards such as the ISO 44001 introduce new forms of organizing on a global level, while national bodies such as the Royal Institute of British Architects produce guidelines and standards accepted by the local industry. Infrastructure projects may even call for national legislation, such as the laws governing the delivery of High Speed 2 in the United Kingdom.

Norms in the construction industry relate to how projects are organised, such as gathering in a project office at the site (Kokkonen and Vaagaasar, 2018) or which project roles and behaviours are acceptable (Gluch and Hellsvik, 2023). Loosemore and Tan (2000) argue that current norms and practices may be the cause of the conflict and adversity in the industry as they restrict actors' behaviour in the projects. One reason for the conflicts is the difficulty in building trust between

organizations (Hansen-Addy and Nunoo, 2014) as expectations of others (Loosemore and Tan, 2000) and views of the project (Hietajarvi and Aaltonen, 2018) –in other words, *norms*– differ.

Cultural-cognitive traits in the construction industry are related both to the standardisation of work and uncertainty in construction projects (Kadefors, 1995) as well as the legitimisation of new project processes (Hetemi et al., 2021). The values, perspectives and cultural backgrounds of project participants are especially important in large-scale infrastructure projects: project managers often have considerable autonomy in designing their organisation and thus their heuristics and cultural-cognitive background impact the project significantly (Eriksson and Kadefors, 2017). As institutions change with the introduction of new delivery models, old heuristics and processes might not fit with the new normal, leading to conflict or adherence to old ways of working.

Moreover, these institutional aspects interact in different constellations on different levels in the organisation. The regulative dimension is the most tangible at the *organisational level*, where regulations and legislation direct the participating organizations' actions (Kadefors, 1995; Hall and Scott, 2019). On the *project level*, when the regulative framework is set, the norms and standards play a much larger role, as do the expectations and behaviours from different project stakeholders (Matinheikki et al., 2019). On an *individual level*, values and heuristics come to the forefront (Eriksson and Kadefors, 2017). Furthermore, the fit between the formal and informal institutions guiding the project determine project outcomes (Wang et al., 2018).

2.3. Networks driving institutional change

Institutions are subject to change and renewal (Holti, 2011; Tukiainen and Granqvist, 2016; Powell and Oberg, 2018). New institutions emerge “in a process of struggle” when actors find novel ways of combining and using the rules, norms and practices of institutions in order to “advocate and fashion new relationships, meanings, and routines” (Holti, 2011, p. 365). Institutional theory has been used to gain a deeper understanding of project organizing over time (Dille and Söderlund, 2011; Morris and Gerdaldi, 2011; Qiu and Chen, 2022; van Marrewijk et al., 2016). Projects are on the one hand subject to institutions, but can on the other hand be used to change institutions (Michaud and Lessard, 2001; Söderlund and Sydow, 2019). For example, the introduction of CPDMs, especially in the public infrastructure transportation sector (Lahdenperä, 2012; Matinheikki et al., 2019), created a demand for new skillsets among participants (Hietajarvi, 2017) and placed more emphasis on early involvement of all key actors in the project process (Lahdenperä, 2012; Walker and Lloyd-Walker, 2015). New collaborative initiatives pose challenges to existing institutions and roles (Morris and Gerdaldi, 2011), especially in large and public projects (Michaud and Lessard, 2001). Project actors base their actions in the project on their preconceived notions of how to perform the tasks in a correct way (Holti, 2011), beliefs and routines (Matinheikki et al., 2019) – notions that do not prepare them for a changing project context, such as the one introduced by the use of CPDM.

In a project context, the actors involved in a particular project form a social network with the specific structure by their interactions (Hellgren and Stjernberg, 1995; Adami and Verschoore, 2018; af Hällström et al., 2021). The project network itself is based on formal ties in the shape of contracts determining the shape and scope of the project (Hellgren and Stjernberg, 1995; Adami and Verschoore, 2018). Networks are seen as important in establishing new institutions and upholding old structures (Powell and Oberg, 2018). However, this network is also shaped by the project organization, such as changing meeting practices, developing policies and promoting a common project culture (Morris and Gerdaldi, 2011). The network, its ties and nodes are thus subject to the forces of the surrounding institutional fields, but also shaping them in turn through interaction within the project and as the network's structure permits.

As the structure of the network shapes the flows through it and collaboration and relational contracting depends on trust and communication (Lahdenperä, 2012; Walker and Lloyd-Walker, 2015), we could therefore expect the project network structure to correlate with the level of collaboration in a CPDM.

2.4. A social network approach to construction

Network theory has recently been applied in construction research to understand the relational structures in projects (Pryke, 2012; Pryke et al., 2018; Steen et al., 2018; Shi et al., 2022). Networks consist of nodes (a meeting point in the network), connected by ties (relations connecting nodes) (Borgatti and Halgin, 2011; Pryke, 2012; Scott, 2013) and facilitate behaviour dispersion (Wang et al., 2016; Zheng et al., 2021) and the creation of relational capital (Wang et al., 2016).

Much network research focuses on nodes and their characteristics in order to identify gatekeepers (Burt, 2001), find those with much social capital (Senaratne et al., 2017) or categorise otherwise highly connected nodes (Cao et al., 2018) as these nodes have an impact on the network. Less research has focused on the ties and their characteristics, although calls for further insight into this area have been audible for decades (Granovetter, 1973; Zeng et al., 2022) and recent research has looked at both formal and informal ties (Papadonikolaki et al., 2017) as well as the role of tie strength in knowledge creation (Wang, 2016) and conflict outcomes (Zeng et al., 2022).

Ties can be bilateral, leading from one person to another and back, or unilateral, meaning they only go in one direction. They can moreover be formal or informal. *Formal ties*, or officially recognised relationships, such as contractual ties, performance incentives, the project organisation, project processes and the physical manifestation thereof, such as meeting minutes, project charts and organisation diagrams (Pryke, 2012; Papadonikolaki et al., 2017). *Informal ties*, or implicit relationships, include social bonds (Uzzi, 1997), daily interaction in the project office (Kokkonen and Vaagaasar, 2018) and physical communication (Papadonikolaki et al., 2017).

Network structure influences the flow of information, ideas, and communication within it (Burt, 2001; Borgatti and Halgin, 2011; Battilana and Casciaro, 2012). The types of networks are related to their structure and two types are discussed in literature: a) *cohesive* networks, with a high degree of structural closure between its nodes and in which actors are tightly connected to one another, and *bridging* networks, with a low degree of structural closure and less connections (Burt, 2001; Battilana and Casciaro, 2012). Cohesive networks with strong social ties are better suited to adopt changes more aligned with the status quo than bridging networks. Bridging networks are rich in structural holes and support changes diverging from the underlying institutional framework (Battilana and Casciaro, 2012).

In this work we frame the studied network as the social ties between individual actors (nodes) within the project organisation (Hellgren and Stjernberg, 1995; Pryke, 2012). As we focus on the social relationships between individuals, since individuals connect the multiple levels of projects, we will not discuss the organisational networks nor project adjacent networks, such as supply chain or stakeholders.

3. Methodology

3.1. Research setting

Public infrastructure construction projects maneuver in political and public institutional environments that have consequences for project delivery (Dille and Söderlund, 2011). How such projects are delivered can have a long-lasting impact on society due to their size and scope (Flyvbjerg, 2014). Infrastructure projects can comprise the development of transportation, energy, telecommunication, and water supply systems (Söderlund et al., 2017), but in this paper we focus on public transportation infrastructure.

The research follows an abductive approach in which the initial focus was on studying the implementation of CPDM through a social network lens. Over time the social network lens could only explain the network ties and structure but not the changes we found in actor behavior and ways of working and an institutional perspective was applied in the later phase.

To gain understanding of the way IOPs influence change in terms of ties and behaviour, we conducted a comparative case study of two Nordic infrastructure projects (Eisenhardt, 1989; Ketokivi and Choi, 2014). The studied projects were both large-scale public transport projects in major cities. To study the case studies, we applied a qualitative approach based on interviews and observations to gain understanding of how relations and ties were formed as well as how the CPDM was implemented in the projects and what its implications were on the project, actors involved and the ties. The qualitative data on ties was combined with social network analysis based on respondent reports to create a deeper understanding of the dynamics within the project network (Clegg et al., 2016; Loosemore et al., 2020) as well as the inter-organizational network dimension (Sydow and Braun, 2018). The projects are of comparable size, span multiple years from start to completion, involve the efforts of several different organizations, and are located in an urban context with multiple third-party stakeholders. In the national context of the case studies, the cases were perceived as megaprojects. Both projects have a phase 1, project development and design, and phase 2, detailed design and construction. Both projects also have a model for early collaboration between key parties (client, contractor and design engineer). The projects were chosen because they were one of the first projects using a new collaborative delivery model in a public project of this size, developed with the intention of testing the new model and possibly changing the traditional way of working in such projects.

The goal of case CentralRail is to refurbish a public transportation hub as part of a large multi-project programme in a major city. Case CentralRail is one of the first major public transportation infrastructure construction projects in the country implementing an Early Contractor Involvement contract (an example of a specific CPDM), implemented to enhance outcomes of such projects. Project development and procurement for CentralRail started in 2014 (tendering phase), phase 1, consisting of planning and design, commencing in 2016 and phase 2, consisting of detailed design and construction, in 2018. The project's expected completion date is in 2026. The project is governed by a bilateral contract between the public client and a main contractor who subcontracts requisite work. Most participants, including the two clients of the project did not have experience in working with a CPDM. The client employed a consultancy firm to set up the project and invited service providers to form teams and tender the project. The contractor and design engineer firms worked together during the tendering stage, which according to both parties heightened their readiness for phase 1. The project organization is based on mirroring structures between the client and the main contractor. The project has a monetary value of approximately 470 million euro. Fig. 1 gives a simplified overview of the project organisation.

The goal of case LightRail is to build new public transportation infrastructure in a major metropolitan hub, crossing city lines. Case LightRail is a public transportation infrastructure construction project that applied an alliance contract. Project development and procurement processes for LightRail started in 2016 (tendering phase), phase 1 (design) in 2018 and phase 2 (detailed design and construction) in 2019. The project was completed in 2023, before schedule. The monetary value of the project is 390 million euro. The project is governed by a multi-party contract where all actors classed as "main actors" (two municipalities and one regional transport agency, two design engineer organizations and two contractor organizations) are part. Most participants, including the two clients of the project did not have experience in working with a CPDM. The project organization is based on a common project organization between all main actors and geographical division

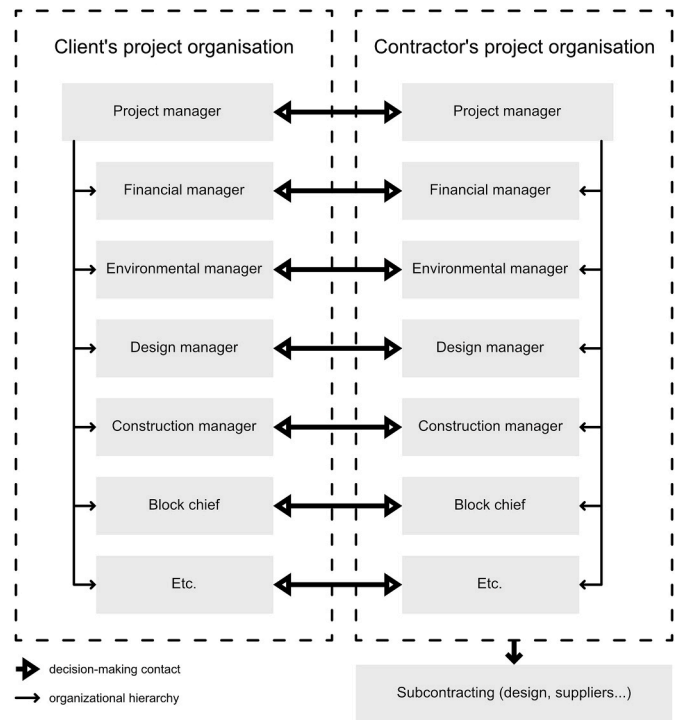


Fig. 1. Organisational chart of case CentralRail.

of the project area, as well as overarching tasks divided according to expertise. Fig. 2 gives a simplified overview of the project organisation.

3.2. Data gathering and analysis

Interviews were held during the project (end of phase 1) and were of both a retrospective nature and the situation at the time of the interview in order to give insight into the changes due to implementing CPDM in the projects. To create a complete picture of the project, explore motivations and understand actor's perception of the phenomena, we

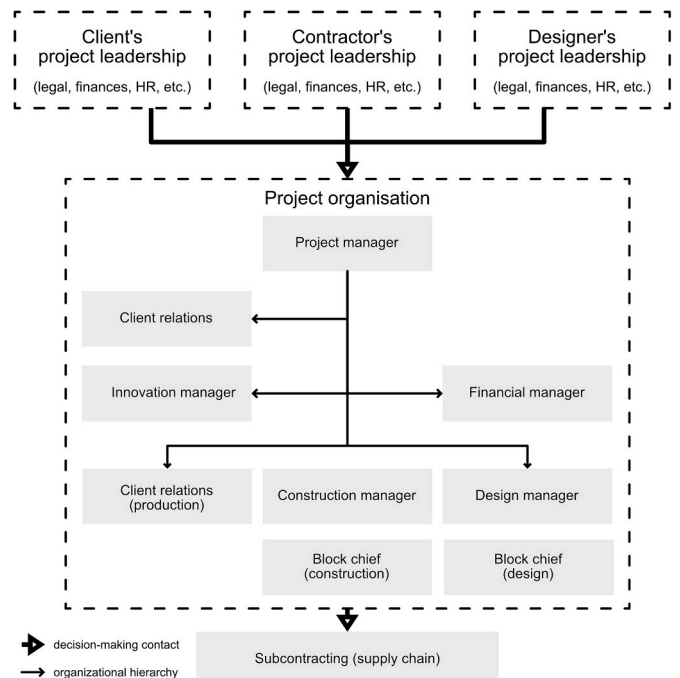


Fig. 2. Organisational chart for case LightRail.

interviewed people from all levels of the project organization and hierarchy. The respondents selected were the main actors in the project organization representing the client, design engineer and contractor organizations and these actors suggested relevant roles to interview (i.e., snowball sampling, Bell et al., 2019) until we achieved saturation among suggestions. Respondents were asked to, among others, (1) describe strengths and weaknesses of the project, (2) describe their perception of the project, (3) their role, (4) the level and type of collaboration in the project (if any), and (5) any changes they had noticed in how they worked in the project when compared to a traditional project and (6) who their closest colleagues were and how often they worked with them. In total, 42 interviews were conducted (20 interviews for case CentralRail and 22 interviews for case LightRail). The interviews were recorded and transcribed. The interviewer furthermore took extensive notes during the interview. All interviews were conducted during the detailed design and construction phase (phase 2), from autumn 2019 to spring 2020. Respondents were assured that the collected data would remain confidential.

To observe social dynamics, behavioral patterns and organizational processes, observations were conducted through extensive note taking, sketches and photographs of the settings based on a specifically developed field guide. The observations were carried out by the first author. CentralRail was observed for two days and LightRail for five days. A home location was chosen in both project's collaborative space, based on the overview of the space it provided. At pre-determined times the researcher walked around the whole space, taking special note of areas outside the reach of the home location. The researcher's presence went unremarked by project participants due to the fluctuating participants in the collaborative space which reduced reactivity (Bell et al., 2019). In addition to the observations of the project office, meetings were also observed. During analysis, the observations were used to confirm or exemplify topics discussed in the interviews.

The qualitative data from interviews and observations was inductively coded in NVivo with coding labels and themes inspired by literature on collaboration and change. All qualitative data were put through systematic stages of naming, data reduction, focused coding, and data display (Locke, 2001). We conducted several rounds of coding and external validation of our findings and ideas.

Next to the interviews and observations, network pictures were created based on the interview responses. The respondents were asked who they worked the most with and to describe their relationship. For example, if the design manager said they worked with the financial manager, but the financial manager did not mention the design manager, this tie would be a unidirectional tie in the network. The networks were based on self-reports and validated through observations and other. Due to the research focus, most respondents were upper and middle managers in the project, although experts and regular workers were interviewed as well. Since managers often bridge different parts of the network, a network based on their connections can help create an overview of the whole project. To map the project network, interview respondents were asked about their relationship with their closest colleagues and how often they worked with them. On this basis, we constructed a simplified network map representing the network clusters between the main project actors of client, contractor and design engineer (see Figs. 3 and 4). The network was restricted to the project organization, thus excluding people in the respondent's home organization. Since the data was collected during early stages of phase 2, the network visualizes the social relations at that time. The nodes represent individual actors in the project network. The ties are unilateral if only one respondent mentioned the relationship and bilateral if both did so. The emergent network was then cross-referenced with observations, enabling a deeper analysis of the network structure.

The networks were analysed in tandem with the qualitative coding and analysis. In addition to traditional measures, such as density (the proportion of existing edges to possible edges in the network; a measure of connectedness), and clustering (how modular, or bridging, the

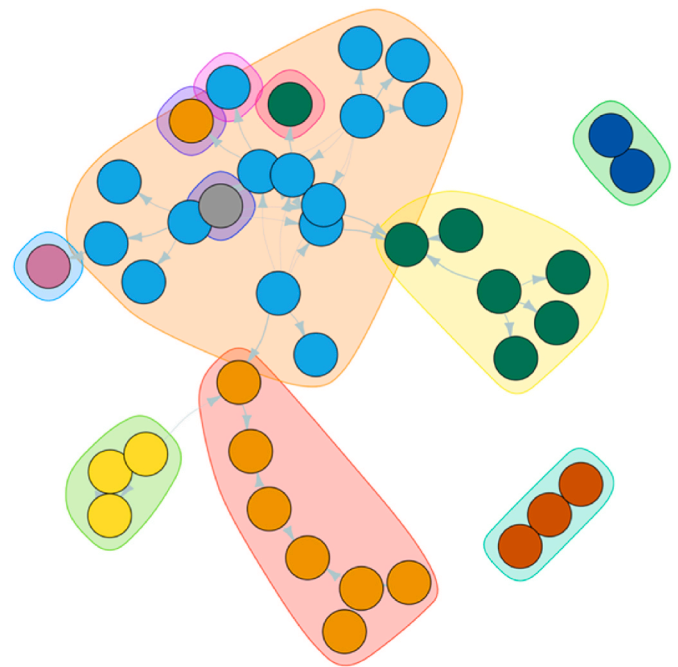


Fig. 3. Network clusters in CentralRail.

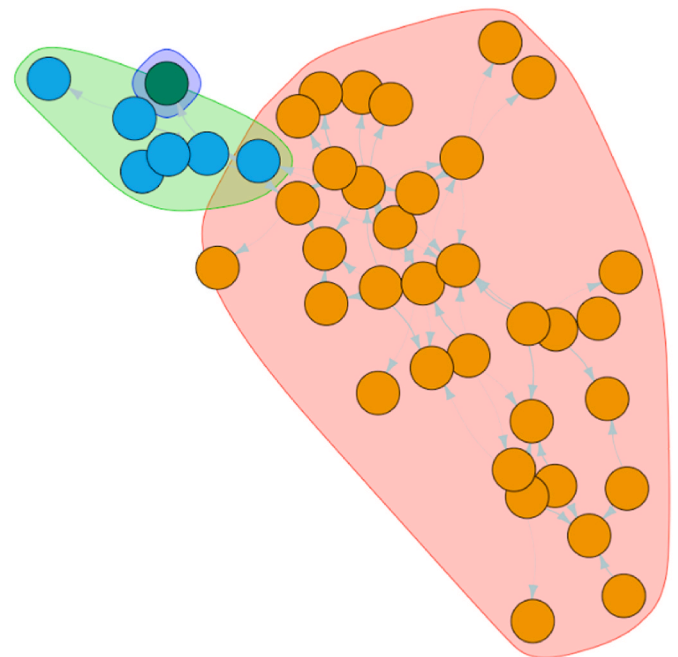


Fig. 4. Network clusters in LightRail.

network is) (Albert and Barabási, 2002; Pryke, 2012; Scott, 2013), we also analysed the networks from a qualitative perspective in order to create a deeper understanding of the dynamics within (Clegg et al., 2016; Loosemore et al., 2020) as well as the inter-organizational network dimension (Sydow and Braun, 2018).

The network pictures gave an awareness of clusters and ties between actors, however, the interview data and observations gave insight in the different perceptions of the involved actors, the project network and norms, values and behavior changes.

4. Findings

We found themes that focused on differences in perception of the project and organization in terms of collaboration and identification, highlighting project identity and identification, as well as changes in actor behavior of client, contractor, design engineer in terms of perception of their role, changes in behavior and/or practice, and changes in the perception of other's roles. The findings are divided and discussed by case CentralRail and LightRail after which we discuss the three different organizational roles of client, contractor and design engineer.

4.1. Case 1: CentralRail

4.1.1. Contractual and relational governance

The project organization was divided by the actors in the bilateral contract, with the roles at the client and contractor's organizations mirroring each other with the goal of increasing communication and collaboration. Collaboration between the contractor and design engineer was mainly viewed as positive, as they had worked together during the tendering phase and had a direct contractual tie. The lack of a direct contractual tie between client and design engineer lengthened the communication paths and the respondents saw this as a barrier for communication since this necessitated the presence of all three main actors when discussing design choices.

The project organization was structured according to a geographical division of the project area. Early in the project, collaboration workshops were held to develop joint ways of working. As part of the collaborative approach, the CPDM worked with a co-located project office, common data platforms and a collectively designed meeting schedule. The client and the contractor were seated according to their organizational affiliation in an open-plan office. The project office was intended for the main actors to interact especially in phase 1. During phase 2 the organization created separate offices for the sub-projects where the pertinent actors from the client and contractor moved. While the co-located project office was meant to enhance collaboration, project participants were mainly seated according to their home organization and meeting rooms were divided according to organizational affiliation, and they were bookable by people from that organization.

There was some focus on the social context of the project organization or perceived changes. "It's not only collaboration between organizations: you also have collaboration between people. And that works well in my opinion" (sub-project manager, contractor). The long-term relationships typical to the industry were seen as enhancing collaboration in the project: "I would say we already knew them all from working together with them in one way or another" (project manager, contractor).

Contractual governance was based on the bilateral contract between the contractor and the public client, while the design engineer had a contractual relationship with the contractor only. The project was however characterized by conflict between the client and the contractor and a high focus on the contract. The contract was mentioned by almost all respondents as a challenge. The project was furthermore marked by uncertainty regarding the division of responsibilities, as well as diverging understandings of the model: "the [contractor's] sub-project managers are not taught what the CPDM contract means" (sub-project manager, client). One part of the contract, for example, contained the usage of a co-located project office for the main project actors to enhance collaboration, without an indication of how the project office should be used. While the client and contractor representatives were present at the office, seated according to their home organization, the design engineer was not contractually obliged to be present and the design engineer only attended the project office during meetings, conducting most of their work at their home office. They seldom attended the sub-project offices.

Respondents reflected on the demands on participants in

collaborative projects and if the current project fulfilled expectations, as well as the importance of personal characteristics suitable for working in a CPDM. This aspect was highlighted by respondents from all actor groups, as exemplified by a manager from the contractor: "I don't know if the problem lies in the organization plan or the roles, but it's rather—there might be the wrong names there". As the project was built on the contract, this formed the basis for the project network, distancing especially the client and design engineer further as they lacked a direct contractual contact.

4.1.2. Traditional norms, values and behavior within the project

Even though the project was set up as a collaborative project testing out a new delivery model, the empirical data highlighted a conservative view of the actors' own and other's role behavior and responsibilities, and the project was in general viewed as being delivered "just like any other project" as stated by a design engineer representative. Although respondents commented on the need for new capabilities in the new delivery framework, behaviors and norms did not appear different or changed. Respondents furthermore mentioned discrepancies in expectations during the design phase and how tensions arose between the client and contractor. The contractor mentioned tensions with the client in phase 1 (the design phase) and discussed ambiguity in using the new delivery model, a lack of engagement from the client and a lack of experience of working with such a model from all parties. The design engineer also identified a lack of experience: "we who worked with the co-location concept and who led it were too junior in this way of work [...] we didn't see the warning signs before it was too late", a statement echoed by a client manager who said "it's not just introducing a new software and then you work like that; rather, it's actually a completely different way of working".

According to the client, the contractor fell back in a more traditional patterns of behavior when tensions arose over the target price, which was set after the conclusion of phase 1. During phase 2 (detailed design and delivery), the client and contractor both mentioned falling back into traditional role behavior: the client by setting requirements and following up deliveries "by the book", and the contractor by merely delivering the product "as stated", rather than pro-active participation in the collaborative organization. The client had expected the contractor to be more involved in the process, for example regarding third-party communication and developing the designs during the early stages of phase 2, while the contractor had expected the client to be more decisive. The client moreover saw the quality of design as the contractor's responsibility, while the contractor saw design quality as the responsibility of the client, who had accepted them at the end of phase 1.

For the design engineer, the contractor was their contractual client, and they consequently did not have a close relationship with the public client/owner. The design engineer's behavior conformed to traditional roles, collaborating with their contractual client (the contractor) and cooperating with the public client/owner through the contractor, who had the contractual tie to the public client. While the contractor and public client were seated at the project office, most of the design engineer's work was done at their home office. This was partly due to the resources available at their home office, such as peer knowledge and experience, well-functioning IT-resources, and support functions. Respondents discussed the project and the project model in disparate terms and brought up challenges related to the contract throughout the interviews.

The respondents did not see much change from their traditional behavior and ways of working, although they did acknowledge that the project was intended to change the industry. "If we are talking about collaboration and ECI in [project], the idea was to actually try it out and that we would get really close to each other. And in that case, it's a bit sad to cement the roles as contractor and client" (manager, client) was a common theme among the answers. "The roles, they are kind of still there. We are still the contractor, and they are still the client, after all" (block chief, contractor). The client organization did not continue with

the model as is, but rather developed the contract model for subsequent projects.

4.1.3. Traditional project identification & perception

The project was described in a myriad of ways, although many descriptions focused on the challenges of the organization. The interviewees mentioned that there was no single project identity and many members referred to their home organization when asked about their background and role. The project held diverse expectations and understandings of the delivery model and the responsibilities of the different actors. Respondents from all actors viewed the project as a traditional project and had not noticed a change in their role behavior, routines or responsibilities compared to traditional projects. Even though many respondents clearly stated that roles and attitudes would need to be changed for a successful collaborative project delivery model, traditional logics of project delivery and role behavior were prevalent. “Well, it’s this old, classic ... ‘the contractors are brusque and design engineers are all too– it takes ages before they give you an answer’” (manager, design engineer) was a prevalent view, while others described it in terms of fixed entities, such as “and then you should have respect for each respective role. One is the client, and one is the executioner. One shall pay and one shall be paid, that’s how I see it” (sub-project manager, client).

4.1.4. Project network

Formal ties: The main formal ties consist of the contract between the client and contractor as well as the contract between contractor and design engineers. Furthermore, other formal ties were found in meetings, organizational structure, the arrangement of the co-located space, and decision-making trees that made up the project’s official organization. Project network interaction focused to a large extent on the formal ties, while informal ties mainly existed between individuals from one organization and less between organizations.

Informal ties: Informal (social) ties mainly existed between individuals from the same organization, although some bridging ties existed as well. These ties were upheld by spontaneous interaction, such as coffee and lunch breaks, which were mainly taken with colleagues seated nearby. There was little face-to-face interaction between representatives from different organizations outside of meetings, although e-mails and the common document platform were actively used in inter-organizational communication. There were also no observed occasions of inter-organizational gatherings in the collaborative space, which respondents corroborated. One respondent from the client mentioned how they were excluded from celebrations organized by the contractor due to internal policies.

Network structure: The network was low in density (density: 0,0371) and highly clustered (cluster: 0,530), with some fragmentation. The most influential nodes were the design team, who acted as a bridge between different parts of the project. Together with the interview responses and observations of the project office, the network was defined as bridging, centering on two main clusters of the client and the contractor. Fig. 3 shows the clustering of the network. The colours are randomly assigned by the program.

4.2. Case 2: LightRail

4.2.1. Contractual and relational governance

The project was governed by a multi-party contract with several main actors. The client first selected suitable two design engineer firms and two contractor firms after approximately two months to “be able to choose the best ones possible” (project manager, client). Although the contractors were not selected at the time, the clients and design engineers held collective workshops to develop joint ways of working and start up the co-located space. When the contractors were selected, they joined the development of the project and the co-located space. All interviewees mentioned that they developed a joint idea about the

delivery model in the early phases of the project (design phase).

Due to the size of the project and the large number of main actors, the project was divided into subsections. The project had a leadership and a management team, with representatives from all participating organizations. The project organization division was based partly on home organization and partly on project needs, with no specific allocation of representatives from the different organizations, both in a structural sense as well as how the individuals were seated at the project office. The multi-party contract between all the main actors was viewed as supporting collaboration: “It really enables collaboration” as a client representative said. They furthermore focused on technical issues rather than contract-related matters when asked about problems in the project. There was, however, some tension in the project’s steering group due to old conflicts between two of the organizations. A previous common project had not gone as planned, and this was visible in the interactions in the group as individuals argued over old grievances by proxy.

The CPDM had a co-located project office, common data platforms, a common introduction process for new project hires, and a collectively designed meeting schedule. The project utilized a collaborative office where key actors were encouraged to sit from Tuesday to Thursday to support collaboration. The client, the contractor and the design engineer were seated according to their geographical task in the project in an open-plan office, except for administrative staff and project leadership who were seated together.

In general, the project organization was viewed in a positive light. Responsibilities and roles were clear, although some concern was raised over the project management team’s ability to guide project participants with traditional tools, such as work evaluations or task reallocation, due to the employment contract being with their home organization and not the project per se. Management team members mentioned difficulties in managing personnel from different organizations without proper contractual tools, which influenced how the project organization could be steered by the management team, thus shaping role development and direction. This was seen as a challenge and had been forwarded to the home organizations as a learning for future projects. For the most, project actors were happy with the multi-party contract and did not mention it except in positive terms.

4.2.2. Changing norms, values and behavior within the project

In LightRail, behaviors and norms in the project were described as “different to normal”, as exemplified by a respondent from a client organization. In general, the change was viewed favorably as it gave more options for informal communication which was viewed as facilitating the delivery process. The client’s behavior was seen as changed the most by respondents from all actors and the constant client presence at the project –as required by the CPDM– necessitated new ways of working, since the client had been used to regular but sporadic contact in earlier projects. Furthermore, respondents noticed a development in the understanding of the new requirements over time: “The client went into this with too few resources, and maybe a bit of wrong ones as well” (manager, client). However, the client presence was seen as positive, and respondents remarked on the ease of communication and joint decision-making their presence enabled. “This alliance model is a new thing for both [municipality 1] and [municipality 2], neither client has tried an alliance in an infrastructure project [...] and the model affects especially the client’s role,” as the client’s project manager said. Moreover, client representatives felt safe in the project organization and like they could speak openly about difficult topics: “I feel like I can say [critical] things I would never say in a traditional project” (manager, client). This change was remarked upon by respondents from all three actor groups. However, a certain internal tension emerged between the client organizations as the smaller municipality felt the larger organization came to dominate them. The individual participants’ previous experience from common projects was moreover seen as a challenge, as they were seen to bring past conflict into the project. This theme was especially visible in the smaller municipality who saw the larger one as

'steamrolling' them.

The contractor's behavior remained relatively similar to a traditional delivery model, but did require changes, especially in the design stage. The complexity of an urban setting and the political powers affecting the project were unfamiliar to the contractor. The contractor was inexperienced with the iterative planning process in the early project phases which conflicted with their institutional logic: contractors were not used to lead design work, as required in the design stage. The early involvement also posed a challenge to the existing structures of revenue and profit generation, demanding new ways of working in and with projects.

The design engineer, who was used to having many projects on at the same time, had to adapt to working mainly on one project. Traditionally, design engineers work on multiple projects at once. Now they spent the majority of their time at the co-located space, focusing on the one project, which required new ways of communicating with their home organization, as well as new mental models of working. The contact to their home organization was a challenge with this set-up since knowledge—embodied in their colleagues—is a major resource for consultants. The design engineers were not used to working closely with the contractors and discussions arose of delivery of work and timing of deliverables.

There was a difference between the contractor and the design engineer, as explained by a representative from the designer: "the contractors are used to arrange themselves more into project organizations, so they have a project-specific boss, which differs from the design engineers ... resource planning and organizing." The differences in behavior and expectations were visible in both meeting observations and interviews. In meetings, the biggest discussions occurred between representatives from the contractor and the main design engineer, and respondents from both mentioned working with the other as a challenge.

However, traditional roles were still noticeable in the project. As a contractor representative said, "design engineers and contractors are ... so different in nature, really each other's opposites". Furthermore, communication to peers was perceived as easier than to strangers: "it's so much easier for a design engineer to discuss with another designer than a contractor" (manager, design engineer). The traditional strongholds were also visible as the project progressed: "in the design stage, the contractor ... was wondering why you have to do this and that and what the meaning of this is and the design engineer was like 'well, this is how things are done' and when we moved to delivery, the roles were reversed" and "we do it like [larger contractor] does it" were common comments.

The client continued to use the model in later transport projects.

4.2.3. Changed project identity and perception

Respondents from all actors viewed the project as different from what they were accustomed to and that they mentioned they had to make changes in their way of work. Respondents viewed the project in two main ways: either as a resilient, yet undefined, entity, or as a flexible and smart organization. Overall, LightRail was viewed as a very good example of the new collaborative project delivery model.

Many respondents mentioned the CPDM as key to the good level of collaboration they had achieved, but also some problems with regards to the involvement of different actors in the project. This was seen as being related to the disparity in timing of their selection rather than a detail that could be rectified in future projects; "if there's something we've learned, it's to get everyone on board at once" as a representative for the design engineer said. Furthermore, the client home organization is using the CPDM in similar subsequent projects.

4.2.4. Project network

Formal ties: Formal ties were the multi-party contract between the parties, agreed-upon project processes as well as different forms of meetings, mainly held in the project office. Management meetings were also held in the open-plan office, enabling all interested project participants to listen to current discussions and matters.

Informal ties: There was a strong focus on developing and maintaining informal ties within the project. For example, communal project activities included communal coffee breaks and a weekly newsletter in the project office. Project participants mainly took coffee and lunch breaks with people seated near themselves. Representatives from different organizations interacted outside meetings, many of them gathering for joint coffee breaks twice a day. The collaborative office space was mentioned as important in the interviews because it enhanced quick communication lines and informal meetings.

There were some ties which were both formal and informal. E-mails and the common document platform were actively used in inter-organizational communication, as were informal instant messaging groups, created for different intra-project communities, such as block managers or responsible for safety. There were also social communities, as well as project-wide events.

Informal ties were discussed by the respondents as a key aspect of the project network formed in the project organization. "It's when you spend time with people that you get to know them", as a respondent from the contractor mentioned. Colleagues were mainly mentioned in a positive light, although tension between the contractor and design engineer was evident. Moreover, respondents in LightRail also mentioned the importance of personal characteristics suitable for working in a CPDM. Several project participants knew each other from earlier projects and had already formed social ties, although people mentioned new acquaintances formed during the project in a very positive light.

Network structure: The network's density was somewhat higher than for case CentralRail (0,04207) with low clustering (0,2373486). The most influential node depended on which metric was used: the project manager had a central role on both closeness, their broker position and eigenvector centrality, while a block chief rose to prominence on closeness, a design engineer on broker, and client representatives on eigenvector centrality. Together with the interview responses and observations of the project office, the network was defined as cohesive, centering on the project manager and client representatives. The cohesive network enabled the institutional spheres of the client, contractor and design engineer to overlap, facilitating a common project logic to emerge in the interaction. Fig. 4 shows the clustering of the network. The colours are randomly assigned by the program.

5. Discussion

The introduction of CPDM is a deliberate effort to change the infrastructure industry (Michaud and Lessard, 2001; Lahdenperä, 2012; Bygballa and Swärd, 2019; Hall and Scott, 2019) towards relational governance rather than the contractual governance model it has hitherto relied on (Galvin et al., 2021; Wang et al., 2021). This change is often initiated by the client in order to mitigate adversity an conflict (Roehrich et al., 2023; Winch et al., 2023). The complexity inherent in the multi-layered institutional context of such projects (Raynard, 2016) obstructs this interaction as different network ties impact the project on different levels.

5.1. Project network

In line with previous research (Adami and Verschoore, 2018; Zeng et al., 2022), the project network formed in the interaction of formal and informal ties. The extent of their effect, however, depended on the institutional level, corroborating the findings of Wang et al., (2018).

As organizations are tied to the project through primarily a formal tie (project contract), the tie guides their engagement in the project. It determines what resources the organisation is obligated to provide and to what extent they are engaged in the project. However, an important informal tie on the organisational level comes through the representatives in the project's steering group. Although their presence is directed by the formal ties of contract and project organisation, their conduct and thus the steering group's efficacy depends on their interpersonal

relationships, as exemplified in LightRail. Thus, although the formal ties have the largest impact on this level, informal social ties still play a large part.

On the *project level*, both formal and informal ties play a large role, validating earlier research (Papadonikolaki et al., 2017; Wang et al., 2018). Formal ties determined in the project set-up, such as the project organisation and process, shaped the project network. However, how these formal ties are interpreted determines the outcome of the network. In CentralRail, which for example had a co-located office as per CPDM guidelines, the interpretation of who should attend and where they should be seated led to a bridging network as the informal day-to-day interactions were limited to the people seated closest by. Conversely, the decision in LightRail to seat people according to role in the project rather than their home organisation led to inter-organisational interaction and frequent informal exchanges. Thus, how formal project-level norms are interpreted and enacted depends on individual heuristics and behaviours. This is in line with findings from Wang et al. (2018), who argue that the fit between informal and formal institutions and networks determine project success.

On an *individual level*, informal ties play the largest role. Although the individual's presence in the project depends on their role in their home organisation, the formal contractual ties connecting them (Kadefors, 1995), as well as the guiding force of professional codes and official regulations (Matinheikki et al., 2019), the social ties with other project participants shaped their perception of the project and thus their network. How people view the day-to-day interactions they have in the co-located space influences their social sphere and which actors they connect with. This is also contingent on network structure, which determines the flow of resources and interactions within the network (Battilana and Casciaro, 2012, Adami and Verschoore, 2018). Frequent communication and strong ties help align nodes (Zeng et al., 2022). In

the bridging and highly clustered network of CentralRail, individual actors could not reach others as easily as they could in LightRail, which led to a retreat to familiar institutional interpretations. Conversely, actors in LightRail created social ties both in the co-located space as well as through informal messaging channels and informal social outings. These informal ties strengthened their common interpretation of the project, which led to a greater agreement on the project's goals and aims. This did not reach the organisational level or the steering group, which was constrained by both the current formal contractual ties and past negative informal ties. Fig. 5 shows the interaction between the organisational and individual level, as mediated through the project.

5.2. Changes in the infrastructure projects

CPDM is a deliberate change effort, introduced by the client to combat conflict and adversity in the construction industry. Several changes follow from this new approach (Holti, 2011; Hall and Scott, 2019).

On the *organisational level*, the main regulative and legal changes stem from the client's actions as they determine the delivery form (Scott, 2014; Denicol et al., 2021). Depending on the context, this might introduce changes in national legislation, but since the client's objective is to change the industry, it has long-term implications on this level. The former reliance on contract is complemented with relational governance in a successfully implemented CPDM as the organisational level accepts the change. These are formal changes (Wang et al., 2018) as they are commonly acknowledged. However, if this change is accepted depends on the formal and informal ties within the network, as discussed above. Norms stay much the same on this level, as the project delivery itself is not much changed from the organisation's point of view. Cultural-cognitive aspects may change although slowly.

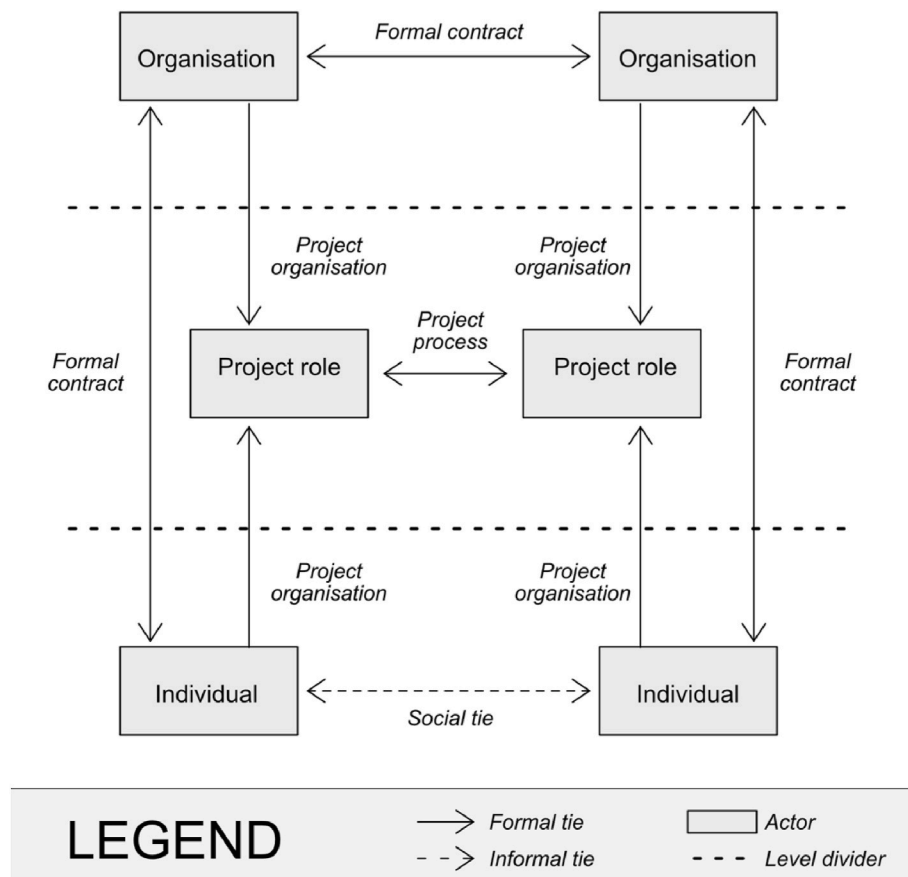


Fig. 5. Interaction between institutional levels as mediated by network ties.

On a *project level*, the regulative changes are less noticeable and are filtered through the formal ties between organizations which determine the project organisation, project processes and introduction of new roles such as collaboration coordinators. In a successfully implemented CPDM these lead to normative changes, such as changes in organisation and process as well as ways of working, as seen in LightRail. Although the project did experience conflict, the disagreement centred on the differences in norms and expectations rather than the expectations laid out by the formal contract, as traditional projects often revert to (Hansen-Addy and Nunoo, 2014) and CentralRail experienced. On a cultural-cognitive level, heuristics may change during phase 1 as the novel interaction between all main actors lead to new perspectives and understanding. The organizational level thus changes the project level through the new delivery model. On this level, participating organizations interpret the requirements and try to fit their norms with the new norms introduced in the project.

However, the change is accepted (or rejected) by individuals. Projects consists of individual employees who communally interpret the new requirements and decide on processes and practices, such as seating plans or meeting schedules. The project organization is negotiated by individuals representing project stakeholders, who then implement roles and responsibilities as they see fit. The success of the organizational level's intended change is thus dependent on the informal network and how individuals interpret their goals. In CentralRail, the bridging informal network and lack of suitable formal ties led to the realization of a traditional project, while the positive informal network in LighRail, combined with suitable formal ties, enabled the intended change. On an *individual level*, the regulative/legal dimension does not change, as individuals are connected to the project through their formal tie to their home organisation. They do experience the changing norms and expectations through potentially novel roles and processes. Cultural-cognitive changes are however filtered through the social interaction in the project. It is well established that the structural position of nodes shape their ability to impact the network and what type of change they can enact (Battilana and Casciaro, 2012). In LightRail, the cohesive network enabled a common understanding to emerge, validating the findings of Battilana and Casciaro (2012). The bridging network in CentralRail, on the other hand, obstructed communication flows (Adami and Verschoore, 2018) and thus deterred the desired institutional change.

5.3. Multi-level tie interaction shaping institutional change

As previous literature rightfully point out, network analysis can explain relations and interactions as a snapshot in time, but lack the power to explain the creation of networks (Scott, 2013; Winch et al., 2023; Pryke et al., 2018). We answer this with showing how networks develop as a result of social interaction within the project organization and how network ties interact with formal ties to shape the project process.

Network ties thus impact the project in different ways depending on which institutional level and their place in the project process. On an organisational level, the formal ties guide the project. An individual is often unable to influence these at the project, although contracts and regulative frameworks are created by individual actors; the interaction between individual actor and formal ties thus takes a long-term character and exists outside the project.

Role behaviours change if the normative and cultural-cognitive pillars of the institution shift. Informal ties, such as inter-organisational friendships and casual meetings in the daily project process can strengthen this change, as seen in LightRail. In CentralRail, the mismatch of expectations of client and contractor, coupled with the fragmented and bridging network structure and organisation-based utilisation of the co-located space, hindered the creation of a project-wide communication network (Battilana and Casciaro, 2012) which led to the rise of gatekeepers in the network and a retreat to traditional

role behaviours. In LightRail, the cohesive network was a result of both the joint formal contract and a project-oriented project organisation.

Regarding the project process, formal ties are important in the beginning, when the project organisation is set up. On an organisational level, these ties are similar between the client, the contractor and the design engineer. Table 1 shows the intersection of institutional dimensions, project levels and network ties on an organisational level. On a project level, the normative change experienced by all actors differ depending on their organisational structure. Table 2 shows the intersection of institutional dimensions, project levels and network ties on a project level. On an individual level, norms and behaviours differ the most. Table 3 shows the intersection of institutional dimensions, project levels and network ties on an individual level.

As studies thus far have looked mainly at the strength of ties (Wang, 2016; Zeng et al., 2022), our study contributes with a new perspective on how networks and network structure can be drivers for institutional change. As much network research looks at nodes and their characteristics as well as their ties (Wang, 2016; Papadonikolaki et al., 2017; Zeng et al., 2022), our findings show the importance of the social ties and network structure in shaping the desired change.

Table 1

The intersection of institutional dimensions, project levels and network ties on the organisational level.

	Regulative/ legislative	Normative	Cultural- cognitive
Client	Change: introduction of CPDM format The client initiates the change through the procurement process and CPDM chosen. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The client organisation must assign individuals for longer times to the project and accept greater project autonomy. Formal tie: Project organisation, process, and roles Informal tie: N/A	Change: N/A Not applicable on the organisational level Formal tie: N/A Informal tie: N/A
Contractor	Change: introduction of CPDM format The contractor can influence the framework used during its development through working groups and industry lobbying, but not once it has been chosen. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The requirements of CPDM does not change the contractors' usual ways of work, as they are a project-based organisation. Formal tie: Project organisation, process, and roles Informal tie: Daily interactions in the co-located space	Change: N/A Not applicable on the organisational level Formal tie: N/A Informal tie: N/A
Design engineer	Change: introduction of CPDM format The design engineer can influence the framework used during its development through working groups and industry lobbying, but not once it has been chosen. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The design engineer must assign individuals for longer times to the project than in traditional projects, as well as accept a physical and psychological distance to the home organisation. Formal tie: Project organisation, process, and roles Informal tie: N/A	Change: N/A Not applicable on the organisational level Formal tie: N/A Informal tie: N/A

Table 2
The intersection of institutional dimensions, project levels and network ties on the project level.

	Regulative/ legislative	Normative	Cultural-cognitive
Client	Change: introduction of CPDM format The client is guided by the chosen CPDM framework. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The client has to adapt to co-location, perpetual project presence and preferably project-based decision-making Formal tie: Project organisation, process, and roles Informal tie: Day-to-day interaction	Change: N/A Not applicable on the project level Formal tie: N/A Informal tie: N/A
Contractor	Change: introduction of CPDM format The contractor is guided by the chosen CPDM framework. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The contractor has to participate in design meetings and give input to unfinished designs. Formal tie: Project organisation, process, and roles Informal tie: Day-to-day interaction	Change: N/A Not applicable on the organisational level Formal tie: N/A Informal tie: N/A
Design engineer	Change: introduction of CPDM format The design engineer is guided by the chosen CPDM framework. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The design-engineer has to adapt to co-location and perpetual project presence. Formal tie: Project organisation, process, and roles Informal tie: Day-to-day interaction	Change: N/A Not applicable on the organisational level Formal tie: N/A Informal tie: N/A

We moreover show how the inter-organisational processes in the project therefore bring together the organisation-level, formal forces, with individual -informal- interpretations and heuristics. We also offer empirical evidence of how project networks and their structure impact the implementation of change (Battilana and Casciaro, 2012).

Finally, we contribute to the growing body of project management literature discussing projects as conduits for institutional change and development through our empirical evidence from two infrastructure delivery projects (cf (Holti, 2011; Tukiainen and Granqvist, 2016a; Aaltonen and Turkulainen, 2022)). Our study gives additional insight in how ties and network structure can drive change and we show how roles, behaviours and processes are influenced by network ties, both formal and informal, and how these influence project delivery. Our research thus supports for example Roehrich et al. (2023) in their conclusions on the need for a multi-level approach to a successful implementation of CPDM.

Especially, in the case of CPDM initiated by public clients, managerial implications include the need to develop an understanding of the interaction between institutional levels and the project network in either supporting or deterring the desired change. The formal ties, including the contractual framework and formal project-set up, in combination with informal and social ties play an important role that can drive desired changes. Insight in the relevance of these ties as well as development of ties can support the implementation of CPDM and help managers understand the dynamics that shape the project and direct its outcomes.

Table 3
The intersection of institutional dimensions, project levels and network ties on the individual level.

	Regulative/ legislative	Normative	Cultural-cognitive
Client	Change: introduction of CPDM format The client is guided by the chosen CPDM framework. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The client has to adapt to co-location, perpetual project presence and preferably project-based decision-making Formal tie: Project organisation, process, and roles Informal tie: Day-to-day interaction	Change: Higher degree of collaboration and presence at the project, giving daily input, 'best for project' mindset Formal tie: N/A Informal tie: N/A
Contractor	Change: introduction of CPDM format The contractor is guided by the chosen CPDM framework. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The contractor has to participate in design meetings and give input to unfinished designs. Formal tie: Project organisation, process, and roles Informal tie: Day-to-day interaction	Change: Iterative process in phase 1 and interaction with design engineer, 'best for project' mindset The contractor has to adapt to the iterative design phase and the uncertainty inherent therein. They must also adapt their expectations regarding the project and process to align with the client and designer. Formal tie: N/A Informal tie: N/A
Design engineer	Change: introduction of CPDM format The design engineer is guided by the chosen CPDM framework. Formal tie: CPDM format Informal tie: individual interaction	Change: Early interaction in project process; co-location The design-engineer has to adapt to co-location and perpetual project presence. Formal tie: Project organisation, process, and roles Informal tie: Day-to-day interaction	Change: Higher degree of collaboration and presence at the project, interaction with contractor during phase 1, 'best for project' mindset The design engineer has to adapt to the linear perception of the contractor and adapt their expectations regarding the project and process to align with the contractor. Formal tie: Project organisation and process Informal tie: Daily interactions in the co-located space; physical meetings

6. Conclusions

The introduction of new project delivery models as deliberate ways of enacting institutional change does not always succeed. Inspired by calls for further insight into project delivery and the drivers of institutional change, we studied two infrastructure projects through the following research question: *How do IOPs with a collaborative approach influence change in terms of ties and behaviour?*

The findings are threefold. First, we show how inter-organisational processes in the project can help change the project institution when the organization-level formal ties, such as contract and project organization, are interpreted in a collaborative manner through and individual

lens. Formal and informal ties in a project care thus in interaction with each other and are interpreted and enacted on different institutional levels.

Second, how network ties impact the project depends on which level is under investigation. On the organizational level, formal ties have a greater impact than on the individual level which is guided by informal ties. The project level consolidates these perspectives, as it is both shaped by the formal ties of contract, project organization and project process, but also by how these are interpreted by individuals through their informal ties. The project thus exists in interaction with its context and is both shaped by institutions and is in the process of shaping them.

Third, a cohesive network structure can enable institutional change by consolidating diverging perspectives through informal ties. The interaction within the project was furthermore governed by formal and informal ties that created the project network. The network perspective helped conceptualize the interaction of institutions within the project. The perspective gave insight into the project structure and how the project can change established institutions through the interaction of formal and informal ties.

We recognize the limitations of this study. The studied projects are on-going and no long-term changes or impacts of using a CPDM have therefore been observed. Since the projects were chosen by purposive sampling, the generalizability of our findings can be difficult since they might not be representative of the phenomenon of actor change. However, since there are few large-scale infrastructure projects conducted in general and in the Nordics in particular, they can still offer valuable insight into the process of megaprojects.

Future research could focus on longitudinal research into the development of networks in megaprojects. Furthermore, the dynamic interplay between the creation of the network influencing institutions and impact of institutions forming networks calls for additional research. Moreover, the differences between contractor and design engineer call for investigation into the institutional differences of these sub-fields within the larger institution of the construction industry.

Interest statement

The authors declare no conflict of interest.

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Previous publication

This paper is originally based on a conference article titled “The dark side of collaboration: The risks of strong ties in collaborative project networks”, presented at the Association of Researchers in Construction Management Annual Conference in 2021. However, during the revision processes, the paper has developed fundamentally.

CRedit authorship contribution statement

Anna af Hällström: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Petra Bosch-Sijtsema:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None

Data availability

The data that has been used is confidential.

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