Title

So alike yet so different: A typology of interorganisational projects

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ABSTRACT

Large projects are predominantly carried out in interorganisational networks that temporarily unify the efforts of multiple firms to work towards a shared goal, such as the construction of a complex infrastructure asset. While earlier research has highlighted multiple features that are salient to these interorganisational projects (IOPs), and discussed how they are managed, research that would systematically address the differences amongst IOPs is still at its infancy. Drawing on a review of existing research on project organising and network research, the current paper proposes a typology of IOPs consisting of three ideal network types: market-based network, dyad-driven network, and integrated core network. Differences amongst the three types of networks in their structural properties, governance, and antecedent factors are discussed in light of empirical examples, extending our understanding of IOPs as dominant forms of organising production across a broad range of industries.

Keywords:

interorganisational projects; typology; network structure; network governance; network antecedents; large project governance

1. INTRODUCTION

In many industries, including construction, television production and shipbuilding, major investment projects are predominantly carried out in interorganisational networks, which temporarily link together the resources, capabilities and knowledge assets of several legally autonomous firms. In the literature, these kinds of interorganisational arrangements are often referred to as project networks (Hellgren and Stjernberg 1995; Ruuska et al., 2011) or as interorganisational projects (IOPs) (Söderlund, 2004; Sydow and Braun, 2018). In the literature, the use of the term 'project network' varies considerably. The term is used by some scholars to describe regional networks[1] of individuals and organisations in which projects are recurrently carried out (Manning, 2005; Sydow and Braun, 2018), while others use the term to refer to interorganisational networks setup up for the purpose of completing a unique task such as the construction of a shopping mall or nuclear power station (Hellgren and Stjernberg, 1995; Ruuska et al., 2011). Thus, for sake of clarity, the term interorganisational project is used throughout the remainder of this paper.

Earlier research has contributed to our knowledge on IOPs by discussing their prevalence in different industries (e.g. Bakker et al. 2011), exploring their salient characteristics (e.g. Hellgren and Stjernberg 1995), elaborating different actor roles and relationship types (Jensen et al. 2006; Manning 2017), and describing various processes for collaboration and coordination of work (Larson and Wikström 2007; Pitsis et al. 2003; Oliveira and Lumineau 2017). However, until recently, most papers have focused on what IOPs have in common, and not on how two IOPs may differ from each other.

[1] Gernot Grabher (2004) has also introduced the notion of 'project ecology' to refer to semi-permanent networks of relationships between organizations and individuals in which projects are repeatedly carried out.

Research on interorganisational networks informs us that network organisations can be categorized according to their structure; that is, in terms of included actors, frequency of various types of ties (contractual, relational, communication, trust), and centralization, i.e. how evenly the ties are spread across the network. Uzzi (1997) has presented a categorization of interorganisational networks based on the frequency of embedded and arm's length ties in them, Nassimbeni (1998) has highlighted salient structural features of three frequent types of interorganisational networks, Provan and Milward (1995) have characterized networks based on their density and centralization, Burt (2004) has highlighted the importance of structural holes, and Gilsing et al. 2008 have addressed the relation between network density and exploration of novel technologies. In addition to these features, also the presence of cliques, i.e. tight groups of organisations within the network has been suggested as a discriminating feature of network structure (Rowley et al. 2005; Provan et al. 2007; Schwab and Miner, 2008). Regarding cliques in a project context, Lundrigan et al. (2015) engaged in a longitudinal study of three major infrastructure projects in the UK and uncovered that certain actors functioned as core members in the observed projects, possessing considerably more decision-making authority compared to peripheral network members. Manning (2017), discussing interorganisational projects in five project-based contexts – cultural industries, event organising, construction, complex product & system development, and collaborative research and innovation, shows that the composition of the core team appears to be associated to industry characteristics. Lundin et al. (2015) have also contrasted interorganisational projects with project-based organisations and project-supported organisations.

In addition to structural features, earlier categorizations of interorganisational networks have frequently examined governance, i.e. how it is ensured that network actors engage in collective and mutually supportive action (Provan and Kenis, 2008) and how power to influence others is distributed amongst network actors (Clegg et al., 2006). Provan and Kenis (2008), and later Raab and Kenis (2009) further categorized governance of interorganisational networks into three distinct types: participant-governed, lead-organisation governed, and network administrative governance. Participant-governed networks are highly decentralized, and their members are acting on a relatively equal basis. In lead-organisation governed networks, also referred to as strategic networks, or hub-firm driven networks (Jarillo 1988; Lundin et al. 2015), a single firm assumes leadership of the network due to its superior resources and/or position within the network. Finally, network administrative governance refers to a specific governance entity jointly set up by the network actors. Networks in IOPs have been characterised as semi-hierarchic (Hellgren and Stjernberg 1995), but it remains unclear if some networks are more hierarchic than others, and if so, why is this the case? Several recently introduced approaches for managing projects, such as project partnering (Chan et al. 2004), alliance models (Hauck et al. 2004), integrated project delivery (Glick and Guggemos 2009), and lean construction (Sacks et al. 2010), are critical towards the assumption of the project operating under a hierarchical chain of command. Lundin et al. (2015) and Sydow and Braun (2018), bridging project research with interorganisational network research, argue that while interorganisational networks are often coordinated by shared governance, several examples of lead-organisation governed projects have been discussed in the literature. Finally, Ruuska et al. (2011) have highlighted how two nuclear power station projects carried out within Europe differed considerably regarding the role of the project owner, relational ties amongst network actors, and contractual agreements.

To further advance the emerging discourse on interorganisational project dissimilarity, the purpose of this paper is, by drawing on earlier literature, to describe *how interorganisational projects differ in terms of their structure and governance, and how these differences may be* *associated with contextual factors*. In the following, we proceed to review literature on IOPs, with a focus on articles discussing the structural properties and governance of IOPs and networks. In addition, we also cover research addressing potential antecedent factors that might be associated with different types of IOPs. Based on this review, we present a typology comprised of three ideal types of ideal networks and discuss each type individually, linking them to illustrative empirical as available in extant literature. The development of a typology represents a top-down approach to categorization of IOPs, whereas development of a taxonomy would have been a bottom-up approach in which empirically observed networks would have been categorized based on their observed characteristics (Doty and Glick, 1994; Baden-Fuller and Morgan, 2010). For the purposes of the present paper, the development of a taxonomy was not considered viable due to the inherent difficulty and cost (in terms of both resource usage and time) in collecting comparable data from representative sample of IOPs. In addition, at the present, no empirically verified measurement instrument for networks within IOPs has been presented.

2. LITERATURE REVIEW: EXPLORING THE DIFFERENCES AMONGST INTERORGANISATIONAL PROJECTS

2.1 RESEARCH APPROACH

Literature reviews can be categorized as either traditional (or non-systematic) or systematic (Cronin et al., 2008). In systematic literature reviews (SLRs), the aim is to reduce bias and increase transparency of the review process by explicitly describing each step of the review process including: journal databases searched, keywords used to identify sources, criteria used for inclusion/exclusion decisions, and process for analysing included articles. In contrast, traditional literature reviews emphasise insights that are iteratively developed from a broad and diverse body of literature that cannot be delimited by means of pre-defined eligibility criteria (such as journal databases and keywords). The present study builds predominantly on two broad streams of research, project organising, and interorganisational networks with the aim of iteratively developing a typology of interorganisational projects that would highlight the salient features of ideal network types. As this is the case, diverse kinds of articles such as those discussing structural features of networks, their governance, and articles providing empirical examples can be considered potentially relevant. Furthermore, as the body of research on interorganisational networks is highly diverse (in terms of articles and terminology used in them), including hundreds (if not thousands) of potentially relevant articles representing at least half a dozen different schools of thought (see e.g. Grandori and Soda, 1995; Oliver and Ebers, 1998; Borgatti and Foster, 2003; Provan et al. 2007), the use of keyword-based identification of sources was deemed unviable and a traditional approach to conducting the literature review was chosen. Earlier, SLRs carried out in project research (e.g. Ahola et al., 2014; Aarseth et al., 2017; von Danwitz 2018) have resulted in valuable insights and categorizations, but to our knowledge, SLRs have not been utilized in the iterative development of typologies. Accordingly, and following examples of earlier conceptual network papers (e.g. Powell 1990; Jones et al. 1997; Nassimbeni, 1998), the inclusion of sources was primarily based on the author's earlier experience in working in this area. In addition, a form of snowball-sampling in which earlier conceptual network papers were carefully examined for potentially relevant references. In addition, the author's international network of colleagues, and two anonymous reviewers of the article suggested additional sources that were included. The analysis of sources was inductive and experimental in the sense, that the author was continuously experimenting with different alternative strategies for describing and categorizing networks in interorganisational projects, placing specific emphasis on the structural features and governance. Over time, many categories (such as actor dynamism) that were initially included were removed from the developing typology as they were not adequately addressed in the identified articles, whereas other themes, such as network structure remained as they received support from a diverse body of literature from both project organising and interorganisational networks discourses.

2.2 INTERORGANISATIONAL PROJECT AS A FORM OF ORGANISING PRODUCTION

Interorganisational projects are temporary networks, purposefully set up to achieve a specific goal, such as the construction of a luxury cruise vessel (Hellgren and Stjernberg 1995). IOPs represent the predominant form of organising production in many industries, including television production (Manning 2005), oil and gas (Olsen et al. 2005), construction (Boland et al. 2007), software (Grabher 2004), event organising (Larson 2002) and advertising (Grabher 2002), whereas more permanent network arrangements, such as demand-supply chains, are commonplace in many manufacturing industries, such as automobile manufacturing (Dyer 1997) and apparel manufacturing (Uzzi 1997). To achieve shared network-level goals – such as the construction of a power plant – heterogeneous firms possessing diverse resources and capabilities form interorganisational networks to complete interdependent tasks required for designing and delivering complex systems, infrastructure assets and events. Compared to mass-produced items, deliverables realised by interorganisational projects are characterised by a higher degree of uniqueness. Very often, these deliverables require the discovery of novel ways to combine complex technologies to meet customer demands (Prencipe, 1997). For example, luxury cruise vessels typically include new-to-the-world elements, such as cocktail bars served by robots and lush gardens to attract demanding customers and to stand out from vessels that are already in operation.

2.3 STRUCTURAL PROPERTIES OF INTERORGANISATIONAL PROJECTS

Interorganisational projects frequently encompass dozens of heterogeneous actors assuming diverse roles, such as owner, designer, architect, constructor, technology integrator, consultancy, equipment manufacturer, subcontractor, service provider, and so on (Hellgren and Stjernberg, 1995; Hobday et al. 2005; Ruuska et al. 2011). Similarly to how the presence cliques and their membership have been highlighted as important structural features of interorganisational networks (Rowley et al. 2005; Provan et al. 2007), Lundrigan et al. (2015) introduced the concepts of *network co*re and *network periphery* to describe IOPs. The network core consists of actors with a significant integrative role in the project and the inter-organizational relationships that bind these actors to each other, whereas network periphery includes all other network actors carrying out more straightforward tasks (such as work subcontracting) and not requiring constant coordination of work with actors within the network core. Accordingly, each actor in an IOP can be categorised into one of these two groups, and the size of the core group can vary from a single organisational actor, e.g. a strong owner-architect responsible for dividing project work into clearly defined work packages, to inclusive arrangements in which several contractors are working in close co-operation under a shared alliance agreement.

Several firms working together repeatedly give rise to the formation of interorganisational relationships (IORs), often characterised by trust, shared norms and reciprocal behaviour (Powell, 1990; Uzzi, 1997). However, several project-based industries, such as construction and shipbuilding, are characterised by inherent discontinuity of business exchanges, i.e. it is typical that a supplier delivering a solution may not be able to secure a further contract with the same customer for several years (Mandják and Veres, 1998). Under these circumstances, developing long-term business relationships poses considerable challenges, and investments made in strengthening relationships may not always pay off. Despite these difficulties, evidence of trust-based IORs has been found even in industries characterised by intensive rivalry and cost pressure. For example, Eccles (1981) discovered that, in the context of the highly cost-focused Massachusetts construction industry, main contractors regularly work with a limited number of trade subcontractors that they learned to work with efficiently, and they only rarely resort to open tendering in key subcontracting areas. More recently, additional evidence of similar relational embeddedness has been provided in other project-based contexts, such as television production (Sydow and Staber 2002), film (Sorenson and Waguespack 2006), offshore construction (Barlow 2000) and shipbuilding (Ahola et al. 2008). While there is no earlier research that would systematically compare the frequency of long-term business relationships across a range of project-based industries, Uzzi (1997) has argued that trust-based IORs are more frequently observed in networks in which no clear-cut hierarchy exists, than in networks relying on clear contractual hierarchies. Hence, it would be reasonable to expect that the frequency of long-term IORs to be higher within the network core as compared to network periphery. Accordingly, Figure 1 below illustrates three ideal types of network configurations in terms of their core and peripheral networks and ties between network actors. The *market-based network* is characterised by a network core of only a single actor assuming the role of an owner/integrator. This arrangement is typical, for example, in relatively noncomplex construction projects characterised by intensive cost-pressure and extensive use of subcontracting. In the *dyad-driven network,* the network core is composed of the client and the systems integrator working closely together. Deliveries of complex products and systems (CoPS) such as missile systems and high-speed trains (Hobday 1998, 2000) provide numerous examples of dyad-driven networks. Finally, the *integrated core network* is characterized by a large network core in which several actors hold a highly significant role in the project. The construction of the Heathrow Terminal 5 provides an example where all main contractors were included in the network core by means of a framework agreement (Davies et al. 2009).

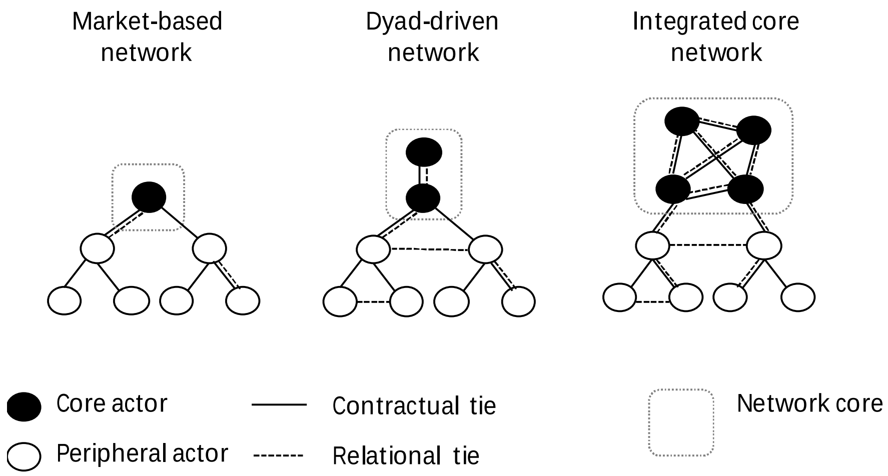


Figure 1 – Three ideal types of networks in interorganisational projects

2.4 GOVERNANCE OF INTERORGANISATIONAL PROJECTS

Locus of high-level decision-making

Interorganisational networks have been shown to differ starkly in regard to the locus of high-level decision-making in the network (Clegg et al., 2006). Grabher (2004) and Lundrigan et al. (2015) have argued that only network core actors are able to influence the network-level goal and associated high-level design choices, while actors in the network periphery are chosen to carry out specific tasks required for completing the project deliverable, but who lack the authority to influence high-level choices. Earlier network research has acknowledged three generic alternatives: shared governance, in which all network members contribute to high-level decisions affecting the functioning of the network, lead-organisation governed, in which a single actor is responsible for high-level decisions, and network-administrative organisation governed networks, in which network actors jointly set up a specific decision-making entity to act on their behalf (Provan and Kenis, 2008; Raab and Kenis, 2009. In the context of IOPs, some actors are responsible for coordinating complex subassemblies requiring interdependent inputs from several other network actors (Prencipe, 1997), while other actors such as equipment suppliers, may have a very independent role in the network (such as the provision of a specific pressure vessel for a power plant). Thus, in a *market-based network*, the project owner makes all significant decisions regarding the project scope. In a *dyad-driven network*, high-level decision-making is shared by the owner and a powerful integrator-actor, while in an *integrated core network*, several network actors with considerable decision-making authority are included in the scope of a multilateral contractual agreement.

As interorganisational projects involve several heterogeneous firms, each guided by their own distinct objectives, it is not uncommon that the goals of the actors participating in the IOP are either in conflict with each other or even with the shared project-level goal. For example, Winch (2004) studied the Transfer and Automated Registration of Uncertified Stock (TAURUS) project, which aimed to replace the paper-based settlement process used by the London Stock Exchange with an automated and centralised register. In the process, he discovered that many project actors were guided by interests that were in direct conflict with the goals of other actors and even the entire project. The claims culture of the construction industry provides a further example of how interests of a network actor may conflict with the overall goal of the project (Beach et al. 2005; Mohamed et al. 2013). Interorganisational networks resort to two generic strategies to reduce the negative effects of goal incongruence. The first strategy, adopted in market-based networks, is to ignore the problem at the network-level and let individual network actors work out their disagreements at a dyadic level as they see fit. The second strategy, adopted in the remaining two types of networks, is to consider goal incongruence harmful for the functioning of the network and to deliberately introduce mechanisms, such as multilateral contracts with interlinked risk and reward sharing structures, and shared macroculture to support the alignment of network actor goals (Barlow, 1998; Jones et al., 1997).

Control is central to achieving efficiency in any type of organisation. To elaborate alternative means of control, Ouchi (1979) classified control mechanisms based on how measurable are the outputs of involved actors, and how much knowledge is available concerning the working procedures. In case the effectiveness and efficiency of working procedures are difficult to assess, as is often the case when a project supplier possesses more expertise in its domain than its customer, measurement focuses on outputs, i.e. the deliverables of network actors. In case the quality of the deliverables of network actors is difficult to evaluate, as is frequently the case in innovative and research-oriented projects (Hobday 1998), measurement focuses on the capabilities, resources and processes of network actors. In situations where neither the outputs nor the process easily lend themselves to evaluation, Ouchi suggests 'clan-based' control, which relies on a process of socialisation that reduces goal incongruence among participating actors. Following a similar logic, Turner and Cochrane (1993) introduced the goals-and-methods matrix, which classifies project organisations based on whether or not their goals and working methods are explicitly known. Respectively, market-based networks, relying on dyadic and traditional contractual arrangements, are likely to resort almost exclusively to output control and leverage control techniques, such as earned value analysis and inspections of milestone deliverables. In contrast, in accordance with Kenis & Provan (2006), integrated core networks place more emphasis on mechanisms for controlling behaviour, such as cross-functional teams, reputation and the establishment of a shared identity for the network, as was the case with the ‘Making history culture’ purposefully developed for the Heathrow T5 project (Brady and Davies 2010). Dyad-driven networks lie between these two extremes.

In addition to the question of network core and network periphery, the issue of how the network boundary is controlled is of paramount importance for the functioning of the network. In projects facing significant cost pressure (as is often the case, for example, in the construction industry), extensive use of subcontracting is frequently the norm (Eccles 1981). Under these circumstances, networks may involve subcontracting chains that are several tiers high (Beach et al. 2005). As a result, the network as a whole does not have the capacity to influence the inclusion of new actors, unless otherwise stated in the contracts. Instead, any network actor may further subcontract a part of its work, further extending the network. However, contrary to Hellgren and Stjernberg’s (1995) argument that network boundaries are non-controllable by their nature, other scholars have provided evidence of networks in which the inclusion of new actors is controlled by either the owner or collectively by the network core members (Barlow et al. 1997; Provan et al. 2007). Recent research on alliance projects has emphasised that the purpose of controlling actor inclusion is to limit opportunistic behaviour and resulting inter-actor conflicts in the network (Black et al. 2000). Thus, it would appear that the degree to which boundaries are controlled varies according to the network type. Market-based networks have no boundary control whatsoever, but on the opposite end, integrated core networks include new actors only based on joint decisions involving multiple network actors. Also in dyad-driven networks, the owner frequently has a significant role in influencing the selection of subcontractors used by the systems integrator (Hobday et al. 2005).

Disputes are likely to emerge in any network involving multiple actors which are guided by their own goals and priorities. Due to the high interdependency of tasks carried out by network actors, disputes are likely to be harmful for the efficiency of the network. For example, if two actors slow down their operations to address an ongoing dispute, the progress of interdependent tasks carried out by the other network actors are frequently affected as well (Ruuska et al. 2011). Market-based networks rely exclusively on dispute resolution at a dyadic level, and actors typically resort to legal mechanisms when their bilateral negotiations fail to reach a mutually acceptable outcome. In dyad-driven networks, the integrator firm and its key suppliers often share a history of working on several projects, are motivated by prospects of future collaboration (Engwall 2003; Jones et al. 1997; Uzzi 1997), and thus are much more likely to act according to the norms of reciprocal behaviour, than firms in market-based networks. In other words, firms expect that the concessions made in the past will be considered when determining how to resolve a current dispute. Integrated core networks differ from the other two types in terms of dispute resolution, as they include explicitly defined dispute resolution practices at the network level. For example, in alliance contracts, it is frequently stated that legal mechanisms cannot be used to resolve disputes among alliance participants, but that solutions to both dyadic and multilateral disputes must be found through bespoke cross-organisational committees (Beach et al., 2005).

2.5 ANTECEDENT FACTORS

From both a theoretical and a practical perspective, it would be important to understand some of the antecedent factors which may be associated to the prevalence of different types of network types identified in this paper. While the intent here is not to develop a deterministic model that could be used by practitioners to select the optimal network type for their project, an understanding of some of the main factors to consider when making this decision may, nonetheless, offers some support to practitioners in their pursuit to increase the success of interorganisational projects.

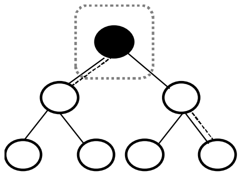
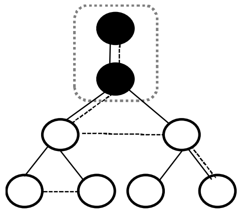
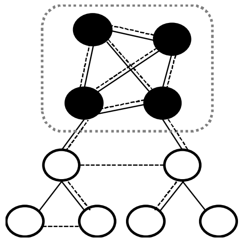
Projects differ in regard to the prioritisation of their high-level goals. In case the project owner is primarily concerned with costs of the project (which is a frequent condition in e.g. in relatively simple construction projects), the adoption of a market-based networks structure would appear likely. In this case the owner would be responsible for all high-level design decisions and make-or-buy analyses regarding individual work tasks dictate the shape of the network (Hellgren and Stjernberg, 1995). In case the project owner's primary interest is to acquire an innovative solution that draws on the expertise of a specific system integrator, which typically possesses rare and world-leading capabilities in its technology domain (Prencipe 1997; Hobday, 1998; Gil et al. 2012; Ahola et al 2017), it would appear more likely that a dyad-driven network form will be utilized. In case the project owner prioritizes functional collaboration and considers disputes as serious threat for the project outcome, it would seem likely that a core team network is established to ensure that the project proceeds without major conflicts between the involved actors (Barlow, 2000; Brady and Davies, 2010).

Project also differ regarding the uniqueness of their deliverable. In case uniqueness is low, it is more likely that some elements of the project designs can be transferred from previous projects. Under these circumstances, it is also likely that work required for completing the project may be broken down relatively easily and purchased via competitive tendering. Thus, when uniqueness of the project deliverable is low, the use of market-based networks appears likely. Projects with a high degree of uniqueness frequently call for more iterative approaches to design and procurement activities. These kinds of iterative approaches are more aligned with the governance characteristics of dyad-driven and core team networks than market-based networks.

Project completion calls for carrying out a complex sequence of tasks that frequently involve interdependencies of sequential, pooled and reciprocal kind (Thompson 1967). Nassimbeni (1998) discusses how interorganisational networks generally respond to interdependencies by means of standardisation (of inputs/outputs, skills, and processes). The inherent temporality and uniqueness of IOPs, however, poses stringent limits towards standardisation. In IOPs, task interdependence may often be reduced by limiting the amount of feedback loops between tasks by means of elaborate planning before the project enters the implementation phase. In the project management domain, specific tools such as the design structure matrix (DSM) have been developed for this purpose (Steward 1981). In planning, a linear approach is generally preferred where different designers work sequentially rather than in parallel on the design. A linear approach to planning can, however, not always be followed. For example, Prencipe (1997) and Hobday (1998) have discussed how in dyad-driven networks, delivering complex products and systems (CoPS), such as missile systems and aircraft engines, which have high technological novelty and interdependence of custom-built systems, continuous and recursive interaction between the systems integrator and its main suppliers is a necessity (Hobday, 1998). Here, tasks carried out by individual network actors are interconnected by reciprocal interdependencies. To support interorganisational collaboration, specific mechanisms, such as co-location and cross-organisational problem-solving teams, are frequently utilised (Brady et al. 2005; Artto et al. 2017). Thus, extensive reciprocal and pooled interdependencies are more likely to be associated to dyad-driven and integrated core networks.

Structural embeddedness, i.e. the frequency of relational ties between actors in a specific geographical region may also be associated to network type (Brass et al. 2005). Manning (2005) has described the German tv-production industry as a context in which both creative individuals and organisations are highly interconnected via relational ties. In contrast, Beach et al (2005) discuss how the UK construction industry is characterized by defensive behaviour and adversarial relationships. It would appear likely that many of the governance practices associated with core team networks, such as co-location and joint problem-solving agreements, would be more effective in networks in which relational ties are somewhat frequent. Thus, market-based networks are likely to be more frequent in contexts with low structural embeddedness whereas core team networks are more frequent in contexts with moderate to high structural embeddedness. This aligns with Bakker et al. (2011) who show that industry is also associated with the size of networks, in terms of the number of participating organisations and the frequency of past ties between network actors. Also, Manning (2017) has compared the characteristics of networks in culture, construction, complex products and systems, collaborative research & innovation, and international development contexts, highlighting that these industries differ in terms of project uniqueness and geographic concentration. Finally, legislation regulating practices for supplier selection in public sector projects is one additional factor that is likely to be associated with market-based and dyad-driven networks, as public-sector projects typically call for an open tendering process in which the organisational tasks (tenders) are clearly specified a priori by the owner. Table 1 below summarises the salient features of the three ideal types of networks in interorganisational projects discussed in the present paper. In the following, we proceed to discuss the three ideal types of networks in light of illustrative examples.

Table 1 – Characteristics of three ideal types of networks in interorganisational projects

	Market-based	**Dyad-driven**	**Integrated core**
			
Structural properties			
Size of network core	One firm (client)	Two firms (client and systems integrator (SI))	More than two firms
Nature of ties between network actors	Predominantly contractual	Both contractual and relational ties between client and SI, predominantly contractual ties in network periphery	Both contractual and relational ties within network core, predominantly contractual ties in network periphery
Governance elements			
Locus of high-level decision-making	Owner	Owner-SI dyad	Network core
Goal alignment by	Contractual sanctions (dyadic)	Contractual sanctions & incentives (dyadic)	Shared gains & losses (network core), contractual sanctions & incentives (periphery)
Forms of control	Output control	Output control, self-control, reputational control/concerns	Output control, self-control, reputational control/concerns
Openness of network boundary (joining new actors)	Fully open (all actors can subcontract work)	Relatively open (System integrator (SI) may control inclusion of subcontractors)	By shared agreement (network core), relatively open (periphery)
Mechanisms for dispute resolution	Legal mechanisms	Norms of reciprocity (SI and key suppliers), legal mechanisms (network periphery)	Cross-organisational teams (network core), norms of reciprocity (network core), legal mechanisms (network periphery)
Antecedent factors & context			
Planning emphasis	Low costs	Innovative solution (leveraging SI's expertise)	Effective interorganisational collaboration
Project uniqueness	Low	Moderate to high	Moderate to high
Types of task interdependency	Predominantly sequential	Sequential, reciprocal and pooled (network core), primarily sequential (network periphery)	Sequential, reciprocal and pooled (network core), primarily sequential (network periphery)

Structural embeddedness	Low	Low to moderate	Moderate to high
Example projects	Construction industry in US (Reve and Levitt, 1984) Norwegian offshore projects in 70s and 80s (Stinchcombe and Heimer, 1985)	Olkiluoto 3 and Flamanville 3 nuclear power stations (Ruuska et al. 2011), various types of Complex Products and Systems (CoPS) including e.g. sea vessels, missile systems, aircraft engines and high-speed trains (Hobday 1998, 2000)	London Olympics, Crossrail (Lundrigan et al. 2015), Heathrow Terminal 2 (Lundrigan et al. 2015) German movie production (Manning 2005; Windeler and Sydow 2001) Waterways for the Sydney 2000 Olympic Games (Pitsis et al. 2003); Andrew oil field (Barlow 2000); Australian alliance-based construction projects (Lloyd-Walker and Walker, 2015)

2.6 THREE IDEAL TYPES OF NETWORKS IN INTERORGANISATIONAL PROJECTS

The market-based network

Market-based networks rely on extensive subcontracting to benefit from price competition and to drive down project costs. Project tasks are defined by the project owner and are carried out by selected subcontractors mostly independently and in a sequential fashion. To safeguard against opportunistic behaviour, detailed contracts that include significant sanctions or punishments for noncompliance or malfeasance are put in place. Measurement activities focus on outcomes – and not on the processes or capabilities of participating firms. Process monitoring is unnecessary as outcome (not process) measures are typically linked to contractual sanctions. Contractual incentives are generally not in place. Coordinated decision-making is largely centralised to a single actor, and the focus during the implementation phase is mainly on responding to unexpected disturbances as they occur. The absence of incentive structures further increases the need to monitor contract partners for opportunistic behaviour, as firms have very little to gain by behaving reciprocally. Low project uniqueness may occasionally give rise to opportunities for standardising certain work phases and establishing efficient project routines. Market-based networks are managed with ‘traditional’ and standardised project management tools and methods, such as WBS and PERT, as well as other approaches discussed in project management standards (e.g. APM, 2006). Literature on public infrastructure projects, particularly literature that was published in the 20th century, provides examples of contexts matching our definition of the market-based network. For example, Reve and Levitt (1984: 20) discuss how ‘*the “filed subbid” system used by Massachusetts and several other US states essentially removes consideration of all other factors than price from general contractors in selecting subcontractors, and from clients selecting the general contractor*’. Under such circumstances, parties have very limited motivation to co-operate to forge long-term relationships with other actors, since the next contract will also be awarded solely on price criteria. Also, Stinchcombe and Heimer (1985), in their elaborate analysis of investment projects in Norwegian offshore oil, pointed out that goal conflict between network actors was a frequent condition. For example, they found that it was often in the interests of designers to maximise the number of technical drawings, while other organisations were simultaneously striving to minimise their number.

The dyad-driven network

Dyad-driven networks operate under two assumptions. First, the integrator firm possesses capabilities in its domain of expertise that are superior to the owner (Prencipe 1997). Second, the owner and integrator need to work in close co-operation to develop a solution that will solve the business needs of the owner. While subcontracting is frequent in dyad-driven networks, it is typical for the integrator firm to develop long-term relationships with several key suppliers used repeatedly in its projects (Ahola et al. 2017). In addition, subcontractors carry out tasks that require only limited interaction with other network actors. Contractual agreements between the core actors typically differ starkly from agreements made with subcontractors. Contracts between the owner and the systems integrator often include incentives and elements facilitating long-term collaboration, whereas contracts among the latter group are more traditional, defining the responsibilities of each actor and sanctions resulting from noncompliance (Ruuska et al., 2011). In addition to construction, the delivery of CoPS in many industries represents another context in which dyad-driven networks represent the norm. Providing detailed examples of CoPS projects from air traffic control and flight simulator contexts, Hobday (1998) emphasises the systems integration competencies of the integrator firm responsible for delivering a fully functional customer solution, and stresses that temporary alliance-like arrangements are frequently developed amongst the owner and the systems integrator.

The integrated core network

Integrated core networks emphasise goal alignment within a relatively large and diverse core actor group. In practice, goal alignment is frequently supported by an alliance agreement that includes clauses for profit/loss sharing amongst alliance members (Laan et al., 2011). At the project front end, the project scope is purposefully defined only at a broad level to allow for flexibility and the development of innovative solutions. Unlike market-based networks, the expectation is that the scope increases in detail and is revised continuously as the project proceeds in the later phases of its lifecycle (Barlow 2000). In integrated core networks, many of the participating firms may share considerable previous experience of working together on past projects and may have developed joint routines and practices. The latter condition is typical, for example, in creative project-based industries, such as fashion (Uzzi 1997) and television production (Windeler and Sydow 2001). In addition, significant emphasis is typically placed on developing shared network-level practices for communication, coordination, change management and dispute resolution (Lahdenperä 2012). The activities of the network core members (such as design) share complex reciprocal interdependencies, and, the traditional linear project model, where designers work sequentially, is substituted by a model in which work is parallel and interorganisational communication is both encouraged and abundant. To facilitate effective resolution of inter-actor conflicts, the multilateral agreement amongst network core members may explicitly state that alliance members may not process their disputes using legal mechanisms (Davies et al. 2009). Instead of emphasising the importance of legal mechanisms, the focus is on developing a shared project identity that supports the alignment of actors' interests, as discussed by Hietajärvi and Aaltonen (2017) who analysed a railway alliance project in Finland. In addition, a 'future-perfect' strategy may be followed where actors are encouraged to voice their concerns, issues and even feelings, as was observed in the waterways project for Sydney Olympic games (Pitsis et al. 2003). Like dyad-driven networks, integrated core networks also frequently rely on extensive use of subcontracting for simple and non-critical tasks. Mechanisms used for safeguarding transactions differ starkly from the previous example of the market-based network. In a densely connected network, an actor's reputation (Jones et al. 1997) is a valuable asset, as a positive relationship enables the firm to participate in future projects. Firms are thus incentivised to protect their relationships, acting as a safeguard which reduces opportunistic behaviour in the relational network. Firms in integrated core networks may also jointly choose to restrict the access of (potentially opportunistic) outside firms by controlling the network boundary. In addition, actors may also collectively punish actors that have chosen to resort to opportunistic behaviour – for example, by sharing detailed information about questionable behaviour on the part of a specific firm (Balio 1987). Examples of projects organised as integrated core networks may be found in several industries, particularly in the last two decades. Project scholars have discussed examples of integrated core networks in infrastructure projects, such as Crossrail (Lundrigan et al. 2015) and Waterways for Sydney Olympic games (Pitsis et al. 2003), movie projects in Germany (Manning 2005), London Olympics (Lundrigan et al. 2015), and offshore oil and gas (Barlow 2000).

3. DISCUSSION

3.1 THEORETICAL AND MANAGERIAL IMPLICATIONS

An emerging stream of literature explores the differences amongst interorganisational projects in different contexts. Specifically, Bakker et al. (2011) have shown how the industry sector is associated with the uniqueness of deliverables, the number of participating organisations, and the frequency of established interorganisational ties in IOPs. Manning (2017) has further highlighted variances in the geographic concentration of several project-based industries, highlighting that network actors that repeatedly work together are frequently situated in the same geographical region. The current paper adds to this emerging stream of research by deriving a typology consisting of three ideal types of networks: market-based network, dyad-driven network, and integrated core network. Market-based networks are characterised by extreme centralisation of high-level decision-making, and the extensive use of subcontracting based on the lowest price. Dyad-driven networks are characterised by intensive and ongoing interaction between the project owner and integrator firm, required for ensuring that the integrator's solution will meet the customer's requirements. Integrated core networks involve a relatively large network core of actors that all have considerable influence on high-level decision-making. Both Lundin et al. (2015) and Manning (2017) have compared features of project-based firms and IOPs and Lundin et al (2015) have shown that IOPs may operate under differing governance arrangements. While these observations are invaluable as they highlight different high-level forms of project organising, they do not specifically address the richness of alternative structural and governance choices within each network form. Thus, somewhat similarly to how Whitley (2006) has highlighted differences amongst project-based firms, the present paper sheds light on some of the discriminating features amongst IOPs. However, it is also important to note that the three ideal network types developed in this paper are theoretically, not empirically[2] derived. As this is the case, empirically observed IOPs are not likely to perfectly fit any of the three types introduced in this article. On the contrary, as identified in research on interorganisational networks (Hennart 1993), it is more likely that some of their features will lie somewhere in the middle between two types. Similarly, as it is impossible to identify perfect empirical examples of Williamson's (1985) market or hierarchy, it is likely to be equally difficult to identify perfect examples of the three ideal types presented here. The typology presented here also connects to categorizations made in earlier research on interorganisational networks. Nassimbeni (1998) explored the coordination of four types of semi-permanent interorganisational networks and argued that standardisation (processes, inputs/outputs, and skills) represents the primary mechanism for coordination. In contrast, the present study found that the role of standardisation in the governance in temporary interorganisational networks to be relatively insignificant. This difference may be partially explained by the inherent uniqueness, discontinuity, and complexity characterizing project organising (Mandják and Veres 1998). In terms of governance, the typology presented here shares similarity with the three governance forms: shared governance, lead-organisation, and network administrative

[2] The paper does, however, draw on earlier empirical research to provide some empirical illustrations of the three network types.

organisation, introduced by Provan & Kenis (2008). Specifically, dyad-driven networks, are largely governed by the system integrator that is responsible for integrating the diverse technological offerings of its subcontractors into a functional customer solution. (Brady et al. 2005). As such, the systems integrator can be considered to assume the role of the lead-organisation. It is, however, important to notice that in dyad-driven networks, the project customer also significantly contributes to the high-level decisions regarding network governance, and in this way acts as a 'second lead-organisation'. The governance arrangement in market-based networks is somewhat similar to that of shared governance, as all network actors engage in governance decisions at a dyadic level (as they coordinate the activities of their direct subcontractors), and these dyadic governance efforts then aggregate to a network level even though there is no single network actor that would possess power to monitor and control all others within the network. The network administrative organisation, as described by Provan & Kenis (2008), however, differs starkly from the integrated core network introduced in the present study, as no specific governance entity is set up to govern the network. Instead, network core actors all actively participate in selection and use of governance mechanisms in the network. Thus, based on this study, it would appear likely, that the network administrative organisation governance mode that has been reportedly used in the airline industry (Sydow et al. 2016), is infrequent in the context of project organising.

In addition to highlighting the structural differences between the three ideal network types, the present study also contributes to the stream of literature discussing the governance of large projects (e.g. Miller et al. 2001; Ruuska et al. 2011; Ahola et al. 2014) by highlighting considerable differences in governance structures adopted in projects and relating them to antecedent factors characterising the project context. The results obtained here imply that IOPs might provide a particularly fruitful context to further study the governance of interrelated economic transactions, as suggested by Zajac and Olsen (1993) and Pryke (2004). Uzzi (1997) and Jones et al. (1997) have identified governance mechanisms operating at a network level. The present study contributes to this discourse by highlighting the prevalence of multilateral contractual structures involving risk and reward structures and joint-problem solving arrangements in integrated core networks.

A further implication of this paper is that governance structures cannot be adopted from one IOP to the next without analysing whether the underlying assumptions regarding the context still hold. Current project management standards are built on the assumption that the project owner controls the project, including all high-level decisions such as setting and modifying the project scope. Such an arrangement would be analogous to the ideal organisational hierarchy introduced by Coase in his seminal piece in 1937. However, as our findings and earlier research (Hellgren and Stjernberg 1995) illustrate, no single actor is in total control of the whole network, and as a result, some of the mainstream project management approaches are likely to be less effective in interorganisational projects in which multiple actors participate to high-level decision-making in the network.

Winch (1989) has characterised the interorganisational project as a ‘nexus of treaties’. In addition, Ruuska et al. (2011) have highlighted multilateral aspects of contracts in IOPs as well. Our findings lend support to these observations as particularly in integrated core networks, the importance of informal governance mechanisms (see, e.g., Poppo and Zenger 2002), such as trust-based IORs, norms of reciprocity and shared microculture, appear to play a crucial role in their governance. Thus, our typology of three ideal network types characterises IOPs as ‘nexuses of dyadic and multilateral, formal and informal treaties’, but also highlights that while market-based networks rely almost exclusively on dyadic and formal governance mechanisms, dyad-driven networks and integrated core networks are governed by richer and more nuanced combinations of dyadic and multilateral contracts as well as both formal and informal governance mechanisms.

3.2 AVENUES FOR FURTHER RESEARCH

The issue of actor dynamism during the lifecycle of an IOP is an intriguing one. Hellgren and Stjernberg (1995) highlighted that the design and implementation phase differs from the front end in terms of involved actors, and Lundrigan et al. (2015) showed how the composition and shape of three empirically observed networks varied over their lifecycles of several years. Extant project research has, however, focused predominantly on the formation and initial phases of networks (e.g. Matinheikki et al. 2016), placing considerable emphasis on the challenges and dynamic nature of these phases. At the same time, less emphasis has been placed on the later implementation phase from an organising perspective (Hellgren and Stjernberg 1995). Given the relatively poor public track record of major investment projects (Flyvbjerg et al. 2003), placing limited emphasis on implementation is rather surprising. Indeed, one could ponder that while the implementation phase may be straightforward for some networks, it might be highly dynamic and challenging for others, perhaps even more so than the front end.

Research on interorganisational networks is often concerned with the performance implications of different network forms (e.g. Provan and Milward, 1995; Provan and Kenis, 2008; Raab et al. 2015). Thus, a logical step forward would be to engage in empirical research addressing the performance of the three ideal types of networks presented in this paper in different contexts. A further future stream of research could be directed towards uncovering different approaches to how multiple organisational actors can jointly contribute to both ex ante and ex post setting of project goals. As earlier research has shown that in IOPs, the knowledge and capabilities of participating actors is highly heterogeneous (Brady and Davies 2004; Eccles 1981; Jones et al. 1997), a key question is how to fully leverage these assets in the project's goal-setting process.

3.3. LIMITATIONS

The typology of three ideal types of networks in interorganisational projects is based on an iterative in-depth review of extant research on project organising and interorganisational networks. Due to the vast amount of potentially relevant sources (see e.g. Grandori and Soda, 1995; Oliver and Ebers, 1998) and diversity of terms and concepts used in them, a systematic literature review approach based on explicit criteria for article identification and inclusion was deemed infeasible. Instead, the selection of sources relies primarily on the author's earlier experience in these research areas, discussions with the author's international network of colleagues working in this field, and suggestions made by anonymous reviewers of the present paper. In any case, even though the involvement of additional experts in the process has reduced selection bias, it could not be eliminated.

As is generally the case with typologies involving interorganisational collaboration (Hennart, 1993) we recognise that IOPs are rich and diverse in their characteristics and do not easily lend themselves to categorisation according to our – or any other – framework. As IOPs reflect the individual cultures and practices of their participating actors, it can be expected that we may empirically observe different kinds of hybrid forms that combine the characteristics of two or more network types presented in the present paper. For example, the IOPs studied in the context of the Norwegian offshore oil industry in the 1970s and 1980s by Stinchcombe and Heimer (1985) can best be categorized as market-based. These projects, however, also had certain elements of hierarchy built into them, such as mechanisms for jointly adjusting the project scope when necessary. To learn more about these kinds of hybrid forms, an understanding of the dimensions in which there is more variance in a similar group of networks would be an important first step.

ACKNOWLEDGEMENTS

To be included in the final version of manuscript.

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