Governance, cooperation and coordination in large inter-organisational project networks: A viable system perspective

Abstract

Purpose: This study furthers the understanding of multi-level analysis in inter-organisational relationships by investigating the interplay of governance, cooperation and coordination in inter-organisational projects (IOPs) on sub-system and project levels.

Design/methodology/approach: We use the Viable Systems Model as a framework to analyse inter-organisational project governance, cooperation and coordination by adopting a multiple-case study.

Findings: The findings illustrate how governance and coordination mechanisms exhibit a filter-down effect on lower sub-systems while cooperation influence is confined within each sub-system. While remarking the importance of specific sub-systems on the overall project performance, the interplay of governance, cooperation and coordination across sub-systems appears to be complex, with governance influencing cooperation and coordination, whereas cooperation and coordination influence each other with an incremental effect.

Originality: Our study defines two propositions that explain how multiple levels of analysis (project and sub-systems) can support the governance of large inter-organisational projects. We elaborate theory on the interplay of inter-organisational project governance, cooperation and coordination.

Keywords: Cooperation; Coordination; Governance; Inter-organisational Project Network; Viable Systems Model

1. Introduction

Inter-organisational projects (IOPs) are increasingly being used to deliver complex products and services (Bakker *et al*., 2011; Grabher, 2004; Davies, 2017). They involve multiple organisations joining forces for a limited time to address the challenge of collaborating and coordinating across different sectors to achieve complex and uncertain economic and social outcomes (Adami *et al*., 2019; Davies *et al*., 2017; Jones and Lichtenstein, 2008; Olsen *et al*., 2005).

Unlike other types of inter-organisational arrangements, such as long-term buyer–supplier relationships and strategic alliances, IOPs are time-limited and vary in scale across different industries (Oliveira and Lumineau, 2017). For example, IOPs may vary from a short-term film production to a long-term and large-scale infrastructure project. This temporality influences the mechanisms that drive collaboration between organisations (Swärd, 2016) and raises questions about their governance (Jones and Lichtenstein, 2008). Furthermore, their unique characteristics such as uncertainty, diversity of goals and multi-organisational boundaries provide an important context to understand inter-organisational relationships (IORs). This, in turn, requires good governance if organisations are to achieve collaboration (Gulati *et al*., 2012; Jones and Lichtenstein, 2008; Sydow and Braun, 2018).

IOPs are often embedded within permanent inter-organisational networks that deliver multiple projects (Sydow and Braun, 2018). This can result in organisational boundary ambiguity, where project actors vary from project to project (DeFillippi and Sydow, 2016). Additionally, the governance structure within the same inter-organisational network can vary from one project to another (Ahola, 2018; Provan and Kenis, 2008), generating complexity in analysing IOPs. Notwithstanding the importance of governance structures and arrangements in explaining poor performance (Albers *et al*., 2016; Flyvbjerg, 2011; Miller and Hobbs, 2005), a common governance analysis framework is needed for inter-organisational collaboration

between actors (Sanderson, 2012). This would enhance the understanding of what actors are doing, irrespective of who is leading the network or working on the project.

IOR governance incorporates formal and informal rules, procedures and mechanisms applied across different organisations and networks that come together to deliver common outcomes. Governance affects inter-organisational collaboration, namely *cooperation* (willingness to collaborate) and *coordination* (ability to collaborate) (Chakkol, Selviaridis and Finne, 2018; Gulati *et al*., 2012; Tee, Davies, and Whyte, 2019). Although relationships and their governance are widely discussed in the management literature (Cao and Lumineau, 2015; Gulati and Singh, 1998; Poppo and Zenger, 2002; Roehrich *et al*., 2020), the majority of this discourse has focused on two parties (dyad) and a singular level of analysis (Poppo and Zenger, 2002; Faems *et al*., 2008; Li *et al*., 2010). More recently, scholars have called for an increased focus on examining relationships beyond the traditional buyer-supplier dyad and incorporating multiple levels of analysis (Lumineau and Oliveira, 2018). In our study, we address this gap by furthering the understanding of governance, cooperation and coordination in six IOPs through a multi-level analysis consisting of two levels, namely, project level (across sub-systems) and sub-systems level. Against this backdrop, we ask: "*How do governance, cooperation, and coordination interplay on sub-systems and project levels in IOPs?"*

To address our question, we explore various governance mechanisms and their relationships with cooperation and coordination to understand how governance affects partners' behaviour and performance in cooperation and coordination across different sub-systems (Gulati *et al*., 2012; Malhotra and Lumineau, 2011; Mellewigt *et al*., 2007; Poppo and Zenger, 2002).

We investigated six projects in three networks (two projects in each network) involving different types of infrastructure (flood defence, water, and rail). We examine how inter-organisational governance (Ahola, 2018; Cao and Lumineau, 2015; Faems *et al*., 2008) and

cooperation and coordination (Castañer and Oliveira, 2020; Gulati *et al*., 2012; Parkhe, 1993) interact and explore their overall effect across IOPs.

By focusing on different governance mechanisms employed, their dynamics across sub-systems boundaries, and their interplay with cooperation and coordination (Ahola *et al.*, 2014; Cao and Lumineau, 2015; Musawir *et al.*, 2020), we make two contributions to the inter-organisational governance literature. First, by examining the relationship and interplay between governance, cooperation and coordination in IOPs (Ahola *et al.*, 2014; Roehrich and Lewis, 2014), our study shifts the focus from dyadic to multi-level analysis (Cao and Lumineau, 2015; Zheng, Roehrich, Lewis, 2008), thereby providing a more nuanced view of IOR governance. Specifically, we find that the filtering down effects of governance, coordination, and cooperation manifest across sub-systems differently. Second, this study provides a framework for analysing IOPs embedded within networks to overcome the issue of blurring of inter-organisational network boundaries across IOPs (DeFillippi and Sydow, 2016). Specifically, we apply the Viable System Model (VSM) (Beer, 1981) as a governance framework focusing on multi-level teams of organisation(s) as sub-systems that exhibit certain roles and functions (Müller *et al.*, 2020). The VSM enables comparison between different projects and understanding of where different mechanisms are enacted, thereby contributing to recent calls for a dynamic perspective (Sanderson, 2012; Sydow and Braun, 2018; Zheng, Roehrich, and Lewis, 2008).

We question the interplay of governance, cooperation and coordination, and their dynamics across sub-systems, thereby addressing a major blind-spot in IOR literature of the paucity of research incorporating multiple levels of analysis (Lumineau and Oliveira, 2018), and derive two propositions. Our results indicate that governance and coordination have a filter-down effect across sub-systems, while cooperation is confined within specific sub-system

interactions in all cases. Further, governance influenced cooperation and coordination, while cooperation and coordination influenced each other in a mutually reinforcing dynamic.

2. Literature review

2.1 Governing inter-organisational projects

Governance of IORs affects cooperation and coordination and is widely discussed in the management literature (Cao and Lumineau, 2015; Gulati and Singh, 1998; Poppo and Zenger, 2002; Roehrich *et al*., 2020) with extant studies covering the interplay of contractual and relational mechanisms (Faems *et al*., 2008; Li *et al*., 2010).

Inter-organisational projects are temporary and have uncertain network relationships with disordering hierarchies (Sydow and Braun, 2018). This influences the effectiveness of project governance mechanisms in managing cooperation and coordination between multiple organisations (Bakker, 2010; Ebers and Maurer, 2016; Engwall, 2003). The temporality of projects also increases the likelihood of opportunistic behaviour by project partners in the later stages of project delivery (Ness and Haugland, 2005). Swärd (2016) suggests that in the final phase of a project, project norms are abandoned, trust declines, and partners must rely on industry norms to govern interactions. This temporality reinforces the need to effectively monitor inter-organisational governance mechanisms as they interact dynamically across the project lifecycle (Zheng, Roehrich and Lewis, 2008).

IOPs are governed by networks of relationships bounded by many salient features such as time, task, transition, and teams that differentiate them from other arrangements (Bechky, 2006; Jones *et al*., 1997; Lundin and Söderholm, 1995). This creates the need to limit opportunistic behaviour (Sydow and Braun, 2018; Williamson, 1975), ensure alignment between diverse stakeholders (Donaldson and Preston, 1995), and coordinate across intra- and inter-organisational boundaries to achieve project objectives (Ahola *et al*., 2014; Söderlund, 2011).

Table 1. Contractual and relational mechanisms of inter-organisational project governance

Contractual governance mechanisms	**Relational governance mechanisms**
Roles and responsibilities (Derakhshan *et al*., 2019 ; Keller *et al*., 2021; Kujala *et al*., 2020;)	Culture (Guo *et al*., 2014; Handley and Angst, 2015; Kujala *et al*., 2020)
Decision-making and structure (Albers *et al*., 2016; Yin and Zajac, 2004)	Social norms and Power (Cao and Lumineau, 2015; Idiagbon-Oke & Oke 2020; Lu et al., 2015)
Articulation and alignment of objectives (Biesenthal and Wilden, 2014; Derakhshan *et al*., 2019)	Leadership (Guo *et al*., 2014; Kujala *et al*., 2020; Sanderson, 2012)
Resource allocation (Kujala *et al*., 2020; Mellewigt *et al*., 2007; Roehrich *et al*., 2020)	Interpersonal relationships (Albers *et al*., 2016; Keller *et al*., 2021)

The relational and contractual governance mechanisms in Table 1 share four main characteristics: phenomenon, parts, causings, and organisation, whereby "entities and activities organised in such a way that they are responsible for the phenomenon" (Illari and Williamson, 2012, p. 120). These characteristics explain behaviours across multiple levels within and across organisations (Craver and Tabery, 2019). Governance mechanisms can influence project teams' coordination, control, exchanges (Williamson, 1979), trust (Olsen *et al*., 2005), motivation (De Man and Roijakkers, 2009), power (Idiagbon-Oke and Oke, 2020) and inter-organisational risk sharing and incentives (Kujala *et al*., 2020). Moreover, the mechanisms in Table 1 influence cooperation and coordination, thereby contributing to the performance of inter-organisational relationships, projects, and networks (Castañer and Oliveira, 2020; Gulati *et al*., 2012; Söderlund, 2011). However, few studies attempt to structure our understanding of governance, cooperation and coordination across multiple levels.

2.2 Inter-organisational cooperation and coordination

Inter-organisational cooperation is a joint relational effort by several actors for their mutual benefit (Söderlund, 2011), or joint pursuit of agreed goals, knowing the contributions and payoffs to different organisations, and signalling a willingness to collaborate (Gulati *et al*., 2012; Tee *et al*., 2019). It may refer to the willingness to maximise joint interests (Zeng and Chen, 2003) by overcoming coordination difficulties (Das and Teng, 1998), to achieve

behavioural outcomes (Gulati *et al*., 2012) and project success (Walker *et al*., 2000). Cooperation is crucial for integrating systems, managing complexity and uncertainty, and supporting flexible and adaptive processes (Whyte and Davies, 2021), making coordination important. Cooperation issues usually concern partners' goal incongruence (Han *et al*., 2019). Some authors distinguish between coordination and cooperation goals: the former refers to goal determination, while the latter is concerned with their implementation (Castañer and Oliveira, 2020). However, few describe their influences across different levels and their relationships with governance (Albers *et al.,* 2016; Schepker *et al*., 2014). For instance, Van Marrewijk *et al*. (2016) found that project organisations are regionally bounded despite some drive towards international cooperation. This shows how inter-organisational cooperation depicts embeddedness with social systems regarding IOPs.

Coordination is the effort required to manage task interdependencies (Puranam and Raveendran, 2013) through the linking, meshing, synchronising, and aligning of actions of actors across system boundaries (Okhuysen and Bechky, 2009). Problems in coordination can result from uncertainty, complexity and pace (Shenhar and Dvir, 2007), impacting other interdependent tasks (Söderlund, 2011). Higher task interdependence and greater environmental uncertainty increase the need for coordination (Galbraith, 1977). Inter-organisational coordination is "the deliberate and orderly alignment or adjustment of partners' actions to achieve jointly determined goals" (Gulati *et al.,* 2012, p.537). It entails aligning actions across organisational members and managing their involvement to achieve project/task goals. This signals two main parameters in coordination: actions and goals. Coordination mechanisms may be employed differently across networks, projects and sub-systems, given the unique nature of projects in networks and the multiplicity of coordination mechanisms. For instance, Nassimbeni's (1998) taxonomy of coordination mechanisms suggests their influence on various network structures and interdependencies. The time limits of projects also influence

the coordination techniques adopted when multiple organisations collaborate (Jones and Lichtenstein, 2008). Oliveira and Lumineau (2017) have also demonstrated the interplay dynamics of coordination mechanisms between integrators and contracts across the project lifecycle. While recent research explained how coordination mechanisms unfold and are orchestrated in networks (Roehrich *et al*., 2023), understanding coordination dynamics and its interface with governance and cooperation provides a nuanced view of its influences across inter-organisational boundaries.

2.3 Interplay between inter-organisational governance, cooperation and coordination

Extant literature on relationships between cooperation and coordination, particularly from an inter-organisational governance perspective, is fragmented (Faems *et al*., 2008; Poppo and Zajac and Olsen, 1993; Zenger, 2002). Scholars view coordination as a function of governance (contract coordination) and cooperation as an outcome of governance mechanisms (Luo, 2008; Oliveira and Lumineau, 2017; Poppo and Zenger, 2002), while others see the two as interrelated functions, interacting across different phases of collaboration (Castañer and Oliveira, 2020; Gulati *et al.*, 2012).

Scholars generally agree that cooperation and coordination are interlinked with inter-organisational governance (Hoetker and Mellewigt, 2009; Reuer and Devarakonda, 2015). However, the nature of the link between governance, cooperation and coordination requires further empirical examination (Castañer and Oliveira, 2020) through understanding the interaction of their mechanisms across multiple levels within and across organisations (i.e., between the client organisation and integrator, integrator and advisor). Transaction cost economics scholars suggest that selecting appropriate governance structures safeguards against opportunistic behaviours (Reuer and Ariño, 2007), and opportunism and misalignment of incentives cause unwillingness to work together and creates cooperation problems (Kretschmer and Vanneste, 2017; Williamson, 1975). Thus, strengthening control and coordination

provisions in contracts increases competence-based trust and the likelihood of cooperation (Malhotra and Lumineau, 2011). IOR governance scholars also caution against overreliance on contractual mechanisms to coordinate relationships (Engelhart, Roehrich, and Squire, 2023). The increasing asset specificity and uncertainty in transactions makes it prohibitively costly to specify every anticipated eventuality and action of parties in the contract. This further results in the development of inherently incomplete contracts (Macneil, 1980), making them a necessary but insufficient mechanism for coordination (Gulati *et al.*, 2012). Therefore, relational modes of governance, such as bilateral information sharing and shared norms and trust, are required to foster continued cooperation and adaptation (Poppo and Zenger, 2002).

Relational governance mechanisms are considered substitutes for or complements of contracts (Cao and Lumineau, 2015; Poppo and Zenger, 2002, Roehrich *et al*., 2020). The substitution school of thought argues that relational governance minimises contractual transaction costs (Dyer and Singh, 1998) and reduces overreliance on detailed contracts that could damage relationships by creating a climate of vigilance and signalling a lack of trust (Malhotra, 2009). In this view, relational mechanisms such as social capital, relational norms and trust are sufficient to govern relationships (Das and Teng, 2001; Gulati and Nickerson, 2008). In contrast, scholars from the complementary school of thought suggest that adopting a relational approach to governance, through the inclusion of coordination provisions in contracts, and building social capital reduces information asymmetry between parties, thereby creating an environment for developing trust and maximising the value of the contractual governance mechanism (Bastl *et al.*, 2012; Liu *et al.*, 2009).

Whilst scholars have extensively studied contractual and relational modes of governance, studies that tackle their influence on cooperation and coordination remain either limited to a single-level and dyadic inter-organisational exchange relationship (Liu *et al.*, 2009; Poppo and Zenger, 2002; Sydow and Braun, 2018), or to the analysis of a single mechanism, such as

control (Das and Teng, 1998). Shifting the focus to governance mechanisms while tackling their interactions with cooperation and coordination in IOPs would enrich our understanding of how and where these mechanisms are employed and their influence.

2.4 A viable system framework for inter-organisational projects

We opted for a common analysis system to develop a consistent understanding of inter-organisational governance and its interplay with coordination and cooperation on multi-level interactions. To examine this interplay across multiple levels, we adopted the Viable System Model (VSM) (Beer, 1981; Müller *et al*., 2020), which allowed us to ground inter-organisational interactions (Beer, 1981) by limiting hierarchies, allowing adaptability, and assuring viability in uncertain and complex environments, such as IOPs (Jackson, 1988). More specifically, we used the VSM model to frame the multi-level interactions to examine the structure and governability of IOPs.

VSM consists of five sub-systems, each with defined roles connected across levels by interacting communication channels that respond to organisation design and context (Lowe *et al*., 2020). Each sub-system consists of organisation(s) that exhibit specific roles. For example, S2 only exhibits a coordination role, and S1s are sub-systems that do the work (i.e., suppliers). This allows for presenting a common framing for different types of structures. Table 2 details this recursive and multi-level framework (Beer, 1981; Espejo and Reyes, 2011).

Table 2. IOPs roles and functions into a VSM multi-level framework

Viable system model	**Functions and roles (in VSM terms)**	**Roles in IOPs**	**Functions in IOPs**
Sub-system 1 (S1)	**Implementation (Operations and their management):** the sub-system that does the work. Sub-system 1 are usually multiple separate entities that specialise in particular work.	Suppliers, subcontractors, and designers.	Organisations that deliver the work packages.
Sub-system 2 (S2)	**Coordination:** Sub-system that aims to limit oscillations and ensure harmony in operations	Members of the client organisation, the integrator or the consultant responsible for coordinating contractors' work	Functions that help integrate the work, e.g., scheduling, personnel coordination, quality control, information coordination

Sub-system 3 (S3)	**Control/Integrator:** Senior management of the operations who regulate and control for oscillations	The integrator/main contractor/client (depending on the structure of the network) usually executes the function of the project management office (PMO)	Operational control of activities in progress, e.g., cost control, scope control, and handling change requests.
Sub-system 3* (S3*)	**Audit and monitor:** Support for S3 in performing quality checks, performance audits, etc.	Client (depending on the roles assigned in the alliance)	Scope audit, quality audit, improvements, etc.
Sub-system 4 (S4)	**Strategy and future planning**	The alliance/network board, including senior members of the client organisation, integrator and consultant	Project planning, purchasing and contracts, future activities, scope changes and strategy
Sub-system 5 (S5)	**Policy:** The highest level of the enterprise that sets the organisation's policy and ethos.	The client organisation/ owner/operator organisation	Defining objectives of project organisation, alliance culture policy and procedures.

The framework provides the means to understand the interplay between governance, cooperation, and coordination on different levels, namely, sub-system level (relating to role interactions such as S4 Strategy - S3 Control) and project level (relating to overall interactions of sub-systems roles) interaction.

3. Methodology

We employed a multiple case study research methodology and adopted an abductive reasoning approach (Dubois and Gadde, 2002; Eisenhardt, 1989; Yin, 2003) to understand the interplay of governance, cooperation and coordination. Our case study approach (Yin, 1994) tackled the multiplicity of actors and events. A middle-range theory (informed by the VSM framework) addressed the interplay between three units of analysis (governance, cooperation and coordination) across sub-systems. This enabled theoretical elaboration (Ketokivi and Choi, 2014) and an in-depth understanding and reformulation of the interplay of the three units.

3.1 Research setting and case selection

Case studies were selected from the Institute of Civil Engineers (ICE) Infrastructure Client Group. Client-led networks chose to participate in understanding how they might reduce transaction costs, opportunistic behaviours, and improve efficiencies in infrastructure projects. All had experience in developing collaborative approaches with their supply chain.

We selected three case studies (networks) each with two embedded cases (projects). Network A consisted of a governmental body that undertook flood defence projects across the UK. Network B belonged to a governmental body operating and undertaking major rail infrastructure projects, while Network C was a major water and water recycling company in England.

Two projects for each network (Appendix 1) were nominated by their programme managers. Programme managers had extensive knowledge of the selected projects. The nominations were based on project performance in terms of time, cost, and the extent to which strategic objectives were achieved. For each network, nominations consisted of a poorly performing project and a well-performing project. Project A^+ was a coastal defence project, while Project A^- was a river flood defence. Project B^+ was a station refurbishment, while Project B^- was extending and widening platforms at an inner-city railway station. Project C^+ consisted of a pumping station installation and eight treatment tanks, while Project C^- was a water treatment plant. This sample provided a range of settings to understand and generalise interacting units of analysis (Eisenhardt, 1989; Yin, 1994), allowing for comparison within and between networks, and ensuring external validity, robustness and generalisability (Eisenhardt, 1989; Yin, 1994). Abductive reasoning allowed for an emergent and iterative approach that adopted the VSM as a framework from one end (Miles and Huberman, 1994), yet refined with the empirical findings (Dubois and Gadde, 2002; Miles and Huberman, 1994) to elaborate theory (Ketokivi and Choi, 2014) in understanding how governance, cooperation and coordination interplayed.

3.2 Data collection

The data were collected in 2016, based on 42 semi-structured interviews (Appendix 1) representing all network projects lasting between 19 and 117 minutes. The number of interviews varied between networks depending on data accessibility, however, the aim was a

representative and comparative sample across participating organisations. Interviews explored the network and project context (objectives, roles, responsibilities) and drivers of innovation and relationships. We interviewed 17 participants from network A, 14 from network B and 11 from network C. This contextual diversity allowed theory elaboration and enabled us to identify similarities and contrasts across the cases (Eisenhardt and Graebner, 2007).

All networks adopted different structures and differentiated between permanent and temporary organisations assumed within the network (Figure 1). However, they were all client/owner-led and were involved in the Project 13 movement toward a collaborative approach (ICE, 2019). Representatives from different parties include owner organisations, project management consultants, suppliers, and contractors. This allowed for a better understanding of sub-system interactions (Lumineau and Oliveira, 2018). Triangulation (Denzin, 2012) was used to increase the validity and reliability of our results. We triangulated our data by interviewing the programme directors across the three networks and gathering spreadsheets from project managers about project and supplier details (costs and time scales, contract types and value, key stages, and objectives). We also discussed and reviewed the emerging results of our analysis with the programme directors to validate our findings (Ruggiano and Perry, 2019). Appendix 2 provides details of our observations.

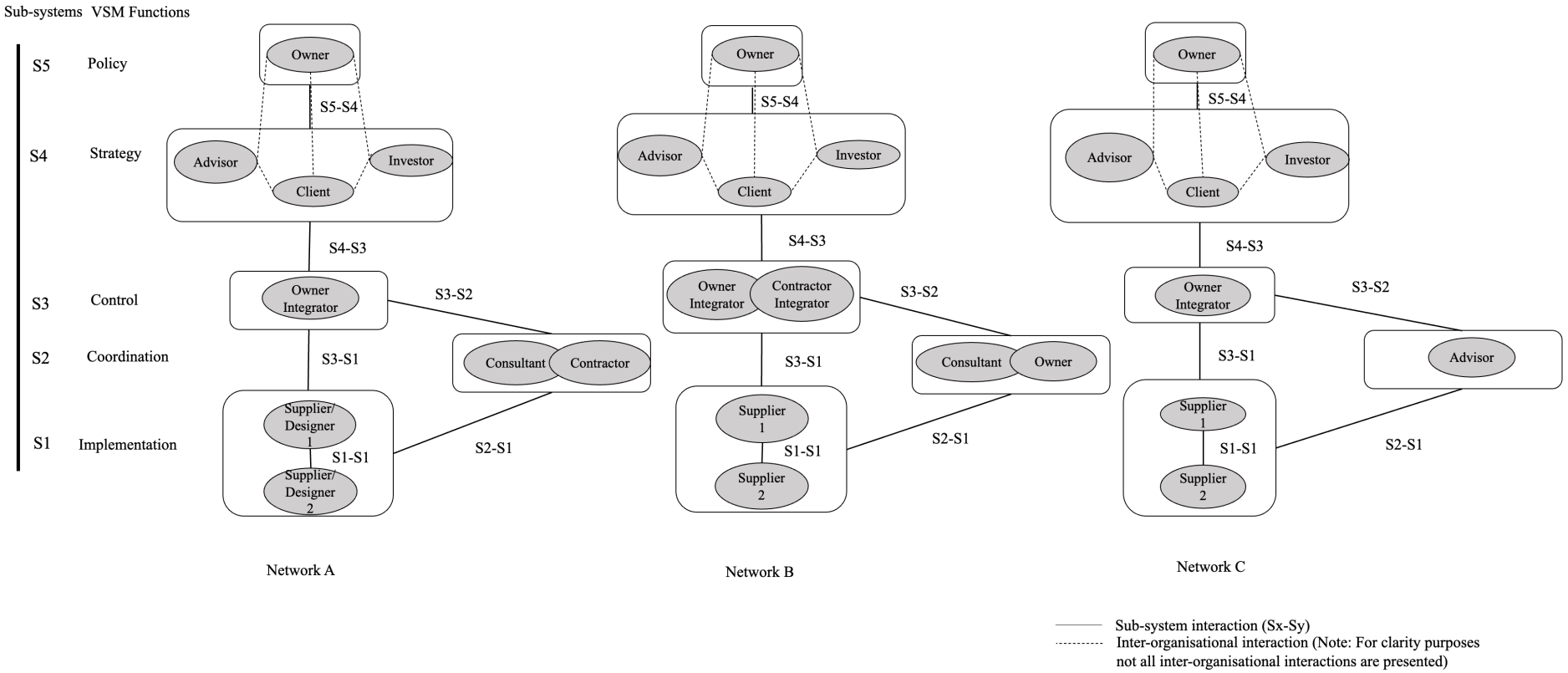

Figure 1 Network A, B, and C structures and sub-systemic interactions

3.3 Data analysis

Thematic analysis was used to analyse the data (Braun and Clarke, 2014), which straddles between theory- and data-driven approaches (Suter, 2012). At the sub-systems level, a common VSM was used to stratify project participating organisations as sub-systems based on their role, which allowed for within and between (network) case comparison and established a benchmark for analysis (DeFillippi and Sydow, 2016).

We followed Braun and Clarke's (2014) six-step approach. First, a top-down approach resulted in three categories: governance, cooperation and coordination. The coding structure also followed a theory-driven framework. The VSM provided a stratification of various sub-systems and enabled us to depict and locate different organisation interactions (Ketokivi and Choi, 2014).

NVivo 12 software was used to develop the coding structure. The VSM codes S_X-S_Y, governance, cooperation, and coordination were apriori categories for the first and second-order themes. As such, the literature delimited the context of our study and served as a source of ideas in our sense-making, theorising and categorisation process (Locke *et al*., 2022). Concurrently, two independent researchers analysed the data and provided separate coding structures that were later cross-checked and synthesised into a new coding structure to ensure validity (Figure 2).

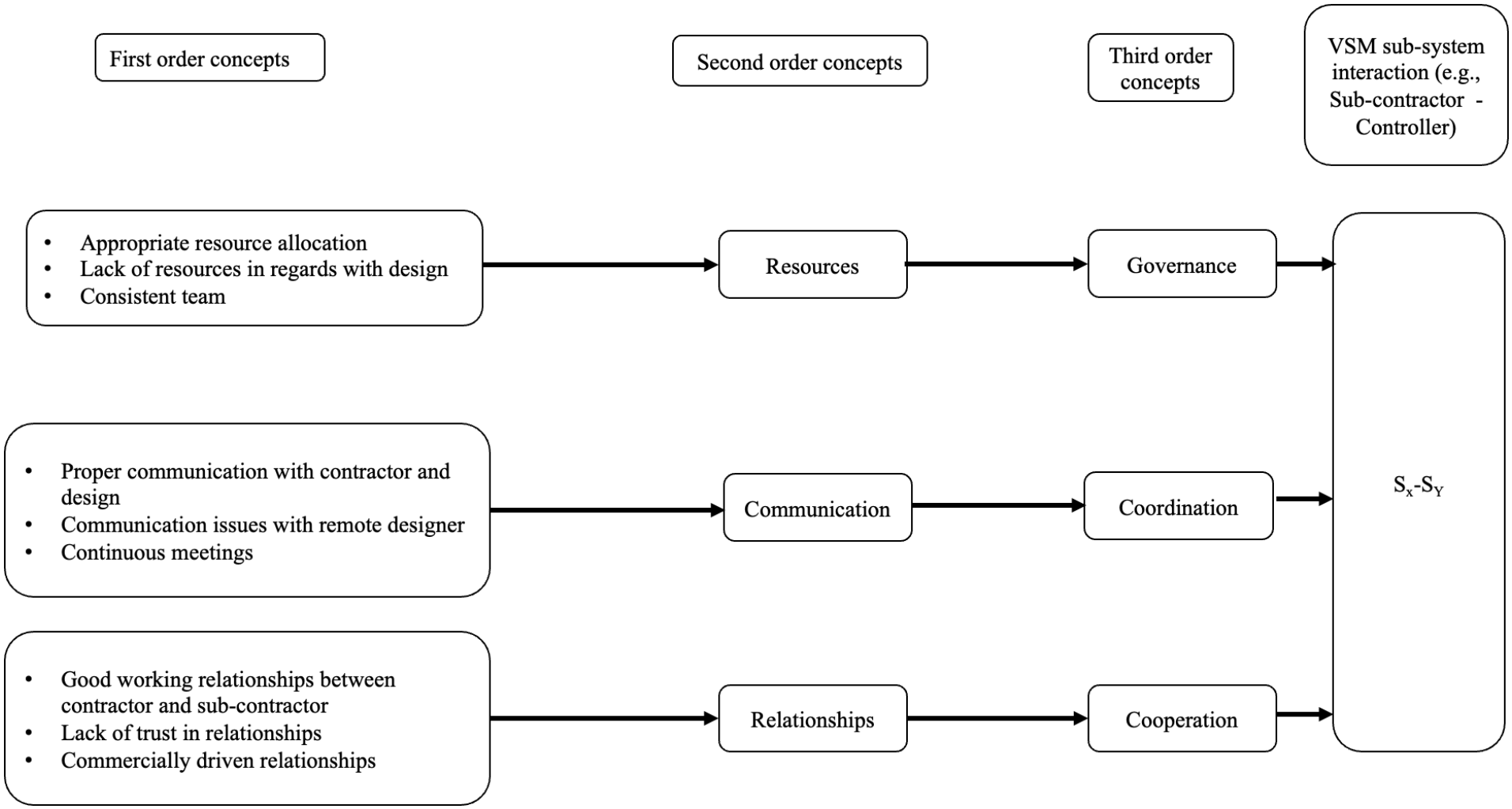

Figure 2 Data structure and codes

Third, first and second-order concepts were generated from descriptions of positive or negative issues arising in specific sub-system interactions pertaining to the interviewees' roles, functions and interactions with other sub-systems. Sub-systems are not limited to one organisation; multiple organisations may be involved depending on the network structure. Accordingly, we labelled positive and negative issues ascribed to participants' interactions with sub-systems serving as evaluations of governance, cooperation and coordination. For example, S3-S1 explicates the interaction between the Owner integrator (S3) and Suppliers (S1) in terms of governance, cooperation and coordination (Appendix 3). Fourth, the coding structure was reviewed through independent cross-comparison between the authors to ensure the reliability and validity of the analytical process. We provided two levels of analysis in terms of sub-system interaction and then a project level. Further, we offered an IOPs cross-case comparison to understand how governance mechanisms influenced cooperation and coordination and vice versa (to generalise from the cases).

4. Results

In all cases, VSM was used as a framework to stratify sub-systems governance, coordination and cooperation interactions. The result of governance mechanisms and how they positively and negatively interact with cooperation and coordination is studied on two levels. On the sub-system level, we analysed sub-system by sub-system interactions (i.e., between S3 and S1), whilst on the project level, we analysed sub-systems interactions (the overall interaction). Sub-system level interactions describe the enacted positive and negative mechanisms between specific sub-systems, i.e., the Owner integrator (S3) and Suppliers (S1). In contrast, the project-level analysis helped us understand the interplay across different sub-systems (i.e., how S3-S1 governance influenced S2-S1 coordination).

4.1 Various governance mechanisms interact between sub-systems and filter down to affect lower sub-systems

Governance mechanisms were mostly observed in S3-S1 (particularly "resources", "objective alignment", "requirements" and "leadership") and S4-S3 ("form of contract" and "appraisal") in Projects A^+, A^-, B^+, C^+ and C^-. For example, in Project A^- the contract form was apparent in S4-S3.

> *"I think certainly the form of contract did influence things – they were a little bit more cautious when there's change because they want to make sure that they are going to get paid for this change." (Owner Executive PM-13)*

In contrast, fewer governance mechanisms were observed in S5-S4 and S1-S1. Despite some commonalities in S4-S1 and S3-S1 sub-system interactions, several governance mechanisms were observed across different projects. For instance, for S4-S1, "unity of demands issues" were observed in Project A^- while "risk management mechanisms" were observed in Project C^+ and C^-. Regarding S3-S1, negative issues in "leadership" were observed in Project B^-, while Project C^+ demonstrated a positive "control" mechanism. Our analysis suggests that high-performing projects exhibited positive governance mechanisms.

Across sub-systems, governance mechanisms at high sub-system levels appeared to filter-down to dynamically impact lower sub-systems (typically down to lower supply chain roles). Referring to Appendix 3, in Project A^- the "form of contract" and "unity of demands" (S4-S3) had a negative downward influence on "requirements" (S3-S1), as illustrated by this supplier:

> *"What the [Owner] wanted was all the precast to match, but [the Consultant] hadn't put that in their works' information, so that led to massive CEs [Compensation events]." (Contractor-supplier PM-11)*

The downward influence of governance mechanisms from higher-order sub-systems was also evident on Project A^+ where "clear project and programme strategy" (S5-S4) had a

positive influence on "objective alignment" (S3-S1). For Project B^+ "issues in appraisals" (S4-S3) affected both "requirements" and "risks" (S3-S1) further down the sub-systems, and in Project C^+ "formal decision making" (S4-S3) positively filtered down to create "accountability" and "objective alignment" (S3-S1). Project C^- governance issues of "rushing planning", "risk management", "lack of engagement" and "stakeholders" (S4-S3) negatively had a knock-on effect to influence "requirements" causing "alignment issues" (S3-S1).

4.2 Common cooperation mechanisms interact in sub-systems and do not extend beyond specific sub-system interactions.

Cooperation mechanisms were observed between S3-S1, S2-21 and S1-S1. Cooperation mechanisms were relatively consistent and included, for example, "relationships", "alignment and purpose", and "opportunism and blaming". Such consistency is mainly due to the behavioural nature of cooperation (Gulati *et al.*, 2012). When it comes to S3-S1, Projects A^- and C^- faced issues in cooperation relating to "relationships", "alignment and purpose" and "opportunism". In contrast, this was not the case for Project A^+, B^- and C^+ where mostly positive cooperation mechanisms were observed. For example, in Project B^- "good relationships" were observed, as illustrated by the quote below:

> *"There was another team based in a different room in the same project office…there were interfaces where our work overlapped and stuff…we had really good relationships with them." (Owner integrator PM-21).*

S2-S1 was more prone to cooperation issues in all projects except Project B^-. Most issues evolved around "blaming" and "bad relationships", while S1-S1 cooperation was deemed positive in all projects.

Across sub-systems, cooperation varied between different sub-system interactions in all projects. For example, in Project C^- issues in "relationships" were observed between S3-S1, while S1-S1 exhibited "good working relationships". There was less significant downward cooperation influence on project participants in lower sub-systems (e.g. Project B^+ C^+ and C^-).

4.3 Coordination mechanisms interact across sub-systems and filter down to affect lower sub-systems.

Coordination mechanisms interacted across all sub-systems (S4-S3-S2-S1). For instance, S4-S3 mechanisms included "engagement" and "early planning and consulting" in all projects:

> *"And so as a board we had the open discussion, and the operator said that they would like a tarmac road, it was their preferred preference; but as a board we agreed that as long as we can meet the outcome." (Owner-integrator PM-33)*

Coordination mechanisms in S3-S1 ranged from "problem-solving", "communication" or "involvement of suppliers and contractors" and "monitoring". For instance, in Project A^+, B^- and C^+ "problem-solving" coordination mechanisms were observed. While "early contractor involvement" was observed in Project A^+, C^- and C^+. S3-S2 was concerned mostly with "cost consultancy" and "contract administration" as seen in Project A^-, A^+, B^+, C^-, and C^+. When it comes to S2-S1, coordination involved "coordination of tasks", "document control", "contract administration", and "process" mechanisms in all projects. In S1-S1, "compensation events", "design", "problem-solving" and "communication" were prevalent coordination mechanisms.

Across sub-systems, coordination mechanisms created a downward influence, whereby issues in higher sub-systems filtered down to affect participants in lower sub-systems. For example, Project A^+ exhibited positive coordination - "engagement with suppliers" (S3-S1) had a downward influence on "communication" (both S2-S1 and S1-S1), and Project C^+ positive "engagement with the operator" (S4-S3) had a positive downward influence on "continuous planning" (S3-S1), "effective scheduling" (S2-S1) and the "structured process" (S2-S3). In contrast, in Project A^- lack of coordination in "early planning" and "consulting with suppliers" (S4-S3) caused a downward influence on "compensation events" and "design coordination" issues in lower sub-systems (S1-S1). While for Project B^- the lack of "early engagement of suppliers" in S3-S1 contributed to "design issues" in S1-S1 as shown below:

"So again I think earlier on there should have been a sit round the table earlier on than physically chucking somebody on site and then trying to fight fires…I wasn't involved that early on; it [design responsibility] had already been agreed." (Consultant-integrator SM-31)

Project B^+ issues in "integration" and "monitoring" (S3-S1) were repeated in lower sub-systems (S3-S2) in terms of "integration" issues and "incomplete planning". These negatively influenced "design coordination" again in a lower sub-system (S1-S1). Project C^- issues "engagement with operations" (S4-S3) affected "design coordination" (S2-S1).

4.4 Complex interplay of governance, cooperation and cooperation across sub-systems

Having stratified governance, cooperation and coordination within and across sub-systems and analysing their interaction, a project-level pattern emerges in their interplay (as shown in Table 3).

Table 3 Example of quotes showing the interplay of governance, cooperation and coordination

Interplay	Example quotes
Governance – Coordination	***Project C+*** "*We procure our supply chain at the cheapest price...So in a very simple example of what I mean by that, they didn't have enough resource pool to deliver the project, and therefore we ended up having electricians installing pipework, which takes a lot longer than it would have done if you'd had a mechanical engineer or mechanical person installing pipework, because it's not their core competency. So they ended up delivering elements late, not to the right quality, and it broke down because they were not honest*." *(Gov S3-S1 Tendering)* *"I think that was there anyway, but because we were commercially stuck with the mechanical partner, we had to organise it, we had to drive it, but it was difficult." (Coord S1-S1 Commercial coordination)*
Governance – Cooperation	***Project A-*** *"There's been previous schemes before… so they'd written the works' information for the precast element of the works, [but] it wasn't all there, and what was there was open to debate, it was open to [all] sort of questions."(Gov S3-S1 Requirements)* *"We worked quite hard, especially…before Christmas…to enhance the [Client's] reputation to demonstrate we are committed. Then after we'd done all that, the [Client] turned round and said we didn't ask you to do it, we're not paying you any extra. That then will lead on to the next project you go off… and that'll be in the back of your mind. It's not really a positive thing." (Coop S3-S1 Alignment and purpose)*

Cooperation – Coordination	***Project B+*** *"The commercial people accused us of not working …efficiently. …This should have been raised by your project team [during the project not at the end]… I'd have put 30 blokes down there we'd have been falling over each other. So what we did, we split it…we utilised it to what we thought was most effective [way]…they bought into it"(Coord S2-S1 Communication).*

Governance influenced cooperation across different sub-systems. It was evident in all projects that there was a highly positive relationship between governance, cooperation and coordination associated with project performance. Typically, well-performing projects exhibited more positive governance, cooperation and coordination mechanisms between sub-systems.

When it comes to governance and cooperation, we found that for Project A^- the "form of contract" and "unity of demands" (Governance) in S4-S3 negatively influenced "alignment and purpose" (Cooperation), and caused "lack of incentivisation of contractors" (Cooperation). While in Project A^+ the clear "strategy and programme of projects" (Governance) in S5-S4 positively influenced "alignment and purpose" in S3-S1 (Cooperation). Governance mechanisms in higher sub-systems appeared to affect lower sub-systems. For instance, Project C^- suffered from a "lack of strategy and programmes of projects" (Governance) in S4-S3 influenced "relationships" and "alignment and purpose" in S3-S1 (Cooperation).

Governance mechanisms influenced coordination across multiple sub-systems. This was observed in all projects. For example, Project A^- suffered from "compensation events (CE)" (Coordination) due to the "form of contract issue" (Governance) in S4-S3. While for Project A^+ "appraisals", "contracts" and "requirements" (Governance) positively influenced "pricing" (Coordination). Project B^+ and B^- issues in "requirements" (Governance) in S3-S1 influenced "design coordination" (Coordination) in S1-S1. In Project C^+ issues in "tendering" (Governance) in S3-S1 affected S1-S1 in terms of "commercial" (Coordination).

Cooperation and coordination mechanisms influenced each other within specific sub-systems, such as S2-S1 and S2-S3. This was the case in Project A^-, A^+, B^+, C^- and C^+. For example, Project B^+ suffered from "blaming" (Cooperation) in S2-S1 due to "lack of engagement" (Coordination) during the project.

5. Discussion

This study empirically compared six projects embedded within three networks (two projects each). We tackled disordered hierarchies and boundaries using specific sub-system roles instead of organisations (DeFillippi and Braun, 2016). This allowed us to investigate governance, cooperation and coordination and their dynamic interplay in IOPs, as shown in Figure 3.

We elaborated on the context of IOPs governance and found a complex interplay between governance, cooperation and coordination. By adopting a micro-analytical and multi-level approach (Roehrich *et al.*, 2020) we showed different sub-system interactions and their influence on project performance.

Specifically, issues emerging in governance and coordination mechanisms filter down from higher sub-systems to lower sub-systems. For example, an issue in tendering (S4-S3) can influence cooperation and coordination of the supply chain (S1-S1). This was also shown in the study of Van Marrewijk *et al.* (2016), where the disconnect between permanent actors influenced execution project phases. This has an important implication in analysing governance mechanisms. Governance mechanisms enacted between sub-systemic interaction, such as between S3-S1, causing cooperation or coordination failure, may not be the root cause mechanism for such failure, as it may come from higher level sub-systems such as S4-S3 interaction that filtered down and caused that issue (Kalra, Lewis, and Roehrich, 2021). Nevertheless, cooperation outcomes were confined to specific sub-system interactions and did

not influence other sub-system interactions, but were influenced by governance. Cooperation issues were found in S3-S1 and S2-S1 interactions, highlighting the roles played by the S3 and S2 in maintaining cooperative behaviours. In contrast to inter-organisational coordination, we found that cooperation had a dyadic influence, while cooperation failures did not extend beyond specific sub-system interactions. For example, cooperation issues of "blaming" in S2-S1 or S3-S1 issues in "relationships" did not impact the lower sub-system (S1-S1) in Project C^- :

> *"So the issue is another supplier, without the forward-thinking about future schemes [and business] …could have detrimentally affected [the project] because they could have…not played ball." (Advisor integrator PM-38)*
>
> *"The relationship on site went very well, my site supervisor got on with everybody and I don't think we had any major issues." (Supplier-42).*

We, therefore, derive the following proposition:

> ***P1: Governance and coordination exhibit a filter-down effect across sub-systems while cooperation is confined within sub-system interactions.***

There is a complex interplay between governance, cooperation and coordination across multiple sub-system interactions which requires analysis across IOR and IOPs sub-systems levels beyond dyadic relationships (Roehrich *et al*., 2020). We have shown how various governance mechanisms can influence cooperation and coordination differently and the need to unpack different dimensions (Cao and Lumineau; 2015; Engelhart, Roehrich, & Squire, 2022; Oliveira and Lumineau, 2017; Roehrich *et al*., 2020). For example, Project A^- governance issues in S3-S1 in terms of "requirements" influenced the coordination down the supply chain (S1-S1) in terms of "design" and "compensation events":

> *"…What [the client] wanted was all the precast to match, but [the designer] hadn't put that in their works' information, so that led to massive compensation events." (Contractor-Supplier S-29)*.

This has also affected cooperation in having issues with alignment and purpose:

> *"…The contractor who was there to deliver the works wasn't really interested in any other outside things that might change things, that might be reported to the client, he was just going to do his job and if things changed and we were looking to instruct initial works he was like, 'Oh, do I have to do that?', and appeared to be playing games all the time." (Owner Integrator PM-31)*

In moving towards the process of "governing" (Sanderson, 2012), our empirical data demonstrated the influence of governance on cooperation and coordination. Coordination and cooperation influence each other and appear to be interdependent. They exhibit a mutual reinforcement effect on each other (Gulati *et al.,* 2012). Although cooperation and coordination are distinct (Kretschmer and Vanneste, 2017), positive cooperation may lead to positive coordination outcomes and vice versa (Faems *et al*., 2008). Therefore, we derive our second proposition:

P2: Governance influences both cooperation and coordination across sub-systems, while cooperation and coordination influence each other in a mutually reinforcing loop within sub-system interactions.

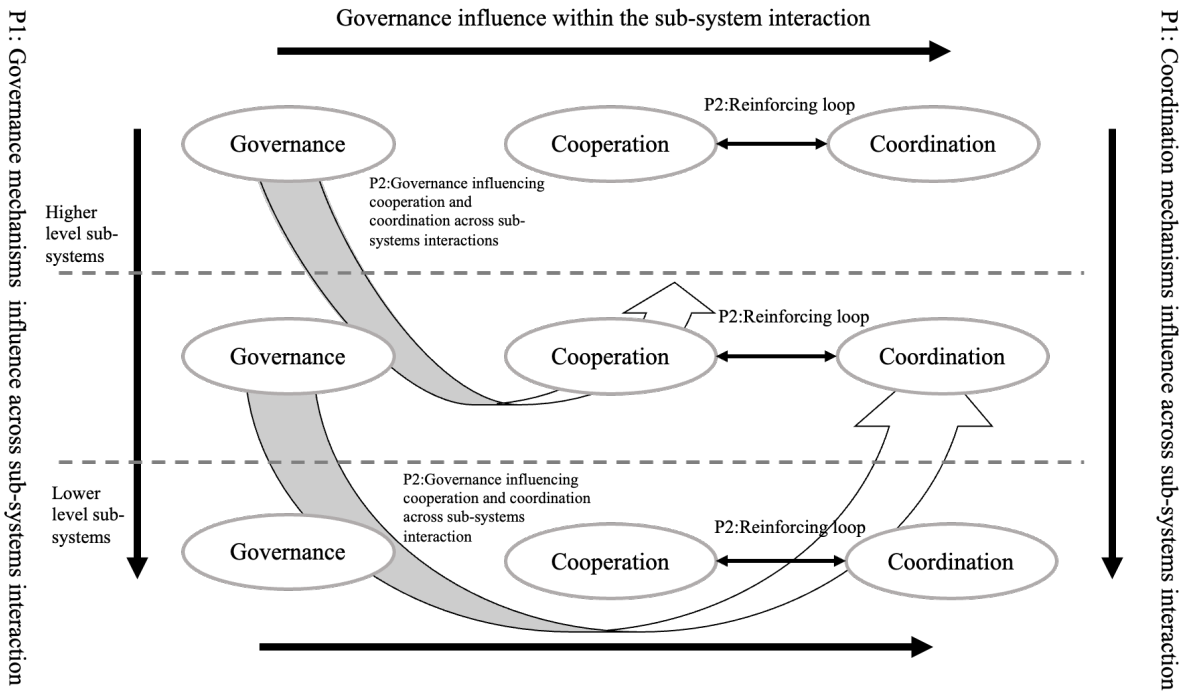

Figure 3 Interplay of governance, cooperation and coordination across multi-level sub-systems

6. Conclusions: Theoretical and Managerial Contributions

This paper addresses the interplay between inter-organisational governance, cooperation and coordination in IOPs within networks. This research advances our understanding of the interplay of governance, cooperation and coordination at multiple inter-organisational project levels.

Previous studies provided valuable insights on the influence of governance on cooperation and coordination in both projects (Ahola *et al*., 2014) and different IOR arrangements (Cao and Lumineau, 2015; Roehrich *et al.*, 2020). However, such analysis was limited to the interplay of governance mechanisms (contractual and relational) with cooperation or coordination. This dyadic relationship overlooked the multiple organisations involved in projects (i.e., suppliers and sub-contractors). First, this research tackles this gap by contributing to IOR and IOPs governance (Cao and Lumineau; Roehrich and Lewis, 2014) and shows how different mechanisms interact across sub-systems (Roehrich *et al*., 2020).

Second, our study contributes to the theoretical discourse of unpacking how governance mechanisms interplay with cooperation and coordination mechanisms across multiple intra- and inter-organisational levels. This nuanced view of IOP governance, cooperation and coordination contributes to our understanding of their mechanisms (Cao and Lumineau, 2015; Roehrich *et al*., 2020). Third, our study provides a common framework of analysis that focuses on sub-systems and addresses differences in network structure and authority (Provan and Kenis, 2008).

Our study has managerial implications. Managers should consider the interplay of governance and coordination across sub-system boundaries. Senior managers should pay attention to governance and coordination mechanisms being designed on higher levels, such as stage gate processes, strategy development and early involvement of contractors, as they have large implications on other governance and coordination mechanisms down the supply chain. While careful attention to cooperation behaviours should be considered on a sub-system level as it was observed to be bounded by the specific interaction (in other words, it does not transcend to other sub-systems), our study shows that governance and coordination can influence cooperation in these sub-systems which again posit the need to have good governance and coordination designed on a higher sub-system level while closely monitoring if any issues in different mechanisms occur. Further, managers should be careful in attributing governance, coordination or cooperation failure to certain mechanisms as it may be that the root cause for such failure are mechanisms designed on a higher sub-system level.

The VSM provides a helpful means to identify and evaluate inter-organisational governance, cooperation and coordination issues in IOPs. Managers can use the model as a diagnostic tool to assess how these mechanisms interact across sub-systems boundaries, irrespective of the nature of the network or context (projects or operations). This will enable practitioners to predict, identify and address major issues and appraise organising structures,

such as network design and contracts. Furthermore, assessing these interactions will allow managers to respond more quickly to opportunism, reduce transaction costs and correct misalignment. This will further help in identifying governance issues throughout the project located in interaction across multiple IOP sub-systems (Kretschmer and Vanneste, 2017).

7. Limitations and future research

Although we identify different governance mechanisms across sub-systems, we do not claim that our list is exhaustive. Data from some sub-system interactions (such as S5-S4) were less accessible. We did not investigate how different contractual and relational mechanisms affect each other or interplay across sub-systems (Poppo and Zenger, 2002). We addressed some inter-organisational relationship blind spots (Oliveira and Lumineau, 2017), but could not cover the full longitudinal timeframe nor investigate the relationship between network and project level. Further research of a nested view of networks, projects and sub-systems could enrich our understanding of such dynamics as projects unfold. Lastly, we acknowledge that prior network relationships can influence project-project relationships, although these were not explored.

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Appendix 1 Network A,B,C details and interview participants

Network A (Joint venture with design and build Contract)	Network A was a third generation framework that was first deployed in 2013 to deliver river and sea flood defence schemes. Competitive design-and-build frameworks (locally arranged) were supported by three specialist advisor frameworks (modelling/mapping /data, environmental services, engineering and asset delivery). A temporary project executive team were appointed to work with the local senior user to establish a business case, contracting strategy, engage stakeholder and clearly establish the project requirements (objective, outcomes, scope, output-specs) prior to accessing delivery capabilities, assessing value-risk and early supplier engagement (via professional services contracts). Contractors assumed the functions of system integrator.
	Project Description
Project A^+	A £29.2 millon coastal defence scheme covering 2.4 km. This involved installing a rock revetment, shingle beach, timber groynes, vehicle ramps, an extension to a designated environmental site and a live firing range**.**
Project A^-	A £6.5 million new river flood defence scheme. This scheme was in its third phase, consisting of steel sheet piles with precast concrete cladding units, raised embankments, precast concrete walls and wetland environments.

	Sector	Project	Role, Function	System	Time in minutes
1	Flood	A+	Consultant, Project Manager (PM)	S2	45
2	Flood	A+	Consultant-Integrator, PM	S2	64
3	Flood	A+	Owner, PM Executive	S3	74
4	Flood	A+	Owner-Integrator, PM	S3	65
5	Flood	A+	Consultant-Integrator, Site Supervisor	S2	53
6	Flood	A+	Designer-Integrator, Architect	S1	53
7	Flood	A+	Contractor-Supplier	S1	40
8	Flood	A+	Supplier	S1	41
9	Flood	A-	Contractor-Supplier, Engineer	S1	49
10	Flood	A-	Designer-Integrator, Architect	S1	58
11	Flood	A-	Contractor-Supplier, PM	S1	59
12	Flood	A-	Owner-Integrator, PM	S3	60
13	Flood	A-	Owner-Integrator, PM Exec	S3	54
14	Flood	A-	Designer-Integrator, Architect	S1	36
15	Flood	A-	Supplier, materials	S1	19
16	Flood	A-	Contractor-Supplier	S1	36
17	Flood	A-	Supplier, offsite manufactured panels	S1	34

Network B (Strategic capability outsourcing alliance)	Network B was first introduced in 2014 to deliver railway station refurbishments through the outsourcing of certain owner capabilities to an advisor network. The established framework agreement allowed the client to contract directly with individual specialist contractors on a cost-reimbursable basis with the benefit of speeding delivery a live operational setting with complex stakeholder interactions. A principal design delivery partner supported the client, while some stand-by joint delivery partners performed the role of systems integrator. The client directly contracted most suppliers who were often in a long term trading relationship.
	Project Description
Project B^+	A £14.5 million station refurbishment, including mechanical and electrical services, information systems and finishes to improve customer services, making them safer to operate and cheaper to maintain.

	Project B-		A £ 3.4 million investment to extend and widen platforms at an inner-city railway station, consisting of site clearance, sheet piling, ground works, capping beam and in-situ concrete.		
18	Rail	B+	Supplier, electrical	S1	65
19	Rail	B+	Consultant-Integrator, PM	S2	104
20	Rail	B+	Owner, PM Executive	S3	52
21	Rail	B+	Owner-Integrator, PM	S3	54
22	Rail	B+	Consultant-Integrator, QS	S2	55
23	Rail	B+	Supplier, tiling	S1	70
24	Rail	B+	Supplier, electrical	S1	117
25	Rail	B+	Consultant-Integrator, Quantity Surveyor	S2	54
26	Rail	B+	Supplier, painting and decorating	S1	63
27	Rail	B+	Owner, Site Manager	S2	40
28	Rail	B-	Contractor-Integrator, CM	S3	115
29	Rail	B-	Supplier, ground works/foundations	S1	46
30	Rail	B-	Supplier, piling	S1	36
31	Rail	B-	Consultant-Integrator, Site Manager	S2	44
			Description		
	Network C		Network C was initiated in 2004, and was thought to be one of the longest running in the UK infrastructure sector. It was formed through an alliance contract by which owner, advisors, contractors and suppliers formed a special-purpose vehicle (SPV) for the delivery of new-build and greenfield-site water and wastewater networks, and processing-plant refurbishment and extensions. The network consisted of seven member organisations, including that of the owner, who played an integrator role in providing systems integration capability across projects. The business plan and programme targets were set and project investment costs agreed by all parties involved in delivering the required outcomes. This was done under a common performance-based commercial model.		
			Project Description		
	Project C+		A £22 million installation of a pumping station and eight new treatment tanks, delivered to a tight 10-month construction deadline, which came in £9 million below budget.		
	Project C-		An £8 million construction of a new water treatment plant on an existing decommissioned site, emerging from regional water supply and demand issues.		
32	Water	C+	Key Supplier (electrical and new mechanical)	S1	88
33	Water	C+	Owner-Integrator, PM	S3	72
34	Water	C+	Key Advisor-Integrator, PM	S2	89
35	Water	C+	Key Advisor-Integrator, Site Manager	S2	75
36	Water	C+	Key Supplier, pumps and valves	S1	57
37	Water	C+	Key Supplier, electrical controls and software	S1	68
38	Water	C-	Key Advisor-Integrator, PM	S2	53
39	Water	C-	Key Advisor-Integrator, Site Manager	S2	73
40	Water	C-	Key Supplier, offsite kiosks and onsite install	S1	68
41	Water	C-	Supplier, switching and controls	S1	41
42	Water	C-	Supplier, onsite electrical	S1	68
				Total	**2,507**

Appendix 2 Research Instruments

2a Interview Protocol

The interview protocol is shown below. The following interview questions were completed by a sample of project owner, consultant, integrator and supplier participants.

Section 1 – Background to Your Project Role

1. **Could you explain the project roles?**
2. **What was your role / that of your organisation within the project team?**
3. **Who were you directly involved with (which members of the team), and key project stakeholders?**
4. **What were the key objectives and goals of this project?**
5. **What were the key project challenges? And how were they dealt with?**
6. **What went very well and what could have been improved?**

Section 2 – Project Relationships and Network Success

7. **What were the process/product innovations on this project?**
8. **What were the mechanisms that drove project success (e.g. team features)?**
9. **What were the consequences on your organisation and was this project typical?**
10. **How were suppliers involved in the various project stages? What was the rationale?**
11. **How were consultants involved in the various project stages? What was the rationale?**
12. **Could you say anything more about the engagement (outside of a contract)?**
13. **Can you explain collaboration on the project?**

2b Supporting data and observation

Three method development workshops (360mins). Workshops including 10 tier two and three suppliers, six contractors and consultants, and six clients. They provided narratives, discussed potential units of analysis, sample design and research methods.

Three programme director initiation interviews (180mins). Programme directors from each network (A,B and C) were asked to identify two projects. They explained project governance mechanisms, and gave their interpretation of the level of cooperation and coordination.

Project background data analysis (n=6, project managers performed a desk study). Project managers completed a spreadsheet giving details on project cost, key dates / stages, objectives and organisational roles.

Supply chain data analysis (n=167 advisors, integrators and suppliers identified in desk study). Project managers completed a spreadsheet on supply chain organisation type, service, project role, contract type, length of relationship, contract value and time scales of their project involvement (e.g. pre-project, options development, design and construction).

Online Project Questionnaire (n=78 participants). A sample of project owners, consultants, integrators and suppliers accessed the project outcomes and innovations of network projects.

Ongoing discussions with programme directors (Network A – 240mins, Network B – 300mins, and Network C – 200mins). Discussion of interim report and emerging results.

Programme director review of final network report (Network A – 90mins, Network B – 120mins, Network C – 120mins). A structured meeting to review findings, test phrasing and agree recommendations.

Steering and community events (n=16 major client organisations, 120mins). The emerging findings were discussed at industry events with various participants invited by 16 major client organisations.

Two network comparison workshops (360mins) Six programme and project directors from Networks A, B and C discussed their reports and made benchmark comparisons.

Appendix 3. Inter-organisational governance, cooperation and coordination (positive and negative) across sub-system interaction level for Project A^{-} and for Project A+ (these are high-order themes that can be grouped under different mechanisms)

	Project A^{-}			Project A^{+}		
Sub-systemic Interaction	**Governance**	**Cooperation**	**Coordination**	**Governance**	**Cooperation**	**Coordination**
Owner (S5) - Client / Advisor / Investor (S4)				Project strategy and programme (+) Establishing good relationships with the community (+) *No proper governance structure* (–)		
Client / Advisor / Investor (S4) - Owner integrator (S3)	Appraisals (+) Establishing long-term relationships (+) *Lack of owner integration and unity of demands* (–) *Form of contract influencing* (–)		Engagement (+) *Early planning and consulting* (–)	Appraisals (+) Form of contract influencing (+)		Engagement (+) Early planning and consulting (+)
Owner integrator (S3) - Suppliers / Designers (S1)	Resources (+) Leadership (+) Objective alignment and shared vision (+) *Requirements* (–)	*Relationships* (–) *Alignment and purpose* (–) *Opportunism* (–) *No incentives to cooperate* (–)	Early contractor involvement (+) Urgent problem solving (+) *Compensation events* (–)	Resources (+) Structure (+) Requirements (+) Leadership (+) Objective alignment and shared vision (+) Risk (+)	Alignment and purpose (+)	Early contractor involvement (+) *No early engagement with client* (–)
Owner integrator (S3) - Contractor / Consultant (S2)			Contract administration (+) *Process* (–)			Contract administration (+) Project management and cost consulting (+) *Process* (–)
Contractor / Consultant (S2) – Suppliers / Designers (S1)		*Bad relationships* (–)	Communication (+) Process (+)	Alignment and purpose (+)		*Communication* (–) *Process* (–)
Supplier (S1) – Designer (S1)	Monitoring (+) Requirements (+)		*Design* (–) *Commuication* (–)	Shared values and culture (+)	Good working relationships (+)	Pricing coordination (+) Alignment of suppliers (+) *Communication* (–)

Note: (+) and (–) signify a positive or negative mechanisms, respectively