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Pluralism at the Front-end of Complex Projects: Governance and Performance Implications

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PLANNING UNDER PLURALISM: IMPLICATIONS TO PROJECT ORGANIZATION DESIGN AND PERFORMANCE

This study illuminates the design of the project-based organizations formed to plan capital-intensive systems and how design impacts organizational performance. The research is grounded on four large infrastructure projects in the UK. We first use Design Structure Matrices to establish that planning is carried on by project organizations with a polycentric architecture. We show that in this pluralistic form of organizing, the project promoter has the authority to set performance targets, but shares authority over the final planning decisions with multiple legally independent actors. We also show that shared decision rights lead to multiple local disputes and pressure to relax the performance targets. Our main contribution is a framework that proposes four differing logics linking organization design and performance contingent on whether, first, the context surrounding the project provides an ‘umpire’ to referee local disputes; and second, the promoter has slack resources to mask slippages in the performance targets from the eyes of third parties. We argue the four logics reveal fundamentally different classes of managerial problems, and draw implications to practice and policy.

INTRODUCTION

A long-standing puzzle in management and policy literature has been to explain why empirical accounts repeatedly show that capital-intensive project organizations struggle to meet the initial performance targets. These accounts matter because announcements of performance targets that turn out way off the mark fuel a perception that the project organization has ‘failed’. This perception is rooted in deep-seated norms that posit ‘successful’ projects manage to avoid scope creep and achieve the goals on time and within budget (Cleland and King 1968, Dvir and Lechler 2004).

Extant theoretical explanations for recurring slippages in performance targets fall within two broad groups. One group blames the actor that promotes and finances the projects (the ‘promoter’) for regularly underestimating the performance targets. The explanations for the promoter’s behaviour range from cognitive optimism bias and strategic misrepresentation (Wachs 1989, Flyvbjerg et al. 2003) to lack of capabilities to realise the value of investing in planning and of letting suppliers’ know-how feed into the planning decisions (Morris 1994, Merrow et al. 1988, Stinchcombe and Heimer 1985). The second view is common too—that capital-intensive projects cannot be planned reliably, not because of agency and capability problems, but because of external events and vested interests that lie outside the promoter’s control. Hence, in the second view, the promoters are hostage to project pathologies including scope creep and collective inflationary consensus (Hall 1972, Shapiro and Lorenz 2000, Altshuler and Luberoff 2003, Miller and Lessard 2000, Gil and Tether 2011), and escalation of commitment (Szyliowicz and Goetz 1995, Ross and Staw 1986).

Whilst critical, the debate on the performance of capital-intensive projects has been stuck for more than *twenty years* (Pinto and Winch 2016). Extant performance studies have privileged the analysis of large datasets by premising that capital-intensive projects are all alike from an organization design perspective (Morris 1994, Miller and Lessard 2000, Flyvbjerg et al. 2003, Merrow et al. 1988). Specifically, this work

assumes that project organizations are authority hierarchies led by a promoter vested with centralised control over planning decisions. Building on this assumption, this work has confirmed regularities on performance slippages. But it rarely allowed to ‘dive down’ into projects. As a result we still know little about how targets are actually set – as Pinto and Winch (2016) put it recently, ‘[planning] remains a ‘black box’.

In this study we propose to move forward the performance debate by examining the planning of capital-intensive projects from an organization design perspective. This cognitive lens focuses on establishing relationships between organisational structure and organizational performance (March and Simon 1958, March and Sutton 1997). Structure relates to the designed arrangements that enable and constrain collective action, this is, the arrangements that define roles and assign authority to make decisions on how to allocate resources and resolve disputes between organizational participants (March and Simon 1958, Lawrence and Lorsch 1967, Scott 1987).

Crucially, an organizational design lens challenges the premise that capital-intensive project organizations are planned by authority hierarchies legitimised by ownership stakes, contracts, and regulation. Admittedly, multiple accounts show that the promoters have power to unilaterally set performance targets at the onset of planning—in this regard, it is fair to say that promoters act as an authority hierarchy. But planning is more than setting targets. During planning, the promoter has to forge a unifying system-goal with multiple autonomous actors so as to entice those actors to contribute resources under their control to the project (Lundrigan et al. 2015). As such planning occurs *before* the promoter has ‘simulated’ an authority hierarchy through development agreements and buyer-supplier contracts (Stichcombe and Heimer 1985). On the contrary, planning occurs within a ‘pluralist’ organizational setting in which the authority to make decisions is diffused across multiple independent actors (Denis et al. 2011). In pluralistic settings, a dominant coalition can rarely mobilize sufficient power to impose their perspective on others (Pettigrew 1973). Rather, in pluralistic settings, major decisions require extensive communication between self-interested agents to resolve disputes rooted in cognitive differences, competing norms, and conflicting goals and interests (Jarzabkowski and Fenton 2006). Hence, major decisions under pluralism are inherently political and involve, perforce, a search for consensus.

This understanding that disputes are endemic to the pluralistic planning stage of capital-intensive projects is instructive. But it leaves outstanding the issue as to how project organization design enables and constrains the searches for consensus. We know that diffused authority creates management complexity. But complexity is not the same as chaos, and scholars of consensus-oriented collective action argue that managers intuitively design structures to attenuate the complexity of pluralistic settings (Ostrom 1990). We also know that relationships between organizational design and performance are contingent on context (March and Sutton 1997). This reasoning leads to our core questions: what is the design of a capital-intensive project organization in the planning stage? To which degree does this design change as the project context varies? And to what extent can we trace project performance to organizational design?

We tackle these questions through multiple-case research. This approach is useful to explore new ideas in comprehensive ways as it enables to reveal the complexity in social settings and the longitudinal interconnections between events (Eisenhardt and Graebner 2007). Our sample consists of four large infrastructure projects in the UK. To vary the context, we examined three projects promoted by the central government (with differing degrees of regulation over planning decisions), and one project

promoted by a private firm. The sample also varies the architecture of the product to be planned because organization design literature claims that managers intuitively leverage product design knowledge to design organizations that are less complex to manage (Sosa, Eppinger, and Rowles 2004, Colfer and Baldwin 2016).

Our study leads to two main conceptual contributions. First, it suggests that—irrespective of the project context and product design architecture—planning disputes emerge and are resolved within a ‘polycentric’ organizational design. Polycentric architectures are an intuitive approach to decompose large arenas of consensus-oriented collective action to reduce management complexity (Ostrom 1972, 1990). Polycentric designs decentralise decision-making authority across nested groups of decision-making power with capacity for mutual adaptation and local variation. In our settings, polycentric architectures give the promoter authority to set performance targets for the project as a whole and for system components. But the promoter must share authority over final local planning choices with different groups of local actors. Hence consensus building is a prerequisite for making planning choices. Our second contribution is to develop a conceptual framework that establishes a relationship between the organizational design of a capital-intensive project and performance. This relationship is contingent on two structures can be deployed to resolve disputes: one relates to whether the environment imposes on the project participants an external ‘umpire’ to referee local disputes; the second relates to whether the promoter has slack resources to mask slippages in the performance targets from the eyes of third parties.

We organize the rest of this paper as follows. First, we review our understanding about designing organizations in pluralistic settings. Next we describe the research design, sample, and methods. The analysis examines the polycentric architecture underlying project organizing, and variance in the structures deployed to resolve disputes. The discussion proposes four organizational design-performance logics. We conclude by addressing boundary conditions and implications to policy and practice.

DESIGNING ORGANIZATIONS IN PLURALISTIC SETTINGS

Pluralistic organizational settings are characterized by the diffusion of decision-making power. In these settings decisions require lengthy talks needed for the actors to understand complex issues and strike a consensus (Susskind and Cruikshank 1987, Thomson and Perry 2006). The risk of inaction is also high if the participants mistrust one another and keep disputing each other’s evidence—what Langley (1995) calls ‘paralysis by analysis’. Furthermore, diffused power makes politics and bargaining part and parcel of the decision-making process (Ring and Van de Ven 1992).

The management complexity endemic to pluralistic settings begs the question as to why an organization would deliberately create a pluralistic setting. The answer to this question lies in the idea that co-opting environmental actors helps organizations to survive (March and Simon 1958). In bringing external actors into the organizational boundaries and sharing decision rights with them, the organization leader accepts a fundamental trade-off: less uncertainty in the environment comes at the expenses of a loss in decision-making autonomy. This trade-off illuminates why promoters of capital-intensive projects open the decision-making process on major planning choices to key stakeholders. For example, Gil and Tether’s (2012) account on the design of Heathrow airport Terminal 5 shows how the airport owner involved the airlines in critical planning decisions. Likewise, consensus building is also central to Pitsis et al. (2003)’s account of the development of infrastructure for the Sydney Olympic Games.

However, the decision to co-opt multiple actors in the project planning stage creates a complex management problem. First, the promoter cannot simulate a hierarchical authority vested in ownership stakes, regulation, and contracts because the co-opted actors are autonomous (Rittel and Weber 1973). Second, because the co-opted actors are drawn from different communities of practice, it is difficult to build a ‘meritocracy-based’ authority to resolve disputes (O’Mahoney and Ferraro 2007). Third, diffused decision-making power makes it hard to use dominant coalitions to enforce individual preferences (Pettigrew 1973). And fourth, the project promoter cannot modularise the organization to sidestep difficulties in building consensus. Modularity enables independent actors unified by a goal to make individual choices with limited need to interact with one another (Baldwin and Clark 2000). But capital-intensive projects produce *one-off* assets which impact multiple actors. Hence, multiple actors with rivalrous preferences will claim rights to directly influence major planning decisions – this is, planning decisions are ‘indivisible’ (Gil and Baldwin 2013).

These circumstances leave the promoter of a capital-intensive project with a complex management problem—as Rittel and Webber (1973) put it, ‘the plurality of objectives held by pluralities of politics makes it impossible to pursue unitary aims’. However, although pluralistic settings are so complex that resemble ‘organised anarchies’ (Cohen et al. 1972), theorists in collective action claim managers intuitively design structures to attenuate complexity (Ostrom 1990, Dietz et al. 2003). One way to do so is by creating polycentric organizations, this is by decentralising authority across nested centres of decision-making. Polycentric designs have been observed in settings as diverse as water resources management in California and police forces in Indiana (Ostrom 1990, 2010). The idea resonates with the notion in organization literature that complexity can be reduced by grouping the participants on the basis of either similarity or complementarity of knowledge (March and Simon 1958, Thompson 1967, Nadler and Tushman 1988, Galbraith 1973). But our lack of in-depth studies limits our knowledge of how these ideas extend into capital-intensive projects.

Related to this, we also know little how capital-intensive project organizations are designed to cope with the high levels of interdependency with the environment in the planning stage. Planning decisions are contentious because they allocate resources in ways that are hard to reverse and impact the property rights of many actors. Since not all environmental actors impacted by the decisions can be co-opted, planning decisions are scrutinised by numerous third parties including the public, press, regulators, and spending watchdogs. This interdependence puts pressure on the promoter to ‘lock in’ early on performance targets. Early commitments reduce ambiguity in the cost-benefit analysis and give the promoter legitimacy to acquire the resources necessary to achieve the goal (Stone and Brush 1996). However, bounded rationality makes it hard for the promoter to set targets wholly aligned with the outcomes of the ensuing searches for consensus. Furthermore, were the promoter to set overly conservative targets and planning could collapse because the project idea would not be convincing. As a result, the chances are real that the promoter will underestimate the initial targets. Initial difficulties to build consensus make it tempting to relax the targets to increase the solution space. But, any slippage in the targets risks eroding the promoter’s legitimacy to ask for more resources (Denis et al. 2011). This is the conundrum facing promoters in the planning stage, a conundrum rooted in the interdependency of the project organization with the environment. Our aim here is to advance our understanding as to how the design of the project organization contributes to resolve this conundrum.

In sum, planning a capital-intensive project, and thus setting performance targets, is rooted in a fundamental tension. On the one hand, managers must share decision rights with multiple autonomous actors to acquire much-needed resources to achieve the goal. On the other hand, managers must limit the amount of concessions to keep the project on target. We discuss next how we set off to investigate how managers manipulate the project organization architecture to cope with this tension.

RESEARCH DESIGN, SAMPLE, AND METHODS

This study adopts a multiple-case research design with embedded units of analysis (Eisenhardt 1989, Yin 1984). Case studies allow researchers to incorporate contextual and temporal dimensions, and thus are suitable to explore novel ideas (Eisenhardt and Graebner 2007). To advance theory and yield generalizable and robust insights we built a diverse sample (Siggelkow 2007). The sample consists of four large infrastructure projects in the UK, and our holistic question asks: can we trace project performance back to the design of the project organization in the planning stage? The sample includes four cases for which we gained exceptional access to the project leaders: i) London Crossrail, a high-capacity railway; ii) London Olympic park; iii) Heathrow airport Terminal 2 (T2); and iv) UK second high-speed railway (HS2). Table 1 summarises for each case the system goal, the actors promoting the project, the outcome of the planning effort, and data sources; appendix I summarises the project timescale, prior history, context, and evolution of the performance targets over time.

--Insert here Table 1 --

We built this sample to increase the generalizability of our insights. First, the cases differ in the architecture of the product under planning (Figure 1 illustrates this point in a stylised way). An Olympic Park suggests a decomposable system. It comprises a set of sport venues connected by underground utilities. But the utilities are ‘slaves’ designed not to constrain planning decisions for the high-value assets. In contrast, railway systems are much less decomposable. All stations connect to the same track and control systems, and must accommodate the same train cars. In turn, an airport is suggestive of a hybrid system—some components are physically linked, for example, the tunnels that connect the concourses, but other components, e.g., car park, hotel, are not. We know that managers intuitively seek to reduce management complexity by aligning organizational architecture with the architecture of the products that the organization produces (Sosa et al. 2004, Colfer and Baldwin 2016). But we were unclear if this logic could extend to the planning stage of capital-intensive projects.

--Insert Figure 1 about here --

Our sample also varies in the project context. The T2 project was promoted by BAA¹, the regulated private owner of Heathrow airport. In contrast, the other schemes were financed by central government acting alone (Olympic park, High-speed 2) or in a coalition with a local public agency (Crossrail). A project promoted by a firm which already owns the necessary land is less interdependent with the environment than one financed by the tax-payers that requires land acquisition. We thus expected to find less tension between the need to share decision rights and announce performance targets in the T2 case than in the public cases. And yet, we were not sure if this logic would hold since any regulated firm is a pluralistic setting. Furthermore large budget contingencies

¹ In 2012 BAA changed its name to Heathrow Ltd; we keep to the BAA name for the sake of simplicity

in the public projects could make it less difficult to resolve emerging disputes. Within the sample of public projects, the context also varies by the extent to which the planning decisions were or not regulated. In the Crossrail and HS2 cases, planning decisions had to be approved by the UK Parliament, the regulator of land use. In contrast, the promoter had autonomy to make planning decisions for the Olympic park. Still, all public projects were led by politicians, and thus we were unclear how regulatory variance would affect the organization design-performance relationship.

1.1. UNITS OF ANALYSIS

Multiple-case studies that embed a unit of analysis are useful to investigate a holistic question without overlooking operational details (Yin 1984). Accordingly, our units of analysis embedded across the four cases were planning disputes. Disputes are situations in which actors disagree and thus illuminate the conflict process and how people resolve conflict (Coleman and Ferguson 2014). In this study, the analysis of disputes was important to explore, first, how decision rights were shared; and second, to explore how differing product architectures and contexts could impact on the design of the project organization and performance. However, it was not our focus to probe into the negotiation processes. We agree that researching connections between organizational design and informal social networks is critical to further our understanding of organizational performance (Van de Ven et al.2013). We also agree dispute resolution hinges on the interplay between formal and informal mechanisms. But we argue that we cannot further our understanding of this interplay in capital-intensive project organizations unless we first understand better the organizational architecture surrounding dispute resolution, and this is the focus of our study.

1.2. DATA COLLECTION

Data collection was part of a broad research program looking at capital-intensive projects from an organization design perspective. In 2011, we first gained access to the top managers of the Olympic Delivery Authority (ODA), the public agency established in 2005 to develop the Olympic park. This agency reported to the four promoters, but had no power of veto over planning decisions. Between 2011 and 2014, we leveraged our access to top managers within the ODA to, first, independently access top managers of other stakeholders directly involved in the planning for the Olympic park; and second, to acquire similar levels of access to participants in the other three cases.

Data collection involved interviews and analysis of archival documents. We arranged the interviews by adopting a snowball approach (Biernacki and Waldorf 1981). Hence, for each case, once we identified salient disputes with the help of the initial respondents, we asked for names of other people who had intimate knowledge of the disputes. In total, we conducted and tape recorded 123 interviews up to 2-hours long. Follow-up interviews were conducted to probe deeper into particular issues, double check a verbal account, and bridge gaps in the database. We were not asked to sign non-disclosure agreements for interview data, but always asked permission to use verbatim quotes and offered to keep the source anonymous; some respondents gave us free rein to use the transcripts, whereas others disallowed the use of particular quotes. We formally committed not to share any reports that were not in the public domain. To gather extra data and allow for member checks (Lincoln and Guba 1985), we shared the emerging findings with the respondents. We also invited 13 respondents to give

presentations and stay for lunch. For each visit, we produced hand-recorded verbatim notes of the talks and of the informal conversations at lunch time.

To improve data accuracy and the robustness of the insights (Jick 1979), we triangulated the verbal accounts against archival data (Miles and Huberman 1994). The planning stage of a large infrastructure project in the UK is highly regulated. In public projects, many documents are uploaded online either because the promoter so it chooses or is mandated to do so under the Freedom of Information Act. Key documents included minutes of board meetings, formal exchanges between the promoter and development partners, and reports announcing performance targets and corresponding plans. In the case of BAA, we studied capital programs, master plans, and consultation documents. The disputes between BAA and the main user of T2, Star Alliance (which included over twenty airlines), were documented in reports produced by the regulator and in formal exchanges between BAA, STAR, and the regulator. The inclusion of the HS2 case was important because planning for this case is still ongoing. HS2 was also our last case study, and we followed Denis et al. (2011) recommendation to use the last case study to test emerging insights and thus sharpen the argument. For all cases, we played information in the project documents against third-party reports. Hence we combed through reports produced by the National Audits Office, Parliamentary committees, spending watchdogs, and other public agencies. Other sources of archival data were articles and interviews with top managers in professional outlets, e.g., *New Civil Engineering*, *Construction News*, and articles in the mainstream press, particularly for disputes that had fallen in the public domain.

1.3. METHODS

Following recommendations for inductive reasoning (Langley 1999, Ketokivi and Mantere 2010) we produced detailed accounts for each case. Each account provides a contextualised and chronologic understanding to guard against account bias (Miles and Huberman 1994). We then used Design Structure Matrices (DSMs) to model the planning problem. DSMs are a research tool from design theory that enables to formally represent a complex system into a square matrix by capturing the interdependencies between its constituent elements (Steward 1981, Eppinger et al. 1994). DSMs have been used to reveal the design architectures of both products and organizations, and have enabled to establish relationships between organizational design and performance (Sosa et al. 2004, MacCormack et al. 2012). The use of DSM was thus appropriate to explore potential relationships between the organizational architecture of capital-intensive projects in planning and performance as we controlled for different product architectures and project contexts.

To date, however, DSMs have rarely been used to model the structure of a planning problem, and thus we had to develop an original protocol. Our aim was not, however, to exhaustively model the planning problem. Rather, our aim was to explore: i) whether changes in the architecture of the planning problem and/or in the context impacted the architecture of the project organization; and ii) the relationship between organisational architecture and performance. To build the DSMs, we used data on planning disputes for major components such as a sport venue or a railway station. Our database consists of 35 disputes which the respondents said offered a good illustration of the focal planning problems. Specifically, we modelled the planning problems by capturing five constituent elements of planning choices: i) local goal (affects interests); ii) cost forecast (affects budget); iii) capacity (affects viability in use); iv) footprint

(affects land take); and v) any controversial sub-element. This stylised approach enabled to model the planning problems by capturing interdependencies between the constituent elements of the planning choices for multiple components. In addition, we also sought to formally establish which organizational actors shared rights to directly influence which planning decisions. Hence, for each DSM, we produced a companion organizational matrix that reveals the membership of the decision-making forums.

The DSM analysis revealed a critical regularity: the creation of project-based polycentric organizations across *all* cases. Furthermore, the DSM analysis revealed variance in the extent to which a referee, external to the project organization, was provided by context to settle disputes that the disputants alone failed to resolve. The DSM analysis could not reveal, however, the impact of the disputes to performance. To address this question, we examined how each dispute impacted the performance targets. In this process, we uncovered a second source of variance—the amount of contingency funds that the promoter had available to attenuate the public impact of cost overruns. This variance mattered because it changed radically the interdependency between the project organization and the environment. As we iterated between the findings and theory development (Miles and Huberman 1994), a contingency relationship between organizational design and performance emerged. We stopped iterating when we reached theoretical saturation. We turn now to present the analysis.

ANALYSIS

We organise the analysis by first showing how the DSM analysis systematically revealed a distribution of decision rights characteristic of polycentric architectures. We then examine variance in the structures surrounding dispute resolution and performance implications.

1.4. THE POLYCENTRIC ARCHITECTURE OF THE PROJECT ORGANIZATION IN THE PLANNING

STAGE

We have previously noted that a polycentric organizational architecture is an intuitive design approach to attenuate the complexity of managing a pluralistic setting (Ostrom 1972, 1990). The basic logic consists of decomposing the organization into a nested structure of decision-making groups with restricted authority to make choices. Within this architecture the high-level authorities retain centralised control over system-wide choices, but share decision-making rights for different local choices with different groups of local actors. As local disputes emerge, the authorities may have, *de jure*, power to enforce their own preferences. But to avoid a political backlash, the authorities prefer instead to search for local consensual solutions until they run out of time. Our analysis confirms this logic by revealing a polycentric organizational architecture across the four cases. Table 2 exemplifies the protocol which we used to interrogate the database of local disputes and construct the matrices. Figure 2 illustrates the analysis with excerpts of the DSMs and corresponding organizational matrices. The cells along the diagonal of our DSMs represent local planning decisions (the decisions are listed to the left of the rows) and the off-diagonal entries indicate interdependency between the decisions. For example, if the DSM has an entry in row *i*, column *j*, the decision concerning element *i* has an impact on the decision concerning element *j*. Hence, the decisions represented in the diagonal cells have inputs entering from the top and bottom decisions, and outputs leaving from the left and right sides.

<Insert Table 2 and Figure 2 here>

A first point to note is the regularity revealed by the DSMs on the architecture of the planning problem: invariably, all matrices show densely populated clusters of off-diagonals 'x'. Each cluster reflects the reciprocal interdependencies among the constituent elements of the planning choices for a component. For example, one component illustrated in Table 2 and Figure 2 is the Olympic Aquatics Centre. The decision to set its local goal as a 'massive iconic venue' is an input for decisions on cost, footprint, and capacity; these decisions, in turn, are inputs to refine the goal. For example: the local goal needs readjustment if: i) the cost is unaffordable; ii) there is not enough land; or iii) a massive venue is unviable in use. As the goal gets readjusted, the other local decisions may need to change too. One level down, a controversial decision to add a 'stylistic' diving board is interdependent only with the goal and cost decisions.

However, the four DSMs differ substantially in the degree of interdependency between the off-diagonal component clusters. For example, the Olympic Park DSM is sparsely populated off the component clusters. This result reflects the technological independency between the sport venues, and thus the modular architecture of the Olympic park. The notable exception is the interdependency between different local cost decisions: increasing the cost for one venue potentially leaves less money to invest in the other venues. In marked contrast, the Crossrail and HS2 DSMs show high interdependency between the component clusters due to the more integral architecture of the railway planning problems. For example, in the case of the HS2 DSM, the local goals for each station are interdependent—the goals need to be analogous to respect equitability of investment across cities. Technological constraints, in turn, create interdependency between the local decisions on station capacity and footprint; and budgetary constraints on create interdependency across all cost decisions. Hence the railway DSMs are densely populated off the component clusters. In turn, the DSM for T2 suggests a problem with hybrid architecture: on the one hand, the cluster of decisions for the car park is, apart from the cost interdependencies, independent from the concourse and baggage system clusters. But the two latter components are connected, and thus the decisions on goal, capacity, and footprint are interdependent

Critically, our analysis uncovers much less variability across the organizational matrices that show which actors have decision rights over which decisions (represented at the right of the four DSMs in Figure 2). At the highest level, all four matrices show a top governing body whose membership is restricted to the actors promoting the project. The promoter (in coalition or solo) and its agent are embedded in all decisions since they are the financier and accountable for performance. For example, in the HS2 case, the UK government and its agent, HS2 Ltd., directly influence all local decisions. Likewise, in the Olympic Park case, the four promoters and their agent, the Olympic Delivery Authority (ODA), share decision rights over all local decisions through the Olympic board. One level down, and consistent with a polycentric architecture, the organizational matrices show a fragmented structure of working groups—so-called 'project boards'. The project board members—local resource-rich actors and the promoter's agent—share decision rights. But the project boards are closed to opponents and resource-poor actors (although consultation reaches all affected parties).

Table 2 and Figure 2 also show how the influence of the local actors is restricted to specific components. For example, the UK government and its agent, HS2 Ltd, share decision rights for the HS2 Euston Station plans with the London government, Transport for London (a local transport agency) and Camden Council (local regulator

of land use); as one respondent said, “you could make HS2 Ltd its own planning authority [but] that would flout democratic processes.” Similarly, the UK government shares with the Manchester government, Transport for Greater Manchester, and other local actors decision rights on the plan for the Manchester station. But the London actors do not participate in the Manchester planning talks and vice-versa. Likewise, in the Olympic Park case, for each sport venue, a different group of sport bodies and other local actors directly shared decision rights with the promoter.

In sum, our DSM analysis establishes the following insights. First we consistently find a degree of decomposability of the planning problem. As expected, this decomposability is high for modular systems like an Olympic park, but low for integral systems like a railway. Second, we find no evidence of strict modular planning problems because of the interdependencies between local cost forecasts. And third, we uncover a polycentric architecture irrespective of the product architecture or project context. In this organizational design, the promoter and its agent have decision-making authority over *all* planning decisions; they can also set unilaterally performance targets. But for each set of local planning decisions, the promoter needs to build consensus with a group of local actors whose decision rights are restricted to that local planning problem. We turn now to examine how this underlying architecture allows for variance in the administrative structures surrounding consensus building.

1.5. STRUCTURAL VARIANCE WITHIN A POLYCENTRIC PROJECT-BASED ORGANIZATION

As aforementioned, within a polycentric organization, the promoter can set performance targets unilaterally but the final decisions hinge on building consensus. Searching for consensual solutions within a solution space constrained by targets set ex-ante leads to multiple disputes. Crucially, our analysis reveals important variance on the structures that surround dispute resolution along two dimensions. The first relates to the extent to which the laws in the environment provide an external ‘umpire’, this is an institutional actor third party to the project organization and mandated to referee the local disputes as an alternative to public courts.² This umpire shows in the DSMs for the HS2 and Crossrail cases, but not in the DSMs for the London 2012 and T2 cases. The second dimension relates the amount of slack resources which the promoter can internally deploy to mask overruns from the eyes of third parties. We observed substantive slack in the public projects, but limited slack in the private project. We turn now to discuss how variance along these two dimensions affects the relationship between polycentric organizing and project organization performance. Table 3 shows an excerpt of our database for six disputes, and illustrates the analysis that follows.

<insert Table 3 about here>

Variance in the use of an ‘umpire’ to resolve local disputes

The extent to which an external umpire to arbitrate between contending parties was institutionalised in the environment varied. In the Crossrail and HS2 cases, disputes were regularly deferred to an umpire because the laws in the environment instructed the UK Parliament to set up a committee to regulate land use. Hence any actor who was ‘materially affected’ by the promoter’s plans could lodge a petition in Parliament.

² According to the Oxford English Dictionary *umpire* and *referee* are synonyms to denote the actor in power to exercise the final authority

The dispute about the HS2 London Euston station (#1) is telling. From the onset of the planning talks in 2010, HS2 Ltd said the UK government preferred a utilitarian, modular station to keep the costs down. But the local actors argued that the existing station, which had not been modernized for 50 years, needed to be fully redeveloped. To persuade government to increase the project scope, the affected local parties commissioned masterplans in support of their vision. But under pressure to keep to the original targets, HS2 Ltd refused to cave in. It was then up for the Ministers in the Cabinet³, a level above, to decide what to do next, as one official explained:

HS2 Ltd, if you like, are the infantry out there; actually doing what they're told by [central] government. So HS2 Ltd get all the fights, appear to have all the fights, are the bad boys, but they're really only doing what they're instructed to do.

Consistent with polycentric organizing, our findings on the Euston station dispute show the local decision rights were *de facto* shared. The UK government may have had *de jure* power to impose its preferences. But rather than forcing the issue, government opted to negotiate. After three years of talks, the scope increased and the cost increased commensurately. Still, a number of issues remained outstanding and dispute resolution was deferred to Parliament; as one local official said, "HS2 Ltd. didn't persuade us that our points were wrong nor did they persuade us their points were right...[petitioning] is ultimately about making your case that your vision is superior." The Parliamentary committee was impartial, but also inefficient. It consisted of elected lawmakers who needed significant time to listen to all the arguments before making a judgement. In the Euston case, the Parliamentary debates lasted three years until a consensual solution emerged that further inflated the scope and cost. The Crossrail Woolwich station dispute (#2) shows a similar pattern linking efforts to build local consensus with performance slippages. In this case, after three years of talks, the promoter refused to add this station to the project to avoid setting up precedence and keeps the costs down. Petitioning thus gave local actors a chance to overturn what in their view was a flawed decision. After 40 months of listening to evidence, Parliament ruled the station should be built, and that the petitioners should partially finance the extra costs (over £250m).

In marked contrast, we did not encounter evidence of external umpires settling disputes in the T2 and Olympics cases. In the T2 case, for example, the more concessions on project scope the airlines asked BAA to make, the more BAA asked to increase the levies and disputes ensued ('we're battling all the time', said one BAA respondent). Our findings also show that BAA and Star were both happy to ask the regulator to mediate disputes. However, since it was within the mandate of the airport economic regulator to cap the levies requested by BAA, the regulator was not 'third party' to the project organization. Furthermore, the regulator lacked the power to settle disputes. One good example is the dispute about the main concourse (#3). The airlines craved a modern campus, whereas BAA planned to simply replace old facilities (in part to avoid umpiring by a public inquiry). Consistent with its preferences, BAA announced a modestly-budgeted £700m new concourse to open in 2012. Star then wrote several letters to the regulator complaining that BAA was ignoring their needs, a claim that BAA found unfair—'I can never get consensus on almost anything', said a BAA director. In the end, BAA agreed to safeguard the airlines' vision, but demanded an increase in the airport levies. The regulator facilitated the negotiations by postponing the deadline to complete the talks in one year. A level below, BAA and Star recruited a

³ The UK Government Cabinet includes the Prime Minister and the most senior ministers

retired director to privately arbitrate less substantial disputes. In the gate dispute [#4], for example, the airlines preferred ‘closed’ gates which they deemed more efficient, whereas BAA favoured ‘open’ gates so passengers could move around up to boarding. To avoid impasse, the arbitrator suggested resolving the differences by building ‘flexible’ gates, an idea which added £5 million to the cost forecast.

The Olympics case provides another example of a context where the decision rights were shared but the participants were left to their own devices to settle the disputes. In this case, mindful of the rigid deadline, Parliament rushed to give planning powers to the ODA, the promoter’s agent, right after the UK won the bid. Still, mindful that unilateral decisions could cause a political backlash, the ODA appointed a ‘design sponsor’ for each project board, and mandated them to search for consensual designs. The Olympics aquatics centre [#5] offers a good example of how the planning talks led to substantive slippages in the performance targets. The promoter had pledged a massive venue designed by a globally famous architect. But as the cost forecast started to spiral the goal became unviable. Yet, backing down from the public pledge was tricky—as one official said, ‘if you challenge them [architect] they will just walk away’. Complicating matters was a constraint imposed by the International Olympic Committee on the minimum capacity of the venue and individual preferences of the local government, the future operator of the asset. Unable to defer dispute resolution to a referee, the parties resolved the issues by keeping the aesthetics, shrinking the venue size, and safeguarding a capacity increase just for the games. But his solution duplicated the cost forecast, and a public outcry ensued—‘they seem to be willing to spend money like water’, said a watchdog⁴. Even more complex was agreeing a plan for the Olympic stadium dispute [#6]. In this case, two claimants to the planning choices, the London Mayor and football clubs, opposed to fold the stadium into an athletics venue after the games, a bid pledge. After two years of failed talks, the ODA suggested increasing the budget by 20% (~£100m⁵) to build retractable seating and safeguard the stadium for dual use in legacy. But football aficionados ruled out what they called a ‘jack-of-all-trades’ design. With time running out, the Olympic board went ahead with a hybrid design for the Games which increased the cost in fifty percent. But the tussles between the disputants dragged until 2014 when the dual-use idea was finally accepted by all the participants. By 2016, the conversion cost had reached £323m, more than duplicating the initial cost forecast for the stadium.

In sum, resolving local disputes consistently required throwing more resources (money, time) into the pot. This finding resonates with claims in the projects literature that promoters regularly underestimate performance targets. But crucially, it shows that performance slippages are rooted in local searches for consensus. And yet, since the performance targets are set by the promoter, it is tempting to blame the slippages on the promoter. We turn now to discuss differences in the administrative structures that the promoter itself can deploy to mitigate this risk, and the impact on performance.

1.6. VARIANCE IN THE USE OF SLACK RESOURCES TO MASK PERFORMANCE SLIPPAGES

A second major source of structural variance surrounding the local disputes relates to the amount of slack resources available to resolve disputes. We focused the analysis on

⁴ Kelso, P. 2008. Olympics 2012 chiefs willing to spend money like water, say MPs. Guardian, 30 April

⁵ All cost figures are presented in final (cash) prices for the sake of simplicity

the contingent funds because they enable the promoter to internalise the cost of local concessions, and thus to sustain a narrative that the project is ‘on target’. In the sampled public projects, UK policy ury recommended promoters to put aside a substantive percentage of the cost forecast into a contingency fund to neutralise optimism bias⁶. The elected leaders adhered to this policy since they also had no appetite to let the budget (cost forecast plus contingency funds) slip multiple times in the public eye; as one civil servant explained: ‘There’s a bandwidth there...if we push it [budget] too far we won’t get the project...so there’s that game that goes on to try and find what the [UK] Treasury’s real limits are...it’s a political decision.’”

The Olympic Park case is a good example. The bid cost forecast (~£4.9bn⁷) turned out to be insufficient to meet the bid pledges and the local disputes likely to ensue—‘it’s like the Olympics will solve all the world’s problems’, said one official. To get a grip on a chaotic situation, in 2005, the promoter set a 2-4-1 target: two years to plan, four to build, and one to test. But by mid-2006, many disputes remained unresolved. Facing an immovable deadline, the promoter chose to set a large contingency (£2.0bn) on top of what was by then a much higher cost forecast (~£6.1bn); one official said:

Treasury were really, really clear...big envelope and never knock on our door for money...actually they were right...we were then able to make decisions...rather than being petrified because we didn’t have enough money to do what we needed to do.

The appendix data shows a similar pattern for HS2 and Crossrail. In both cases, the promoters faced a public outcry at the planning onset related to cost slippages. To mitigate the risks of further overruns the promoters set large contingencies. The use of the contingency funds was scrutinised by watchdogs to reduce moral hazard—‘[contingencies] are there for known risks, not for somebody’s betterment’, said one official. But similarly to London 2012, both Crossrail (NAO 2014) and HS2 (Butcher 2015) depleted their contingencies; still, in the public discourse, all projects were ‘on target’. In marked contrast, in the privately-financed T2, this procedure was ruled out. First, BAA seemed confident on its ability to parry any backlash caused by cost slippages since there was less public scrutiny. And second, since BAA had a guaranteed return on capital investment, the airlines and regulator were against large contingencies to keep the construction costs down. As a result, the T2 planning unfolded with a single-digit contingency which was insufficient to mask cost overruns.

In sum, our cross-case analysis reveals two regularities: i) project organizations are polycentric to make pluralism more manageable; and ii) slippages in performance targets are necessary to resolve disputes endemic to a polycentric architecture. Within this broad relationship between organization design and performance, we observe within-set variance in, first, whether an external umpire is in post or not to referee disputes; and second, the amount of slack the promoter can internally deploy to resolve disputes. The juxtaposition of structural variance along these two dimensions creates fundamentally different classes of managerial problems. We turn now to discuss how these insights further our understanding of capital-intensive project organizations.

2. DISCUSSION

⁶ *Supplementary Green Book guidance-Optimism bias*, a recommendation issued by the UK Treasury

⁷ Includes £971m (venues); £89m (conversion costs); £640m (Olympic infrastructure); £1040m (non-Olympic infrastructure); £700m (local transport schemes); £766m (land) plus VAT (NAO 2007)

The debate on the performance of capital-intensive projects has been stuck for two decades: one explanation traces performance slippages to competence and agency problems with the promoter; other traces them to externalities. Underlying both views is the assumption that project organizations are authority hierarchies. Here, we sought to move the debate forward by probing deeper into this form of organizing.

By employing Design Structure Matrices (DSM) we establish that capital-intensive project organizations have a polycentric architecture at the planning stage—a finding consistent with predictions of theorists in consensus-oriented collective action (Ostrom 1972, Ostrom 2010). Specifically we show that decision rights over planning choice are decentralised within a nested structure of local decision-making groups. Decision rights determine the boundaries of the organization—as Pfeffer and Salancik (1978: 32) argue, an organization ends where its discretion ends and another’s begins. Hence our findings suggest the resource-rich local actors which are awarded decision rights are *de facto* members of the project organization. And yet, these actors remain autonomous from the promoter until they forge a development agreement. Still the pluralistic project organization is not wholly flat. Our analysis shows that the promoter has centralized authority to set performance targets and to constrain the solution spaces ex-ante of collective searches for consensual decisions. This conceptualization of project organizations is crucial to further our understanding of their performance.

First, a polycentric architecture is advantageous in enabling the promoter to achieve the system-goal. If the promoter did not share decision rights, the affected local actors would be less willing to volunteer their own resources. By co-opting local actors and designing a ‘negotiated environment’ (Cyert and March 1963), the promoter creates conditions for the project organization to survive. For example, in the Crossrail and HS2 cases, local governments would be much less likely to volunteer time, effort, and money if they felt the UK government was paying lip service to shared decision-making. Second, a polycentric architecture gives the promoter authority to set budgets and deadlines. These numeric targets are necessary to fill the strategic void created by the ambiguity that is endemic to pluralistic settings (Denis et al. 2001, 2006, Stone and Brush 1996). For example, it is hard to conceive how the Olympics project could forge ahead without a commitment on a preliminary budget for bidding purposes. Third, a polycentric architecture attenuates management complexity by leveraging knowledge of the product architecture to decompose the project organization, a finding in agreement with design theory (MacCormack et al. 2012, Colfer and Baldwin 2016). In a polycentric design, participation in each inner centre of shared decision-making power is restricted to the actors directly affected by a system component. By aligning organizational and system architectures, a polycentric design reduces the size and heterogeneity of the local groups, attenuating the complexity of the local searches for consensual solutions (Cemerer and Knez 1996, Heath and Staudenmayer 2000). And fourth, by negating the potential for promoter dominance in local choice, a polycentric design allows for ambiguous projections of future resource allocation. This ambiguity creates space for conflicting goals and helps avoid defections of organizational members (Jarzabkowski and Fenton 2006, Denis et al 2001). Consistently, announcements of targets enabled to gain momentum to promote the project. But the ensuing slippages in the targets were critical to sustain support for the evolving plans.

The main disadvantage of a polycentric organizational architecture is its inadequacy to meet normative expectations in the context for keeping the project on target. A polycentric design opens local choice to local actors within a constrained solution space. But because self-interest encourages the participants in joint searches to try to

optimize solutions (Knudsen and Levinthal 2007), local actors will demand concessions; as March and Simon (1993 p.312) put it, ‘we create our wants, in part, by experiencing our choices’. Planning talks thus put pressure on the promoter to relax the targets, a pressure exacerbated by the irreversible nature of long-lived planning choices, which makes it harder for people to give ground when seeking a compromise (Gil and Tether 2011). And yet, the promoter lacks autonomy to relax those targets because the targets create interdependency with the environment. In other words, a polycentric design leaves the promoter in a Catch-22: if it governs by diktat, it alienates the local actors; if it abandons the performance targets, the project ‘fails’. For example, the reputation of the Olympics project was impaired after the bid budget was dropped; likewise, the HS2 reputation was marred after the promoter uplifted the budget after the bid. At the limit, a polycentric architecture creates a real risk of planning talks unravelling. The history of our cases is telling: two failed attempts to promote Crossrail, three failed attempts to host the Olympics; and a Heathrow airport terminal awaiting replacement for more than 20 years. This evidence is consistent with agent-based simulations that show decentralized searches of solutions for interdependent problems can bog down (Mihm et al. 2010).

The consistency of the polycentric architecture across our diversified sample suggests capital-intensive projects are indeed a ‘population of organizations’ (Hannah and Freeman 1989) that share the same architecture and face similar vulnerabilities. However, our analysis also suggests different contexts create fundamentally different managerial problems within this form of organizing, which invalidates indiscriminate comparisons. We discuss next a proposed framework that establishes logic between organization design and organization performance contingent on contextual structures.

A Framework of Capital-intensive Project Organization and Performance

Our analysis traces regular slippages in the performance targets to local searches for consensus endemic to polycentric organizing. However, the cases differ substantially in two key administrative structures deployed to resolve local disputes. Alternative permutations inform a contingency framework linking organization design to performance. Figure 3 illustrates our main contentions. On the horizontal axis, we differentiate project contexts with/without external umpiring. On the vertical axis, we show internal availability of slack; whilst slack is a continuous dimension, for the sake of the argument we assess its availability as either “limited” or “substantial.”

<Insert Figure 3 about here>

Understanding the Role of Umpiring

The umpire is a structure external to the project organization and institutionalised in the context for giving authoritative judgement over disputes internal to the project. In other words, the umpire acts as a safeguard against the risk of self-interested actors failing to achieve a common interest (Olson 1965). Importantly, the umpire is different from private arbitration (Heine and Kerk 2017). Private arbitrators are members of the organization tasked to leverage their latitude in decision making and observability power to reward disputants with a greater share of the surplus of the joint activity (Lumineau and Oxley 2012). As such, private arbitrators are third party to the dispute, but not third party to the organization. In contrast, umpires are similar to a public court and thus operate under strict procedural rules and lack expert knowledge.

The main benefit of an umpire is the provision of a referee effective to avoid hold-ups by individual parties. This referee cannot be co-opted, has no property rights, and thus

is impartial. In the Crossrail and HS2 cases, the Parliamentary committee was granted legal powers to settle any dispute if planning talks failed. This dispute resolution structure was arguably more efficient than a public court, and successfully prevented disputes to evolve into legal action. But the lawmakers lacked knowledge and were busy people. Thus the committee needed substantive time to assimilate the arguments. Notwithstanding these inefficiencies, the disputants systematically deferred dispute resolution to the umpire, creating a major source of uncertainty. Hence the presence of an umpire appears to create a negative precondition for the parties to cooperate, an insight in agreement with collection action literature (Frey 1994, Ostrom 1990). The late intervention of the umpire also led to significant delays and cost overruns. Umpires thus amplify project interdependency with the environment, making it harder to meet normative expectations of performance. Knowing this, the UK Parliament chose to get out of the way for the Olympic park project. This suggests that the presence of an umpire fundamentally changes the management problem.

Understanding the Role of Slack Resources

Unlike umpires, slack resources such as contingency funds are an administrative structure controlled by the promoter and thus internal to the project organization. The main advantage of slack resources is that they help disputants reconcile their interests without having to resolve the problem, what Cyert and March (1963) call ‘quasi-resolution’ of disputes. However, literature on slack is also in agreement that there is a real risk of slack encouraging inefficient behaviour (see Dolmans et al. 2014 for a recent review). It is outside the scope of this study to resolve this trade-off in the context of capital-intensive project organizations. Our point here is to show that the amount of slack available also fundamentally changes the management problem.

In our setting, public policy pragmatically encouraged promoters to establish large contingencies to accommodate cost hikes over time. All public projects took advantage of the policy, and set conservative budgets. Our analysis shows that the promoters consistently depleted the contingency funds to finance local concessions. From this perspective, it is fair to say that slack created a self-fulfilling prophecy. However, slack also consistently enabled the promoters to sustain a narrative of high-performance and to claiming the projects were on ‘target’. Hence slack did not change the polycentric architecture of the project organization neither pre-empted disputes. But slack effectively reduced interdependency with the environment (Engwall 2003).

In marked contrast, BAA management and the airlines fought against the use of excessive slack, denouncing the government’s use of, in their view, ‘over-egged budgets’. Interesting, our evidence shows the cost overruns in T2 were more moderate relative to the other projects. But T2 cannot be compared with the Crossrail or HS2 projects because there were no umpires in the context. This restricts our comparison to T2 and the Olympic park projects. Like T2, the Olympics park project had no umpire. But unlike T2, the Olympic promoter built in substantive slack to mask late cost hikes. The fact the Olympics contingency was all depleted again suggests a self-fulfilling prophecy. It thus seems fair to say limited slack makes disputants more accountable for the outcomes of collective searches for consensual solutions. Significantly, our sample does not include a case that conflates umpiring and limited slack [top right quadrant]. This situation is discouraged by UK policy, a point that we return to in the last section.

In sum, our conceptual framework suggests that scope creep and overruns are rooted in local disputes endemic to polycentric organizing. And yet, simply saying that performance slippages are endemic to this form of organizing is not a satisfactory

theoretical approach. Here, we show how different permutations of two structures, one internal and another external, create fundamentally different classes of managerial problems. Our framework is therefore a first step toward a more general theoretical synthesis that addresses the question of why different projects perform the way they perform. It also creates a conceptual basis to help us compare performance across different classes of projects and examine the effectiveness of alternative practices.

CONCLUSION

In this study we have sought to advance our understanding of capital-intensive project organizations. We illuminate how planning choice occurs within a polycentric architecture to make pluralism more manageable, and show different classes of management problems within this organization design. This conceptualization enables to reconcile two strands of conflicting explanations on capital-intensive project performance. In agreement with claims that trace underperformance to externalities, we trace performance slippages to the interaction of the promoter with multiple autonomous, resource-rich actors. The difference is that our work endogenizes these actors, moving them inside the organisational boundaries because they share decision rights. And in agreement with claims that trace underperformance to the promoter's behaviour, our study confirms that initial targets are set unilaterally and invariably optimistic. But we also show this pattern is rooted in an optimism that consensus will not be as costly to build as it actually is. This insight adds nuance to ideas that optimism bias is rooted in agency problems and incompetence. Let's be clear. We are not suggesting to rule out these explanations of underperformance. But equally, we should not ignore that building consensus is a 'struggle' (Dietz et al. 2003), particularly when the organization is highly interdependent with the environment. Under these circumstances, a good dose of optimism is needed to believe capital-intensive goals are achievable. In other words, the promoter's optimism bias is both a blessing and a curse.

Importantly, our study only illuminates the performance impact of the arrangements designed to mandate interactions for exchanging and mobilizing resources in pursuit of collective goals (Gulati and Puranam 2009). As such our work is agnostic about how informal social structure affects the relationship between organization and performance; we cannot also shed light on the influence of emergent interactions, negotiation tactics, and patterns of individual behaviour and corresponding norms, beliefs, and values underlying such interactions, tactics, and behaviours. We agree, however, that robust explanations of performance should aim at combining formal and informal elements since underlying designed structures are actions carried on by individuals (Van de Ven et al. 2013, Simon 1947). But we cannot reach this level of understanding unless we first understand the formal design of capital-intensive project organizations. This is our contribution in this study.

Still it is fair to ask how far our insights might be generalizable and three boundary conditions are in order. First, infrastructure projects are socially complex but not so technologically complex that planning choices cannot be comprehended by multiple actors in the environment. The capability to discern what is at stake encourages these actors to claim decision rights. In contrast, in technologically complex settings such as aeronautical (Brusoni et al. 2001) and science (Tuertscher et al. 2014) the understanding of what is at stake is restricted to subject-matter experts. This enables to reconcile pluralism with meritocracy-based authority, which creates a different problem.

Second, planning choices for large infrastructure projects are hard to reverse once approved, and tend to impact the individual property rights of multiple actors. Hence planning choices are, perforce, controversial. But not all capital-intensive projects impact property rights and unfold under contentious system-goals. In the response to the Columbia space shuttle disaster (Beck and Plowman 2014), for example, a benign system goal enabled cooperation and a sense of collective identity to flourish rapidly between dissimilar actors who had never worked together. This suggests that the quality of the goal is another boundary condition that merits further investigation.

And third our study is grounded in the UK context which encouraged polycentric organizing; umpires and slack are also designed arrangements rooted in UK policy. But these characteristics are not universal. The observed emphasis on underpinning final planning choice on formal cost-benefit analysis itself is also not universal. As Porter (1995) notes, intimate social networks among elites in some countries allow for much more informal decision-making processes under pluralism. Hence caution is needed before extending our insights to fundamentally different institutional contexts.

Limitations notwithstanding, our study has important implications for policy. The regular occurrence of scope creep and overruns has dogged the reputation of capital-intensive projects and project leaders. Implicitly here is the assumption that promoters have centralised authority, and thus if projects overrun it is the promoter’s fault. This conception has fuelled ideas that promoters are not to be trusted, which inform policy such as optimism bias and umpires. Recognizing that planning choices happen within a polycentric architecture suggests a different direction for policy. If organization design allows for shared decision rights, then policy wants to encourage shared accountability for the outcomes. This suggests, for example, policy could ask participants to accept private arbitration to resolve disputes, freeing the time of umpires to resolve disputes with actors which had not been co-opted into the project organization. We conjecture that private arbitration could make the project organization less interdependent from the environment, and thus reduce uncertainty. This, in turn, would enable to reduce slack resources and mitigate the risk of inefficient and opportunistic use of resources.

In conclusion, this study sees capital-intensive project organisations as forms of polycentric organizing under pluralism. It also reveals fundamentally different classes of problems within this broad population of organizations. These insights do not make these organizations less complex or suggests simple solutions. But they illuminate the structure of the management problems and help move forward the performance debate.

APPENDIX –Summary of Sampled Projects: History, Context, and Performance

Project History and Context	Summary of Performance (cash prices unless stated)
<p>Crossrail: Main Planning Effort: occurs between 2001 and 2008. Prior History: The idea of building a cross-London railway first gained momentum in the seventies but the UK government dropped the plan after a few years because of cost concerns; the idea was reignited in the nineties but planning again unravelled after five years. The start of the third attempt happened in 2001 when the UK and London governments formed a coalition to promote the scheme. Performance baseline: during planning, the goal evolved from a 9km central London train to open by 2012 into a 118km high-capacity commuters’ train to open by 2017; the cost and schedule targets evolved commensurately. Context: Construction could not start before the promoter acquired from the Parliament the power to force land sales.</p>	<p>Cost forecast evolution 2001, ~£4.7bn 2003, ~ £9.8bn 2007/8, ~ £10.9bn Final (as of 2016) ~£14.0bn</p> <p>Contingency 2006/7, ~£5.0bn 2010, ~£4.0bn (~ £1.0bn removed after financial crisis)</p>

<p>Planning unfolded under pressure to submit a proposal to Parliament before the 2005 elections; in 2008 Parliament gave the UK government authorization to proceed.</p>	<p>2016/7, contingency depleted</p> <p>Completion forecast evolution</p> <p>2000, fully open in 2012</p> <p>2003, fully open in 2016</p> <p>2008, fully open in 2017</p> <p>2016: fully open in 2019/20</p>
<p>London Olympic park: <u>Main planning effort:</u> occurs between 2001 and 2007. <u>Prior history:</u> The idea of hosting the 2012 Olympics in London emerged in 1995 after the UK lost for the third time the contest to host the Olympic Games. In 2001 the UK government formed an initial coalition to promote the scheme with the London government and the British Olympic Association. <u>Performance baseline:</u> In 2002, the International Olympic Committee (IOC) opened the competition; it gave the promoter two years to develop an intermediate bid and six additional months to submit the final bid; the scope and cost forecasts evolved during the bidding process and afterwards. Facing an immovable deadline, the promoter spent 18 months after winning the contest to refine the plan and produce a performance baseline ('Yellow book'), which was updated in 2009 ('Blue Book'). <u>Context:</u> after London gained the contest, Parliament rushed to give government the power necessary to force land sales; and LOCOG, a IOC's watchdog, joined the promoter organization and gained veto power on the top governing board.</p>	<p>Cost Forecast Evolution</p> <p>2002, ~ £1.1bn</p> <p>2004, ~ £4.9bn</p> <p>2007, ~ £6.1bn</p> <p>Final: ~£8.1bn (<i>includes post-games conversion</i>)</p> <p>Contingency</p> <p>2007, ~£2.0bn</p> <p>2013, no contingency left</p> <p>Completion forecast: immovable</p> <p><i>But some planning disputes were only temporarily resolved for the Games in 2012</i></p>
<p>Heathrow Airport T2. <u>Main planning effort:</u> occurs between 2005 and 2009. <u>Prior History:</u> The goal of consolidating all operations by Star Alliance, a network of over 20 airlines, in a new terminal was announced in 2005; in that same year BAA, the private airport owner, started building Terminal 5 to consolidate the operations of One World, a rival alliance; <u>Performance baseline:</u> The initial goal was to replace the old T2 building with a new building so-called 'Heathrow East'; BAA also aimed to complete planning by 2008 to coincide with the end of the regulatory cycle, but the timescale was later extended. During planning, the T2 goal evolved into a modern T5-like campus to develop in two stages; the first stage would open by 2013 and the second by 2018. The first phase opened in 2014; as of 2017, no plan exists to start the second phase. <u>Context:</u> Construction could not start before the performance baseline was approved by the regulator. By regulation BAA had to treat all airlines in the same way, which put BAA under pressure to open T2 on time</p>	<p>Cost forecast evolution</p> <p>2005, ~ £1.3-1.8bn</p> <p>2006, ~ £2.0bn</p> <p>2008, ~ £2.4bn</p> <p>Final (2015): ~£2.8bn</p> <p>Contingency funds</p> <p>2008, ~£200m (8% of cost forecast)</p> <p>Schedule forecast evolution</p> <p>2005, open in 2012</p> <p>2008, open in 2013</p> <p>Actual completion (1st phase): 2014; 2nd phase put on hold</p>
<p>High-speed 2 <u>Main planning effort</u> occurs between 2009 and 2017 (first phase) and 2009-2020 (second phase) (<i>as of 2017</i>). <u>Prior history:</u> The idea to develop a new national railway gained momentum in 2008 after the financial crisis. In 2009 the UK government created HS2 Ltd, a public agency tasked to plan the</p>	<p>Cost forecast evolution (10/11 prices)</p> <p>2010, ~ £22.7bn</p> <p>2012, ~ £22.7-27.6bn +£5.8bn (train cars)</p>

<p>scheme. Performance baseline: The initial goal was to open the first phase connecting London and Birmingham (225km) by 2026 and open a second phase connecting Birmingham to various Northern cities (248km) by 2032/3; in 2015, scope shifted between the two phases, and pledges were made to develop complementary railway lines (Crossrail 2, HS3). Context: Construction could not start before government acquired from the UK Parliament the power to force land sales. Planning unfolded under pledges by government that the plans for the first phase would be approved by Parliament before the 2015 general elections; the plans for the first phase were finally approved two years late in March 2017.</p>	2014, ~£28.2bn+£6.0bn(train cars)
	2015, ~£31.5bn+£6.5bn(train cars)
	<p>Contingency (10/11 prices)</p> <p>2010, ~£7bn</p> <p>2012, ~£10.2bn</p> <p>2013 ~ £14.4bn</p>
	<p>Schedule forecast evolution</p> <p>2010, planning (1st phase) done by 03/2015</p> <p>2015, planning (1st phase) in 2016</p> <p>2017, planning (1st phase) ends</p>

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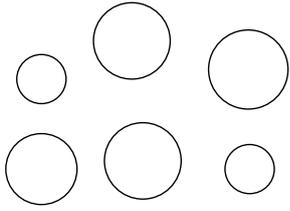
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TABLE 1 - DESCRIPTION OF THE SAMPLE OF CASES, INTERVIEWEES, AND ARCHIVAL DATABASE

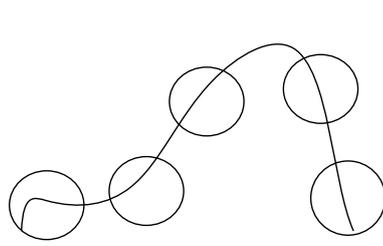
Cases	London 2012	Heathrow T2	London Crossrail	UK High-speed 2
System-level goal	Build an Olympic park to host Games and catalyse urban regeneration	Build a new terminal campus to create a dual-hub at Heathrow airport	Connect the East and West outer London with a new high-capacity train system	Build a cross-country railway to increase national transport capacity
Membership of the promoter	Coalition: <i>UK and London governments; BOA(\$); LOCOG(\$)</i>	Solo: <i>BAA (regulated airport owner)</i>	Coalition: <i>UK and London Governments</i>	Solo: <i>UK Government</i>
Outcome of the planning effort	Formal performance baseline <i>Yellow book (2007)</i> <i>Blue book (2009)</i>	Legal contract setting performance targets <i>5-year capital investment plan</i>	Legal contract setting scope and assurances <i>Parliamentary bill</i>	Legal contract setting scope and assurances <i>Parliamentary bill</i>
Interviews on local disputes	36 (11 disputes)	19 (5 disputes)	33 (9 disputes)	35 (12 disputes)
Number and description of organizations interviewed	8: <i>London2012 (bid company) ODA (promoters' agent); LOCOG (games operator); OPLC (park operator); Transport for London (TfL); CLM (programme manager); Land Lease (private developer); Network Rail (owner of rail infrastructure)</i>	5: <i>STAR Alliance, Air Canada, BAA, HETCo and Balfour Beatty (private design and build companies)</i>	8: <i>CLRL (promoters' planning agent); Crossrail, (promoters' delivery agent); Network Rail; UK Treasury; Transport for London (TfL); Canary Wharf (private funder); Bechtel, Transcend (consultants)</i>	11: <i>HS2 Ltd (promoter's agent); Manchester City Council (MCC); Greater London Authority (GLA); Transport for London (TfL); Borough of Camden; Transport for Greater Manchester (TfGM); Network Rail; UK Treasury; Manchester Airport; CH2MHill, AECOM (consultants)</i>
Archival data	Total number of documents: 134	Total number of documents: 114	Total number of documents: 122	Total number of documents: 101
Documents on the planning effort organised by categories: (news articles in the press not included)	<i>Strategy and planning documents: 84</i> <i>Financial reports: 6</i> <i>Formal communication: 5</i> <i>Newsletters and PR documents: 17</i> <i>Design documents: 7</i> <i>Meeting minutes: 15</i>	<i>Strategy and planning documents: 74</i> <i>Financial reports: 6</i> <i>Formal communication: 19</i> <i>Newsletters and PR documents: 8</i> <i>Design documents: 4</i> <i>Meeting minutes: 3</i>	<i>Strategy and planning documents: 74</i> <i>Financial reports: 2</i> <i>Formal communication: 6</i> <i>Newsletters and PR documents: 23</i> <i>Design documents: 9</i> <i>Meeting minutes: 8</i>	<i>Strategy and planning documents: 46</i> <i>Financial reports: 6</i> <i>Formal communication: 20</i> <i>Newsletters and PR documents: 12</i> <i>Design documents: 12</i> <i>Meeting minutes: 5</i>

(§)BOA - British Olympic Association; LOCOG, London Organising Committee of the Olympic and Paralympic Games and International Olympic Committee (IOC)'s watchdog;

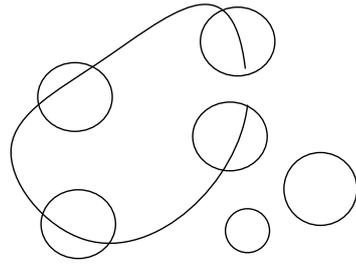
Figure 1 – Stylised representation of different infrastructure design structures



Modular system design
(e.g., Olympic park)



Integral system design
(e.g., railway system)



Hybrid system design
(e.g., airport terminal)

Table 2- Excerpt of Protocol to Uncover Design Structure of the Planning Problems and Distribution of Decision Rights

Case	Dispute	Selected quotations on the intra-component interdependencies and coding for the Design Structure Matrix	Interdependencies	Claimants to the strategic design choices	Selected quotations on the ownership of the strategic choices for the organizational matrix (<i>claimants in italic</i>)
London Olympic c Park	Dispute over the goal of the stadium	The football clubs weren't coming forward with money [COST]... so we [Olympic board] decided to invest into an athletics legacy venue [GOAL] and all facilities on top would be temporary so they could be demountable [CAPACITY]	COST→GOAL→CAPACITY	#>10 4 promoters; 2 football clubs; promoter's agent; athletics body; 4 local governments; others	<i>I [promoter's agent-ODA] said [to Olympics board] what's wrong with leaving an athletics centre... why do we have to publicly subsidise the richest clubs in the world? why? It's public land... don't renege on your responsibility to public sport</i>
	Dispute over the goal of the Aquatics centre	The bid needed an iconic building [GOAL]... it wasn't just a pool for a community facility [GOAL]... this was grand, [FOOTPRINT/ CAPACITY] ostentatious... costs a lot of money [COST] to build... so the reasons were about predominantly making a statement [GOAL] about London's bid	GOAL→FOOTPRINT/CAPACITY→COST→GOAL	#>10 4 promoters; IOC; promoter's agent; architect, local governments; others	<i>It's difficult to anticipate willingness of an architect like Zaha to compromise... the roof was everything, if you lose that flow, there would be no way she would continue... London boroughs, accessibility interest groups, equality groups, etc... each one wanted the utopian solution</i>
	Dispute over the diving boards of the Aquatics centre	I always saw it [aquatics centre] as a sculpture [GOAL] really and that's why we [ODA] put the diving boards [SALIENT SUB-ELEMENT]... one afternoon... a guy says 'there's this very stylistic design [GOAL] but we cannot afford it' [COST]... and said 'give us a price... at least £0.5m extra [BUDGET], you're authorised'	GOAL→SUB-ELEMENT→COST→GOAL→BUDGET	#>10 4 promoters; International Olympic Committee; promoter's agent; award-winning architect; user groups; local government	<i>They [Swimming federation] didn't like our [ODA] diving boards, and they wanted them to be changed, and we said we weren't going to change... LOCOG was playing a political game telling [ODA] that we can still change them when... we [ODA] weren't going to change</i>
High-speed 2	Dispute over the goal of the London Euston Station	The complexity comes, really, because... you need quite a bit of land [FOOTPRINT], and there's nowhere in central London [GOAL] just sitting vacant to receive... against our requirement, which is... a target of £1.7bn or so [COST], we can't... afford a station with a double-deck scenario [CAPACITY/FOOTPRINT]	FOOTPRINT→GOAL→COST→CAPACITY/FOOTPRINT	#>7 UK Government, Agent (HS2 Ltd); Local borough; Mayor of London; TfL; Station manager (NR); multiple train operators	<i>This is all the art of the possible isn't it?... HS2 Ltd is a government agent being oppressed... Mayor of London, Camden Council, Transport for London, Network Rail, they all need to give a bit... we [London First] absolutely could referee... it's just not one of our priorities... it's very resource-intensive... like doing UN peace negotiations</i>
	Dispute over the goal of the Manchester Station	HS2 have proposed a station that... sits on its own [GOAL]... so its own concourse, access [FOOTPRINT/CAPACITY], all that... in our design [GOAL] we see one integrated station with everything open so you can walk, different levels [CAPACITY] because land is at different levels [FOOTPRINT]	GOAL→CAPACITY→FOOTPRINT→GOAL→CAPACITY→FOOTPRINT	#>6 UK Government, Agent (HS2 Ltd); Local government; local transport agency; station manager; train operators	<i>The design process has been collaborative... we [Manchester City Council] are engaged with the work they [HS2 Ltd] might be doing around station design; they're engaged with us on the wider regeneration program... our objective is always to try to get to a consensus</i>
Heathrow	Dispute over the goal of the new terminal	We [BAA] got some more money [COST] to deliver safeguarding of structures which will be needed for later [GOAL] So we are building tunnels under the taxiway [FOOTPRINT/CAPACITY] at the moment and those weren't included [GOAL]	COST→GOAL→CAPACITY/FOOTPRINT→GOAL	#>30 Airport operator (BAA); regulator; Star Alliance (>20 airlines); other airlines; local council	<i>I [Star Alliance director] wrote to the planning authority, 'I don't think you should approve this [Heathrow East building proposal] because it's only a terminal building; it does not have from a campus perspective all of the elements which is going to make this work'</i>
Crossrail	Dispute over the need for toilets at the Farringdon station	Whilst we have no legal obligation to provide toilets [SALIENT SUB-ELEMENT], one or two councils have demanded them... can you really accept that one of the major interchange hubs in London [GOAL] doesn't have any public toilets? So the board accepted that... about £1m extra [COST]	SUB-ELEMENT→GOAL→COST	#>7 2 promoters, promoter's agent; 2 local governments; London underground; politicians	<i>The London Assembly Committee Chair described the failure to provide toilets at Crossrail stations as "a missed opportunity" and said the rail scheme offered "an ideal and cost-effective chance to increase the numbers of toilets in the capital" [London Assembly report]</i>

Table 3 – Excerpt of the Evidence on the Resolution of Planning Disputes: Outcomes and Implications to Performance Targets

Case	Embedded dispute		Dispute resolution mechanism	Outcome	Implications to the Local Performance Targets		
					Extra scope	Completion date	Cost (final prices unless stated)
High-speed 2	Euston St.	#1, Low local goal congruence <i>Utilitarian vs. 'world-class' station</i>	Umpire <i>UK Parliament (Land use regulator)</i>	Mutual compromise facilitated by umpire (after 4 major design cycles) <i>The principle...that all the works...are on the HS2 credit card has been accepted [TfL official]</i>	Yes <i>Commitment to fully redevelop Euston station</i>	Relaxed <i>Dispute was resolved in 2017; completion of works delayed from 2026 to 2033</i>	Relaxed <i>2010, ~£2.0bn (09 prices) 2011, ~£1.1bn (11 prices) 2014, ~£2.2 bn (11 prices) 2015, ~£4.5bn (TfL forecast)</i>
		Crossrail	Woolwich St.	#2 Low local goal congruence <i>Divergences over the business case</i>	Umpire <i>UK Parliament (Land use regulator)</i>	Mutual compromise facilitated by umpire (after 2 major design cycles) <i>Parliament rules that station should be built, but asks for local finance</i>	Yes <i>Construction of the station agreed</i>
Heathrow T2	Main Concourse			#3, Low goal congruence <i>Modern campus vs. facility replacement</i>	Planning talks <i>Airport economic regulator mediated planning talks</i>	Mutual compromise (after 3 major design cycles) <i>Future expansion of main concourse building is actively safeguarded</i>	Yes <i>Extra capacity for future expansion (tunnels, basements)</i>
		London Olympic Park	Stadium	#4 Rivalry over local planning choice <i>Open versus closed gates</i>	Planning talks <i>Independent director arbitrated planning talks</i>	Mutual compromise (2 major design cycles) <i>Gates can be open, but only if new boarding technology is adopted</i>	Yes <i>Flexible building grid to leave both options open</i>
London Olympic Park	Stadium			#5, Low goal congruence <i>Small vs. massive aesthetically sophisticated venue</i>	Planning talks <i>Long series of meetings between project participants</i>	Mutual compromise (after 3 major design cycles) <i>Sophisticated roof stays, but venue shrinks to a third of its original size</i>	Yes <i>Temporary 15,000-seats added just for the games</i>
		London Olympic Park	Stadium	#6, Low goal congruence	Planning talks <i>Long series of meetings</i>	Mutual compromise (after 4 major design cycles)	Yes <i>Retractable seating</i>

		<i>Football vs. athletics venue in legacy</i>	<i>between project participants</i>	<i>2007, potentially demountable venue 2013, dual-use venue</i>	<i>added in 2013</i>	<i>6 years of talks in 2013</i>	<i>2008, ~£541m Final (2015): ~£706m</i>
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Figure 2- Excerpts of the Design Structure Matrices of the Planning Problem and Corresponding Organizational Matrices (all sample)

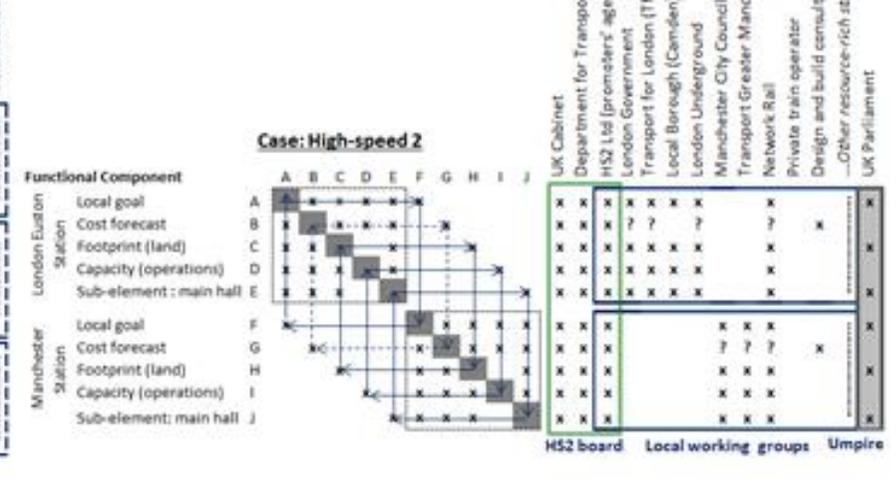
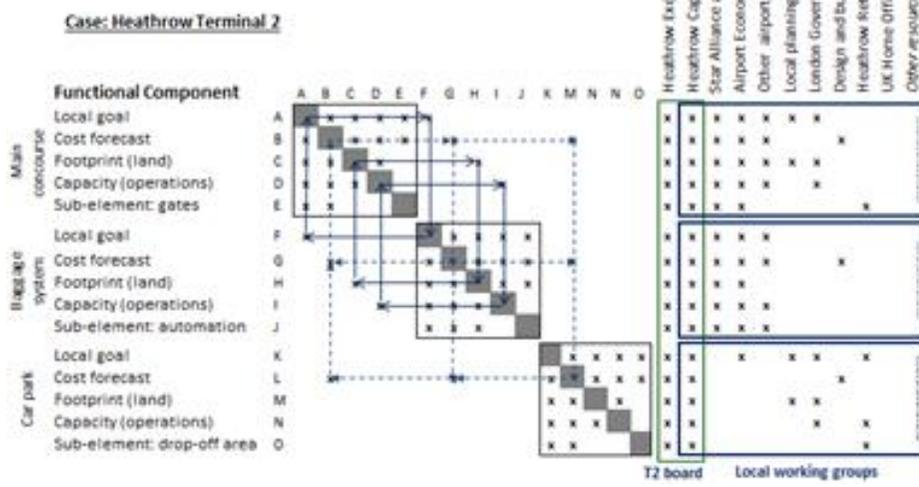
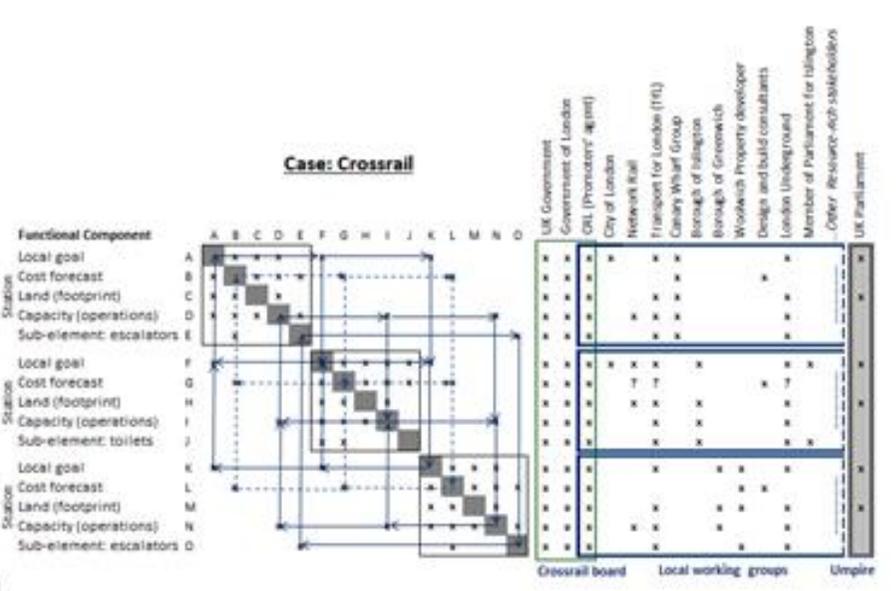
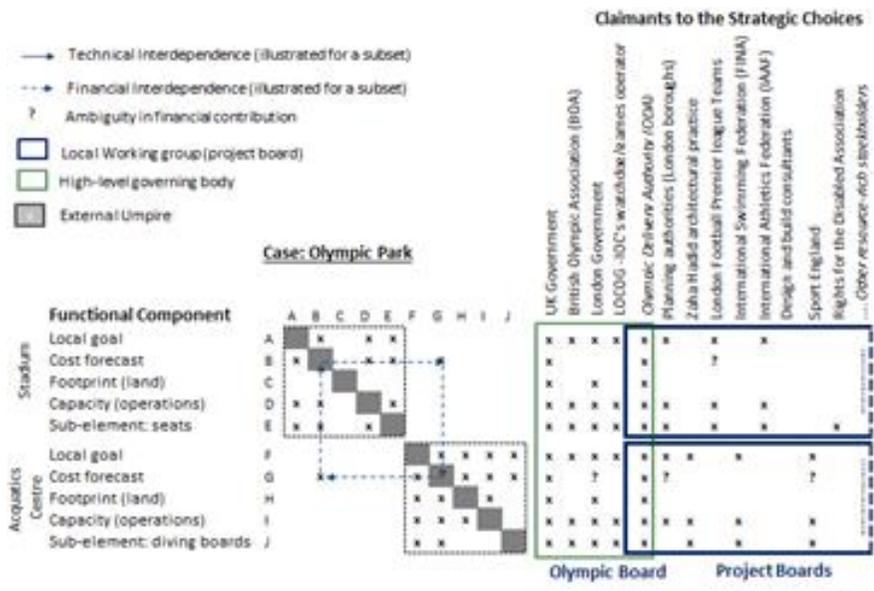


FIGURE 3- CONTINGENT FRAMEWORK ON PROJECT ORGANIZATION DESIGN-PERFORMANCE LOGIC

Internal Slack for Resolving Disputes	External Umpire for Resolving Disputes	
	Not available	Imposed by the Environment
Limited	<p>Organizational design allows for moderate slippages in the performance targets</p> <p>Organizational design encourages shared accountability for slippages in the performance targets</p> <p><i>Example: Heathrow T2</i></p>	<p>Organizational design creates high risk of major slippages of the performance targets <i>in the public eye</i></p> <p>Organizational design creates high risk of impasse if slippages of the performance targets are ruled out</p> <p><i>No example: Scenario discouraged by UK public policy</i></p>
Substantial	<p>Organizational design creates real risk that performance targets will slip until there is no more slack left</p> <p>Organizational design allows to mask slippages in the performance targets from the eyes of third parties</p> <p><i>Example: Olympic Park</i></p>	<p>Organizational design creates real risk that performance targets will slip until there is no more slack left and umpiring process is completed</p> <p>Organizational design allows to mask slippages in the performance targets from the eyes of third parties</p> <p><i>Example: HS2, Crossrail</i></p>

Planning under Pluralism: Implications to Project Organization

Design and Performance

This study illuminates the design of the project-based organizations formed to plan capital-intensive systems and how design impacts organizational performance. The research is grounded on four large infrastructure projects in the UK. We first use Design Structure Matrices to establish that planning is carried on by project organizations with a polycentric architecture. We show that in this pluralistic form of organizing, the project promoter has the authority to set performance targets, but shares authority over the final planning decisions with multiple legally independent actors. We also show that shared decision rights lead to multiple local disputes and pressure to relax the performance targets. Our main contribution is a framework that proposes four differing logics linking organization design and performance contingent on whether, first, the context surrounding the project provides an ‘umpire’ to referee local disputes; and second, the promoter has slack resources to mask slippages in the performance targets from the eyes of third parties. We argue the four logics reveal fundamentally different classes of managerial problems, and draw implications to practice and policy.

1. Introduction

A long-standing puzzle in management and policy literature has been to explain why empirical accounts repeatedly show that capital-intensive project organizations struggle to meet the initial performance targets. These accounts matter because announcements of performance targets that turn out way off the mark fuel a perception that the project organization has ‘failed’. This perception is rooted in deep-seated norms that posit ‘successful’ projects manage to avoid scope creep and achieve the goals on time and within budget (Cleland and King 1968, Dvir and Lechler 2004).

Extant theoretical explanations for recurring slippages in performance targets fall within two broad groups. One group blames the actor that promotes and finances the projects (the ‘promoter’) for regularly underestimating the performance targets. The explanations for the promoter’s behaviour range from cognitive optimism bias and strategic misrepresentation (Wachs 1989, Flyvbjerg et al. 2003) to lack of capabilities to realise the value of investing in planning and of letting suppliers’ know-how feed into the planning decisions (Morris 1994, Merrow et al. 1988, Stinchcombe and

Heimer 1985). The second view is common too—that capital-intensive projects cannot be planned reliably, not because of agency and capability problems, but because of external events and vested interests that lie outside the promoter’s control. Hence, in the second view, the promoters are hostage to project pathologies including scope creep and collective inflationary consensus (Hall 1972, Shapiro and Lorenz 2000, Altshuler and Luberoff 2003, Miller and Lessard 2000, Gil and Tether 2011), and escalation of commitment (Szyliowicz and Goetz 1995, Ross and Staw 1986).

Whilst critical, the debate on the performance of capital-intensive projects has been stuck for more than *twenty years* (Pinto and Winch 2016). Extant performance studies have privileged the analysis of large datasets by premising that capital-intensive projects are all alike from an organization design perspective (Morris 1994, Miller and Lessard 2000, Flyvbjerg et al. 2003, Merrow et al. 1988). Specifically, this work assumes that project organizations are authority hierarchies led by a promoter vested with centralised control over planning decisions. Building on this assumption, this work has confirmed regularities on performance slippages. But it rarely allowed to ‘dive down’ into projects. As a result we still know little about how targets are actually set – as Pinto and Winch (2016) put it recently, ‘[planning] remains a ‘black box’.

In this study we propose to move forward the performance debate by examining the planning of capital-intensive projects from an organization design perspective. This cognitive lens focuses on establishing relationships between organisational structure and organizational performance (March and Simon 1958, March and Sutton 1997). Structure relates to the designed arrangements that enable and constrain collective action, this is, the arrangements that define roles and assign authority to make decisions on how to allocate resources and resolve disputes between organizational participants (March and Simon 1958, Lawrence and Lorsch 1967, Scott 1987).

Crucially, an organizational design lens challenges the premise that capital-intensive project organizations are planned by authority hierarchies legitimized by ownership stakes, contracts, and regulation. Admittedly, multiple accounts show that the promoters have power to unilaterally set performance targets at the onset of planning—in this regard, it is fair to say that promoters act as an authority hierarchy. But planning is more than setting targets. During planning, the promoter has to forge a unifying system-goal with multiple autonomous actors so as to entice those actors to contribute resources under their control to the project (Lundrigan et al. 2015). As such planning occurs *before* the promoter has ‘simulated’ an authority hierarchy through development agreements and buyer-supplier contracts (Stichcombe and Heimer 1985). On the contrary, planning occurs within a ‘pluralist’ organizational setting in which the authority to make decisions is diffused across multiple independent actors (Denis et al. 2011). In pluralistic settings, a dominant coalition can rarely mobilize sufficient power to impose their perspective on others (Pettigrew 1973). Rather, in pluralistic settings, major decisions require extensive communication between self-interested agents to resolve disputes rooted in cognitive differences, competing norms, and conflicting goals and interests (Jarzabkowski and Fenton 2006). Hence, major decisions under pluralism are inherently political and involve, perforce, a search for consensus.

This understanding that disputes are endemic to the pluralistic planning stage of capital-intensive projects is instructive. But it leaves outstanding the issue as to how project organization design enables and constrains the searches for consensus. We know that diffused authority creates management complexity. But complexity is not the same as chaos, and scholars of consensus-oriented collective action argue that managers intuitively design structures to attenuate the complexity of pluralistic settings (Ostrom 1990). We also know that relationships between organizational design and

performance are contingent on context (March and Sutton 1997). This reasoning leads to our core questions: what is the design of a capital-intensive project organization in the planning stage? To which degree does this design change as the project context varies? And to what extent can we trace project performance to organizational design?

We tackle these questions through multiple-case research. This approach is useful to explore new ideas in comprehensive ways as it enables to reveal the complexity in social settings and the longitudinal interconnections between events (Eisenhardt and Graebner 2007). Our sample consists of four large infrastructure projects in the UK. To vary the context, we examined three projects promoted by the central government (with differing degrees of regulation over planning decisions), and one project promoted by a private firm. The sample also varies the architecture of the product to be planned because organization design literature claims that managers intuitively leverage product design knowledge to design organizations that are less complex to manage (Sosa, Eppinger, and Rowles 2004, Colfer and Baldwin 2016).

Our study leads to two main conceptual contributions. First, it suggests that—irrespective of the project context and product design architecture—planning disputes emerge and are resolved within a ‘polycentric’ organizational design. Polycentric architectures are an intuitive approach to decompose large arenas of consensus-oriented collective action to reduce management complexity (Ostrom 1972, 1990). Polycentric designs decentralise decision-making authority across nested groups of decision-making power with capacity for mutual adaptation and local variation. In our settings, polycentric architectures give the promoter authority to set performance targets for the project as a whole and for system components. But the promoter must share authority over final local planning choices with different groups of local actors. Hence consensus building is a prerequisite for making planning choices. Our second

contribution is to develop a conceptual framework that establishes a relationship between the organizational design of a capital-intensive project and performance. This relationship is contingent on two structures can be deployed to resolve disputes: one relates to whether the environment imposes on the project participants an external ‘umpire’ to referee local disputes; the second relates to whether the promoter has slack resources to mask slippages in the performance targets from the eyes of third parties.

We organize the rest of this paper as follows. First, we review our understanding about designing organizations in pluralistic settings. Next we describe the research design, sample, and methods. The analysis examines the polycentric architecture underlying project organizing, and variance in the structures deployed to resolve disputes. The discussion proposes four organizational design-performance logics. We conclude by addressing boundary conditions and implications to policy and practice.

2. Designing Organizations in Pluralistic Settings

Pluralistic organizational settings are characterized by the diffusion of decision-making power. In these settings decisions require lengthy talks needed for the actors to understand complex issues and strike a consensus (Susskind and Cruikshank 1987, Thomson and Perry 2006). The risk of inaction is also high if the participants mistrust one another and keep disputing each other’s evidence—what Langley (1995) calls ‘paralysis by analysis’. Furthermore, diffused power makes politics and bargaining part and parcel of the decision-making process (Ring and Van de Ven 1992).

The management complexity endemic to pluralistic settings begs the question as to why an organization would deliberately create a pluralistic setting. The answer to this question lies in the idea that co-opting environmental actors helps organizations to survive (March and Simon 1958). In bringing external actors into the organizational boundaries and sharing decision rights with them, the organization leader accepts a

fundamental trade-off: less uncertainty in the environment comes at the expenses of a loss in decision-making autonomy. This trade-off illuminates why promoters of capital-intensive projects open the decision-making process on major planning choices to key stakeholders. For example, Gil and Tether's (2012) account on the design of Heathrow airport Terminal 5 shows how the airport owner involved the airlines in critical planning decisions. Likewise, consensus building is also central to Pitsis et al. (2003)'s account of the development of infrastructure for the Sydney Olympic Games.

However, the decision to co-opt multiple actors in the project planning stage creates a complex management problem. First, the promoter cannot simulate a hierarchical authority vested in ownership stakes, regulation, and contracts because the co-opted actors are autonomous (Rittel and Weber 1973). Second, because the co-opted actors are drawn from different communities of practice, it is difficult to build a 'meritocracy-based' authority to resolve disputes (O'Mahoney and Ferraro 2007). Third, diffused decision-making power makes it hard to use dominant coalitions to enforce individual preferences (Pettigrew 1973). And fourth, the project promoter cannot modularise the organization to sidestep difficulties in building consensus. Modularity enables independent actors unified by a goal to make individual choices with limited need to interact with one another (Baldwin and Clark 2000). But capital-intensive projects produce *one-off* assets which impact multiple actors. Hence, multiple actors with rivalrous preferences will claim rights to directly influence major planning decisions – this is, planning decisions are 'indivisible' (Gil and Baldwin 2013).

These circumstances leave the promoter of a capital-intensive project with a complex management problem—as Rittel and Webber (1973) put it, 'the plurality of objectives held by pluralities of politics makes it impossible to pursue unitary aims'. However, although pluralistic settings are so complex that resemble 'organised

anarchies' (Cohen et al. 1972), theorists in collective action claim managers intuitively design structures to attenuate complexity (Ostrom 1990, Dietz et al. 2003). One way to do so is by creating polycentric organizations, this is by decentralising authority across nested centres of decision-making. Polycentric designs have been observed in settings as diverse as water resources management in California and police forces in Indiana (Ostrom 1990, 2010). The idea resonates with the notion in organization literature that complexity can be reduced by grouping the participants on the basis of either similarity or complementarity of knowledge (March and Simon 1958, Thompson 1967, Nadler and Tushman 1988, Galbraith 1973). But our lack of in-depth studies limits our knowledge of how these ideas extend into capital-intensive projects.

Related to this, we also know little how capital-intensive project organizations are designed to cope with the high levels of interdependency with the environment in the planning stage. Planning decisions are contentious because they allocate resources in ways that are hard to reverse and impact the property rights of many actors. Since not all environmental actors impacted by the decisions can be co-opted, planning decisions are scrutinised by numerous third parties including the public, press, regulators, and spending watchdogs. This interdependence puts pressure on the promoter to 'lock in' early on performance targets. Early commitments reduce ambiguity in the cost-benefit analysis and give the promoter legitimacy to acquire the resources necessary to achieve the goal (Stone and Brush 1996). However, bounded rationality makes it hard for the promoter to set targets wholly aligned with the outcomes of the ensuing searches for consensus. Furthermore, were the promoter to set overly conservative targets and planning could collapse because the project idea would not be convincing. As a result, the chances are real that the promoter will underestimate the initial targets. Initial difficulties to build consensus make it tempting to relax the targets to increase the

solution space. But, any slippage in the targets risks eroding the promoter's legitimacy to ask for more resources (Denis et al. 2011). This is the conundrum facing promoters in the planning stage, a conundrum rooted in the interdependency of the project organization with the environment. Our aim here is to advance our understanding as to how the design of the project organization contributes to resolve this conundrum.

In sum, planning a capital-intensive project, and thus setting performance targets, is rooted in a fundamental tension. On the one hand, managers must share decision rights with multiple autonomous actors to acquire much-needed resources to achieve the goal. On the other hand, managers must limit the amount of concessions to keep the project on target. We discuss next how we set off to investigate how managers manipulate the project organization architecture to cope with this tension.

3. RESEARCH DESIGN, SAMPLE, AND METHODS

This study adopts a multiple-case research design with embedded units of analysis (Eisenhardt 1989, Yin 1984). Case studies allow researchers to incorporate contextual and temporal dimensions, and thus are suitable to explore novel ideas (Eisenhardt and Graebner 2007). To advance theory and yield generalizable and robust insights we built a diverse sample (Siggelkow 2007). The sample consists of four large infrastructure projects in the UK, and our holistic question asks: can we trace project performance back to the design of the project organization in the planning stage? The sample includes four cases for which we gained exceptional access to the project leaders: i) London Crossrail, a high-capacity railway; ii) London Olympic park; iii) Heathrow airport Terminal 2 (T2); and iv) UK second high-speed railway (HS2). Table 1 summarises for each case the system goal, the actors promoting the project, the outcome of the planning effort, and data sources; appendix I summarises the project timescale, prior history, context, and evolution of the performance targets over time.

--Insert here Table 1 --

We built this sample to increase the generalizability of our insights. First, the cases differ in the architecture of the product under planning (Figure 1 illustrates this point in a stylised way). An Olympic Park suggests a decomposable system. It comprises a set of sport venues connected by underground utilities. But the utilities are ‘slaves’ designed not to constrain planning decisions for the high-value assets. In contrast, railway systems are much less decomposable. All stations connect to the same track and control systems, and must accommodate the same train cars. In turn, an airport is suggestive of a hybrid system—some components are physically linked, for example, the tunnels that connect the concourses, but other components, e.g., car park, hotel, are not. We know that managers intuitively seek to reduce management complexity by aligning organizational architecture with the architecture of the products that the organization produces (Sosa et al. 2004, Colfer and Baldwin 2016). But we were unclear if this logic could extend to the planning stage of capital-intensive projects.

--Insert Figure 1 about here --

Our sample also varies in the project context. The T2 project was promoted by BAA¹, the regulated private owner of Heathrow airport. In contrast, the other schemes were financed by central government acting alone (Olympic park, High-speed 2) or in a coalition with a local public agency (Crossrail). A project promoted by a firm which already owns the necessary land is less interdependent with the environment than one financed by the tax-payers that requires land acquisition. We thus expected to find less tension between the need to share decision rights and announce performance targets in the T2 case than in the public cases. And yet, we were not sure if this logic would hold since any regulated firm is a pluralistic setting. Furthermore large budget contingencies in the public projects could make it less difficult to resolve emerging disputes. Within

¹ In 2012 BAA changed its name to Heathrow Ltd; we keep to the BAA name for the sake of simplicity

the sample of public projects, the context also varies by the extent to which the planning decisions were or not regulated. In the Crossrail and HS2 cases, planning decisions had to be approved by the UK Parliament, the regulator of land use. In contrast, the promoter had autonomy to make planning decisions for the Olympic park. Still, all public projects were led by politicians, and thus we were unclear how regulatory variance would affect the organization design-performance relationship.

3.1. Units of Analysis

Multiple-case studies that embed a unit of analysis are useful to investigate a holistic question without overlooking operational details (Yin 1984). Accordingly, our units of analysis embedded across the four cases were planning disputes. Disputes are situations in which actors disagree and thus illuminate the conflict process and how people resolve conflict (Coleman and Ferguson 2014). In this study, the analysis of disputes was important to explore, first, how decision rights were shared; and second, to explore how differing product architectures and contexts could impact on the design of the project organization and performance. However, it was not our focus to probe into the negotiation processes. We agree that researching connections between organizational design and informal social networks is critical to further our understanding of organizational performance (Van de Ven et al.2013). We also agree dispute resolution hinges on the interplay between formal and informal mechanisms. But we argue that we cannot further our understanding of this interplay in capital-intensive project organizations unless we first understand better the organizational architecture surrounding dispute resolution, and this is the focus of our study.

3.2. Data Collection

Data collection was part of a broad research program looking at capital-intensive projects from an organization design perspective. In 2011, we first gained access to the

top managers of the Olympic Delivery Authority (ODA), the public agency established in 2005 to develop the Olympic park. This agency reported to the four promoters, but had no power of veto over planning decisions. Between 2011 and 2014, we leveraged our access to top managers within the ODA to, first, independently access top managers of other stakeholders directly involved in the planning for the Olympic park; and second, to acquire similar levels of access to participants in the other three cases.

Data collection involved interviews and analysis of archival documents. We arranged the interviews by adopting a snowball approach (Biernacki and Waldorf 1981). Hence, for each case, once we identified salient disputes with the help of the initial respondents, we asked for names of other people who had intimate knowledge of the disputes. In total, we conducted and tape recorded 123 interviews up to 2-hours long. Follow-up interviews were conducted to probe deeper into particular issues, double check a verbal account, and bridge gaps in the database. We were not asked to sign non-disclosure agreements for interview data, but always asked permission to use verbatim quotes and offered to keep the source anonymous; some respondents gave us free rein to use the transcripts, whereas others disallowed the use of particular quotes. We formally committed not to share any reports that were not in the public domain. To gather extra data and allow for member checks (Lincoln and Guba 1985), we shared the emerging findings with the respondents. We also invited 13 respondents to give presentations and stay for lunch. For each visit, we produced hand-recorded verbatim notes of the talks and of the informal conversations at lunch time.

To improve data accuracy and the robustness of the insights (Jick 1979), we triangulated the verbal accounts against archival data (Miles and Huberman 1994). The planning stage of a large infrastructure project in the UK is highly regulated. In public projects, many documents are uploaded online either because the promoter so it

chooses or is mandated to do so under the Freedom of Information Act. Key documents included minutes of board meetings, formal exchanges between the promoter and development partners, and reports announcing performance targets and corresponding plans. In the case of BAA, we studied capital programs, master plans, and consultation documents. The disputes between BAA and the main user of T2, Star Alliance (which included over twenty airlines), were documented in reports produced by the regulator and in formal exchanges between BAA, STAR, and the regulator. The inclusion of the HS2 case was important because planning for this case is still ongoing. HS2 was also our last case study, and we followed Denis et al. (2011) recommendation to use the last case study to test emerging insights and thus sharpen the argument. For all cases, we played information in the project documents against third-party reports. Hence we combed through reports produced by the National Audits Office, Parliamentary committees, spending watchdogs, and other public agencies. Other sources of archival data were articles and interviews with top managers in professional outlets, e.g., *New Civil Engineering*, *Construction News*, and articles in the mainstream press, particularly for disputes that had fallen in the public domain.

3.3. Methods

Following recommendations for inductive reasoning (Langley 1999, Ketokivi and Mantere 2010) we produced detailed accounts for each case. Each account provides a contextualised and chronologic understanding to guard against account bias (Miles and Huberman 1994). We then used Design Structure Matrices (DSMs) to model the planning problem. DSMs are a research tool from design theory that enables to formally represent a complex system into a square matrix by capturing the interdependencies between its constituent elements (Steward 1981, Eppinger et al. 1994). DSMs have been used to reveal the design architectures of both products and

organizations, and have enabled to establish relationships between organizational design and performance (Sosa et al. 2004, MacCormack et al. 2012). The use of DSM was thus appropriate to explore potential relationships between the organizational architecture of capital-intensive projects in planning and performance as we controlled for different product architectures and project contexts.

To date, however, DSMs have rarely been used to model the structure of a planning problem, and thus we had to develop an original protocol. Our aim was not, however, to exhaustively model the planning problem. Rather, our aim was to explore: i) whether changes in the architecture of the planning problem and/or in the context impacted the architecture of the project organization; and ii) the relationship between organisational architecture and performance. To build the DSMs, we used data on planning disputes for major components such as a sport venue or a railway station. Our database consists of 35 disputes which the respondents said offered a good illustration of the focal planning problems. Specifically, we modelled the planning problems by capturing five constituent elements of planning choices: i) local goal (affects interests); ii) cost forecast (affects budget); iii) capacity (affects viability in use); iv) footprint (affects land take); and v) any controversial sub-element. This stylised approach enabled to model the planning problems by capturing interdependencies between the constituent elements of the planning choices for multiple components. In addition, we also sought to formally establish which organizational actors shared rights to directly influence which planning decisions. Hence, for each DSM, we produced a companion organizational matrix that reveals the membership of the decision-making forums.

The DSM analysis revealed a critical regularity: the creation of project-based polycentric organizations across *all* cases. Furthermore, the DSM analysis revealed variance in the extent to which a referee, external to the project organization, was

provided by context to settle disputes that the disputants alone failed to resolve. The DSM analysis could not reveal, however, the impact of the disputes to performance. To address this question, we examined how each dispute impacted the performance targets. In this process, we uncovered a second source of variance—the amount of contingency funds that the promoter had available to attenuate the public impact of cost overruns. This variance mattered because it changed radically the interdependency between the project organization and the environment. As we iterated between the findings and theory development (Miles and Huberman 1994), a contingency relationship between organizational design and performance emerged. We stopped iterating when we reached theoretical saturation. We turn now to present the analysis.

4. ANALYSIS

We organise the analysis by first showing how the DSM analysis systematically revealed a distribution of decision rights characteristic of polycentric architectures. We then examine variance in the structures surrounding dispute resolution and performance implications.

4.1. The Polycentric Architecture of the Project Organization in the Planning Stage

We have previously noted that a polycentric organizational architecture is an intuitive design approach to attenuate the complexity of managing a pluralistic setting (Ostrom 1972, 1990). The basic logic consists of decomposing the organization into a nested structure of decision-making groups with restricted authority to make choices. Within this architecture the high-level authorities retain centralised control over system-wide choices, but share decision-making rights for different local choices with different groups of local actors. As local disputes emerge, the authorities may have, de jure, power to enforce their own preferences. But to avoid a political backlash, the authorities prefer instead to search for local consensual solutions until they run out of

time. Our analysis confirms this logic by revealing a polycentric organizational architecture across the four cases. Table 2 exemplifies the protocol which we used to interrogate the database of local disputes and construct the matrices. Figure 2 illustrates the analysis with excerpts of the DSMs and corresponding organizational matrices. The cells along the diagonal of our DSMs represent local planning decisions (the decisions are listed to the left of the rows) and the off-diagonal entries indicate interdependency between the decisions. For example, if the DSM has an entry in row *i*, column *j*, the decision concerning element *i* has an impact on the decision concerning element *j*. Hence, the decisions represented in the diagonal cells have inputs entering from the top and bottom decisions, and outputs leaving from the left and right sides.

<Insert Table 2 and Figure 2 here>

A first point to note is the regularity revealed by the DSMs on the architecture of the planning problem: invariably, all matrices show densely populated clusters of off-diagonals 'x'. Each cluster reflects the reciprocal interdependencies among the constituent elements of the planning choices for a component. For example, one component illustrated in Table 2 and Figure 2 is the Olympic Aquatics Centre. The decision to set its local goal as a 'massive iconic venue' is an input for decisions on cost, footprint, and capacity; these decisions, in turn, are inputs to refine the goal. For example: the local goal needs readjustment if: i) the cost is unaffordable; ii) there is not enough land; or iii) a massive venue is unviable in use. As the goal gets readjusted, the other local decisions may need to change too. One level down, a controversial decision to add a 'stylistic' diving board is interdependent only with the goal and cost decisions.

However, the four DSMs differ substantially in the degree of interdependency between the off-diagonal component clusters. For example, the Olympic Park DSM is sparsely populated off the component clusters. This result reflects the technological

independency between the sport venues, and thus the modular architecture of the Olympic park. The notable exception is the interdependency between different local cost decisions: increasing the cost for one venue potentially leaves less money to invest in the other venues. In marked contrast, the Crossrail and HS2 DSMs show high interdependency between the component clusters due to the more integral architecture of the railway planning problems. For example, in the case of the HS2 DSM, the local goals for each station are interdependent—the goals need to be analogous to respect equitability of investment across cities. Technological constraints, in turn, create interdependency between the local decisions on station capacity and footprint; and budgetary constraints on create interdependency across all cost decisions. Hence the railway DSMs are densely populated off the component clusters. In turn, the DSM for T2 suggests a problem with hybrid architecture: on the one hand, the cluster of decisions for the car park is, apart from the cost interdependencies, independent from the concourse and baggage system clusters. But the two latter components are connected, and thus the decisions on goal, capacity, and footprint are interdependent

Critically, our analysis uncovers much less variability across the organizational matrices that show which actors have decision rights over which decisions (represented at the right of the four DSMs in Figure 2). At the highest level, all four matrices show a top governing body whose membership is restricted to the actors promoting the project. The promoter (in coalition or solo) and its agent are embedded in all decisions since they are the financier and accountable for performance. For example, in the HS2 case, the UK government and its agent, HS2 Ltd., directly influence all local decisions. Likewise, in the Olympic Park case, the four promoters and their agent, the Olympic Delivery Authority (ODA), share decision rights over all local decisions through the Olympic board. One level down, and consistent with a polycentric architecture, the

organizational matrices show a fragmented structure of working groups—so-called ‘project boards’. The project board members—local resource-rich actors and the promoter’s agent—share decision rights. But the project boards are closed to opponents and resource-poor actors (although consultation reaches all affected parties).

Table 2 and Figure 2 also show how the influence of the local actors is restricted to specific components. For example, the UK government and its agent, HS2 Ltd, share decision rights for the HS2 Euston Station plans with the London government, Transport for London (a local transport agency) and Camden Council (local regulator of land use); as one respondent said, “you could make HS2 Ltd its own planning authority [but] that would flout democratic processes.” Similarly, the UK government shares with the Manchester government, Transport for Greater Manchester, and other local actors decision rights on the plan for the Manchester station. But the London actors do not participate in the Manchester planning talks and vice-versa. Likewise, in the Olympic Park case, for each sport venue, a different group of sport bodies and other local actors directly shared decision rights with the promoter.

In sum, our DSM analysis establishes the following insights. First we consistently find a degree of decomposability of the planning problem. As expected, this decomposability is high for modular systems like an Olympic park, but low for integral systems like a railway. Second, we find no evidence of strict modular planning problems because of the interdependencies between local cost forecasts. And third, we uncover a polycentric architecture irrespective of the product architecture or project context. In this organizational design, the promoter and its agent have decision-making authority over *all* planning decisions; they can also set unilaterally performance targets. But for each set of local planning decisions, the promoter needs to build consensus with a group of local actors whose decision rights are restricted to that local

planning problem. We turn now to examine how this underlying architecture allows for variance in the administrative structures surrounding consensus building.

4.2. Structural Variance within a Polycentric Project-based Organization

As aforementioned, within a polycentric organization, the promoter can set performance targets unilaterally but the final decisions hinge on building consensus. Searching for consensual solutions within a solution space constrained by targets set ex-ante leads to multiple disputes. Crucially, our analysis reveals important variance on the structures that surround dispute resolution along two dimensions. The first relates to the extent to which the laws in the environment provide an external ‘umpire’, this is an institutional actor third party to the project organization and mandated to referee the local disputes as an alternative to public courts.² This umpire shows in the DSMs for the HS2 and Crossrail cases, but not in the DSMs for the London 2012 and T2 cases. The second dimension relates the amount of slack resources which the promoter can internally deploy to mask overruns from the eyes of third parties. We observed substantive slack in the public projects, but limited slack in the private project. We turn now to discuss how variance along these two dimensions affects the relationship between polycentric organizing and project organization performance. Table 3 shows an excerpt of our database for six disputes, and illustrates the analysis that follows.

<insert Table 3 about here>

Variance in the use of an ‘umpire’ to resolve local disputes

The extent to which an external umpire to arbitrate between contending parties was institutionalised in the environment varied. In the Crossrail and HS2 cases, disputes were regularly deferred to an umpire because the laws in the environment instructed the UK Parliament to set up a committee to regulate land use. Hence any

² According to the Oxford English Dictionary *umpire* and *referee* are synonyms to denote the actor in power to exercise the final authority

actor who was ‘materially affected’ by the promoter’s plans could lodge a petition in Parliament. The dispute about the HS2 London Euston station (#1) is telling. From the onset of the planning talks in 2010, HS2 Ltd said the UK government preferred a utilitarian, modular station to keep the costs down. But the local actors argued that the existing station, which had not been modernized for 50 years, needed to be fully redeveloped. To persuade government to increase the project scope, the affected local parties commissioned masterplans in support of their vision. But under pressure to keep to the original targets, HS2 Ltd refused to cave in. It was then up for the Ministers in the Cabinet³, a level above, to decide what to do next, as one official explained:

HS2 Ltd, if you like, are the infantry out there; actually doing what they’re told by [central] government. So HS2 Ltd get all the fights, appear to have all the fights, are the bad boys, but they’re really only doing what they’re instructed to do.

Consistent with polycentric organizing, our findings on the Euston station dispute show the local decision rights were *de facto* shared. The UK government may have had *de jure* power to impose its preferences. But rather than forcing the issue, government opted to negotiate. After three years of talks, the scope increased and the cost increased commensurately. Still, a number of issues remained outstanding and dispute resolution was deferred to Parliament; as one local official said, “HS2 Ltd. didn’t persuade us that our points were wrong nor did they persuade us their points were right...[petitioning] is ultimately about making your case that your vision is superior.” The Parliamentary committee was impartial, but also inefficient. It consisted of elected lawmakers who needed significant time to listen to all the arguments before making a judgement. In the Euston case, the Parliamentary debates lasted three years until a consensual solution emerged that further inflated the scope and cost. The Crossrail Woolwich station dispute (#2) shows a similar pattern linking efforts to build local consensus with

³ The UK Government Cabinet includes the Prime Minister and the most senior ministers

performance slippages. In this case, after three years of talks, the promoter refused to add this station to the project to avoid setting up precedence and keeps the costs down. Petitioning thus gave local actors a chance to overturn what in their view was a flawed decision. After 40 months of listening to evidence, Parliament ruled the station should be built, and that the petitioners should partially finance the extra costs (over £250m).

In marked contrast, we did not encounter evidence of external umpires settling disputes in the T2 and Olympics cases. In the T2 case, for example, the more concessions on project scope the airlines asked BAA to make, the more BAA asked to increase the levies and disputes ensued ('we're battling all the time', said one BAA respondent). Our findings also show that BAA and Star were both happy to ask the regulator to mediate disputes. However, since it was within the mandate of the airport economic regulator to cap the levies requested by BAA, the regulator was not 'third party' to the project organization. Furthermore, the regulator lacked the power to settle disputes. One good example is the dispute about the main concourse (#3). The airlines craved a modern campus, whereas BAA planned to simply replace old facilities (in part to avoid umpiring by a public inquiry). Consistent with its preferences, BAA announced a modestly-budgeted £700m new concourse to open in 2012. Star then wrote several letters to the regulator complaining that BAA was ignoring their needs, a claim that BAA found unfair—'I can never get consensus on almost anything', said a BAA director. In the end, BAA agreed to safeguard the airlines' vision, but demanded an increase in the airport levies. The regulator facilitated the negotiations by postponing the deadline to complete the talks in one year. A level below, BAA and Star recruited a retired director to privately arbitrate less substantial disputes. In the gate dispute [#4], for example, the airlines preferred 'closed' gates which they deemed more efficient, whereas BAA favoured 'open' gates so passengers could move around

up to boarding. To avoid impasse, the arbitrator suggested resolving the differences by building ‘flexible’ gates, an idea which added £5 million to the cost forecast.

The Olympics case provides another example of a context where the decision rights were shared but the participants were left to their own devices to settle the disputes. In this case, mindful of the rigid deadline, Parliament rushed to give planning powers to the ODA, the promoter’s agent, right after the UK won the bid. Still, mindful that unilateral decisions could cause a political backlash, the ODA appointed a ‘design sponsor’ for each project board, and mandated them to search for consensual designs. The Olympics aquatics centre [#5] offers a good example of how the planning talks led to substantive slippages in the performance targets. The promoter had pledged a massive venue designed by a globally famous architect. But as the cost forecast started to spiral the goal became unviable. Yet, backing down from the public pledge was tricky—as one official said, ‘if you challenge them [architect] they will just walk away’. Complicating matters was a constraint imposed by the International Olympic Committee on the minimum capacity of the venue and individual preferences of the local government, the future operator of the asset. Unable to defer dispute resolution to a referee, the parties resolved the issues by keeping the aesthetics, shrinking the venue size, and safeguarding a capacity increase just for the games. But his solution duplicated the cost forecast, and a public outcry ensued—‘they seem to be willing to spend money like water’, said a watchdog⁴. Even more complex was agreeing a plan for the Olympic stadium dispute [#6]. In this case, two claimants to the planning choices, the London Mayor and football clubs, opposed to fold the stadium into an athletics venue after the games, a bid pledge. After two years of failed talks, the ODA

⁴ Kelso, P. 2008. Olympics 2012 chiefs willing to spend money like water, say MPs. Guardian, 30 April

suggested increasing the budget by 20% (~£100m⁵) to build retractable seating and safeguard the stadium for dual use in legacy. But football aficionados ruled out what they called a ‘jack-of-all-trades’ design. With time running out, the Olympic board went ahead with a hybrid design for the Games which increased the cost in fifty percent. But the tussles between the disputants dragged until 2014 when the dual-use idea was finally accepted by all the participants. By 2016, the conversion cost had reached £323m, more than duplicating the initial cost forecast for the stadium.

In sum, resolving local disputes consistently required throwing more resources (money, time) into the pot. This finding resonates with claims in the projects literature that promoters regularly underestimate performance targets. But crucially, it shows that performance slippages are rooted in local searches for consensus. And yet, since the performance targets are set by the promoter, it is tempting to blame the slippages on the promoter. We turn now to discuss differences in the administrative structures that the promoter itself can deploy to mitigate this risk, and the impact on performance.

4.3. Variance in the Use of Slack Resources to Mask Performance Slippages

A second major source of structural variance surrounding the local disputes relates to the amount of slack resources available to resolve disputes. We focused the analysis on the contingent funds because they enable the promoter to internalise the cost of local concessions, and thus to sustain a narrative that the project is ‘on target’. In the sampled public projects, UK policy ury recommended promoters to put aside a substantive percentage of the cost forecast into a contingency fund to neutralise optimism bias⁶. The elected leaders adhered to this policy since they also had no appetite to let the budget (cost forecast plus contingency funds) slip multiple times in the public eye; as one civil servant explained: ‘There’s a bandwidth there...if we push

⁵ All cost figures are presented in final (cash) prices for the sake of simplicity

⁶ *Supplementary Green Book guidance-Optimism bias*, a recommendation issued by the UK Treasury

it [budget] too far we won't get the project...so there's that game that goes on to try and find what the [UK] Treasury's real limits are...it's a political decision.”

The Olympic Park case is a good example. The bid cost forecast (~£4.9bn⁷) turned out to be insufficient to meet the bid pledges and the local disputes likely to ensue—‘it's like the Olympics will solve all the world's problems’, said one official. To get a grip on a chaotic situation, in 2005, the promoter set a 2-4-1 target: two years to plan, four to build, and one to test. But by mid-2006, many disputes remained unresolved. Facing an immovable deadline, the promoter chose to set a large contingency (£2.0bn) on top of what was by then a much higher cost forecast (~£6.1bn); one official said:

Treasury were really, really clear...big envelope and never knock on our door for money...actually they were right...we were then able to make decisions...rather than being petrified because we didn't have enough money to do what we needed to do.

The appendix data shows a similar pattern for HS2 and Crossrail. In both cases, the promoters faced a public outcry at the planning onset related to cost slippages. To mitigate the risks of further overruns the promoters set large contingencies. The use of the contingency funds was scrutinised by watchdogs to reduce moral hazard—‘[contingencies] are there for known risks, not for somebody's betterment’, said one official. But similarly to London 2012, both Crossrail (NAO 2014) and HS2 (Butcher 2015) depleted their contingencies; still, in the public discourse, all projects were ‘on target’. In marked contrast, in the privately-financed T2, this procedure was ruled out. First, BAA seemed confident on its ability to parry any backlash caused by cost slippages since there was less public scrutiny. And second, since BAA had a guaranteed return on capital investment, the airlines and regulator were against large contingencies to keep the construction costs down. As a result, the T2 planning unfolded with a single-digit contingency which was insufficient to mask cost overruns.

⁷ Includes £971m (venues); £89m (conversion costs); £640m (Olympic infrastructure); £1040m (non-Olympic infrastructure); £700m (local transport schemes); £766m (land) plus VAT (NAO 2007)

In sum, our cross-case analysis reveals two regularities: i) project organizations are polycentric to make pluralism more manageable; and ii) slippages in performance targets are necessary to resolve disputes endemic to a polycentric architecture. Within this broad relationship between organization design and performance, we observe within-set variance in, first, whether an external umpire is in post or not to referee disputes; and second, the amount of slack the promoter can internally deploy to resolve disputes. The juxtaposition of structural variance along these two dimensions creates fundamentally different classes of managerial problems. We turn now to discuss how these insights further our understanding of capital-intensive project organizations.

5. DISCUSSION

The debate on the performance of capital-intensive projects has been stuck for two decades: one explanation traces performance slippages to competence and agency problems with the promoter; other traces them to externalities. Underlying both views is the assumption that project organizations are authority hierarchies. Here, we sought to move the debate forward by probing deeper into this form of organizing.

By employing Design Structure Matrices (DSM) we establish that capital-intensive project organizations have a polycentric architecture at the planning stage—a finding consistent with predictions of theorists in consensus-oriented collective action (Ostrom 1972, Ostrom 2010). Specifically we show that decision rights over planning choice are decentralised within a nested structure of local decision-making groups. Decision rights determine the boundaries of the organization—as Pfeffer and Salancik (1978: 32) argue, an organization ends where its discretion ends and another’s begins. Hence our findings suggest the resource-rich local actors which are awarded decision rights are *de facto* members of the project organization. And yet, these actors remain autonomous from the promoter until they forge a development agreement. Still the

pluralistic project organization is not wholly flat. Our analysis shows that the promoter has centralized authority to set performance targets and to constrain the solution spaces ex-ante of collective searches for consensual decisions. This conceptualization of project organizations is crucial to further our understanding of their performance.

First, a polycentric architecture is advantageous in enabling the promoter to achieve the system-goal. If the promoter did not share decision rights, the affected local actors would be less willing to volunteer their own resources. By co-opting local actors and designing a ‘negotiated environment’ (Cyert and March 1963), the promoter creates conditions for the project organization to survive. For example, in the Crossrail and HS2 cases, local governments would be much less likely to volunteer time, effort, and money if they felt the UK government was paying lip service to shared decision-making. Second, a polycentric architecture gives the promoter authority to set budgets and deadlines. These numeric targets are necessary to fill the strategic void created by the ambiguity that is endemic to pluralistic settings (Denis et al. 2001, 2006, Stone and Brush 1996). For example, it is hard to conceive how the Olympics project could forge ahead without a commitment on a preliminary budget for bidding purposes. Third, a polycentric architecture attenuates management complexity by leveraging knowledge of the product architecture to decompose the project organization, a finding in agreement with design theory (MacCormack et al. 2012, Colfer and Baldwin 2016). In a polycentric design, participation in each inner centre of shared decision-making power is restricted to the actors directly affected by a system component. By aligning organizational and system architectures, a polycentric design reduces the size and heterogeneity of the local groups, attenuating the complexity of the local searches for consensual solutions (Cemerer and Knez 1996, Heath and Staudenmayer 2000). And fourth, by negating the potential for promoter dominance in local choice, a polycentric

design allows for ambiguous projections of future resource allocation. This ambiguity creates space for conflicting goals and helps avoid defections of organizational members (Jarzabkowski and Fenton 2006, Denis et al 2001). Consistently, announcements of targets enabled to gain momentum to promote the project. But the ensuing slippages in the targets were critical to sustain support for the evolving plans.

The main disadvantage of a polycentric organizational architecture is its inadequacy to meet normative expectations in the context for keeping the project on target. A polycentric design opens local choice to local actors within a constrained solution space. But because self-interest encourages the participants in joint searches to try to optimize solutions (Knudsen and Levinthal 2007), local actors will demand concessions; as March and Simon (1993 p.312) put it, 'we create our wants, in part, by experiencing our choices'. Planning talks thus put pressure on the promoter to relax the targets, a pressure exacerbated by the irreversible nature of long-lived planning choices, which makes it harder for people to give ground when seeking a compromise (Gil and Tether 2011). And yet, the promoter lacks autonomy to relax those targets because the targets create interdependency with the environment. In other words, a polycentric design leaves the promoter in a Catch-22: if it governs by diktat, it alienates the local actors; if it abandons the performance targets, the project 'fails'. For example, the reputation of the Olympics project was impaired after the bid budget was dropped; likewise, the HS2 reputation was marred after the promoter uplifted the budget after the bid. At the limit, a polycentric architecture creates a real risk of planning talks unravelling. The history of our cases is telling: two failed attempts to promote Crossrail, three failed attempts to host the Olympics; and a Heathrow airport terminal awaiting replacement for more than 20 years. This evidence is consistent with

agent-based simulations that show decentralized searches of solutions for interdependent problems can bog down (Mihm et al. 2010).

The consistency of the polycentric architecture across our diversified sample suggests capital-intensive projects are indeed a ‘population of organizations’ (Hannah and Freeman 1989) that share the same architecture and face similar vulnerabilities. However, our analysis also suggests different contexts create fundamentally different managerial problems within this form of organizing, which invalidates indiscriminate comparisons. We discuss next a proposed framework that establishes logic between organization design and organization performance contingent on contextual structures.

A Framework of Capital-intensive Project Organization and Performance

Our analysis traces regular slippages in the performance targets to local searches for consensus endemic to polycentric organizing. However, the cases differ substantially in two key administrative structures deployed to resolve local disputes. Alternative permutations inform a contingency framework linking organization design to performance. Figure 3 illustrates our main contentions. On the horizontal axis, we differentiate project contexts with/without external umpiring. On the vertical axis, we show internal availability of slack; whilst slack is a continuous dimension, for the sake of the argument we assess its availability as either “limited” or “substantial.”

<Insert Figure 3 about here>

Understanding the Role of Umpiring

The umpire is a structure external to the project organization and institutionalised in the context for giving authoritative judgement over disputes internal to the project. In other words, the umpire acts as a safeguard against the risk of self-interested actors failing to achieve a common interest (Olson 1965). Importantly, the umpire is different from private arbitration (Heine and Kerk 2017). Private arbitrators are members of the

organization tasked to leverage their latitude in decision making and observability power to reward disputants with a greater share of the surplus of the joint activity (Lumineau and Oxley 2012). As such, private arbitrators are third party to the dispute, but not third party to the organization. In contrast, umpires are similar to a public court and thus operate under strict procedural rules and lack expert knowledge.

The main benefit of an umpire is the provision of a referee effective to avoid hold-ups by individual parties. This referee cannot be co-opted, has no property rights, and thus is impartial. In the Crossrail and HS2 cases, the Parliamentary committee was granted legal powers to settle any dispute if planning talks failed. This dispute resolution structure was arguably more efficient than a public court, and successfully prevented disputes to evolve into legal action. But the lawmakers lacked knowledge and were busy people. Thus the committee needed substantive time to assimilate the arguments. Notwithstanding these inefficiencies, the disputants systematically deferred dispute resolution to the umpire, creating a major source of uncertainty. Hence the presence of an umpire appears to create a negative precondition for the parties to cooperate, an insight in agreement with collection action literature (Frey 1994, Ostrom 1990). The late intervention of the umpire also led to significant delays and cost overruns. Umpires thus amplify project interdependency with the environment, making it harder to meet normative expectations of performance. Knowing this, the UK Parliament chose to get out of the way for the Olympic park project. This suggests that the presence of an umpire fundamentally changes the management problem.

Understanding the Role of Slack Resources

Unlike umpires, slack resources such as contingency funds are an administrative structure controlled by the promoter and thus internal to the project organization. The main advantage of slack resources is that they help disputants reconcile their interests

without having to resolve the problem, what Cyert and March (1963) call ‘quasi-resolution’ of disputes. However, literature on slack is also in agreement that there is a real risk of slack encouraging inefficient behaviour (see Dolmans et al. 2014 for a recent review). It is outside the scope of this study to resolve this trade-off in the context of capital-intensive project organizations. Our point here is to show that the amount of slack available also fundamentally changes the management problem.

In our setting, public policy pragmatically encouraged promoters to establish large contingencies to accommodate cost hikes over time. All public projects took advantage of the policy, and set conservative budgets. Our analysis shows that the promoters consistently depleted the contingency funds to finance local concessions. From this perspective, it is fair to say that slack created a self-fulfilling prophecy. However, slack also consistently enabled the promoters to sustain a narrative of high-performance and to claiming the projects were on ‘target’. Hence slack did not change the polycentric architecture of the project organization neither pre-empted disputes. But slack effectively reduced interdependency with the environment (Engwall 2003).

In marked contrast, BAA management and the airlines fought against the use of excessive slack, denouncing the government’s use of, in their view, ‘over-egged budgets’. Interesting, our evidence shows the cost overruns in T2 were more moderate relative to the other projects. But T2 cannot be compared with the Crossrail or HS2 projects because there were no umpires in the context. This restricts our comparison to T2 and the Olympic park projects. Like T2, the Olympics park project had no umpire. But unlike T2, the Olympic promoter built in substantive slack to mask late cost hikes. The fact the Olympics contingency was all depleted again suggests a self-fulfilling prophecy. It thus seems fair to say limited slack makes disputants more accountable for the outcomes of collective searches for consensual solutions. Significantly, our sample

does not include a case that conflates umpiring and limited slack [top right quadrant]. This situation is discouraged by UK policy, a point that we return to in the last section.

In sum, our conceptual framework suggests that scope creep and overruns are rooted in local disputes endemic to polycentric organizing. And yet, simply saying that performance slippages are endemic to this form of organizing is not a satisfactory theoretical approach. Here, we show how different permutations of two structures, one internal and another external, create fundamentally different classes of managerial problems. Our framework is therefore a first step toward a more general theoretical synthesis that addresses the question of why different projects perform the way they perform. It also creates a conceptual basis to help us compare performance across different classes of projects and examine the effectiveness of alternative practices.

6. CONCLUSION

In this study we have sought to advance our understanding of capital-intensive project organizations. We illuminate how planning choice occurs within a polycentric architecture to make pluralism more manageable, and show different classes of management problems within this organization design. This conceptualization enables to reconcile two strands of conflicting explanations on capital-intensive project performance. In agreement with claims that trace underperformance to externalities, we trace performance slippages to the interaction of the promoter with multiple autonomous, resource-rich actors. The difference is that our work endogenizes these actors, moving them inside the organisational boundaries because they share decision rights. And in agreement with claims that trace underperformance to the promoter's behaviour, our study confirms that initial targets are set unilaterally and invariably optimistic. But we also show this pattern is rooted in an optimism that consensus will not be as costly to build as it actually is. This insight adds nuance to ideas that

optimism bias is rooted in agency problems and incompetence. Let's be clear. We are not suggesting to rule out these explanations of underperformance. But equally, we should not ignore that building consensus is a 'struggle' (Dietz et al. 2003), particularly when the organization is highly interdependent with the environment. Under these circumstances, a good dose of optimism is needed to believe capital-intensive goals are achievable. In other words, the promoter's optimism bias is both a blessing and a curse.

Importantly, our study only illuminates the performance impact of the arrangements designed to mandate interactions for exchanging and mobilizing resources in pursuit of collective goals (Gulati and Puranam 2009). As such our work is agnostic about how informal social structure affects the relationship between organization and performance; we cannot also shed light on the influence of emergent interactions, negotiation tactics, and patterns of individual behaviour and corresponding norms, beliefs, and values underlying such interactions, tactics, and behaviours. We agree, however, that robust explanations of performance should aim at combining formal and informal elements since underlying designed structures are actions carried on by individuals (Van de Ven et al. 2013, Simon 1947). But we cannot reach this level of understanding unless we first understand the formal design of capital-intensive project organizations. This is our contribution in this study.

Still it is fair to ask how far our insights might be generalizable and three boundary conditions are in order. First, infrastructure projects are socially complex but not so technologically complex that planning choices cannot be comprehended by multiple actors in the environment. The capability to discern what is at stake encourages these actors to claim decision rights. In contrast, in technologically complex settings such as aeronautical (Brusoni et al. 2001) and science (Tuertscher et al. 2014) the understanding of what is at stake is restricted to subject-matter experts. This enables to

reconcile pluralism with meritocracy-based authority, which creates a different problem.

Second, planning choices for large infrastructure projects are hard to reverse once approved, and tend to impact the individual property rights of multiple actors. Hence planning choices are, perforce, controversial. But not all capital-intensive projects impact property rights and unfold under contentious system-goals. In the response to the Columbia space shuttle disaster (Beck and Plowman 2014), for example, a benign system goal enabled cooperation and a sense of collective identity to flourish rapidly between dissimilar actors who had never worked together. This suggests that the quality of the goal is another boundary condition that merits further investigation.

And third our study is grounded in the UK context which encouraged polycentric organizing; umpires and slack are also designed arrangements rooted in UK policy. But these characteristics are not universal. The observed emphasis on underpinning final planning choice on formal cost-benefit analysis itself is also not universal. As Porter (1995) notes, intimate social networks among elites in some countries allow for much more informal decision-making processes under pluralism. Hence caution is needed before extending our insights to fundamentally different institutional contexts.

Limitations notwithstanding, our study has important implications for policy. The regular occurrence of scope creep and overruns has dogged the reputation of capital-intensive projects and project leaders. Implicitly here is the assumption that promoters have centralised authority, and thus if projects overrun it is the promoter's fault. This conception has fuelled ideas that promoters are not to be trusted, which inform policy such as optimism bias and umpires. Recognizing that planning choices happen within a polycentric architecture suggests a different direction for policy. If organization design allows for shared decision rights, then policy wants to encourage shared accountability

for the outcomes. This suggests, for example, policy could ask participants to accept private arbitration to resolve disputes, freeing the time of umpires to resolve disputes with actors which had not been co-opted into the project organization. We conjecture that private arbitration could make the project organization less interdependent from the environment, and thus reduce uncertainty. This, in turn, would enable to reduce slack resources and mitigate the risk of inefficient and opportunistic use of resources.

In conclusion, this study sees capital-intensive project organisations as forms of polycentric organizing under pluralism. It also reveals fundamentally different classes of problems within this broad population of organizations. These insights do not make these organizations less complex or suggests simple solutions. But they illuminate the structure of the management problems and help move forward the performance debate.

APPENDIX –Summary of Sampled Projects: History, Context, and Performance

Project History and Context	Summary of Performance (cash prices unless stated)
<p>Crossrail: <u>Main Planning Effort:</u> occurs between 2001 and 2008. <u>Prior History:</u> The idea of building a cross-London railway first gained momentum in the seventies but the UK government dropped the plan after a few years because of cost concerns; the idea was reignited in the nineties but planning again unravelled after five years. The start of the third attempt happened in 2001 when the UK and London governments formed a coalition to promote the scheme. <u>Performance baseline:</u> during planning, the goal evolved from a 9km central London train to open by 2012 into a 118km high-capacity commuters' train to open by 2017; the cost and schedule targets evolved commensurately. <u>Context:</u> Construction could not start before the promoter acquired from the Parliament the power to force land sales. Planning unfolded under pressure to submit a proposal to Parliament before the 2005 elections; in 2008 Parliament gave the UK government authorization to proceed.</p>	<p>Cost forecast evolution 2001, ~£4.7bn 2003, ~ £9.8bn 2007/8, ~ £10.9bn Final (as of 2016) ~£14.0bn</p>
	<p>Contingency 2006/7, ~£5.0bn 2010, ~£4.0bn (~ £1.0bn removed after financial crisis) 2016/7, contingency depleted</p>
	<p>Completion forecast evolution 2000, fully open in 2012 2003, fully open in 2016 2008, fully open in 2017 2016: fully open in 2019/20</p>
<p>London Olympic park: <u>Main planning effort:</u> occurs between 2001 and 2007. <u>Prior history:</u> The idea of hosting the 2012 Olympics in London emerged in 1995 after the UK lost for the third time the contest to host the Olympic Games. In 2001 the UK government formed an initial coalition to promote the scheme with the London government and the British Olympic Association. <u>Performance baseline:</u> In 2002, the International Olympic Committee (IOC) opened the competition; it gave the promoter two years to develop an intermediate bid and six additional months to submit the final bid; the scope and cost forecasts evolved during the bidding process and afterwards. Facing an immovable deadline, the promoter spent 18 months after winning the contest to refine the plan and produce a performance baseline ('Yellow book'), which was updated in 2009 ('Blue Book'). <u>Context:</u> after London gained the contest, Parliament</p>	<p>Cost Forecast Evolution 2002, ~ £1.1bn 2004, ~ £4.9bn 2007, ~ £6.1bn Final: ~£8.1bn (<i>includes post-games conversion</i>)</p>
	<p>Contingency 2007, ~£2.0bn 2013, no contingency left</p>
	<p>Completion forecast: immovable <i>But some planning disputes were only temporarily resolved</i></p>

rushed to give government the power necessary to force land sales; and LOCOG, a IOC's watchdog, joined the promoter organization and gained veto power on the top governing board.	<i>for the Games in 2012</i>
<p>Heathrow Airport T2. <u>Main planning effort:</u> occurs between 2005 and 2009. <u>Prior History:</u> The goal of consolidating all operations by Star Alliance, a network of over 20 airlines, in a new terminal was announced in 2005; in that same year BAA, the private airport owner, started building Terminal 5 to consolidate the operations of One World, a rival alliance; <u>Performance baseline:</u> The initial goal was to replace the old T2 building with a new building so-called 'Heathrow East'; BAA also aimed to complete planning by 2008 to coincide with the end of the regulatory cycle, but the timescale was later extended. During planning, the T2 goal evolved into a modern T5-like campus to develop in two stages; the first stage would open by 2013 and the second by 2018. The first phase opened in 2014; as of 2017, no plan exists to start the second phase. <u>Context:</u> Construction could not start before the performance baseline was approved by the regulator. By regulation BAA had to treat all airlines in the same way, which put BAA under pressure to open T2 on time</p>	<p>Cost forecast evolution 2005, ~ £1.3-1.8bn 2006, ~ £2.0bn 2008, ~ £2.4bn Final (2015): ~£2.8bn</p>
	<p>Contingency funds 2008, ~£200m (8% of cost forecast)</p>
	<p>Schedule forecast evolution 2005, open in 2012 2008, open in 2013</p> <p>Actual completion (1st phase): 2014; 2nd phase put on hold</p>
<p>High-speed 2 <u>Main planning effort</u> occurs between 2009 and 2017 (first phase) and 2009-2020 (second phase) (<i>as of 2017</i>). <u>Prior history:</u> The idea to develop a new national railway gained momentum in 2008 after the financial crisis. In 2009 the UK government created HS2 Ltd, a public agency tasked to plan the scheme. <u>Performance baseline:</u> The initial goal was to open the first phase connecting London and Birmingham (225km) by 2026 and open a second phase connecting Birmingham to various Northern cities (248km) by 2032/3; in 2015, scope shifted between the two phases, and pledges were made to develop complementary railway lines (Crossrail 2, HS3). <u>Context:</u> Construction could not start before government acquired from the UK Parliament the power to force land sales. Planning unfolded under pledges by government that the plans for the first phase would be approved by Parliament before the 2015 general elections; the plans for the first phase were finally approved two years late in March 2017.</p>	<p>Cost forecast evolution (10/11 prices) 2010, ~ £22.7bn 2012, ~ £22.7-27.6bn +£5.8bn (train cars) 2014, ~£28.2bn+£6.0bn(train cars) 2015, ~£31.5bn+£6.5bn(train cars)</p>
	<p>Contingency (10/11 prices) 2010, ~£7bn 2012, ~£10.2bn 2013 ~ £14.4bn</p>
	<p>Schedule forecast evolution 2010, planning (1st phase) done by 03/2015 2015, planning (1st phase) in 2016 2017, planning (1st phase) ends</p>

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Table 1 - Description of the Sample of Cases, Interviewees, and Archival Database

Cases	London 2012	Heathrow T2	London Crossrail	UK High-speed 2
System-level goal	Build an Olympic park to host Games and catalyse urban regeneration	Build a new terminal campus to create a dual-hub at Heathrow airport	Connect the East and West outer London with a new high-capacity train system	Build a cross-country railway to increase national transport capacity
Membership of the promoter	Coalition: <i>UK and London governments; BOA(\$); LOCOG(\$)</i>	Solo: <i>BAA (regulated airport owner)</i>	Coalition: <i>UK and London Governments</i>	Solo: <i>UK Government</i>
Outcome of the planning effort	Formal performance baseline <i>Yellow book (2007)</i> <i>Blue book (2009)</i>	Legal contract setting performance targets <i>5-year capital investment plan</i>	Legal contract setting scope and assurances <i>Parliamentary bill</i>	Legal contract setting scope and assurances <i>Parliamentary bill</i>
Interviews on local disputes	36 (11 disputes)	19 (5 disputes)	33 (9 disputes)	35 (12 disputes)
Number and description of organizations interviewed	8: <i>London2012 (bid company) ODA (promoters' agent); LOCOG (games operator); OPLC (park operator); Transport for London (TfL); CLM (programme manager); Land Lease (private developer); Network Rail (owner of rail infrastructure)</i>	5: <i>STAR Alliance, Air Canada, BAA, HETCo and Balfour Beatty (private design and build companies)</i>	8: <i>CLRL (promoters' planning agent); Crossrail, (promoters' delivery agent); Network Rail; UK Treasury; Transport for London (TfL); Canary Wharf (private funder); Bechtel, Transcend (consultants)</i>	11: <i>HS2 Ltd (promoter's agent); Manchester City Council (MCC); Greater London Authority (GLA); Transport for London (TfL); Borough of Camden; Transport for Greater Manchester (TfGM); Network Rail; UK Treasury; Manchester Airport; CH2MHill, AECOM (consultants)</i>
Archival data	Total number of documents: 134	Total number of documents: 114	Total number of documents: 122	Total number of documents: 101
Documents on the planning effort organised by categories: (news articles in the press not included)	<i>Strategy and planning documents: 84</i> <i>Financial reports: 6</i> <i>Formal communication: 5</i> <i>Newsletters and PR documents: 17</i> <i>Design documents: 7</i> <i>Meeting minutes: 15</i>	<i>Strategy and planning documents: 74</i> <i>Financial reports: 6</i> <i>Formal communication: 19</i> <i>Newsletters and PR documents: 8</i> <i>Design documents: 4</i> <i>Meeting minutes: 3</i>	<i>Strategy and planning documents: 74</i> <i>Financial reports: 2</i> <i>Formal communication: 6</i> <i>Newsletters and PR documents: 23</i> <i>Design documents: 9</i> <i>Meeting minutes: 8</i>	<i>Strategy and planning documents: 46</i> <i>Financial reports: 6</i> <i>Formal communication: 20</i> <i>Newsletters and PR documents: 12</i> <i>Design documents: 12</i> <i>Meeting minutes: 5</i>

(§)BOA - British Olympic Association; LOCOG, London Organising Committee of the Olympic and Paralympic Games and International Olympic Committee (IOC)'s watchdog;

Figure 1 – Stylised representation of different infrastructure design structures

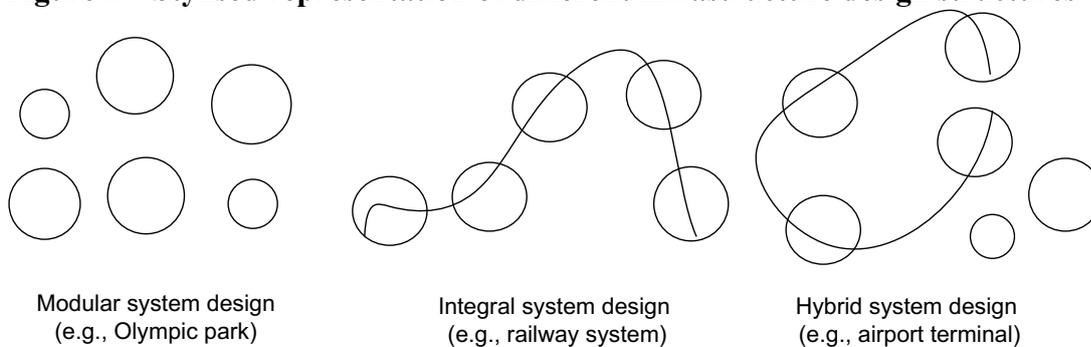


Table 2- Excerpt of Protocol to Uncover Design Structure of the Planning Problems and Distribution of Decision Rights

Case	Dispute	Selected quotations on the intra-component interdependencies and coding for the Design Structure Matrix	Interdependencies	Claimants to the strategic design choices	Selected quotations on the ownership of the strategic choices for the organizational matrix (<i>claimants in italic</i>)
London Olympic c Park	Dispute over the goal of the stadium	The football clubs weren't coming forward with money [COST]... so we [Olympic board] decided to invest into an athletics legacy venue [GOAL] and all facilities on top would be temporary so they could be demountable [CAPACITY]	COST→GOAL→CAPACITY	#>10 4 promoters; 2 football clubs; promoter's agent; athletics body; 4 local governments; others	<i>I [promoter's agent-ODA] said [to Olympics board] what's wrong with leaving an athletics centre... why do we have to publicly subsidise the richest clubs in the world? why? It's public land... don't renege on your responsibility to public sport</i>
	Dispute over the goal of the Aquatics centre	The bid needed an iconic building [GOAL]... it wasn't just a pool for a community facility [GOAL]... this was grand, [FOOTPRINT/ CAPACITY] ostentatious... costs a lot of money [COST] to build... so the reasons were about predominantly making a statement [GOAL] about London's bid	GOAL→FOOTPRINT/CAPACITY→COST→GOAL	#>10 4 promoters; IOC; promoter's agent; architect, local governments; others	<i>It's difficult to anticipate willingness of an architect like Zaha to compromise... the roof was everything, if you lose that flow, there would be no way she would continue... London boroughs, accessibility interest groups, equality groups, etc... each one wanted the utopian solution</i>
	Dispute over the diving boards of the Aquatics centre	I always saw it [aquatics centre] as a sculpture [GOAL] really and that's why we [ODA] put the diving boards [SALIENT SUB-ELEMENT]... one afternoon... a guy says 'there's this very stylistic design [GOAL] but we cannot afford it' [COST]... and said 'give us a price... at least £0.5m extra [BUDGET], you're authorised'	GOAL→SUB-ELEMENT→COST→GOAL→BUDGET	#>10 4 promoters; International Olympic Committee; promoter's agent; award-winning architect; user groups; local government	<i>They [Swimming federation/Fina] didn't like our [ODM] diving boards, and they wanted them to be changed, and we said we weren't going to change... LOCOG was playing a political game telling Fina that we can still change them when... we [ODA] weren't going to change</i>
High-speed 2	Dispute over the goal of the London Euston Station	The complexity comes, really, because... you need quite a bit of land [FOOTPRINT], and there's nowhere in central London [GOAL] just sitting vacant to receive... against our requirement, which is... a target of £1.7bn or so [COST], we can't... afford a station with a double-deck scenario [CAPACITY/FOOTPRINT]	FOOTPRINT→GOAL→COST→CAPACITY/FOOTPRINT	#>7 UK Government, Agent (HS2 Ltd); Local borough; Mayor of London; TfL; Station manager (NR); multiple train operators	<i>This is all the art of the possible isn't it? HS2 Ltd is a government agent being oppressed... Mayor of London, Camden Council, Transport for London, Network Rail, they all need to give a bit... we [London First] absolutely could referee... it's just not one of our priorities... it's very resource-intensive... like doing UN peace negotiations</i>
	Dispute over the goal of the Manchester Station	HS2 have proposed a station that... sits on its own [GOAL]... so its own concourse, access [FOOTPRINT/CAPACITY], all that... in our design [GOAL] we see one integrated station with everything open so you can walk, different levels [CAPACITY] because land is at different levels [FOOTPRINT]	GOAL→CAPACITY/FOOTPRINT→GOAL→CAPACITY→FOOTPRINT	#>6 UK Government, Agent (HS2 Ltd); Local government; local transport agency; station manager; train operators	<i>The design process has been collaborative... we [Manchester City Council] are engaged with the work they [HS2 Ltd] might be doing around station design; they're engaged with us on the wider regeneration program... our objective is always to try to get to a consensus</i>
Heathrow	Dispute over the goal of the new terminal	We [BAA] got some more money [COST] to deliver safeguarding of structures which will be needed for later [GOAL] So we are building tunnels under the taxiway [FOOTPRINT/CAPACITY] at the moment and those weren't included [GOAL]	COST→GOAL→CAPACITY/FOOTPRINT→GOAL	#>30 Airport operator (BAA); regulator; Star Alliance (>20 airlines); other airlines; local council	<i>I [Star Alliance director] wrote to the planning authority, 'I don't think you should approve this [Heathrow East building proposal] because it's only a terminal building; it does not have from a campus perspective all of the elements which is going to make this work'</i>
Crossrail	Dispute over the need for toilets at the Farringdon station	Whilst we have no legal obligation to provide toilets [SALIENT SUB-ELEMENT], one or two councils have demanded them... can you really accept that one of the major interchange hubs in London [GOAL] doesn't have any public toilets? So the board accepted that... about £1m extra [COST]	SUB-ELEMENT→GOAL→COST	#>7 2 promoters, promoter's agent; 2 local governments; London underground; politicians	<i>The London Assembly Committee Chair described the failure to provide toilets at Crossrail stations as "a missed opportunity" and said the rail scheme offered "an ideal and cost-effective chance to increase the numbers of toilets in the capital" [London Assembly report]</i>

Table 3 – Excerpt of the Evidence on the Resolution of Planning Disputes: Outcomes and Implications to Performance Targets

Case	Embedded dispute		Dispute resolution mechanism	Outcome	Implications to the Local Performance Targets		
					Extra scope	Completion date	Cost (final prices unless stated)
High-speed	Euston St	#1, Low local goal congruence <i>Utilitarian vs. 'world-class' station</i>	Umpire <i>UK Parliament (Land use regulator)</i>	Mutual compromise facilitated by umpire (after 4 major design cycles) <i>The principle...that all the works...are on the HS2 credit card has been accepted [TfL official]</i>	Yes <i>Commitment to fully redevelop Euston station</i>	Relaxed <i>Dispute was resolved in 2017; completion of works delayed from 2026 to 2033</i>	Relaxed <i>2010, ~£2.0bn (09 prices) 2011, ~£1.1bn (11 prices) 2014, ~£2.2 bn (11 prices) 2015, ~£4.5bn (TfL forecast)</i>
Crossrail	Woolwich St	#2 Low local goal congruence <i>Divergences over the business case</i>	Umpire <i>UK Parliament (Land use regulator)</i>	Mutual compromise facilitated by umpire (after 2 major design cycles) <i>Parliament rules that station should be built, but asks for local finance</i>	Yes <i>Construction of the station agreed</i>	Relaxed <i>Dispute only fully resolved in 2013 after 7 years of planning talks</i>	Relaxed <i>2005, £0m (no station) 2008, £150m (local claimant pays) 2013, £166m (£16m from promoter)</i>
Heathrow T2	Main Concourse	#3, Low goal congruence <i>Modern campus vs. facility replacement</i>	Planning talks <i>Airport economic regulator mediated planning talks</i>	Mutual compromise (after 3 major design cycles) <i>Future expansion of main concourse building is actively safeguarded</i>	Yes <i>Extra capacity for future expansion (tunnels, basements)</i>	Relaxed <i>Dispute pushed back the end of the planning in one year</i>	Relaxed <i>2005, ~£666m (final prices) 2008, ~ £1bn (£200m in safeguards) 2015, £1.2bn</i>
		#4 Rivalry over local planning choice <i>Open versus closed gates</i>	Planning talks <i>Independent director arbitrated planning talks</i>	Mutual compromise (2 major design cycles) <i>Gates can be open, but only if new boarding technology is adopted</i>	Yes <i>Flexible building grid to leave both options open</i>	Stable <i>Dispute resolved during the planning process</i>	Relaxed <i>2008, ~£5m extra</i>
London Olympic c Park	quatics centr	#5, Low goal congruence <i>Small vs. massive aesthetically sophisticated venue</i>	Planning talks <i>Long series of meetings between project participants</i>	Mutual compromise (after 3 major design cycles) <i>Sophisticated roof stays, but venue shrinks to a third of its original size</i>	Yes <i>Temporary 15,000-seats added just for the games</i>	Stable <i>Dispute resolved during the first two years allotted for planning talks</i>	Relaxed <i>2004, ~£128m 2007, ~ £236m Final (2010): ~£262m</i>
	Stadium	#6, Low goal congruence <i>Football vs. athletics venue in legacy</i>	Planning talks <i>Long series of meetings between project participants</i>	Mutual compromise (after 4 major design cycles) <i>2007, potentially demountable venue 2013, dual-use venue</i>	Yes <i>Retractable seating added in 2013</i>	Relaxed <i>Goal dispute resolved after 6 years of talks in 2013</i>	Relaxed <i>2004, ~ £468m 2008, ~£541m Final (2015): ~£706m</i>

Figure 2- Excerpts of the Design Structure Matrices of the Planning Problem and Corresponding Organizational Matrices (all sample)

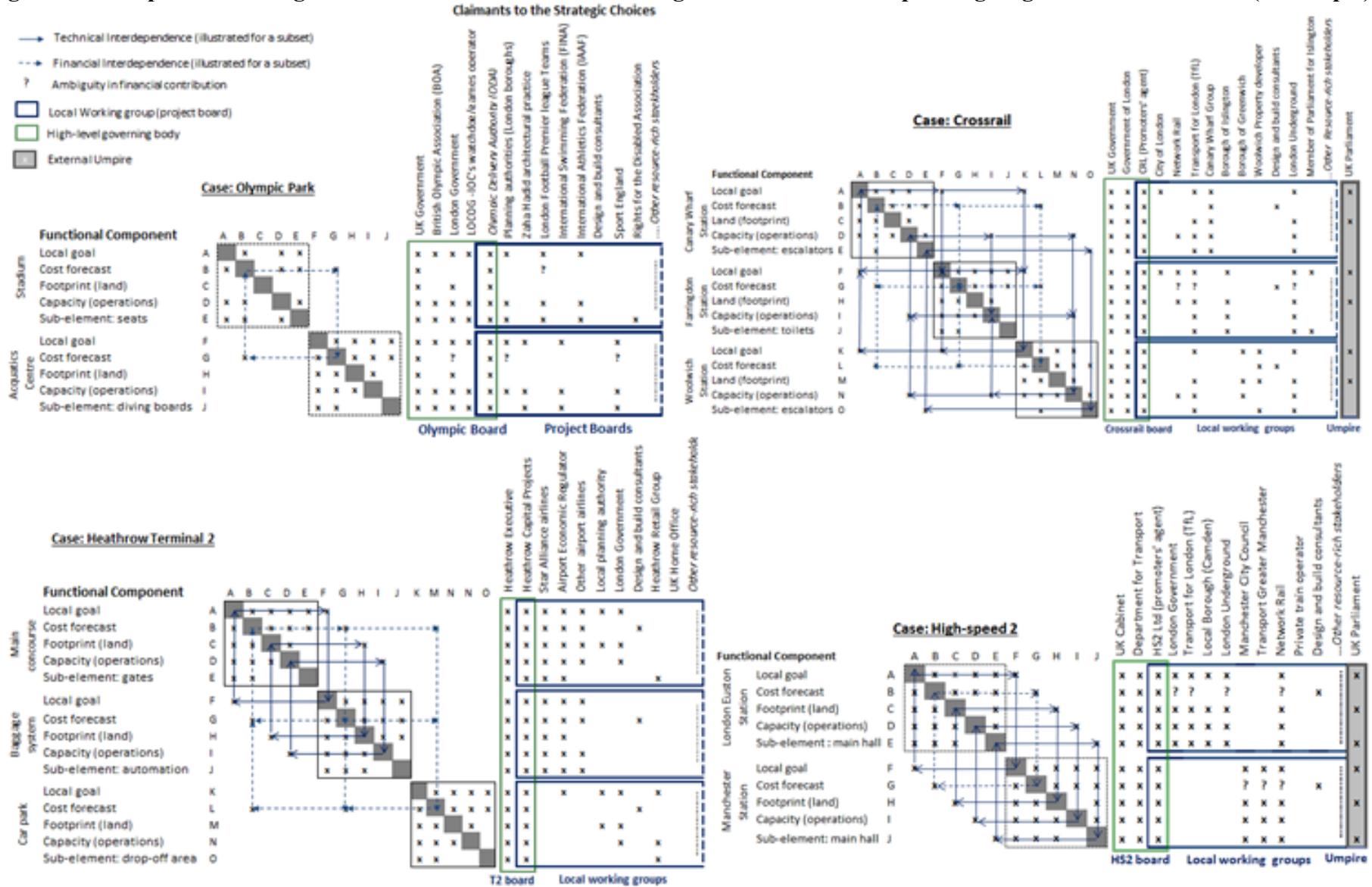


Figure 3- Contingent Framework on Project Organization Design-Performance Logic

Internal Slack for Resolving Disputes	External Umpire for Resolving Disputes	
	Not available	Imposed by the Environment
Limited	<p>Organizational design allows for moderate slippages in the performance targets</p> <p>Organizational design encourages shared accountability for slippages in the performance targets</p> <p><i>Example: Heathrow T2</i></p>	<p>Organizational design creates high risk of major slippages of the performance targets <i>in the public eye</i></p> <p>Organizational design creates high risk of impasse if slippages of the performance targets are ruled out</p> <p><i>No example: Scenario discouraged by UK public policy</i></p>
Substantial	<p>Organizational design creates real risk that performance targets will slip until there is no more slack left</p> <p>Organizational design allows to mask slippages in the performance targets from the eyes of third parties</p> <p><i>Example: Olympic Park</i></p>	<p>Organizational design creates real risk that performance targets will slip until there is no more slack left and umpiring process is completed</p> <p>Organizational design allows to mask slippages in the performance targets from the eyes of third parties</p> <p><i>Example: HS2, Crossrail</i></p>