Megaprojects: A Design and Strategy Perspective

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Abstract

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Modern society faces complex problems of collective action that require the development of long-lived capital infrastructure to cope with issues such as population growth, energy shortages, rising sea levels, and migration to cities. These so called ‘megaprojects’ require collaboration between legally independent organizational actors including governments, public bodies and firms. However despite being an important element of a competitive society in both developed and developing countries megaprojects are frequently attacked by pundits in both the media and academia for failing to live up to performance expectations. This research seeks to advance the extant megaproject debate by answering three high-level sweeping questions – what are megaprojects, why are they perceived as performing so badly, and what can management do about it?

In answering these questions the research makes a number of contributions. First, it argues that megaprojects are consensus-oriented organizational networks formed to develop large systems of non-decomposable components to be shared in use by many autonomous actors. Second, it finds that megaproject projects have ambiguous performance due to the co-existence of conflicting ‘performance narratives’ created by stakeholder groups. Further, it shows that these competing narratives stem from the evolution of the megaprojects organizational structure over time. And finally, the research proposes a sequencing strategy that aligns the growth of the megaproject network with the hierarchy of product design choices to improve the perceptions of performance.

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Preface

The papers presenting within this thesis are the product of joint work with my supervisory team. The first and third papers in this thesis are co-authored with Prof. Nuno Gil and are available as part of the Centre for Infrastructure Management (Manchester Business School) working paper series. The second paper in this thesis was co-authored with both Prof. Nuno Gil and Prof. Phanish Puranam and is available in the proceedings for the Academy of Management Annual Meeting, Vancouver, August, 2015.

Introduction

1 Background

Some major challenges facing modern society include population growth, energy shortages, rising sea levels, and migration to cities. A unifying characteristic of these challenges is that society cannot address them effectively without developing new long-lived, capital-intensive infrastructure such as transport systems, energy and water networks, and a range of social assets including schools, hospitals, and urban parks. The production of these infrastructures occurs through so-called 'megaprojects', organizational networks formed to, first, agree on an appropriate design for an asset, and second, to agree upon a strategy for building the infrastructure. To achieve their goal megaprojects require collaboration between legally independent organizational actors including governments, public bodies, and firms. As many infrastructure assets, e.g., railway stations, airport concourses, power plants, are operationally non-decomposable, and their production requires resources owned by different actors, megaprojects, as a form of organizing, create large arenas of consensus-oriented collective action.

Extraordinarily, however, extant studies on megaprojects have failed to appreciate the complications created by the consensus orientated nature of megaproject production activities. Unsurprisingly then megaprojects are frequently attacked by pundits in both the media and academia for failing to live up to idealized performance expectations (usually cited in terms of cost and delivery schedule). This is of particular concern as megaprojects are considered an important element in creating a competitive economy in both developed and developing societies[1]

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[1] The World Economic Forum's Global Competitiveness Report 2012-2013, for example, ranks infrastructure as one of the four pillars of the Basic requirements category in the Global Competitive Index

Contemporaneous explanations of the reasons behind these perceived failures range from the use of inappropriate contracts with the suppliers in the face of design and environmental uncertainty (Stinchcombe & Heimer, 1985); escalation of commitment in which backers of a megaproject are unable to publicly admit failings (Ross & Staw, 1993); scope creep and sunk cost fallacies (Shapiro & Lorenz, 2000); a failure to undertake adequate front-end planning (Morris, 1994); lack of capital investment in flexible asset designs (Gil & Tether, 2011); evolution in the environment which managers fail to account for (Miller & Lessard, 2001); and ambitious project promoters resorting to strategic misrepresentation and optimism bias to get the project initiated (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Wachs, 1989).

This study suggests this broad body of literature has two significant problems which simultaneously offer an opportunity to advance the research debate. First, extant research provides no common, theoretically grounded, definition of what form of organizing production activities a megaproject is. And second, megaprojects are frequently, although there are exceptions, implicitly treated as if they were temporary organizations managed by a unitary actor with absolute decision-making power, and thus the blame for failure is typically placed with an unfortunate project manager, politician, or company director.

This three-paper thesis aims to reset the megaproject debate by treating the megaproject as an organizational network. Rooted in the theoretical construct of a 'meta-organization' the thesis attempts to answer three high-level sweeping questions – what are megaprojects, why are they perceived as performing so badly, and what can management do about it?

2 Research Setting

This research was conducted inductively with the insights mainly derived from three in-depth case studies on megaprojects which unfolded concurrently in London: 1. 2012 Olympic Park; 2. Heathrow airport's Terminal 2 (T2); and 3. Crossrail.

Each of these megaprojects can be characterized by an identifiable system-level goal. In the case of the megaproject to build London's Olympic Park, the aim was to provide both the sporting venues and athlete accommodation to host the Games, whilst catalyzing the urban regeneration of the East London area around the park and the modernization of London's congested transport networks. The Heathrow airport Terminal 2 project had a goal of co-locating the airline members of the Star Alliance, which accounted for approximately 25 per cent of all traffic going through Heathrow airport into a modern terminal. The ultimate goal was transform Heathrow airport into an airport with two hubs: one for Start Alliance, and another for One World, Star direct rival operating from the T5 campus that opened in 2008. Finally, the goal of the Crossrail project was to deliver a high-capacity railway to increase the capacity of London's transport network by 10% by building a new underground system and upgrading existing railway infrastructure.

In addition, to develop the argument in the third paper, I drew from empirical findings from a fourth case study – the contemporaneous development of High-speed 2, a £50bn national high-speed rail network connecting London to the Northern regions by 2032 that is being promoted by central government and their appointed agent, HS2 Ltd. Data collection for the HS2 case study was entirely undertaken by other PhD students and faculty affiliated to the Manchester Business School Centre for Infrastructure Development (CID)—the research group which provided an institutional 'home' throughout the duration of my PhD studies.

Data collection took place over a period of 3 ½ years of field work beginning in the summer of 2011, and was part of a much broader empirical research program set up by my PhD advisor, Professor Nuno Gil, to advance our theoretical understanding of megaprojects as a form of organizing the production of new large infrastructure in democratic societies. Unprecedented access to the top leadership teams of the three megaprojects in the initial sample that informed my research had been negotiated prior to my arrival to the doctoral research program. In addition, during my tenure as a PhD student, our research group succeeded to further negotiate similar levels of access to the HS2 megaproject. And exceptionally, in 2014, our research group gained access to commercially-sensitive cost reports and other archival documents for the first three projects in my sample— the information was shared under a non-disclosure agreement, and thus we are prohibited from releasing the actual documents into the public domain.

In summary the research makes use of several data sources including semi-structured interviews with a range of actors, analysis of archival documents, and on-site visits. All in all, 88 formal interviews were conducted for the three projects that inform the first two papers in the research dissertation, and 35 additional interviews were carried for the HS2 case. Specifically, I attended the majority of the interviews for the Crossrail and Heathrow T2 cases with Professor Nuno Gil sharing lines of questioning. The interviews for the London Olympics were carried out solely by Professor Gil with some taking place prior to my participation in the doctoral programme due to time constraints imposed by the opening of the Olympic Games. Each interview lasted between 1 and 2 hours, and they were all recorded and transcribed. We did not sign non-disclose agreements for any interview. But we always asked permission to use quotes. Occasionally, we were asked to stop the tape recorder and prohibited of using particular in vivo quotes.

In addition to the interviews, I attended a number of presentations led by members of the infrastructure industry including attending two practitioner conferences which shed light on the empirical settings. Throughout my doctoral research 12 senior managers were invited to give talks in the school about their own projects, and stay for lunch with the members of the research group—we took detailed notes of these presentations and lunch conversations.

Finally, these interviews and presentations were complemented by numerous site visits to Crossrail sites, and I personally spent four weeks carrying out on-site observation, and having informal meetings, at Heathrow T2 where I gained access to internal project records and financial data.

3 Contributions of the Thesis

3.1 The Three Paper Structure

The thesis is structured into three interrelated papers whose contributions, apart from the first, build upon the preceding paper(s). I wrote the first and final draft of each of the papers presented in this thesis. Between these stages Professor Nuno Gil and I worked iteratively on drafts of the papers in the order that they are presented herein. For the second paper "*The (under) performance of mega-projects: A meta-organizational perspective"* my co-supervisor Professor Phanish Puranam contributed an iteration of the paper prior to submission.

The first paper titled "*Megaprojects: An Evolving Hybrid Meta-Organization*" introduces the primary theoretical lens—the meta-organization construct—that informs the remainder of the thesis.

Briefly, meta-organizations are networks of legally autonomous actors collaborating under an identifiable system-level goal (Gulati, Puranam, & Tushman, 2012). The membership of a meta-organization can include individuals, communities, public bodies, and firms who are bound by a collective strategy. Joining a meta-organization allows members to gain access to markets, peer networks, and resources outside of their traditional scope and undertake activities which are beyond their individual capabilities. The defining qualitative attribute that distinguishes meta-organizations from other organizational forms is the absence of employment relationships, or ownership stakes, as sources of authority between the members of the meta-organization (Gulati et al., 2012). Importantly, meta-organizations are not self-organizing networks. Rather, they are guided by a central 'systems architect' —an actor who attempts to shape the development of the meta-organization in pursuit of a higher-order goal.

The first paper in this thesis asks the question – what form of organizing is a megaproject? In answering it, we propose a new conceptual framework for understanding megaprojects—the 'hybrid' meta-organization. This hybrid megaproject meta-organization has two constituent structures – a core and periphery. The core, a porous collective led by a coalition, shares the right to directly influence the final design of an indivisible structure for common use. The periphery, a closed supply chain, provides expert knowledge and labor for the system and carries out the actual engineering and construction of the infrastructure, but has limited direct influence over the high-level design choices. Furthermore through examining the hybrid meta-organization longitudinally, the empirical study provides an insight into the development lifecycle of megaprojects, and explores the processes through which megaproject organizational networks are created and grow.

Building upon this hybrid meta-organization model the second paper in this thesis "*The (under) performance of mega-projects: A meta-organizational perspective*" looks to answer the question: how does evolution in organizational structure affect performance expectations? A key insight that emerges from examining megaprojects as a hybrid meta-organization is the inherent instability in the system's membership. As megaproject promoters seek to gain support for their vision irrespectively if it is a new airport, a high-speed railway, or an Olympic park they are forced to attract the attention of powerful stakeholders in the environment who control vital resources such as land, capital, and legal powers. However, these stakeholders are not altruistic – they contribute their resources in exchange for a stake in the infrastructure's design. Thus as every new wave of stakeholders joins the megaproject meta-organization a new set of would-be designers are unleashed. Hence we argue that there is a strong relationship between changes to the meta-organization's membership, changes to the final design of the infrastructure, and changes to the expected performance of the system (in terms of cost and schedule).

Importantly, the changes in the meta-organization structure necessary to acquire new meta-organization members create ambiguity in the final evaluations of performance of the megaproject as a whole. To develop this argument the paper presents a set of mechanisms that underpin performance ambiguity. First, members of the megaproject meta-organization are drawn from differing ideological and epistemic backgrounds and may have differing high-level preferences for the final design. As infrastructure is bound by gravity and other laws of physics and technological constraints it is often impossible to reconcile two opposing design preferences into a single technical design. This limitation leaves one or more parties dissatisfied with the outcome.

Second, members of the meta-organization may hold differing views over design efficiency and effectiveness. For example, a stakeholder with a preference for efficiency may wish to freeze the design of the infrastructure early on in the development process to give a more accurate cost and schedule forecast. In marked contrast, a stakeholder with a preference for effectiveness may wish to invest in a flexible design that can be changed relatively late to accommodate emerging design requirements despite the additional capital cost incurred.

Third, stakeholders that arrive at different stages of the development process often challenge the design choices and corresponding performance targets of extant meta-organization members. Inevitably, coalitions form between like-minded stakeholders and political battles are waged over the final design – the loser in these conflicts can feel disenfranchised and see the megaproject as a poor performing organization regardless of other factors.

Finally, a layer of complexity is added when one considers the timescales involved in megaproject developments. With decades passing between planning and construction, there is ample time for the environment in which the megaproject operates to evolve in ways difficult to foresee ex-ante but which can trigger events that force changes into the final design, and thus invalidate existing performance expectations. Given these complications, megaproject performance becomes politically charged with members crafting narratives that either support or attack the megaproject's strategy.

The third paper in the thesis builds upon the concept of managing in ambiguous environments and draws upon literature in strategy and in development of complex products and systems. Taking the perspective of the megaproject promoter as the 'systems architect', the final paper examines what capabilities are needed to act strategically in a megaproject meta-organization and what strategies are available to attenuate inter-organizational conflict within the politically-charged arena of infrastructure design. The search for strategic capabilities departs from the understanding that indivisible design decisions in a megaproject are, perforce, consensus-oriented—this violates a precept in design theory that posits that indivisible designs are best developed by tight-knit teams lodged within one organization as opposed to be developed by different teams lodged across different organizations.

The central question that the third paper then asks is: what can the megaproject promoter do to attenuate the management complexity stemming from the structural misalignment between the modular structure of the megaproject meta-organization and the non-decomposable structure of infrastructure components? In this paper we argue that the megaproject promoter must be armed with a deep knowledge of both the landscape of potential stakeholders to collaborate with, as well as of the technical design structure which they are developing. We argue that megaproject environments can be conceptualized along four dimensions: emergent vs established and modular vs integral. We then posit that an adept megaproject architect can enact two strategies – sequencing of membership and adding slack and/or flexibility in design to improve the system's stability. By eliminating development bottlenecks in an orderly fashion, and ensuring that the system has enough slack to accommodate emergent demands, the architect may attenuate conflict in the system. This, in turn, contributes to stabilize the performance expectations, and thus to sustain the legitimacy of the megaproject in the eyes of stakeholders and external observers.

The central recommendations are grounded on empirical evidence that suggests reveals practices that comply with the two strategies as postulated in the paper, but also instances where the strategies are patently violated, and contributed to emerging controversies that led to slippages in the performance targets. Whilst the effects of violations of our strategies reinforce the core argument, the fact they happen begs the question as to why they occur. Hence we discuss in the paper the pitfalls ahead of a promoter attempting to implement idealized strategies. The discussion illuminates, first, good reasons that can motivate a promoter to deliberately deviate from such strategies—

even if admittedly some of those reasons are not universally seen as ‘good’ and are indeed morally condemned by a few observers in the industry and academia; and second, the paper discusses instances where the environment rules out any effort to implement elements of the strategy.

In conclusion, this doctoral dissertation—by treating the megaproject as an organizational network—offers three answers to the three questions that it set up to answer. First, it argues that megaprojects are consensus-oriented organizational networks formed to develop large systems of non-decomposable components to be shared in use by many autonomous actors. Second, it traces the ambiguity in the performance of megaprojects, and thus the co-existence of conflicting narratives regarding how they perform, to the evolution of the structure of participation in the megaproject organizational network. And third, it proposes two sets of strategic capabilities which allow megaproject architects to build robust systems.

3.2 Conceptual Synthesis

Conceptually this doctoral dissertation treats megaprojects as a complex, dynamic, organizational network made up of collaborating actors who also compete to have their own requirements integrated into the scheme. The thesis posits that mega-projects can be conceptualized as a meta-organization – a network guided by a system architect, whose social and technical structure co-evolve creating ambiguity in performance at a system level. It then examines the managerial capabilities required to orchestrate the evolution in organizational and technical structures and suggests managerial capabilities and strategies that can aid in reducing conflict therein. The conceptual foundations are summarized in Figure 1

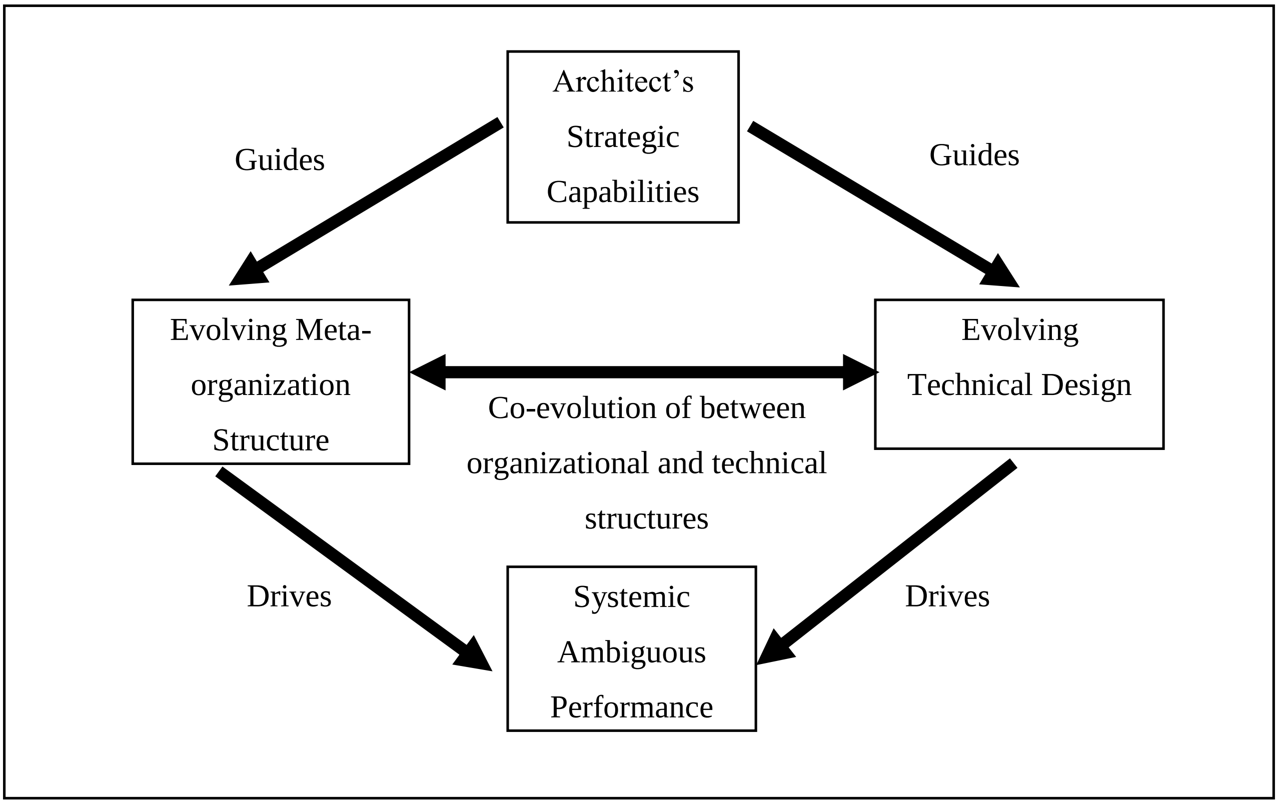
Architect's Strategic Capabilities
Guides
Guides
Evolving Meta-organization Structure
Evolving Technical Design
Co-evolution of between organizational and technical structures
Drives
Drives
Systemic Ambiguous Performance

Figure 1 - Conceptual Foundations

Figure one shows, at a level of abstraction, the relationship between some of the key insights found within the thesis:

i. Architect's Strategic Capabilities. Megaproject managers – system architects – develop strategic capabilities to manipulate the meta-organization structure and technical design. These capabilities instantiate themselves as the ability to identify, and select new organization members; handle unexpected changes in membership; and add flexibility and organizational slack to the technical design.

ii. Evolving Meta-organization Structure: Megaprojects can be seen as a hybrid meta-organization which grows (and shrinks) over time to acquire resources. The meta-organization involves two key structures a core and periphery. The core provides resources in exchange for control over the technical system, and the periphery provides expert knowledge and labor in exchange for profitable contracts.

iii. Evolving Technical Design: As the megaproject organizational structure grows it involves substantial shifts in the technical design. Technical designs in megaprojects are relatively integral but managers can choose to keep designs flexible and invest in slack to accommodate change.

iv. Dualism between Technical and Organizational Systems: Through the thesis a key insight is the dualism between technical and organizational systems as they are orchestrated by the system's architect. As the meta-organization grows to acquire new members it is imbued with a new set of preferences that alter the design. Conversely any technical design has a set of required resources which indicate which actors from the environment will be claim a place in the organization system

v. Systemic Ambiguous Performance: At a system level, we argue, there is no integrated performance measurement which allows megaprojects to be judged as successful. Rather we argue that each individual member will hold their own performance evaluation of the scheme and will create a narrative that justifies their opinion. In lieu of an overarching performance measurement for the entire system we argue that successful system architects are those that build meta-organizations robust enough to survive the development process.

The remainder of this thesis is structured into the three papers followed by a concluding chapter summarizing the key insights and reflecting on the process of the doctoral research.

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Paper 1

Megaprojects: An Evolving Hybrid Meta-Organization

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Nuno Gil

Megaprojects: An Evolving Hybrid Meta-Organization

Megaprojects, formed to develop a vast array of capital assets, are ubiquitous in today's society. But organization science has yet to qualitatively distinguish them from other modes of organizing. Through a longitudinal study of the development of three megaprojects—London's Olympic Park, London's Crossrail, and Heathrow airport's Terminal 2—we argue they are a hybrid meta-organization consisting of two symbiotically related structures. At the core, a flat collective shares control over the system-level goal and design requirements; its membership mirrors the organization that will later share the asset in use. At the periphery, a transactional collective designs and builds, but has no rights over the requirements. A longitudinal analysis reveals two developmental processes—parading, and the hard way— underlying the evolution of the megaproject organizational towards a configuration to fit the environment. We conclude with a discussion of how megaprojects combine the characteristics of a porous, flat organization with those of a closed, hierarchical organization.

1 INTRODUCTION

Megaprojects have long been understood as large temporary networks of public and private actors, connected through a complex web of relationships, who jointly work to deliver a capital asset such as a high-speed train, an Olympic park, or an airport terminal. Empirical examinations of these ventures have mainly focused on the seemingly endemic problems of cost and schedule overruns. Explanations have swayed between inappropriate contracts with the supply chain (Stinchcombe & Heimer, 1985), managerial escalation of commitment (Ross & Staw, 1993), inadequate upfront strategizing (Morris, 1994), stakeholder management failures (Lessard, 2008), lack of investment in design flexibility (Gil & Tether, 2011) to bleak suggestions of underhand strategic misrepresentation, optimism bias, and technical incompetence (Flyvbjerg, Bruzelius, & Rothengatter, 2003).

The debate has remained inconclusive, and extraordinarily, we still lack studies that qualitatively distinguish megaprojects from other inter-organizational forms. If we do not know what megaprojects are, how can we make sense of what we observe empirically? And crucially, how can we propose better ways to manage and govern megaprojects if we cannot differentiate them from other well-researched organizational forms such as buyer-supplier networks and distributed communities of production? Hence this study asks: what form of organization is a megaproject?

In this paper we use the conceptual lens of the meta-organization to qualify the structural characteristics of a megaproject. Meta-organizations are networks of legally autonomous actors collaborating under an identifiable system-level goal (Gulati, Puranam, & Tushman, 2012). The membership of a meta-organization can include individuals, communities, public bodies, and firms who are bound by a collective strategy. This enables the members to gain access to markets, peer networks, and resources outside of their traditional scope and undertake activities which are beyond their individual capabilities (Astley & Fombrun, 1983). Critically, meta-organizations share a common qualitative attribute—the absence of employment relationships, or ownership stakes, as sources of authority between the members of the meta-organization (Gulati et al., 2012).

Despite the absence of traditional sources of authority, meta-organizations are not self-organizing systems. Instead, at their heart is a central founding actor, an entrepreneurial architect, who plays a key role in shaping the system-level architecture (Gulati et al., 2012). A system-level architecture can be defined in terms of "its components, their relationships to each other and to the environment, and the principles guiding its design and evolution" (Maier, Emery, & Hilliard, 2001). Thus the meta-organization's founding architect plays a role both in identifying, promoting and developing the system-level goal as well as in designing the managerial structures and processes needed to achieve that goal.

In this paper we use the conceptual lens of the meta-organization to qualify the structural characteristics of a megaproject. In doing so we contribute first, to our understanding of megaproject evolution – allowing us to categorize types of actors, and their conditions for entering the system, and also extend meta-organization theorizing by providing a novel structure that does not easily fit into the extant categories provided in the literature. We find that the boundaries that define its core membership, those that control the strategy, are porous with some actors being invited by extant members, whilst others force their membership through lobbying. Conversely we find that the boundaries for are closed periphery actors who make provide labor for the system. We also find a co-existence of heterarchical decision-making between the founders and key resource holders, with hierarchical decision-making between the founders and the vast project supply chain. This duality, we argue, is the result of megaprojects having two constituent organizational structures—a *core* and a *periphery*—that are fundamentally different, equally important, and symbiotically related to one another.

Following Siggelkow's (2002) lead to understand evolution toward fit, we examine the underlying developmental processes that shape how the megaproject's organizational configuration evolves to fit the environment. Unlike other organizations, the system-level goal of a megaproject is invariably achieved through the production of a capital asset. Thus, to uncover the developmental processes underlying megaproject evolution, we focus our study on the decision-making processes to design and develop the asset. Furthermore, designs provide the instructions for making man-made artefacts (Baldwin & Clark, 2000; Simon, 1981). As such, the designs can be expected to determine to a large extent the resources that the megaproject organization needs to acquire, and hence the resource-rich actors the founders need to entice.

We organize the remainder of this paper as follows. In Section 2, we discuss the meta-organization construct as it stands in the extant literature and how it connects to the mirroring theory linking design and organization structures. After explaining our methods in Section 3, Section 4 analyses the three megaprojects. We conclude by discussing the implications of our theory to our understanding of both megaprojects and meta-organizations.

2 DESIGNING META-ORGANIZATIONS

The extant theory of meta-organizations as it is posited in the literature shows a stark contrast between traditional firms and network forms of organizing. In the traditional conception of the firm the organization's design is greatly influenced by a central actor – the owner-entrepreneur (Kimberly & Miles, 1980). In a meta-organization, this role is assumed by the founding architect who, during the organizations early stages, imprints an archetypal structure and ideology (Boeker, 1989; Eisenhardt & Schoonhoven, 1990; Stinchcombe, 1965). But in contrast to a traditional firm, the meta-organization's founder is neither employer nor owner of the other members. Instead the founder relies on other mechanisms to exert its influence including supplier contracts, resource dependencies, technical expertise, and reputation (Blau, 1964; Gulati & Sytch, 2007; Raymond, 2008)

The founder influences two key structural properties of meta-organization design – member stratification and boundary conditions (Gulati et al., 2012). By creating a system that stratifies members' decision rights, the founder provides a degree of authority to certain members. In highly stratified meta-organizations, members of the upper tiers have increased decision-making privileges and responsibility. Conversely, in meta-organizations with flatter structures, members are held to be relatively equal.

When designating boundary conditions the architect influences the mechanisms through which external actors become members of the meta-organization (Gulati et al., 2012). When the boundaries are closed, a single ‘gatekeeper’ or the community at large selects new members from the environment based upon the resources that a potential member can bring in, e.g., labor or technology, capital, or less tangible inputs such as branding and reputation (Rothaermel & Boeker, 2008) . In contrast, open meta-organizations have few, if any, conditions for membership. Their members are self-selected with members volunteering for tasks (Lakhani & von Hippel, 2003). In open systems, the founder provides a democratic framework and some control mechanisms under which the memberships are allowed to develop with relative autonomy (Lee & Cole, 2003)

The meta-organization construct raises interesting questions to theory linking design and organization. Product development is a core activity for many meta-organizations (Baldwin & von Hippel, 2011). And importantly, mirroring theory suggests that development organizations want to align their structure with that of the product they are designing. In doing so organizations are thought to improve operating performance and product quality (Brooks, 1975; Henderson & Clark, 1990; Sanchez & Mahoney, 1996). Hence, the theory proposes, integral designs are best handled by individuals or small teams of like-minded actors, and conversely modular designs lend themselves to be designed by modular organizations.

3 RESEARCH SETTING AND METHODS

The discourse surrounding meta-organizations is still embryonic, leaving scope for exploratory inquiry. Comparative case studies have long proved a fruitful approach to building theory (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). They are particularly appropriate for contextual research (Yin, 1984) and suit well studies of process and change (Pettigrew, 1990). Hence to advance theory, we grounded our study on three megaprojects that unfolded concurrently in London: 1. 2012 Olympic Park; 2. Heathrow airport's Terminal 2 (T2); and 3. Crossrail.

A duality characterized the system-level goal of the publicly financed £6.7bn[2] project to build an Olympic park. It aimed to provide the sporting venues and athlete accommodation to host the Games, whilst catalyzing the urban regeneration of the East London area around the park. In contrast, the £2.5bn Heathrow T2 project was wholly financed by the airport's regulated private owner and operator, BAA. The goal was to co-locate the airline members of Star Alliance, which accounted for approximately 25 per cent of all traffic going through Heathrow, into a modern terminal. Using a mix of public and private finance, the goal of the £14.8bn Crossrail project was to deliver a high-capacity railway to increase the capacity of London's transport network by 10%; it involved building a tunnel and eight stations in central London and modernizing existing over-ground commuter lines east and west of London.

We chose this sample to vary two key attributes of megaprojects and build a diverse and polarized sample as recommended for process-focused inductive studies (Siggelkow, 2007). First, the cases differ by the sources of finance. We considered finance an important differentiating factor since we expected more potential members making claims on the development of a publicly financed megaproject than in a privately financed one.

Second, the megaprojects differ in terms of the potential for prior and future relationships between the members. The Olympic park was a sui generis endeavor unlikely to be repeated for decades to come. In contrast, the key actors in Heathrow T2 had a long history of collaboration in both day-to-day business dealings and prior airport expansion projects. In this dimension, Crossrail again was a hybrid. It was the first major commuter line jointly promoted by the national government and Transport for London. But talks were on going to recreate a similar arrangement to promote a north-south commuter line so-called Crossrail 2.

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[2] All prices in outturn costs, i.e., final or estimated final costs adjusted for inflation, unless indicated otherwise

The existence of prior and potential future relationships creates an environment more amenable for relational contracts to develop and influence behaviors (Gibbons & Henderson, 2012). Thus we could presumably expect to find different decision-making dynamics between a megaproject in which founders and key resource holders had expectations to work together again versus one with fewer incentives to collaborate.

4 DATA COLLECTION

We triangulated several data sources in this study including semi-structured interviews, analysis of archival documents, and on-site visits in order to improve the accuracy of our data and the robustness of the conceptual insights (Jick, 1979; Miles & Huberman, 1984: 234). Recent developments in organizing megaprojects in the UK have led that on paper their structures resemble corporate governance structures. Thus, to limit respondent bias (Eisenhardt 1989), for each megaproject, we interviewed executive and non-executive directors working for the founding architects or the public agency acting as their agent. We also interviewed senior managers in public agencies and operators participating in the megaproject, and staff in the supply chain firms involved in the project delivery activities.

The 2 ½ year field work began in the summer 2011 after the authors negotiated access to the top executive team of the Olympic Delivery Authority (ODA), the public agency set up in 2006 to deliver the Olympic park. Through its Learning Legacy project, ODA had committed to share knowledge and lessons learned. The ODA executive felt our independent theory building study fit nicely with their initiative. Armed with the ODA's letter of endorsement and the list of interviewees involved with the Olympic park, we found it easy then to line up comparable groups of interviewees at Crossrail and Heathrow T2. All in all, we conducted 75 interviews, one to two hours long, which we transcribed and organized in a digital database.

The interviews were complemented by numerous site visits, including a four week on-site observation at Heathrow T2 carried out by one of the authors. We chose Heathrow T2 for a longer observation on site because it gave opportunities to garner archival documents which were not confidential but would be otherwise difficult to access. Our archival data included internal and external documentation. For each case, internal sources included project reports, design documents, minutes from board meetings, financial statements, and project newsletters; for the publicly financed projects, we also studied parliamentary debates and documents upload online in response to requests under the UK's Freedom of Information Act.

External sources of data included detailed technical and managerial accounts and interviews with senior project staff in the trade press such as New Civil Engineer, Building Magazine, and Construction News, along with a vast array of newspaper and magazine articles. We focused data collection on understanding the evolution of the meta-organization's membership and concomitant evolution of the development of the capital asset. The archival documents helped to cross check the informant's accounts. Our emphasis on theory building meant that the information we sought was not deemed commercially sensitive, and we were not asked to provide anonymity or run quotes by the interviewees. Table 1 summarizes the job roles of the interviewees, their parent organization, and the number of interviews made.

Table 1 - Summary of Characteristics of the Case Sample and Interviewees

Case	System-level goal	Framework for goal delivery	Relational context for key resource holders	Organizational actors interviewed	Description of the actor	Informant interviewed (by job roles and number of interviews)
London Olympic park	Create an Olympic park to catalyze regeneration of East London	~£7bn public investment ~8 years of preliminary talks (1995-2003) ~9 years to develop and deliver (2003-2012) Immovable completion date	One-of-a-kind project Past and future collaborations: *Key resource holders had not and were unlikely to work together again*	Olympic Delivery Authority (ODA)	Public agency created to deliver the Olympic park	Chairman (#2); chief executive (#4); project sponsors (#3); directors of: construction/ property/ procurement; finance/ commercial/ design & regeneration (#3)/ transport/ utilities & infrastructure; head of design; head of programme assurance
				London2012 Ltd	Agency that produced bid	Bid advisor
				Organizer of the Games (LOCOG)	Private company created to deliver the games	Director of venues & infrastructure; Head of venue development
				Olympic Park Legacy Company	Public agency created to operate the park in legacy	Director of infrastructure
				Transport for London	Public agency in charge of London's transport	Director of games transport
				CLM ; Lend Lease	Private management and development companies	Programme supply chain manager; director of infrastructure; program director; deputy head of procurement; assurance officer; commercial director
Heathrow airport Terminal 2 (T2)	Modernize old airport terminal to co-locate the Star Alliance	£2.5bn private investment ~4 years of preliminary talks (2002-2006) ~9 years to develop and deliver (2006-2014) Fixed penalties if BAA changes plans without prior approval	One of many Past and future collaborations: *Key resource holders had and will continue to work together*	Star Alliance	Consortium of airlines	Project director (#2)
				Air Canada	Member of Star Alliance	General manager for commercial operations
				British Airport Authority (BAA)	Private airport operator and owner	Planning and programme director; capital director (#2); project director (#2); director of program control & performance (#2); director of integration; director of operations
				HETCo; Balfour Beatty	Private design and build consortiums	Commercial director; construction director; project director (#2)
London Crossrail	Expand railway infrastructure for commuters	~£14.8bn public-private investment ~6 years of preliminary talks (1995-2001) ~17 years to develop & deliver (2001-2018) Flexible completion date	One of potentially two Past and future collaborations: *Some key resource holders had and expected to work together again*	Crossrail (CRL)	Public agency created to deliver scheme	Programme supply chain manager; chairman; chief executive (#3); directors of commercial/ procurement /technical/ central area/ infrastructure/ delivery/ program/ financial/ operations; chief engineer; chief of staff; project manager (#2) ; head of risk management
				Network Rail	National railway operator	Director of infrastructure; chief executive
				Transport for London	Public agency in charge of London's transport	Director of operations
				Canary Wharf	Private funder of one station	Executive director
				Cross London Rail Links (CLRL)	Public agency created to promote scheme	Executive chairman; acting chief executive/managing director; financial director

5 DATA ANALYSIS

The research followed an inductive multiple case study methodology. Our core question (Eisenhardt 1989) was: what organizational form is a megaproject? To address this question, we explored the underlying developmental processes in each case through four related key questions: Which were the actors involved in development, and why did they get involved? How did they make design decisions? And what conditions allowed them to partake in development? Gulati et al's (2012) typology was our core frame of reference (Van de Ven, 2007) and provided a set of high-level codes (Miles & Huberman, 1994)

To allow for a more detailed level of inquiry (Yin 1984), we embedded units of analysis focused on the development of key functional components and the organizational structure underneath the design decisions. We used design theory to define a component as a distinct element which performs a relatively well-defined function or set of functions (Ulrich, 1995)

In a snowball fashion (Biernacki & Waldorf, 1981), we asked interviewees to introduce us to respondents who could provide complementary points of view. We also worked with interviewees to select units of analysis that could illustrate the concomitant evolution of the meta-organization's configuration and the development of the functional elements. Hence in the Olympic park, we probed in-depth into the development of the Olympic stadium, the aquatics center, and the Olympic village. For Heathrow T2, we focused on the development of the master plan and the baggage handling system. And for Crossrail, we focused the inquiry on the development of two central London stations and the train control systems.

To make sense of our data, we first developed detailed chronological accounts for each case. As we cycled between data and literature, a theory started to emerge that megaprojects were a hybrid meta-organization with two constituent structures. As we refined our theory, we kept filling gaps in our understanding through subsequent interviews. By late 2012, we had reached theoretical saturation as additional data failed to lead to new conceptual insights.

6 ANALYSIS: META-ORGANIZING AND DEVELOPING A MEGAPROJECT

Our analysis is structured around the evolution of the three megaproject organizations, and development decision-making therein. We first show how a megaproject organization emerges. The founding members create an inter-organizational *core* which sets the higher-order design requirements of the system-level goal. Core members share rights to develop the requirements, but in order to succeed they must negotiate a mutually acceptable goal.

The project supply chain firms in turn form a *peripheral* structure that implements the core's strategy. The suppliers bring knowledge and labor into the organization. Applicants compete against a market of rivals to be selected by the core. Unlike the flatness of the core, decision making in the periphery is hierarchical with formal contracts enforcing the decision-making authority of the core. The peripheral members design and build, but have no authority to change or veto the requirements – that design right is reserved solely for the core members.

We next examine how the two structures, core and periphery, evolve and make development decisions as they progress from an embryonic stage through gestation to delivery. We qualify the stages by the porosity of the boundaries and membership of the two structures, and by the nature of the agreements holding the members together. Table 2 and Figures 1-3 summarize our data and provide a backdrop illustration for the analysis.

Table 2 - Longitudinal summary of the megaproject meta-organization's constituent structures and membership

Case	Embryonic stage			Gestation stage			Delivery stage		
	Core		Periphery membership	Core		Periphery membership	Core		Periphery membership
	Membership	Development decision-making		Membership	Development decision-making		Membership	Development decision-making	
London Olympic park	3 founding architects *British Olympic Association (BOA); local government (Mayor of London) ; central government*	Flat, informal *Two MoUs between Mayor and government endorsed by BOA*	Closed boundaries *3 private consultants*	Porous boundaries >60 new members: *e.g., bid company;4 local councils; architectural lobby; IOC (*); transport bodies; 16 funders; 35 official sport federations, etc.*	Flat, mostly informal *Founders and new members negotiate mutually acceptable bid*	Closed boundaries *~ 3 private consultants*	Boundaries remain porous ;~# new members: *ODA (founders' agent); private developers; games and legacy operators; local communities; interest groups*	Flat, mostly formal *Members renegotiate budget and designs of master plan & venues;* *ODA-Locog negotiate handover protocol*	Closed boundaries *~ 1,600 supply chain firms at peak*
Heathrow airport T2	3 founding architects *BAA; Star Alliance; central government*	Flat, informal *Star Alliance and BAA sign off two MoUs endorsed by government*	Closed boundaries *No members join periphery*	Porous boundaries ~ 60 new members *the Heathrow broader airline community*	Flat, juxtaposing formal & informal agreements *BAA- airlines-regulator negotiate formal capital plan (2008-2013)* *BAA-18 Star airlines negotiate new informal MoU*	Closed boundaries *2 private consortiums*	Membership stable: *Only one new member (BAA T2 operator)*	Flat, mostly formal *BAA-airlines-regulator negotiate detailed design, capital plan (2014-2019)*	Closed boundaries *~ 160 supply chain firms at peak*
London Crossrail	3 founding architects *Central government; local government (Mayor); City of London Corporation (*)*	Flat, informal *Talks between central and local government, but no MoU signed off*	Closed boundaries *Central government working with 2 consultants*	Porous boundaries ~ 400 new members *founders' agent; 37local councils; Network Rail; private partners (e.g., BAA; Canary Wharf); 365 petitioners*	Flat, juxtaposing formal & informal agreements *Founders and Parliament negotiate Crossrail Act; Register of undertakings & Assurances* *Gentlemen's agreements on private finance*	Closed boundaries *4 private consultants*	Boundaries remain porous; ~# new members *CRL (founders' agent); EU regulators; private developers; local councils*	Flat, mostly formal *Founders and new members negotiate detailed design, private finance*	Closed boundaries *~ 1,700 supply chain firms expected at peak*

(*) IOC- International Olympic Committee; The City of London Corporation (City)is the municipal governing body of the City of London, the location of much of the UK's financial sector

6.1 Megaproject embryo: The conception of a meta-organization

A new meta-organization is conceived when a few actors, the founding architects, engage in talks to collaborate. During the embryonic stage, the founders craft a mutually acceptable system-level goal but stay short of developing it and making legally binding commitments. As they become more confident in their ability to converge their interests, they may signify their ambition by symbolically signing off a protocol or Memorandum of Understanding (MoU), instances of relational contracts with no legal implications (Gibbons & Henderson 2011). A transactional periphery where the founders contract out services may emerge at this stage if the founders lack in-house capabilities to do without supply chain firms. Figure 1 illustrates the evolution of the two structures in this stage for the three megaprojects.

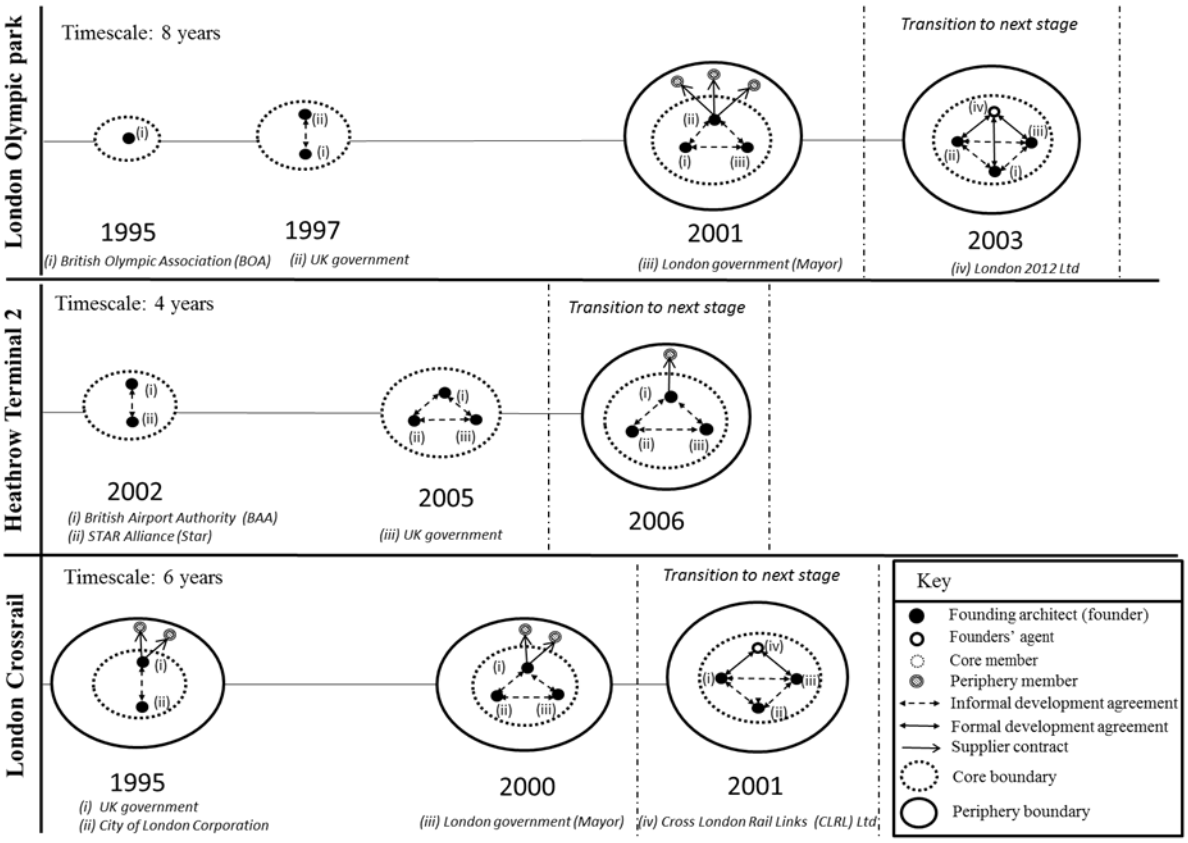
London Olympic park
Timescale: 8 years
Transition to next stage
1995
1997
2001
2003
(i) British Olympic Association (BOA)
(ii) UK government
(iii) London government (Mayor)
(iv) London 2012 Ltd
Heathrow Terminal 2
Timescale: 4 years
Transition to next stage
2002
2005
2006
(i) British Airport Authority (BAA)
(ii) STAR Alliance (Star)
(iii) UK government
London Crossrail
Timescale: 6 years
Transition to next stage
1995
2000
2001
(i) UK government
(ii) City of London Corporation
(iii) London government (Mayor)
(iv) Cross London Rail Links (CLRL) Ltd
Key
Founding architect (founder)
Founders' agent
Core member
Periphery member
Informal development agreement
Formal development agreement
Supplier contract
Core boundary
Periphery boundary

Figure 1 - Megaproject embryo: conceiving a meta-organization

.London 2012 illustrates the conception of a new meta-organization as three legally autonomous actors volunteer their resources to support a cause. The idea to bid for the 2012 Summer Olympic Games in London dates back to the mid-1990s. The British Olympic Association (BOA) first contemplated a London bid in 1995 right after the International Olympic Committee (IOC) rejected its third proposal (all set in other UK cities). In 1997, one of the major political parties made a manifesto commitment to back the BOA's plans. By 1999, political pressure mounted for a firm commitment: "there is an urgent need for greater ministerial involvement....to this country's future success in attracting major events", said a Parliamentary report. But work only began in earnest in June 2001 when the Greater London Authority (GLA), a public agency headed by the Mayor of London, joined the BOA and government to form a 'Key Stakeholders Group' to study the viability of a London bid.

During this stage, the relationship between the founders remained informal and flat. As none of them had sufficient skills to develop a bid, they selected three firms to help compare potential sites and provide feasibility studies—and a symbiotic relationship emerged with an incipient transactional periphery (discussed later). Amid spiraling cost estimates, in 2003, the government and the Mayor signed a MoU agreeing to back the bid, and after the three founders settled on an outline master plan for the Olympic park, they signed another MoU agreeing to a public sector funding package. In a position to bid for the Games but without in-house capabilities to do so, the founders created a public agency, London2012 Ltd, and gave it a budget to develop a bid and chase the key resource—the IOC's support; after 8 years of informal talks and studies, the whole venture was ready to move into development.

In this example each founder provided critical resources or functions to the embryonic organization. The GLA had powers to acquire land and develop a master plan; the UK government could finance the scheme; and only the BOA could nominate London as a potential host city. As the embryo was being conceived, amid lobbying groups competing for different locations, a system-level goal crystallized around regenerating a swathe of industrial wasteland in East London, heavily bombed during WWII, whilst creating a "sporting legacy" for the nation.

A similar social matching process (Barnett, Mischke, & Ocasio, 2000) characterized the embryonic stage for rebuilding Heathrow's T2, although the developmental process took half the time. T2's genesis dates back to 2002 when the UK government authorized BAA to build a new terminal (T5) to co-locate British Airways[3] operations by 2008, this released "space on the chess board" to facilitate further renovation of the airport. Immediately, Star Alliance (hereafter Star) demanded a 'guarantee of parity' and co-location for all its members. For BAA, this represented an opportunity to have two major airline alliances using Heathrow as a hub; and a year of negotiation, Star and BAA signed a MoU to collocate Star's members 'under one roof' by 2010. To meet this pledge BAA planned to expand the airport with a sixth terminal; but such a move required the UK government's approval. After the initial plan to build the sixth terminal raised major political opposition, the founders settled on a compromise—to rebuild the old T2 by 2012. To announce their consensus around the new goal, BAA and Star signed a new MoU in 2005.

At this stage, BAA priced the scheme at £1-1.5bn, a resource they would wholly provide; as one of Star's directors quipped "Star doesn't have a cheque book". Still, as part of its regulated business model, BAA needed to negotiate a budget with the industry regulator and the airport's entire airline community. As such BAA needed to further specify the design requirements that would fulfil the scheme's system-level goal. To this end, in 2006, BAA hired a consultant to conceptualize the new T2 design; with the emergence of this first periphery member, the meta-organization transitioned into the next stage.

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[3] British Airways was the leader of the OneWorld Alliance, the Star Alliance's main rival at Heathrow airport

Crossrail's history, like the Olympics, was peppered with failure; attempts to promote the scheme in both the 1970s and 1980s both failed to meet enough support and the respective meta-organizations collapsed. The meta-organization we studied reflects the third attempt to promote Crossrail. It began in the mid-nineties with the City of London Corporation (City) lobbying the government to revise the scheme. But progress was hindered by difficulty locating sufficient finance for the scheme. It was not until the end of the decade, when the City itself pledged capital, that the scheme began to take shape—"funding talks breathe life into Crossrail", announced one headline (NCE 1998) whilst a civil servant said "'they [City] seem to see the project in a similar way to ourselves". The Government commissioned feasibility studies, but it was not until the London Mayor took post in 2000 that it found another enthusiastic partner. But amid spiraling cost estimates and conflicting ideas about the system-level goal, the founders needed to draw on the supply chain to develop a mutually acceptable scheme. And in 2001, the national and local governments created a 50-50 joint venture, Cross London Rail Links, with a £154m budget undertake detailed design work.

Our analysis reveals a recurring pattern for the emergence of a megaproject meta-organization. A single actor envisages a new capital asset, but alone cannot mobilize enough resources to achieve their aim. It relies instead on attracting partners interested in sharing the utility of the capital asset to volunteer their resources in exchange for design rights. This process as the social matching process is affected by the determination of the parties and the vagaries of the environment and local politics

(Barnett, Mischke, & Ocasio, 2000). An incipient transactional periphery emerges if the founders lack in-house design capabilities. The informal nature of the agreements between the core members is the qualifying characteristic of this stage—the core members engage in talks to craft a mutually acceptable goal, but are yet to legally commit to its development.

6.2 Megaproject gestation: Parading, or the hard way

We define the start of gestation when the founders formally appoint an agent or a key supplier to develop the system-level goal. Throughout gestation, the boundaries of the meta-organization's core remain porous as its founders must let the membership expand to acquire additional resources that are critical to the scheme's success. New external actors are invited to contribute their resources in return for a stake in the development of particular elements; uninvited actors also fight to force their membership (discussed later). Decision-making within the core remains flat as the founders engage in negotiations both to formalize prior pledges, as well as make a spate of new informal agreements with the newer core members. The core assembles a periphery of suppliers that operate solely through formal contracts typically held with a single core member. We next analyze two processes, illustrated in Figure 2, through which the megaproject evolves in this stage: 'parading' and 'the hard way'.

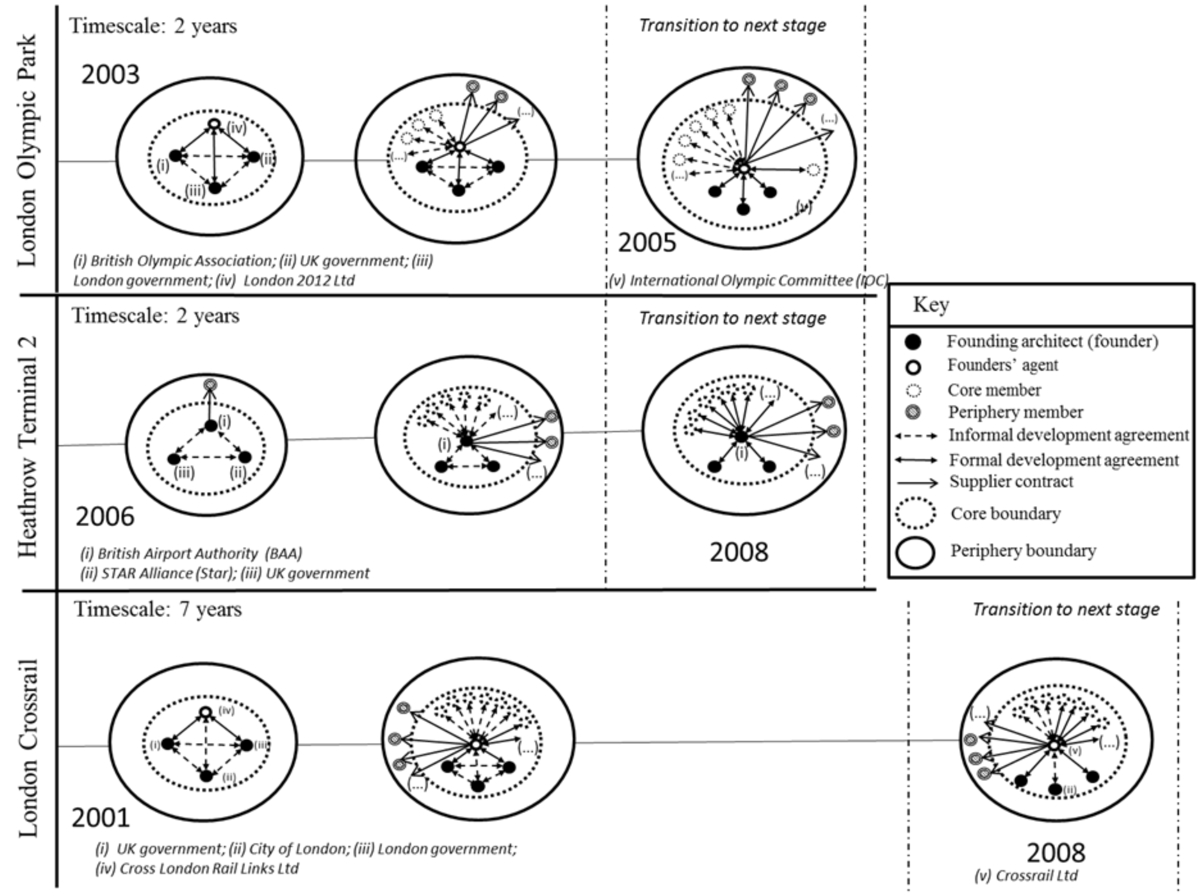
London Olympic Park
Timescale: 2 years
2003
(i)
(ii)
(iii)
(iv)
(...)
Transition to next stage
(v)
2005
(i) British Olympic Association; (ii) UK government; (iii) London government; (iv) London 2012 Ltd
(v) International Olympic Committee (IOC)
Heathrow Terminal 2
Timescale: 2 years
2006
(i)
(ii)
(iii)
(...)
Transition to next stage
2008
(i) British Airport Authority (BAA)
(ii) STAR Alliance (Star); (iii) UK government
Key
Founding architect (founder)
Founders' agent
Core member
Periphery member
Informal development agreement
Formal development agreement
Supplier contract
Core boundary
Periphery boundary
London Crossrail
Timescale: 7 years
2001
(i)
(ii)
(iii)
(iv)
(v)
(...)
(i) UK government; (ii) City of London; (iii) London government;
(iv) Cross London Rail Links Ltd
Transition to next stage
2008
(v) Crossrail Ltd

Figure 2 - Megaproject gestation: expansion of the meta-organization

6.2.1 Parading

The Games' case is telling of a brief gestation in which the founders sought to attract new members through grandiosity; making informal, exciting, and often speculative pledges, agreements, and promises. With London2012 ltd being created in June 2003, coinciding with the London announcing its intentions to bid, it was given an original £15m budget by central government which soon soared into £30m. The bid company quickly grew from what one respondent described as "three people, a card box, and a mobile phone" into a staff of 80, whilst the founders' senior management took directorship positions on the board. The IOC gave cities less than two years to submit a final bid which pressurized the core members to converge their heterogeneous design preferences and priorities. The process the IOC used to select a city was multipart including first a questionnaire covering high level themes of the cities' bid to be completed by January 2004. London2012 Ltd branded the meta-organization as a 'regeneration games' to attract local support. But London2012 ltd would have to move fast the IOC would require a fully formed bid to be submitted in November 2004, quickly followed by IOC visits to candidate sites in February 2005, and finally the IOC members would vote on their preferred location in July 2005.

London2012 limited engaged a wide range of stakeholders during this 2 year period including the Lee Valley Regional Park Authority, the four East London boroughs, and the individual sports associations controlled by the British Olympic Association. London2012 ltd reasoned that the endorsement of these core actors would boost the bid's credibility; the lead architect said 'If London can say it's got planning permission for the Olympics, it puts us ahead.' In turn, other actors forced entry into the core but saw their design rights restricted for particular elements. For example, the architectural community lobbied for world-class designs, and joined the panel that chose the architect for the aquatic center. Amongst the population at large support for the Olympic bid remained high despite a sharp spike in estimated budget during the bidding process. However, there were suggestions that opposition was mounting in the environment from Londoners aggrieved at local tax to fund the game, and Transport Unions who feared the increased workload on London's already stretch transport infrastructure.

The deals brokered between the core members remained informal. As the bid regeneration advisor put it: 'the money doesn't exist in the beginning... but you cannot bid for those resources until you know you're in the game and you win'. Hence the only formal contracts were held between the bid company and the peripheral suppliers selected to put assist with the bid book.

The resultant agreements would morph in November 2004 into a ‘bid book’, which captured the pledges of all core members ranging from the founders to London’s transport agencies and local councils. One bid advisor described the process:

> *The Olympics is a beauty parade.......frankly, the bid was not much more than a concept, a sales document...it’s speculative, [it’s] sales, meetings ... persuading people to back them. You don’t do the detailed feasibility work because... you might have 1 in 10 or 1 in 4 chances... there’s a philosophy of winning it and then worry about how we‘re going to deliver it.*

The IOC controlled an irreplaceable resource- the Olympic brand - the acquisition of which would pave the way for the founders to obtain both the capital and land to deliver the Games. This idiosyncrasy automatically gave the IOC and all the affiliated sports federations’ membership in the core, and enabled them to stipulate requirements such as minimum capacities for the venues and acceptable distances between the venues and village.

6.2.2 The hard way

In marked contrast, the gestation of the other two megaprojects was beset by conflict between the core members. In both cases, a full-fledged development of the system-level goal was a prerequisite to acquire critical resources such as BAA’s guaranteed return on the capital to build T2, or the capital and power to buy land in Crossrail’s case. BAA, for example, first pledged that T2 would “rival the scale and ambience” of T5. But Star disliked the design of the original proposal and asked the local councils to reject it because, the Star director said, “from a campus perspective it doesn’t have all the elements which is going to make this work”. Star felt aggrieved that the timescale spelt out in the MoU had slipped, and told the regulator of BAA’s behavior in a letter: “BAA and BA are indirectly conspiring not to allow a competitor equal ability to see the realization of facilities that match the T5 campus.”

Star and BAA’s relationship remained fractured throughout the development process. Star’s project director recalled: “I got called Mr. Masterplan because … [I said] ‘you cannot design this from the bottom up, it has to be top-down with the master plan’”. To complicate matters, BAA had to invite Heathrow’s remaining airline community (approximately 60 airlines) to attend ‘constructive engagement’ meetings to discuss the scheme. These design discussions were needed to fix, in advance of construction, a capital expenditure plan for T2. This legally binding agreement would specify triggers of pecuniary penalties if BAA failed to fulfil obligations later on. Through multilateral bargaining, the core agreed to ditch the aspiration for T2 to rival T5’s aesthetics, and BAA replaced the architect. After two years, the core formally agreed the higher-order design requirements for the first phase, and a commensurate budget and timescale. In addition, BAA and Star signed a new MoU with more detailed design requirements for the new terminal.

With a larger and more heterogeneous group of actors joining the core, Crossrail’s gestation was even harder. To receive land purchasing powers from the UK parliament, the core needed to settle on detailed design requirements and a budget. From the onset lobby groups, spearheaded by the London business community, demanded a change to the system-level goal; a former transport minister joined the chorus and said: “We cannot simply submit the same application that failed last time... it's got to be a lot more than a central London tunnel.“(NCE 2002). Aware that in the years following previous bids for Crossrail Canary Wharf had changed London’s economic geography[4] , the founders invited Network Rail, the owner of the national network, to reshape the goal.

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[4] Along with the traditional City, Canary Wharf is London’s second main financial centre located in East London

The boundaries of the Crossrail's core remained porous throughout, and many actors invoked their right to enter design discussions—'it's all politics at this stage... you do the design, then the politics, then back to the design...you come up with an idea, work it up... and then react to the comments', explained the acting CEO. Numerous local councils, for instance, demanded station enhancements and noise mitigation along the route; London Underground insisted Crossrail stations and their stations should be connected, and private firms pledged finance in exchange for stations on their land. Once the founders' agent introduced the design to Parliament it set off a new round of formal design deals with local communities, businesses, other councils and individuals—'people come out of the woodwork with concerns' said the managing director.. But the petitioners' involvement in the development lasted only the time it took to hammer out a deal.

The scheme remained in gestation for 8 years during which time the relationship between the local and national governments oscillated —one respondent called it 'a complete bloodbath,' whereas another described it more as 'normal rough-and-tumble politics'. Under the chairman's mantra that Crossrail had to be 'world-class and affordable' the core finally settled on a design and commensurate budget. But it managed to only tacitly agree on a 2017 opening date. And the private entities' pledges to supply money remained gentlemen's agreements celebrated with a handshake, but yet to fold into contracts drafted by lawyers.

The qualifying property of gestation is therefore the juxtaposition of formal and informal development agreements between the core members. But, as observed, the proportion between the two varies. On one end of the spectrum is *parading* wherein the core elects to chase *one* resource which will guarantee the acquisition of all the others. This approach, which by no means is 'easy' when many organizations are playing the same game, speeds gestation by postponing many difficult decisions. On the other end is the hard way which requires the core members to formally negotiate the requirements and commensurate resources to survive. In this case, gestation is protracted and fraught with conflict at the core.

6.3 Megaproject Delivery: Relative Stability in the core, explosion in the periphery

We define the start of delivery when the core has acquired sufficient resources to begin the construction of the scheme. In delivery, the core members must crystalize the remaining informal agreements in preparation for the hiring of a vast construction supply chain. The core membership remains relatively stable, but its boundaries remain porous. For instance, the asset operators who supply operational knowledge can be a late comer if they were yet to become a member. And occasionally, new parties may lobby or be invited for a late inclusion (discussed later). Figure 3 illustrates the exponential growth of the periphery vis-à-vis a relatively stable core.

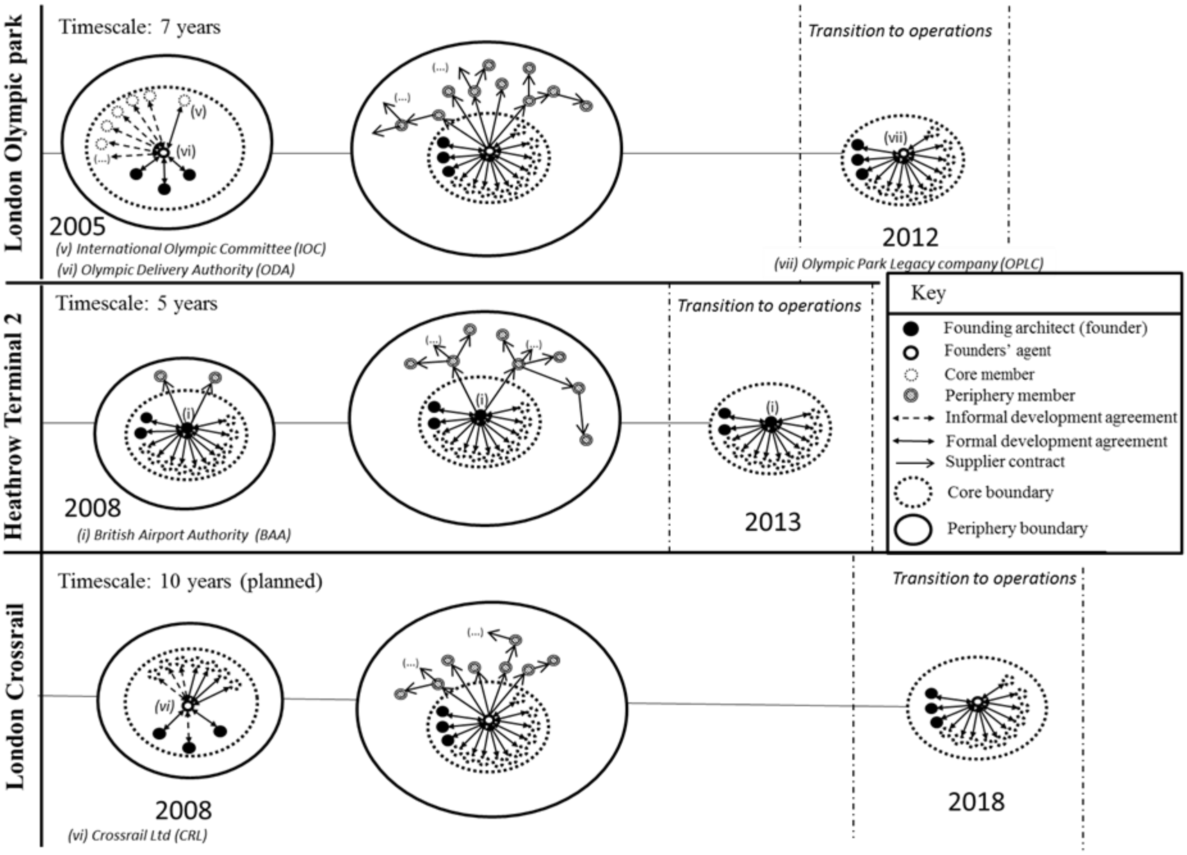
London Olympic park
Timescale: 7 years
(v)
(vi)
(...)
2005
(v) International Olympic Committee (IOC)
(vi) Olympic Delivery Authority (ODA)
Transition to operations
(vii)
2012
(vii) Olympic Park Legacy company (OPLC)
Heathrow Terminal 2
Timescale: 5 years
(i)
2008
(i) British Airport Authority (BAA)
Transition to operations
2013
Key
Founding architect (founder)
Founders' agent
Core member
Periphery member
Informal development agreement
Formal development agreement
Supplier contract
Core boundary
Periphery boundary
London Crossrail
Timescale: 10 years (planned)
(vi)
2008
(vi) Crossrail Ltd (CRL)
Transition to operations
2018

Figure 3 - Megaproject delivery: stability at the core, explosion at the periphery

If the meta-organization paraded through gestation, it inevitably faces major challenges in delivery. After London won the bid, for instance, the bid book folded into a contract—'they [IOC] certainly learned the trick...that you deliver in the spirit of that contract but not in the detail', said one bid advisor. With seven years to deliver, the founders set up a new agent, the Olympic Delivery Authority (ODA), and created layers of governance to oversee the whole enterprise. ODA were granted powers to buy land, award planning consent, and transact with the supply chain —'we're firmly on the driving seat', said one ODA director. Still, the IOC demanded the creation of the games operator, LOCOG[5]. As the IOC's watchdog, 'effectively the bid company' quipped one respondent, LOCOG joined the core— "we build the theatre, LOCOG is the impresario putting on the show" was ODA's leitmotif. The main task for ODA was to formalize prior pledges. One ODA director said:

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[5] London Organizing Committee of the Olympic and Paralympic Games

We spent the first year trying to get to a point where ... we could go back to Government and say 'this is the detailed scope, the delivery plan, and this is what it's going to cost' and....they all fell off their chairs because it had very little relationship to the bid book.

The 'disconnect between bid promises and reality' as put by one ODA director required the founders, their agent, and other core members to renegotiate a new master plan and a comfortable (~£8bn) budget capable to cope with all the challenges in the pipeline ('if you're going to be hanged, might as well be for a sheep as for a lamb, argued the ODA's chairman). It then took two years for the core members to produce the 'yellow book', a formal agreement that became the linchpin of their relationships. The ODA's chief executive said:

the rule was there would be no money released and budget approved until the yellow book was signed off....It set out bills of quantities, assumptions on timetable, exclusions, work assumed by others, and a full detailed scope. It was an incredible powerful control document

The growth of periphery membership to deliver the park was exponential. And at its peak, around 2009, the ODA had signed off direct contracts with 1,600 project suppliers.

In marked contrast, the Heathrow T2's meta-organization inherited a detailed plan and a budget. And yet, at the onset of delivery, a BAA review found a £250m shortfall in funding. Locked in a formal contract, BAA insisted to bed down upfront the details of any development agreements yet to formalize. This posed major difficulties to Star whose members were not all on the same page, and thus wanted more time to develop. One BAA director compared airlines to a child entering a sweetshop: 'some days they might want some pear drops and liquorish; they're not quite sure, but they know they want something.' When push came to shove, Star refused to sign off the design proposed by BAA:

> *They [BAA] bring new drawings to this meeting and people, myself included [Star project director], said 'what's that?' They had changed a whole bunch of stuff they hadn't discussed....so we then wrote a letter back saying ... that if they didn't rectified the design within the next 3 months, we would be writing to the regulator*

To resolve the conflict, BAA and the airlines rekindled negotiations on the master plan. BAA insisted that a modern baggage handling system could only be installed in the second phase, but to soothe Star it agreed to 'safeguard' (Gil, 2007) for this by building a basement area upfront ('If I had more space, I would put the bloody baggage system in', said one BAA director). The core also agreed to shift capital committed to other parts of the airport to fund an enhanced T2, and to delay the opening one more year. The future BAA operator joined the core at this stage, but the issues with them got resolved through the company's hierarchy.

The periphery membership grew as expected. But BAA chose to chunk the project in big work packages to reduce the number of firms in direct contract. Uniquely to this case, as the core members continued to work out a detailed design for T2's first phase, they concurrently started the first round of formal negotiations for the development of the second phase.

The Crossrail's meta-organization's core also grew slightly in delivery. Similar to the Games case, the founders appointed a new agent, Crossrail Ltd (CRL). The new people pointed to a £2bn shortfall in financing. Since the budget had already been fixed, it became imperative to renegotiate the design requirements and chase new sources of funding. One chief concern was to fold the financial pledges of private entities into formal contracts. Another priority was to engage in a round of new design deals with local councils and private developers for property developments above the stations. And hence the private developers joined the core. Concurrently, the core members started discussions to ditch design features such as station enhancements that were yet to be legally committed. One CRL director said:

> *When I joined, the forecast cost was several billion [pounds] higher than the maximum funds available.... You find pieces of scope that have no justification because nowhere ...it said 'do this piece of work'...we agreed to do something, [but] it was never a legal commitment*

The core members also engaged in an organizational process to appoint a Crossrail operator amid sharp disagreement between the founders as to the extent this actor should be given design rights and hence invited to join the core. The evolution of the meta-organization's periphery then followed the normal course. At its peak, Crossrail reckons it will play host to over 1,700 suppliers selected through a competitive tendering process.

In summary, the delivery stage is qualified by the efforts of the meta-organization's core to stabilize membership and solidify commitments, and the concomitant need to grow the periphery to 'get things done'. The two structures are symbiotically related: the core needs the periphery to achieve the goal, which creates opportunity for the periphery to generate profit. We next examine three developmental processes underlying the growth of the core membership.

6.4 The porous boundaries of the core

The boundaries of the core remain porous throughout development, but the core is not open to everyone. Hence resource-rich actors can buy their membership or wait to be invited by an existing member. The Olympic village is a good example. At the onset of delivery, the core realized a private developer had been awarded planning consent for part of the land—'the Olympics was basically stymied because it didn't control the central pieces of the land', explained the ODA CEO. To acquire the land, the core invited this developer to join in and reengineer a new master plan. With the land issues out of the way, the core selected another developer, a so-called 'delivery partner', to design the village provided it put equity on the scheme. But when this developer had to be bailed financial out two years into delivery, it saw its membership rights revoked.

The core then had to renegotiate a new village design. After lengthy talks (‘the tension was to maintain the bed numbers, the landscape’ explained a Locog director), the village size was reduced and the internal layouts of the building blocks altered to suit the needs of a developer who pledged equity if part of the village could be converted in social housing.

A second example, of changes to the core membership late in the scheme came when BMI the key airline for STAR alliance’s occupation of Heathrow T2 was taken over by a rival airline due to financial pressure. This shock loss of a key part of the meta-organization left BAA and STAR with a significant gap in their plans for the operation of the terminal casting uncertainty over whether the newly freed space would be used by rival airlines or by STAR themselves and how that would impact on the interior design of the building. Thus demonstrating that it is not only the growth of new members that can change design requirements.

Whilst communal bargaining is central to the core’s decisions once an external actors becomes a member its power to influence development can seem disproportional to its stake. This potentially makes the design process arduous and as such the core are reticent to allow resource poor actors to become members

6.4.1 Keeping potential core members at bay

The development of the Olympic Stadium is telling of the core’s efforts, although not necessarily in unison, to fend off a resource-poor actor’s efforts to force membership. As part of the bid the founders committed to transform the stadium into a smaller venue to host athletics events after the games. But from the onset premier league clubs lobbied for a football legacy. Their political maneuvering was met with disdain by the core members affiliated with athletics, but supported by those who worried about creating a white elephant. Conscious of the time limited nature of the scheme the ODA prompted the core to make a decision regarding the football clubs potential membership. Admitting he was not a football fan, the ODA chief executive said:

> *What's wrong with leaving an athletics center... why do we always have to have a football club? Why do we have to publicly subsidize the richest clubs in the world? It's public land, it costs a fortunate to accommodate...don't renege on your responsibility to public sport*

After months of heated discussions during which not a single club dared to commit capital, the clubs were excluded from influencing the stadium's design. But the core remained divided—'we went to the board three times...there were no credible bids. Full stop', recalled one ODA Director. Still, some members favored investment in retractable seating to create a dual-purpose stadium, an idea opposed by the football lobby (which deemed it sub-optimal) and by other core members (which found it too expensive). Ditching an athletics legacy was also out of question. In the end, the core settled on an expensive flexible stadium, which could either be demountable for athletics or adapted to host football—'one of our trickiest decisions', said the ODA chairman which regretted a dual stadia had not met enough traction.

Crossrail provides a second example of the core members' maneuvering to keep a potential member at bay. Early on in gestation, the European Union regulator ruled that Crossrail needed to implement a yet to be developed new rail traffic management system, and offered some money to R&D. With a fixed budget and a history behind of railway projects that had derailed after going for untested technologies, the founders wanted to apply for derogation. But Network Rail who owned the national network opposed since it was planning to adopt the new technology in other parts of the network. One Crossrail director put it

> *It's hugely complicated...the signaling system that they [Network Rail] have is not the one they are going to have in 2019. We [Crossrail] have got to get our technology to*

work with their new technology, and neither of them exist at the moment in working practice

Ultimately, the core members judged that on balance they preferred to manage the interface risks with Network Rail to incurring the risks of adopting untested technology, and opted, successfully, to stave off the EU's attempt to act as a standard-setting actor (Iansiti & Levien, 2004)

The Heathrow T2 case is also interesting because the development could be tactically framed as a replacement like for like of the old T2. This approach would neutralize the local council's planning power to influence the development, effectively excluding them from the core. But it created a tricky situation for Star. On the one hand, Star appreciated that the development could progress a lot faster without the local council on board. But on the other hand, Star worried that a staged approach would make it easier for BAA to ditch plans to develop a full-fledge campus later on. With Star divided about what to do ('we don't have the power of veto, said a Star director), BAA went ahead with a staged planning application.

We now turn to analyze how an uninvited actor can, after a fight, enter into the core.

6.4.2 Forcing membership into the core

A third process shaping the evolution of core toward fit were situations where it accepted defeat after failing to swat away an actor forcing membership. Crossrail's Farringdon station is a case in point. The local council asked for the design to accommodate toilet facilities but could not force the decision because its core membership was restricted—the Council had planning powers for the over ground developments, but not the underground areas. To their dismay, the founders in gestation told them to 'bugger off' because underground toilets were not encouraged by the police—'they're nothing but a nuisance', said the managing director. Unwilling to accept defeat, an elected local politician decided to raise a ruckus in Parliament:

> Will the Minister [of Transport] join me in urging Crossrail to build some toilets at Farringdon?...They are causing years of inconvenience to local residents and businesses—this is the least they can do. At the end of the day, men piss (sic) against everything around here.[6]

Increasingly concerned that the situation could escalate, the founders finally caved in to the council's demands three years into the delivery stage. We conclude the analysis with a brief examination of the influence of the periphery over the development.

6.5 The growing influence of the periphery in development

We did not observe any instance of the core awarding rights to design the requirements to a peripheral member, nor an instance of the core committing to let the delivery contracts to the consultants appointed in gestation. Still, as the periphery membership expands in delivery its influence over the requirements grows concomitantly since the core needs to account for the commercial impact of any late design deal. And importantly, it can become quite hard to replace a peripheral member once formally hired.

The Games case is telling of the periphery's influence over the core's embryonic development decisions, and the core's awareness of the commensurate risks of suppliers behaving opportunistically. When the founders were mulling over bidding for the Games back in 2001, they contracted a supplier to develop a cost-benefit analysis. With a master plan yet to be developed, the supplier outlined the requirements and a ballpark cost. This baseline turned out to be however very low, and the budget estimate significantly overshot after two years of informal deals between the founders, and a review by another supplier appointed as a watchdog. Forced to defend its methodology from insinuations of strategic misrepresentation and optimism bias (Flyvbjerg et al. 2003), the first supplier said 'we developed our own specimen Games—and I must emphasize specimen Games... that provided the basis of our appraisal....the methodology was accepted by the Treasury... [it] was very strong.[7]

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[6] Daily Hansard- Debate, Commons Debates, House of Commons, 23 June 2011

The Aquatics center in the Games case illustrates a similar symbiotic relationship but in gestation. As part of the bid strategy, the founders and newer core members committed to signature architecture for the Aquatics center; a Locog director recalled: "we needed an iconic building, something to capture people's imagination". At the onset of delivery, however, it became obvious the design did not fit the site and way exceeded the bid budget. This created a dilemma because the core did not want to go back on their word. But persuading the architect to sign off a more affordable design was tough—'if you challenge these people they'll just walk away... they're big fish in probably quite small ponds,' explained the ODA chairman mindful they had been forced to foot the bill for promises past.

Once the meta-organization moves into delivery, it gets arguably even more difficult to substitute key suppliers. The need to let the design evolve, however, is endemic because the boundaries of the core remain porous and the environment keeps changing—'to say there'll be no change, it's like saying the sun will never rise', quipped a BAA director. Hence the amount of flexibility the core builds in the contracts with the suppliers largely dictates the extent to which they will push back on the core's requests to change the design requirements.

The case of Heathrow T2 is telling because, faced with a tight and fixed budget, BAA engaged in arm's length practices with the supply chain firms. The BAA capital director said: "[open] competition is the best way for me to demonstrate value for money to the regulators... there‘s going to be less opportunity for those companies who sit on their hands.” Unsurprisingly, BAA’s stance made the peripheral members more aggressive commercially to protect their profit margins—‘sometimes we’re being accused of being inflexible; I think sometimes the client [BAA] is guilty of not listening’, said one supplier director. To the dismay of Star, the tensions between BAA and the project suppliers then amplified BAA’s reluctance to change the requirements—“You spend your time upfront specifying, and if you have to make changes it better damn well be good”, said BAA’s capital director.

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[7] Bostock , M. (2003). Minutes of Evidence taken before the Culture, Media and Sport Committee. Examination of Witnesses. House of Commons. UK Parliament. 14 January 2003

In summary, our analysis of three megaprojects through a meta-organization lens uncovers two constituting structures: a porous core that controls the design requirements, but has no in-house capability to design. And a closed periphery that can design, but is excluded from debates to set the requirements. Decision-making that intermediates the relationship between the evolving core and periphery is hierarchical and pivots around transactional contracts. In contrast, decisions within the core are the outcomes of intense bargaining.

We now discuss this conceptualization in light of theory in meta-organizing and design.

7 DISCUSSION

Our analysis suggests that megaprojects fit well the meta-organization construct (Gulati et al. 2012). Irrespectively of the developmental path followed by a megaproject, it unifies a network of legally autonomous actors under a shared goal. In agreement with theory, its actors range from firms and public agencies to communities and individuals, and the source of authority between them are not ownership stakes or employment relationships.

However, megaprojects fit poorly with the four ideal meta-organization types defined in terms of boundary conditions and member stratification. Mega-projects cannot be classified as open systems since a significant class of members—the project supply chain—cannot self-select or volunteer for tasks. The megaproject suppliers, as expected of a system with closed boundaries, must instead apply for membership and wait to be selected by the founders or their agent. But equally a megaproject cannot be classified as a closed system because its boundaries are relatively porous, particularly in the early development stages, for resource-rich members interested in sharing the capital asset in use and hence influence the design requirements. And throughout the megaproject life-cycle, uninvited actors can force membership to influence the requirements and thus shape the organization's identity (Santos & Eisenhardt, 2005) if the core fails to block their attempts.

Neither do megaprojects fit linearly with the two ideal types that differentiate the meta-organization's members. In stratified meta-organizations, the higher-tier members have increased decision-making privileges and take additional responsibility for orchestrating the efforts of other members. This fits with the relationship between the core and the vast project supply chain. Only the former share rights to set the requirements, at least directly. The latter understand this as a condition of the selection process, but stay vigilant to ensure the actions of the former do not hurt their commercial interests. Concurrently, decision-making in megaprojects is rather flat amongst the members that contribute critical resources in exchange for rights to influence the design requirements. Amongst them, decision making requires extensive negotiation to achieve community consensus as typical of egalitarian systems.

Hence, we argue, megaprojects are a hybrid meta-organization. Crucial to understand this hybrid form is to acknowledge its two constituent structures, the core and the periphery.

7.1 The flat, porous core

We define the megaproject's core as a flat organizational structure that collectively holds the authority to negotiate the design requirements that qualify the system's goal. The core cannot be considered truly open, rather it has a degree of porosity which allows actors to claim membership in exchange for their resources. Thus the core's membership is limited to a select few members who wish to contribute (or indeed wish to freeride) – these members can be proactively sought by the architect to strengthen the scheme, or can emerge from the environment and force their own membership through lobbying. The inception of a core is a social matching process in which the founder and other potential parties seek out a mutually acceptable goal (Barnett et al., 2000). For the founders, core membership is permanent and gives them system-wide rights, whereas for others is transient and bound to a functional element. As characteristic of planning processes in ambiguous contexts (Stone & Brush, 1996), the core faces a balancing act. On the one hand, it needs to entice actors interested in sharing the future asset to commit resources in exchange for a stake in development. On the other hand, it must collectively nail down a goal to gain legitimacy and align the resource commitments with the development needs.

However, not all critical resource holders are substitutable which translates into an unexpected boundary condition for the core – some newer members self-select themselves; others can force their way in. This suggests that the megaproject's core has no single gatekeeper empowered to exclude external actors. Hence, consistent with the extension of mirroring theory into capital development settings (Gil and Baldwin 2013), the structure of the core gradually comes to mirror that of the organization that will share the asset in use.

However, these core members are unlikely to have the same preferences and priorities for the requirements of the system's goal. Not only they have different skills and knowledge bases, but are also likely to operate under different planning horizons, a major cause of conflict in social processes (Ostrom, 1990) and capital design (Gil, Miozzo, & Massini, 2012; Gil & Tether, 2011) For example, some actors were focused on getting the master plan of the Olympic park right for the Games, whereas others were chiefly concerned with getting it right for legacy. Likewise, BAA makes a capital investment to last decades, whereas Star airlines operate under much shorter planning horizons—in effect, the key domestic carrier that was part of Star left the alliance mid-course throwing BAA's plans for a hub in disarray.

Heterogeneity in preferences and priorities across these claimants would be less of an issue if the designs were modular. But unlike open sourcing (MacCormack, Baldwin, & Rusnak, 2012) , large-scale assets exhibit have a degree of integrality that makes them difficult to partition due to simple physical constraints and the one-to-one relationship to the land (Gil and Baldwin 2013). Hence, endemic to the core, we argue, is an appropriation problem characteristic of development processes with the structural properties of an Ostrom (1990)'s common-pool resource.

To satisfy the requirements of one core member, another needs to give up some of its demands. Since no design is viable without the critical resources provided by the many non- excludable actors, the core members must engage in a collective bargaining throughout development, negotiate trade-offs, strike compromises, and hammer out deals. This is in agreement with empirical accounts of megaprojects that report intense competition between project stakeholders for control of the design, budget, and timescale (Flyvbjerg et al., 2003; Merrow, 2011) and political interference from public agencies (Miller & Lessard, 2001).

7.2 The closed, transactional periphery

Whilst the core dictates the design requirements of the megaproject, its members rarely have the in-house knowledge, skills, and labor necessary to design and build. Rather, the core acquires these resources through a selection process. In contrast to the monopoly that some core members exercise over particular resources, multiple suppliers with similar capabilities compete on the open market. For example, the political endorsement of the City of London to Crossrail is not substitutable, but there are a few suppliers capable to design and build stations and tunnels. Hence exchanging one supplier for another with equivalent professional capabilities, ceteris paribus, does not require major changes to the requirements.

That is not to suggest that all potential project suppliers are equivalents; an actor seeking membership to the megaproject must demonstrate their suitability through competition against peers. But rather that the suppliers' main activities involve supporting the core and translating its requirements into designs and physical artefacts—the suppliers are not hired to disregard, alter, or veto the design requirements. Hence, we call the suppliers peripheral members of the meta-organization. Because they only become meta-organization members if the core selects them, the boundaries of the periphery are effectively closed throughout.

Peripheral members work in a procedural fashion; work is carried out in accordance with formal transactional agreements with the core member who granted them membership. Peripheral members can propose changes to the requirements set by the core, but it is up to the core to accept them or not. Of course this does not minimize the role that suppliers play in achieving the system's goal. For example, as the core members scramble to reconcile their divergences, they risk unravelling a project or depleting planning contingencies if they do not work with suppliers first to assess the potential impacts of any design deals to be brokered after letting contracts. In this sense, the value of involving the suppliers in the megaproject development process early on is similar to that stemming from early supplier involvement in new product development processes (Womack, Jones, & Roos, 1990)

Still, suppliers are controlled hierarchically through formal contracts. Suppliers may be free to subcontract work out to other suppliers, but their actions must remain within the bounds of the design requirements set forth in the formal contract held with the core.

Notwithstanding suppliers' exclusion from the core, periphery and core stay symbiotically related as the meta-organization evolves. The periphery can undoubtedly make certain choices on requirements more appealing than others. The periphery for example could not intervene until the core resolved what it wanted for the Olympic stadium. But once the core settled on a demountable stadium, it was entirely up to the private consortiums bidding for the job to produce alternative proposals. And once one supplier was selected and the transactional conditions were agreed, the core effectively became locked in a contractual relationship. The core could still potentially change some of the design requirements, which it did, but only after negotiating the impact with the suppliers to pre-empt future litigation.

Whilst different forms of supplier contracts vary in the amount of flexibility built in to accommodate change, the appointment of a major supplier invariably restricts the flexibility hitherto enjoyed by the core members to make design deals. The core can still go ahead and change things, but should not assume the suppliers will foot the bill. Open market selection together with hierarchical decision-making are thus the periphery's qualifying attributes, i.e., the periphery exhibits the structural properties of an extended enterprise (Gulati et al., 2012).

Finally, whilst the architect selects the periphery from a competitive market there are sometimes internal pressures within the meta-organization that try to influence the choice of a rival periphery. For example in the case of Crossrail there was a tension between the EU regulations around fair competition for selecting suppliers and background pressure from government and lobby groups to provide contracts to UK based suppliers. Falling foul of the EU's regulations would have serious ramifications for Crossail's reputation, whilst at the same time central government was worried about a political fallout over giving much needed work to a rival of British firms. Thus even when selecting a periphery architects must be careful to balance the demands of the other core members and maintain legitimacy in the eyes of external onlookers.

7.3 Co-Evolution of Organizational Structure and Technical Design

Literature on product development can shed some light into the inner workings of megaproject systems. Complex systems of production can be considered in terms of a technical architecture and an organizational architecture (Baldwin & Clarke, 2000). In a megaproject context the technical architecture can be viewed as the design of the infrastructure asset; whilst the organizational architecture is the makeup and structure of the meta-organization itself. These two architectures are inherently interrelated as the choices of organizational structure influence the choices of technical structure and vice versa. At the outset of a new development the system level goal of the meta-organization places boundaries on the technical design to achieve that goal.

Our analysis has shown that the organizational structure of the meta-organization – the core and periphery – grows through periodically in the fashion found in punctuated equilibrium models of organizational change (see Gersick, 1991 for a review) to bring in new resources and technical capabilities. During periods of change new ideas, and demands, flood into the system from core members. And during periods of relative equilibrium designs are gradually formalized and made increasingly detailed by the periphery members. As this process occurs the technical system itself is redefined to fit the zeitgeist of the meta-organization.

At a system's level the specifics of changes caused by an individual member may be masked, but the co-evolution of the technical and organizational systems becomes increasingly apparent when studying specific components in the overall design. Consider the simplified timeline for the London Olympic Aquatics Centre showing in Table 3. Each major shift in the organizational structure after the initial announcement of a scope is accompanied by a direct change to the technical structure of the infrastructure design. Importantly the aquatics center shows that even at a late stage in the development, 3 years, into the delivery stage of the scheme there still changes to the core and it results in significant design changes. Thus we cannot consider the meta-organization to enter complete inertia even if the delivery stage has begun.

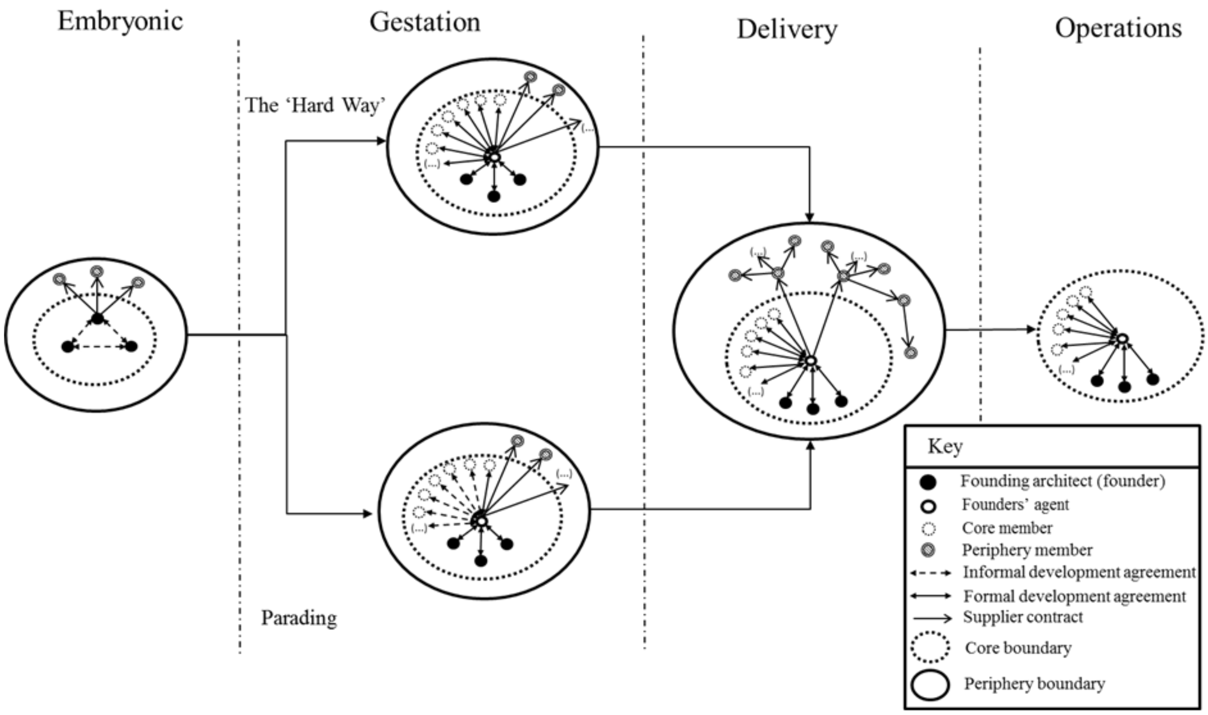
Table 3 – Evolution of Membership and Scope in the Olympic Aquatics Centre

Date	Organization Changes	Scope Changes
2000	British Olympic Association	No scope announced
2002	Greater London Authority, Mayor of London	No scope announced
2003	London 2012 Ltd (Bid Company)	17,500 seats; 2x 50m pools; 2 training pools; diving pool
2004	Architects lobby ; Sport England; Newham Council; Amateur Swimming Association; British Swimming; University of East London; Lee Valley Regional Park Authority	20,000 seat; 4 x50m pools; diving pool; polo pool; 3,300m2 wave-shaped roof; health & fitness area
2006	ODA (founder's agent); Locog (operator); International Swimming Federation (FINA)	17,500 seats, Community Area, Seating to be reduced to 2,500 after the Games
2008	Local Interest groups (disabled advisor, local community, faith advisor)	Addition of disabled facilities; communal areas; inclusive changing facilities
2009	Olympic Park Legacy Company; Broadcasters	Addition of ammonia chillers, a better lighting system, and more sophisticated temperature control;

7.4 Evolving Towards Fit

There is an important distinction between megaprojects and the settings that the meta-organization construct was derived from. Managed ecosystems, buyer-supplier networks, membership organizations, and open communities of production are designed to last. In contrast, megaproject organizations are, by design, temporary systems even if their entire life-cycle can last decades. The finitude of the megaproject offers clarity to its purpose. The founders negotiate a meta-organization to develop an operating asset within a budget and a timescale and hence to achieve a system's goal. As the megaproject nears its goal, the meta-organization's vast periphery drops off, whereas the core members must themselves adjust their agreements in order to fit the legal and operating conditions for sharing the asset in use.

This temporality is essential to understand two different developmental paths through which the megaproject organization can evolve towards a configuration that fits—parading and the hard way, illustrated in Figure 4. The distinction is a matter of degree and different megaprojects are likely to be arrayed along the spectrum. Our intention here is not to define two discrete approaches, but to draw attention to a fundamental difference in the developmental paths underlying what otherwise are quite similar hybrid meta-organizations.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Founders' agent
Core member
Periphery member
Informal development agreement
Formal development agreement
Supplier contract
Core boundary
Periphery boundary

Figure 4 - Two ideal megaproject meta-organization developmental paths

The two developmental paths share the same basic configuration in an embryonic stage: a core conceived by the founders and an eventual incipient periphery. Because social matching implies a degree of serendipity in forming a new organization (Barnett et al., 2000), it varies the time it takes to conceive a new organization. But the qualifying characteristic of the embryonic core—the informal nature of the development agreements between founders—is valid irrespectively of how long it takes to find the right partners.

Crucially, however, the megaproject meta-organization can follow two distinct paths in gestation. If it opts to parade throughout, the development agreements between the core members remain informal. They will sketch out deals and informal pledges, but stay short of hard commitments. There is a great deal of bargaining going on between the core members. But there is also consensus that the requirements remain malleable if the enterprise succeeds. This path attenuates conflict at the core and inevitably shortens the time to go through gestation.

If successful, however, parading leads to major challenges in delivery when the time arrives to fold informal pledges into formal agreements. This developmental process is vulnerable to gaming because the megaproject becomes hard to kill when the negotiation of concomitant resources is still very much up in the air. To the outside observers, parading raises cynicism and mistrust about the enterprise, and calls for more accountability especially if the call for resources in delivery later spirals from what was originally promised. To those in the core, parading may be a once in a lifetime opportunity to achieve a goal.

In contrast, the hard way requires folding the informal deals between core members into formal agreements as a pre-requisite for the megaproject to survive. The risks the meta-organization gets stuck are very real unless the core gets its act together around the design requirements and the commensurate resources. Inevitably, the core members need a lot more time to converge under this approach. Heathrow T2, a relatively 'small' megaproject took approximately the same time as the Olympics in gestation, whereas the Crossrail gestation took almost four times more after two decades of failed attempts. The 'hard way' does not mean things will not change later on. The environment will change and hence the core must adapt the requirements and its own configuration to stay fit. In this sense, both developmental paths are similar. But the hard way has more potential to lock the core in a set of requirements and configuration which will be complicated to change in delivery if need be.

Interestingly, in both cases that followed the hard way, the core members could reasonably expect to have to work together again. In contrast, if the Olympic bid was successful, the core members would be unlikely to work together again for decades to come after decades waiting for an opportunity to regenerate East London. Put differently, there was less of a shadow of the future, and hence of a sense that absconding from early pledges would have negative consequences for future actions (Gibbons & Henderson, 2011). It is not our task here to assess the merits and downsides of parading versus the hard way. Rather, our aim here is to use the meta-organization lens to illuminate how the two work and co-exist.

8 CONCLUSION

Our study contributes to two bodies of literature – megaproject research and meta-organization research - previously unconnected in management theory. By applying a meta-organizational lens to megaprojects it has allowed us to develop more precise descriptions of the structural elements therein.

We argue that megaprojects are a hybrid form of meta-organization with two constituent and evolving structures symbiotically related: a core characterized by porous boundaries and heterarchical decision making over development; and a periphery characterized by closed boundaries and hierarchical decision-making over designing and building activities. Second, we have shown that these structures co-evolve in a process of punctuated equilibrium with the technical structure of the infrastructure asset. This has allowed us to clarify the conditions under which megaprojects grow through the acquisition of new members, and to categories the roles that those members play at various stages in the lifecycle development. By unpacking the relationships at the core of the megaproject we have highlighted previously unseen dynamics as actors move into the organization, join coalitions, and periodically vie for control over the design. This focus on a fluctuating core of actors we hope will extend megaproject theorizing beyond a focus on buyer-supplier dyads to a discussion of the complex power dynamics at the heart of the organization.

Furthermore, we believe that this new conceptualization can allow us to reexamine existing claims that megaprojects fail to perform. The existing explanations do not seem mutually exclusive. A stakeholder management failure (Miller & Lessard, 2001) can equate with failure to invest in design flexibility (Gil & Tether, 2011) or in flexible supplier contracts (Stinchcombe & Heimer, 1985), whereas poor front-end strategizing (Morris 1994) and escalation of commitment (Ross & Staw, 1993) do not disallow suggestions of strategic misrepresentation or optimism bias (Flyvbjerg et al., 2003).

Whilst our study does not resolve the debate on performance we believe our conceptualization creates a vocabulary and a structure which can be used to interrogate megaproject data, interpret puzzling situations, and inform managers' judgment calls. For example, our study highlights how resource dependencies, e.g., capital, land, knowledge, planning consent, limit the founders' ability to exclude other actors from core membership. This suggests the founders face a herculean struggle to reconcile heterogeneous claims into a single indivisible design unless they relax boundary conditions, e.g., budget, timescale, scope. In simple capital settings, creating a design commons—a polycentric organization with local decision-making forums (Gil & Baldwin, 2013)—has turned out to be an advantageous organization form to tackle a similar design production problem. It merits further research whether similar design principles apply to a megaproject organization.

Finally, our study does not correspond to hitherto examined types of meta-organizations. The porosity of the core membership in a megaproject is unlike a traditional business ecosystem in which a 'keystone' architect opens up their technical designs to a large community but retains a firm control over the overall system's strategy. Here instead we see a novel case of strategy itself being opened up towards a limited community of claimants whose legitimacy to make changes to designs is not always clear cut.

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Paper 2

The (under) performance of mega-projects: A meta-organizational perspective

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The (under) performance of mega-projects: A meta-organizational perspective

Abstract

This study links evolution in organizational structure to ambiguity in the definition of performance in the context of organizations formed to develop long-lived infrastructure: so-called ‘mega-projects’. Based on a longitudinal, inductive analysis of three mega-projects in London, we argue that a mega-project is a meta-organization with two symbiotically-related constituent structures. The core, led by a coalition, is a mutable collective that shares control over the goal of the project and corresponding high-level design choices. The periphery is a supply chain selected to design and build the infrastructure, but lacks the authority to change the high-level choices. As the mega-project structure evolves over time, we show that the founders and new comers renegotiate the high-level choices and slippages in performance targets ensue. The conflation of committals to different baselines, differing preferences for efficiency and effectiveness, and rivalry in high-level choices gives rise to competing performance narratives which cannot be reconciled. Thus, we argue, the disappointing and controversial (under) performance of mega-projects may be a result of how their organizational structure develops, rather than due to any agency or competence related failure per se.

1 INTRODUCTION

Mega-projects involve vast networks of public and private actors formed to develop capital intensive infrastructure. Their outputs include Olympic parks, airports, railways, power plants and other long-lived assets that play a vital role in the socio-economic development and sustainability of modern societies. They represent an important form of public-private collaboration.[8]

Despite their social significance, mega-projects have a reputation for disappointing performance. The performance of a mega-project is typically evaluated on whether they deliver a useful asset within the cost and schedule targets announced at the onset of planning (Hall 1972; Merrow, McDonnell and Arguden 1988, Morris 1994, Szyliowicz and Goetz 1995). Against the initial baseline, mega-projects frequently suffer schedule and cost overruns. For instance, Merrow et al. (1988) report 88% average cost growth and 17% average schedule slippage from a sample of 52 civilian mega-projects. There is variation across sectors, with 44.7% average cost overrun reported for rail projects and less than half that at 20.4% average cost overrun for roads (Flyvbjerg, Bruzelius and Rothengatter 2003).

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[8] The World Economic Forum’s Global Competitiveness Report 2012-2013, for example, ranks infrastructure as one of the four pillars of the Basic requirements category in the Global Competitive Index

A number of explanations have been offered for this (controversial) disappointing performance. They include the idea that the initiators of such projects: a) use inflexible contracts with the suppliers despite high uncertainty in the high-level design requirements (Stinchcombe and Heimer 1985); b) succumb to escalation of commitment, scope creep, and sunk cost fallacies (Ross and Staw 1993; Shapiro and Lorenz 2000); c) under-invest in front-end planning (Morris 1994) and in flexible design structures (Gil and Tether 2011); d) keep shaping the final design in response to unforeseen evolution in the environment (Miller and Lessard 2001); and finally e) are guilty of strategic misrepresentation (at worst) and optimism bias (at best) to get the project initiated (Flyvbjerg et al. 2003; Wachs 1989). Common to all these explanations is the assumption that mega-projects are controlled by a unitary actor whose characterization ranges from outright incompetent to Machiavellian.

In this study, we move beyond this unitary actor approach to treat the mega-project as an organization—and study how the structure of the interaction between its members may explain the organization's outcome. We use the lens of "meta-organizations" to explore the development of megaprojects. By doing so we uncover important structural elements: a fluctuating coalition at the core which shares strategy; and a vast peripheral supply chain that brings expert knowledge into the system. By understanding the dynamics of these structures we can shed light on the dramatic changes to megaproject performance targets. And ultimately argue that whilst performance exists definitively for individual members of the megaproject, it is ambiguous when integrated at the system level.

Meta-organizations are networks of legally autonomous actors collaborating under an identifiable system-level goal (Gulati, Puranam, and Tushman 2012). The meta-organizing lens addresses the distribution of the resources and appropriation of value central to buyer-supplier networks, distributed communities of production, and managed business ecosystems (Baldwin 2012; Baldwin and von Hippel 2011; Womack Jones, and Roos 1990, O'Mahony and Bechky 2008). The design dimensions of meta-organizations include the openness of the network’s boundaries, the degree of stratification in the member’s decision rights, and the sources of authority within the system.

Mega-projects exhibit the distinguishing qualitative attribute of a meta-organization—the absence of employment relationships or ownership stakes as a basis for authority relationships between its members (Gulati et al. 2012). Hence a mega-project is formed when a group of legally independent parties including governments, public agencies, interest groups, communities and firms endorse the venture in the early planning stage (Altshuler and Luberoff 2003; Szyliowicz and Goetz 1995). To explore how the evolution of the mega-project organizational structure may influence performance, we conduct a longitudinal inductive study of three mega-projects. The system-level goals of these mega-projects were to produce an Olympic park, an airport terminal, and a railway network. Surprisingly, a longitudinal analysis of the evolution of the structure of participation in a mega-project has yet to be undertaken in the literature. We believe such an analysis can shed new light on the structure and performance of mega-projects.

We organize the remainder of this paper as follows. In Section 2, we draw on theory on meta-organizations and design to discuss the mega-project form of organizing. After explaining our method and introducing our database in Section 3, Section 4 proceeds with the analysis of development processes for our sample of mega-projects and concomitant evolution in the performance targets. We conclude by discussing the link between structure and performance in mega-project meta-organizations where a collective perforce shares control over the goal and the plan to achieve it.

2 META-ORGANIZATIONS AND MEGA-PROJECTS

A precept of the emerging theory on meta-organizations is that, despite absence of the sources of authority used in traditional firms, they are not self-organizing systems but rather must be designed and managed (Gulati et al. 2012). At the heart of a meta-organization is a central founding actor, an entrepreneurial architect, who imprints an archetypal structure and ideology during the meta-organization's early stages (Boeker 1989; Eisenhardt and Schoonhoven 1990; Stinchcombe 1965) and shapes the system-level structure. This structure defines the "components, their relationships to each other and to the environment, and the principles guiding its design and evolution" (Maier, Emery and Hilliard 2001). Thus the meta-organization's founder (or founders) play a role in identifying, developing, and promoting a superordinate goal, and in designing the structures to achieve that goal.

In lieu of ownership stakes or employment relations, the meta-organization's founder(s) relies on other mechanisms to exert its influence such as supplier contracts, resource dependencies, technical expertise, and reputation (Blau 1964; Gulati and Sytch 2007; Raymond 2008). Specifically, the founder influences two structural properties of the meta-organization—member stratification and boundary permeability. In highly stratified meta-organizations, members of the upper tiers have greater decision-making privileges and responsibility, whereas in flatter organizations members are held to be relatively equal. When setting the boundary permeability, the founder influences how external actors become members of the meta-organization. When the boundaries are closed, a single ‘gatekeeper’ or the community at large select new members from the environment based upon the resources that they can offer, e.g., labor or technology, capital, or less tangible inputs such as branding and reputation (Rothaermel and Boeker 2008). In contrast, open meta-organizations have few, if any, conditions for membership. Their members are self-selected and members volunteer for tasks (Lakhani and Von Hippel 2003). In such open systems, the founder provides a democratic framework and some control mechanisms under which the membership can self-develop (Lee and Cole 2003).

The notion of a meta-organization maps well to empirical accounts of mega-projects (Altshuler and Luberoff 2003; Flyvbjerg et al. 2003; Grun 2004; Hall 1972; Hughes 1998; Merrow et al. 1988; Miller and Lessard 2001; Szyliowicz and Goetz 1995). The development of a large infrastructure requires the acquisition of diverse resources controlled by various parties including land, capital, planning consent rights, political support, and technical and management capabilities. As the founders seek to attract the support of resource-rich actors, decisions about their membership ensue. Potential supporters are unlikely to be altruistic; to court them, the founders must offer some incentive. Empirical accounts suggest that resource holders commit to supplying resources conditionally in exchange for gaining rights to directly influence the final design of the megaproject’s assets (Gil and Baldwin 2013; Gil and Tether 2011; Miller and Lessard 2001).

When a collective of heterogeneous actors share the right to directly influence the high-level design choices for a long-lived, monolithic structure that they will share in use, as it is the case of mega-projects, high rivalry between their preferred choices ensues. And when *high rivalry* in design choices juxtaposes with the *low excludability* of the claimants from development because they control critical resources, Gil and Baldwin (2013) argue that collective action problems become endemic to development, i.e., situations wherein different parties share the goal but may lack incentives not to free-ride or skirt commitments (Axelrod 1984; Hardin 1968; Olson 1965). The more parties involved, the more complicated collective action becomes (Ostrom 1990, Gray 1989). We can thus expect complicated problems of collective action to be endemic to mega-projects.

Yet between this picture of a meta-project as being subject to collective actions problems, and the specifics of how its structure influences outcomes, there remains a substantial gap. We lack a clear sense of why schedule overruns and critiques that mega-projects produce white elephants are so prevalent, and whether these can in any manner be linked to the distribution of decision rights amongst a host of independent actors. This important gap in knowledge motivates this study.

3 RESEARCH SETTING AND METHODS

Comparative case studies, a fruitful approach to building theory (Eisenhardt 1989; Eisenhardt and Graebner 2007), are particularly appropriate for contextual research (Yin 1984) and suit well studies of process and change (Pettigrew 1990). Hence to advance theory, we grounded our study on three mega-project meta-organizations formed to develop three large infrastructures in London: 1. the 2012 Olympic Park; 2. Heathrow airport's Terminal 2 (T2); and 3. Crossrail.

A duality characterized the goal of the publicly financed £7.1bn[9] development of an Olympic park. It aimed to provide the sporting venues and athlete accommodation to host the 2012 Games, whilst catalyzing the urban regeneration of the area surrounding the park. In contrast, the £2.6bn Heathrow T2 development was wholly financed by the airport's private owner and operator, BAA[10]. The goal was to co-locate into a new terminal the airline members of STAR Alliance (STAR), which accounted for approximately 25 per cent of all traffic going through Heathrow airport. Using a mix of public and private finance, the £15.8bn Crossrail development aimed to deliver a high-capacity train to increase the capacity of London's railway network by 10%; it involved building a tunnel and eight stations in central London and upgrading over-ground commuter lines east and west of London.

We chose this sample to vary three key attributes of mega-project organizations and thus build a diverse and polarized sample as recommended for process-focused inductive studies (Siggelkow 2007). First, the cases differ by the sources of finance. We considered finance an important differentiating factor since we expected more and diverse parties making claims on the design and development of the publicly funded mega-projects than on privately financed ones.

Second, the cases differ in terms of the potential for prior and future relationships between the members of the mega-project organizations. The Olympic park was a sui generis endeavor unlikely to be repeated for decades to come. In contrast, the key parties in Heathrow T2 had a long history of collaboration in both day-to-day business dealings and prior airport expansion schemes. On this dimension, the Crossrail meta-organization again was a hybrid. It was the first major commuter line jointly promoted by the national government and the London government. But talks were ongoing to recreate a similar arrangement to promote a north-south commuter line so-called Crossrail 2.

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[9] All prices in anticipated or final outturn (cash) costs, i.e., costs adjusted for inflation unless indicated otherwise

[10] In late 2012, BAA changed its name to Heathrow Ltd; for simplicity, we keep to the BAA name in our account

The existence of prior and potential future relationships creates an environment more amenable for sustaining collaborations (Gibbons and Henderson 2012; Gray 1989; Newcomb 1956, Thompson and Perry 2006). Thus we expected less difficulty in resolving differences amongst members in a mega-project in which people had worked together in the past compared to one-off ventures.

Third, the mega-projects in our sample varied in terms of the flexibility allowed in their schedules. While the Olympic Park had an immovable completion date, the other two projects would (potentially) be able to negotiate additional time to complete their activities. This variation allowed us to observe differences in the collective dynamics under different levels of schedule constraints.

3.1 Data Collection

We triangulated several data sources for this study including semi-structured interviews with a range of actors, analysis of archival documents, and on-site visits. Triangulation was important to improve the accuracy of our data and the robustness of the conceptual insights (Jick 1979; Miles and Huberman 1984:234) particularly because when discussing organization performance people's recollections are vulnerable to revisionism and self-aggrandizement (March and Sutton 1997).

Recent developments in the practice of organizing mega-projects in the UK have had the effect that on the surface their governance structures resemble corporate governance structures. Thus, to limit respondent bias (Eisenhardt 1989), for each mega-project, we interviewed executive and non-executive directors, as well as senior management and technical staff of the public agencies (or corporate division in BAA's case) established to plan and later deliver the scheme. We also interviewed managers of the founders and other public agencies and firms that directly influenced the goal and the plan to achieve it, and staff of the suppliers doing the design and construction works.

The 2-year field work began in the summer 2011 after we negotiated access to the top executive team of the Olympic Delivery Authority (ODA), the public agency set up in January 2006 to deliver the Olympic park. Through its internal Learning Legacy project, the ODA had committed to share knowledge and lessons learned. The ODA executive felt our wholly independent theory building study fit nicely with their initiative, and agreed to contribute in kind. Armed with the ODA's letter of endorsement and a list of interviewees involved with the Olympic park, we then sought to line up comparable groups of interviewees at Crossrail and Heathrow T2. All in all, we conducted 75 formal interviews, one to two hours long, which we transcribed and organized in a digital database. In addition, throughout the research, we regularly invited top managers to give talks to our graduate-standing students which were followed by a Q&A period and lunch. In total, we organized eight events which created opportunities to ask complementary questions and take extra notes.

The interviews, presentations, and lunch discussions were complemented by numerous site visits, including a four week on-site observation at Heathrow T2 carried out by one of the authors. We chose Heathrow T2 for a longer observation on site because it gave opportunities to garner archival documents which were not confidential but would be otherwise difficult to access. For each case, our archival data included documentation internal and external to the mega-project organization

We organized our database of archival documents in seven broad categories (see Table 1). *Strategy and planning documents* include project feasibility studies, records of public consultations, outputs from planning bodies, and reports generated by central or local governments and regulatory investigations (for the publicly financed projects, we also studied parliamentary debates and documents released in response to requests made under the UK's Freedom of Information Act). Together with the interviews, power point presentations, and records of executive and high-level meetings ('*meeting minutes*') this information was crucial to chart the evolution of the structure of participation of the meta-organizations and commensurate evolution in performance targets. Other sources of data on the evolution of performance targets were *financial reports* including annual company accounts and budgetary audits, and *news articles* in the national and trade press.

To learn more about salient inter-organizational controversies that surfaced during the interviews, we examined *formal communications* including open letters exchanged between members of the mega-project organizations or sent by independent actors native to local communities affected by the mega-project organization; we also studied *newsletters and public relations (PR)* documents including magazines, presentations, and multimedia created to inform the public about the works undertaken, and thus providing an additional source of data on announcements of performance targets.

Finally, *design documents* were useful to appreciate the quality of the evolving structure of the designed artefacts and include architectural renderings, technical drawings, schematics, and detailed project scope documents. To learn more about the design structures, we also studied detailed technical and managerial accounts and interviews with senior managers in the trade press.

We focused data collection on understanding the evolution of the meta-organization's membership and concomitant evolution of the high-level design choices and cost and schedule targets. The archival documents helped to cross check the informants' accounts. Our theoretical emphasis meant that we were not seeking to share commercially sensitive information, but we offered nonetheless to make the quotes anonymous to avoid potential bias (Podsakoff et al. 2003). Table 1 summarizes the overarching characteristics of each mega-project, the documents in our database organized by the salient categories, and the official roles of the interviewees and their employers.

Table 1- Summary of Characteristics of the Case Sample and Interviewees

Case	Goal	High-level framework for achieving the shared goal	Archival Database	Actors interviewed	Description of the actor	Informants interviewed by official job roles
London Olympic park	Develop 1Olympic park to host the 2012 Olympic games and catalyze regeneration of East London	~£7.1bn final public investment (2013) ~8 years of planning talks (1995-03) ~9 years to design and develop (2003-12) Immovable completion date	Total number (except news articles): 469 *Strategy and planning documents: 260* *Financial reports: 6* *Formal communication: 5* *Newsletters and PR documents: 111* *Design documents: 16* *Meeting minutes: 71* *News articles: 219*	Olympic Delivery Authority (ODA)	Public agency created to lead the development and delivery of the Olympic park	Chairman; two chief executives; design managers ('sponsors'); executive directors of: construction/ property/ procurement; finance/ commercial/ design and regeneration/ transport/ infrastructure; head of design; head of program assurance
				London 2012 Ltd.	Agency that produced the bid	regeneration advisor; transport advisor
				Games Organizer (LOCOG)	Private company created to deliver the games	Director of venues and infrastructure; head of venue development
				Olympic park operator (OPLC)	Public agency created to operate the park in legacy	Director of infrastructure
				Transport for London	Public agency in charge of London's transport	Director of games transport
				CLM ; Lend Lease	Private management and development firms	Program supply chain manager; director of infrastructure; program director; deputy head of procurement; assurance officer; commercial director
Heathrow Terminal 2 (T2)	Develop new airport terminal to co-locate the STAR Alliance	~£2.6bn final private investment (2014) ~4 years of planning talks (2002-06) ~9 years to design and develop (2006-14) Financial penalties if BAA unduly lets completion date and/or budget slip	Total number (except news articles): 114 *Strategy and planning documents: 74* *Financial reports: 6* *Formal communication: 19* *Newsletters and PR documents: 8* *Design documents: 4* *Meeting minutes: 3* *News articles: 40*	STAR Alliance	Consortium of airlines	Project director
				Air Canada	Member of STAR Alliance	General manager for commercial operations
				BAA	Private airport operator and owner	Planning and program director; capital director; project director; director of program control and performance; director of integration; director of operations; director of development
				HETCo; Balfour Beatty	Private design and build consortiums	Commercial director; construction director; project director
London Crossrail	Develop new cross-London high-capacity railway	~£15.8bn public-private investment (2014 estimate) ~6 years of planning talks (1995-01) after two previous failed attempts ~18 years to design and develop (2001-19) Flexible completion date	Total number (except news articles): 122 *Strategy and planning documents: 74* *Financial reports: 2* *Formal communication: 6* *Newsletters and PR documents: 23* *Design documents: 9* *Meeting minutes: 8* *News articles: 274*	Crossrail (CRL)	Public agency created to deliver scheme	Program supply chain manager; chairman; chief executive; executive directors of commercial/ procurement /technical/ central area/ infrastructure/ delivery/ program/ financial/ operations; chief engineer; chief of staff; project manager; head of risk management
				Network Rail	Public railway owner	Director of infrastructure; chief executive
				Transport for London (TfL)	Public agency in charge of London's transport	Director of operations
				Canary Wharf	Private funder of a station	Executive director
				Cross London Rail Links(CLRL)	Public agency created to promote the scheme	Executive chairman; acting chief executive/managing director; financial director

3.2 Data Analysis

The research followed an inductive, multiple case study approach. Our core question (Eisenhardt 1989) was: can the performance of mega-projects be traced back to their organizational structure? To address this we sought answers to a set of subsidiary questions including: what form of organizing is a mega-project? Which actors influence the system-level goal and the high-level design choices? And how does evolution in organizational structure affect performance targets? The typology provided by Gulati et al. (2012) was our cognitive frame of reference (Van de Ven 2007) and provided a set of high-level codes (Miles and Huberman 1994). To allow for a more detailed level of inquiry (Yin 1984) we embedded units of analysis that captured high-level decisions in the development of key functional components. We define a component as a distinct element of the infrastructure asset which performs a relatively well-defined function or set of functions (Ulrich 1995).

Following a snowballing process (Biernacki and Waldorf 1981), we asked the first interviewees to introduce us to respondents who could provide complementary points of view for our core questions. We also worked with interviewees to sample components that could illustrate the concomitant evolution of the organizational structure, high-level choices, and plan to achieve the goal.

Following recommendations for inductive reasoning (Ketokivi and Mantere 2010) and to guard against potential account bias (Miles and Huberman 1994), we first developed detailed chronological accounts for each case.[11] This was important to take a process orientated approach to theorization (Langley 1999; Van de Ven and Poole 2002) and develop reliable theory (Miller, Cardinal, and Glick 1997). As we cycled between empirical data and theory, a theory started to emerge that the organizational structure of mega-projects could be internally differentiated into two constituting elements, a core and a periphery, that the composition of the core was in flux for a significant period after initiation, and that this raised interesting questions regarding system level performance.

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[11] These detailed factual accounts were published with a presentation style similar to a Harvard-style teaching case study and circulated for comments

As we refined our theory, we proceeded to fill gaps in our understanding through subsequent interviews. By mid-2013, we had reached theoretical saturation as additional data was no longer leading to new conceptual insights.

4 ANALYSIS

We begin by recounting briefly outlining the stages of megaproject development from conception through to delivery with particular focus on the development of a strategic core of actors who control the design of the infrastructure asset and thus are in the greatest position to influence performance. We then explore what is meant by performance in megaprojects at an individual and system level, before demonstrating mechanisms that cause ambiguity in performance at the system level.

Table 2 compiled from analyzing archival and interview data, illustrates the longitudinal data that underpins our analysis.

4.1 Embryonic stage: How a mega-project meta-organization is conceived

Our cross-case analysis reveals a recurring pattern characterizing the emergence of a mega-project. A single actor envisages demand for a new infrastructure, but alone cannot mobilize enough resources to achieve the goal, and thus attempts to attract other interested partners. Hence the emergence of a new mega-project is a social matching process (Barnett, Mischke, and Ocasio 2000) in which a new organization is conceived after a few independent parties, the founders, succeed in forming a coalition by agreeing in broad terms a plan to solve a set of interdependent problems. During this embryonic stage a coalition of founding members form an embryonic core structure which collectively craft a mutually acceptable system-level goal and a plan to achieve that goal including the project scope, and corresponding budget and schedule targets. Public announcements of high-level expectations are used symbolically to garner commitment and legitimacy (Stone and Brush 1996), but the founders stay short of making legally binding commitments.

The case of London 2012 demonstrates the emergence of an incipient core of three founding members. Each founder provided critical resources or functions to the embryonic organization: the Greater London Authority had powers to acquire land; the UK government could finance the scheme; and only the British Olympic Association could nominate potential host cities. As the embryo was conceived, a system-level goal was crafted around using the development of an Olympic park to regenerate a swathe of industrial wasteland in London. During this stage, the relationship between the founders remained non-binding and flat.

We witnessed a similar process in the embryonic stage of the Heathrow's T2. In that case BAA saw an opportunity to have two airline alliances using Heathrow as a hub, and after one year of talks, STAR and BAA signed a MoU to collocate STAR's members 'under one roof'. To meet this pledge, BAA sketched a vision for a sixth terminal and a new runway. But after a public outcry, the founders settled on a more modest goal—to rebuild the old T2. To announce a new consensus, BAA and STAR signed a new MoU in late 2005. As part of its regulated business model, BAA needed to negotiate the scope, budget, and schedule with the regulator and the whole airport's airline community. Thus accommodating the new members would require a substantial evolution of the T2 meta-organization.

We analyze next how the embryonic structure evolves in the next development stage.

Table 2 - Evolution of the Membership, Scope, and Cost and Schedule Targets of the Mega-project meta-organizations in our Sample

Case	Mega-project lifecycle	Membership of the mega-project organization		Evolution of the Public Announcements of Performance Targets associated to the System-level Goal		
		Core	Periphery	Planned scope	Estimated expenditure	Completion
Olympic Park	Embryo (9 years) 1994 to June 2003	Three Founders *British Olympic Association (BOA); UK Government; London government (Mayor)*	3 firms	Initial scope *1994, Build Olympic park and village* *01.03, Build Olympic park and village, regenerate swathe of derelict land, improve local transport system*	Initial cost estimate *12. 99, £1bn-£2.5bn (1999 prices)* *01.03, £1.98bn (2003 prices) (w/ 90% confidence) for Olympic park and land; private finance for Olympic village*	Immovable *summer 2012*
	Gestation (2 years) July 2003 to June 2005	Growth in membership *+ London 2012 bid company (founders' agent); 4 London boroughs; Architectural lobby; Transport bodies; 16 funders; International Olympic Committee (IOC); 35 Sporting bodies*	10 firms	Scope evolves and grows *11.04, Olympic park framed as catalyst of East London regeneration; Improve London transport network; add 'iconic' venues; athletics' stadium in legacy*	Slippage *11.04, £3.3bn (2004 prices)/£4.2bn (final prices without VAT) for Olympic park and land; private finance for Olympic village; £8.9bn for London transport schemes*	
	Delivery (7 years) July 2005 to July 2012	Growth in membership *+ODA (founders' delivery agent); private developer for Olympic village; Olympic Park operator; local communities; interest groups; late buyer of part of the Olympic village*	1,600 tier-one suppliers at peak	Scope evolves further and shrinks *2007, new master plan for sustainable Park in legacy with smaller permanent venues; fewer temporary venues; relocate and shrink Olympic village*	New slippage *03.07, £9.2bn (final prices w/ VAT): £6.1bn for Olympic park and local transport schemes + £3.0bn contingency + £8-9bn for London wider transport scheme* *12.13, £10.2bn (final prices w/ VAT): £7.1bn Olympic park and local transport schemes + security + others; +£7.2bn for London Transport schemes(§)*	
Heathrow T2	Embryo (4 years) 2002 to 2006	Three Founders *BAA; STAR Alliance; Industry regulator*	N/A	Initial scope *2005, Six terminal and third runway* *2005/6, One main terminal building with one satellite and airfield around*	Initial cost estimate *2005,£1-1.5bn (2005 prices)*	Initial target *2005, Phase 1 open in Summer 2012*
	Gestation (3 years) 2006 to 2009	Growth in membership *+Heathrow airport's broader airline community (over 60 airlines); Local Council; UK*	20 tier-one firms	Scope evolves and grows *2007, T2 will be a T5-like campus; phase 2 opening around 2016* *2009, Actively safeguard for phase 2 expansion; phase 2 opening in*	Slippage *07.2006, £1.6bn (2006 prices) for phase 1; phase 2 budget unresolved* *05.2009, £2.2bn (2008/09 prices): phase 1 includes ~5% contingency (§); phase 2 budget unresolved*	Slippage *2006, Phase 1 opens 12/2012* *2009, Phase 1 opens 11/2013*

		Home office; BAA Retail		*2019*		
	Delivery (5 years) 2009-2014	Decrease in membership *Loss of critical member (BMI, STAR Alliance's domestic carrier)*	150 tier-one firms	Scope evolves further and shrinks *2010, Phase 1 gets further enhanced* *2013, Phase 2 postponed indefinitely*	New slippage *05.10, £2.6bn (2010/11 prices) for phase 1; phase 2 budget unresolved* *12.13, £2.6bn (final prices) for phase 1; phase 2 budget unresolved*	New slippage 2010, Phase 1 open 14/15 2013, Phase 1 open 2014
Crossrail	Embryo (6 years) 1995 to 2001	Three founders *Central Government; London Government (Mayor); City of London Corporation*	2 tier-one firms	Initial scope *1998-2001, 9km central London rail tunnel; 5 stations in central London*	Initial cost estimate *1998, £2.1bn (1998 prices) railway infrastructure and train cars; assumes scheme wholly privately financed* *2000, £2.3-2.8bn (2000 prices): railway infrastructure and train cars; assumes scheme wholly publicly financed*	Initial target *1998, open in 2008* *2000, open in 2011-12*
	Gestation (7 years) 2001 to 2008	Growth in membership *+CLRLL (founders' development agent); Parliament; 365 Petitioners; 37 local councils; transport agencies; Private funders of stations*	4 tier-one firms	Scope evolves and grows *2002, 118km East-West London railway; 8 stations in central London; new stations at Heathrow airport and London's Financial District*	Slippage *2003, ~£9.8bn (2002 prices): £6.9bn (infrastructure) + £2.9bn (contingency); ~£650m train cars (private finance)* *11.2007, £15.9bn (final prices w/VAT) including contingency (~£5bn) but excluding train cars (¥)*	Slippage *2003, Open in 01.2016* *2007. Open in 12.2017*
	Delivery (planned to last 11 years) 2008 to 2019	Growth in membership *+Crossrail Ltd (founders' delivery Agent); railway operator; property developers; High-speed 2 Ltd*	1,700 tier-one suppliers at peak	Scope evolves, first shrinks, then grows *2009, links to London Tube dropped* *2010, extra London station* *2012, safeguard interchange with HS2* *2014, 30km route extension to Reading*	Stable after initial drop *10.2010, £14.8bn (final prices) incl. contingency (~£3bn); assumes private finance for train cars (£1bn)* *03.2013, £15.8bn (final prices): £14.8bn (railway infrastructure)+£1.0bn train cars*	New slippage *2010, Fully open in 12.2018* *2013, Fully open in 12.2019*

(§) Construction prices inflation at 0% between 2008 and 2011

(¥) £10.3bn at 2002 prices gives a final price of around £13.6.bn using a discount factor of 3.5 % (the rate used in 2005), roughly comparable to Crossrail's £15.9bn final price (£13.28bn plus VAT at 17.5%)

4.2 Gestation: Expanding the Mega-project Meta-organization's core

We define the start of gestation when the founders formally appoint an agent, who acts on their behalf, to sharpen the system-level goal and further develop the plan to achieve the goal. Throughout gestation, the boundaries of the mega-project organization's core remain porous as its founders must let the membership expand to acquire more resources without which the scheme cannot forge ahead.

In gestation, the core members select suppliers that operate through formal contracts. The suppliers work to integrate prior high-level design choices and performance targets with the preferences of the newer core members feeding back potential options for the core members to debate. Importantly, our analysis suggests that the environment creates two distinct paths for the development process that vary in the extent the core members invest time and effort in creating binding agreements in gestation.

Throughout gestation the extant members of the London Olympic Games organization keenly sought the support of one critical actor—the International Olympic Committee (IOC). The IOC controlled an irreplaceable resource—the Olympic brand—the acquisition of which would pave the way to obtain all the remaining resources. To attract the IOC's support, the extant core members of the Games organization tailored the bid to, at the very least, meet the requirements supplied by the IOC and the associated sport federations.

In marked contrast to the Olympics, the Crossrail and Heathrow T2 meta-organizations forged ahead with binding deals. In both cases, the broader institutional environment demanded from the founders and other parties potentially interested in joining the mega-project to take a far more labored approach to incorporating their various preferences for the high-level design requirements.

The Crossrail case illuminates this struggle. For the Crossrail meta-organization to acquire the capital and receive legal powers to compulsory buy land, the UK Parliament needed to approve the system-level goal and the high-level scope based on a fixed budget. From the onset, the London's leading business lobby group and influential politicians demanded a change to the goal; a former transport minister said: "We cannot simply submit the same application that failed last time" (NCE 2002). Aware of changes to the London's economic geography, the founders invited other parties to reshape the goal including the private owners of the Heathrow airport and Canary Wharf (London's second financial center) and Network Rail, the public monopolist that owned the UK railway network.

In summary, the qualifying property of the gestation of a mega-project meta-organization is the juxtaposition of binding and non-binding development deals amongst a growing core membership. We now turn to discuss the final evolution in the mega-project's meta-organizational structure.

4.3 Delivery: Expanding and Engaging the Mega-project Meta-organization's Periphery

We define the start of delivery when the mega-project meta-organization has acquired sufficient the critical resources needed to begin detailed design and construction. In delivery, the core members must nail down the remaining development deals before they start hiring the supply chain after which the space for negotiating changes to high-level choices becomes substantially more constrained. The core membership is now relatively stable, but its boundaries stay porous. For instance, new parties may lobby or be invited for a late inclusion or indeed extant members may leave or be replaced.

To resolve the loose ends, the mega-project meta-organization goes through a last round of substantial structural changes. After London won the bid, for instance, the bid book folded into a legal contract—'they [International Olympic Committee, IOC] certainly learned the trick... you deliver in the spirit of that contract but not in the detail', said one bid advisor. With seven years to deliver, the founders together with an IOC's watchdog, LOCOG,[12] formed an Olympic board to govern the enterprise, and created an agent, the Olympic Delivery Authority (ODA), to buy land, manage the project, and select the suppliers—'we were firmly on the driving seat', recalled one ODA director.

Faced with an immovable completion date and concerned about legacy, the ODA spent two years negotiating with the now vast collection of core members a new set of high-level design requirements and performance targets for the scheme—'there was a 'disconnect between bid promises and reality', said one ODA director. Concomitantly, the number of suppliers selected to work on the Park started to grow steadily up to 1,600 at peak, and decision-making at the core got more and more constrained.

Substantial changes in structure also happened at the onset of the delivery for Heathrow T2. But in marked contrast with the Games case, the new management team at the helm (redeployed by BAA from the last mega-project at the airport) inherited a rigid set of high-level requirements and a budget. And yet, new management insisted that there was a £600m shortfall in finance.

To avoid an impasse, the core members rekindled negotiations. BAA soothed STAR by offering some concessions over design provisions aimed at making it less costly to further expand the terminal in phase 2. The core members also agreed to shift to T2 capital that had been committed to smaller schemes, and to delay the T2 opening another year. The number of suppliers joining the organization grew as expected, although BAA chunked the works in large packages to reduce their number.

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[12] London Organising Committee of the Olympic and Paralympic Games

The interlock between the gestation and delivery for Crossrail suggests a similar pattern. The new agent taking a central role in the meta-organization, CRL, also pointed to a shortfall in financing. But as in the T2 case, the budget was fixed, and thus the alternative left was to renegotiate the scope and the completion date. The boundaries of the core stayed porous, and property developers and operators were invited for talks before freezing the high-level requirements. Discussions to ditch non-binding requirements were also initiated before selecting the vast periphery.

In summary, the delivery is qualified by a last round of substantial structural changes in the mega-project meta-organization, starting off with the arrival of new management. This triggers a last round of talks as to how to achieve the goal before action becomes severely constrained by the growth in the periphery. We turn now to analyze how this structural evolution impacts on performance.

4.4 Linking Organizational Evolution and Ambiguity in Performance

4.4.1 Megaproject Performance: Individual and Collective Perspectives

Our longitudinal analysis reveals a relationship between the evolution of the mega-project meta-organization's membership and the potential for this to be accompanied by episodic re-definition of the system level performance targets. These system level performance targets are typically defined in terms of the scope of works, budget, and schedule constraints. The Olympic park, for example, was floated by the British Olympic Association in 1999 as a £1-2.5bn capital investment to end in a £17bn enterprise when accounting for all expenditure in building the park, regenerating East London, upgrading London's transport network, and hosting the 2012 Olympic Games. Likewise, Crossrail evolved from a £2.1bn privately financed 9km central London train to open by 2008 into a £16bn (mostly publicly financed) 148km commuters' train to fully open by 2019; and T2 evolved from a new £1-1.5bn concourse to open in 2012 into a £2.6bn fully-fledged campus to open by 2019.

We found that megaproject performance is made into a complex problem by the nature of the megaproject network. As set forth in Table 2 and briefly encapsulated above megaprojects go through periods of upheaval in which new members join a core coalition and seek to have an input into the design of the infrastructure.

Megaproject performance is typically judged along the dimensions of scope (or utility), cost, and schedule and is assessed as to whether final figures met upfront targets. Our analysis of the megaproject meta-organization suggests two levels of megaproject performance. Performance targets as set by the individual and performance targets set at a system level negotiated by the entire core collective over time.

Within the meta-organization each member holds their own goals and thus can be expected to hold, at the very least privately, individual performance targets that allow them to judge how the project performed. Thus a supplier may see a high performing megaproject as one that delivers both a profitable contract as well as enhancing (or at least not damaging) their own reputation. Whereas a local council who contributes no funding to a megaproject may have little concern for the budgetary concerns of the scheme as long as the assets deliver them long term utility. Individual performance targets may remain relatively static throughout an organization's membership – thus they can compare what they demanded upon their arrival with what they achieved at the conclusion of the megaproject.

Matters are made more difficult when we turn to the system level performance. System level performance is, as with individual performance, measured in practice in terms of scope, budget, and cost. However, system level performance targets are not merely the composite of individual targets they are the result of periodic negotiations about what is achievable in the scheme. Thus they may differ substantially from individual performance targets. When they do so, that leaves the megaproject open to dissident members who criticize the scheme for failing to meet their own performance targets. As not all possible combinations of individual performance targets can be integrated into the system level targets there will always be some members who feel disenfranchised by the processes.

In summary, underpinning the system level performance targets of scope, cost, and schedule are tradeoffs between the effectiveness of the system (how well it matches the needs of its stakeholder group) and efficiency (how much value was created in comparison with time and cost expenditures). Each individual within the meta-organization can be expected to have their own preference for how to balance this trade off.

Finally, performance for the system's architect may differ from other members as the architect is entrusted to ensure the system itself survives thus for a megaproject architect organizational tensions are added to maintain legitimacy and commitment of members.

Table 3 summarizes the tensions between the dimensions of performance and the meta-organization.

Table 3 - Tension between performance dimensions and the meta-organization

Effectiveness	Efficiency	Organizational Pressures
• Economic Performance • Technical Functionality • Social Fit • Environmental Fit • Political Legitimacy	• Cost • Schedule	• Legitimacy • Commitment • Evolving Organizational Structures • Environmental Uncertainty • Misalignment between product and organization structure

We now turn to look at the drivers of system level performance change in more detail and why they result in ambiguity in overall system performance.

4.4.2 Drivers of System Level Performance Changes

Importantly, substantial changes to the system level performance targets occur under two distinct conditions of membership change. The first pattern of change occurs in gestation when an influx of new resource holders into the core leads to calls for widening the scope. Hence the Olympics saw a significant scope increase coinciding with the founders' attempts to please IOC, appease the Sports federations, and placate public agencies and lobbyists. Similarly, as new members joined in Crossrail in gestation, the goal evolved to resolve broader transport problems across Greater London.

As it requires considerable effort to negotiate these changes, the full effect of a new member's demands may remain inadequately integrated into performance baselines unless the environment prohibits the scheme to forge ahead before the expectations are reconciled—this was the case of Crossrail and T2. In contrast, London2012 dodged the scrutiny from the UK Parliament, and thus the reconciliation of the performance targets took place only much later on in delivery.

A second equally substantial change to the system level performance targets occurs when the founders appoint an agent to manage project delivery. At this interlock, this so-called delivery agent has to recruit the suppliers who will further challenge the core's assumptions through the tendering process and constrain decision-making at the core. To protect perceptions of their own performance, the delivery agent wants to commit to a more robust performance baseline aligned with more recent information, and thus sets off a new round of negotiations for the performance targets.

Hence after the appointment of the ODA in the Olympics, CRL in Crossrail, and new management at T2, the performance targets were invariably readjusted. For example, in the Olympics, the scope was reduced and the budget grew after the ODA took the helm of development, but the schedule remained fixed; and in Crossrail, the schedule slipped and scope was removed after the CRL got on board, but the budget remained unaltered. One respondent quipped about this pattern, "they [delivery agent] will immediately say 'it's their [predecessors] fault, they've stuffed up all the estimates'...and they [predecessors] will say 'bloody amateurs, couldn't they build it for that?'".

Admittedly, not all changes in the system level performance targets can be attributed to negotiations carried on by founders and newer core members. Crossrail began with a goal around a central London train, but over time London's economic geography altered. Arguably this evolution in the environment contributed to a rethink of the core membership, and to subsequent changes in performance targets. Furthermore, when development lasts decades unforeseen events occur that directly impact on performance targets. The financial crisis, for example, required the UK government to bail out the developer of the Olympic village and to ask Crossrail to devolve £1bn of contingency funds; both cases held the founders' feet to the fire and forced them to defend their prior performance targets. And in the T2 case, during development, BAA changed hands and later the government told the company to end its monopoly control over the London airports. These changes contributed to BAA's decision to shelve plans for the second phase. The airlines were outraged, but a BAA director said—'you created the beast, and this is how the beast is playing out'.

Major changes in the environment were, however, exceptional in contrast to the empirical pattern that links evolution in the mega-project organizational structure to changes in the performance targets. We now examine three mechanisms that motivate the changes to performance targets, and explain how these changes in turn create ambiguity in evaluations of performance, and thus trace the ambiguity in performance back to the evolution in the structure. The scheme in Figure 1 illustrates the logic that emerges from the analysis of our empirical findings.

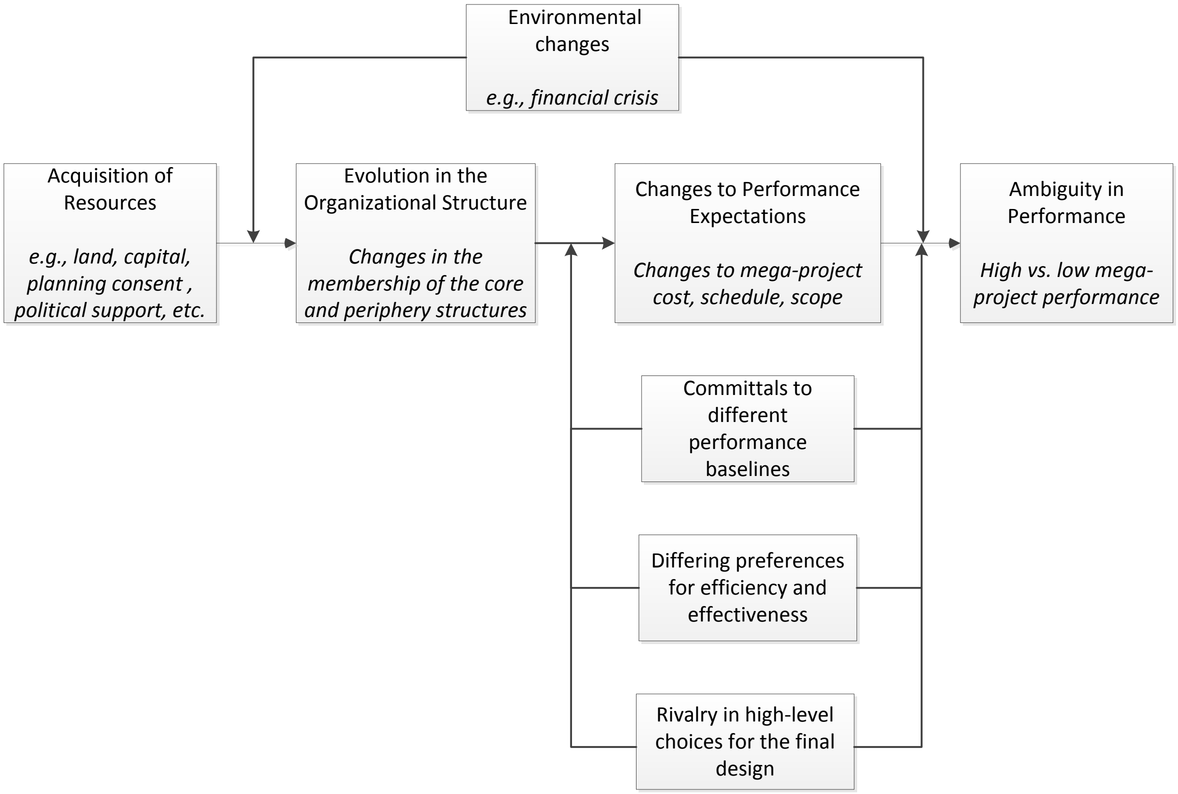
Environmental changes
e.g., financial crisis
Acquisition of Resources
e.g., land, capital, planning consent , political support, etc.
Evolution in the Organizational Structure
Changes in the membership of the core and periphery structures
Changes to Performance Expectations
Changes to mega-project cost, schedule, scope
Ambiguity in Performance
High vs. low mega-project performance
Committals to different performance baselines
Differing preferences for efficiency and effectiveness
Rivalry in high-level choices for the final design

Figure 1 – The link between Evolution in Structure and Ambiguity in Performance

The logic of figure 1 is summarized as follows; an influx of new members alters the organizational structure of the meta-organization. This new meta-organizational structure must then negotiate a new baseline performance and accompanying scope. This causes tension between those that disagree between rival design choices, and those that disagree over the trade off over design efficiency and effectiveness. As these schisms cannot typically be overcome through further negotiation it results in a myriad of different interpretation of performance. These problems are then exacerbated by shifts in the environment which can change the public narrative between efficiency and effectiveness. Crossrail was hit by one such environmental shift causing previous accepted targets to suddenly be seen as bloated and requiring over 600 design ideas to be stripped from the scheme – undoubtedly to the dismay of those who had fought hard to have them included. Our data suggests that even when the core reaches a state of relative stability there still exists long unresolved argument over the ‘best’ way to build the infrastructure. This is especially true when the system as a whole is under pressure to commit to schedule targets – thus spending time resolving one misalignment between member preferences can just as easily create another with a new set of members. An example of long running animosity of overall system performance can be seen in the relationship between STAR Alliance and BAA. The airport operator and airline group remained adversarial throughout the T2 scheme; STAR felt from the outset that their individual performance targets would never be met by BAA. They argued vehemently that the design failed to match up to that offered to its rivals in British Airways; whilst BAA maintained that STAR had been offered the best value for money available given the current environmental conditions. Whilst time pressure from the regulatory cycle forced STAR into accepting BAA’s offer they strongly objected at every turn, and arguably damaged BAA’s reputation in the eyes of the regulator which during this period stripped BAA of much of its monopoly over the UK’s airports.

We now examine this logic in more detail in the remaining sections.

4.4.3 The Influence of Committals to Different Performance Baselines

Our findings suggest that each iteration of the performance baseline reflects the zeitgeist of the new mega-project organizational structure and corresponding high-level preferences. Yet not everyone will agree with the legitimacy of the newer baselines. In particular, the aforementioned announcements of new baselines at the interlocks between development stages are controversial.

If the intent is to slam the mega-project performance, or to craft a narrative of strategic misrepresentation and optimistic bias (Flyvbjerg et al. 2003), our sample suggests that critics can refer back to the original project baseline to support the argument. The comparisons of cost data are not linear because of longitudinal changes in accounting reporting practices. But the three mega-projects in our sample do fare badly when their performance is evaluated in this way.

Despite this, many praise the observed mega-projects for their performance. In the Games case, for example, top management of the delivery stage brazenly stated that their performance was a story of great leadership—"for the ODA all came together", said its Chairman in 2013 proud that the ODA had delivered the Olympic park within the budget it negotiated in 2007. And yet enthusiasm was not universal particularly after the founders and the ODA agreed to sharply increase the budget envelope at the onset of delivery—"we've been treated like imbeciles by those who believe they've a divine right to squander other people's money", said a tabloid (Hardman 2011), and the respected Financial Times concurred "the costs were grossly and persistently underestimated" (Kay 2013).

In summary, as the mega-project structure evolves, performance targets change irrespectively of whether prior targets were or not scrutinized by the environment. They change because new management chooses to commit to new performance baselines. By renegotiating high-level design choices, and by building in slack in the budget and schedule if possible, new management hedges against the perceived risk that targets have to slip later on to accommodate more demands from new latecomers to the core, supplier bids higher than anticipated, or changes in the environment. The co-existence of committals to different performance baselines, each one associated to a legitimate organizational structure fuels antagonistic evaluations, and ambiguity in performance ensues.

We examine next how performance can be evaluated differently irrespectively of the baseline.

4.4.4 The Influence of Differing Preferences between Efficiency and Effectiveness

Our analysis shows that the core members of a mega-project will dispute the need to change the high-level choices as development unfolds. Some members show a preference for fixing upfront the project scope and corresponding performance targets; for these members high performance is about efficiently delivering on the upfront commitments. For others notably new latecomers to the core and actors that operate under uncertainty over their needs for the infrastructure in use, high performance is about providing flexibility to adapt the scope as development unfolds, and thus maximize the asset's long-term effectiveness. These different but equally legitimate perspectives about how the mega-project should perform are difficult to reconcile, and as the organization evolves and core members negotiate hard choices between efficiency and effectiveness, ambiguity in performance arises.

The Heathrow T2 case offers a good example. Due to volatility endemic to the airline industry, throughout development STAR kept pushing for changes in the high-level design requirements and asked to delay design commitments. But at the onset of delivery, with a new BAA capital projects team at the helm, the airlines were asked to bed down all the design requirements. The airlines hit back saying that they were not ready to commit. Frustrated, one new BAA director compared the airlines to a child entering a sweetshop: 'they're not quite sure, but know they want something.'

As it turned out, the conflict between the concerns of the new BAA capital management team with efficiency and the STAR's demands for flexibility dragged throughout the delivery stage. STAR successfully pushed for major changes at the onset of delivery—'if you've to make changes, it better damn well be good', threatened the BAA capital projects director—after which BAA froze the design requirements to the dismay of STAR. But two years before the opening, the domestic carrier of STAR left the alliance, which wreaked havoc on the occupancy strategy for the future terminal, and BAA was forced to let the cost target slip again to accommodate a new round of very late changes.

A similar pattern was observed in the other schemes. At the onset of the delivery of Crossrail, for example, new management fired an opening salvo by announcing a controversial freeze of the high-level design requirements ten years ahead of the opening date. And in London2012, under pressure to get the suppliers on board, the Olympic Delivery Authority sought to freeze the requirements and budget once it got in post into a new baseline so-called the 'Yellow Book'. The sport federations protested that it was premature to freeze the requirements before the 2008 games, the 'Beijing effect' as they put it, and a long list of exclusions had to be co-produced to accompany the Yellow Book.

In the absence of objective data about the socio-economic value of ploughing ahead to keep development on target versus letting the targets slip to accommodate change, different and subjective evaluations of performance arise as a function of the discretionary emphasis put upon efficiency versus effectiveness. Parties that fail to force late change slam the mega-project performance on the basis of lack of flexibility. Those that won the fights hail the performance by stressing the need to be efficient. This leads to different concomitant evaluations, and ambiguity in system level performance ensues.

4.4.5 The influence of Rivalry in Preferred High-level Choices for the Final Design

A final mechanism that explains changes to performance targets and how these changes in turn create ambiguity in performance pertains to the rivalry in the preferences for the final design amongst core members, as well as in the preferences between those at the core and outsiders that failed to directly influence the final design. The case of T2, wherein BAA, STAR, and the regulator crafted the system-level goal of the scheme, illustrates how collective development of a single, monolithic, designed artifact for common use is complicated. It was the regulator's role to ensure that all the airlines were treated equally; to this end the regulator had the power to veto BAA's plans. Still, STAR never felt wholly enfranchised because, in its view, the regulator did little to force BAA to meet the initial pledges. STAR also never fully accepted BAA's argument, accepted by the regulator, that physical constraints made it impossible to add a modern baggage handling system in the first phase—'there's an inherent weakness in everything that is being supplied', said the STAR director.

The development of the other schemes was also beset by conflicts over high-level design choices between founders and latecomers to the meta-organization's core. For example, the Olympics founders were accused of callous indifference to leaving a "white elephant" after a coalition inside the core staved off calls by football aficionados to renege on the bid promise to create an athletics venue in legacy[13]. Other fights are fueled by the delivery agent's preferences for high-level design choices that allow them to hedge against the risks of schedule and/or budget slippages during project delivery. Hence Crossrail management was accused of paying lip service to their motto for a 'world-class railway' after turning down the EU railway regulator's call to adopt leading edge technology. And Crossrail management's decision to renege upon prior non-binding commitments such as enhancements to the stations outside London infuriated the respective local councils and the architectural lobby who accused management of leaving a 'mediocre legacy'; after a gory fight leaked to the public press, the managers were forced to make a series of embarrassing U-turns.

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[13] The battle dragged throughout development, and after the Games the stadium was leased to a premier league football team, with the national government footing the bill for the ex-post reconversion of the asset

Finally, other fights were caused purely by antagonistic preferences for the final design. A good example is one that opposed a local council against the Crossrail founders. The founders opposed to the idea of adding toilets to the local station ('we told them to bugger off …they [toilettes] are nothing but a nuisance', said one respondent). But the Councilors could not disagree more; after years of unsuccessful talks, the proponents raised a ruckus in Parliament ('will the Minister [of Transport] join me in urging Crossrail to build some toilets?'). After this well publicized political move[14], the founders appear to have taken fright and caved in to the Council's demands.

In summary, actors that lose fights over the high-level design choices are tempted to shame the performance of the mega-project in the court of public opinion, whereas the winners will proudly stand by their decisions. Given the lack of a universal definition of performance and of time and resources to resolve the emerging controversies through dialogue and using objective evidence, the debate on mega-project performance remains inconclusive and mired forever in political fights.

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[14] Arguably because of the use of the word 'piss' in Parliament, Daily Hansard- Debate, Commons Debates, House of Commons, 23 June 2011 and Hoggart, S. (2011). Looking after number one. The Guardian 23 June

5 DISCUSSION

Our analysis suggests that mega-projects are a hybrid form of meta-organization blending properties from both open, pluralistic systems (Garud et al. 2014, Shipilov et al. 2014, Kratz and Block 2008) with closed, hierarchical systems (Simon 1962, March and Simon1993). To make sense of this hybrid we argue that a megaproject consists of two interdependent structures – a core and a periphery (Hannan and Freeman 1984; Siggelkow 2002; Thompson 1967). The core consists of those members that possess resources critical to the achievement of the system-level goal, and which are not easily substituted. In contrast, the periphery consists of those members that hold resources that can be acquired through market transactions. The mega-project's founders hold substantial amount of decision-making power, but lack absolute authority. Over time the founders, out of necessity, invite other stakeholders to join the core, thus core membership evolves over time through entries (and sporadic exits) of other actors. A high degree of interdependency between the core actors operating under time pressure results in bargaining aided by face-to-face interactions and knowledge exchanges to seek consensus. The structure at the periphery, in contrast, is formed by a vast supply chain selected to design and build the infrastructure but not granted direct influence over the high-level choices.

Mega-project meta-organizations are thus not open systems such as open communities of production (Lakhani and Von Hippel 2003; O'Mahony 2003), global communities of scientists (Tuertscher et al. 2014), or managed business ecosystems (Baldwin and von Hippel 2011) since a significant class of members—the project supply chain—cannot self-select or volunteer for tasks. Rather the mega-project suppliers must apply for membership and compete to be selected as typical of a meta-organization with closed boundaries such as

OEM-supplier networks or closed consortia. But equally, a mega-project meta-organization is not a wholly closed system because the boundaries of the core are permeable. Throughout development, new parties can gain core status through lobbying or leveraging valuable resources to force their preferences into high-level choices.

Nor do the organizational structures that we observe fit neatly between highly stratified and flat decision-making bodies. In stratified meta-organizations, the higher-tier members have increased decision-making privileges and take additional responsibility for orchestrating the efforts of other members; they also rely on an authority hierarchy built upon employer-employee relationships and legal contracts to resolve emerging controversies (Gulati et al. 2012). This fits with the relationship between the mega-project's core and the supply chain where contracts are used to simulate hierarchical authority (Stinchcombe 1965; Stinchcombe and Heimer 1985). In marked contrast, the decentralized governance structure held between the core members of a mega-project reflects more egalitarian systems in which interdependency of the member's resources creates a relative equality.

We turn now to discuss how these idiosyncratic features of the mega-project meta-organizations suggest theoretical and practical complications relative to other known meta-organizations.

5.1 The permeable boundaries of the mega-project meta-organization's core

The inception of a mega-project's core is a 'social matching process' (Barnett et al. 2000) in which the founder and other parties seek out a mutually acceptable goal and plan to achieve it. For the founders, core membership is permanent and gives them system-wide decision rights ex-officio. Other parties that join the core as the development progresses, e.g., a local council, by the nature of their position, may also gain decision rights ex-officio but these will be bound to particular components.

The permeable boundaries of the core are necessary for the founders to attract commitments of resources from powerful actors who could otherwise oppose to the mega-project and prevent it from thriving. Increasing the size of the collaborative brings additional resources that can be drawn upon to provide a benefit enjoyed by all (Gray and Clyman 2003; Ostrom 2005). But the permeability of the core also exacerbates pluralism (Shipilov et al. 2014) and the risks that some actors feel marginalized and leave the enterprise (Pratt and Foreman 2000), and thus the costs of resolving differences.

Importantly, the mega-project's core has no single gatekeeper or 'systems-integrator' (Brusoni et al. 2001) that unilaterally controls core membership and product design architecture. Occasionally parties which hold non-critical resources gain access to the meta-organization's core through effective lobbying and bargaining. This can be problematic as extant core members may disagree on the legitimacy of latecomers who, in their view, seek to benefit disproportionally to their stakes. This in turn undermines efforts to achieve goal congruence, a useful action to encourage unfamiliar parties to collaborate (Beck and Plowman 2014). By the same token, as the core structure evolves, coalitions of members can form which seek to renege on prior pledges and disenfranchise less powerful members.

The mega-project core members therefore operate under a relatively pluralistic structure. They share the goal of getting the infrastructure done. But they belong to different communities of practice (Brown and Duguid 1991), and thus are individually motivated by different interests, knowledge bases, and beliefs. Hence, they may fundamentally disagree over how to achieve the goal, and the epistemic and cognitive differences (Puranam et al. 2012) are complicated to bridge In such pluralistic environment it is hard to rely on a meritocracy-based authority (Hippel and Krogh 2003) to resolve controversies. To complicate matters, the core members operate under deadlines imposed by rigid electoral or regulatory cycles, which limit the scope of the discussions and undercut collaboration (Susskind and Cruikshank 1987). Thus the core is under pressure to cut deals at the same time it seeks consensus through cycles of knowledge exchange and transformation and production of compelling evidence and superior arguments (O'Mahony and Bechky 2008; Tuertscher et al. 2014). In pluralistic and constrained developments, the parties find it tempting to use mutual gains bargaining and interest-based negotiations to pragmatically bridge differences (Garud et al. 2014; Gil and Baldwin 2013).

Hence the mega-project is rife in controversies amongst core members, some of which turn into political fights; controversies and fights between core members and outsiders wishing to enter into the core are also common. These confrontations can drag for years creating high uncertainty over the high-level design choices until a mutually acceptable solution emerges, the opponents are defeated, a dissenting party defects, or the venture collapses. A degree of self-selected membership together with relatively flat decision-making are thus the qualifying attributes of the mega-project core.

5.2 The vast but closed mega-project meta-organization's periphery

Since the core members of a mega-project rarely have the in-house knowledge, skills, and labor necessary to design and build the infrastructure, they acquire these resources by using market mechanisms (Ouchi 1980) to select a complementary supply chain. As the suppliers do not have a monopoly over key resources they must compete for membership. For example, the endorsement of the local councils to the Crossrail scheme was irreplaceable, but a few suppliers were capable of designing and building the railway stations. Hence exchanging one supplier for another with similar capabilities, ceteris paribus, does not require changes to the high-level design requirements.

Potential suppliers are not however all equivalents, and a supplier seeking membership to the mega-project must prove it is the best for the job. Still, the suppliers are selected not to disregard, alter, or veto the high-level choices, but to translate them into drawings, specifications, and physical artifacts. If the design requirements change, the supplier itself may need to be replaced—the architecture firm for T2 was replaced mid-course, for example, after the core dropped their aspiration for T2 to aesthetically match T5. Because a supplier can only become a member if it gets selected by the mega-project's core, the boundaries of the meta-organization's periphery are effectively closed.

Unlike the bargaining and decentralized governance observed at the meta-organization's core, the suppliers carry out their work in accordance with contracts they hold with one or more core members. Suppliers can subcontract work out to other firms, but the actions must remain within the bounds of the contract. Suppliers can also propose changes to the high-level choices, but only the core has the authority to approve such changes. Still, the periphery members play a key role in validating the core's goal and the performance assumptions underpinning the plan to achieve it.

Critically, after the core lets out contracts to the suppliers, the core members lose the flexibility hitherto enjoyed to make development deals (Williamson 1975). Many schemes unravel when either the core forges ahead in gestation without sounding out suppliers if the performance targets are realistic, or the core hammers out late development deals without negotiating first the extra costs and risks with the suppliers already on board (Stinchcombe and Heimer 1985). Core members and suppliers are thus symbiotically related. The core needs the suppliers to get things done for a target price and timescale; the suppliers need the opportunities created by the core to make profit. Market selection together with binding contracts qualify the mega-project organization's periphery.

5.3 Linking Evolution in Organizational Structure to Ambiguity in Performance

Prior studies of the relationship between organizational structure and performance illuminate the elusiveness of this relationship. Not only different structures can lead to similar levels of performance (Doty, Glick and Huber 1993; Gresov and Drazin 1997), but also performance is shaped by interactions between high- and lower-level choices (Siggelkow and Rivkin 2009) and environmental factors (Child 1972; Davis, Eisenhardt and Bingham 2009). Our research uncovers another factor: the evolving nature of the definition of performance—a process of constantly shifting goalposts as the core membership remains in flux—independently makes the measurement of the structure-performance link difficult. Our research shows that ambiguity at a systems level arises both in the "baseline against which performance is evaluated" and in the "definition of performance".

First, in mega-project meta-organizations, core members do not join all at the same time, and different core members have different preferences, beliefs, and priorities; they also differ in the planning horizons, a major cause of problems in collective action (Ostrom 1990, Ansell and Gash 2007, Gil and Tether 2011). When many autonomous actors are part of a constrained collaborative development and share the right to design a single non-decomposable asset their preferred choices are mutually exclusive and thus subtractable, i.e., it is one or the other (Gil and Baldwin 2013).

Endemic to mega-project meta-organizations is thus a problem of appropriation characteristic of developments in which organizational and design structures do not mirror one another, and thus are misaligned (Colfer and Baldwin 2010). Mega-projects consist of sets of monolithic components with varying degrees of interdependence. Still, a coalition with system-wide rights to design the whole shares the right to directly influence the design of each component with many heterogeneous actors. Thus the *design in the making* exhibits the qualifying properties of a common-pool resource—many autonomous claimants are entitled to use the resource, but its use by one claimant deprives others from the flow of potential benefits (Ostrom 1990). And indeed, not all core members will see their preferred choices making into the final design. As the core membership grows, and thus the structure changes, the problem of appropriation grows commensurately, and the core faces hard choices.

To bridge the differences within a solution space constrained by announcements of performance targets, the leading coalition and latecomers can opt to bargain and use politics—a pattern of developments that unfold under pressure (Eisenhardt and Bourgeois 1988; Gersick 1994). But this creates winners and losers, which creates risks that some parties defect (Garud et al. 2014; Tuertscher et al. 2014) and thus a failure to harness the benefits of pluralism (Kraatz and Block 2008). Gaps in expectations between the design that some actors craved and what they got fuels different evaluations of performance irrespectively if the mega-project stayed or not within the cost and schedule targets.

Another alternative for resolving controversies that arise during development between core members is to relax the boundaries of the problem, and therefore *if the environment allows,* let the schedule and/or cost targets slip. Slippages in the performance targets allow for different interpretations of the performance, and thus ambiguity in performance on two accounts.

First, even if different parties evaluate performance against the same baseline, slippages are framed (Benford and Snow 2000; Gray and Clyman 2003; Gray et al. 2014) as failures by those actors who put efficiency above adapting development to late requests for design change. In contrast, for others it is more important to flex design to emerging needs than meeting initial performance targets. For the latter, slippages evince that the autonomous parties succeeded to bridge their differences.

And second, slippages in cost and schedule targets create different legitimate baselines against which performance can be evaluated. Our findings show that major slippages in targets are associated with discrete interlocks between development stages, and thus with fundamental changes in the membership of the mega-project. Hence the last actors to announce performance targets argue it is only legitimate to evaluate mega-project performance against the targets that their structure announced and committed to. Other actors, in contrast, underplay the significance of changes in scope, and insist it is legitimate to evaluate performance against the baseline committed to by a prior organizational structure. Of course outcomes of evaluations of performance vary according to the adopted baseline, and since it is not easy to rule one out, ambiguity in performance ensues.

The ambiguity in performance that we trace back to the organizational evolution gets further amplified by the interaction between the mega-project and the environment. For one, the inability of some actors in the environment, despite fierce lobbying, to enter the meta-organization's core and change the design requirements contributes to concomitant differences in evaluations of the performance of a mega-project. Other actors in the environment may simply oppose to the whole venture. Excluded or otherwise disenfranchised, these actors may seek to highlighting inconsistencies and pointing to prior expectations against which the scheme will be shown to be doing poorly. Radical discontinuities in the environment such as a financial crisis or the breakup of a monopolist are sporadic, but can change performance expectations and thus amplify ambiguity in performance.

As characteristic of inductive studies, there are important limitations to the generalizability of our insights. To lessen the effect of this our sample was diverse, but all the schemes unfolded in London, a global city in a democratic nation with stringent planning laws and a strong regime of property rights. Organizations like the World Economic Forum argue that infrastructure and institutions are two pillars of what makes societies competitive (WEF 2013). But institutions differ substantially across societies. We thus do not claim as universal our conceptualization of a mega-project as a hybrid meta-organization, neither the link between evolution in structure and ambiguity in performance.

Furthermore, the mega-projects in our sample were also either publicly financed, or financed by a private monopolist operating in a regulated environment. More research is thus needed before extending our insights to infrastructure promoted by firms operating in more competitive markets.

6 IMPLICATIONS FOR PRACTICE

Managers of mega-projects, we argue, have been denigrated by suggestions of incompetence and Machiavellian guile. By looking to mega-projects as a meta-organization, our study claims that they are not developed by unitary actors but by evolving collectives. Furthermore, we argue that mega-project managers lack the sources of authority found in hierarchies or contracts with respect to co-members of the core structure (though they have this mechanism with respect to handlings with the periphery), and thus managers must negotiate a set of performance expectations that satisfices (Simon 1981) an evolving host of dissenting independent actors and political masters.

Specifically, our study sheds light on the often contradictory pressures that managers of mega-projects are forced to reconcile. In the face of a changing environment, and ongoing growth of meta-organization membership, mega-project managers are encouraged to be adaptable and create new performance baselines to meet incoming challenges. But releasing new performance targets which are inconsistent with previous announcements generates complaints that the scheme is inefficient and is spiraling out of control. Equally, failing to adapt to changing conditions attracts similar levels of disdain of lobbyists for change (from both within the meta-organization and outside) who accuse mega-project managers of being undemocratic and indifferent to risks of producing a 'white elephant'. In the absence of a clear cut definition of performance, to maintain the legitimacy to manage, mega-project managers are thus constantly struggling to balance their commitment to a prior set of performance expectations against the need to let the performance expectations evolve.

Hence mega-projects suffer from being 'designed by committee' (Rosenkopf, Metiu and George 2001) resulting in tumultuous changes to the scope and to cost and schedule targets; unifying all members under a shared goal and plan to achieve it, this is a 'future perfect' (Pitsis et al. 2003), that is itself a goal difficult to achieve. That said, we see five areas where managers can reduce the costly impact of conflict and/or avoid the perception of poor performance.

Given that critics frequently attack mega-project performance on two fronts, the gap between early and late expectations and the frequency with which expectations change, managers should do more to persuade the leading coalition of founders to delay the release of time and budget estimates for as long as possible. We recognize that this is easier said than done, however. Political masters operate under rigid electoral cycles and thus under pressure to make announcements. And without announcing precursory commitments to tangible performance targets, the founders may struggle to build legitimacy for the scheme and thus to acquire critical resources (Stone and Brush 1996).

In this vein, managers may find respite in committing to flexible targets *if the environment allows*. For example, soft openings can be announced instead of rigid opening dates—both T2 and Crossrail did that; and managers may also lobby late claimants for using their own budgets to finance late design changes, which allows keeping stable the budget at the heart of the scheme.

A second method of avoiding the perception of poor performance is building substantial contingencies onto the scheme's critical path and budget envelope before releasing performance targets. This adds organizational slack, i.e., uncommitted resources reserved to satisfy individual and sub-group objectives (Bourgeois 1981). This approach gives managers more room to resolve conflicts under pressure (Cyert and March 1963; Galbraith 1973) and buffers performance expectations from the impacts of discontinuities in the environment (Thompson 1967). It thus masks slippages—as one manager said "undershooting always causes more problems than overshooting", and was applied both in London 2012 and Crossrail. But there are trade-offs. Large contingencies make it harder to sell the scheme in gestation. And they can become a self-fulfilling prophecy and encourage opportunistic members to make even greater claims on the final scope. London2012, for example, depleted practically all its contingency, and Crossrail is 'going down the same way', one respondent said.

A third approach to improve the perception of performance lies in cutting out the source of late changes. Throughout gestation, the growth of the core membership, and thus creating a pluralistic enterprise (Shipilov et al. 2014) is vital to acquire key resources to forge ahead. But the more core members the more complicated collective action becomes (Ostrom 2005) and thus it is tempting to fend off lobbying from other parties to enter the core. Excluding resource-poor claimants brings short-term benefits but undermines legitimacy (Gray 1989), and increases the risk of late conflict if the excluded claimants force a late entry into the core and form a coalition to overturn high-level choices.

7 FURTHER RESEARCH

Our research highlights two important areas for further research. Given ambiguity in system level performance success, as we have argued, for the architect may be seen in terms of building a robust megaproject that can be buffered from internal and external shock but what strategic levers do architects have available to protect the scheme from rampant conflict and environment shifts? It may be worth exploring the extent to which managers have scope to influence the sequence of entry of members into the core. It can be tempting to allowing the members with the most bargaining power over the design choices with greatest interdependencies enter the core first. But if the inclusion process is too slow, the resources maybe stretched too thin, momentum is lost and legitimation problems arise (Johnston et al. 2010). Thus there is a trade-off. And it remains undetermined here the extent managers have freedom to manipulate the order and pace through which the core grows and thus the sequence and pace of collective action problems that core members face.

Second, our study suggests that megaproject strategy is not controlled by hierarchical governance but rather through the formation of power coalitions who dictate the development of the scheme – sometimes against the wishes of the architect themselves. This raises an interesting question as to the development of robust governance structures in megaproject settings. Gil and Baldwin (2013) have suggested that collaborate developments in infrastructure can resemble Ostrom's (1990) commons governance. This nested, polycentric approach decentralizes authority and gives local groups substantial decision-making autonomy insofar they do not violate higher-level rules. When local groups fail to converge, they *defer* the search for satisfying solutions to top governing bodies. If commons governance is robust, collectives self-develop social norms of cooperation, trustworthiness, and reciprocity, and thus avoid tragic outcomes (Ostrom 1990). However, further work is needed to demonstrate if this concept of commons governance can be extended into megaproject meta-organizations.

8 CONCLUSION

This study offers an explanation for the prevailing perceptions of poor performance of mega-projects using the lens of meta-organizations. Prior studies on mega-projects have labeled slippages in time, cost, and scope as indicative of poor performance. By relaxing the assumption that mega-projects are unitary organizations, our study has uncovered a hybrid meta-organization. At the core, a porous collective led by a coalition shares the right to directly influence the final design of an indivisible structure for common use. At the periphery, a closed supply chain does the actual design and build works, but has limited direct influence over the high-level choices. Our task here has been to explore the link between this organizational structure and performance.

We find that the changing nature of the core membership and the bargains and compromises struck among its members imply that the scope of the mega-project: a) will evolve considerably; b) will deviate substantially from initial estimates; c) will be measured on very different dimensions; and d) will always leave some core (and non-core) members dissatisfied. The conflation of committals to different baselines, differing preferences for efficiency and effectiveness, and rivalry in high-level choices gives rise to competing performance narratives which cannot be reconciled. Perceived performance is therefore ambiguous, and frequently described as disappointing by at least some stakeholders. Environment-driven changes to performance expectations exacerbate ambiguity in performance, but are not be the main reason as to why performance is ambiguous. The environment in which a mega-project unfolds creates a public record of initial targets created by de jure structures. These targets allow people to legitimate interpret them as commitments to unmovable milestones, and thus can be used to buttress accusations of underperformance when the expectations change.

Normatively, system level performance in a megaproject could be tracked on a number of levels. Given a means to extract the totality of member preferences within the system it would be possible to look at the effectiveness of the trade-offs between different design choices, and budget and schedule allocations, to see if manager were maximizing the potential design space i.e. was there a set of design parameters, which better satisficed the most amount of users in terms of effectiveness and efficiency. Unfortunately the complexity of the megaproject meta-organization makes such an analysis extremely difficult and is unlikely to be undertaken by many of the megaproject actors themselves who are only temporarily affiliated with the scheme.

Thus on a more rudimentary level we argue that in the same way that beauty is in the eye of the beholder, when it turns to mega-project meta-organizations, different actors see different things. Their statements of performance are often political and shaped by the expectations that they choose to adopt as the baseline and by the extent to which throughout development and in the end the actors achieve what they crave. In such conditions high performing meta-organizations may be those where the greatest number of actors share a positive performance narrative.

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Paper 3

Strategic capabilities for megaproject architects: sequencing network growth and bottleneck removal

Colm Lundrigan

Nuno Gil

Strategic capabilities for megaproject architects

This study discusses strategic capabilities necessary to improve the performance of the promoters of new developments of large infrastructure so-called megaprojects. To get to the end goal, promoters must assemble vast networks of resource-rich, autonomous actors and share with them direct control over high-level design decisions for indivisible components. Hence promoters are ‘system-architects’, and they need architectural knowledge both of the stakeholder landscape and technical design to carry on their task structure. We then suggest two strategies which allow promoters to build resilient megaprojects; first by sequencing the growth of their organizational networks – acquiring powerful central actors first - and second by adding flexibility and slack to the scheme’s designs to absorb emergent problems. Next, we develop a conceptualization of institutional environments which demonstrates when and where such strategies might be effective. Finally, we discuss pitfalls that may prevent promoters from stabilizing their networks and thus prevent slippages in performance expectations, a prerequisite to sustain public legitimacy for the scheme.

1 INTRODUCTION

Megaprojects, the organizational networks formed to develop large infrastructure such as airports, railways and power plants, the backbone of modern society, are an important form of public-private partnership. Infrastructure gaps, traditionally the preserve of developing economies, are now a major issue for developed economies too. The case of United States is telling. Cities like Boston are notorious for their crumbling public transport systems; and the multi-billion dollar damages caused by the Hurricanes Sandy and Katrina, and late deadly bridge collapses, have spotlighted the country’s chronic underinvestment in infrastructure.[15] Population growth, rising sea water levels, and migration flows are phenomena all expected to amplify infrastructure needs throughout the century at a time many governments are cash-strapped. Improving megaproject performance is thus paramount since worldwide spending—in the order of four trillion dollars yearly—is way short of meeting future worldwide needs.

This study aims to turn the page on this debate by offering a number of insights into the development of megaprojects, the needed capabilities of their leading actor – the so-called 'system architect' - and their strategic approach to growing their organizational network whilst overseeing the development of the infrastructure's design.

Drawing from literature on the development of complex products and systems, we argue that megaprojects are a complicated form of organizing production activities since the multiparty organizational structure behind a new development is misaligned from the structure of key functional components in any large infrastructure. Since the end goal is to produce long-lived, capital-intensive assets, the stakes are high and thus new infrastructure developments are ridden with inter-organizational conflict.

Yet, megaproject promoters that are adept, we argue, are proactive in handling the 'wicked' planning problems (Churchman, 1967; Rittel & Webber, 1973) that are endemic to these enterprises. Since judging the performance of a megaproject system as a whole is complex (Lundrigan, Puranam & Gil, 2015) we define an adept architect as one who can build a robust system capable of enduring through internal and environmental turmoil (Miller & Lessard, 2001). In order to create a robust system the architect must ensure that they maintain legitimacy and commitment from those actors who contribute towards the megaproject, whilst adapting the organizational structure and technical design to meet the needs of a changing environment.

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[15] For a detailed view of the global infrastructure gap see, for example, the Global Competitiveness Reports that are yearly produced by the World Economic Forum.

In this study we propose that adept architects must develop two intertwined capabilities rooted in the knowledge of technical design and stakeholder landscape. These capabilities may be derived from hiring staff and suppliers with prior experience of similar megaprojects (e.g. familiarity with the regulatory environment, experience of working on the same type of infrastructure design) or through the accumulation of knowledge gained throughout the megaproject's own lifecycle.

Technical design knowledge involves understanding the system components, how they interface, and the rules governing the interfaces (Baldwin & Clark, 2000; Henderson & Clark, 1990). This knowledge is necessary for the architect to identify the hierarchy of design choices, assess interdependencies between choices, and the sequence of design decisions. Knowledge of the stakeholder landscape in turn is critical to design the structure of participation in the megaproject organizational network—this is, to identify which actors should join (and when) the working groups formed to develop the infrastructure components.

A megaproject promoter that has architectural knowledge can strategically plan to eliminate bottlenecks in development which dampens the risk of late slippages in the performance targets (Baldwin, 2014). Specifically, the promoter can do three things. First, it can align the hierarchy of design choices with the growth of the megaproject network. Commitments on high-level decisions should be made after the claimants to system-wide resources[16] are on board so as to create a high-level solution space that can cope with a variety of potential local pressures. Second, lower-level design choices should not be locked in without involving key local players that have a stake in the outcome. If decision-making groups are delineated to legitimate claimants, the promoter can expect less uncooperative behavior and free riders who refuse to compromise and make claims wholly disproportional to their stakes. Thirdly, the promoter can establish an adequate degree of flexibility and slack in the technical system to accommodate the potential for emergent actors and unforeseen events.

An alignment of the sequence the development deals with the growth of a network of legitimate claimants can mitigate risks of late arrivals of steamrollers who attempt to overturn commitments made in their absence. This, in turn, reduces the need for the promoter to, first, build massive budget and schedule contingencies so as to have organizational slack for coping with late disruptive claims[17]; and second, to engage in tough bargaining processes and tricky political activity for fending off political attacks on upfront development decisions. Ensuring that sufficient slack is available within the system allows the promoter to accommodate compromise in the technical design of the system by building ‘hybrid’ solutions that meet the needs of more parties – however, the promoter must be careful not to create an unrealistic budget which could damage their legitimacy in the eyes of their backers.

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[16] Here we use the term system-wide to indicate resources which impact across the entirety of the megaproject’s technical design. For example if a megaproject has a single funder, whose capital is used to build all components, then that funder holds system-wide rights to make decisions over the use of said capital.

[17] This practice was taken to the extreme in the UK after Treasury issued guidance on the need to substantially adjust cost and schedule forecasts with optimism bias factors, a practice that is unsustainable

In summary, an adept promoter acts strategically to influence how the environment ‘shapes’ the network (Miller & Lessard, 2001). In so doing, chances reduce of development failures in terms of impasse, endless iterations or unaffordable deals whilst keeping the decision-making process democratic (O'Mahony & Ferraro, 2007).

We ground our argument on a four-year long empirical study of four megaprojects in the UK (Lundrigan, Puranam, & Gil, 2015). Three schemes were mostly publicly financed: London Olympics, Crossrail (a high-capacity London railway), and HS2 (a high-speed railway connecting London and the Northern regions). The fourth, a new terminal (T2) at Heathrow airport, was financed by BAA, the airports’ private owner. Our sample of 121 interviewees included: i) top management and technical staff from BAA, UK government, London government, and public agencies; ii) design consultants and contractors; and iii) user groups such as Star Alliance (the occupier of T2), local governments, and owners of interdependent infrastructure such as Network Rail (the owner of the UK railway infrastructure) and Transport for London.

In addition to interviews we examined hundreds of archival documents such as technical and strategic project reports, parliamentary reports, design documents, and minutes of board meetings. We also examined commercially sensitive documents, e.g., cost reports, design change logs, and project dashboards, shared after we formally committed not to disclose the original documents under any circumstances. Finally, we invited 12 practitioners to give talks to our students and stay for lunch, documented numerous informal conversations, and developed detailed factual accounts for each case that we circulated for comments.

The remainder of this article is structured as follows. First we discuss the structural misalignment problem central to large infrastructure development and how megaproject promoters can develop strategic capabilities. We then examine the promoter's task structure and the capabilities necessary to carry on those tasks well. Next we variations in the megaproject environment which impact on the strategies available to the megaproject's promoter. Finally, we present two strategies that the promoter can make use of for their environment – sequencing the arrival of new members to control the growth of the megaproject, and adding flexibility and slack to technical designs to accommodate emergence.

2 MEGAPROJECTS: A PROBLEM OF STRUCTURAL MISALIGNMENT

Megaproject networks are not self-organizing systems. Rather, they combine elements of open and flat structures characteristic of distributed communities of production such as open source with the closed and stratified hierarchical structures found in OEM-supplier networks and managed business ecosystems (Gulati, Puranam, & Tushman, 2012). Leading this organizational network is the megaproject promoter—typically a coalition of actors unified by the grand idea. For example, the development of the Olympic park was led by the London and UK governments together with the British Olympic Association, whereas the T2 development was led by BAA, the airport owner, Star, an alliance of airlines, and the regulator. As the systems architect, the promoter is responsible for guiding the growth of the megaproject organizational network concurrently with the development of the technical design for the infrastructure. Promoters do so by influencing the boundary conditions and the distribution of decision-making rights.

The megaproject promoter does not have, however, absolute control over the high-level decision-making process. Rather, at the core of the network where strategic decision are made, the promoter shares direct control over the decision-making process with other autonomous actors which are unified by the superordinate goal and control non-substitutable resources. The boundaries of the core are porous as would-be designers can force their membership through virtue of the resources they hold. Within the core, decision-making is therefore consensus-oriented as no single body holds enough resources to force a decision.

In contrast, the periphery of the megaproject network is closed and populated by design and build suppliers that hold substitutable resources that can be acquired on the market. The suppliers join the megaproject through a process of selection and their relationship is governed by formal contracts that simulate an authoritative hierarchy (Stinchcombe & Heimer, 1985). Suppliers contribute labor and technical expertise, but have no direct control over strategic development decisions.

A central point in the literature on the development of complex products and systems is that the misalignment between organizational and product design structures is a source of managerial complexity (Colfer & Baldwin, 2010; Henderson & Clark, 1990; Sosa, Eppinger, & Rowles, 2004). This lack of mirroring occurs when the technical system is hard to decompose, but the design tasks are complex and thus require technical expertise that is fragmented across different units of a company or firms. To improve work coordination across boundaries, modular designs should be developed by modular organizations whereas integral designs are better developed by tight-knit teams lodged within a single organization.

A problem of structural misalignment is also central to new infrastructure development. Infrastructures are systems of indivisible components. For example, an airport includes runways, concourses, and a control tower; a railway includes stations, tracks, and control systems. Each non-decomposable component is shared in use by many autonomous actors who directly influence development because they control resources that are not up for sale and are critical for the scheme to forge ahead, e.g., land, finance, planning consent, and political support. Hence infrastructure developments create at the core, perforce, large arenas of consensus-oriented collective action wherein 'wicked' planning problems surface which are hard to resolve to the satisfaction of all the potential members of the production network.

Complicating matters is the 'one-off' nature of megaprojects. The development participants rarely have prior experience of working together, nor do they operate under the shadow of potential future developments. The fact they will share the asset in use may thus not be enough to develop robust relational contracts, agreements that require a long time to forge as they presuppose clarity of goals and credibility of both parties (Gibbons & Henderson, 2012). Rather, in the planning phase the megaproject promoter must rely, at best, upon fragile 'Memorandums of Understanding' that cannot be legally enforced and can be reneged upon with surprising ease.

Conflicts notwithstanding, the megaproject promoter must lead searches for mutually consensual design solutions whilst keeping to system-wide performance targets (i.e. the higher order requirements that encompass the entire infrastructure design) in terms of schedule and cost to sustain legitimacy for the enterprise in the eyes of third parties. Striking a consensus on a design is difficult when the claimants are drawn from different ideological, institutional, and epistemological frames. Exacerbating difficulties is the potential absence of key claimants at the outset of development. This creates a real risk of late arrivals of new claimants who disagree with prior decisions prompting another round of discussions that put pressure on performance targets committed to upfront. Slippages of targets fuel accusations the promoter was dishonest or lost control over the enterprise. Hence the promoter faces a delicate balance in that to keep the scheme on target requires authoritative decisions which create a risk of alienating resource-rich actors who can defect or lobby to overturn decisions.

3 STRATEGIC CAPABILITES FOR THE MEGAPROJECT ARCHITECT

Strategic capabilities are bundles of valuable routines which guide decision-making of managers at a micro level and of organizations at a macro level (Dosi, Nelson, & Winter, 2000). These valuable routines find their roots in the distributed knowledge held by individuals. Within an organization, the dissemination and combination of individuals' knowledge allow for the development of increasingly complex decision-making routines. Thus strategic capabilities are built from a hierarchy of knowledge beginning at the task-specific and individual level, and progressively integrated towards bundles of routines which inform higher-order decision-making for the organization as a whole. Literature on capabilities is motivated by fundamental questions about how organizations operating in competitive markets can survive in the long term (Eisenhardt & Martin, 2000; Teece & Pisano, 1994).

In marked contrast, megaproject promoters do not compete in market settings where the ability to adapt and overtake rivals is a necessary part of strategizing[18], nor do they need to concern themselves with organizational survival in perpetuity—the megaproject network disbands once the infrastructure is up and running. Still megaproject promoters need to be strategic to get to the end goal. Megaprojects are capital-intensive enterprises that compete for scarce resources, and thus their sustainability during the planning period (which lasts years) cannot be taken for granted, and indeed many major schemes collapse in planning.

Promoters have, however, limited opportunity to develop strategic capabilities through repeated experiences, and thus have to rely on 'primitive accumulation'—a process which allows capabilities to emerge without full understanding of final operating conditions (Dosi et al., 2000; Lave & Wenger, 1991). Primitive accumulation requires employing experienced staff drawn from a community of practice who are familiar with the environment and technologies at hand, and information-sharing processes to facilitate learning from prior experiences; primitive accumulation also relies on the experience and know-how of professionals who perform established job roles. Thus, in the planning stage, the capabilities of the megaproject promoter can be considered a patchwork of heterogeneous knowledge drawn from subject-matter experts. To speed up capability development, the promoter recruits seasoned managers for non-executive and executive roles who bring a wealth of contacts and 'lessons learned' from prior undertakings[19]. This recruitment process contributes to an institutionalized process of isomorphism (DiMaggio & Powell, 1983), and indeed the megaprojects which we studied exhibit similar organizational structures and development processes. Crucially to the point of this study, the presence of common practices across the sample suggests opportunity to develop promoters with strategic capabilities to guide the development of the megaproject network and the technical design.

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[18] However this does not imply that megaprojects exist in a static environment; changing economic and political conditions can always pose a threat to a megaproject's survival.

[19] For example, the CEO of the Olympic Delivery Authority is now chairman of HS2 Ltd.; the CEO of Crossrail Ltd was construction director of the Heathrow's T5 project; the CEO of HS2 Ltd used to be

In product development, strategic capabilities encompass two interrelated subsets—one pertaining to the social or contractual system, and another to the technical system (Baldwin, 2014; Baldwin & Clark, 2000). In megaproject settings, the social and contractual capabilities guide the growth of the network that develops and builds the artefact. To first achieve a mutually consensual design solution, the promoter needs to set the organizational boundaries, stratify decision-making rights, identify resource-rich actors, and integrate them into the network. Once the planning problem is out of the way the promoter needs to procure an array of suppliers to carry on the design and build tasks, and to write the contracts that govern the buyer-supplier relationships.

Figures 1 and 2 illustrate the growth of the megaproject organizational networks for Heathrow T2 and London 2012 throughout the development life-cycle, and the concomitant evolution of the cost forecast in final prices. In the first stage, ideation, an idea emerges that unifies a leading coalition of autonomous actors—this entity becomes the promoter and has direct control over the system-wide performance expectations, e.g., total cost, completion date, and the design requirements or scope. This stage is followed by planning

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capital projects director at Network Rail; the T2 capital director was the director of the UK largest nuclear complex, etc.

during which the promoter engages in analytical deliberations, bargaining processes, and political activity with a vast array of actors to develop a viable plan to achieve the gran idea. In the final stage, implementation, the suppliers are selected to carry on the engineering and construction work.

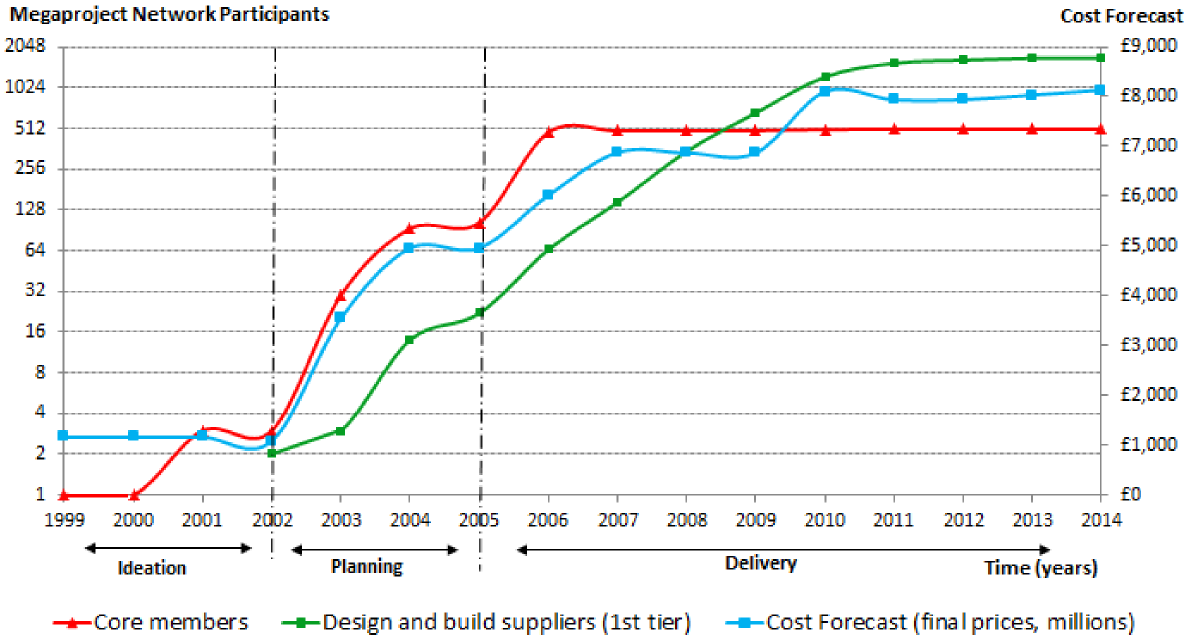

Figure 1 - Relationship Between growth of the 2012 Olympic Park meta-organization and infrastructure cost

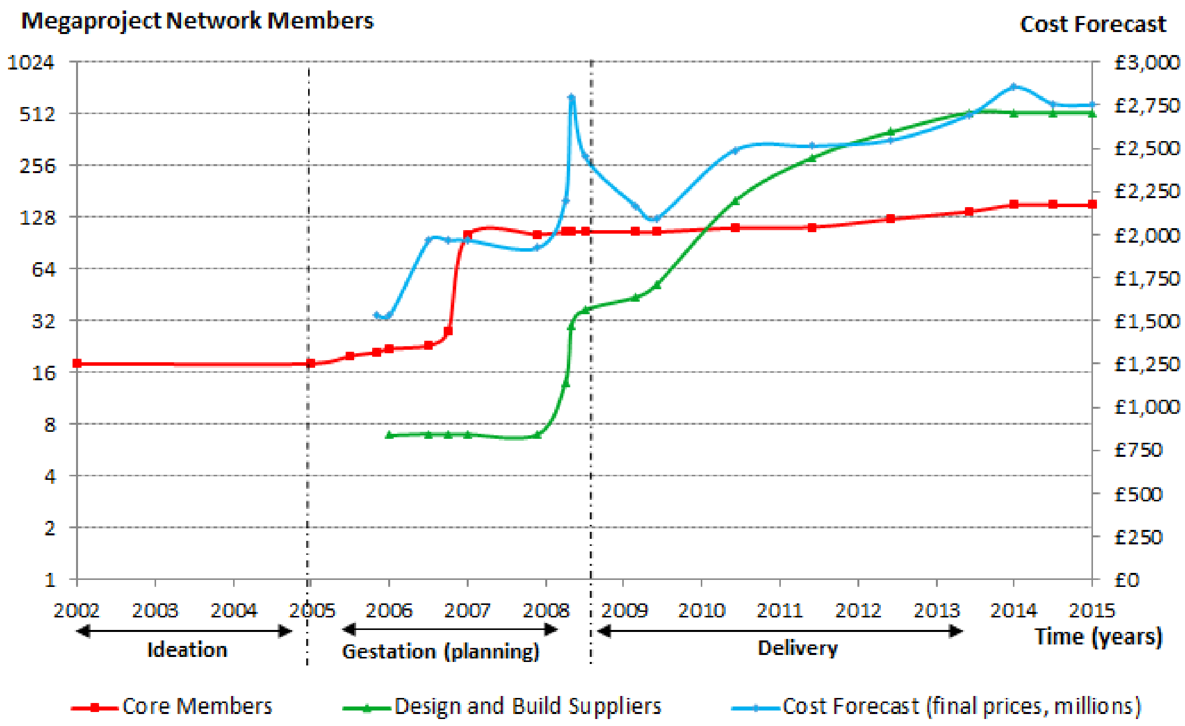

Figure 2 - Relationship Between growth of the Heathrow T2 meta-organization and infrastructure cost

Technical capabilities guide the development of the infrastructure components and the rules governing how the components interface. For example, developing an Olympic park requires deciding which sport venues to include, their capacities, which ones are temporary vs. permanent, and producing a master plan exacting the location of the venues, the Olympic village, and the media center. Likewise, developing an airport terminal involves deciding the number and shape of the concourses, the layout of the tunnels and bridges for people and baggage to move around, and the interfaces between the concourse gates and the airfield.

In summary, megaproject promoters need architectural knowledge to understand the architectures of the organizational network and of the technical design for the infrastructure. Each of these architectures consists of a design structure and a task structure (Baldwin, 2014; Baldwin & Clark, 2000). The design structure specifies components and their relationships, whilst the task structure consists of the activities necessary to instantiate the design structures. We turn now to discuss the task structure of the promoter and then the strategic capabilities needed to carry on the tasks well.

4 THE TASK STRUCTURE OF THE MEGAPROJECT PROMOTER

At the onset of a new infrastructure development the megaproject promoter faces two main tasks: i) grow the organizational network to attract much needed resources; and ii) develop a technical design for the new infrastructure—the basic set of instructions expected to show how to allocate resources commensurately with the resources that have been acquired. In lieu of ownership stakes or employer-employee relations, to exert influence, the promoter has to rely on resource dependencies, technical expertise, and reputation (Gulati et al., 2012; Maier, Emery, & Hilliard, 2001).

Hence it is the task of the megaproject promoter to corral resource-rich actors in the core to conform to a shared development strategy. But if a promoter engaged all potential claimants at the same time this could create an unmanageable sprawl of claimants risking making even the most basic decisions excruciatingly difficult. Thus, the promoter seeks first to produce a concept that satisfices the powerful actors and brings momentum and legitimacy. This concept frames the goal and is used to convince other actors of the scheme's viability and worthwhileness. Still, the risk is real of powerful actors arriving late and attempting to force the promoter to renege on earlier decisions in favor of their own preferences. Reneging on prior decisions is hazardous for the promoter who risks defection of former supporters.

The extreme operational longevity of infrastructure amplifies the difficulties in striking a consensus in development. Given the high stakes, some claimants will ask a high price for their cooperation and rule out losing an argument without a fight. Hence, to carry on the dual tasks of developing a technical design and the corresponding organizational network, the promoter must engage in analytical deliberations side by side with bargaining processes and political activity—a pattern typical of collaborations which aim not at producing innovative outcomes but at ‘getting things done’ and sustaining legitimacy in the eyes of third parties (Lawrence, Hardy, & Phillips, 2002).

For example, the coalition leading the Olympic Park had to work with over 100 claimants to the final designs including local governments, landowners, sport associations, interest groups, political parties, and the International Olympic Committee; it subsequently selected over 1,500 first-tier suppliers to carry on the design and build tasks. Likewise, the coalition leading the T2 scheme worked with over 150 claimants to the design including non-Star airlines, local governments, and retailers, and over 500 first and second-tier suppliers.

As the megaproject promoter persuades other autonomous actors to contribute their resources, the network’s core becomes gradually misaligned from the relatively integral technical design. Complicating the promoter’s task is the lack of absolute control over who has a legitimate right to influence the technical design. Many actors are non-substitutable, i.e., their resources cannot be easily replaced. For example, if the promoter of the Olympic Park failed to garner the support of the International Olympic Committee then the scheme would fail. The promoter is also limited in resources and cognition (Simon, 1972) and thus not privy enough to the preferences of other actors to have a complete understanding necessary to develop ex-ante a convincing design that would satisfy their claims. For example, the Crossrail scheme began with a design concept limited to central London; by the time the claims of other actors were incorporated in the design the scheme had evolved into a Greater London commuters' train.

The structural misalignment that grows as an infrastructure development forges ahead is common to pluralistic enterprises—the involvement of more parties attracts extra resources that potentially bring a benefit for all to enjoy but leads to problems of appropriation due to conflicting interests (Garud, Gray, & Tuertscher, 2014; Ostrom, 1990). In the case of infrastructure, the misalignment occurs irrespectively if the system as a whole is decomposable or not (Gil, 2015). In the case of the modular Olympic park, for example, just to resolve the design of the stadium, the promoter had to engage with fifty claimants with differing preferences for what the local goal should be in legacy varying between an athletics venue, a football stadium, and a dual-purpose venue. Misalignment problems have also beset the more integral HS2 scheme after local governments asked central government to supply more money for developing world-class stations and long tunnels to minimize property blight. In this case, controversies have been exacerbated due to technical interdependences across the stations and the need to preserve equitability across cities.

In summary, the megaproject promoter treads a precarious path. On the one hand development choices in terms of technical issues and cost and schedule forecasts must be kept flexible enough to accommodate differing preferences. On the other hand, those choices must be robust enough to attain, and maintain, firm commitments from the first actors to join the network. We turn now to discuss the capabilities needed to perform this job effectively.

5 THE CAPABILITY TO SHAPE THE MEGAPROJECT NETWORK

As said a primary task of any promoter is to design the structure of the megaproject organizational network. The boundaries of the core are porous and the promoter has limited influence to keep powerful actors at bay. But not all actors are powerful and resource-rich. For those with limited resources and no legal rights to enter the core, it is up to the promoter to decide what to do. We distil the capabilities necessary for the promoter to exercise good judgment to: *identify* potential members, *select* members where appropriate and handle *emergent claimants*.

5.1 Identification of Potential Members of the Megaproject Network

Megaproject promoters rarely if ever are powerful enough to operate alone, and thus must seek out potential new members which are willing to volunteer their resources in aid of the scheme. But these actors are not altruistic. Resource-rich actors will only support a scheme in return for the right to directly influence development, and they may choose to withdraw support should they become dissatisfied with the promoter's bargain. This necessity of acquiring critical resources may be described in terms of technical and strategic bottlenecks (Baldwin, 2014).

Technical bottlenecks are technological constraints that hinder the performance of a system. One example can be drawn from the Heathrow's T2 case. In early designs BAA proposed that Star used an old baggage system located in another terminal to process their customers' luggage. This would potentially slow down Star's operations and thus constrain system performance. With BAA unwilling to invest upfront in an entirely new baggage system and Star unwilling to accept the initial design, a deadlock ensued. The bottleneck was removed after a technological solution surfaced—BAA would safeguard for Star's ambition by building in T2 a large basement for a new baggage system to be installed in a second phase. A second example pertains to the development of the HS2 stations. Here the cities turned down the government's proposed designs because of the lack of integration with the old stations. The principle that doing so improves HS2 performance is consensual. But technologically no easy solutions exist yet to carry out the necessary works without severely disrupting day-to-day operations. Faced with this bottleneck, the designs remain unresolved.

Strategic bottlenecks arise when an external party controls an irreplaceable resource for a system to function. Hence, in megaprojects, actors that hold vital resources inherently control strategic bottlenecks and have power to directly influence the technical infrastructure design especially in regimes with strong property rights. If a promoter fails to negotiate with a party holding a strategic bottleneck then a deadlock ensues until either a solution surfaces that bypasses the need for that particular resource, or the resource-rich actor changes their stance.

In the case of Crossrail, for example, the initial London-centric concept was shelved twice after it met strong political opposition in Parliament. Only after the promoter changed the system-level goal to a commuters' train, Crossrail succeeded to inch forward. A second example is the support of the Mayor of London to the HS2 scheme which is conditional on getting finance to build another railway so-called Crossrail 2. The Mayor's claim that HS2 will choke London's underground transport system is contestable, and the promoter has demurred to change the HS2 high-level design. Doing so could create a dangerous precedent likely to weaken the promoters' bargaining power in negotiations with other actors. But ignoring the Mayor's claim creates a real risk of major disruption later on. Since the issue is hard to bypass by appealing to a higher-order authority, the parties continue to search for a mutually consensual solution that will allow eliminating this strategic bottleneck.

Empirically megaproject promoters can identify potential members through a number of different methods. Firstly, a number of megaprojects are carried out repeatedly through the same network of actors albeit with unique goals for each scheme. Heathrow Airport for example has a predefined community of airlines (although these are subject to change periodically due to external forces) and has carried out a number of large infrastructure works in 5 year cycles – thus the community of actors is easily identifiable and their rights are protected by a regulator. Second, many key actors in megaprojects can be identified by their legal rights – within the UK central and local governments have established processes to approve infrastructure works and promoters should be aware of their necessary inclusion. Finally, private legal rights such as claims to land can be identified through formal records allowing a promoter to see whose rights their proposed scheme encroaches upon. However, as we discuss later when considering emergent actors, not all potential claimants can be so readily seen from formal records.

In summary, the competency with which the promoter identifies the bottlenecks, as well as who controls the resources necessary to eliminate the bottlenecks, impacts the capability to carry on the design tasks. Delays in resolving the issues also increase the risk of late slippages in the performance expectations which affects the scheme's public legitimacy. We discuss next how promoters that are strategic influence which actors enter the network's core.

5.2 Selection of Potential Members of the Megaproject Network

Once a megaproject promoter identifies the actors who control strategic bottlenecks, the question that follows is whether the promoter has power to *select* them to join the network. If the environment does not offer any realistic alternative to an incumbent resource-rich actor, the issue is not one of changing one actor for another. And indeed in many instances the decision to join the network's core rests solely with the resource-rich actors themselves—a process that is akin to the self-selection mechanism witnessed in open networks.

The process of selecting members and integrating them into the megaproject system varies across institutional environments but promoters are often able to draw upon both formal and informal channels of communication to establish relationships with potential members. In the early stages of schemes promoters may act informally to sound out support or opposition to their scheme through closed door meetings and non-binding consultation processes – to that end promoters hire seasoned veterans to campaign on behalf of the scheme. These early adopters may choose to announce their intentions through a Memorandum of Understanding. More formally all of our cases saw a large number of actors join through a pre-established set of mechanisms such as a Parliamentary Bill, regulator governance mechanisms, or an Olympic bid process. For example Crossrail's promoters chose to make use of a hybrid legal bill – a process through which a proposed scheme is entered into Parliament for debate (to acquire legal powers) – which involves a period of consultation in which any parties affected by the scheme can self-identify through a claims process. This gave Crossrail advance warning of any opposition to their plans which allowed them to agree deals with many actors, and prepare defenses against those actors they wished to ignore, prior to the scheme receiving funding[20].

In other situations the promoter can indeed decide over whether to include or exclude actors from the network's core. Local communities, for example, only need to be consulted by law and thus the decision to let them directly participate in decision-making is in the promoter's hands. The same is true for key user groups. Bringing users on board encourages them to volunteer tacit knowledge of needs-in-use, and thus facilitates the acquisition of this sticky resource. But this knowledge is not a strategic bottleneck per se as the promoter can choose to press ahead with its own design choices regardless of opposition from user groups.

The megaproject promoter therefore faces a trade-off when mulling over giving dubious claimants access to the strategic decision-making process and veto power on the final design choices. Letting more claimants into the network potentially brings in useful resources but also increases rivalry in preferences. And once the promoter invites one actor to join in it cannot exclude that actor unless it goes back on his word. This juxtaposition of rivalry in design choices between non-excludable parties transforms high-level design choices into a shared resource (Gil & Baldwin, 2013). And creates a real risk of development failure if some actors refuse to compromise and reciprocate, a risk that is amplified the larger the group sharing power.

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[20] Despite the promoters' efforts, the number of petitions remains large – 365 lodged against Crossrail (although 261 were later withdrawn) and more than 2,000 against HS2 (first phase). The Parliamentary process is a major source of uncertainty and delays. But calls to eliminate the process have fell flat as society at large sees it as needed to uphold the principles of democratic decision-making and a strong regime of property rights

A megaproject promoter who is knowledgeable about the stakeholder landscape can identify a priori the actors that definitely need to enter in the network's core, those that can be kept at bay with limited risk of disruption, and those whose status hinges on a judgement call. This knowledge is also needed to anticipate the extent actors are likely to cooperate or not. In contrast a less capable promoter struggles to discern potential co-operators from free riders because it cannot comprehend how the resources each actor controls shape future behaviors. Poor judgements lead to emerging controversies that put pressure on the performance targets.

It also falls to the megaproject promoter to select the suppliers that will perform the engineering and construction works through market mechanisms. These suppliers rarely have rights to directly influence strategic decisions. But uncertainty in the design requirements complicates the relationship between the promoter and suppliers. This uncertainty juxtaposed with the high specificity of one-off transactions increases the risk that suppliers act opportunistically to push up costs (Williamson, 1975). A discussion on how promoters can approach the market efficiently under these challenging circumstances is, however, outside the scope of our study.

5.3 Handling Unexpected Changes to the Organizational Structure

Thought the promoter continually carries out their process of identification and selection in some megaprojects significant actors emerge to challenge for the right to enter into the organization.

These emergent actors may lack de jure rights and so can be overlooked entirely by the scheme's promoters. If those actors are powerful enough, that is they can build a strong case supported by extant members of the meta-organization, they can conquer de facto rights to join – even against the promoter's wishes. Promoter can choose to deflect potential members who they feel are trying to become free riders but may lose their arguments if a powerful coalition within their own organization goes against them. As each member of the scheme may have their own views on the legitimacy of a potential member's claims emergent actors can be extremely disruptive to development.

One example of such an outcome is the involvement of the football clubs in the development of the Olympic stadium. Two clubs claimed rights to directly influence the final design whilst ruling out contributing finance. The promoter deemed this attitude inappropriate and hit back by rejecting the legitimacy of the football clubs' claims[21]. Still, the clubs remained powerful[22] actors who were able to drum up support for their idea and managed to force the promoters' hand after a protracted fight.

Promoters can attempt to offset the emergence of unforeseen actors through early consultations whereby interested parties can, without binding agreement, voice their concerns about the project. In turns this reduces the potential of a completely unforeseen actor emerging from the shadows. A strategy of consultation was undertaken heavily by HS2 which publicly shared some elements of their design for critique and feedback – importantly these consultations were not legally binding but rather acted as a means to gather information. However, not all promoters are fortunate to have the time available to conduct consultation – the 2012 London Olympics had mere months to develop from an ambitious announcement into a fully-fledged bid. And opening up your design to general claimants for feedback carries a high risk of early naysayers selectively attacking the scheme with the limited information provided – something HS2 has already suffered in its early stages.

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[21] We use legitimacy in terms of what is legitimate in the face of socially-accepted norms (see Suchman, 1995)

[22] We use power here in a Weberian sense (Weber, 1947), and thus capable to force someone to so something they otherwise would not do.

In other situations the megaproject organization may be shocked by the loss of an existing, vital, member. It is not unusual for the development life-cycle of a new large infrastructure from ideation to handover to operations to last more than one or two decades. As time goes by, the status of some design participants evolves and sometimes changes dramatically. Actors that were strategically selected to join the core may lose the capacity to contribute the resources pledged upfront, and new actors then have to be found late in the process to overcome new bottlenecks that arise unexpectedly.

One example is the major iteration that occurred less than two years away from the opening of Heathrow T2 after Star lost its key domestic airline. The leading coalition had deemed inconceivable that this event could occur in the short-term. And when it did, it caused havoc in the occupancy strategy for T2, leaving the promoter with the risk of opening a terminal too big for the new needs. The promoter had then to find new occupiers with new preferences for the final design, and embark on a £100m iteration to redesign the whole internal layout. To make up for lost time, BAA unilaterally attempted the redesign much to the ire of Star. This turn of events was ironic since the size of T2 had been a contentious issue after BAA rejected Star's original preference for an even larger campus.

A second example is the loss of the private developer expected to finance the Olympic village. The developer was appointed in 2007 and went ahead and selected various architectural practices to design a massive village in line with its own commercial goals and the criteria negotiated between the megaproject promoter and the International Olympic Committee. But by mid-2008, hit by the financial crisis, the developers' capacity to finance foundered. It then took two years for the promoter to identify an alternative financial backer putting pressure on an already tight schedule. In the midst of a late iteration, a deal was struck to develop a much smaller village and transform part of it into social housing after the games.

In summary, emergent actors and actors who leave the megaproject can have disastrous results for the schemes longevity. Whilst identification of threatening members – particularly through canvassing and opening up the design to discussion in public forums – can reduce the likelihood of a damaging emergent member it is not sufficient to prevent them occurring. Later we examine how a strategy of retaining slack in resources and flexibility in design can help soften the blow of emergent actors.

6 THE CAPABILITY TO DEVELOP A TECHNICAL DESIGN

Concurrent with the organizational growth of the megaproject network, the promoter must oversee the development of a technical design. Taken as a whole infrastructure systems are usually at least partially decomposable into components that can be developed relatively independently. Thus the megaproject promoter can stratify stakeholders into local working groups delineated to the actors with a legitimate stake in the component of interest; each group is then tasked to find out a ‘satisficing’ (Simon, 1956) design through a consensus-orientated search.

To guide the design discussions, the megaproject promoter needs to draw upon prior architectural knowledge of similar technical systems and adapt it to local requirements. Promoters that lack sufficient technical knowledge supplement it by employing one or more expert suppliers. Early technical designs are simplistic potentially consisting of the key core functional components of the future operating system. As the promoter attracts increasing supporters for the scheme, they too will have a role in identifying potential components, subcomponents, and in elaborating the rules governing the interface between the components.

The development process gets tricky because the system-level design decisions are governed by a coalition. The membership of the coalition may become fixed after a few years of high-level talks, but controversies still run rampant between the members. One example is the development of Heathrow T2. The organizational structure of the coalition was consolidated after three years of high-level talks between BAA, Star, and the regulator. But goal congruence was low as Star pushed for a grand vision for Heathrow T2 to match the rival's facilities whilst BAA pushed for a more modest piecemeal approach. Reconciling their differing preferences took in total six years of deliberations and tough negotiations during which it turned out impossible to accurately forecast the final costs and opening date.

When moving from discussions on system-level decisions to the design of particular components the number of claimants spirals. Hence it is at component level that the misalignment between organization and design structures becomes more acute. In the London Aquatics center, for example, 29 claimants were involved in the initial design discussions including local governments, user and interest groups, and owners of interdependent assets; the number had grown to over 50 claimants when the time arrived for the suppliers to join in, and we compiled similar figures for the Crossrail and HS2 stations and T2 concourses (Lundrigan et al., 2015).

The extent the component development processes are interdependent varies according to whether the infrastructure as a whole is modular in a strict technological sense, e.g., Olympic park, or more integral, e.g., railways. Irrespectively, the difficulties of seeking mutually consensual local designs are invariably amplified by system-wide budget and schedule constraints. Throwing more time and money into a design sub-problem can resolve a local problem. But local slippages put pressure on system-wide targets and thus create a tricky precedence and equity issues. And for some infrastructure, a delay in developing one component has a knock-on effect on other components. Thus decisions to let local targets slip are seldom taken in haste.

In summary infrastructure design is the outcome of consensus-oriented searches for local solutions which vary in degree of technical interdependence but invariably unfold constrained by system-wide cost and schedule targets. We turn now to discuss how the megaproject promoter can combine technical and organizational design capabilities to improve performance.

6.1 Aligning Network Growth with Design Co-Production

The two capabilities described herein are inherently interrelated as the choices of social structure influence the choices of technical structure and vice versa. At the outset of a new development the megaproject promoter crafts an infrastructure design concept that establishes the boundaries of the system-level goal. The future asset will encroach on the property rights and interests of many environmental actors and thus development bottlenecks ensue. As the promoter, driven by necessity, seeks to eliminate bottlenecks with the support of these actors pressure grows to change the design. New deals impact an ever widening circle of environmental actors, and make slippages in cost and schedule forecasts almost inevitable.

Slippages in performance targets fuel a variety of readings that range from accusations of dishonesty and incompetency, to sunk cost fallacies, escalation of commitment to a failing goal, and claims that megaproject outcomes are shaped by the environment (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Miller & Lessard, 2001; Morris, 1994; Ross & Staw, 1993). We argue, however, that the root cause of the problem lies not in agency or environmental issues but on the ‘catch-22’ situation that megaproject promoters face at the onset of a new scheme—the technical architecture cannot be accurately established without the totality of the social architecture, and yet the social architecture cannot be specified without some semblance of a complete design and corresponding performance targets.

To conform to upfront performance targets and thus sustain legitimacy in the eyes of third parties, promoters could try to force their design preferences. But since the promoter lacks absolute authority, unilateral actions are likely to backfire. The promoter could also engage in endless iteration until a mutually consensual solution surfaces, but in practice promoters operate under rigid timescales dictated by election and regulatory cycles. This leaves the promoter with fewer options to get things done. One option that has received much attention pivots around combining deliberative processes with mutual-gains bargaining and political activity. These are commons mechanisms to get things done in inter-organizational collaborations that lack a shared understanding of the problem that brings people together, and seems unrealistic to do without them. But the point here is that they do not need to rule new infrastructure development. And indeed, our argument suggests that promoters can act strategically to pre-empt conflict and attenuate pressure on performance targets by manipulating the growth of the network. We turn now to discuss two strategic levers that the megaproject promoters can use to build a robust megaproject organization through controlling the growth of membership and adding resource slack and flexibility to designs.

7 A STRATEGIC APPROACH TO CO-EVOLUTION OF ORGANIZATION AND DESIGN

7.1 Sequencing the Growth of the Megaproject Network

Megaproject promoters have limited strategic choice in selecting powerful actors within the environment but can influence when they join the network; promoters can also select less powerful actors. Promoters who have architectural knowledge of the organizational and design structures, and know how to harness it, can thus identify which actors should join the network's core first and be party to high-level decision-making processes. By manipulating the growth of the network, the promoter restricts the flow of new members whilst intentionally not leaving behind any resource-rich actor. As a respected and enduring consensus takes shape, a deep technical design structure (Gersick, 1991) can also emerge that locks the development participants into particular final design choices and is robust to sustain late attacks from claimants with limited legitimacy.

To plan an optimal sequence for the entry of members in the megaproject network's core, the promoter needs to derive their priority from the importance of the resources under their control. Bundles of resources which are most critical to eliminate bottlenecks can be assessed by considering the number and centrality of the components that require those resources. For example, the monopolistic owner of Heathrow airport operates in a regulated environment—no plan for a major infrastructure development can therefore progress without the airport operator securing first from central government political backing, a non-substitutable resource. Hence the early targets for a megaproject promoter to purse are those actors who control resources with impact on the system-level elements. The actors who hold system wide resources are by definition very few, and thus they should be part of the leading coalition.

Once the structure of the leading coalition is firmed up, and system-level design decisions are agreed, the development must proceed to decisions over individual components[23]. This requires the promoter to identify the bottlenecks stymieing the development of particular components, and bring into the network those actors, and only those, who control resources that are non-substitutable and necessary to remove those bottlenecks. For example, to forge ahead with the HS2 scheme, central government had to set up for each city on the route a local working group. Whilst the central government plans to finance the scheme in its entirety, it is virtually impossible for government alone to decide where to locate the railway stations and how each station interfaces with the surrounding built environment. Hence government has no alternative but to engage in a genuine effort with the city leaders to search for mutually consensual design solutions which will eventually involve supplementary local finance. Figure 3 schematically represents the archetype of a sequencing strategy that aligns the growth of the megaproject network with the concomitant co-production of the design.

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[23] In practice the development process is more iterative, but a linear presentation is chosen for the sake of clarity in presenting the argument

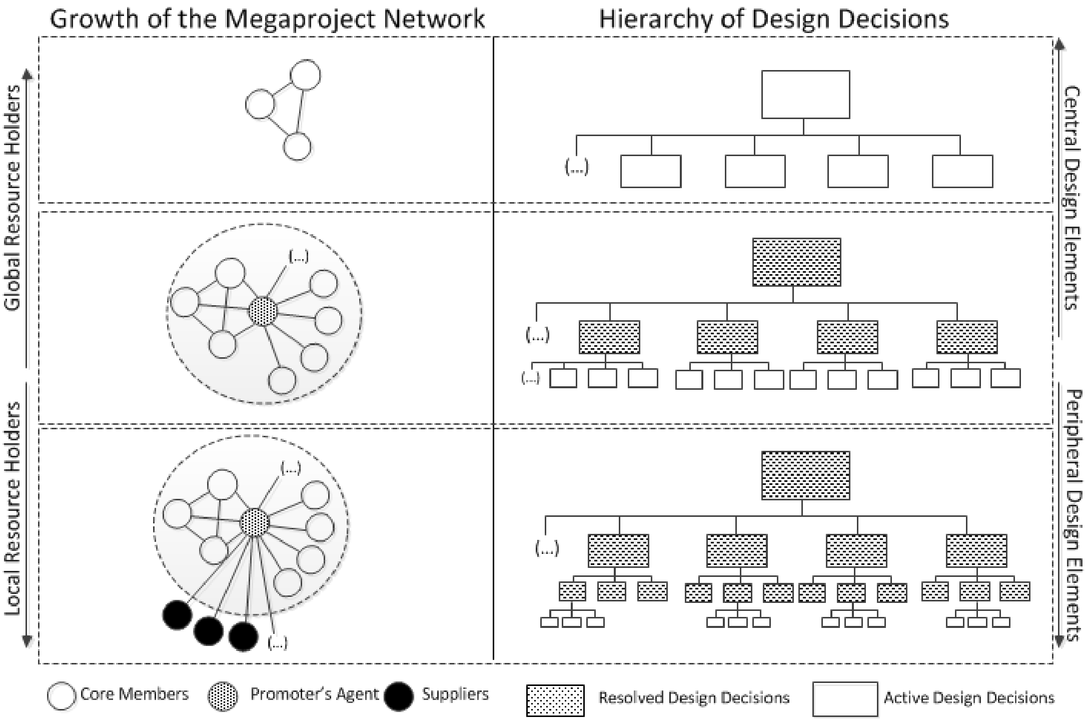

Growth of the Megaproject Network
Hierarchy of Design Decisions
Global Resource Holders
Local Resource Holders
Central Design Elements
Peripheral Design Elements
(...)
Core Members
Promoter's Agent
Suppliers
Resolved Design Decisions
Active Design Decisions

Figure 3 - Strategic alignment of megaproject network growth and design co-production

A similar rationale of aligning component design choices with the arrival of the corresponding resource-rich actors can be extended to key user groups. Legal frameworks typically oblige the megaproject promoter to consult users, but rarely give users ex officio rights to directly influence the development process. Still, users own tacit knowledge of needs-in-use. This knowledge is a non-substitutable resource that is hard to acquire unless users see an incentive to volunteer it, and one incentive that works is to share with users the right to directly influence development of the components they care with (Gil & Baldwin, 2013). Failure to appreciate this can lead to costly late change. The case of the Aquatics center is telling. Faced with spiraling costs the promoter unilaterally chose to ditch over thirty design items that had resulted from conversations with the user groups including moveable pool floors, greater numbers of temporary seats, and a sophisticated roof system.

The decision provoked an outcry, and in the subsequent year most elements found their way back into the final design.

7.2 Adding Slack and Flexibility to Cope with Emergent Issues

Whilst sequencing member entry may be an effective strategy when it is available it does not provide protection against previously unidentified emergent claimants nor the shock loss of important members during the scheme's lifecycle.

Fortunately, megaproject promoters have two more strategic levers available in their arsenal. The first is to build substantial contingencies into the scheme's schedule and budget to accommodate late changes. This process is commonly termed as adding organizational slack (uncommitted resources reserved to satisfy individual and sub-group objectives) (Bourgeois 1981). Adding slack allows gives promoters more room to maneuver in negotiations with new claimants and resolve conflicts (Cyert and March 1963; Galbraith 1973). This strategic lever is applicable both if a new member is identified and selected, where promoters can calculate how much slack a new claimant might use up, as well as more importantly buffering the megaproject from environmental shock (Thompson 1967). Adding slack has a secondary benefit of masking turbulence from critical observers by protecting higher order performance metrics. Organizational slack was heavily applied both in London 2012 and Crossrail.

Adding flexibility into megaproject designs is a secondary way to add robustness to the megaproject. Early entrants to the megaproject need flexibility to engage in wide ranging discussions, whilst late comers can encounter a more constrained solution space. Adding flexibility to the design structure also attenuates conflict because it leaves options open and thus lowers future adaptation costs (Gil, 2007; Gil, Biesek, & Freeman, 2015; Gil & Tether, 2011). But to ‘future proof’ large integral designs against an array of foreseeable claims invariably demands investment in costly safeguards, e.g., deeper foundations, redundant equipment, and may sacrifice operational performance. This opens the proponent of flexible designs up to criticism and is not uncommon that cost concerns win out when the budget is tight or people run out of time to continue the debate.

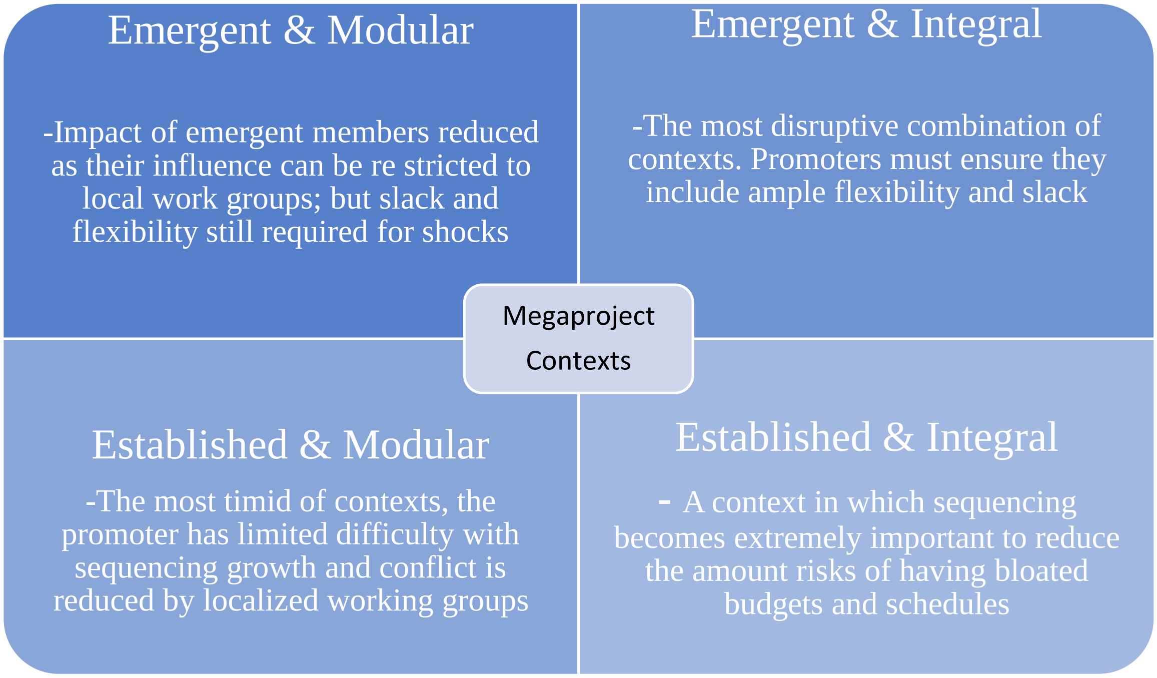
The case of the terminal gates at Heathrow T2 is telling—the design participants failed to reach a consensus on whether the gates should be open or closed. BAA, the airport owner, preferred open gates to bring down capital costs and facilitate the circulation of passengers up to the time they needed to board the aircraft. In contrast, some airlines insisted to operate with closed gates which they deemed more efficient. A potential way out was to develop a flexible design but BAA fiercely opposed to the idea—the company was investing in a new generation of boarding technology, and a solution of compromise would hike capital costs in a few million pounds. The fight between the two parties only got resolved after the issue escalated to an arbitrator which recommended indeed investing in a flexible design solution.

8 VARIABILITY IN MEGAPROJECT CONTEXTS

We have seen that megaproject promoters can grow their network in two ways; first by the selection and identification of new members; and second by accepting (or being forced to accept) emergent members who were hitherto unidentified. Whilst all of the megaprojects in our sample had some degrees of both selection and emergence there were some much more stable than others. To illustrate this consider the cases of the 2012 Olympic Games and Heathrow’s Terminal 2. Heathrow and its owner BAA undertook their airport expansion scheme with a pre-established community of actors in the form of airlines and regulators. This established setting of relative stability would be an ideal setting in which to carry out our sequencing strategy. In contrast the 2012 London Olympics was an entirely new endeavor and whilst some of the large actors including the International Olympic Committee (who award the Games) would be readily identifiable there were far more unexpected claimants who pushed for ever more exciting designs. Knowing that this was likely to happen the promoter ensured a large amount of financial slack was added to the system to cover eventual, unknown, claimants.

There is a second factor which also impacts on the extent to which sequencing and slack can or should be applied to a megaproject context – namely, the extent to which the designs are integral or modular. An integral design is far more vulnerable to emergent actors as changes – even those at the periphery – can have spillover effects into over components in the design. Consider again the Olympics, each asset such as a stadium is relatively unconnected to the others and as such can be developed by localized interests. A system like HS2 or Crossrail on the other hand have heavily integrated railways, stations, and control systems. The more integral the scheme's design is the more flexibility and slack needs to be accounted for in the system – sequencing whilst it may reduce the impact cannot prevent disruptive late arrivers even if they are identifiable far in advance. Thus promoters who wish to succeed in delivering their scheme should, in addition to sequencing, adjust the amount of slack in their system to account for their expected levels of emergence and modularity.

In Figure 4 we summarize the combinations of potential environment and design interactions.



-Impact of emergent members reduced as their influence can be re stricted to local work groups; but slack and flexibility still required for shocks

-The most disruptive combination of contexts. Promoters must ensure they include ample flexibility and slack

-The most timid of contexts, the promoter has limited difficulty with sequencing growth and conflict is reduced by localized working groups

- A context in which sequencing becomes extremely important to reduce the amount risks of having bloated budgets and schedules

Figure 4 - Environment and Design Combinations

9 PITFALLS FOR STRATEGIC ACTION

We have derived our argument from interrogating data on the consensus-oriented planning of four megaprojects. However, the analysis reveals instances where our argument holds well as well as flagrant violations of the strategies postulated here. Violations invariably led to controversies that beset the sample cases, and contributed directly to the slippages in the system-wide targets that affected all the schemes without exception (illustrated in Figure 1 for the cases of the Olympic park and T2 cases). These violations were nonetheless not sufficient to founder the planning efforts—all developments but HS2 succeeded in planning after a history of prior failed attempts; and whilst HS2 is still in planning, the principle of it has been approved by Parliament, and has thus jumped this major hurdle.

This suggests the alignment of the hierarchy of design choices with the arrival of the claimants to the megaproject network's core is not a necessary condition to keep an infrastructure development afloat. Rather it is an archetype of a strategy that is context sensitive and subject to variation in implementation. If we accept suboptimal strategies can still lead promoters to the end goal, it matters to discuss which factors drive promoters to deviate from our two strategies—after all, in so doing, the promoter incurs the risk of conflict imploding later on and jeopardizing the public legitimacy of the scheme. In the discussion that follows, we group the pitfalls facing megaproject promoters into four categories.

9.1 The perils of building large collective action arenas too fast

First, the megaproject promoter must be wary of the inherent risks in consensus-oriented collective action. Pluralistic organizations are advantageous to attract voluntary contributions of resources that when pooled together enable to achieve objectives that a single organization alone cannot achieve. But getting things done in any collective action arena is a struggle (Dietz, Ostrom, & Stern, 2003). This struggle exacerbates in large infrastructure developments where potential claimants are drawn from across ideological, institutional, and epistemic boundaries, and thus the risk of conflict is high due to semantic, syntactic, and pragmatic differences; large groups with fewer prospects to work together again further complicates mutual cooperation (Ostrom, 2005). Hence while optimally promoters may not want to exclude key resource-rich actors from high-level development decisions on the components they care, the arrival of these claimants to the network’s core can create unintended complications that promoters also need to be mindful.

The HS2 development is telling of this pitfall. The promoter of HS2, the central government, made a deliberate choice to exclude local governments from formal high-level conversations about which cities the new railway should be connecting and the best route for connecting the cities. Lacking strategic local input, but eager to make a public announcement of the final route choice and corresponding cost and schedule targets, the HS2 promoter relied on the owner of the national railway network to make educated guesses about the outcomes of future local discussions. Once the promoter established the working groups with the city leaders to agree the designs of the stations, pressure mounted to relax the cost targets and indeed the targets have slipped (although the source of finance remains unresolved).

For the promoter, however, the risk of making educated guesses was far outweighed for what it calculated were greater risks had it involved upfront the local players. Indeed the promoter was wary of failing to even agree an inter-city layout and outright losing public legitimacy for the scheme if it opened up the discussion prematurely. Doing so could fuel all sorts of rumors difficult to quash around property blight, and substantially increase the risk of the scheme becoming a political football and collapsing. Hence, promoters should not ignore the perils of rushing to build a large collective action arena. Undefined boundaries amplify difficulties to get to consensus and can turn collective action arenas easily into chaos.

9.2 The perils of delaying the arrival of powerful claimants

Whilst good reasons can exist to delay the arrival of resource-rich actors into the network’s core, a second pitfall facing the megaproject promoter is the potential risk of losing legitimacy for the scheme if it delays the arrival of powerful actors. Collective action arenas are complicated enough to govern when there is proportionality between costs and benefits (Ostrom, 1990). So promoters that act strategically do not further complicate matters by deliberately opening up the arena to resource-poor actors that are unwilling to cooperate and strike a consensus.

Our findings show, however, that it can be really difficult to implement this principle. Some actors, when realizing that they are being kept at bay from early development talks, may run low on patience and start attacking the scheme. These actors may rule out contributing resources in exchange for the right to directly influence the design. But if the stakes are high, they will not be ready to lose without a fight. A fight can potentially make it harder for the promoter to both attract new commitments of resources from other actors and maintain commitments from extant members. Even if going for a fight is the right thing to do, it can thus be difficult for a promoter to hold on to their nerve as opposed to cave in to fear.

One good example is the case of the football clubs that gained de facto rights to directly influence the development of the Olympic stadium right after the UK won the bid. As aforementioned the clubs' participation was not altogether desirable since they shied away from making any substantial financial contribution. But the promoter was wary of excluding the clubs concerned that drawing the battle lines that way could spur a political fight. The risk would then be high that the clubs would lobby aggressively for design changes, seeding discord within the coalition, and causing havoc. The decision to include the football clubs irked, however, the athletics community that had backed the Olympic bid on the basis that the Olympic stadium in legacy would become an athletics venue. Impasse was temporarily avoided at the eleventh hour by adopting a rigid design for the games that served neither group optimally; consensus on using retractable seating to build a dual-purpose venue (an idea ruled out in the first two years of planning) was finally reached one year after the games. By the time a deal surfaced the costs had almost doubled the initial forecast.

9.3 The risk of passing up time-bound opportunities

A third pitfall facing megaproject promoters that can encourage them to accelerate the acquisition of members is the risk that not doing so squanders time-bound opportunities to acquire vital resources to move forward with an idea that has been going around for years. Whilst megaprojects create in the short-term substantial economic activity and jobs, their long-term socio-economic value is often subjected to vivid, inconclusive debates. Decisions to forge ahead therefore rarely occur insulated from budgetary and electoral cycles. Eagerness to seize time-bound opportunities can force the promoter to accelerate the rate at which the network's core becomes misaligned from high-level development decisions. As key claimants to those decisions finally join the party, slippages in performance targets ensue.

This was the case of London2012. Only if the Olympics contest was won could the promoter acquire the wherewithal to, first, regenerate a large swath of derelict land in East London; and more importantly, to increase the capacity of London's congested transport networks which some pundits argued risked sparking riots in a near future. However, the rules of the game set by the International Olympic Committee (IOC) accounted only for two years to put together a bid. This was patently insufficient to work out a detailed plan and commensurate cost forecast, but the promoter deemed the opportunity too good to be missed.

The pledges in the bid documents around the legacy for London and inclusiveness swayed the judges and the promoter acquired the vital resource to forge ahead. After the victory, the promoter coined the slogan 2-4-1: two years to plan, four to build, and one to test. But overnight it found itself facing claims on the final design choices from over 120 claimants and engaged in negotiations to expropriate 350 landowners. When the time to start construction arrived, the promoter had yet to resolve many emerging controversies; by then the cost forecast had already slipped £1bn relative to the original forecast. To avoid further slippages, the promoter then built a massive £3bn contingency on top of a £6bn cost forecast.

9.4 The peril of adding slack to performance targets

Prima facie it would seem that adding slack to a megaproject system is an ideal strategy – it allows the promoter to overcome shocks in the environment and can help ease tensions by encourage compromises in design.

However, promoters must be careful not to misjudge the amount of contingency they add to a scheme – beginning with too high a budget requirement can make it more difficult to attract backers especially if other investment. However, there is a peril of adding too much slack in the early phases of a megaproject - it puts pressure on the promoter to deliver value for money, and opens up easy attack for opponents to the scheme. This is particularly true if the slack resource that promoters choose is financial as this will attract the most serious attention. In some cases promoters will be able reduce the need for financial contingency by increasing the schedule of the project. Crossrail for example was accused of being grossly over budget midway through its lifecycle due to changing economic factors and so delayed their opening date by a year to reduce costs. This however simply opens up the scheme to critics who accuse it of being overschedule.

In summary, the four pitfalls highlight that good reasons can exist why managers may choose not to upfront request more slack is added to financial and schedule estimates, nor may they always sequence the entry of members in accordance with their centrality and the level of development in the design – even when it is possible. These exceptions may be common but their impact reinforces our argument- sequencing the arrival of members where possible and ensuring enough flexibility and slack are available to handle emergent threats gives managers at least a modicum of control in an otherwise chaotic setting.

10 CONCLUSION

In this study we have examined the intertwinement between organizational and technical structures in a megaproject context. We have argued that adept megaproject promoters are those who are able to succeed in building a robust enterprise that can withstand the internal pressures caused by a conflict coalition of would-be designers, as well as environmental shocks to the system. The antecedents of being adept we argue are in the promoters capability to design both the megaproject organization and simultaneously the technical design. To that end promoters need to be capable to identify which actors in the environment control which resources; they also need to discern which potential claimants can only enter into the network if the promoter selects them versus those who are resourceful enough to elbow their way in. And second, the promoter needs to be capable to understand the architecture of the technical system, and thus the resources necessary to eliminate emerging bottlenecks.

We argue that by sequencing the arrival of identified actors with the hierarchy of design choices the promoter can avoid some of the tensions created by the misalignment of the organizational structure and technical structure. Resource-rich actors that claim legitimate rights to influence system-level decisions should enter the network’s core. As high-level decisions get crystallized, it is then the turn to involve local actors with legitimate stakes to search for mutually consensual local design solutions.

Aligning network growth with design decisions does not eliminate all controversies. Hence sequencing is not a substitute for building organizational slack in the form of budget and schedule contingencies. Crucially, megaproject promoters that are strategic are not hostages of how the environment shapes network growth. They recognize that any strategy can only be implemented imperfectly given the pitfalls ahead. But they still seek to leverage architectural knowledge to shape the network growth and the sequence of controversies that ensue.

Put differently, a megaproject promoter that is strategic shows enough political astuteness to attempt to avoid falling prey to a messy arena of collective action wherein restricted information flows, covert actions, and tough bargaining rule decision-making processes. By attenuating structural misalignment, and making use of flexible designs coupled with sufficient slack, the promoter can mitigate the risk of potential schism with extant members caused by the late slippages in the performance targets disproportional to the value added by late changes to the scope. As the performance expectations remain less unstable, the public’s perception of the performance of the promoter improves. This in turn helps the promoter to gain more legitimacy for the scheme in the eyes of third parties.

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Conclusion

The research presented in this thesis began with three core questions:

i. What form of organizing is a megaproject?

ii. How does evolution in organizational structure affect performance expectations?

iii. What can the megaproject promoter do to attenuate the management complexity stemming from the structural misalignment between the modular structure of the megaproject meta-organization and the non-decomposable structure of infrastructure components?

In answering these questions we have posited that megaprojects can be seen as hybrid meta-organizations which operate through consensus-oriented deal making between a resource rich set of core actors who negotiate the overarching strategy of the scheme. We further argued that this hybrid meta-organization grows (and shrinks) over time as new actors join, and leave, whilst those that remain drift between periods of activity and inertia depending on where their interests in the final technical design lie. At the heart of this meta-organization is a system architect who seeks to marry together the evolution of the organizational and technical structures that exist in the megaproject.

Further we have argued that changes to the organizational structures drive changes to performance metrics as new and existing members of the meta-organization periodically push for (or resist) changes to the infrastructure's technical design. This in turn creates a series of performance baselines which are specific to the organization and technical structure at the time of their creation. The coexistence of multiple performance baselines, along with a high degree of rivalry, competing preferences for both efficiency and effectiveness, and environmental fluctuations, create ambiguous performance at the system level. Politically sophisticated members can create a perception of strong or poor performance by manipulating which performance baselines (and technical designs) they choose.

Finally, we have argued that although at a systems level there is no reasonable way to combine each member individual performance expectations into coherent metrics this does there is still a measure of success by which megaprojects can be judged – namely the ability to see the job through to completion. Adept architects, we argue, are those able to build robust governable enterprises. In order to do so we posit that the architect must develop a deep knowledge of the organizational and technical system which allows them to correctly identify (where possible) a strategy for attracting new members, dealing with emergent threats, and maintaining legitimacy and commitment in the face of changes to the technical system and accompanying increases in cost and time requirements.

1 Future research

This thesis represents part of a wider research tract into on one hand the empirical world of megaprojects, which are becoming increasingly important in a socio-economic sense, and on the other recent research from the world of organizational design. With that said there are a number of interesting future questions to consider in this research space:

How do organizational designs for megaprojects vary across institutional environments? The sample in this thesis is limited to a small number of London based projects which occurred simultaneously – it could prove fruitful to understand the impact that operating in different regulatory environments, and in particular different property right regimes, would have on the potential designs of megaproject. Are systems with alternative property rights regimes more robust, or do increased levels of unrest and/or corruption negate any benefits?

Along the same theme is the increasing institutionalization of megaprojects within the UK. The sample in this thesis, as well as those used by other researchers, indicate that the process for managing a megaproject are becoming routinized – often relying on the same individuals to manage the schemes. What implications does this have for performance? Could isomorphic processes lead to a more harmonious megaproject where core members know what to expect – or will it introduce subtle biases which hinder architects from forging a more unique path?

Finally, there is great scope for the work in this thesis to be extended with quantitative approaches. A more convincing argument could be made by research that build quantitatively testable propositions from the arguments made herein. For example what precise factors have the greatest impact on performance change in the core – actor size, type of resource, number of extant actors etc.?

2 Thoughts on the doctoral process

Finally I would like to reflect on the doctoral process and some of the areas in which my approach could be improved upon. Perhaps the most challenging part of the PhD was the speed at which the journey began – when I entered the doctoral process data collection was already underway, and was completed in my second semester. Whilst this gave more time for analysis, it did require me to carry out a great deal of the data collection when I was still not confident with my knowledge of methods nor the fully versed the world of megaprojects. Secondly, it would have been interesting to carry out some of the aforementioned quantitative experiments myself but access to enough financial data to make a comparison between cases arrived during the final stages of the PhD leaving me without enough time. Finally, the papers themselves could have benefitted from my being more evenhanded in their development, instead I spent a disproportionate amount of time completing the second piece due to journal and conference submissions and the accompanying editorial process that follows.

Appendix

1 List of Interviewees for the Case Studies

The following is a list of formal interviews for this research organized by case. The Olympic interviews were carried out between Summer 2011 and Spring 2012; Crossrail and Heathrow interviews took place between Spring 2012 and Spring 2013. All interviews were carried out in the London offices of the respective case with the exception of interviewees that are other Manchester University staff which took place in the Manchester Business School.

Name of Interviewee	**Job Role**	**Year**
	Olympic Games Interviews	
Simon Wright	ODA Director Of Utilities And Infrastructure	2011
Howard Shiplee	ODA Director Of Construction	2011
Mike Cornelius	ODA Director Of Commercial And Procurement	2011
Kenna Kintrea	ODA Head Of Programme Assurance	2011
Ian Crockford	ODA Project Sponsor Aquatics/Project Sponsor Stadium	2011
Hugh Sumner	ODA Director Of Transport	2011
Sue Kershaw	ODA Transport Managers	2011
Ralph Luck	ODA Director Of Property	2011
John Nicholson	ODA Project Sponsor Aquatics Program Executive	2011
Alison Nimmo #3	ODA Director Of Design And Regeneration	2011 & 2012
Jerome Frost	ODA Header Design	2011
John Armitt	ODA Chairman	2011
Dennis Hone	ODA Finance Director/Chief Executive	2011
David Higgins	ODA First Chief Executive	2011 & 2012
Colin Nash	OPLC Executive Director Of Infrastructure	2011
Mark Dickinson	Lend Lease Development Village	2011
James Bulley	Locog Director Of Venues And Infrastructure	2011
Paul May	Locog Head Of Venue Development	2011

Mark Ever	Transport For London Delivery Unit And Transport For London Games Transport	2011
Louise Hardy	CLM Director Of Infrastructure	2011
Ken Owens	CLM Commercial Director	2011
Martin Rowark	CLM Deputy To The Head Of Procurement	2011
John Mead	CLM Programme Supply Chain Manager	2011
Ian Galloway	CLM Program Director	2011
Dave Evans	CLM Park/Village Assurance Officer	2011
	Crossrail Interview	
Martin Buck #2	Crossrail Commercial Director	2012 & 2013
John Mead	Crossrail Programme Supply Chain Manager	2012
Martin Rowark	Crossrail Procurement Director	2012
Chris Sexton	Crossrail Technical Director	2012
Andrew Wolstenholme #3	Crossrail Chief Executive	2012 & 2013
Chris Dulake	Crossrail Chief Engineer	2012
Andy Mitchell #2	Crossrail Program Director	2012 & 2013
Ailie Macadam	Crossrail Delivery Director (Bechtel)	2012
Robert Flanagan	Crossrail Finance Operations Director	2012
David Higgins #2	Network Rail Chief Executive	2012 & 2013
Bill Tucker	Crossrail Area Director	2012
Linda Miller	Crossrail Project Manager	2012
Tim Grimshaw	Crossrail Project Manager Farringdon	2012
Simon Kirby	Network Rail Director Of Infrastructure Project	2012
Cliff Bryant	Canary Wharf Executive Director	2012
Terry Morgan	Crossrail Chairman	2012
Mike Stubbs	Transport For London Director Operations Over Ground And Crossrail	2012
Sarah Johnson	Crossrail Chief Of Staff	2012
Michael Herbert	Manchester Business School Planning Department	2012
	Heathrow T2 Interviews	

Steven Morgan #3	BAA Capital Director	2012 & 2013
Steven Livingstone	BAA Program Control And Performance Director	2012
Joanne White	BAA Eastern Campus Program Director	2012
Duncan Pickard	T2a Project Director	2012
Julian Foster	T2B Project Director	2012
Matt Palmer	T2 Integration Director	2012
Tony Court	T2A HETCO Construction Director	2012
Simon Owens	T2A HETCO Commercial Director	2012
Keith Cannin	T2B Project Director Balfour Beatty	2012
Brian Woodhead	BAA T2 Terminal Operations Director	2012
Mark Johnson	Star Alliance Project Director	2012
Murray Williamson	Air Canada	2012
Phil Wilbraham	BAA Executive Director	2012
Matt Palmer	T2 Integration Director	2012

The remainder of this appendix contains three case studies underpinning this research. The case studies have a dual purpose. Firstly, they helped organize the narratives for each of the cases providing a way to keep abreast of important actors, quotes, and dates. Secondly, they were created as teaching aides providing students with a specific problem faced by managers in a megaproject context which the student could endeavor to solve.

2 Case 1 – Crossrail

CROSSRAIL: BUILDING LASTING VALUE

Authors: Colm Lundrigan, Nuno Gil, Franziska Drews

A year had passed since the Crossrail, a multi-billion pound intra-city railway, had successfully gained the backing of the U.K. government. Crossrail's sponsors in the Department for Transport and Transport for London had successfully led the scheme through a parliamentary bill process. Following this a number of executives had been appointed to oversee the delivery of Crossrail. One such executive was Andrew Mitchell who had recently begun his appointment as Programme Director of Crossrail. Andrew brought a wealth of experience to Crossrail having formerly been a director of the Thameslink project - a large extension of London's existing underground network. Andrew's role in Crossrail was to ensure that the railway was delivered on time and on budget. But already it was clear that Crossrail was struggling.

Crossrail, after a number of false starts, had gained government support during an economic boom in the early 2000's. The programme had been created under the banner of a "world class affordable railway" but now, in 2009, Andrew and the other members of Crossrail's delivery organization found themselves mired by a global financial crisis. The U.K was approaching an election year and much of the media's focus was on the size of the U.K.'s budget deficit; large public works like Crossrail were liable to become targets for the media's ire. In only a few months' time a newly elected government would almost certainly want to conduct a review of all major public spending. That meant that Andrew and his team would have to demonstrate that Crossrail really was offering value for money to taxpayers.

The most noticeable problem was that Crossrail, which was still in the design phase, was already projected to cost £17.9bn - £2bn more than had been allotted in public funding. Undoubtedly sceptics, both internal and external to the programme, expected Crossrail to fail. Successive governments had poured hundreds of millions of public funds into the scheme only to see it scrapped time and time again in turbulent economic climates. Even some long standing members of the Crossrail team had not truly expected the programme to reach completion when the scheme was finally backed by parliament in 2008. How would Andrew help get Crossrail back on stronger footing financially? And how could he prompt his organization to overcome the inertia that had seen Crossrail's planning phase last almost three decades?

THE HISTORY OF CROSSRAIL

The idea of building a cross London railway had been mooted as far back as the 1940s. But with the U.K.'s economy struggling to recover from World War II the plans for both a North-South line and an East-West line across the city were set aside. The U.K. government revisited the concept in 1974 with the publication of the London Railway Study. The aim of this early scheme was, at first glance, simple; build an underground tunnel across central London with a set of new stations. But with an estimated cost of £300m the plan was deemed too expensive, especially given that London's existing infrastructure had not yet reached its capacity limit.

Lobbyists from the rail industry sought to reignite the Crossrail debate in 1980 when the now defunct British Rail, a nationalised organization that at the time operated the majority of railways within the U.K., published a leaflet promoting "a cross-London rail link" which would reduce commuter time across the city. However, it was not until 1989 that Crossrail regained substantial momentum when, alongside two other possible transport schemes, it featured as a viable suggestion in the government's new Central London Rail Study. British Rail and London Transport (now Transport for London) developed the scheme to the point that it gained significant backing from the U.K. Government in 1990. Following this in 1991 a private bill was submitted to Parliament which estimated the costs of the scheme to be £2bn. The private bill would be needed to grant key legal powers to the scheme including the compulsory purchase of land. Though the bill received considerable support at the time the U.K. was once again hit by an economic downturn and the number of rail passengers dropped considerably. Ultimately the first Crossrail bill was failed to pass through parliament in 1994, although its supporters attempted in vain to push through the plans under the guise of the existing 1992 Transport and Works Act. In 1996, a year before the next election, the U.K. Government formally withdrew its support for the Crossrail scheme. However, this second attempt to deliver Crossrail did leave some hope for its supporters - the land required for Crossrail would now be protected by a safeguarding mechanism. This safeguarding meant that any new construction developments that interacted with the potential route of Crossrail would have to be negotiated with representatives of the scheme.

In 1997 a newly elected Labour government came to power and during its first four year term efforts were again made by lobbyists to rally support for Crossrail. But with other major rail works running concurrently in the city – including a long running extension of the existing underground lines in the businesses districts – Crossrail did gain traction with Government representatives. By 2000, with another election year approaching, the Government invited the Strategic Rail Authority (SRA), a public body tasked with developing a strategy for rail infrastructure, to undertake a study of passenger capacity in London. The output of this was the "London East West Study" which recommended two new underground services. One, an East-West line running from Paddington to Liverpool Street Station **(Exhibit 1)** which would one day become the Crossrail project. And a second running southwest between the London Boroughs of Hackney and Chelsea which could be developed after Crossrail was completed.

At this point Transport for London (TfL) was created (replacing London Transport) with a remit to manage the city of London's transport network. TfL was to be a local government body, reporting to the Mayor of London, and formed part of the wider Greater London Authority (GLA). One of TfL's first tasks was to form a joint venture with the Strategic Rail Authority to further study Crossrail. This joint venture named Cross London Rail Links Ltd (CLRLL) had an initial budget of £154m with which to undertake a feasibility study of routes, including stakeholder engagement, as well as further project definition work. The feasibility study conducted by CLRLL estimated that an intra-city Crossrail would cost £3bn. Soon after the scheme was denounced by London's business leaders who claimed that the plans were inadequate as they did not extend Crossrail to London's critical financial districts at Canary Wharf or to London's main airport - Heathrow.

The public denouncement seemed to have the right effect, as shortly afterwards the government's Transport Minister stated that Crossrail should be extended. Later the Mayor of London announced that the Crossrail scheme would indeed include extra tunnels to Abbey Wood (via Canary Wharf) and Heathrow Airport as well as the soon to be redeveloped area of Stratford which was the focal point of London's bid to host the Olympic Games in 2012. The increasing scope of Crossrail was of course accompanied by a large increase in costs. In early 2002 the costs were estimated to be £6.9bn but by mid-2003 costs had already risen to an estimated £10bn. This rapid increase in costs led to conflicting views over how the scheme should be funded, a number of potential funders could be identified at this stage including central government's Department for Transport, TfL, and a number of private businesses who would benefit from the scheme.

Concurrently the U.K's Transport Minister voiced central government's support for Crossrail, but cautiously ordered another study to be undertaken to review the scheme's deliverability and financing. By early 2005 this review was finished and the route had yet again extended considerably to run from Maidenhead to Shenfield, to accompany the extensions to Heathrow Airport and Abbey Wood. This now meant that what had begun as a central underground railway, running in parallel to London's existing underground services, had now extended to include 118km of the greater London area and would require both over ground and underground services. Much of the Crossrail scheme outside of central London would focus on renovating existing stations and tracks which currently managed by the rail operator Network Rail. It was unclear at this stage to what extent Network Rail would be involved in funding and delivering Crossrail. With a growing scope the scheme's costs were now estimated at £9bn and would be capable of transporting 600,000 passengers a day in ten-car trains. It was hoped at this stage, rather optimistically, that work could begin on building Crossrail by 2007. These proposals were put forward to the U.K. Parliament in the form of a hybrid bill by Secretary of State for Transport in the first half of 2005. A hybrid bill is necessary for many large infrastructure projects to create legal powers which enable work to commence. Hybrid bills are preferred over the alternative public bills as they allow both the public good and private interests to be considered during the parliamentary process. As a House of Commons representative would declare:

> *"Although promoted by the Secretary of State as a matter of public policy, it adversely affects the private interests of certain individuals and organisations, who may therefore be entitled to have their objections considered by a select committee under a quasi-judicial procedure akin to that for private bills."*[24]

Passing a hybrid bill is a challenging process as there is no limit to the number of public and private opponents that can plead their case against the bill. The Crossrail Bill received over 400 petitions in opposition. Opponents were given the opportunity to alter Crossrail's plans by pointing out perceived flaws in either the design of the railway or the way in which CLRLL intended to build it. Each of these petitions was heard in front of a specially created Select Committee of politicians who challenged Crossrail's promoter, CLRLL, to respond to oppositions demands. The result of many of these petitions was a list of 'undertakings and assurances' which were incorporated into the bill – these would specify a number of conditions Crossrail would have to meet during its construction and operation. Many of these undertakings and assurances would apply across the entirety of the Crossrail programme and would add considerable overheads – for example concerns over cyclists in London meant that Crossrail was required to ensure that every HGV driver provided by suppliers undertook training about the dangers of 'vulnerable road users'.

Crossrail's bill had its first and second reading in the House of Commons in 2005 and the Select Committee began the petition process in January 2006, which due to the volume of petitions lasted 22 months. Although Crossrail was inching closer to formally gaining government approval conflict over the planned route continued to plague the parliamentary process. In June 2006 Crossrail's train depot, which had been located in Romford, was relocated after the MP for the area argued that:

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[24] First Special Report of Session, House of Commons – Select Committee on the Crossrail Bill, 2006 – 07, p.5

> *“ the decision [to locate the depot in Romford] is ill thought*-out *and has not taken into consideration the negative effect that the development and subsequent use of this depot will have on the quality of life of those who live in the surrounding area.”*

Ultimately the depot was moved from Romford to Old Oak Common where an existing rail depot was in operation. Furthermore, negotiations were on-going surrounding the scale of some of the stations including increasing the capacity of the central Liverpool Street Station. In October 2006 a station at Woolwich was dropped from the Crossrail scope amidst concerns that Crossrail was already becoming too expensive. This decision was quickly challenge when the Member of Parliament (MP) for Woolwich and Greenwich demanded that the station be included. In March 2007 the Select Committee agreed with this demand if the station could be privately financed. Berkley Homes, a private property developer, agreed in principle to put up capital to fund the Woolwich station which would improve the value of their property development in the area. Elsewhere other MPs were trying in vain to argue that the route should be extended further to Reading or Ebbsfleet

In December 2006 the Strategic Rail Authority, joint backer of the Crossrail scheme, was closed by the Government and much of its powers transferred to the central Department for Transport (DfT). From a Crossrail perspective this meant that the work of passing Crossrail’s bill through parliament and establishing funding would now be split between the Transport for London and the Department for Transport. However, this was not to prove an easy relationship as TfL and DfT did not always agree about which party should control Crossrail’s development. As Martin Buck, Commercial Director of Crossrail, would later say:

> *“Political instability almost always goes with the territory in a capital city. And that [applies] to both political perspectives and funding. If [local and national government] are aligned, funding tends to flow, if they are not funding is more difficult.*

By July 2007 the House of Commons Select Committee had completed its review process and there was a significant pressure for Crossrail's backers to finalise a funding package before the Government's comprehensive spending review due in October. If CLRLL could not agree a funding deal the project could potentially be delayed a further three years. Fortunately, by October 2007 the funding strategy had been resolved **(Exhibit 2)**. . The details of the government's spending review revealed that £7.7bn of Crossrail's budget was set to be underwritten by TfL in the form of debt, most of which was to be earned back through taxes on local businesses and ticket revenues. Another £4.7bn was to be underwritten by the Department for Transport (DfT).

Network Rail would raise £2.3bn in debt which would be used solely to redevelop the stations and over ground tracks outside of central London. Network Rail would be key to Crossrail's success as they controlled the train schedule for much of the U.K. – with Crossrail now extending into the Greater London area it would be intersecting with a number of Network Rail controlled routes. In the early days of Crossrail there had been a debate as to whether CLRLL should manage the design and delivery of the entirety of Crossrail's route. That would require to CLRLL to construct both underground and over-ground lines across the Greater London area, as well as the accompanying stations. However, this was soon dismissed as the management of the over-ground routes nationwide was already a task being performed by Network Rail. Thus an agreement was made that Network Rail would take charge of all works on the existing over-ground network **(Exhibit 1)**. London Underground, a subsidiary of TfL, would also be brought into the Crossrail scheme to manage Crossrail's interfaces with existing underground facilities. This would allow CLRLL to focus primarily on the new works in the critical central section which would deliver 80% of Crossrail's revenue.

Finally, a portion of the funding would be provided by a number of private organizations with CLRLL were already engaged in preliminary talks with; these included the British Airport Authority (BAA), the Canary Wharf Group, Berkley Homes, and the City of

London Corporation. However, the exact details of the funding and how they would impact on Crossrail's delivery

Worryingly for Crossrail's supporters the drawn out bill process was risking valuable opportunities to generate value across the region. In 2005 construction was planned to begin a 2007 but with the hybrid bill taking months to move through Parliament this start date seemed highly unrealistic. Meanwhile work was beginning on the construction of London Olympics' venues. With these aiming to be completed by 2012 there were concerns that the construction industry would not be able to support two huge simultaneous megaprojects. In short there was a very real risk that with two megaprojects seeking to procure from similar supply chains the increased demand would lead to a spike in prices. As Norman Haste, CLRL's chief executive put it: "*It's naive to think it will not put up construction costs*"[25]. Upon this backdrop London's businesses with the support of the city's Mayor, lobbied actively for Crossrail's construction to start as soon as possible. With London being overwhelmed by 300,000 commuters a day, and the numbers still rising, there was a fear that growth would stagnate as early as 2016 without an improved infrastructure network. Furthermore, Crossrail's development was expected to have a spill-over effect into the wider London region – increasing property prices, and spurring private developments, by bringing a further 1.5 million people within an hour of the city. A study by Voltera consultants in 2007 underscored this point, as they found that delays to Crossrail would cost the U.K's economy £1.5bn a year through a loss of investment.

In July 2008, having passed through the House of Lords, the Crossrail Bill finally gained Royal assent and became the Crossrail Act. Doug Oakervee the CLRLL executive chairman stated:

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[25] Norman Haste speaking at the second hearing of the Crossrail Bill at the House of Commons

> *"Royal Assent is the most significant milestone in the history of Crossrail"*[26]

With that, CLRLL transformed from being a successful project promoter to becoming a megaproject delivery agent. To mark the beginning of this new era CLRLL was replaced by Crossrail Limited (CRL). In December 2008 CRL became a wholly owned subsidy of Transport for London. Although CRL was to be a subsidiary it was intended to act as an independent body with its own board of directors and executive powers. The reasoning behind this was to protect the Crossrail scheme from further political interference. Keith Berryman, CLRLL managing director, who guided the project through the parliamentary process marked the transition saying:

> *"I think we should allow ourselves just a few moments to congratulate ourselves before beginning the real job of building a world class and affordable railway."*[27]

Crossrail was set to open by 2017, with enabling works predicted to begin in 2009. These would be followed by station construction and tunnelling works throughout 2010-11. Crossrail's construction was set to be the largest in Europe requiring a staggering 14,000 employees. The railway would stretch for 118km encompassing 21.5km of double bore tunnels under London, running from Heathrow and Maidenhead in the East to Shenfield and Abbey Wood in the West. There would be a number of new Crossrail stations at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel, Woolwich and Canary Wharf. Upon completion Crossrail was expected to add £30bn to the UK economy by increasing the number of commuters that could affordably reach London's business heartland.

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[26] Doug Oakervee, CLRL executive chairman, July 2008, in "Parliament gives Crossrail all clear", NCE, 23.07.2008

[27] Keith Berryman, CLRL managing director, August 2008 in "Crossrail is finally here: we must all get behind it", NCE, 5.08.2008

BUILDING THE CROSSRAIL DELIVERY ORGANIZATION

Delivering Crossrail was set to be a mammoth task even by megaproject standards. But the task was perhaps made harder by the unusual sequencing of events that unfolded in the early days of CRL's existence. CRL's management team, inherited from the now defunct CLRLL, had a number of tasks that they attempted to run concurrently. First there were a number of private funding agreements to be confirmed with the private sector. Second CRL's management were under pressure to begin identifying suppliers who would be able to advance Crossrail's detail design in time to meet the programme's 2017 deadline. And simultaneously there was a realisation that running CRL as a delivery organization would require very different management skills to running CLRLL as a scheme promoter. Thus Crossrail's sponsors began a recruitment drive to select a new executive team. Attempting to agree funding deals, hire internal managerial, and select suppliers concurrently meant that many key supplier contracts and financial agreements were created prior to selecting a full time executive team.

CRL's interim management began by establishing a Design Framework Agreement this high level framework would guide the selection of design contractors for the tunnels and shafts, stations, and railway management system. In December 2008 CRL announced that twelve firms had been selected to become part of the design framework. These firms would then compete for packages of work on the Crossrail project. As part of the contract awarding process CRL would monitor the framework participants to ensure that no single organization was taking on too much risk within the project.

In late 2008 three major funding deals were finalised by CRL. The first deal, struck in November, was a £230m deal with BAA, the owners of Heathrow Airport, to connect Crossrail to their facilities. The second deal was a £350m funding package between the City of London Corporation. The final deal, between the Canary Wharf Group and CRL, was somewhat unique in that it greatly reduced CRL's control over the design and construction of a key station.

Originally, Crossrail's sponsors had approached the Canary Wharf Group, owners of a significant portion of the land in London's financial district, to see if they would be willing to invest in Crossrail in exchange for a station that would vastly increase the amount of commuters to the area. This was an attractive proposition to the Canary Wharf Group as the area was expanding much quicker than London's existing infrastructure network. But as CRL began to further study the potential for a Canary Wharf station they believed that it would require a substantial sum of money to construct. The difficulty lay in the location of the station which would require tunnelling to be carried out underneath the river Thames. CRL had estimated that the station would cost up to £1bn to build. At such an inflated cost the Canary Wharf Group were reluctant to make an upfront investment.

Instead Canary Wharf Group requested Cliff Bryant executive director of their subsidiary Canary Wharf Contractors Ltd to convince Crossrail's sponsors to agree to a more cost effective plan. Cliff managed to negotiate a deal in which Canary Wharf Group would invest £150m and Crossrail's sponsors would invest a fixed £350m to build the station. As a condition to this Canary Wharf Group's subcontractors would be allowed to manage the design and build of the station themselves without inference from CRL[28]. Whilst CRL's interim management had been hesitant to allow a private contractor to take the risk of delivering a critical station at half price, the sponsors favoured the deal. With the deal agreed Canary Wharf Station's design and construction moved out of CRL's control; Cliff Bryant was insistent that there would be:

> *"No Crossrail people anywhere near us …it was very important to us in negotiation of a development agreement that we were in control of the things"*

With financial and supplier deals moving forward CRL's interim management were keen to supplement their managerial capabilities through hiring in private sector specialists. CRL decided to hire two partner organizations providing what was intended to be two distinct roles. One would be termed a Programme Partner and the other a Project Delivery Partner. The Programme Partner would bring programme management expertise to the megaproject. Much of the Programme Partner's role would be on the so called 'soft' aspects of managing Crossrail including stakeholder engagement and design negotiation. CRL envisaged that the

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[28] The station design was still constrained by Crossrail's high level functional requirements i.e. trains per hour, platform length etc. and construction had a fixed deadline set by CRL .

Programme Partner would integrate seamlessly with their own team. On the other hand, the project delivery partner (PDP) would bring 'hard-nosed' project management skills into the megaproject. The PDP would remain a separate and distinct organization within the megaproject; tasked with managing the supply chain within the megaproject ecosystem. As CRL's interim Programme Director explained:

> *"The PDP will manage the design process and administer the construction contracts and as such will need a strong commercial capability. We [CRL] are giving the PDP a high degree of responsibility and accountability in design and construction."*[29]

By August 2008 shortlists for the tendering of both Programme Partner and PDP were released. Four organizations were invited to tender for the role of Programme Partner whilst five more were invited to tender for the role of PDP. In March 2009 the contracts were awarded. The £100m Programme Partner contract was awarded to the Transcend Consortium, a joint venture between Aecom (40%), CH2M Hill (40%) and the Nichols Group (20%) with experienced infrastructure manager Jhan Schmitz appointed as the consortium's leader. The PDP contract, worth £400m, was awarded to a joint venture between Bechtel, Halcrow and Systra which became known as Crossrail Central. A month later, in April, CRL announced an Enabling Works Framework Agreement. Like the Design Framework Agreement the Enabling Works Agreement would allow CRL to tender packages of work to a set number of suppliers. Seventeen firms were offered the opportunity to compete for four year contracts to develop site facilities, demolition, civil structures, and utilities on the central section of Crossrail's route.

In May 2009, with a large number of suppliers and partners already selected, CRL began recruiting its board of directors. The board was set to include three executive and five non-executive directors. Two of the non-executive roles would be given to the members of the sponsoring organizations – DfT and TfL. Another non-executive role would be given to Terry Morgan as Crossrail's Chairman. Executive roles were given to Andrew Mitchell who was appointed as Programme Director, Rob Holden who became Chief Executive, and David Allen taking the post of Finance director. The CRL board was ultimately tasked with upholding the 'Project Development Agreement' a set of requirements set out by Crossrail's sponsors. However, with concerns over the use of public funds the sponsors were unwilling to grant delegated authority to CRL's board. Instead the Department for Transport and Transport for London imposed a strict governance structure which required all high level decision making to be approved by their own executive board. As Terry Morgan would explain:

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[29] Graham Plant, CRL interim programme director, December 2008 in "Crossrail: Coming up with the goods", NCE, 15.12.2008

> *"The sponsors recognised that we needed to create a governance [structure] that could represent us to the public. And at that time all of the key decisions, although we managed the process ... had to be ratified by the sponsors. And we had to meet certain gateways in governance terms demonstration that we had the confidence to manage a project like this"*

Crossrail's governance system was designed to ensure that CRL had the right "people, processes, and procedures" in place. If CRL's directors could demonstrate competency then the sponsors would, after a number of formal review points spanning the early years of Crossrail's delivery, allow CRL to run almost entirely independently. Having Crossrail's sponsors holding the ultimate authority in the megaproject did come at a cost. Decision making was made slower and more costly as decisions were passed back and forth between the sponsor's board and the CRL board. Because Crossrail's sponsors did not themselves have the competences to understand all technical aspects of the scheme they appointed a Project Representative team. This team of skilled professionals would review project reports and technical designs to help inform the sponsor's decisions. In April 2009 Jacobs Engineering UK Ltd. were appointed to the role of Project Representative.

In addition to the two executive boards, CRL created a programme level board **(Exhibit 3)** – this would be used as a forum to allow Crossrail's many 'industry partners' to share information. Many of these industry partners were themselves partially funding Crossrail as was the case with the Canary Wharf Group, Network Rail, Berkley Homes and the British Airport Authority. Others, such as London Undergound were managing the updating of existing facilities that would integrate with Crossrail's railway.

Unbeknown to its designers Crossrail's delivery organization had a fatal flaw. The decision to have a separate Project Delivery Partner and a Programme Partner operated by separate private consortiums proved problematic. On paper the Programme Partner, Transcend, was intended be integrated with CRL and as such would have authority over the separate Project Delivery Partner – Crossrail Central. However, Crossrail Central's members were more used to competing against Transcend's members for project work. This appears to have led to a series of heated conflicts surrounding which party had authority to make decisions. Ultimately the fractured working relationship left Transcend, CRL and Crossrail Central working with little integration. CRL's chairman Terry Morgan explained:

> *"There was an obvious sign of silo mentality and there wasn't what I would describe as a Crossrail team there were three silos."*

CROSSRAIL UNDER PRESSURE

With a complex and slow governance structure, and difficulties in managing the Programme Partner and PDP, Crossrail's delivery organization was certainly having teething problems. But this didn't stop the design phase continuing apace. CRL was midway through the process of issuing compulsory purchase orders to acquire the land needed for Crossrail's route. Compulsory purchase orders allow CRL to forcibly purchase property at an estimated market rate. CRL intended to complete the acquisition of critical land in central London by December 2009.

Two major developments were announced in May 2009; the first came from the government's Transport Minister Lord Adonis who revealed that an extension to the Crossrail route to Reading had been safeguarded. Whilst no firm commitment was made to extend the route, the possibility was made more likely when Network Rail boosted its capital expenditure to renovate Reading's existing station. The second major announcement in May was the commencement of construction at the Canary Wharf Station. Interestingly the privately designed and constructed Canary Wharf Station was beginning its construction phase before CRL had managed to tender its detail design contracts for the rest of Crossrail. These CRL led design contracts were finally announced in phases through May 2009 and January 2010. To support the letting of these contracts two new directors were appointed in June 2009; Martin Buck, who had worked with CLRLL, was appointed Commercial Director and David Bennett, formerly of the Project Representative Team, was appointed Implementation Director.

With an executive team finally assembled and much of the supply chain engaged in a design process with local stakeholders Crossrail seemed to finally be heading forward after years of political uncertainty. However, the newly appointed Crossrail executives had entered the organization as the U.K's economy began to collapse. As Programme Director Andrew Mitchell was all too aware that although currently on schedule Crossrail's budget requirements had been quietly growing over the last 18 months. Since Royal Ascent Crossrail's cost estimates had bloated by a massive £2bn. Andrew would need to convince both Crossrail's other executives, as well as the sponsors, that something would need to change saying:

> *"When I joined [CRL and Crossrail's board] the forecast cost was several billion [pounds] higher than the maximum funds available. So it was fairly obvious that something needed to be done, because we didn't have an affordable project – and it wasn't even close."*

External pressure on the Crossrail team was mounting; Hazel Blears Secretary of State for Communities and Local Government clashed with the Chancellor of the Exchequer and the Mayor of London over the local business tax that was to be used to generate £3.5bn in funding for Crossrail. Hazel Blears wanted to give businesses the right to vote on their contribution to the scheme, but her opponents feared that this would risk losing vital funding in an already difficult climate. Matters were made worse by an approaching election and the opposition parties were unwilling to publicly commit to any major projects started by the interned government. A spokesman for the Conservative party, the largest of the opposition parties, said in a statement:

> *"We have clearly set out our principles: that all programmes must demonstrate value for money, and we will be seeking to get value for money in all spending."*[30]

Mayor of London, Boris Johnson, remained stoutly in support for Crossrail telling The Times newspaper:

> *"This is one of those moments in politics when you reverse the usual rule and get in a hole - and keep on digging"*

The budget wasn't Andrew's only concern Crossrail's schedule left little room to testing and commissioning – let alone conducting a value engineering process to reduce costs. Andrew reflected:

> *"[We're] making time based decisions and not cost or value based decisions"*

Matters weren't helped by a seemingly ever expanding scope for Crossrail. Councillors in North Kensington were continuing to lobby for a new Crossrail station in their area. And as late as October 2009 government ministers were extending Crossrail's safeguarding to include Gravesend in Kent. After years of planning and negotiation Crossrail's designs had also acquired a lot of extra features, each costing time and money, many of which seemed to offer little commercial benefit to the scheme.

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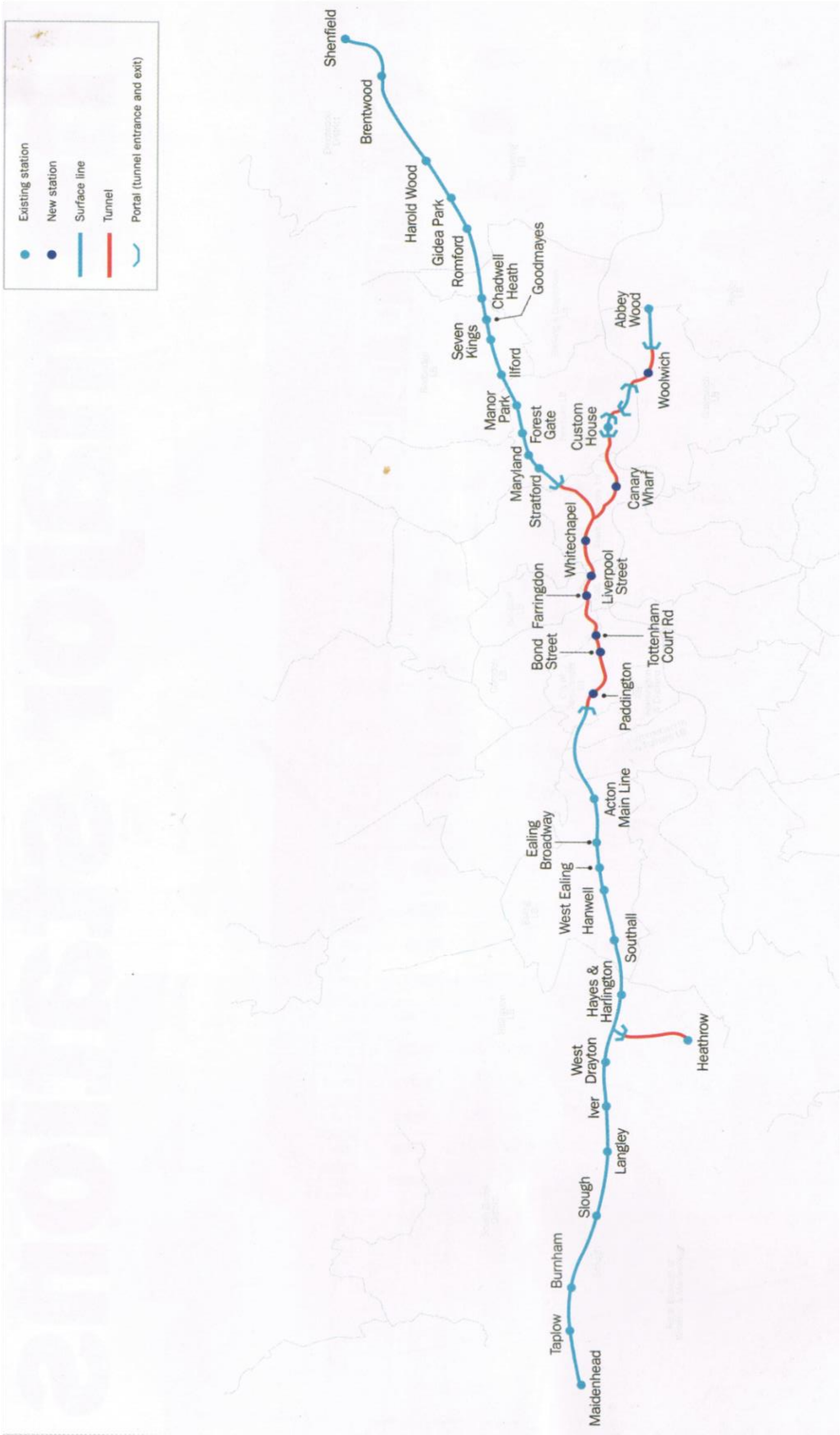
[30] Conservative party spokesman, "Crossrail faces review if Tories win next election", NCE, 14.05.2009

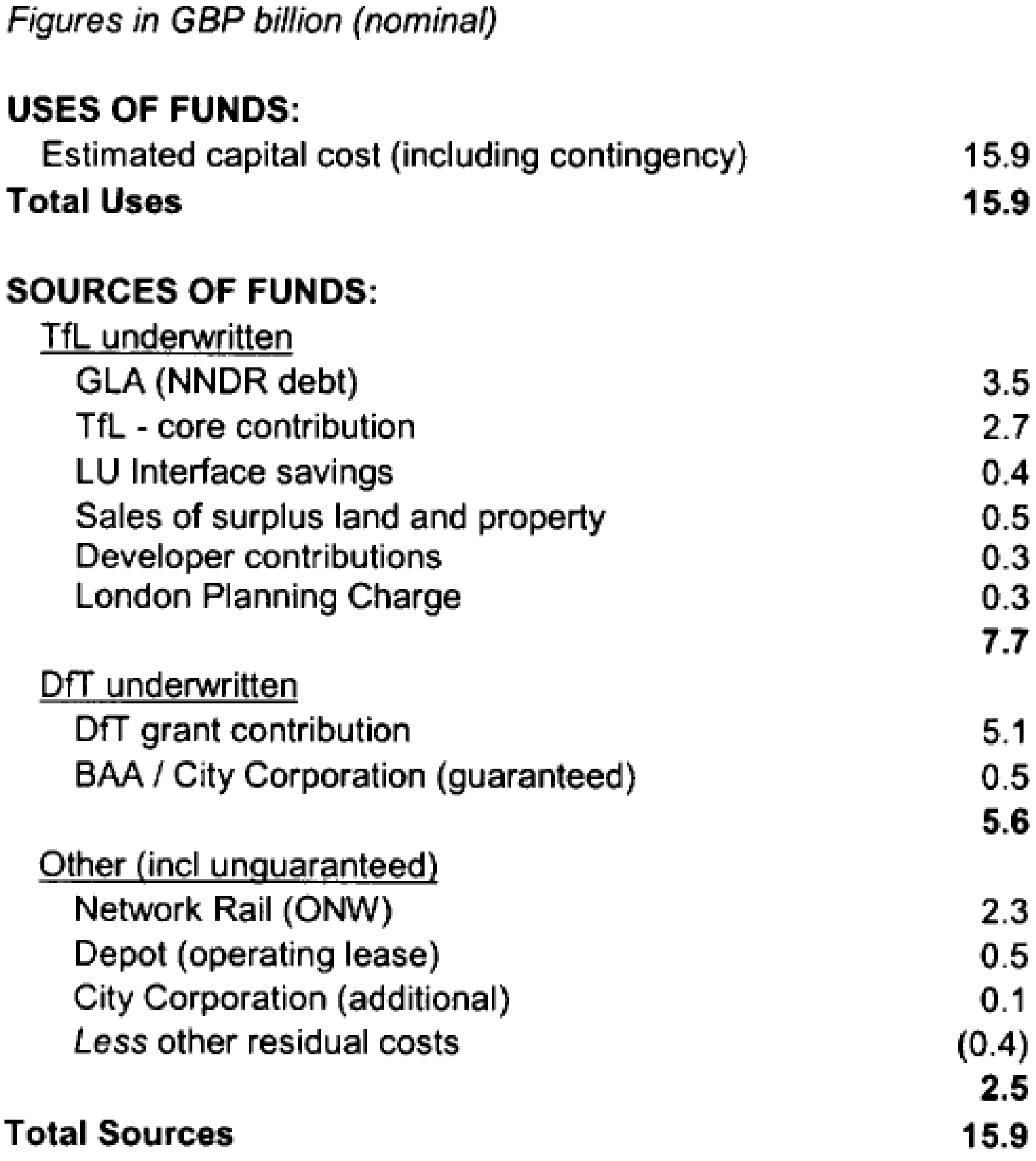
With only 8 months until the next election how could Andrew get Crossrail’s budget back on track? Would it be possible to reduce the scope of Crossrail to cut costs? Certainly it would be impossible to remove key parts of the route or to alter the alignment of the railway. But there were many parts of Crossrail’s emerging designs which did not correspond with the functional brief given to CRL by its sponsors. Or would it be a wise decision to try and delay construction on a number of projects to give designers time to value engineer their proposals? This seemed attractive but would a new government accept the idea? Or would Crossrail simply be an easy target to show the public that they were serious about cutting the public spending deficit?

Exhibit 1 – Crossrail's Route


Existing station
New station
Surface line
Tunnel
Portal (tunnel entrance and exit)
Shenfield
Brentwood
Harold Wood
Gidea Park
Romford
Chadwell Heath
Goodmayes
Seven Kings
Ilford
Manor Park
Forest Gate
Maryland
Stratford
Abbey Wood
Woolwich
Custom House
Canary Wharf
Whitechapel
Liverpool Street
Farringdon
Tottenham Court Rd
Bond Street
Paddington
Acton Main Line
Ealing Broadway
West Ealing
Hanwell
Southall
Hayes & Harlington
Heathrow
West Drayton
Iver
Langley
Slough
Burnham
Taplow
Maidenhead

CRL managed sections shown in red; Network Rail managed sections shown in Blue

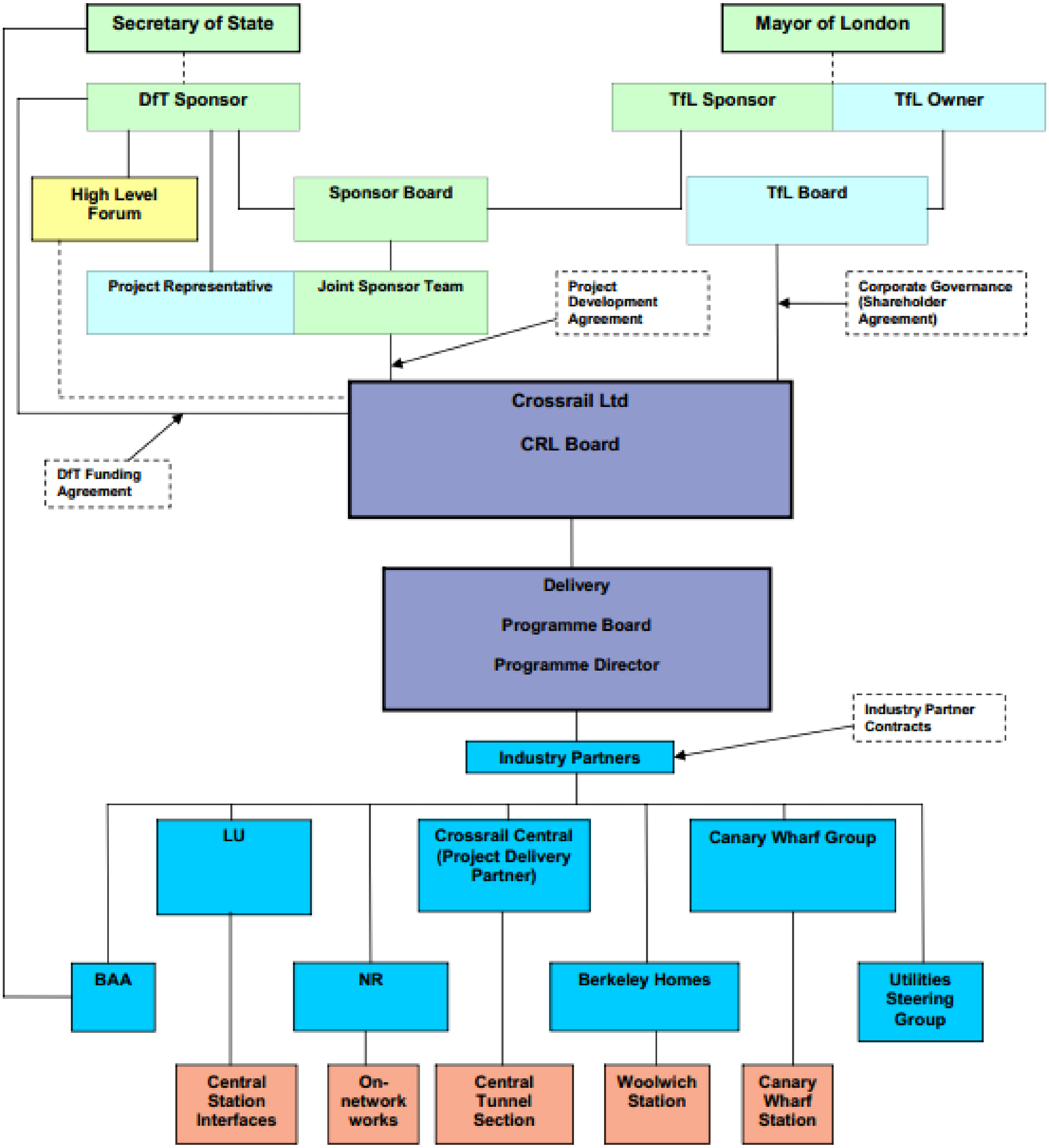
Exhibit 2 – Financing plan of 2007 (published in "Heads of Terms in relation to the Crossrail Project", November 2007, Secretary of State and TfL)



Figures in GBP billion (nominal)

USES OF FUNDS:	
Estimated capital cost (including contingency)	15.9
Total Uses	**15.9**
SOURCES OF FUNDS:	
TfL underwritten	
GLA (NNDR debt)	3.5
TfL - core contribution	2.7
LU Interface savings	0.4
Sales of surplus land and property	0.5
Developer contributions	0.3
London Planning Charge	0.3
	7.7
DfT underwritten	
DfT grant contribution	5.1
BAA / City Corporation (guaranteed)	0.5
	5.6
Other (incl unguaranteed)	
Network Rail (ONW)	2.3
Depot (operating lease)	0.5
City Corporation (additional)	0.1
Less other residual costs	(0.4)
	2.5
Total Sources	**15.9**

Exhibit 3 – Crossrail's Governance Structure



Secretary of State
Mayor of London
DfT Sponsor
TfL Sponsor
TfL Owner
High Level Forum
Sponsor Board
TfL Board
Project Representative
Joint Sponsor Team
Project Development Agreement
Corporate Governance (Shareholder Agreement)
Crossrail Ltd
CRL Board
DfT Funding Agreement
Delivery
Programme Board
Programme Director
Industry Partner Contracts
Industry Partners
LU
Crossrail Central (Project Delivery Partner)
Canary Wharf Group
BAA
NR
Berkeley Homes
Utilities Steering Group
Central Station Interfaces
On-network works
Central Tunnel Section
Woolwich Station
Canary Wharf Station

Exhibit 4 – Timeline of Crossrail 1974 – 2009

1974 – London Rail Study published suggesting tunnel to connect east and west London rail lines

1989 – Central London Rail Study published suggesting Crossrail for first time

1991 – Crossrail introduced to parliament as private bill

1994 – Crossrail bill fails in House of Commons, route is safeguarded

2002 – CLRL founded and new project definition and feasibility studies launched

2003 – CLRL submits final business case, Secretary of Transport orders review

2004 – Review finds Crossrail to be viable (£9bn cost estimate)

2005 – Crossrail Bill introduced to House of Commons as Hybrid Bill by the Secretary of Transport (£15-16bn cost estimate)

2006 – House of Commons Select Committee starts hearing petitions against Crossrail

Business and Mayor increase pressure to build Crossrail to support economic growth of London

2007 – House of Commons Select Committee concludes
Plan for financing Crossrail agreed upon (£15.9bn total costs)
Bill read in House of Lords

2008 – Royal Assent, Crossrail Act established

2009 – Contracting starts for e.g. project delivery partner (Crossrail Central), programme partner (Transcend)

Crossrail executive and non-executive board members are selected

Construction officially launched with start of construction in Canary Wharf

3 Case 2 – Heathrow Terminal 2

BAA: The Intelligent Client?

Authors: Colm Lundrigan, Nuno Gil, Caitlin Wyndham

A month had passed since Steven Morgan had taken the post of Director of Capital Programmes at BAA in February 2009, and the news didn't look good. The UK's Competition Commission were expected to announce that BAA had been abusing its dominant market position and would likely demand that BAA's regulated asset base (RAB) be dismantled through the sale of Gatwick, Stansted, and either Edinburgh or Glasgow International airport. With the loss of several profitable airports, BAA was now increasingly reliant upon its most important asset - Heathrow Airport. Described by many as "an inspirational leader with a strong belief in the value of competition", Steven, a former rear admiral from the US Navy, was deeply committed to overhaul the firm's approach to procuring capital projects. Steven thought of himself as a major systems acquisition expert. As the former commercial director of Sellafield Ltd, the UKs largest nuclear complex, Steven had led the overhaul of £700m/year procurement activities and contract management involving major construction and cleanup projects for which Sellafield had been awarded the World-Class designation in independent benchmarking studies.

At BAA, Steven, had been appointed to oversee over £9bn in construction projects ranging from building new terminals to new runways. Steven's priority was to turn the page on BAA's traditional approach to capital procurement. Steven felt BAA had over relied on long-term frameworks and cost reimbursable contracts which had placed the risk entirely with the company and had failed to drive value for money. And Steven would not hesitate to remind BAA's executive committee of the botched opening of the £4.3bn Terminal 5 (T5) campus on 27th March 2008. Passengers had been promised a "calmer, smoother, simpler airport experience"[31], and were confronted instead with cancelled flights, baggage delays, and a temporary suspension in check-in labeled by the press as a national embarrassment. While BAA and British Airways (BA), the main occupier of T5, were careful not to publicly blame each other both suffered a publicity disaster. T5 had been completed on time and to a high technical standard but the opening was marred by human error. It took BA over a month before it was able to operate a full schedule. And a month later BAA and BA agreed to delay the move of BA's 120 long-haul services from T4 to T5 until the autumn 2008.

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[31] "Final preparations for Terminal 5", British Airways press release, 18 March 2008

For Steven, the priority was to change BAA's approach to capital procurement. He wanted the company to move away from long-term framework agreements and the overall ‘Rethinking Construction’ ethos spearheaded by a former BAA chief executive, Sir John Egan. As Steven insisted, BAA needed to be an 'Intelligent Client'! He wanted the BAA executive to endorse his plan to use the company's largest ongoing capital programme at Heathrow - the £2.1bn Heathrow East programme recently renamed to T2 - as a test bed for implementing the change. Steven was mindful that the T2 programme was going through potential major changes in scope particularly with regard to how baggage would be handled. He also understood that T2’s main customer, the Star Alliance, was significantly different from British Airways. The Star Alliance represented 25% of Heathrow’s passengers, spread across 18 airlines, and whilst this was not as many passengers as British Airways provided it was still significant. T2 would co-locate all of the Star Alliance airlines - a major step to restore parity between the Star Alliance and their rival BA following the building of the Terminal 5. Steven was convinced that to cope in such a changed environment BAA needed to rethink again its capital procurement strategy.

The British Airports Authority

The British Airports Authority (BAA) was created in 1965 as a vehicle to manage a number of state owned airports within the United Kingdom. Initially, the organisation controlled the airport infrastructure at London Heathrow, Gatwick and Stansted. Over the next two decades the company expanded its operations to include airports in Southampton, Edinburgh, Glasgow and Aberdeen. In the 1980s, the UK suffered a prolonged period of recession which drove the then Conservative government to privatise a number of industries. In 1986, the parliament passed the Airports Act which mandated the privatisation of the British Airports Authority creating BAA plc. which was listed on the

London Stock Exchange and became a constituent of the FTSE 100 index. The initial capitalisation of BAA was £1,225 million. Following the privatisation, the company continued to expand the number of airports in its portfolio by undertaking short-term airport lease contracts in the United States and mainland Europe. By 2005, BAA owned and managed seven UK airports: Heathrow, Gatwick, Stansted, Southampton, Edinburgh, Glasgow International, and Aberdeen, representing 60% of total passenger numbers in the UK, 92% of travellers to and from the London area, and 86% in Scotland.

In June 2006, with a commanding market position, and in the midst of a £4.2bn capital programme to add a state-of-the-art fifth terminal campus (T5) to Heathrow, BAA plc. was subject to a hostile takeover bid by the Airport Development and Investment Ltd (ADI). ADI was a wholly-owned subsidiary of FGP TopCo Ltd, in which Grupo Ferrovial SA (Ferrovial), a Spanish infrastructure consortium, were the majority shareholder (61.06%). Other shareholders included Caisse de dépôt et placement du Québec (28.94%), which managed public pension plans in the Canadian province of Quebec, and GIC Special Investments, a sovereign wealth fund established by the Government of Singapore (10%). The highly leveraged bid - ADI was borrowing nearly £9bn from five banks - valued BAA plc. at £10.11bn, and represented a 49% premium on the company's market value before the takeover approach became public.[32]

Upon the successful completion of the takeover, BAA was delisted from the London Stock Exchange and formed BAA Ltd. Margaret Ewing, who stepped down as CFO shortly after the takeover, later observed Ferrovial was driving the business "purely from a financial perspective". And another former director would note "It's a different leadership model, and the drivers have changed (…) Under the former CEO, it was a FTSE 50 company on the public-private boundary. That changed when Ferrovial came on board. Now it's about saving cash."[33] But Ferrovial insisted they had a long-term commitment while noting that

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[32] The initial offer of £8.75bn was turned down after BAA insisted it 'did not begin to reflect the true value of BAA's unique portfolio'

[33] Stewart, D. (2008). "BAA the Economy Class Client," *Building* ,4

"BAA is not a public, but a responsible private company (…) It must be understood that we will not build runways or terminals unless there is a commercial incentive."[34] From then onwards, BAA rarely managed to get out of the headlines. And it started facing investigations by the Competition Commission the Civil Aviation Authority, the Department for Transport, and a Parliamentary Committee.

Less than a year had passed following BAA's acquisition by the Ferrovial-led consortium when the Office of Fair Trading (OFT) referred the BAA airports to the Competition Commission (CC) for investigation on 29 March 2007. CC carried investigations into merges, markets, and the regulated industries. The OFT had identified potential adverse effects on competition relating to a combination of features: joint ownership of airports, regulation, development restrictions, and capacity constraints. A day later, the Civil Aviation Authority (CAA), the industry's regulator for England, also asked CC to inquiry into the maximum level of airport charges at Heathrow and Gatwick for the five years beginning on 1 April 2008, and to investigate if BAA had pursued a code of conduct adverse to the public interest in the past. In a submission to CC in May 2007, *Putting Passengers First*, BAA stated its disagreement with significant elements of the OFT analysis and challenged the conclusions. In CC's report on the charges to airlines at Heathrow and Gatwick submitted to CAA in September 2007 (the Q5 report), CC concluded that the two airports had failed to manage security queuing and queue times to avoid unacceptable delays to passengers, crew and flights and consequently had not furthered the reasonable interests of the users. CC also expressed concern with significant increases in BAA's projected capital and operating expenditure during the course of the regulatory review for Q5. (CAA's final determination on airport charges at Heathrow and service standards was published on 11 March 2008[35].) And in April 2008, in its interim

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[34] Nelson, S. (2006). BAA CEO addressing the Heathrow Consultative Committee, December.

[35] This was a controversial process with Financial Times reporting the claim made by airlines that a rise in fees represented a "reward for failure", despite an overall reduction in the return on capital investment from 7.75% to 6.2% at Heathrow for BAA owners.

Emerging Thinking report published for consultation, CC stated that BAA had failed to proper consult the Star Alliance regarding the T2 programme during the Constructive Engagement process, an assertion that BAA refuted in its response. CC also judged the lack of competitive pressures faced by BAA had contributed to the lack of investment in new airport capacity in the South East of England, and were not serving well the interests of either airline or passengers. In August 2008, CC published its provisional findings confirming its findings in the interim report, and BAA put forward an evidenced case that their ownership of the airports had not “distorted, prevented or restricted competition” in September 2008. In the same month, BAA announced the sale of Gatwick. But in December 2008, the CC published its ‘Provisional Remedies’ for its market investigation of BAA’s UK airports where it proposed the divestment by BAA of two of its three London airports. And the CC also proposed undertakings for Heathrow focused on improving the consultation process between HAL and airlines to make constructive engagement work more effectively.

Concurrently to this process, in October 2007, the House of Commons Transport Committee (Committee) announced an inquiry into the future of BAA, and in March 2008 the Committee published a report *The Future of BAA*. This report delivered a very damaging assessment of the company pointing that its step by step risk averse capital expansion had only been possible because it did not face competitive pressure from other airport operators to introduce more capacity more rapidly. It also pointed that the company’s ownership of all London major airports had exacerbated delays in delivering runway capacity, and that BAA had shown weakness in consultation, lack of responsiveness to the airlines' needs, and lack of genuine 2-way dialogue and exchange of views. In memorandums submitted to the Committee, different airlines argued the lack of strategic investment at Heathrow for decades had led to chronic congestion, delays, poor customer experience and insufficient capacity to meet demand.

The Department for Transport (DfT), which had been working closely with the CC, was another organisation looking into the same matters. And after announcing an independent review of airport regulation in April 2007, one year later the DfT commissioned two separate but complementary reviews of the framework for the airport regulation in response to widespread criticism of BAA's management of several airports, particularly Heathrow, calls by the airlines to break the BAA monopoly, and the previous reports by the House of Commons Transport Committee. DfT also commissioned a report on air passenger experience from the Consumer Protection Group of the CAA. And in November 2007 announced a public consultation (*Adding capacity at Heathrow*) on the construction of a third runway and sixth terminal at Heathrow. Amidst a raft of bad news, and a change of Chief Executives in April 2008, BAA received good news in January 2009 - the Secretary of State for Transport announced conditional support for plans for a third runway and a six terminal at Heathrow, subject to a limit on air transport movements at Heathrow to be reviewed in 2020 to ensure compliance with noise conditions.

But more bad news was in store. In March 2009, the CC finally published its final report on the investigation on the supply of airport services by BAA in the UK, and ruled that BAA had been abusing its dominant market position and demanded that BAA's asset base be dismantled through the sale of Gatwick, Stansted and either Edinburgh or Glasgow International airport. Whilst BAA had already put Gatwick for sale, the company decided to legally challenge the order to sell Stansted and further break-up the company. The CC also called for HAL to strengthen its consultation process with the airlines, arguing that demand for airport services is a market that derives from the demand for flights, and changes in price/quality of airport services can affect demand by affecting airline behaviour or passenger behaviour. In addition, the CC noted Heathrow was the most convenient airport for many passengers particularly business travellers and would continue to have substantial market power and would require price control after divesture. In the same month, DfT announced a consultation until June 2009 on a proposed reform to the economic regulation of airports to put the interests of passengers at the centre of the new regulatory regime.

Airport Regulations

Aviation is a critical part of the UK's economy with UK airports handling hundreds of millions of passengers every year. In order to ensure that airport operator such as BAA continue to invest capital to improve the UK's airport infrastructure, the industry is overseen by a regulatory body – the Civil Aviation Authority (CAA). Airport operators generate a large portion of their revenues from charges levied on airlines that land and take-off from their airports. The CAA caps the maximum amount that an airport operator can charge airlines, and charges are revised every five years (a quinquennium*)*. The price caps reflect the overall value of the regulated asset base (RAB) in order to ensure that the airport operator can have appropriate reasonable rate of return on capital investment into infrastructure, service and operations. Increases in the price caps from one quinquennium to the next are determined based on the amount of capital that the airport operator commits to invest over the new quinquennium, and the amount of profit the company is allowed to make in order to pay for the capital investment. Thus, the more CAA authorises an airport operator to invest in improving the airport infrastructure the higher the fees that operator may ultimately charge. Airport charges are designed to increase incrementally provided the operator meets trigger conditions. These triggers define the dates at which certain projects must be completed – failure to reach a trigger reduces the maximum amount that the operator can charge. But operators do not have total freedom in choosing how and how much they can invest; the price capping mechanism requires that operators engage the airline community and CAA to negotiate how the capital should best be invested. As all airlines ultimately share the cost of an operator's investment, and they all pay the same fees, each airline competes to have their needs met during the quinquennium. When a large amount of capital is being invested into a new terminal which will only benefit selected airlines, this can generate resentment from other airlines as it was the case of T5. In January 2007 prior to the opening of T5 Mark Johnson, the representative of the Star Alliance at Heathrow, asked:

"The T5 Campus is about to 'go live' and is being proclaimed as a world-class *facility, having received directly and indirectly more than 25% of its funding from Star Alliance members. All of this raises the question: Will competitive equivalence, therefore, be matched at the same time for Star Alliance members?"*

If an operator fails to deliver the improvements offered to the airlines at the start of that quinquennium, the CAA can impose additional penalties. Operators who exceed the agreed upon budget for a project also cannot increase fees to reclaim the extra costs without first demonstrating to both the airlines and CAA that the additional outlay offered value for money.

Heathrow Airport

Heathrow Airport was the world's third busiest airport[36] and represented BAA's most strategically important asset. Heathrow was also the closest airport to central London, and some studies estimated it contributed around 0.8-0.9% to the UKs GDP. Heathrow was founded in 1929 and expanded rapidly through the 1950s and 1960s to house three terminal buildings. In 1989 a fourth terminal was added to meet growing demand. However, these first four terminals made use of a sprawling network of taxiways inherited from the original "Star of David" pattern of runways which were liable to congestion creating serious delays to air traffic referred to by the media as "the Heathrow hassle". In the late nineties, the airport was already operating in excess of planning standards on peak periods. In 2000 Heathrow handled about 63 million passengers per annum (mppa) from nearly 460,500 air transport movements (atms), while its planned capacity was around 60 mppa from 440,000 atms.[37] And demand forecasts for Heathrow projected demand to be in the range of 118-143 mppa in 2016.[38] The £4.2bn Terminal 5 campus was starting to address the capacity problems at Heathrow. As a greenfield development[39], T5 had adopted a modern "toast rack" layout that maximised the use of the land by placing the main terminal building (T5A) and its satellites (T5B, T5C) perpendicular to the runways. But T5 left unresolved the congestion problems in the central terminal area (T1, T2, and T3), which was the basis for operations of the airlines that were part of the Star Alliance.

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[36] By passenger number – Airports Council International 2008

[37] Heathrow was subjected to a planning restriction of 480,000atms, but not on the number of passengers using the airport

[38] With two thirds of the market for long-haul passengers in the UK, Heathrow competed with other hubs in Continental Europe, eg., Paris, Frankfurt, and in Middle East , e.g., Dubai

[39] The T5 development was not hindered by the existing terminal buildings

Airline Alliances at Heathrow Airport

In 2008 the airline industry was dominated by three large airline alliances Oneworld, SkyTeam and Star Alliance. Each alliance sought to encourage its members to coordinate and connect their routes together to provide services over a wider geographical area and maximise passenger numbers through transfers and code-sharing. To achieve this, the alliances used key airports as ‘hubs’ to transfer passengers between alliance members, as well as frequent flyer programs, terminal co-location, and joint ground handling wherever possible. Being a member of an airline alliance also allowed the airlines to reduce operational costs by sharing ground staff, joint purchasing of fuel, aeroplane parts, and in-flight service commodities. Alliance members also shared market intelligence in order to maximise each airline’s business. But alliance members were expected to have differing requirements in terms of airport facilities. Some airlines tried differentiating their services within an airport by making use of branded VIP lounges, check-in desks, and boarding gates. The heterogeneous nature of the alliances meant that members placed contradictory demands upon airport operators. To resolve these conflicts the alliances employed representatives who collated the requirements of all members into a ostensibly coherent set of specifications for airport operators to work towards.

Heathrow was a critical hub for the Oneworld Alliance who accounted for over 50% of the passengers travelling through the airport. At Heathrow the leading carrier for OneWorld was BA. As both a domestic and international carrier, BA could bring passengers from across the UK to Heathrow where they could connect to international flights. Connecting passengers were a vital part of both BA and BAA’s market strategy. Oneworld’s dominant position at Heathrow meant that BA and its partners were solely occupying the modern T5 campus **[Exhibit 1]**

The Star Alliance was the second largest customer group at Heathrow representing around 25% of the passengers. Star had been established in established in 1997 by Lufthansa, Scandinavian airlines, Air Canada, Thai Airlines and United Airlines, and was headquartered in Frankfurt, Germany. By 2008 Star was the largest airline alliance with 21 members. Star was host to both large international airlines and smaller domestic airlines. It had a particular focus on business travel and for several years had been awarded the Best Airline Alliance by Business Traveller Magazine and Skytrax. Their vision was: ‘to be the leading global airline alliance for the high value international traveller’ and their mission was ‘to contribute to the long-term profitability of its members beyond their individual capabilities’. Star had a ‘Move under One Roof’ policy to improve passenger transfer times and make transfers and code-sharing easier for both airlines and passengers. This policy was formalised with BAA in 2002 when the two organisations signed a first memorandum of understanding (MoU) agreeing to offer collocation at Heathrow by 2010. This agreement was further developed in a second MoU in January 2005 which led to the development of the Heathrow East proposal that offered co-location for the Olympics. The key airline for Star at Heathrow was British Midlands International (BMI). As the only UK member of Star Alliance, BMI provided much needed domestic and regional flights. With the major Star airlines based outside of the UK, in Germany and United States, Star had not used Heathrow as a hub preferring instead to transfer connecting passengers at Frankfurt Airport.

The Heathrow East/Terminal 2 Programme

In June 2005 BAA, under pressure from the CAA, and in response to the Government’s 2003 Air Transport White Paper, and DfT guidance on airport master planning released a draft long-term strategy for consultation. The central focus of the interim master plan was on adding a controversial third runway and a sixth terminal to Heathrow. Following a period of consultation which ran until October 2005, BAA announced in November 2005 the £1-1.5bn Heathrow East Terminal (HET) scheme with a statement of support from Virgin and Star **[Exhibit 2].** The vision offered was of a modern terminal building (later termed T2A) and a midfield pier (T2B) with the toast-rack layout similar to that used on T5. The first development phase of HET pivoted around delivering the first phase of the main building and the intention was to open it in time for the London 2012 Summer Olympics.

In January 2006, BAA appointed Foster and Ove Arup to advance the design of HET, and in July 2006 BAA presented plans for a £1.6bn project to the Heathrow airport consultative committee. HET was to be a key part of a £6.2bn, 10-year investment programme to transform Heathrow. The ambition for the HET's main building was to rival the scale and ambience of Richard Rogers' T5 main building. Work was scheduled to start on site in 2009 and involved demolishing the 1950s T2 and Queen's buildings - the oldest parts of the airport. BAA insisted that the scheme was not going to increase passenger capacity and would produce 40 per cent less carbon dioxide than the existing terminals. HET would be delivered in 2 phases, and would be fully operational around 2016 offering 180,000 sqm of modern facilities with capacity to accommodate 30mppa. After a period of public consultation BAA submitted an outline planning application to Hillingdon Council in October 2006 just for the main building, and the company was granted outline planning permission by the Mayor of London and Hillingdon Council on 27th July 2007 with a projected opening of summer 2012. Another application followed to build a midfield pier. BAA hoped that by co-locating the Star Alliance in a new bespoke terminal it would induce its members to use Heathrow, rather than Frankfurt, as a central hub for connecting passengers. This would make Heathrow one of the world's only airports acting as a hub for two major alliances. But Star Alliance insisted that to restore competitive equivalence with Oneworld, BAA needed to invest into a new campus rather than building new terminals in a piecemeal fashion. And disappointed, Star asked the Council to reject the HET planning application because it failed to include all the elements that could make the Heathrow East campus work [40].

During the Constructive engagement period than ran initially until January 27th 2008, and which unfolded concurrently with the public consultation to agree the capital investment programme for Q5, BAA's relationship with Star began to turn sour. There were two main points of contention between Star and BAA. First the opening dates of the first and second phases, and second, the exact scope of each phase. In terms of opening dates, Star became frustrated after BAA announced in December 2007 that the completion date for the first phase was delayed to December 2012 conditional on a number of assumptions to discuss with the airlines. Somehow it seemed the Summer 2012 deadline had been nothing but a ruse to help gain planning consent. The delay stoked resentment from the Star Alliance, but BAA justified the delay due to changes in the timings of the move sequences [**Exhibit 3**]. Star's only available recourse was to complain to BAA and to the regulator, CAA, which the airline alliance did extensively **[Exhibit 4].** By January 2007, the tension between the two organisations was so intense that in the Star response to the CCA consultation paper on Heathrow price control for Q6, Star suggested that "BAA and BA are indirectly conspiring not to allow a competitor equal ability to see the realisation of facilities that match the T5 Campus, albeit some 5 years later.“

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[40] This piecemeal approach enabled however BAA to apply for a general permitted development order, avoiding a protracted full planning permission process

The debate around the scope of the T2 programme was equally fierce. Star had developed a long term set of requirements for Heathrow's eastern campus **[Exhibit 5].** Insisting on a campus vision, the alliance requested a main terminal building (T2A), with two satellite buildings (Terminals 2B and 2C). These would be serviced by an underground passenger transit system, as well as a multi-storey car park for passengers, an automated baggage handling system, as well as a utility station. For the first phase Star demanded that BAA constructed both a 4.5bay wide main terminal and two smaller versions of both satellites whilst providing modern underground connectivity for baggage and passengers. For Star, these requirements were needed to achieve competitive equivalence with the T5 campus within an acceptable time-frame. According to Star, however, BAA countered this demand with an offer of a 4.0 bay wide main building, a small midfield pier (T2B), and a bridge connecting T2A and T2B for passenger connectivity. Star would have to use the existing baggage system in T1. Mark Johnson, who had been recruited to represent Star's interests during the HET, was dismayed by what he saw as a lack of foresight from BAA. And conflict flared over the lack of an integrated baggage system with Mark Johnson retorting: '*this is the first time ever in the world a brand-new terminal with 20 million passengers is going to be opened without a new baggage system...and it's a nightmare because…if you don't build the baggage system in T2 there is an inherent weakness in everything that is being supplied in the first phase of T2.'*

Star and BAA continued to have a fractured relationship, with Star pushing for BAA to take into account the wider implications of the long-term master plan. Mark Johnson remarked: *“I got called Mr Masterplan because I was the guy with the masterplan ... [I said] you cannot design this from the bottom up it has to be top-down with the master plan. If you don't have that, you don't know what you're asking for”*. Throughout this process, HAL kept revising the capital expenditure plan that needed to submit to CAA in January 2008. The amount of investment grew rapidly after BAA realised it had significantly underestimated the cost and scope of the first phase of Heathrow East **[Exhibit 7]**. To help produce a concept that BAA, CAA, and the airline community deemed both acceptable and affordable, Ferrovial brought in a famous Spanish architect Luis Vidal to adapt Foster’s design. Finally, in March 2008, the CAA set the new price caps for Q5 (2008-2013) based on BAA’s plans to spend £2.2bn to deliver the first phase of the T2 Programme by November 2013 and overall spend of £4bn at Heathrow. By now, as part of the tripartite negotiations between BAA, CAA, and the airline community, BAA had settled for including in the first phase of the T2 programme: 1. demolishing the old T2 and associated piers, the Queens administrative building, part of T1, and two multi-storey car parks; and 2. delivering the first phase of the main building (T2A), a midfield pier (T2B), a multi-storey car park, and a power station. In the second phase, after demolishing the remainder of the old T1, BAA would deliver the second phase of T2A, another satellite (T2C), a baggage handling system, and a passenger transit system connecting all the buildings. BMI, a key Star member felt aggrieved with the outcome of the Constructive Engagement process. And in April 2008, it threatened legal action against BAA if plans for HET were further scaled back.

But the design for the Heathrow East continued to evolve. With T5 people joining the T2 programme after April 2008, Star unexpectedly found some allies for the campus vision it had long been fighting for. The new programme director for HET, a former T5 project leader, changed the names of the Heathrow East (HET) and midfield pier to T2A and T2B. And he outrightly accepted Star’s point that if BAA were ever to provide a baggage handling connecting T2A to T2B and T2C, the first phase needed to include a baggage handling basement in T2B and tunnels connecting all the buildings to avoid digging up the taxiways in the second phase. Clearly, BAA needed to change the design concept agreed for Q5. Realising the whole construction programme was going to be delayed given that BA needed an additional year to move out of the old T2 after the fallout from the T5 opening, BAA initiated a major change. It turned to Mott MacDonald, an engineering consultancy, to hastily modify the T2B delivery strategy to allow for building in a massive basement. BAA also acquiesced to Star demands to provide underground passenger connectivity between T2A and T2B in the first phase, scraping the original plan for a bridge. And new tunnels were added to the scope of the first phase to safeguard underground inter-terminal baggage and train connectivity from T2A through T2B to T2C in the future [**Exhibit 6**]. But BAA explained it was physically impossible to provide an underground system for handling departures bags until the second phase due to the proximity of the first phase of T2A with a London underground line. BAA's director for Programme Control and Performance said: *'If we could we wouldn't be spending nearly £200 million on enhancing a baggage system in T1. We would like to build it in T2, but we can't. If we had more space, we would put the bloody baggage system in T2A.* BAA also changed the T2A layout in response to feedback from T5, and introduced separate security areas for transfer and direct passengers. As the scope of the first phase for the T2 campus evolved, BAA faced at some point a £600m shortfall relative to the £2.2bn budgeted in the Q5. The pressure on costs became enormous, with BAA executive demanding a 'single version of the truth'. Through value engineering, the shortfall got down to around £250m. Because the Q5 figures were fixed, BAA needed the airline community and CAA to endorse a review of its overall capital investment plan for Heathrow.

In August 2008, BAA finally submitted a revised outline planning application (followed by a reserved matters design report in September) for T2. The company insisted T2 would not increase capacity but rather was about replacing like for like to provide competitive equivalence with T5 to keep to the terms of the general permitted development order. But the company postponed again the opening of the T2. BAA was committed to prevent any repeat of the T5 experience with T2. And it decided to add an extra period of operational readiness testing to the end of the first phase of the T2 programme. The T2 campus would not be opened for passenger use until summer 2014, and the second phase until 2018. In

January 2009, BAA, airlines, and CAA agreed three triggers for HET: 1. Demolition of T2 should enable start of HET construction by March 2011; 2. the T2A phase 1 building should be weather-tight by February 2012, and 3. the T2A phase 1 construction should have progressed sufficiently for operational trials to commence in November 2013 [**Exhibit 8**]

The Intelligent Client Model

It was with a backdrop of a loss-making Heathrow Ltd. after net interest payable [Exhibit 9], an acrimonious relationship with Star, successive delays of the T2 opening, and escalation in the scope of the first phase of the T2 programme that in February 2009 BAA recruited Steven Morgan as Director of Capital Programmes. This post placed him in charge of overseeing a £9bn capital expenditure with over £4bn being spent at Heathrow alone . Steven's job was made harder as he had inherited a £250m+ shortfall in funding for the quinquennium. Steven's arrival also coincided with a period of tumultuous change in Heathrow's operating environment. The T5 opening fiasco, which had generated media frenzy, had subsided but the damage to BAA's reputation was significant. To make matters worse the CC was nearing the completion of an investigation which seemed likely to force BAA to sell a number of its profitable airports. And the UK economy had entered into a recession after the worst financial crisis the world had faced since the 1930s. The 2008 financial crisis had cast the £4.3bn T5 investment as profligate. BAA had posted a loss in 2008 and did not pay dividends. Phil Wilbraham, who in April 2008 had moved from T5 to become T2 Programme Director noted that "*on T2 there was immense pressure on cost because there were some people who weren't involved who generally believed that we had overpaid on T5, although we proved to the regulator that we didn't".* Now, perhaps more than ever before, BAA was under pressure to demonstrate it was an intelligent client.

In the face of these commercial pressures BAA began to reflect on the contracting strategy which had driven the T5 investment - the so called 'T5 agreement'. T5 had been BAA's first terminal investment in 14 years and prior to undertaking the project BAA had been concerned by the propensity for megaproject budgets to spiral out of control. The T5 agreement had set out a bold plan for BAA to be solely responsible for both the project's design and management. As a traditionally operations-based business, BAA had to hire over a thousand professional designers and project managers to supplement its existing staff. And it selected a novel commercial strategy. The T5 agreement made use of cost reimbursable construction contracts which guaranteed contractors a profit margin regardless of how the scope of the project changed. Suppliers did not have to competitively bid for the work, but rather were selected from a pool of long-term framework agreements based on their competence and reputation. In T5, BAA was concerned that with more traditional fixed price contracts contractors often charge a premium to accommodate change to the design. BAA believed that cost reimbursable contracts, which placed all risk of loss with BAA, would prevent contractors seeking to take advantage of changes to the design. This flexibility was considered particularly critical on Terminal 5 as BA, the T5 main occupier, was repositioning its business model to better compete with low cost carriers, and introducing a great deal of technological uncertainty to the project[41].

It was Steven Morgan's responsibility now to tell BAA the most appropriate procurement strategy for T2. He was not totally dismissive of the T5 agreement, but said *"That model for T5 may well have been the right model for that era but we are hoping to get something that is equivalent to T5 for £2bn".* This reflected a perception that had gained momentum in the company since 2006 that the T5 agreement had led to an expensive undertaking. And when BAA started to procure the second phase of T5 in 2007, the £300m T5C satellite to be completed by the end of 2010, it used a different strategy. BAA felt the supply chain had moved on from the 1990s, and that suppliers had more capabilities to take greater accountability for managing design and construction risk. As a result, BAA announced a new era pivoting around a third generation of contracts. It reduced the number of long-term frameworks to nine CBIs (Complex Build Integrators) and five CBCs (Commodity Build Contractors), who were expected to provide design and delivery management and control on behalf of BAA. And for T5C, BAA awarded all the works (design, construction, project management) to one firm under a Value in Partnership framework for a target price of

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[41] Examples of this uncertainty include onsite self-service and online check-in procedures, the introduction of the larger A380 aircraft

£230m[42]. Subsequently, when awarding the contract for the midfield pier (the first phase of T2B) in 2008, BAA decided to shift risk even more to the contractors, and awarded the project through a £84m fixed-price contract to Balfour Beatty, the largest fixed-price contract that BAA had ever let for an airside project. The belief that BAA had struck good bargains for T5C and T2B reinforced senior manager's confidence in this new approach. The BAA's Head of Commercial explained: *"We're not talking about indiscriminate transfer of risk to the supply chain. If you take a portfolio of projects, there are some parts where a supplier can manage the risk effectively with little involvement required from BAA."* [43] And by January 2008, as T5 work was petering out, BAA axed 200 staff from its construction project management division in a simplification process.

But both T5C and the first phase of the mid field pier (T2B) were small satellites with standard pier facilities. The track transit and baggage system extensions to T5C were also relatively straightforward. In contrast, T2 was in many aspects was more challenging than T5 given that construction would take place in the middle of an operational airport whereas T5 was a greenfield project. Steven knew this: *"The challenges are not to be underestimated. We are constructing a significant new building in the middle of one of the world's busiest airports and ensuring the operating airport is not affected is an absolute priority."* Notwithstanding this, Steven believed BAA procurement practices needed to be upended. And he was bold*: "I don't want to say that 'you lot have had it too easy' but we did have an environment where BAA took most of the risk and the margins that we paid were very good. Now to get that kind of return I expect good performance."* Drawing upon his experience in asset acquisition, Steven's solution was to argue for a new model - the 'intelligent client' model. Steven then summarized this model into 'Ten Commandments' **[Exhibit 10].**

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[42] Two key packages were nonetheless left outside Carillion's package of work including baggage (a fixed price contract with VanderLande), and the airfield (managed by BAA and constructed by Ferrovial Agroman)

[43] Getting the procurement right is crucial. Planning for a Successful Future 2008. New Civil Engineering

The intelligent client model required that clients invested in extensive identification and definition of needs up-front, based on a strategic master plan. The work would be broken into related packages which could then be competitively procured in the market. Steven was a firm believer in competition. Steven was proposing to rip up the long-term frameworks in the BAA's long established procurement book. Frameworks would only be used for work valued at £25m or less. And even for work between £10 and £25m, he wanted to introduce some competition between the framework companies. He argued *"Competition is the best way for me to demonstrate value for money to the regulators. Open competition is even better. There is an opportunity for more companies to make money with better margins if they deliver. But there is going to be less opportunity for those companies who sit on their hands and don't deliver − you are going to have to earn it.... That is not the way we did it here. We ran a competition based on corporate CVs. We didn't have prices or proposed management teams. That is not the way the system is supposed to work."* Contract competition would factor in upfront cost as well as total lifecycle cost and exposure to risk for both client and the contractor. Tenders would be rigorously evaluated in a plenary session, collating all the relevant information for the bid into a single point for discussion, where experts could rank the quality of the bid in its totality.

As with the T5C model, an intelligent client BAA would not take a 'hands on' design and management approach. Rather these roles would be tendered to the most suitable candidates. BAA would assume the role of programme manager collating broad performance measures to ensure that the wider programme, budget, and schedule were being met whilst trusting the contractors to handle day-to-day project issues. And Steven also wanted unambiguous contracts. As he said *"it's not a matter of let's hold hands and sing kumbaya around the camp fire − it's more about defining what we are doing and rewarding for performance. I want a cooperative incentivised relationship with my contractors but I don't want to be their partner. That is important. I want to be their customer."*

Steven shied away from the fixed-price model adopted for the first phase of T2B, but following the example of T5C, he planned to move towards target cost and schedule type contracts. A target cost and schedule contract splits any cost savings made by the contractor during delivery between the client and the contractor, with around 25% going to the contractor, provided contractors deliver by a pre-specified date. Similarly any overspends would also be split between the contractor and the client with the contractors losses capped at a maximum of 10%.In addition, Steven proposed to introduce an award fee mechanism that gave him unilateral control over part of the savings that would otherwise be gained automatically by the contractor. The award fee was a bonus which could be earned by contractors who displayed appropriate behaviours. Appropriate behaviours could include ensuring workers behaved safely or implementing innovative ways to working. And Steven said *"I want them [contractors] to make more money but they will have to earn it. If they can come up with an idea that saves us money, I will not only protect their fee but I'll give them a reward on top."* Thus Steven hoped to create a balanced environment where contractors were rewarded for a good performance, but would still challenge BAA's decisions knowing that there was no guarantee of profit. And of course Steven understood the economic downturn would help him to bring down costs. In his own words *"what I am seeing is that most folks, maybe because of the economy, are hungry to get a bigger piece of the pie and are willing to earn it."*

Finally, Steven argued for a strong set of governance mechanisms whereby changes would need to be thoroughly vetted. Requests for scope changes would need to be discussed at length with the airline community before being sent for consideration by the senior management of BAA **[Exhibit 11].** Steven summed up his sentiment on design changing saying: *"You spend your time up front specifying and if you have to make changes it better damn well be good".*

Potential for Change in Terminal 2

Although the proposed intelligent client model was geared towards resisting changes to the design, the nature of the Terminal 2 programme created a high potential for design change. The Heathrow East campus needed to meet the diverse needs of the 18 members of the Star

Alliance at Heathrow. This was in marked contrast with the T5 programme in which BA was going to be the sole occupier. Some airlines like BMI were small players in the global marketplace but at Heathrow they were the biggest Star Alliance member. Others like United were very large in the global mix but Heathrow for them was just an important outstation. Some were short haul, others were long haul; some had A380s and others did not. And more airlines were expected to join the Star Alliance over time. The divergent requirements of the airlines were illustrated in late 2008 when BAA were seeking to finalise the design of the passenger boarding gates for T2B. Two designs were proposed one with a closed gated design and the other an open gated design. With closed gates passengers awaiting their flight are moved into a glass walled waiting area ready to board the flight. With open gates passengers are free to roam the building, visiting retail areas, until their flight is called. BAA's commercial arm preferred to have open gate rooms as this allows BAA to generate income from passengers who shop in the retail area. This point of view was shared by some members of the Star Alliance who felt it improved the passenger experience. However, other Star Alliance airlines preferred closed gate rooms which, because passengers are already waiting at the appropriate gate, offer operational efficiencies. Mark Johnson, the Star Alliance's representative explained: *"we might want open [gates] and we might want closed [gates], there must be a way that we can design the satellite to [be] flex[ible] between those two whilst we haven't got a decision".* But BAA decided not to wait, and in January 2007 Star complained that BAA had ruled out closed gates, and started a formal dispute. This was later resolved by CAA who ruled in that most of T2 would have open gates, but part of T2B would have closed gates. BAA would be allowed to transform the latter into open gates if it addressed the airlines' concerns with operational efficiency. For this, BAA needed to invest in positive boarding technology that would enable to inform airlines whether the passengers had already passed security, and technologies to enable passengers to self-validate the boarding tickets.

Simultaneously, the Star Alliance had been pushing for new developments such as changes in the lounges for the commercial important passengers and automated self-baggage drops for international flights[44]. These systems, which were already around for domestic flights, had the potential to reduce the operational costs for international flights. BAA had built a trial site, and the airlines were starting to trial a machine. Assuming the results were positive, the parties were debating whether to get them into T2 so as to open it with the latest technology. However, accommodating this late change to the T2A departures area which was designed for 56 standard check-in desks would cost both time, increase risks of delays and malfunction, and add a few extra million pounds. And BAA wasn't sure if airlines understood those implications, and compared airlines to a child entering into a sweetshop: ' some days they might want some pear drops and liquorish; they're not quite sure, but they know they want something. That is the level of flexibility they want to have.' Importantly, any further capital investment would have to be negotiated with the airline community and CAA. This negotiation carried a risk for the Star Alliance itself – if their proposed changes failed to be introduced into T2, the idea could still be taken by a rival alliance who would then push to have the technology in their own terminal. If BAA were seen to adopt a tough stance on technological innovation in T2 but then introduced changes elsewhere, it would likely spark another conflict with Star.

Other changes were expected to emanate internally including a series of modifications to the layout of T2A. This so called "programme D" included adding a larger retail area to accommodate changing luxury markets, rearranging the departures lounge, increasing the size of the transfers zone, and introducing new security arrangements. And it was unclear when all change would stop trickling into the programme.

****

Accommodating uncertainty in the design of the gate room and the potential introduction of new technologies would incur additional cost and time both to design the solution and then to implement it. Steven's intelligent client model which worked on the premise that the requirements would be specified upfront would be challenged by such issues. And the sources of changed seemed to be many. Would Steven's model further endanger the quality of the relationship between the Star alliance and BAA, and ultimately endanger BAA's legitimacy to operate a regulated asset? Surprisingly, the Star alliance, seemed to be genuinely happy with Steven's appointment as it shared the perception T5 had been an expensive terminal in part due to the one-size-fits-all way through which it had been procured. But to what extent would the BAA executive and its new shareholders endorse Steven's aggressive commercial approach?

---

[44] This meant passengers alone and without help from a host would issue themselves the tags, put the tags on the items, and put them on the conveyor belt

Exhibit 1 – Overview of Heathrow airport and location of the three Airline Alliances

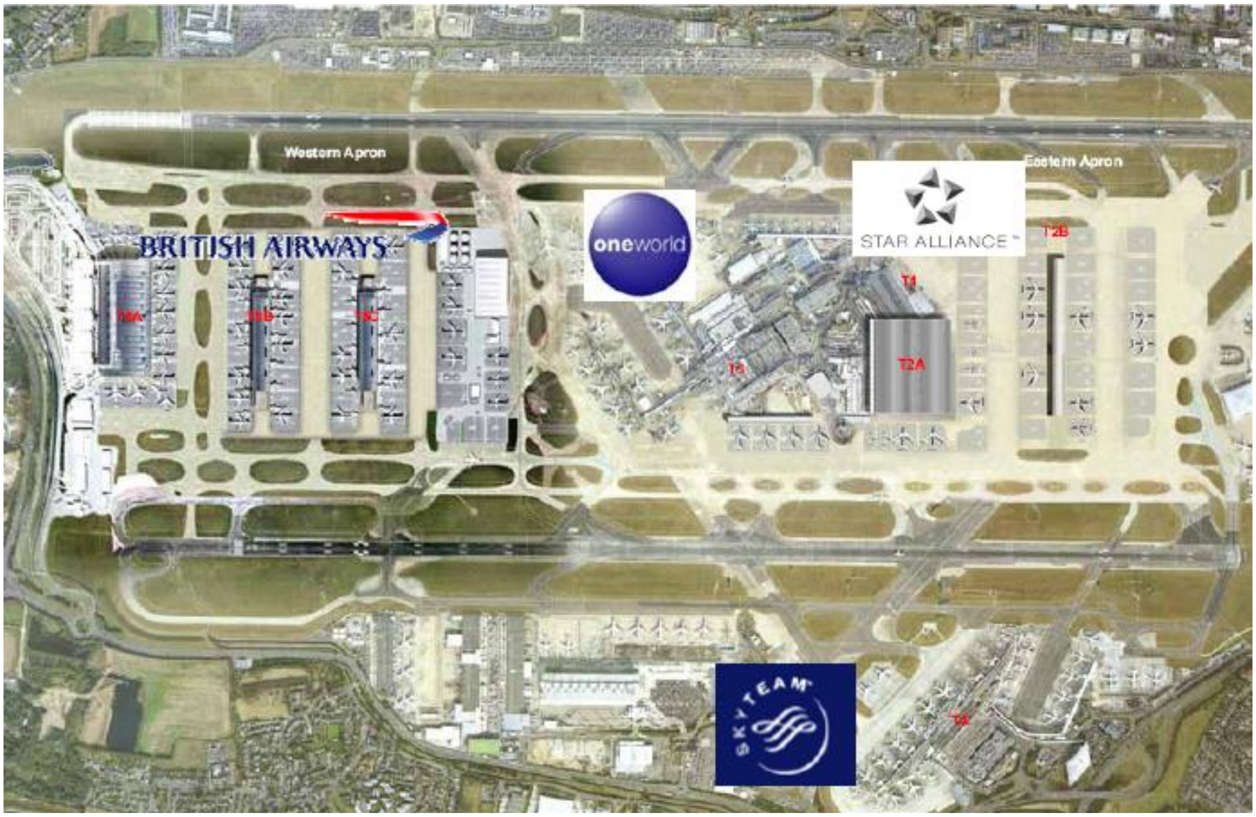
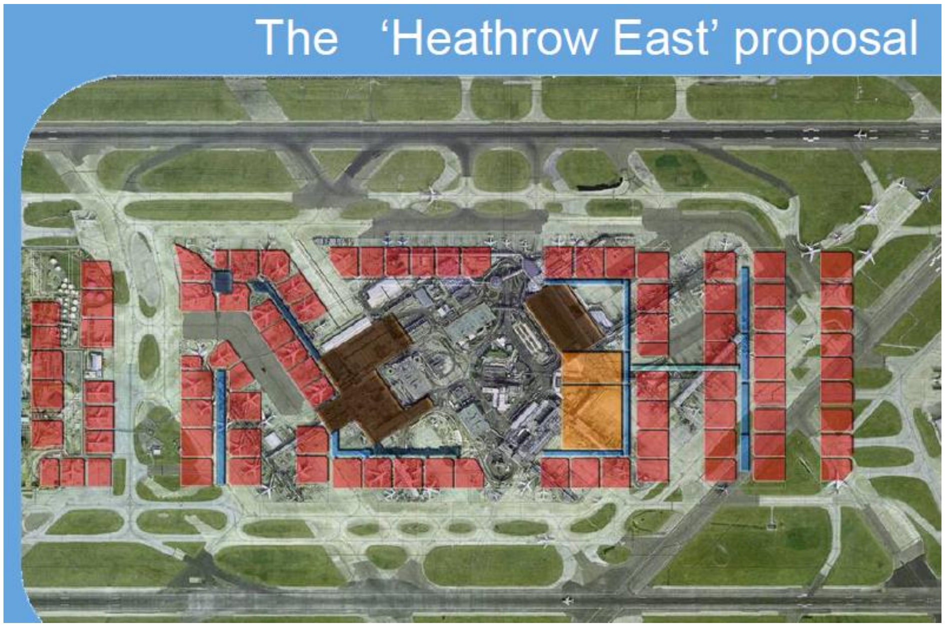
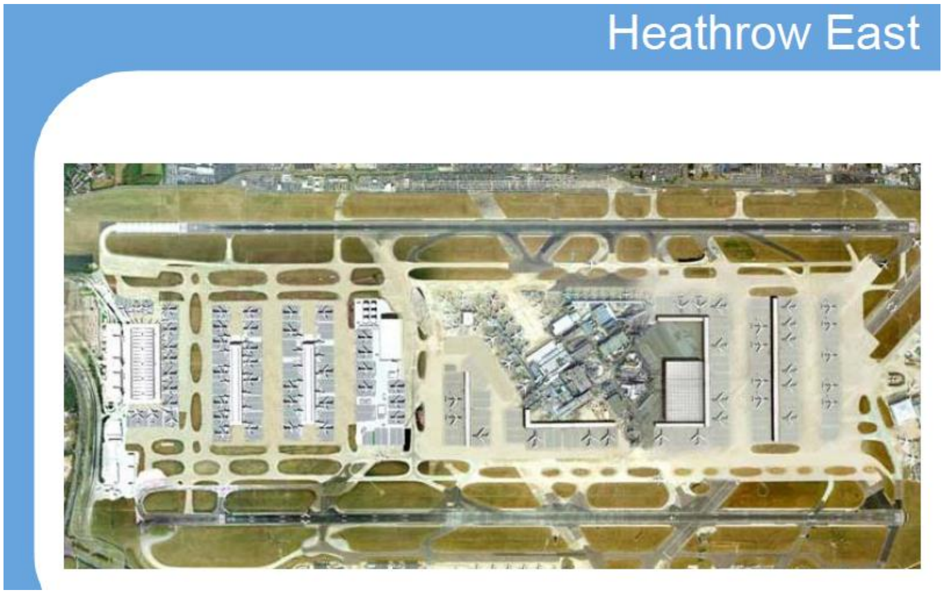

Western Apron
Eastern Apron
BRITISH AIRWAYS
oneworld
STAR ALLIANCE
T5A
T5B
T5C
T3
T1
T2A
T2B
SKYTEAM
T4

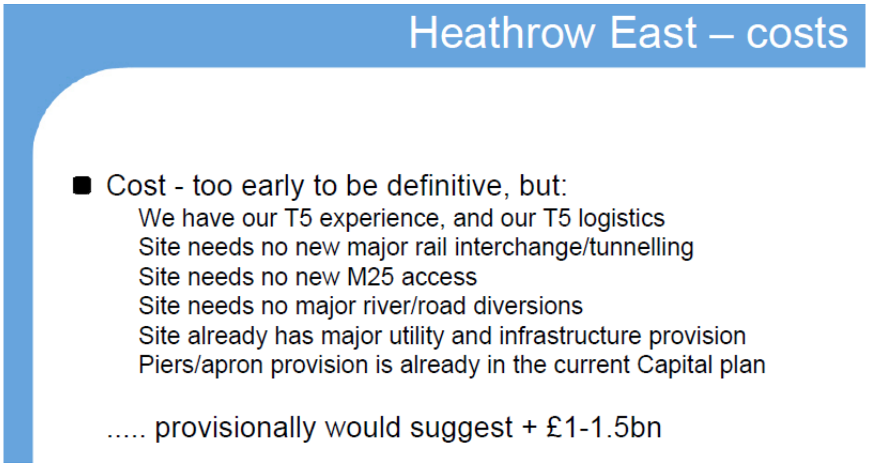
Exhibit 2 – The November 2005 Heathrow East proposal presented by BAA



The ‘Heathrow East’ proposal



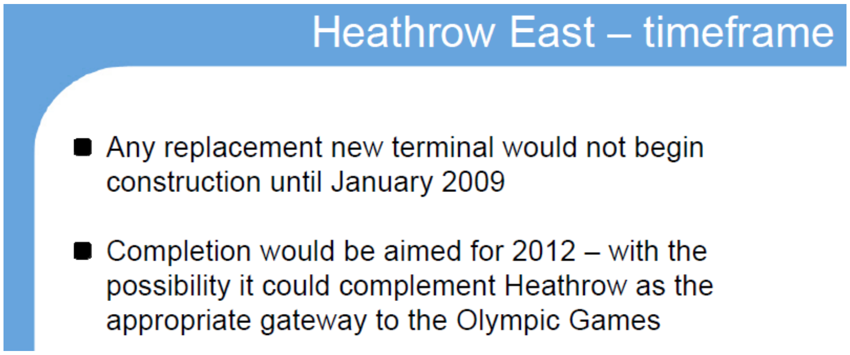
Heathrow East



Heathrow East – costs

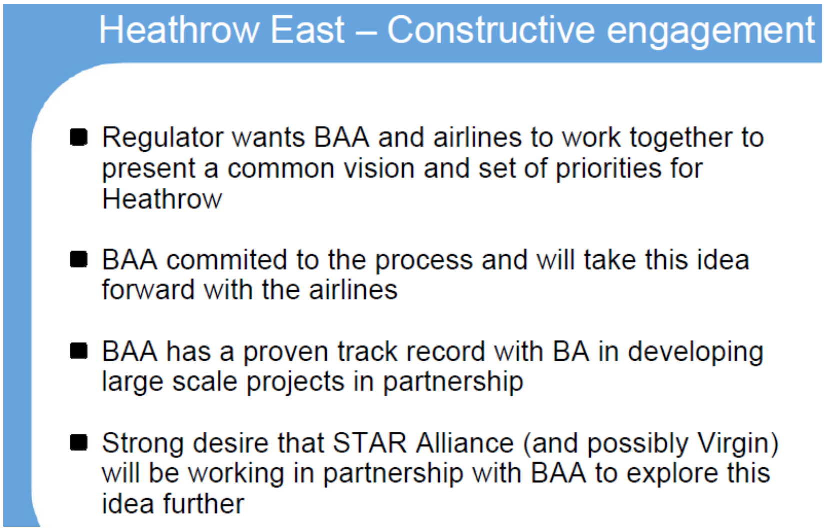
- Cost - too early to be definitive, but:
  - We have our T5 experience, and our T5 logistics
  - Site needs no new major rail interchange/tunnelling
  - Site needs no new M25 access
  - Site needs no major river/road diversions
  - Site already has major utility and infrastructure provision
  - Piers/apron provision is already in the current Capital plan

..... provisionally would suggest + £1-1.5bn



Heathrow East – timeframe

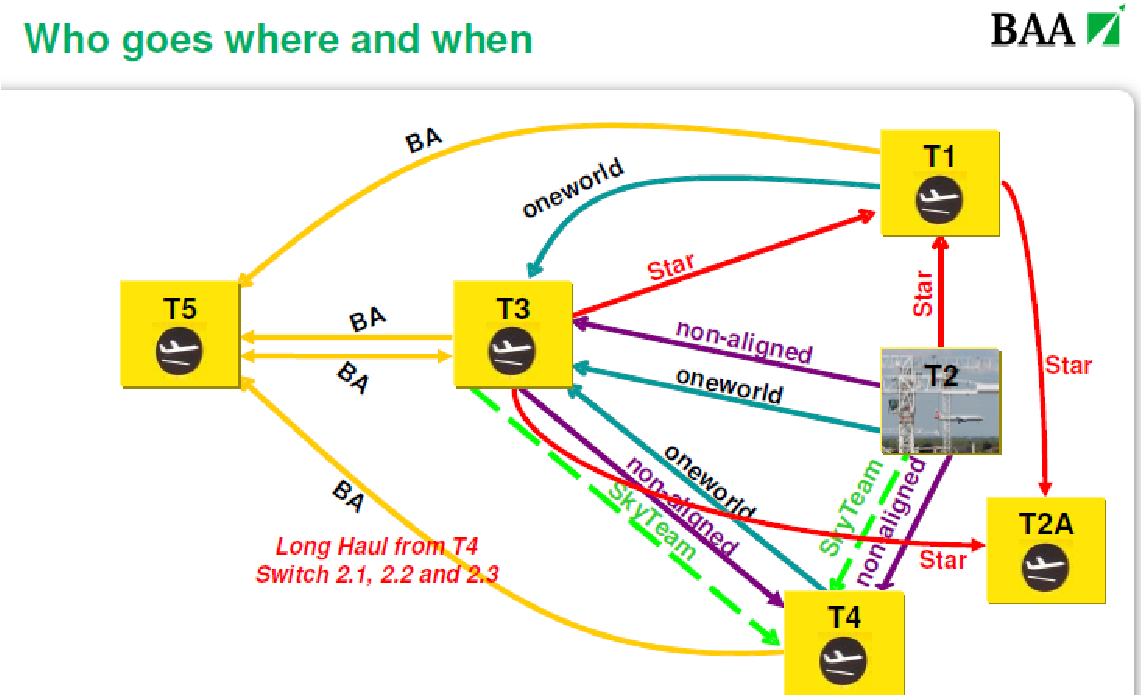
- Any replacement new terminal would not begin construction until January 2009
- Completion would be aimed for 2012 – with the possibility it could complement Heathrow as the appropriate gateway to the Olympic Games



Heathrow East – Constructive engagement

- Regulator wants BAA and airlines to work together to present a common vision and set of priorities for Heathrow
- BAA commited to the process and will take this idea forward with the airlines
- BAA has a proven track record with BA in developing large scale projects in partnership
- Strong desire that STAR Alliance (and possibly Virgin) will be working in partnership with BAA to explore this idea further

Exhibit 3- Planned moves at Heathrow (BAA presentation to Heathrow Airport Charges Consultation in November 2008]



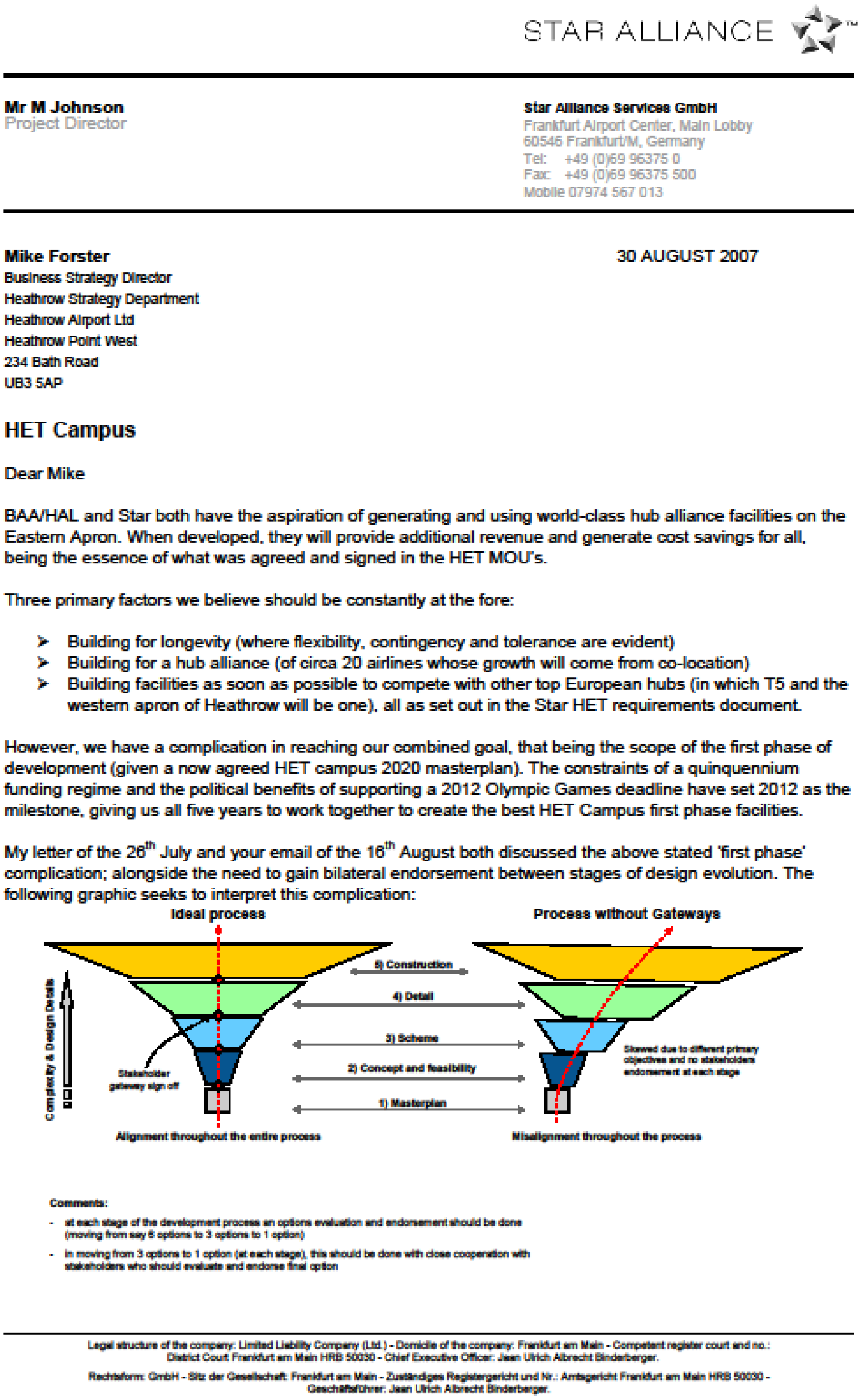
Who goes where and when

BAA

BA
oneworld
T1
Star
T5
BA
T3
non-aligned
Star
T2
Star
oneworld
BA
oneworld
non-aligned
SkyTeam
SkyTeam
non-aligned
BA
Star
T2A
T4

Long Haul from T4
Switch 2.1, 2.2 and 2.3

Exhibit 4 – Letters from Mark Johnson, Star representative



STAR ALLIANCE™

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Mike Forster
Business Strategy Director
Heathrow Strategy Department
Heathrow Airport Ltd
Heathrow Point West
234 Bath Road
UB3 5AP

30 AUGUST 2007

HET Campus

Dear Mike

BAA/HAL and Star both have the aspiration of generating and using world-class hub alliance facilities on the Eastern Apron. When developed, they will provide additional revenue and generate cost savings for all, being the essence of what was agreed and signed in the HET MOU's.

Three primary factors we believe should be constantly at the fore:

- Building for longevity (where flexibility, contingency and tolerance are evident)
- Building for a hub alliance (of circa 20 airlines whose growth will come from co-location)
- Building facilities as soon as possible to compete with other top European hubs (in which T5 and the western apron of Heathrow will be one), all as set out in the Star HET requirements document.

However, we have a complication in reaching our combined goal, that being the scope of the first phase of development (given a now agreed HET campus 2020 masterplan). The constraints of a quinquennium funding regime and the political benefits of supporting a 2012 Olympic Games deadline have set 2012 as the milestone, giving us all five years to work together to create the best HET Campus first phase facilities.

My letter of the 26th July and your email of the 16th August both discussed the above stated 'first phase' complication; alongside the need to gain bilateral endorsement between stages of design evolution. The following graphic seeks to interpret this complication:

Ideal process
Process without Gateways
Complexity & Design Details
5) Construction
4) Detail
3) Scheme
2) Concept and feasibility
1) Masterplan
Stakeholder gateway sign off
Skewed due to different primary objectives and no stakeholders endorsement at each stage
Alignment throughout the entire process
Misalignment throughout the process

Comments:

- at each stage of the development process an options evaluation and endorsement should be done (moving from say 6 options to 3 options to 1 option)
- In moving from 3 options to 1 option (at each stage), this should be done with close cooperation with stakeholders who should evaluate and endorse final option

Legal structure of the company: Limited Liability Company (Ltd.) - Domicile of the company: Frankfurt am Main - Competent register court and no.: District Court Frankfurt am Main HRB 50030 - Chief Executive Officer: Jean Ulrich Albrecht Binderberger.

Rechtsform: GmbH - Sitz der Gesellschaft: Frankfurt am Main - Zuständiges Registergericht und Nr.: Amtsgericht Frankfurt am Main HRB 50030 - Geschäftsführer: Jean Ulrich Albrecht Binderberger.

Whilst we would not wish to have further unilateral decisions on limited information being presented to us as a 'fait accompli', we will register our discord (that in our opinion four foundation blocks in HET Campus Phase 1, building on the masterplan, are not in alignment; that of a 4.5 bay wide building, baggage in HET, appropriate pax and baggage system connectivity and satellites of a length and depth to meet requirements), and now work with your teams in the evolution of scheme designs.

We would hope, in trusting you in that you are 'committed to providing optimal facilities', that our concerns can be placated via your teams analysis and evolution of scheme designs, in particular meeting functional tolerances for a hub alliance campus. We do reserve our position and would want yours to be revised should the evolution via appropriate modeling not secure our joint confidence, when seeking to conclude scheme design.

Your team has presented your concept design review, which appears to be made up of

a) The Concept Design Review Presentation
b) The HET/Airline Gateway Review (8th/9th August 2007) Issues Log
c) The Heathrow East version 3.0 – July 07 laminated sheet
d) A HET Information Pack (Aug 07) containing GA's, two cross sections, a stakeholder process including a design options matrix, scheme design programme and fixity milestones, review of PET Star requirements, ESR gantry details, and ICS Stage Report.

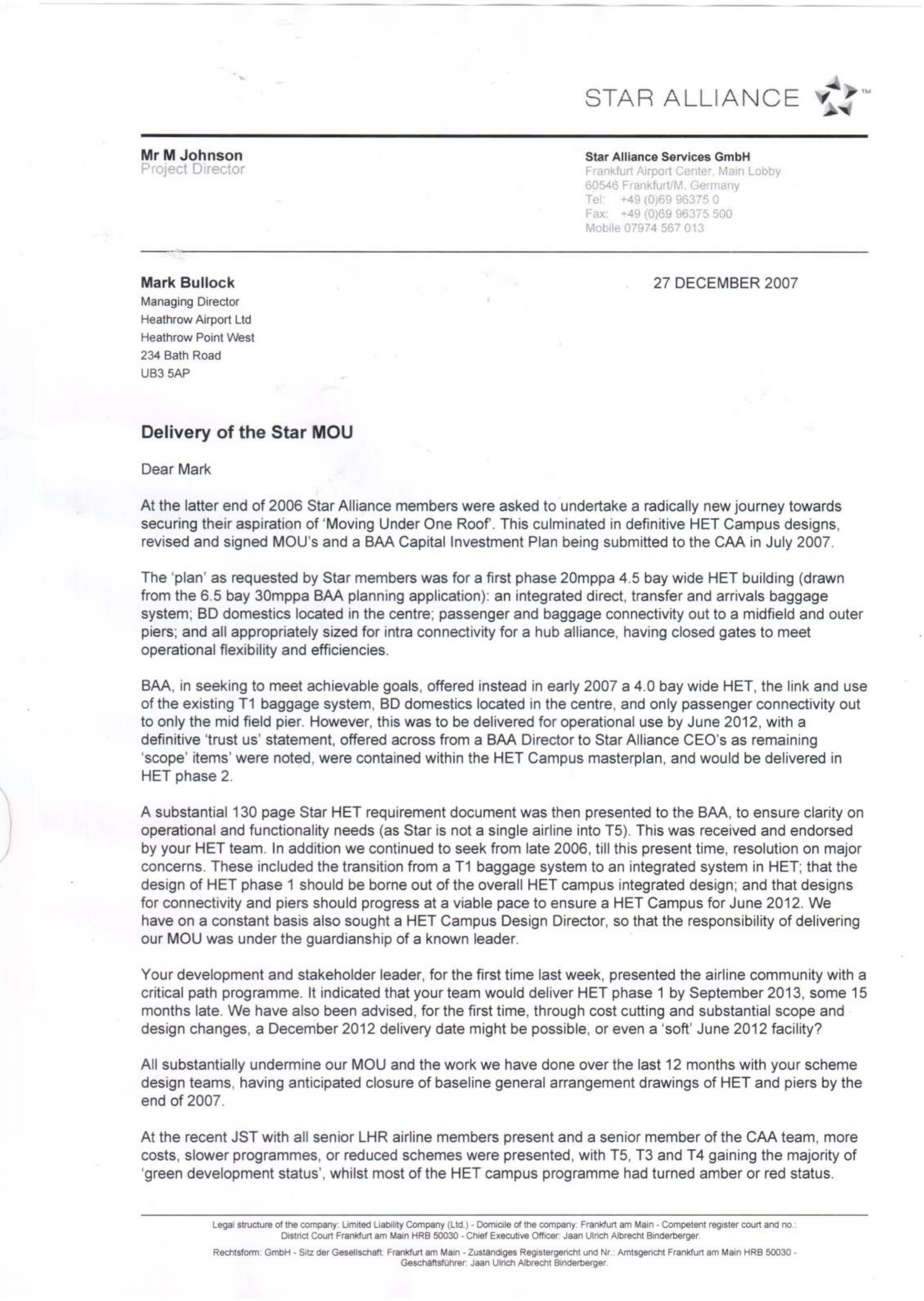
It would be helpful if the above could be co-ordinated into an appropriate 'concept design' close out document, which we have suggested aligns with the contents of the Star HET requirements document and your design options matrix (a matter raised with Janna who is actioning said request).

Finally could you please advise who is or will be the Design Director of the HET campus? With such as a person in place it should enhance communication channels between key parties and would be a welcome interface through what will be important design evolution stages, reporting up to Hock Lye and yourself, as Chairs for the JSG.

Yours sincerely

Mark Johnson
LHR Project Director

Star PET & JSG



STAR ALLIANCE

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27 DECEMBER 2007

Delivery of the Star MOU

Dear Mark

At the latter end of 2006 Star Alliance members were asked to undertake a radically new journey towards securing their aspiration of 'Moving Under One Roof'. This culminated in definitive HET Campus designs, revised and signed MOU's and a BAA Capital Investment Plan being submitted to the CAA in July 2007.

The 'plan' as requested by Star members was for a first phase 20mppa 4.5 bay wide HET building (drawn from the 6.5 bay 30mppa BAA planning application): an integrated direct, transfer and arrivals baggage system; BD domestics located in the centre; passenger and baggage connectivity out to a midfield and outer piers; and all appropriately sized for intra connectivity for a hub alliance, having closed gates to meet operational flexibility and efficiencies.

BAA, in seeking to meet achievable goals, offered instead in early 2007 a 4.0 bay wide HET, the link and use of the existing T1 baggage system, BD domestics located in the centre, and only passenger connectivity out to only the mid field pier. However, this was to be delivered for operational use by June 2012, with a definitive 'trust us' statement, offered across from a BAA Director to Star Alliance CEO's as remaining 'scope' items' were noted, were contained within the HET Campus masterplan, and would be delivered in HET phase 2.

A substantial 130 page Star HET requirement document was then presented to the BAA, to ensure clarity on operational and functionality needs (as Star is not a single airline into T5). This was received and endorsed by your HET team. In addition we continued to seek from late 2006, till this present time, resolution on major concerns. These included the transition from a T1 baggage system to an integrated system in HET; that the design of HET phase 1 should be borne out of the overall HET campus integrated design; and that designs for connectivity and piers should progress at a viable pace to ensure a HET Campus for June 2012. We have on a constant basis also sought a HET Campus Design Director, so that the responsibility of delivering our MOU was under the guardianship of a known leader.

Your development and stakeholder leader, for the first time last week, presented the airline community with a critical path programme. It indicated that your team would deliver HET phase 1 by September 2013, some 15 months late. We have also been advised, for the first time, through cost cutting and substantial scope and design changes, a December 2012 delivery date might be possible, or even a 'soft' June 2012 facility?

All substantially undermine our MOU and the work we have done over the last 12 months with your scheme design teams, having anticipated closure of baseline general arrangement drawings of HET and piers by the end of 2007.

At the recent JST with all senior LHR airline members present and a senior member of the CAA team, more costs, slower programmes, or reduced schemes were presented, with T5, T3 and T4 gaining the majority of 'green development status', whilst most of the HET campus programme had turned amber or red status.

Legal structure of the company: Limited Liability Company (Ltd.) - Domicile of the company: Frankfurt am Main - Competent register court and no.: District Court Frankfurt am Main HRB 50030 - Chief Executive Officer: Jaan Ulrich Albrecht Binderberger.

Rechtsform: GmbH - Sitz der Gesellschaft: Frankfurt am Main - Zuständiges Registergericht und Nr.: Amtsgericht Frankfurt am Main HRB 50030 - Geschäftsführer: Jaan Ulrich Albrecht Binderberger.

Star Alliance members, by dint of being a size suitable for facilities planned for the Easter Apron of LHR, are at the end of your short-term development and 'transformation' deliberations, without it would appear a guardian to maintain promises, albeit compromises, that were agreed and signed.

In addition we are being asked by the CAA to sign off what should be a finished and formalised Capital Investment Programme between BAA and LHR airlines by the 21st January, within which clear and definitive development 'triggers' should be noted. One power point presentation has eradicated 12 months of planning and constructive engagement, leaving any hope to arrive at agreed and known triggers a total impossibility.

At no time over the last twelve months have your team shared the enormity of a 15 month programme delay, and even a request for clarity at our CEO's once a year meeting on the 13th December 2007 was fed

> 'BAA remains committed to making HET available for the 2012 Olympics' and ' our focus is to provide STAR passengers and airlines with a quality product as soon as is possible, and to support your hub operation on the eastern apron in a robust and efficient manner'

whilst the whole of BAA senior management knew an Olympic date, to align with the Star MOU, to be an impossibility.

T5 and the solutions for Skyteam and Oneworld hub alliances are clear and known. 2008 and 2009 programmes and adequate capital all align to their MOU's, with timely move sequences that match needs and expectations. Star certainly has not received this support or clarity from senior HET campus management.

So what is Star to do from here, as a shopping list of problems, challenges and changes, rather than solutions, has been BAA's sudden end of year message to Star CEO's?

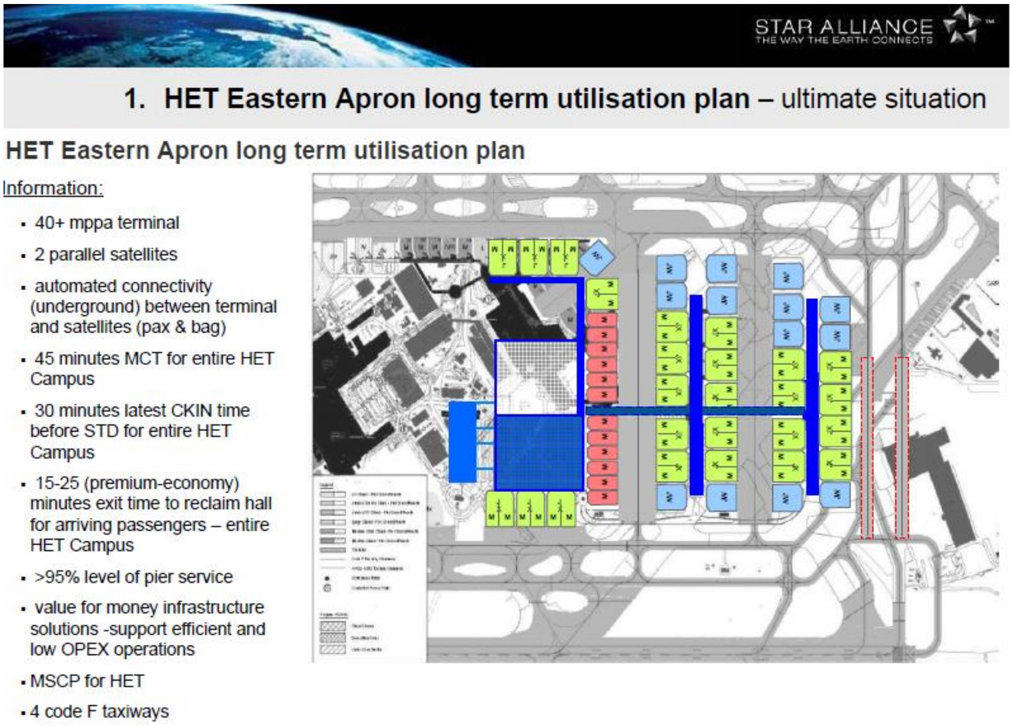
There have been, and still are solutions, many you might not be aware of given your relatively new role as MD of HAL, albeit lessons learnt from T5 are matters you are well versed in. Could we therefore please meet to discuss a more productive and constructive way forward for 2008, as soon as possible, as to disenfranchise 25% of your customers, needs urgent attention at the very top level in HAL.

Yours sincerely

Mark Johnson
LHR Project Director

cc
Star JSG (through to CEO's)
Paul Ellis – LACC Chair
Jim Hunter – AOC General Secretary
David Stewart - IATA LACC
Daniel Storey – Head, Airports Price Control, CAA

Exhibit 5 - Star Alliance's presentation on Heathrow East (17 January 2008)

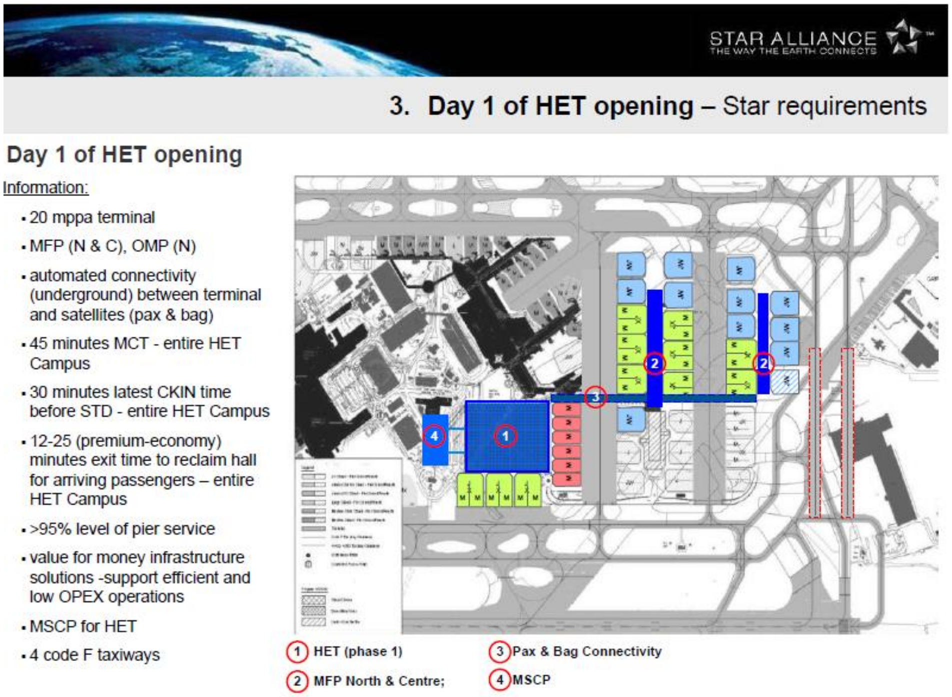

STAR ALLIANCE
THE WAY THE EARTH CONNECTS

1. **HET Eastern Apron long term utilisation plan** – ultimate situation

HET Eastern Apron long term utilisation plan

Information:

- 40+ mppa terminal
- 2 parallel satellites
- automated connectivity (underground) between terminal and satellites (pax & bag)
- 45 minutes MCT for entire HET Campus
- 30 minutes latest CKIN time before STD for entire HET Campus
- 15-25 (premium-economy) minutes exit time to reclaim hall for arriving passengers – entire HET Campus
- >95% level of pier service
- value for money infrastructure solutions -support efficient and low OPEX operations
- MSCP for HET
- 4 code F taxiways


STAR ALLIANCE
THE WAY THE EARTH CONNECTS
1
2
2
3
4

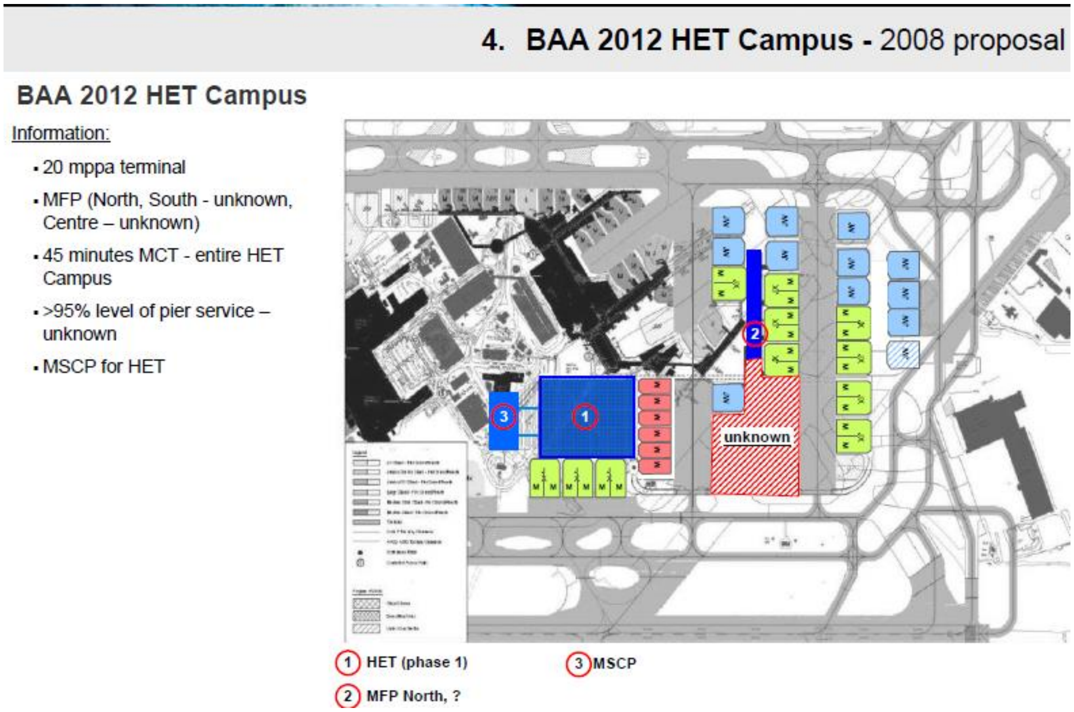
3. **Day 1 of HET opening** – Star requirements

Day 1 of HET opening

Information:

- 20 mppa terminal
- MFP (N & C), OMP (N)
- automated connectivity (underground) between terminal and satellites (pax & bag)
- 45 minutes MCT - entire HET Campus
- 30 minutes latest CKIN time before STD - entire HET Campus
- 12-25 (premium-economy) minutes exit time to reclaim hall for arriving passengers – entire HET Campus
- >95% level of pier service
- value for money infrastructure solutions -support efficient and low OPEX operations
- MSCP for HET
- 4 code F taxiways

① HET (phase 1)
② MFP North & Centre;
③ Pax & Bag Connectivity
④ MSCP



4. **BAA 2012 HET Campus -** 2008 proposal

BAA 2012 HET Campus

Information:

- 20 mppa terminal
- MFP (North, South - unknown, Centre – unknown)
- 45 minutes MCT - entire HET Campus
- >95% level of pier service – unknown
- MSCP for HET

① **HET (phase 1)**

② **MFP North, ?**

③ **MSCP**

Exhibit 6 – Two Overviews of T2B and T2A phase 1 (BAA Capital Investment Plan 2009)

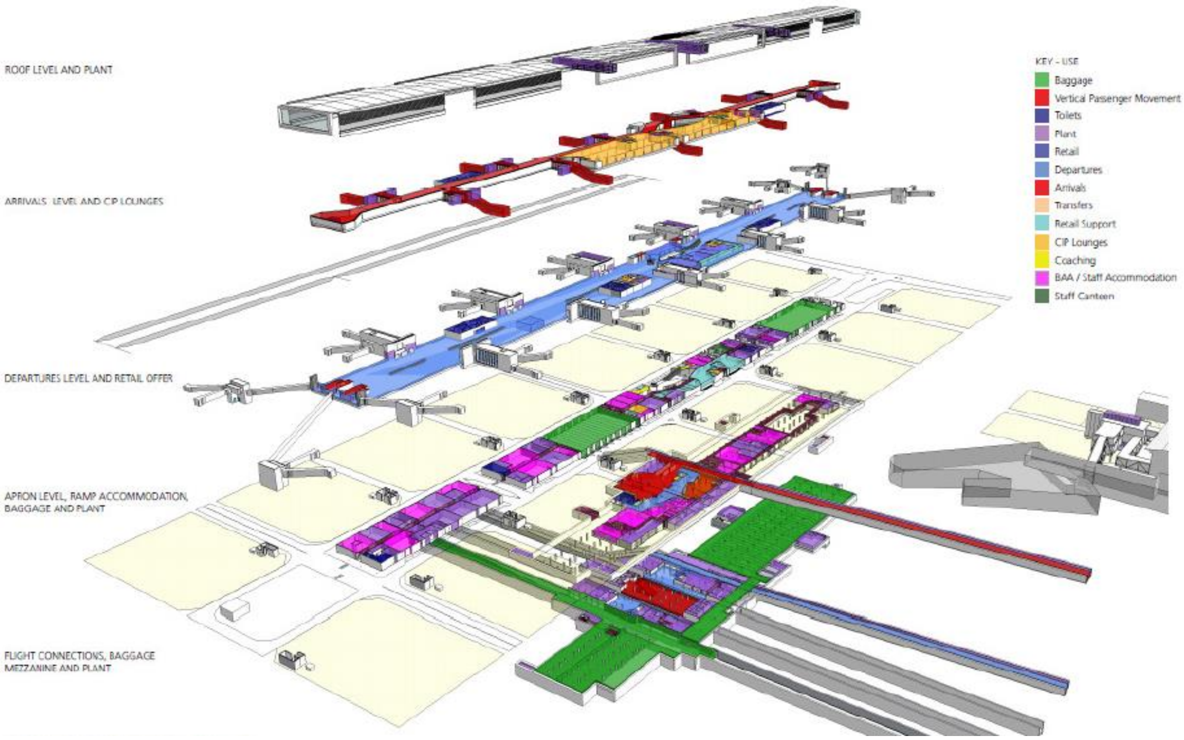

ROOF LEVEL AND PLANT
ARRIVALS LEVEL AND CIP LOUNGES
DEPARTURES LEVEL AND RETAIL OFFER
APRON LEVEL, RAMP ACCOMMODATION, BAGGAGE AND PLANT
FLIGHT CONNECTIONS, BAGGAGE MEZZANINE AND PLANT
KEY - USE
Baggage
Vertical Passenger Movement
Toilets
Plant
Retail
Departures
Arrivals
Transfers
Retail Support
CIP Lounges
Coaching
BAA / Staff Accommodation
Staff Canteen

Exhibit 7 – Q5 capital and operating expenditure revisions during the quinquennium review (from CC's emerging thinking report, April 2008)

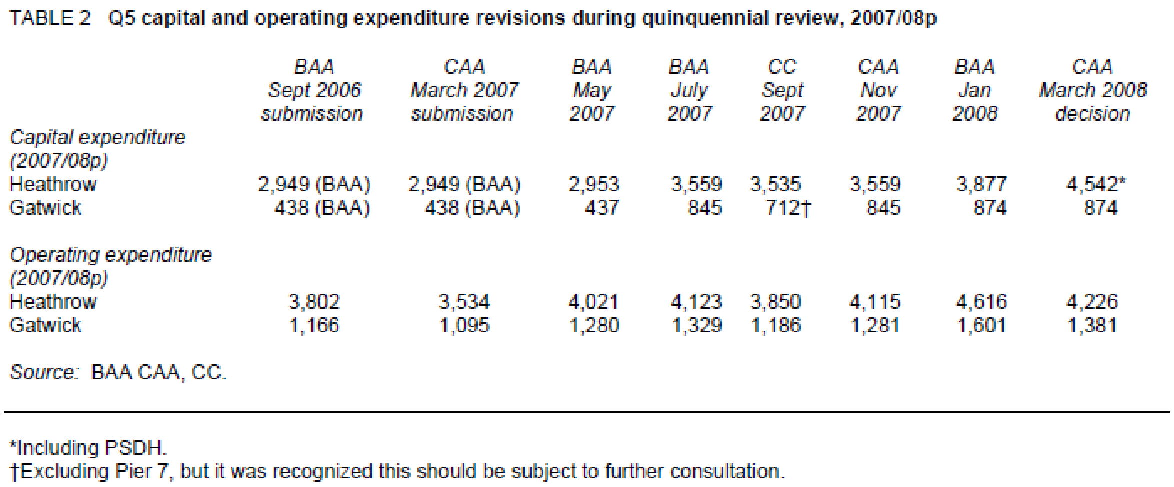


TABLE 2 **Q5 capital and operating expenditure revisions during quinquennial review, 2007/08p**

	BAA Sept 2006 submission	*CAA March 2007 submission*	*BAA May 2007*	*BAA July 2007*	*CC Sept 2007*	*CAA Nov 2007*	*BAA Jan 2008*	*CAA March 2008 decision*
Capital expenditure (2007/08p)								
Heathrow	2,949 (BAA)	2,949 (BAA)	2,953	3,559	3,535	3,559	3,877	4,542*
Gatwick	438 (BAA)	438 (BAA)	437	845	712†	845	874	874
Operating expenditure (2007/08p)								
Heathrow	3,802	3,534	4,021	4,123	3,850	4,115	4,616	4,226
Gatwick	1,166	1,095	1,280	1,329	1,186	1,281	1,601	1,381

Source: BAA CAA, CC.

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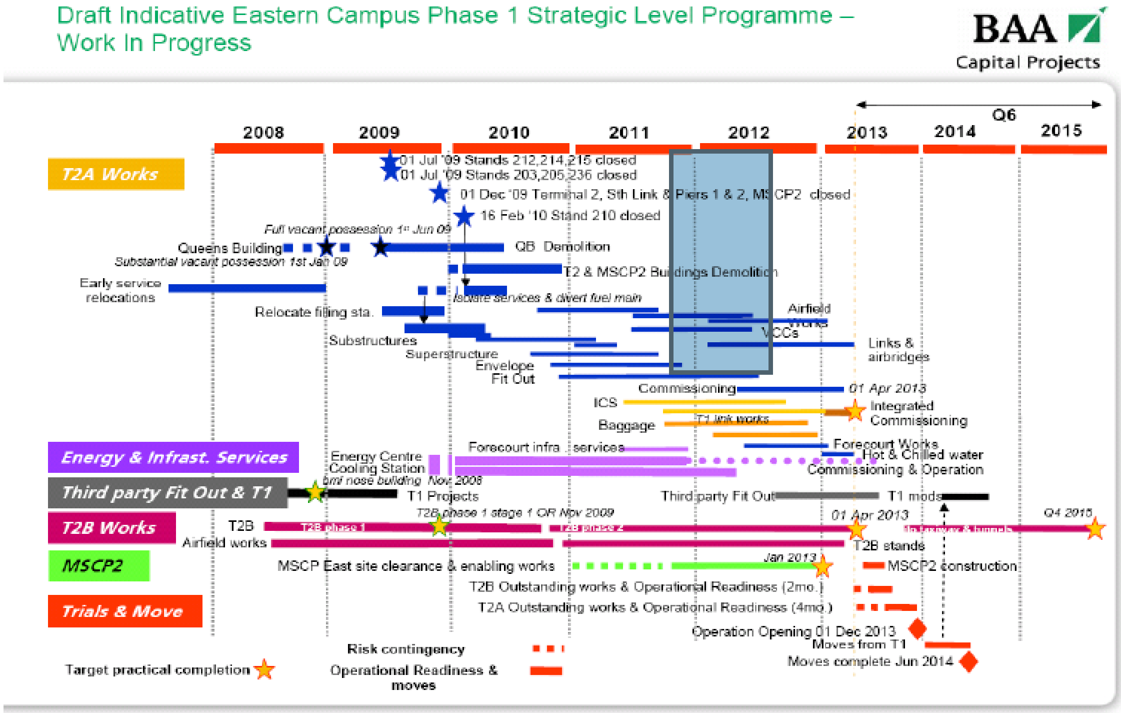
*Including PSDH.

†Excluding Pier 7, but it was recognized this should be subject to further consultation.

Exhibit 8- BAA Capital Investment Plan 2009 – Draft Indicative Eastern Campus strategic level programme



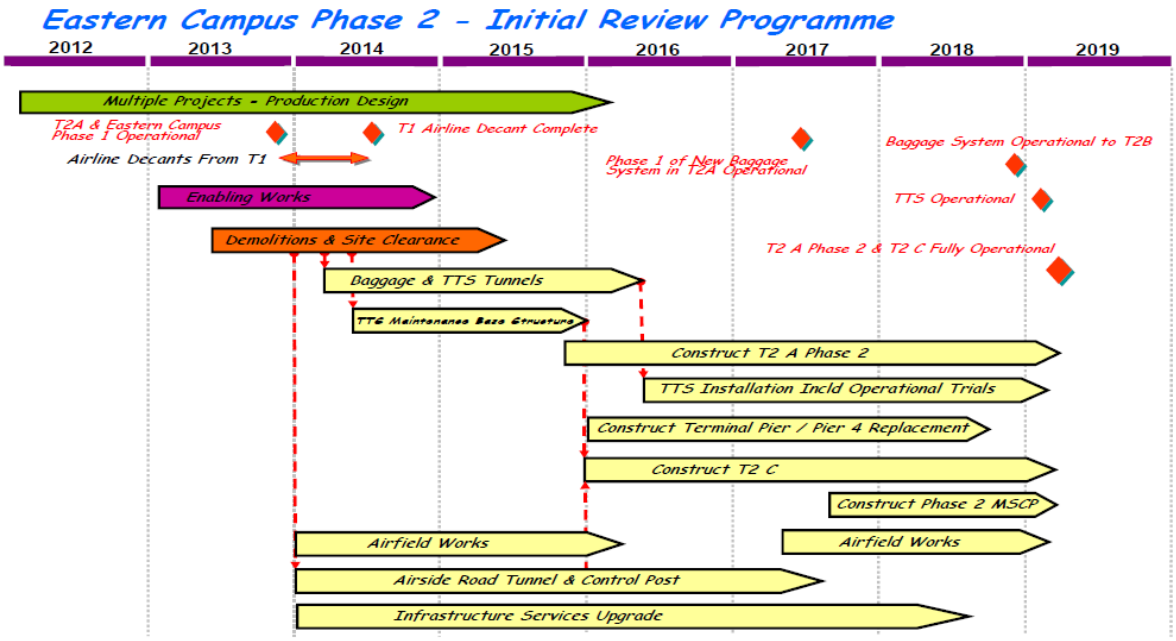
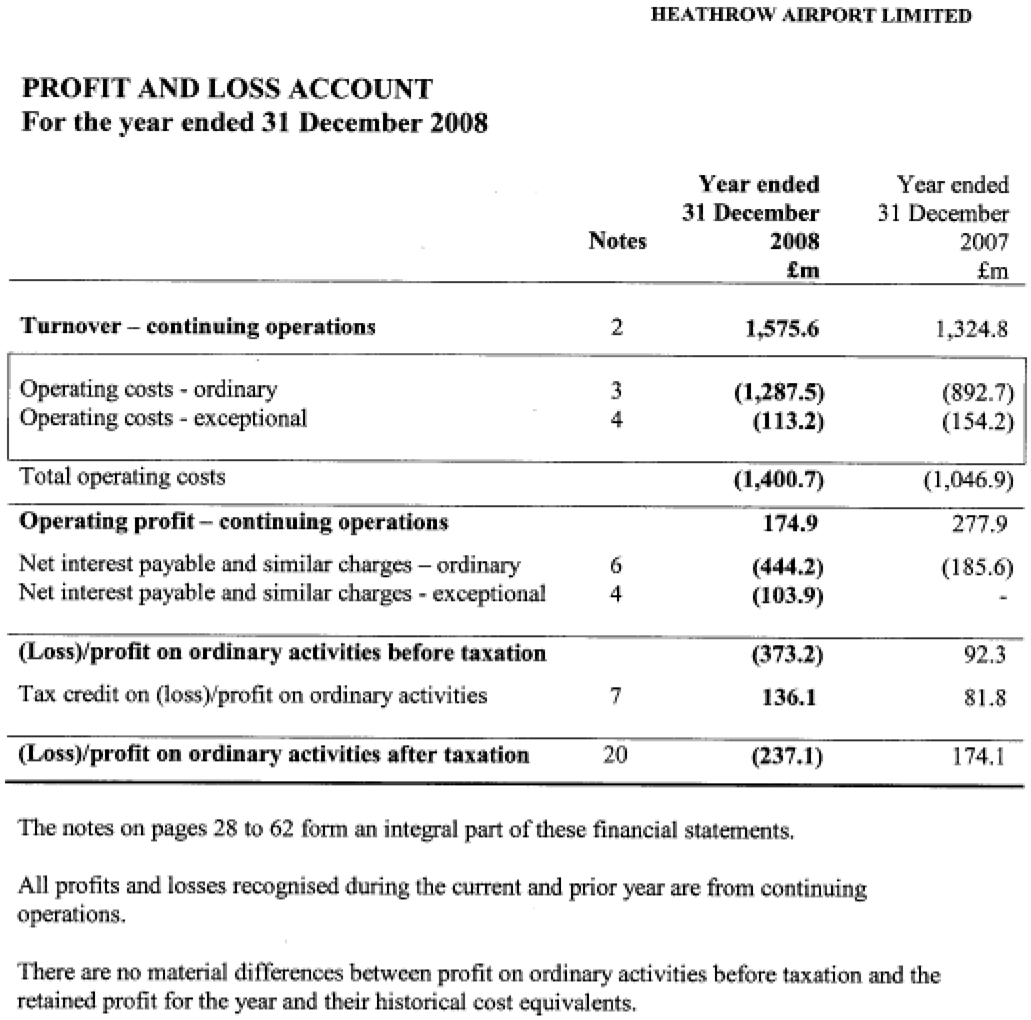


Exhibit 9 - HAL Report and financial statements for year that ended in 31 Dec 2008



HEATHROW AIRPORT LIMITED

PROFIT AND LOSS ACCOUNT
For the year ended 31 December 2008

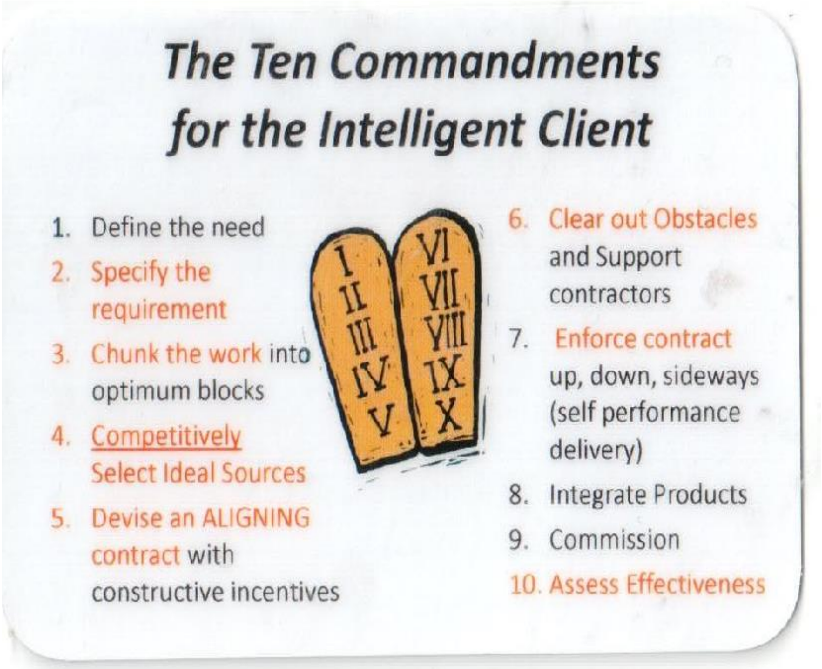
	Notes	Year ended 31 December 2008 £m	Year ended 31 December 2007 £m
Turnover – continuing operations	2	**1,575.6**	1,324.8
Operating costs - ordinary	3	**(1,287.5)**	(892.7)
Operating costs - exceptional	4	**(113.2)**	(154.2)
Total operating costs		**(1,400.7)**	(1,046.9)
Operating profit – continuing operations		**174.9**	277.9
Net interest payable and similar charges – ordinary	6	**(444.2)**	(185.6)
Net interest payable and similar charges - exceptional	4	**(103.9)**	-
(Loss)/profit on ordinary activities before taxation		**(373.2)**	92.3
Tax credit on (loss)/profit on ordinary activities	7	**136.1**	81.8
(Loss)/profit on ordinary activities after taxation	20	**(237.1)**	174.1

The notes on pages 28 to 62 form an integral part of these financial statements.

All profits and losses recognised during the current and prior year are from continuing operations.

There are no material differences between profit on ordinary activities before taxation and the retained profit for the year and their historical cost equivalents.

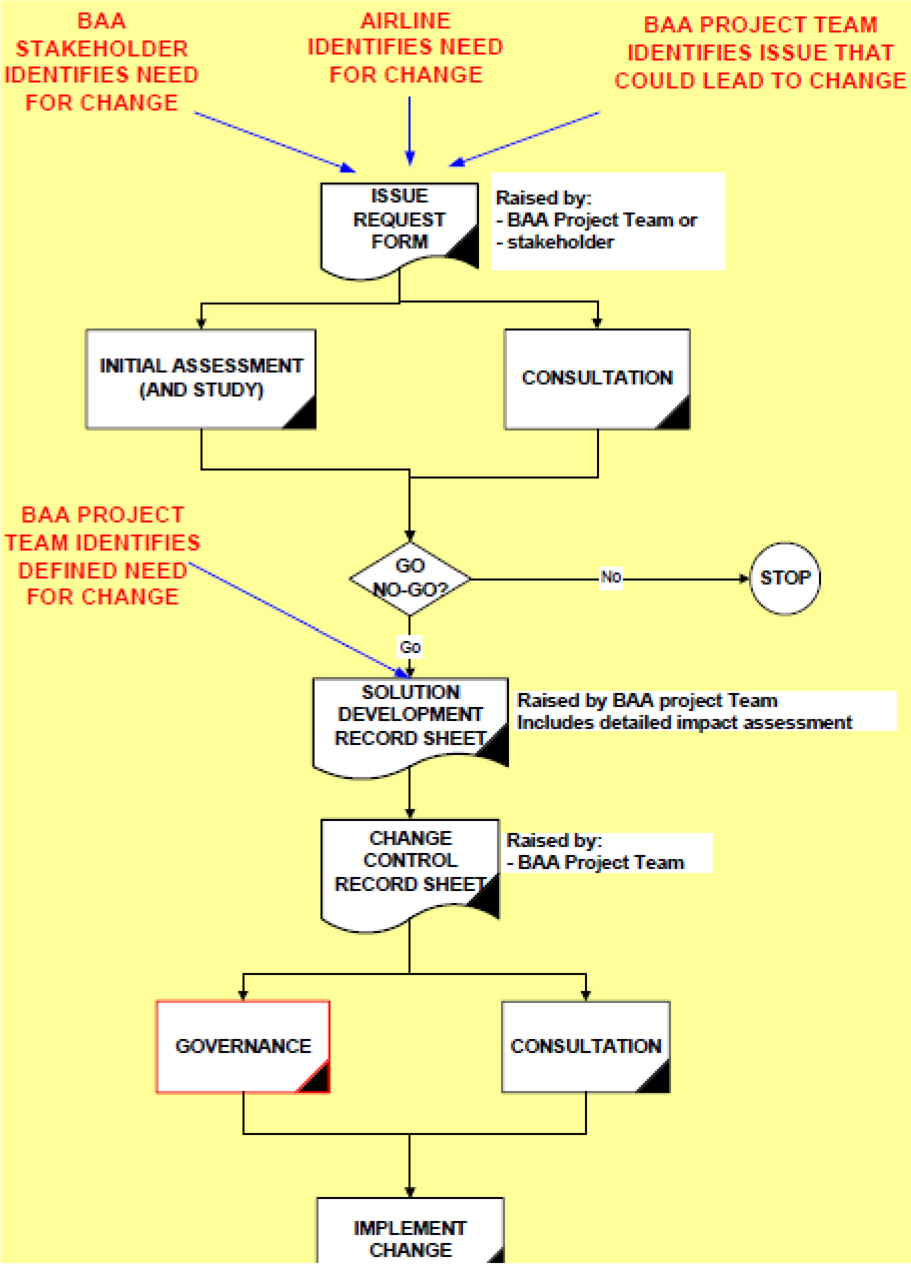
Exhibit 10– Steven Morgan's Ten Commands for the Intelligent Client Model



The Ten Commandments for the Intelligent Client

1. Define the need
2. Specify the requirement
3. Chunk the work into optimum blocks
4. Competitively Select Ideal Sources
5. Devise an ALIGNING contract with constructive incentives
6. Clear out Obstacles and Support contractors
7. Enforce contract up, down, sideways (self performance delivery)
8. Integrate Products
9. Commission
10. Assess Effectiveness

Exhibit 11 – The governance of change in BAA under an ‘intelligent client’ model


BAA STAKEHOLDER IDENTIFIES NEED FOR CHANGE
AIRLINE IDENTIFIES NEED FOR CHANGE
BAA PROJECT TEAM IDENTIFIES ISSUE THAT COULD LEAD TO CHANGE
ISSUE REQUEST FORM
Raised by:
- BAA Project Team or
- stakeholder
INITIAL ASSESSMENT (AND STUDY)
CONSULTATION
BAA PROJECT TEAM IDENTIFIES DEFINED NEED FOR CHANGE
GO NO-GO?
No
STOP
Go
SOLUTION DEVELOPMENT RECORD SHEET
Raised by BAA project Team
Includes detailed impact assessment
CHANGE CONTROL RECORD SHEET
Raised by:
- BAA Project Team
GOVERNANCE
CONSULTATION
IMPLEMENT CHANGE

4 Case 3 – The 2012 London Olympic Games

LONDON 2012: THE REGENERATION GAMES (A)

Authors: Colm Lundrigan, Nuno Gil, Diana Ioancea

As Alison Nimmo, acting chief executive at the interim Olympic Delivery Authority (iODA), and David Higgins, future chief executive of the ODA sipped their coffees on their way to the Devon House offices of the London Development Agency (LDA)[45], they chatted about the need to rethink the delivery strategy for the London Olympic Park. It was January 2006 and six months had passed since Jacque Rogge, the president of the International Olympic Committee (IOC), had announced on July 6th 2005 that London had been awarded the Games of the XXX Olympiad in 2012. The ODA would only become a legal entity in April 2006. But with a fixed deadline to meet, Alison and David felt that the ODA needed to hit the ground running.

Alison and David were not strangers to the London Olympics. Alison's involvement dated back to the bid period in 2004 when the bid team recruited her to improve London's host bid. The £30m bid (outturn costs), led first by Barbara Cassani and then Lord Sebastian Coe, had been funded mainly by public money. One of the core themes of the London's Olympic bid had been the regeneration of the Lea Valley area in East London [**Exhibit 1**], and Alison had been brought in as a part-time advisor to help resolve some issues with the master plan planning permission. Alison's background was in urban regeneration, and she had played a central role in the programme to rebuild the Manchester town centre after the 1996 IRA bombing and in Sheffield's 'Heart of the City' regeneration programme. After

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[45] The London Development Agency was the Regional Development Agency for Greater London that existed as a functional body of the Greater London Authority (GLA) to drive sustainable economic growth (business, jobs, regeneration) within London. The GLA was led by the Mayor of London, an elected politican, who along with the 25 members of the London assembly was accountable for the strategic government of Greater London. Since the creation of the role of Mayor in 2000, the position had been held by Ken Livingstone, a Labour politician

London was awarded the Games, Sebastian Coe became the chairman of LOCOG, the London Organizing Committee of the Olympic and Paralympic Games. And Alison became acting chief executive of the iODA. David Higgins was appointed ODA's chief executive designate in December 2005 with effect from 30 March 2006 when he would step down from his leadership role at English Partnerships, the UK's largest regeneration agency. In that role, David had joined the bid's legacy committee in 2004 to understand how London 2012 could contribute to turn around East London, which in his words was a 'national disgrace, physically and socially [with] 3 million people, and no place to shop, to have decent office buildings, no big town centre'. David brought with him experience with Olympic projects having been chief executive of Lend Lease Corporation, the global property and Construction Company that had worked on the 2000 Olympic Games in Sydney. One of the first major decisions for the iODA executives was the extent to which they should change the already revised master plan for the 200-hectare Olympic Park - a central feature of the original bid – before submitting a new planning application. They would need to convince the four London boroughs affected by the change, the stakeholders sitting on the future ODA board, and crucially, the newly formed Olympic Board of the benefits of changing strategy. The Olympic Board controlled the scope and included the most powerful stakeholders - the Department for Culture, Media and Sport (DCMS); the Mayor of London overseeing the Greater London Authority (GLA); the British Olympic Association (BOA), and LOCOG. Most certainly, they would also need to hold talks with the IOC and with the international sports federations affected by the proposed changes. These negotiations had the potential to be complex as under Swiss law the bid book folded into a formal contract between IOC and the host city[46]. Would all the stakeholders bite the bullet, and accept that the bid book was a speculative, marketing document that could be delivered in spirit but not in the details?

For one, some venues seemed far too large to work in legacy, others seemed to be located in the wrong places, and put bluntly, there were too many temporary venues which would have no long term impact on the city's regeneration efforts. Matters were arguable made worse for the iODA executives as a number of critical, potentially binding, decisions had already been made during the bid process. The design contract for an ambitious and massive aquatics centre had been awarded in January 2005 to the world renowned architect Zaha Hadid after an international competition led by the LDA. But it was hard to see how the concept, budgeted for £73m, could work in legacy. The bid had also committed to deliver an Olympic stadium that would provide an athletics legacy after the games. But members of the premier league football community were lobbying against this plan. And in regards to the Olympic Village, the iODA team and a private consortium had already reached a hand-shake agreement that the iODA could move the Olympic Village to the Stratford city. This private consortium controlled the land and their planned residential and commercial development received planning consent at the same time that the Olympic Park master plan received planning consent. Alison explained:

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[46] The host city contract was signed by the IOC, The Mayor of London, and BOA. But LOCOG was responsible to ensure the bid commitments were met, and it had to report back to IOC every 6 months on the project progress

"The main Southern access road to the Westfield shopping centre went right through where the aquatics centre was, and the power lines went right through the village. So basically, the first thing we had to do was to get all the teams together and actually redo the jigsaw."

Should the ODA de-risk the programme, but eventually provoke the anger of this consortium, by extending the boundaries of the compulsory purchase order around the Stratford city? [**Exhibit 2**] This was going to be unpopular and could trigger a legal challenge. And then there were issues with the budget... David and a small team had concluded the £2.3bn public subsidy was not enough even just to deliver in the spirit of the bid - *"all we did",* David said, *"was picking up the pages that were lying on the floor and look at the exclusions and assumptions. It didn't take time to work out."* An inadequate budget would keep their hands tied in the back, and forced them to keep asking the government for more money as in a sort of Chinese water torture.

In many ways, Alison, David, and other future ODA executives felt they were part of a relay race having been passed a strategy, from the bid team, which had already been set in motion. If the ODA dropped the baton, everyone involved in the London Olympics would lose the race. But what should be the ODA's priority? The Games date was immovable. But the Olympics act would make the ODA not only responsible to deliver the park for the

Games, but also to build a legacy for London. Would the ODA be able to align the practical realities of delivery whilst remaining true to the spirit of London's bid? Could the ODA executive create a compelling narrative for change which would win over all those stakeholders who had backed the bid? And how, with so many stakeholders, would the ODA prevent potential conflicts from disrupting vital decisions?

THE OLYMPIC GAMES HISTORY

The Summer Olympic Games were a quadrennial event that had represented for the host country and cities a springboard to increase their global presence. The modern Olympic Games Movement had begun in the latter part of the 19th century, with the first modern summer event being held in Athens 1896. The event drew inspiration from the antiquated Olympic Festival held until the 4th century AD in Olympia, Greece. To manage the modern Games, Baron Pierre de Coubertin created the International Olympic Committee (IOC) on June 23rd 1894. The IOC was an international non-governmental, not-for-profit organization based in Lausanne, Switzerland. Its role was to promote and support the development of sports by co-operating with governments, sports federations, commercial sponsors, and the media.

After a tumultuous period in 1999 when the IOC had to respond to allegations of corruption, the organisation reformed the Games bidding process, and became more transparent. It also changed its constitution to include 115 members – 15 of them active Olympic athletes, elected by their peers, 15 from National Olympic committees (NOCs), 15 from international sports federations, and 70 members not linked to a specific function. IOC also abolished individual visits by the IOC members to Candidate Cities, reduced the term of office for the IOC president, established an Ethics Commission, started to publish reports on sources and use of income, and opened their sessions to the media. Jacques Rogge, a former Olympian, was elected to the IOC's Presidency on July 16th 2001. And in 2002, following recommendations of an internal report, the IOC amended the Olympic Charter to emphasise the importance of the Olympic Games legacy in host cities.

Since 1999, the Olympic bidding process had two stages. First, NOCs nominated a city from within their national territory to put forward their application to the IOC. From these applicant cities, the IOC executive selected a number of candidate cities who were deemed capable of hosting the Games. The candidate cities then had a chance to further develop their bids before making a final presentation. The bids were often tied in with wider political or social motives. Host cities were selected by a majority vote from a secret ballot. If no city received a majority, then the lowest ranked candidate was eliminated and a further round of voting took place.

THE HISTORY OF THE GAMES IN THE UNITED KINGDOM

With two Games hosted in 1908 and 1948 and a further three unsuccessful bids, the UK was no stranger to the Olympic Games. London's last Games in 1948, the first Olympic Games hosted after the end of World War II, came to be known as the 'austerity Games' because of the tough economic climate in which they were held. By the 1980s, the U.K. sport community was eager to bring the Games back to the country but was seeking an alternative city to host the Games. And in the mid-eighties, the British Olympic Association[47] (BOA) sponsored an unsuccessful bid to host the 1992 Olympic Games in Birmingham, but lost it to Barcelona. They (BOA) next attempted, in 1990 and 1994, to put Manchester forward for the 1996 and 2000 Games respectively. But again lost both times, first for Atlanta and then for Sydney. Amidst these failures, in 1995, the BOA worked with Manchester in a successful bid to host the 2000 Commonwealth Games, regaining the enthusiasm for submitting a new Olympics bid. Feedback from IOC indicated that London would be the only British city able to attract enough votes to win. But bidding for the Olympics had become very expensive and required government backing. In 1997, the BOA received a vote a confidence when the newly elected Labour Party committed to bringing back the Olympics to the UK in its manifesto. And the BOA began work on a feasibility study for a London bid. But the bidding process was soon derailed after major controversies surrounding a new national stadium at Wembley. With construction planned to start in 2000, the scheme was beset by political skirmishes around the vision, involving the Football Association, the BOA, the Mayor of London, and the central government. A thorny issue related to whether the new stadium should be designed to host only football and rugby events, or host as well the future Olympic ceremonies and athletics events. After a few years of fraught negotiations, the plans for building a dual-purpose stadium were ditched. And in 2000, BOA submitted a feasibility study to the Government containing options for a London Olympics. It estimated a £1-2.5bn public capital investment required in the event of a successful bid to pay for enhancing London's transport system and build Olympic infrastructure.[48]

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[47] The BOA was the National Olympic Committee for Great Britain and Northern Ireland. It was privately funded, and included as its members the thirty-three National Governing Bodies of each Olympic sport. Its mission statement read "The BOA is the strong, independent voice for British Olympic Sport and is responsible for promoting the Olympic Movement throughout the UK."

BIDDING FOR LONDON 2012

In June 2001, the central government set up a Key Stakeholders' Group whose membership included two government departments (DCMS, HM Treasury), the GLA overseen by the Mayor of London, Ken Livingstone, and the BOA; a Steering Group was also formed to include the Stakeholders Group plus the London Development Agency (LDA), UK Sport[49], Sport England[50], and the Cabinet Office Performance and Innovation unit (observer status).

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[48] Campbell, D. (1999). £2.5bn bill threatens Olympic bid. The Observer.

[49] Established by Royal Charter in 1997, UK Sport was responsible for investing around £100 million of public funds each year – from both the National Lottery and the Exchequer – in high performance sport. The ~90 people, London-based organisation was accountable to the Department for Culture, Media and Sport (DCMS), and had a remit at the 'top end' of Britain's sporting pathway, with no direct involvement in community or school sport.

[50] Sport England was another non-departmental public body under the DCMS. It was organised in nine regions, and its remit was to grow the number of people doing sports from all diverse backgrounds and help them move up to the elite level by working with national governing bodies of sport, and other funded partners.

In November, a confidential report by surveyors Insignia Richard Ellis Ltd on land availability commissioned by the Key Stakeholders Group identified four main sites, all in East London, on the basis of the IOC criteria and a study of previous Olympic bids. By then, it became clear that the Games could be a major catalyst to accelerate the LDA's plan to regenerate a vast industrial wasteland near East London that had been heavily bombed during World War II, and create a residential and commercial quarter in a new urban park stretching along the cleaned-up River Lea Valley.

With plans for the Olympic bid beginning to take shape slowly, British sport celebrated winning their bid to host the 2005 World Athletics Championship in London. However, in October 2001 celebrations turned to embarrassment as the proposed plans for a £100m athletics stadium in London were abandoned. Despite efforts to relocate the World Championship to Sheffield, Britain was forced to withdraw their winning bid casting serious doubt over their Olympic Games ambition. Embarrassment notwithstanding, work continued on the Olympic bid, and in January 2002 the Key Stakeholders' Group commissioned Arup, an independent firm of designers, planners and engineering consultants, to assess the overall costs and benefits of staging the 2012 Olympic Games in the Lower Lea Valley in East London. Arup was tasked with assessing the physical development requirements, the wider economic and other impacts, legacy issues, the bidding process, and the implications of not bidding for the 2012 Olympic Games.

After the IOC issued the provisional deadlines for selecting the host city in March 2002 [**Exhibit 3**], Arup in association with Insignia Richard Ellis published the report on May, 21st 2002, which took the form of an outline proposal for a 'specimen' games with four legacy venues. Building on the consensus at the time on what the content should be, Arup's report outlined the economic implications of London 2012, highlighting the wider economic, social, sporting, and cultural benefits. It considered that the projected transport flows could be accommodated without delays and without unacceptable disruption to normal travel in London. But it also pointed to a perception that there was no scope for the London's rail and road networks to accommodate additional demand. The firm explained

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that it had not conducted stakeholder consultation, and had not factored in the effects of inflation on the figures for public and private investment [**Exhibit 4**]. The summary cost-benefit analysis estimated (in 2002 prices discounted to present value at 6%) that the net cost of bidding was £6m, and the total cash flow including benefits amounted to expenditure around £1899m for an income around £1651-1981m. The capital investment was estimated around £403m[51] for venues and infrastructure (including a £59m Aquatics Centre and a £263-283m Olympic Stadium that could leave a football or athletics legacy). The figures included a £109m risk contingency that accounted for 5% risk of cost escalation in bidding and staging, and 30-50% escalation in capital costs. The figures excluded the regeneration costs of the Lower Lea Valley and assumed that the Olympic Village would be private financed. The report suggested the creation of an Olympic Development Agency to deliver the capital investment and of an Olympic Transport Agency to plan and manage all aspects of transport for the Games. It also noted that a delayed bid would be unattractive politically given the urgency and expectations for regenerating East London. In the same year, the DCMS commissioned the Institute of Commercial Management Research to conduct a survey of public opinion regarding a potential bid for the 2012 Games which produced encouraging results for the politicians [**Exhibit 5**].

In the summer of 2002, with the top brass of the sport community and UK politicians rubbing shoulders at the Manchester Commonwealth Games, the largest multi-sport event ever to be held in the UK at the time, the idea of the 2012 bid gained further traction. Notwithstanding the fourfold increase in the final price tag for the Manchester Commonwealth games relative to the £150m initial budget,[52] the event had propelled the city’s reputation globally. It had also left behind high-quality sports infrastructure including a £32m aquatic centre and a £111m athletics stadium. The stadium was planned to convert into a football stadium and act as catalyst for the regeneration of East Manchester, an area left derelict after the departure of heavy industry decades before. Importantly, sports authorities used the Manchester event to reassure the government of the UK‘s capability to deliver large sporting events. This was helped after the IOC President declared that the Manchester’s Games had gone a long way to restoring Britain’s credibility for hosting large sporting events. The idea for a London bid was well anchored now.

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[51] The report recognised international comparisons were difficult, but noted that the infrastructure cost of Sydney had been around £1.2bn based on figures from an IOC official report and ministerial statements in the press

[52] Cost escalation was attributed to a conflation of factors including added security costs, increased games expectations after the 1998 games in Kuala Lampur, inaccurate budgeting, and inexperience of the

In January 2003 at request of the DCMS, PricewaterhouseCoopers validated the Arup’s cost analysis. Their subjective probabilistic assessment suggested a higher capital investment, and introduced capital costs for transport [**Exhibit 6**]. The results suggested an expected £1.61bn base case public subsidy (with inflation) if the Olympics bid was successful with a 5% chance that outturn costs could be above £3.55bn and the public subsidy above £1.88bn. Subsequent revisions of the figures of costs and revenues undertaken by the DCMS during 2002 for the Olympic Evaluations final report involved a critical appraisal of risks and contingencies, a probability analysis, and benchmarking against the Sydney 2000 Games. After adding inflation to the Arup cost figures, the outturn costs for hosting the Games increased to £3,558M. And when this figure was combined with contingencies for risks, the total expenditure rose to an estimated £4,674M with a total revised public subsidy set at £2,624M **[Exhibit 7]**.

By then, public concerns were mounting that the cost figures could balloon further. On January 23rd 2003, for example, the House of Commons Culture, Media and Sport Committee published a Report on the London 2012 bid. The Committee monitored the policy, administration and expenditure of the DCMS on behalf of the House of Commons

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organising committee; (outturn) costs were £320m in venues/infrastructure; £225m regeneration; £125m in transports and the electorate, and conducted inquiries into areas of interest within its remit.[53] The Committee described the Arup report as being of ‘limited use for purposes of accountability’, noting that the report itself admitted it was a hybrid between a cash flow business plan and a conventional cost-benefit analysis. But it conceded that the Arup’s conclusions offered a good baseline for long-term public expenditure. In response to the issues raised by the Committee on the evolution of the cost estimates from the Arup Report to the latest figures, DCMS explained it had inflated the Arup’s figures using an assumption of 2.5% a year through to the end of the Olympic project period, and also undertaken a critical appraisal of risks and contingencies, a probability analysis, and benchmarking. DCMS had left unchanged the Arup assumptions of a five percent staging contingency and a capital contingency of 30-50 per cent across the period 2009-12. DCMS recognised that a few elements were still unresolved including the possible diversion of funds from other schemes and projects, the most effective way to deliver the Games and the role of the Government, the transport arrangements that would be necessary, and the potential for a premiership football club to take on the Olympic stadium. The key stakeholders were nonetheless clearly excited with the potential legacies for elite and grassroots sport, the impact on the Thames Gateway Regeneration plan for Strafford City and the whole Lea Valley area, and the potential socio-economic impact for the UK of staging the Games in their view.

Encouraged by confidence in the new figures and boosted by a ‘winnability’ study submitted to the Government by UK Sport,[54] the Government and the Mayor of London signed a Memorandum of Understanding (MoU) agreeing to back a London bid in January 2003. When the IOC invited BOA to submit a bid in May 2003, the country was ready to respond. And the Government and Mayor entered into a Funding MoU which outlined a public sector funding package (PSFP) of £2.375bn for the Games, plus an additional £1.044bn set aside for non-Olympic infrastructure work on the site of the park to fund the costs of undergrounding two main power lines and cleaning up the land. The public sector funding package was the sum of a £1.5bn funding from the government raised through a Olympic National lottery game, £625m from GLA (raised from a council tax surcharge), and £250m from the LDA. The government committed to underwrite contingency liabilities. It was time to form a bid team [**Exhibit 8**].

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[53] The Committee was independent in choosing its own subjects of inquiry and sought written oral evidence from a wide range of relevant groups or individuals. At the end of each inquiry, it produced a report setting out its findings. The Government had 2 months to respond to each of the report’s recommendations

[54] Established by Royal Charter in 1997, Uk Sport was responsible for investing around £100M of public funds, from both the National Lottery and the Exchequer, each year in high performance sport.

In June 2003, Barbara Cassani, an American businesswoman, founder of the low-cost carrier 'Go Fly' and the 2002 Veuve Clicquot Businesswoman of the Year, was appointed by the stakeholders group to chair the bid team. Tessa Jowell, then Secretary of State for Culture, Media and Sport, declared: *"Barbara Cassani has the skills, business acumen and drive to give London the best chance to bring the Games to the UK. We are confident that she will forge a team capable of beating off the stiff competition from our rivals. The prize is worth chasing. Barbara Cassani is the woman to lead the chase"*[55]. A few days after Cassani's appointment, London was formally nominated as a potential candidate for the 2012 Games in July 2003. And in the same month, the LDA committed up to £15m for London 2012 to prepare and submit a bid, and over £478m to purchase and remediate 161 hectares at the site of the future Olympic park. This was the time when "*the Olympic bid company was little more than three people and a mobile phone"*, recalled Jason Prior, Vice President of the consultancy EDAW who were brought in to work on the Olympic master plan[56].

This commitment was approved by the Government's Central projects review group, which however limited the LDA spending to £298m for land up to 6th July 2005 and postponed the approval of the balance pending the bid decision. In September, Keith Miles, an English entrepreneur and football aficionado, was appointed CEO of London2012 Ltd.

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[55] Local Government Chronicle, 19 June 2003

[56] 2012 Olympics – Key Decision Today, New Civil Engineering, 9 September 2004

With less than 6 months to submit a formal proposal by the 15th January 2004, the London 2012 bid team had no time to waste. Under Cassani's stewardship, the bid team grew to a staff of 80. It also appointed a raft of engineering and architectural consultants; the world-acclaimed architect Zaha Hadid - an Iraqi-British architect- was appointed to design an iconic aquatics centre. And Sport England committed to make £51m available to support the Aquatics Centre and the Velodrome. With technical support from the LDA, the Cassani's team developed a master plan for the bid which listed where events would be held, what infrastructure would be built, and provided an updated budget. In January 2004, London 2012 submitted both the London's bid to IOC and an outline planning application for the Olympic and legacy master plan to four boroughs. As Jason Prior of EDAW said 'If London can say it's got planning permission for the Olympics, then it puts us ahead at the start of the process.'

In May, the IOC ranked London's proposal in third place from nine entries. London had become a candidate city, and the results suggested that the British bid was not lagging that far behind their rivals in Paris and Madrid. Other selected candidate cities were New York and Moscow. Feedback received from the IOC suggested however that the lack of quality of the master plan and inadequate transport plans had raised doubts over the UK's commitment. Still, by then, the thought of 'what if we win?' rang alarm bells in other government departments, notably the Treasury, which had had up to that point limited input in the bidding process, arguably because they had until that point believed that the London bid had a very low chance of winning.

The bid team now had approximately 10 months to dramatically improve the final submission. On May 17th, 2004, Cassani announced that she was stepping down in favour of Olympic Gold medallist and politician Lord Sebastian Coe. Cassani justified her choice saying that she felt the bid had reached a stage where Coe's track record in the Olympic movement would be more useful to the bid than her technical and managerial experience.[57]

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[57] As Sir Bob Scott, chairman of the Manchester Olympic Bid Committee's in 1996 and 2000, and the successful bid to host the Commonwealth Games of 2002 put it [to suceed, the leader has] "sharp, shrewd

Cassani stayed with the bid team, serving under Lord Coe as Vice Chairman responsible for technical aspects of the bid. Lord Coe's contract explicitly tasked him to produce a bid within the public sector envelop already set out by the Government and the Mayor [**Exhibit 9**]. In October 2004, the bid team was granted outline planning application for an Olympic and Legacy master plan with a series of planning conditions. And on 15 November, 2004, London submitted their final bid document. In the candidate file submitted, the overall capital investment had spiralled to £9.87bn, including £7.1875bn in transport; the budget for the private organization LOCOG was set at £1.54bn. The outturn costs of the future ODA amounted to approximately £3.6bn, including £971m in venues, £89m for venues legacy conversion, £640m in Olympic park infrastructure, £466m for transport infrastructure, £1.044bn for regenerations costs (assumed as costs that would be incurred as part of the planned regeneration of the Lower Lea valley), and £234m for others (which included £190m for security costs). The size of public sector funding package (£2.3bn) did not change due to a number of assumptions. First, the bid assumed that around £738m in project finance initiative (PFI) deals could be implemented for some infrastructure and regeneration projects notably around utilities. It also assumed that the village would be wholly privately financed, and the Home Office would fund most security costs; and that the £1bn for the regeneration works could be funded out of existing government programmes. Finally, the bid excluded VAT at the request of IOC for bids to be tax neutral [**Exhibit 10**]

Once the bid was submitted it triggered a frenetic lobbying period led by the high-ranking sportspeople and top UK politicians including Tony Blair, the UK's prime minister. Supporting the skilful lobbying was a narrative in the bid around not only the regeneration of East London, but also 'changing the face of British Sport'[58]. There was also a promise that the games would set new standards of inclusive (encompassing the whole life experience of disabled people) and sustainable design in sporting facilities, residential developments, transport procurement, and service delivery [**Exhibit 11**]. Between February

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and knowing, but unthreatening as well. This is a world in which a lot of kissing goes on, lots of 'how are you's'!"

[58] Lord Coe, The Guardian, 6 July 2005

and March 2005, the IOC evaluation commission made 4-day visits to each candidate cities. In London, they were hosted a gala dinner by Her Royal Majesty the Queen at Buckingham Palace. And the confidence in London's chances to win the bid increased although many recognised it would be a neck-and-neck race with the rival bids. After presentations by the Candidate Cities and a 48 hour visit of Tony Blair to Singapore, in the first round of a secret ballot on July 5th 2005, the bids from London and Paris emerged as the favourites with London leading by one vote. But after 4 rounds of votes, London was chosen with 54 of 104 votes [**Exhibit 12**].[59] After been appointed Minister for the Olympics, Tessa Jowell, the DCMS secretary declared "'We have come from nowhere to win the Olympics and that is quite something' [60], whilst Lord Coe, the bid team chairman, told Jacques Rogge at a news conference, 'We won't let you down'.[61]

THE GOVERNANCE OF LONDON 2012

Celebrations over the success of London's bid were marred by the tragic terrorist attacks in London the day after, which immediately invalidated the assumptions in the bid around security. It was time now to turn thoughts to the practicalities of delivering an Olympic Games. The bid document provided a plan for the delivery of the Games, but there was now a need to create the organizational bodies which would take ownership of the Games post-award.

On July 14, 2005, the government introduced the London Olympics bill to parliament which would grant powers to the future Olympic Delivery Authority (ODA), and in August the London Development Agency (LDA) accepted to take the leadership of a transitional role after the Mayor proposed an overall transitional system of governance [**Exhibit 13**]. The LDA would host an interim ODA (iODA) – the Olympic Delivery Group or Committee - for which Alison Nimmo was later appointed acting chief executive with executive support from Transport for London (TfL) and the LDA. Immediately after the award, the first priority for the iODA tem was the reconciliation of the London 2012 planning permission with the private-led master planning permission for Strafford City. The two applications had been granted planning consent but had ignored each other so the private-led plan could progress independently in the event of the London 2012 bid failing. But they now needed to be merged into one coherent scheme. To facilitate the reconciliation, the deputy prime minister issued a letter of direction for English Partnerships to carry the necessary financial and legal arrangements. This, as David Higgins put it, was *"the oxygen to fuel the commercial development of Strafford"*. And through a number of workshops it led to a handshake agreement about how the two schemes could be married in November 2005.

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[59] And the running joke was that when they said London, lots of people said 'oh, shit, what's going to happen?'

[60] The Guardian, 6 July 2005

[61] BBC Sport, 6 July 2005

Unlike LOGOC, the ODA was planned to be an entirely publicly funded body and as such accountable to the Treasury. The ODA would be granted compulsory purchase order (CPO) powers to lay claim to the land of the Olympic Park, and local authority planning rights to build the Games infrastructure; the ODA would also be responsible to develop the transport plans for London 2012. And it would also be up for the ODA to negotiate how to fold the bid commitments into design briefs that could be tendered, and to ensure the long-term sustainability of the Olympic facilities. The ODA executive would report to an independent ODA board of executive and non-executive directors that would give representation to the numerous organisations that had endorsed the bid. There was an ongoing debate however as to the number and diversity of stakeholders to invite to the ODA board, which could range from the GLA, TfL, rail companies, the city of Manchester, sports organisations, disability organisations, utility companies, and various professional bodies.

With the Olympic bill awaiting passage through Parliment, and the recruitment processes for the ODA chairman and chief executive ongoing since September 2005, the governance structure of the interim ODA was refined [**Exhibit 14],** and the iODA started to make demarches to recruit a Director of Procurement. This role would oversee the procurement of a master plan designer for the Olympic Park, and an infrastructure and a programme manager, and to let the most urgent contracts. Amongst those, was the need to confirm the Aquatics Centre architect Hada's appointment for the delivery stage. The iODA/LDA team also felt urgent to issue a compulsory purchase order (CPO) over subterranean cylinders of land in order to start undergrounding the two overhead power lines with total route length of 13km that existed on the future Olympic park [**Exhibit 15**]. As part of a ‘first 90 days’ action plan, the iODA planned to let contracts before the end of 2005 to achieve an active switchover in the summer 2008. The LDA and DCMS needed, however, to agree a budget for the project which was initially estimated around £191m. Concurrently, the LDA commissioned KPMG to reassess its financial commitments. And by October 2005, the KPMG Project Wells report told LDA to expect its base costs of land assembly, remediation, underwriting, and bid support[62] to be closer to £1.164bn+VAT (£600m alone for land acquisition), a price tag significantly above the estimated £15m for bid support, £250m for underwriting the cost of delivering park and venues, and £450m for land assembly. By November 2005, the LDA had submitted the CPO statement to the undergrounding project.

The IOC regulation also required the creation of a separate entity to manage the hosting of the events. The Games were expected to cater for 26 Olympic Sports and 20 Paralympic Sports, 14,700 athletes, 21,000 people media and 10.8M ticket-holders, numbers equivalent of staging 46 World Championships simultaneously. And on October 5th 2005, the London Organising Committee of the Olympic and Paralympic Games (LOCOG) was founded. LOCOG was a private company, limited by public guarantee, created by the BOA, the Mayor of London, and the DCMS. The LOCOG’s remit was to manage the hosting of the event including ticketing, sponsorship, and broadcasting. As the face of the Olympics, the LOCOG undertook the legal obligation to deliver the Olympics according to the bid book and IOC technical requirements. No changes to the commitments made in the host city contract could be made without consulting LOCOG. As such, many people in the original bid team joined the LOCOG. Lord Coe was appointed LOCOG chairman, and Keith Mills was appointed Deputy Chairman. The DCMS remained ultimately accountable for the success of the Games and their legacy.

An Olympic Board that held executive power over the entire London 2012 enterprise including both ODA and LOCOG was also created. This Board consisted of a Government appointed Olympics Minister, Tessa Jowell (DCMS Secretary of State); the Mayor of London; the Chair of the BOA, Colin Moynihan; and the Chair of LOGOC. The Board would meet monthly, with the chair alternating between the Mayor and the Secretary of State. The Olympic Board would be in ultimate control over the scope of the ODA activities. It would be advised by an Olympic Board Steering Group (OBSG) and supported by an Olympic Programme Support Unit (OPSU). To oversee the use of public funds by the ODA it would create an Olympic Projects Review Group (OPRG), a group that would bring together all the funding bodies including GLA, DCMS, the Olympic Lottery Distribution Fund, the National Lottery Distribution Fund, Sport England, UK Sport, LDA, and HM Treasury. And to oversee the activities of the Olympic board, the government would also create within DCMS a Government Olympic Executive (GOE). The GOE would bring together not only the funders, but numerous other stakeholders including the Home Office, the National Audits Office (NAO), Parliament, the Cabinet, and the Department for Transport. As the iODA team waited for the approval of the Olympics bill, it became clear that the budget needed to be revised again. And in October 2005, the DCMS appointed KPMG to work with the future ODA executives and chairman on an Olympic Cost and Funding Validation study. By December, David Higgins was selected as ODA chief executive and Jack Lemmon, former chief executive of the Chanel Tunnel, as chairman. In a harbinger of what was going to be a tense relationship[63], they both claimed ownership to the core rule underpinning the delivery strategy for the Olympic park - the 2-4-1 formation: The first two years would be for planning: *"get ourselves really well organised a bit like the Japanese do",* recalled Alison, *"build the delivery machine, the procurement, get all planning permissions, rail possessions, statutory purchases, develop delivery plans, get the choreography right";* then 4 years to build; and then hand over the park to LOCOG to give them one year to run the test events.

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[62] The outturn cost of the bid had evolved into £30m

Delivering the London 2012 Olympic Park

The venues that would host the London 2012 games were predominantly located within London although some venues, such as the Weymouth and Portland National Sailing

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[63] Jack Lemmon had also applied for the chief executive job

Academy or the Eton College Rowing Centre at Dorney Lake were located by necessity outside the boundaries of Greater London [**Exhibit 16**]. Similarly, football events were going to be staged at several grounds around the UK with the finals for football competition planned for Wembley. Within Greater London, the locations for the venues that would host the London 2012 games were divided into three zones: the Central Zone, the River Zone, and the Olympic Zone. Beach volleyball, for example, was planned to take place at the Horse Guard's Parade in central London, whereas near the river, the Dome would stage gymnastics, and the ExCeL exhibition centre would host boxing, judo, taekwondo, weightlifting, and wrestling.

But undoubtedly, the centrepiece of the bid was the Olympic zone. The bid commitment was to regenerate not only waste and industrial land at the site of the future 200-hectare Olympic Park, but also to contribute to regenerate the neighbouring Stratford city and the Lower Lea Valley. Stratford city would see a key property development that would include the Olympics Athletes Village and the International Broadcast/Main Press Centre. After the Games end, the Olympic park would be transformed into one of the largest urban parks in Europe. As Alison put it:

"If we had all the time in the world, it would take 25 years to do this, and we would do things in a nice, obviously sequential phasing way, build a bit, sell a bit. But we will have to squeeze those 25 years of regeneration and civil [engineering] and venues into seven, and will have to do a lot of parallel working."

A key part of the success of the Olympic park would be determined by the long term success of the sporting facilities. After the Olympiad, some venues would be dismantled, others would be repurposed, and some would remain as they had existed during the games. The 200-hectare Olympic park would house five permanent venues: a 25,000-seat athletics stadium pared down from the 80,000-seat Olympic stadium, an aquatics centre, a velodrome with BMX circuit, a hockey centre, and an indoor sports centre. Other venues such as the sports complex with indoor arenas to stage volleyball, basketball, and handball would be dismantled or relocated after the games. All the venues would be co-located within walking distance to the Olympic Village which would provide 17,320 beds to accommodate all athletes and accredited officials, and to an International Broadcast/Main

Press Centre. After the games, the Village would become a district of the Stratford City, and would be converted into 3,600 apartments; a new use would need to be found for the press centre.

The plan would be a boost to East London. But it would be unlikely that all of the land owners and tenants would agree with the proposed enforced purchase of the land, which would spark conflict with the ODA. There was a real risk someone could trigger a legal battle if they refused to accept the compensation to leave the land. And new places would need to be found for occupiers such as allotment holders and Traveller communities. Beyond the 200-hectare Olympic park and the Stratford city development, hosting the Games was set to act as a catalyst for the wider regeneration of the Thames Gateway, the 40-mile stretch of mainly brownfield land earmarked by the government as a growth area where 200,000 homes were planned. The Government had committed to redevelop the Lower Lea Valley, including the construction of the Lea Valley White Water centre in Hertfordshire. Estimates suggested that the delivery of the Olympic Park would create 7,000 jobs in the construction industry, and the bid document predicted that around 12,000 jobs would be created from the post-games legacy.

The bid had also committed to a massive investment in transport, accelerating an investment programme that was already underway. The Jubilee line that linked North West London through Central London to the Olympic park was expected to see a 25% increase in capacity with more and longer trains. The capacity of the North London line would treble and that of the Great Eastern lines would double. The Docklands Light Railway, the automatically-driven light rail network in east London, would be extended to London City Airport and Woolwich. And the high-speed Channel Tunnel Rail Link that connected King’s Cross St Pancras to continental Europe would be extended to the Stratford International Station at the Olympic park. This shuttle service, dubbed the Olympic Javelin, would bring the Stratford city within seven minutes of central London and provide transportation links capable of transferring 240,000 people per hour.

The Olympic Stadium

The Olympic Stadium was planned to host some of the Opening and Closing ceremonies, and the athletics. As the centre piece of the Olympic Park, the stadium had remained a point of contention long before the BOA had formally nominated London for the 2012 Games. In 1999, as the BOA conducted feasibility studies of the Olympics, plans were unfolding to construct a new national football stadium at Wembley. The Football Association (FA) who controlled the stadium had lobbied the government for funding, and had been awarded a £120m Lottery grant conditional on building a stadium that could also stage major athletics events. The FA then commissioned Sir Norman Foster architects to produce plans for a 90,000 seats football stadium that could fall to 67,000 for athletics events as parts of the lower seating tier being covered by a 6m high temporary platform supporting a track. This proposal rejected the government's preferred solution for building retractable seating on the stadium's lower tier, and was received with dismay by the BOA which argue that the FA's proposed stadium would be too small to meet the IOC requirements. BOA also stated that sight lines for athletics seating were unsatisfactory as spectators in the lower tiers would be unable to see the running track properly. The controversy prompted the DCMS Secretary of State in December 1999 to commission an independent report on Norman Foster's proposed design to consultant DLA Ellerbe Becked. The report confirmed that the sightlines would be too poor for many spectators[64]; it also stated that football could not be played for two years around the Olympics because the track had to be ready for trials one year in advance, and at least four months would be needed to raise the platform. This meant that the FA would be facing significant loss in revenue over that period. The report also raised issues as to whether the stadium roofing could create difference in shadow between tracks that would make it harder to beat world records. It pointed that in ideal conditions, the athletics axis demanded a 15 degrees from north summer time orientation to prevent glare in runner's eyes, whereas football needed a wintertime north-south axis. Furthermore, the report argued that with such concept, the sightlines equivalent to those at the Atlanta Olympics could not be achieved for running events.

Subsequently, in February 2000, the Culture Secretary, Chris Smith, vetoed plans for a £20m temporary athletics track. Ken Bates, a former football club chairman charged with heading the Wembley project, blamed interventions by the Government at the behest of BOA for derailing the project saying: *"There is no reason why athletics could not be staged at Wembley. What we've got is the Olympic tail wagging the national stadium dog."*[65] But Chris Smith, the DCMS minister rejected these claims stating: *"We decided in December that Wembley should focus on football and rugby league and we should look elsewhere for a good athletics venue".* On March 24th 2000, plans were announced for a new athletics venue at Picketts Lock in the Lea Valley. This was followed by an announcement on April 3rd 2000 that the 2005 World Athletics Championships would be held in this 43,000 seat dedicated athletics venue. With an initial cost of £87m, the Picketts Lock Arena seemed an attractive proposition for athletics organizers when compared to the costly Wembley venture. But in a rush to provide a location for the World Athletics Championship the full cost of the hosting an international event at the Picketts Lock Arena had not been considered. And on October 4th 2001 Sports Minister, Richard Caborn, stated that the plans for the World Athletics Championships at Picketts Lock were to be scrapped because of the increased costs: *"It would have cost almost a quarter of a billion pounds to stage it at Picketts Lock and we could not justify that... It's an awful lot of tennis rackets, an awful lot of sports coaches and an awful lot of football pitches".* Despite attempts to move the World Athletics Championships to Sheffield, U.K athletics was forced with much chagrin to withdraw its bid, casting serious doubts over the country's ability to host an Olympic Games. With the abandonment of Picketts Lock, plans re-emerged for a multi-function Wembley stadium. One alternative would borrow from the Stade de France in Paris which used massive movable stands to cover much of the athletics track during football and rugby events. But with the costs at Wembley already spiralling[66], the idea was ditched in January 2002.

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[64] New Civil Engineering, 9 Dec 1999

When Arup completed their investigation into the feasibility and costs of a London 2012 Olympic bid in May 2002, its specimen bid assumed the development of a new 80,000 seat stadium – the capacity was a IOC design requirement. And one of the key legacy claims in the bid was that the Olympics would provide a long term athletics legacy in London, by reducing the 80,000 seats stadium post games to make a dedicated 25,000 seat athletics stadium [**Exhibit 17**]. But from the onset, the politically powerful premiership football community questioned the practicalities of a 25,000 seat athletics only stadium in London. They raised questions about its commercial sustainability in the long term, even comparing the decision to previous public venues such as London's Millennium Dome which had failed to meet its projected crowds and were perceived by some as a waste of public money. They noted that in the UK, athletics did not typically generate the crowds or sponsorship money that Britain's football clubs did; if ODA insisted in keeping to the bid commitment, weren't the government simply funding another infamous white elephant? Several Premier League football clubs in London had stadiums nearing the end of their lifecycle. Couldn't the stadium be designed so one of these could become a long term occupier of the Olympic Stadium through a lease deal?

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[65] http://news.bbc.co.uk/1/hi/sport/627280.stm

[66] After a 3-year delay, the old stadium was only completely demolished in February 2003 and planned to open in 2006. But by 2005, the project had run into a major dispute between the contractor and the client, and the construction costs were spiraling to over £700m

Based on the Wembley experience, the ODA reckoned that any potential premiership club would balk at the idea of leaving a permanent athletics track separating fans from the football pitch. And they were likely resist as well to the French model of a dual-purpose venue. Football clubs disliked the costs and time spent protecting the track to roll over the seating and vice versa to switch between types of events, and argued that solution led to seats with poor lines of sight over the pitch. On the other hand, suggestions to demolish the Olympic Stadium post games and rebuild a dedicated football stadium would completely disenfranchised athletics. A football stadium with the regular influx of 60,000 supporters was also perceived to impact negatively the regeneration strategy. And surely such a change to the vision of the bid would anger those LOCOG members like Lord Coe who had fought to have athletics placed at the centre of the urban regeneration scheme. Alison Nimmo was wary of the situation becoming fractious as it had in the Wembley Arena: *"nobody wanted a Wembley situation"*. Meanwhile David Higgins, an Australian fan of rugby, felt passionate about keeping the athletics legacy:

"it was written in the brief document that the athletics track was permanent. It was always a permanent commitment in the bid… What's wrong with leaving an international athletics centre? What's the matter with that as a brief? Why do we always have to have a football

club? Why do we have to publicly subsidize the richest clubs in the world? Why? It's public land, it costs a fortunate to accommodate, and you've got 200 schools in this valley, public schools, that have very limited public playing fields, public sports facilities...don't renege on your responsibility to public sport and public participation"

Still, the premiership football clubs were not ready to give up. West Ham, a club based in the borough of Newham where the future stadium would be located, was positioning itself as a serious contender and was not ruling out a solution that kept the field and track in legacy. West Ham was in the process of finalising a deal with an Iceland consortium fronted by former UEFA executive committee member Eggert Magnusson to buy the club for £85m, also involving Billionaire Icelandic owner Bjorgolfur Gudmundsson. Another contender was Tottenham Hotspur/AEG, a rival premiership football club, but less interested in the idea of retaining a permanent athletics track. Interestingly, LOCOG deputy chairman and former CEO of the London 2102 bid company, Sir Keith Mills, was a follower of Tottenham Hotspurs for many years. [67] And Sir Keith Mills was a vocal critic of the idea of keeping a running track inside the Olympic stadium so long as an athletics legacy was created elsewhere in London. He was sceptical that the solution could stack up commercially. For the ODA executive, the sixty-four thousand dollars question was: how could they get the Olympic board to agree a brief which would enable ODA to go to the market to procure a design-build consortium for the stadium?

THE AQUATICS CENTRE

The Aquatics Centre was another of the permanent venues in the Park. The IOC requirements at the time of Arup's report demanded a facility complex with a minimum capacity for 17,500-seated spectators for speed and synchronised swimming in the 50m competition pool, 10,000-seated spectators for diving events in the diving pool, two additional 50m pools, and back of the house facilities. The idea of building a landmark aquatics centre as part of East London regeneration immediately gained enough traction and a group of stakeholders agreed that the project should go ahead irrespectively of the result of the London 2012 bidding process. The venue should be designed to accommodate the IOC requirements through a combination of temporary and permanent facilities. The stakeholder group behind the project, some of which promised to make funds available, included the LDA, the DCMS, the London 2012 bid company, Sport England, the London Borough of Newham, the Lee Valley Regional Park Authority, the Amateur Swimming Association, British Swimming, and the University of East London. If the London bid was successful, the aquatics centre after the Games would convert into a smaller 2500-seated facility with one 50m competition pool, one 50m training pool, and a diving pool, making it easy for community and elite swimming use. It would also include a health and fitness area.

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[67] Sir Keith Milles would later that year be appointed non executive director of Totteham Hotspur plc.

A stroke of marketing genius was the selection of the Iraqi-British architect Zaha Hadid with engineering experts Ove Arup and Partners and top swimming pool architects S&P in January 2005 to design the Aquatics Centre. The selection was made through an international competition run by the LDA for a proposed regeneration site that LDA already owned at Stratford. Zaha Hadid, who had been the first woman to be awarded the prestigious international Pritzker Architects Prize in 2004, proposed with her team a massive but highly sophisticated facility with a sinuous, undulating rood that charmed the jury co-chaired by Lord Richard Rogers, another world-renowned London based architect and Lord Carter of Coles, Chair of Sport England[68] [**Exhibit 18**]. The powerful London architectural community had been lobbying London 2012 for investment into architectural masterpieces and good design at the Olympic Park, and the London 2012 bid team agreed that at least one asset needed the ‘wow factor’ to contrast to the other more standard venues, making the overall bid more compelling. As Keith Mills, Chief Executive of London 2012, said[69]:

“This is an outstanding design that will create a spectacular building, delivering the essential ‘wow’ factor for the 2012 Olympic Games and Paralympic Games. It will then be

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[68] The other members of the Panel that chose the design were Observer architecture critic Deyan Sudjic, Ray Jupp, Chair of Newham Swimming Club, Shaun Dawson CEO of Lee Valley Regional Park Authority, Tony Winterbottom, Executive Director LDA, Ricky Burdett of the Greater London Authority’s Architecture and Urbanism Unit and Francine Houben, Mecanoo Architecten.

[69] Zaha Hadid chosen to design first Olympic venue”, Greater London Authority press release, 31 Janaury 2005

cleverly transformed following the Games by taking away the majority of the 20,000 seats, which will not be needed, turning it into more intimate spaces suitable for community use. It gives the community a lasting sporting legacy."

After the Games, the £73m Aquatics centre (bid book budget) would become a facility for the local community, clubs and schools, as well as elite swimmers, attracting over 800,000 visitors a year. It would also cater for national and European events, with regular events such as Triathlon England and British Swimming. The ODA executive did not dispute the aesthetic and technical quality of the design concept of the Zaha's team, but noted that it would be very hard to make the concept work in legacy financially. Not only was the budget inadequate, but the massive concept was far too ambitious for the physical site: *" when you look to the physical site", explained David, "and try to fit the original design to the site of course you know it does not fit... but having been selected for the site, it was going to be challenging to get the architect to change... to explain [to the architect] why the concept would not work".*

THE ATHLETES' OLYMPIC VILLAGE

During the Games, the Athletes' Olympic village would be the hub for athletes from all over the world. It would be located within the Olympic Park and neighbouring the Stratford city. This was important since the bid committed that 80% of athletes would be within 15-20 minutes of their events and 97% would be within 30 minutes of their events. To meet the IOC requirements, the 35-hectare village would provide accommodation to 16,800 athletes and officials in one- and two-bedroom apartments in elevator-serviced blocks at eight storeys or less, with a further 1,000 possible. It would also include a main dining area with capacity for 6,000 at any one time, and a range of other services including shopping centres, cinemas, banks, and medical facilities. The bid committed that all athletes would be able to stay at the Village. After the games, the Olympic Village would become East Village, and would be transformed into new 4,000 homes with a mixture of affordable tenures and shared equity, and facilities for the local community. Kitchens would be installed, along with new carpets and timber floors. Right from the offset, the bid assumed like in Sydney that the village would be funded by a private developer as part of a larger redevelopment project at no cost to the public. But David argued *"well, that's not realistic, is it? It's going to cost something.... we need to buy the land, put infrastructure in... if we need to build 4,000 apartments, we may need a subsidy of £50k per apartment, that will cost £150-200m."* There was also a plan that the development could unfold in two stages, with a second stage after the games aimed at further expanding the facilities. The Olympic Village's accommodations would be the most spacious in the Olympics history. Each apartment would include internet access and wireless networking and other state-of-the-art technology.

The ODA executives were mindful, however, that they needed to secure first the land of Strafford City site where they would like to locate the Village in order to integrate it better with the Olympic park master plan. This was not a trivial task. By November the ODA had reached a hand-shake agreement with the private consortium that controlled a large chunk of Strafford City and had got planning consent for a major residential and mixed use scheme. According to this plan, the residential component of the Stratford City would become the Olympic village, and the multi-story car park planned for the Stratford City site would support the Games, enabling the ODA to drop the bid plan to build a temporary car and coach parking site on Fish Island. Still, Alison felt there were strong players in the property market seeking to make large profits by attempting to hold the government to ransom over the Olympic Village. . The ODA could undercut their moves by extending the boundaries of the compulsory purchase order (CPO) to include Stratford City. This was going to be politically sensitive. But could the ODA afford not to do it? Most of the Stratford City land was Crown land in the hands of the London & Continental Railways (LCR). The LDA/English Partnerships did not have powers to acquire Crown Land, but the Olympic Act would give that power to the ODA. But if the private-led commercial development, which included the massive Westfield shopping centre, did not go ahead, could the Olympic Park and Village work in legacy?

Were people really ready to concede a bit of ground to come up with a better plan? Would they understand the need to reshuffle the deck chairs? To complicate matters, local businesses were unhappy that the bid master plan encroached on a large swathe of land south of the main park. Should the iODA team explore folding the original master plan into a more compacted plan? Should they remove the south area from the CPO, moving more facilities into the core site and others into other London venues? These issues seemed to be potential showstoppers.

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The ODA executive found that not much could be learned from the previous games. The history of the Olympics planning and construction stages was not one of harmony to the extent that David could not recall a Games "where the equivalents of ODA and LOCOG had not got at each other throats, and had not had multiple changes of CEOs in both companies". Athens, the last city to host the Games, had become renowned for experiencing massive problems in the run up to the games in 2004. The programme delivery ran late and the costs increased threefold from €4.5bn to €13bn. The games were also expected to leave derelict facilities due to lack of integration of the bid with a legacy strategy. Sydney 2000 was also understood to be a poor example to follow. There had been a considerable number of problems passing control from one agency to the other, and the delivery body and SOCOG, the LOCOG equivalent, had a fraught relationship with other stakeholders, explained David. And as for Beijing, the city that was going to host the games in two years time, little had been revealed about how the process in China was unfolding. But observers perceived that the Chinese organisers were running on what amounted to an unlimited budget[70], building impressive assets such as the awesome 'Bird's Nest' Olympic Stadium and the 'Water Cub' Aquatic Centre, and there was no way London would be able to match that. This seemed to leave the ODA executive with no alternative but to try to make changes to the master plan, the budget, and the delivery strategy. But would all the stakeholders bite the bullet? And how reluctant would LOCOG be to renegotiate the design requirements before the Beijing games? After all, it was necessary to continue to improve the design of the venues in order to increase chances of breaking world records, and perpetuate the mystic around the Games.

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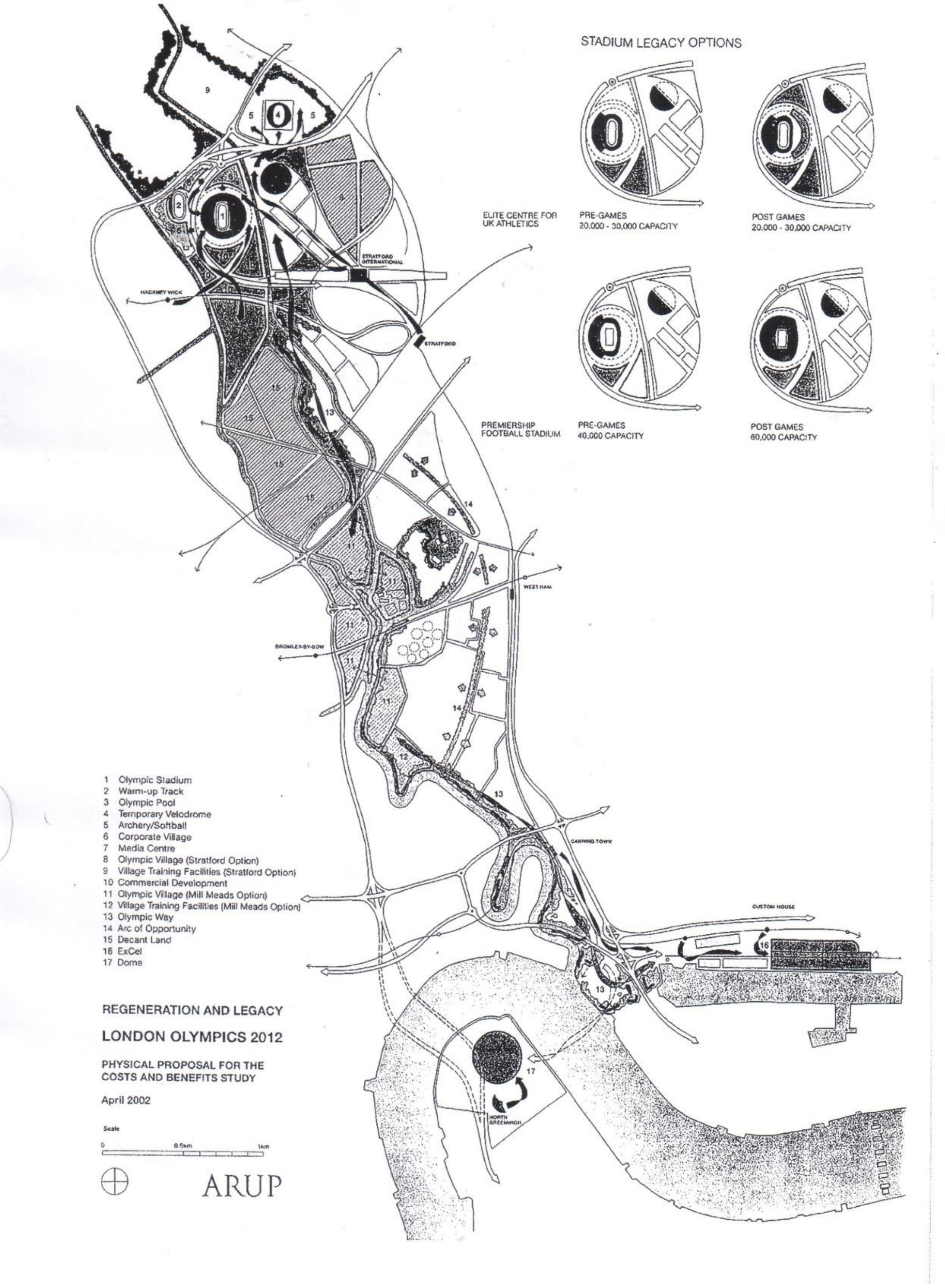
[70] The budget was later rumoured to be above £20bn

Exhibit 1 – Proposed Olympic Site and Lea Valley Regeneration Area


STADIUM LEGACY OPTIONS
ELITE CENTRE FOR UK ATHLETICS
PRE-GAMES 20,000 - 30,000 CAPACITY
POST GAMES 20,000 - 30,000 CAPACITY
PREMIERSHIP FOOTBALL STADIUM
PRE-GAMES 40,000 CAPACITY
POST GAMES 60,000 CAPACITY
STRATFORD INTERNATIONAL
STRATFORD
HACKNEY WICK
WEST HAM
BROMLEY-BY-BOW
CANNING TOWN
CUSTOM HOUSE
NORTH GREENWICH
1 Olympic Stadium
2 Warm-up Track
3 Olympic Pool
4 Temporary Velodrome
5 Archery/Softball
6 Corporate Village
7 Media Centre
8 Olympic Village (Stratford Option)
9 Village Training Facilities (Stratford Option)
10 Commercial Development
11 Olympic Village (Mill Meads Option)
12 Village Training Facilities (Mill Meads Option)
13 Olympic Way
14 Arc of Opportunity
15 Decant Land
16 ExCel
17 Dome
REGENERATION AND LEGACY
LONDON OLYMPICS 2012
PHYSICAL PROPOSAL FOR THE COSTS AND BENEFITS STUDY
April 2002
Scale
0
0.5km
1km
ARUP

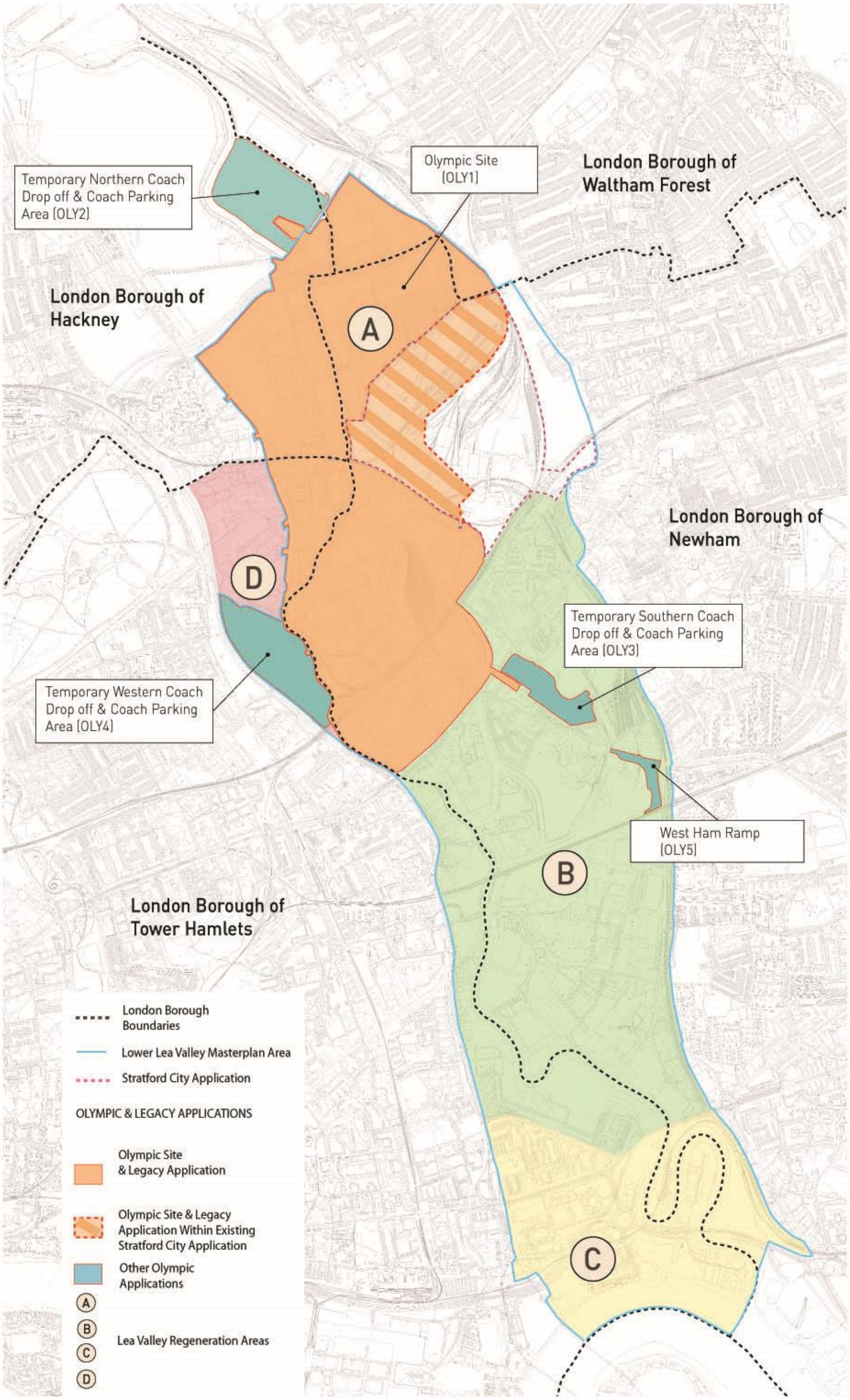

Temporary Northern Coach Drop off & Coach Parking Area (OLY2)
Olympic Site (OLY1)
London Borough of Waltham Forest
London Borough of Hackney
A
London Borough of Newham
D
Temporary Southern Coach Drop off & Coach Parking Area (OLY3)
Temporary Western Coach Drop off & Coach Parking Area (OLY4)
West Ham Ramp (OLY5)
B
London Borough of Tower Hamlets
C
London Borough Boundaries
Lower Lea Valley Masterplan Area
Stratford City Application
OLYMPIC & LEGACY APPLICATIONS
Olympic Site & Legacy Application
Olympic Site & Legacy Application Within Existing Stratford City Application
Other Olympic Applications
A
B
C
D
Lea Valley Regeneration Areas

Exhibit 2 – Proposed boundaries for the Compulsory Purchase Order (2005)

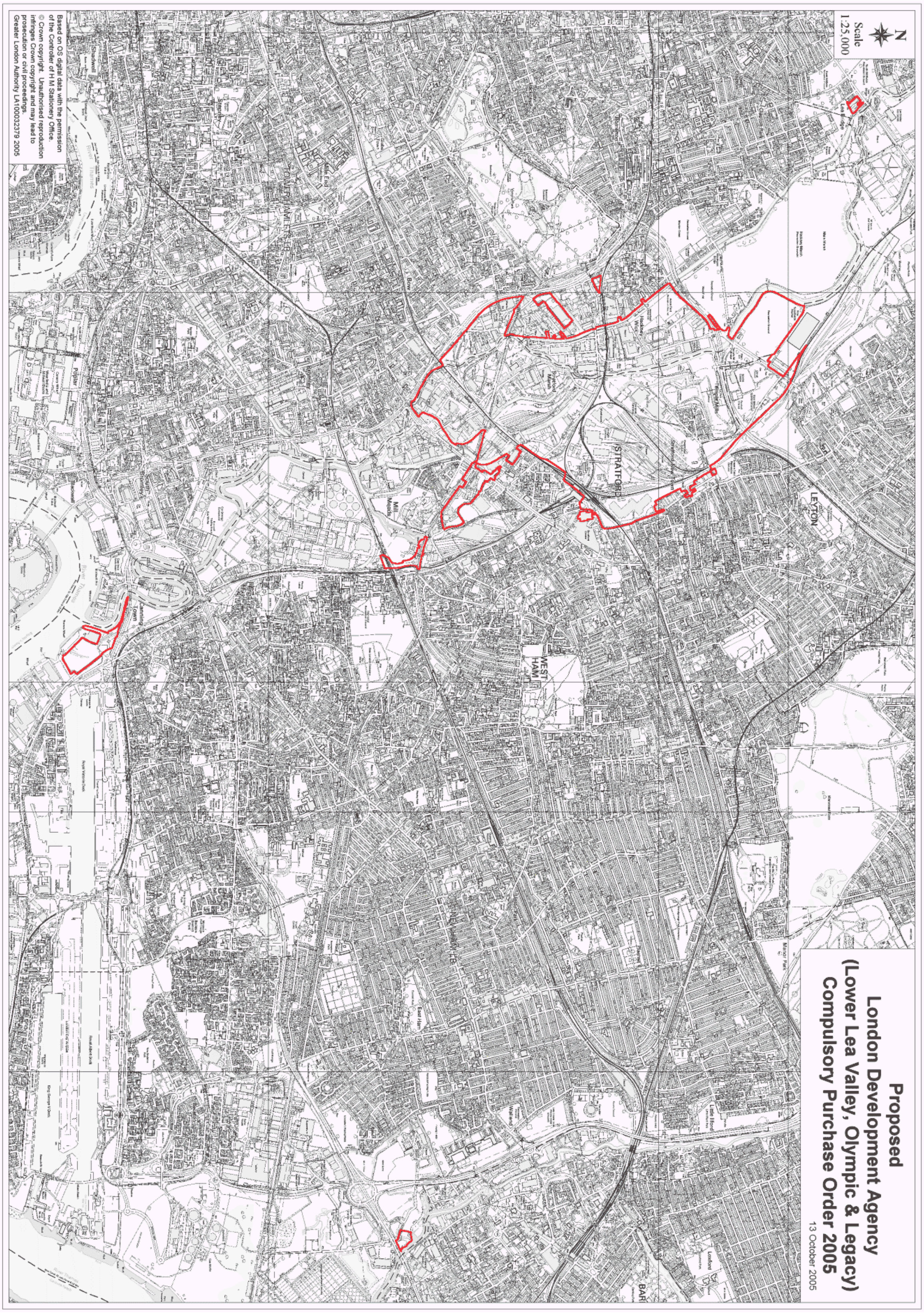
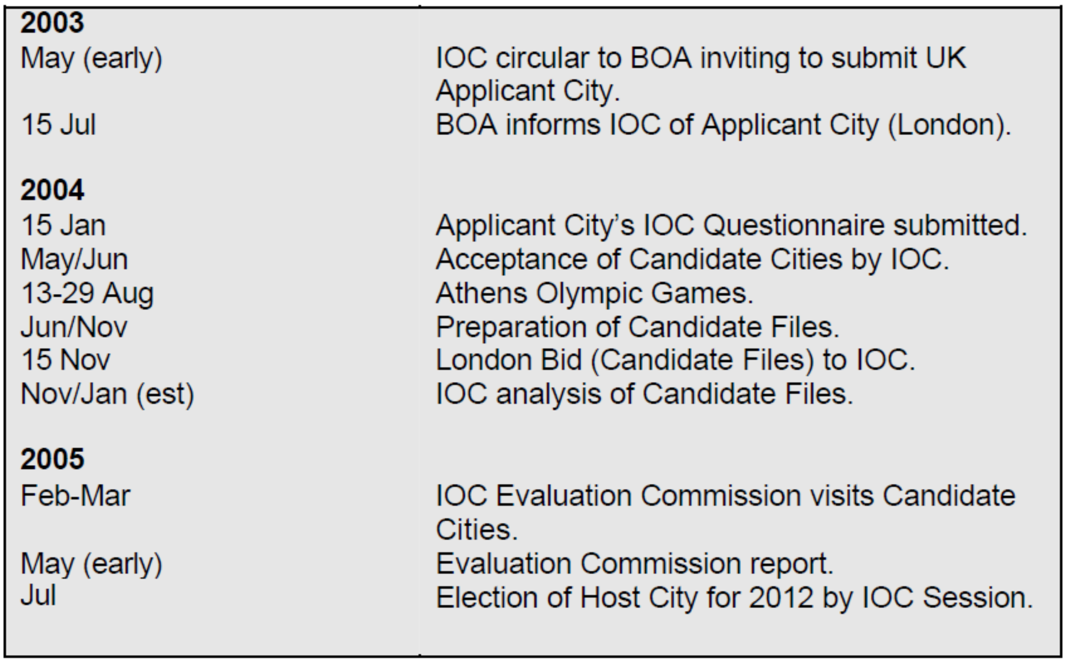
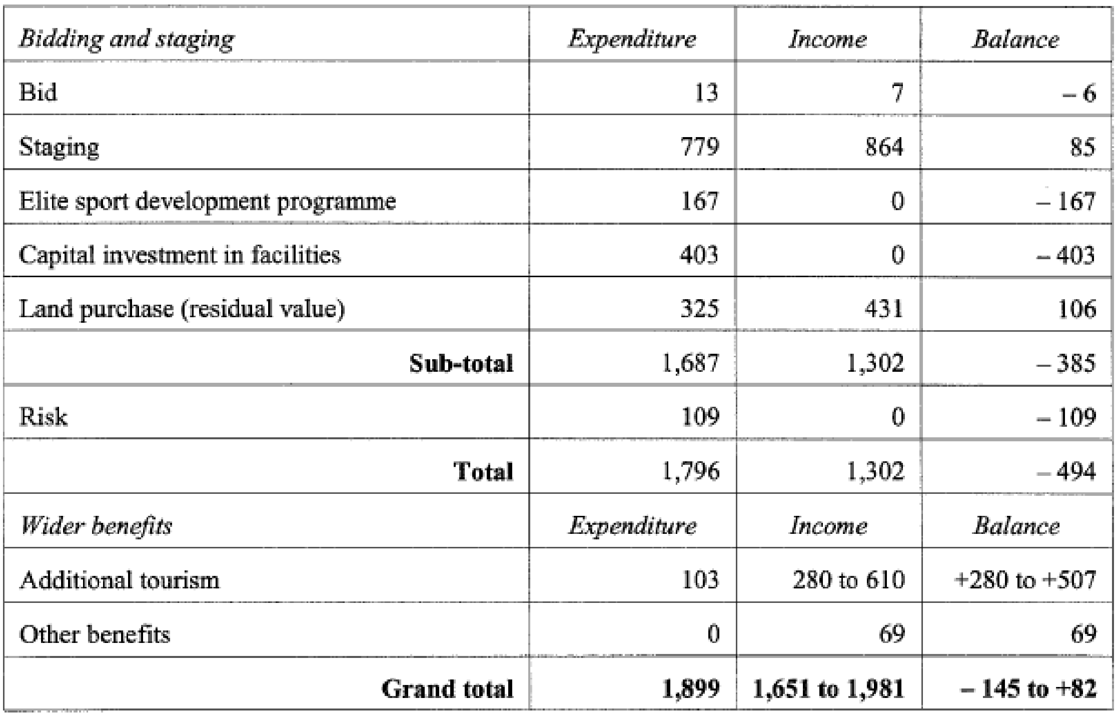

N
Scale
1:25,000
Proposed
London Development Agency
(Lower Lea Valley, Olympic & Legacy)
Compulsory Purchase Order 2005
13 October 2005
STRATFORD
LEYTON
WEST HAM
Mill Meads
Based on OS digital data with the permission of the Controller of H M Stationery Office.
© Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.
Greater London Authority LA100032379 2005

Exhibit 3 – Provisional IOC bidding table (published in 2002)



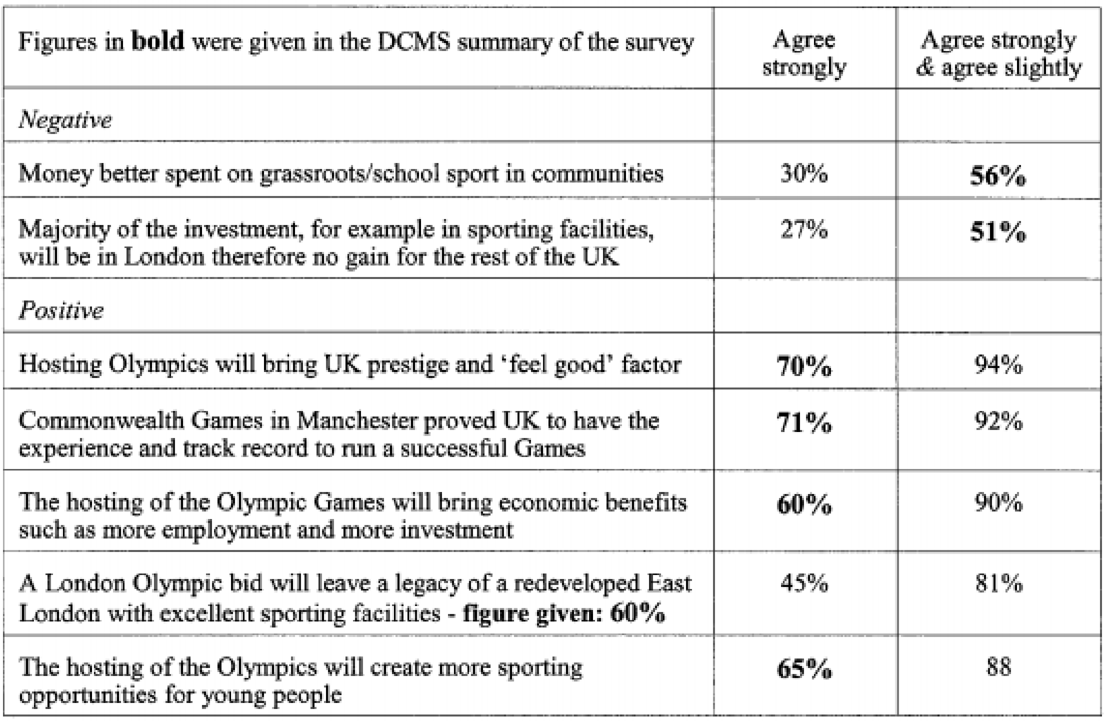
2003	
May (early)	IOC circular to BOA inviting to submit UK Applicant City.
15 Jul	BOA informs IOC of Applicant City (London).
2004	
15 Jan	Applicant City’s IOC Questionnaire submitted.
May/Jun	Acceptance of Candidate Cities by IOC.
13-29 Aug	Athens Olympic Games.
Jun/Nov	Preparation of Candidate Files.
15 Nov	London Bid (Candidate Files) to IOC.
Nov/Jan (est)	IOC analysis of Candidate Files.
2005	
Feb-Mar	IOC Evaluation Commission visits Candidate Cities.
May (early)	Evaluation Commission report.
Jul	Election of Host City for 2012 by IOC Session.

Exhibit 4 – Attributable costs and incomes for bidding, preparing, and staging the Games (Arup report 2002)



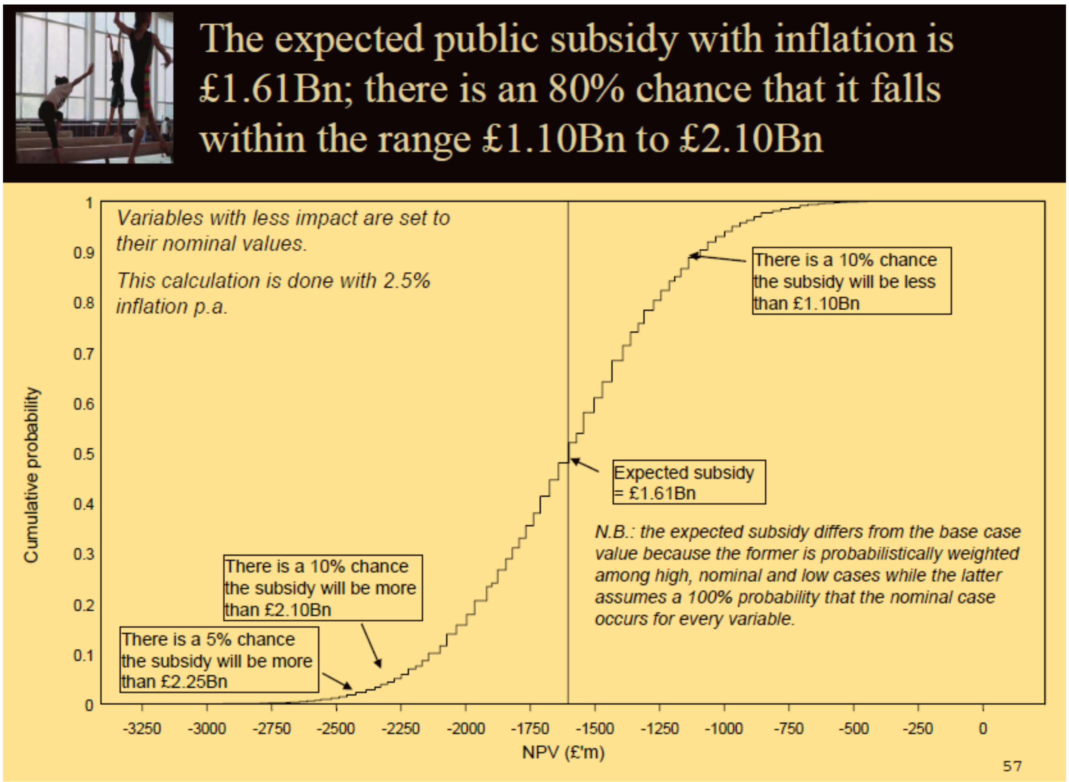
Bidding and staging	*Expenditure*	*Income*	*Balance*
Bid	13	7	– 6
Staging	779	864	85
Elite sport development programme	167	0	– 167
Capital investment in facilities	403	0	– 403
Land purchase (residual value)	325	431	106
Sub-total	1,687	1,302	– 385
Risk	109	0	– 109
Total	1,796	1,302	– 494
Wider benefits	*Expenditure*	*Income*	*Balance*
Additional tourism	103	280 to 610	+280 to +507
Other benefits	0	69	69
Grand total	**1,899**	**1,651 to 1,981**	**– 145 to +82**

Exhibit 5 - Research into Public Opinion by the DCMS (Source: House of Commons, Culture, Media and Sport Committee – Third Report of Session 2002-03 p. 24)



Figures in **bold** were given in the DCMS summary of the survey	Agree strongly	Agree strongly & agree slightly
Negative		
Money better spent on grassroots/school sport in communities	30%	**56%**
Majority of the investment, for example in sporting facilities, will be in London therefore no gain for the rest of the UK	27%	**51%**
Positive		
Hosting Olympics will bring UK prestige and 'feel good' factor	**70%**	94%
Commonwealth Games in Manchester proved UK to have the experience and track record to run a successful Games	**71%**	92%
The hosting of the Olympic Games will bring economic benefits such as more employment and more investment	**60%**	90%
A London Olympic bid will leave a legacy of a redeveloped East London with excellent sporting facilities - **figure given: 60%**	45%	81%
The hosting of the Olympics will create more sporting opportunities for young people	**65%**	88

Exhibit 6 – Conclusions from PwC's report (January 2003)



The expected public subsidy with inflation is £1.61Bn; there is an 80% chance that it falls within the range £1.10Bn to £2.10Bn

Variables with less impact are set to their nominal values.

This calculation is done with 2.5% inflation p.a.

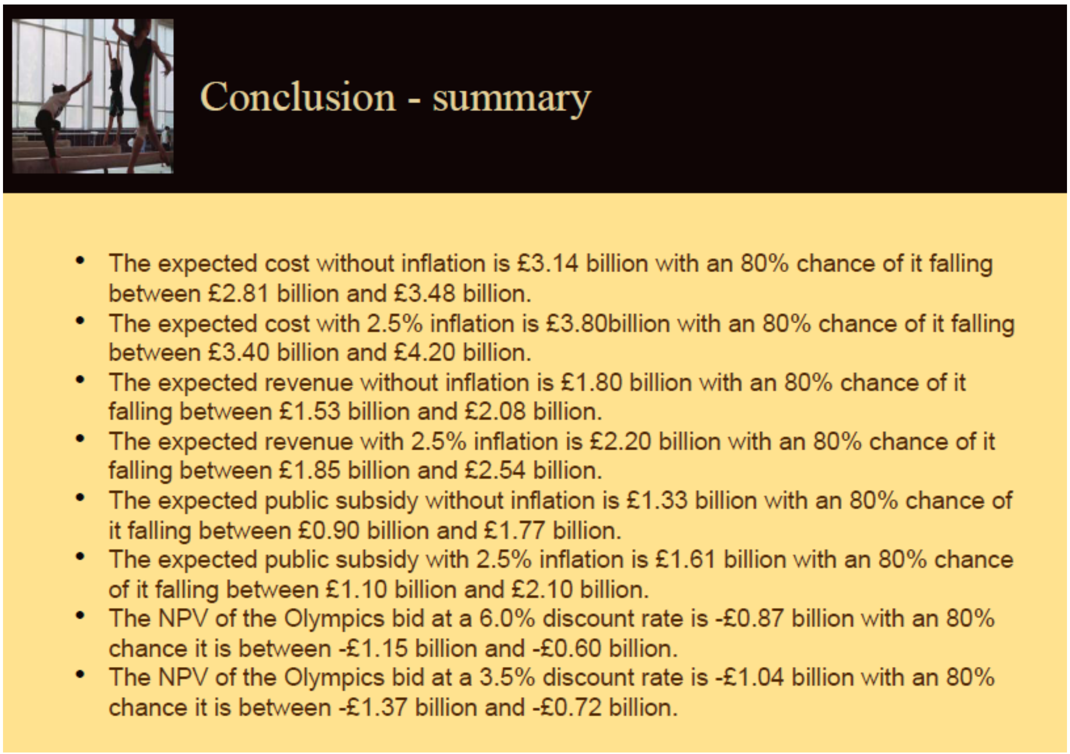
There is a 10% chance the subsidy will be less than £1.10Bn

Expected subsidy = £1.61Bn

N.B.: the expected subsidy differs from the base case value because the former is probabilistically weighted among high, nominal and low cases while the latter assumes a 100% probability that the nominal case occurs for every variable.

There is a 10% chance the subsidy will be more than £2.10Bn

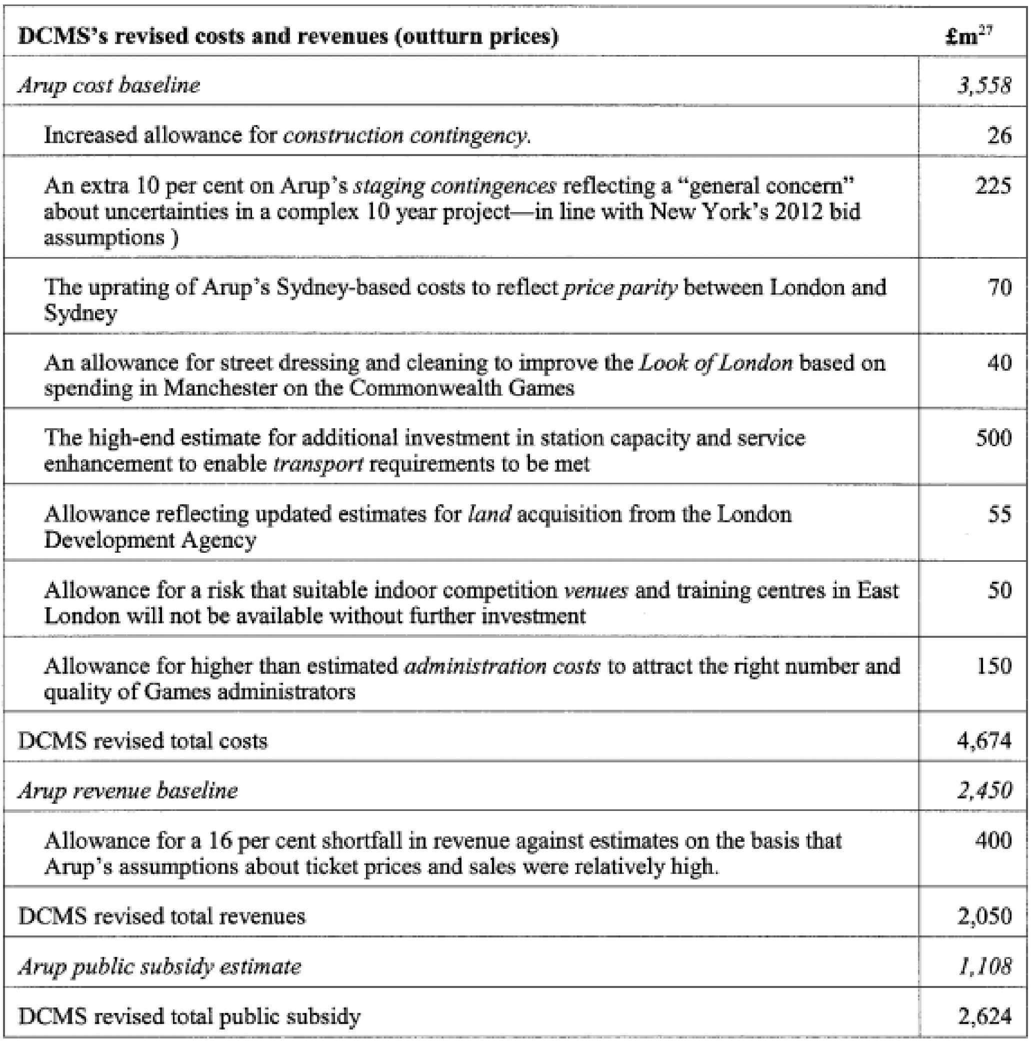
There is a 5% chance the subsidy will be more than £2.25Bn



Conclusion - summary

- The expected cost without inflation is £3.14 billion with an 80% chance of it falling between £2.81 billion and £3.48 billion.
- The expected cost with 2.5% inflation is £3.80billion with an 80% chance of it falling between £3.40 billion and £4.20 billion.
- The expected revenue without inflation is £1.80 billion with an 80% chance of it falling between £1.53 billion and £2.08 billion.
- The expected revenue with 2.5% inflation is £2.20 billion with an 80% chance of it falling between £1.85 billion and £2.54 billion.
- The expected public subsidy without inflation is £1.33 billion with an 80% chance of it falling between £0.90 billion and £1.77 billion.
- The expected public subsidy with 2.5% inflation is £1.61 billion with an 80% chance of it falling between £1.10 billion and £2.10 billion.
- The NPV of the Olympics bid at a 6.0% discount rate is -£0.87 billion with an 80% chance it is between -£1.15 billion and -£0.60 billion.
- The NPV of the Olympics bid at a 3.5% discount rate is -£1.04 billion with an 80% chance it is between -£1.37 billion and -£0.72 billion.

Exhibit 7 – DCMS's revised costs and revenues (outturn prices) (Source: Third Report of Session 2002-2003, House of Commons, Culture, Media and Sport Committee, 2003, p. 16.)



DCMS's revised costs and revenues (outturn prices)	**£m**[27]
Arup cost baseline	*3,558*
Increased allowance for *construction contingency.*	26
An extra 10 per cent on Arup's *staging contingences* reflecting a "general concern" about uncertainties in a complex 10 year project—in line with New York's 2012 bid assumptions)	225
The uprating of Arup's Sydney-based costs to reflect *price parity* between London and Sydney	70
An allowance for street dressing and cleaning to improve the *Look of London* based on spending in Manchester on the Commonwealth Games	40
The high-end estimate for additional investment in station capacity and service enhancement to enable *transport* requirements to be met	500
Allowance reflecting updated estimates for *land* acquisition from the London Development Agency	55
Allowance for a risk that suitable indoor competition *venues* and training centres in East London will not be available without further investment	50
Allowance for higher than estimated *administration costs* to attract the right number and quality of Games administrators	150
DCMS revised total costs	4,674
Arup revenue baseline	*2,450*
Allowance for a 16 per cent shortfall in revenue against estimates on the basis that Arup's assumptions about ticket prices and sales were relatively high.	400
DCMS revised total revenues	2,050
Arup public subsidy estimate	*1,108*
DCMS revised total public subsidy	2,624

Exhibit 8 – London2012 Bid Company Board Management Structure [from Response to the questionnaire for cities applying to become Candidate cities to host the 2012 Games]

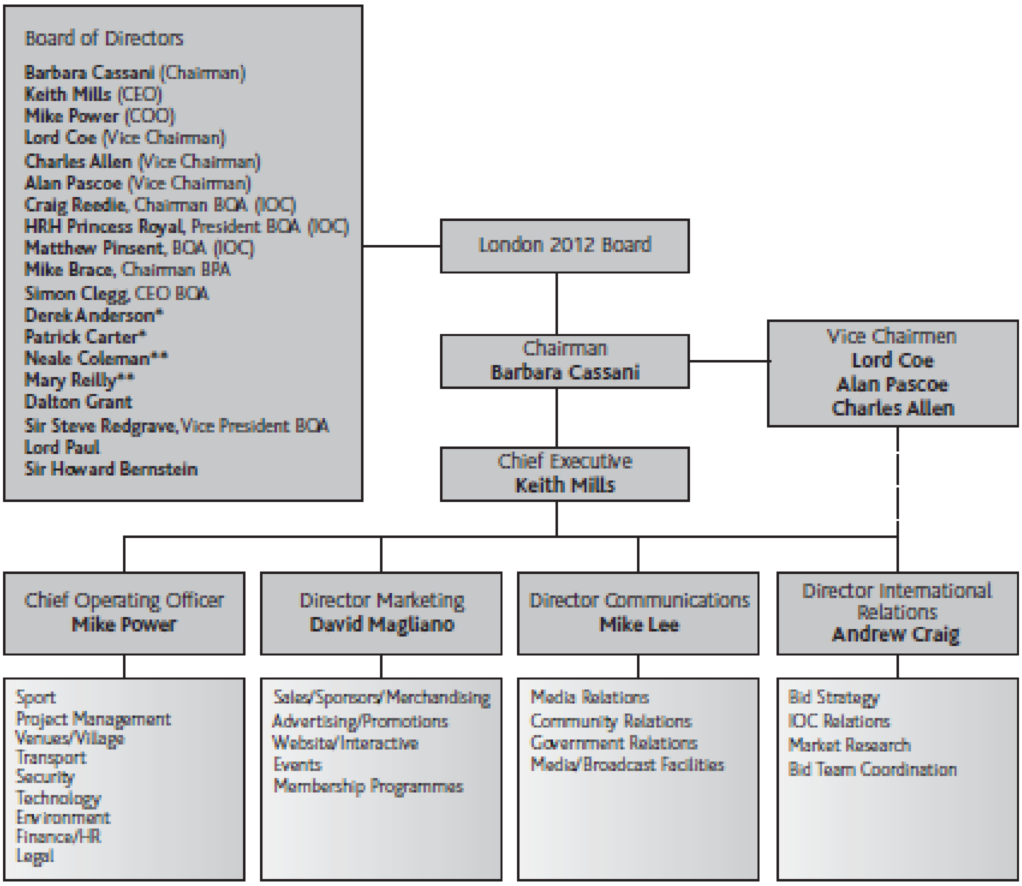
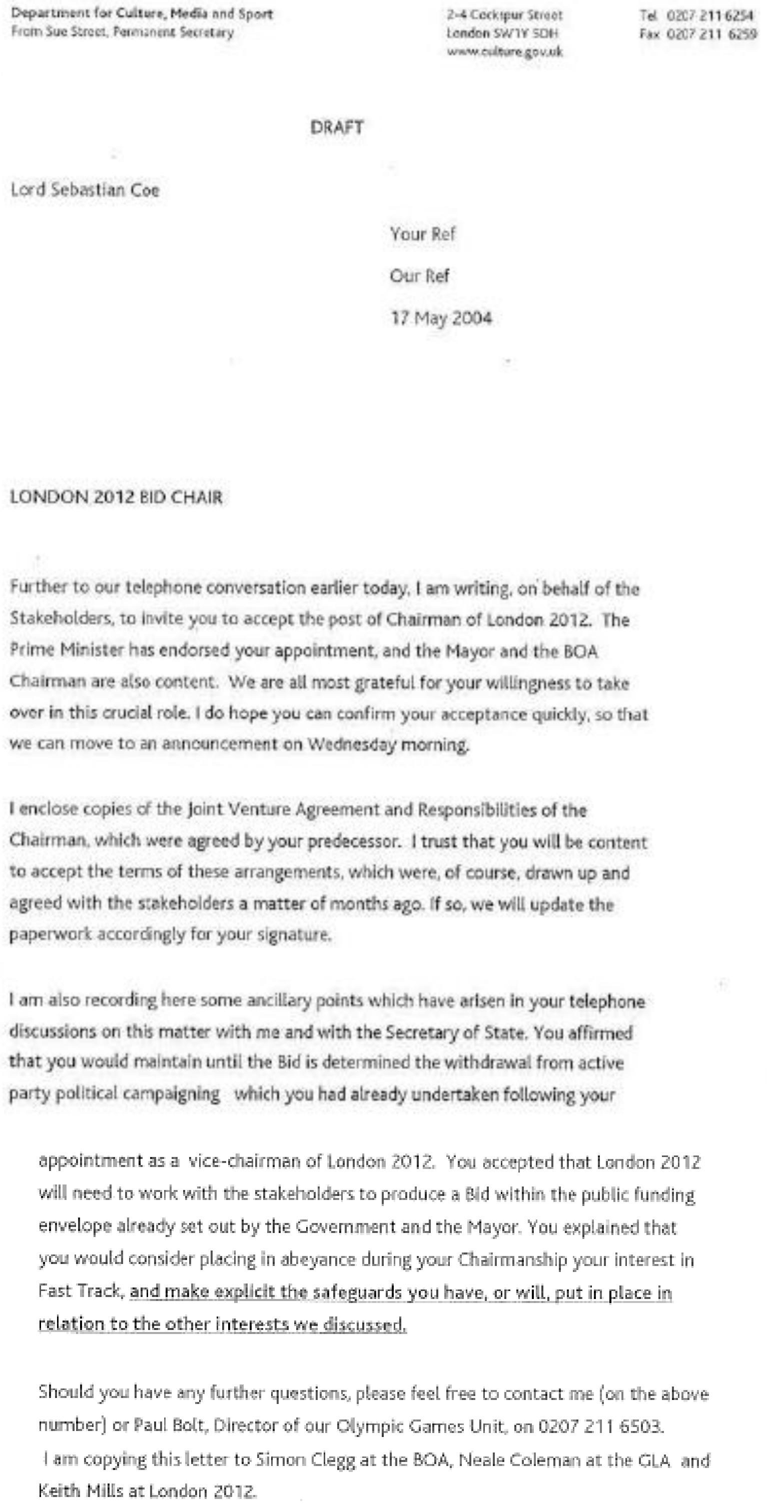

Board of Directors
Barbara Cassani (Chairman)
Keith Mills (CEO)
Mike Power (COO)
Lord Coe (Vice Chairman)
Charles Allen (Vice Chairman)
Alan Pascoe (Vice Chairman)
Craig Reedie, Chairman BOA (IOC)
HRH Princess Royal, President BOA (IOC)
Matthew Pinsent, BOA (IOC)
Mike Brace, Chairman BPA
Simon Clegg, CEO BOA
Derek Anderson*
Patrick Carter*
Neale Coleman**
Mary Reilly**
Dalton Grant
Sir Steve Redgrave, Vice President BOA
Lord Paul
Sir Howard Bernstein
London 2012 Board
Chairman
Barbara Cassani
Vice Chairmen
Lord Coe
Alan Pascoe
Charles Allen
Chief Executive
Keith Mills
Chief Operating Officer
Mike Power
Director Marketing
David Magliano
Director Communications
Mike Lee
Director International Relations
Andrew Craig
Sport
Project Management
Venues/Village
Transport
Security
Technology
Environment
Finance/HR
Legal
Sales/Sponsors/Merchandising
Advertising/Promotions
Website/Interactive
Events
Membership Programmes
Media Relations
Community Relations
Government Relations
Media/Broadcast Facilities
Bid Strategy
IOC Relations
Market Research
Bid Team Coordination

Exhibit 9 - DCMS letter to Lord Sebastian Coe, 17 May 2004



Department for Culture, Media and Sport
From Sue Street, Permanent Secretary

2-4 Cockspur Street
London SW1Y 5DH
www.culture.gov.uk

Tel 0207 211 6254
Fax 0207 211 6259

DRAFT

Lord Sebastian Coe

Your Ref

Our Ref

17 May 2004

LONDON 2012 BID CHAIR

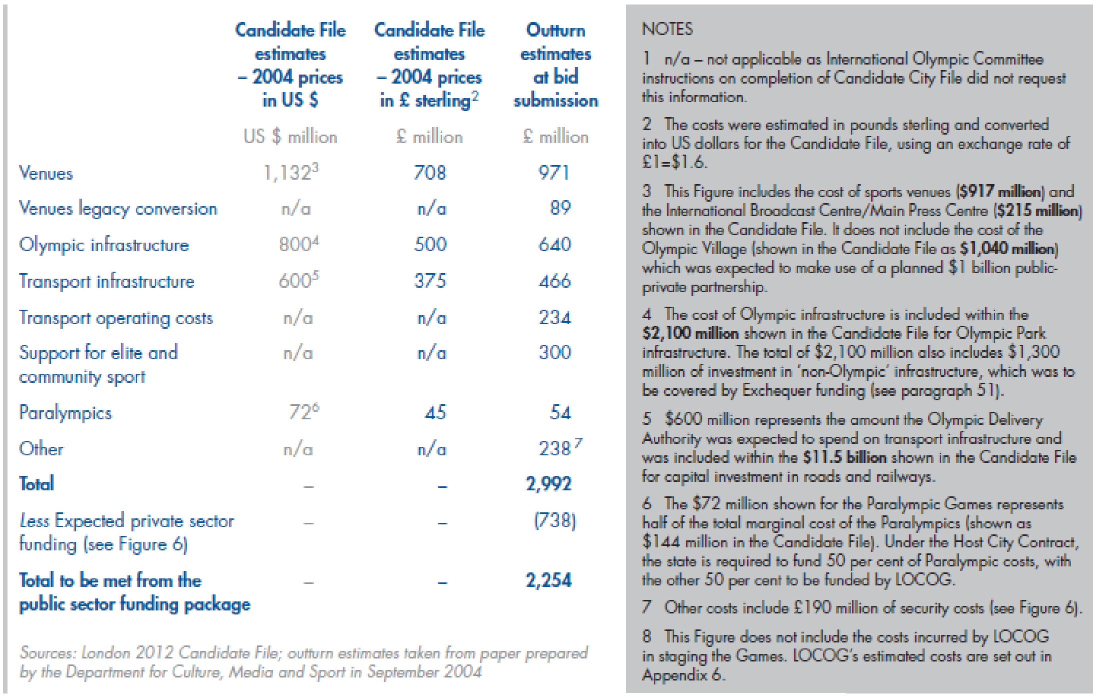
Further to our telephone conversation earlier today, I am writing, on behalf of the Stakeholders, to invite you to accept the post of Chairman of London 2012. The Prime Minister has endorsed your appointment, and the Mayor and the BOA Chairman are also content. We are all most grateful for your willingness to take over in this crucial role. I do hope you can confirm your acceptance quickly, so that we can move to an announcement on Wednesday morning.

I enclose copies of the Joint Venture Agreement and Responsibilities of the Chairman, which were agreed by your predecessor. I trust that you will be content to accept the terms of these arrangements, which were, of course, drawn up and agreed with the stakeholders a matter of months ago. If so, we will update the paperwork accordingly for your signature.

I am also recording here some ancillary points which have arisen in your telephone discussions on this matter with me and with the Secretary of State. You affirmed that you would maintain until the Bid is determined the withdrawal from active party political campaigning which you had already undertaken following your appointment as a vice-chairman of London 2012. You accepted that London 2012 will need to work with the stakeholders to produce a Bid within the public funding envelope already set out by the Government and the Mayor. You explained that you would consider placing in abeyance during your Chairmanship your interest in Fast Track, and make explicit the safeguards you have, or will, put in place in relation to the other interests we discussed.

Should you have any further questions, please feel free to contact me (on the above number) or Paul Bolt, Director of our Olympic Games Unit, on 0207 211 6503.
I am copying this letter to Simon Clegg at the BOA, Neale Coleman at the GLA and Keith Mills at London 2012.

Exhibit 10 – Estimates at the time of the bid of the cost to be covered by the Public Sector Funding Package for the 2012 Games National Audit Office report 2007 *Preparations for the London 2012 Olympic and Paralympic Games – Risk assessment and management, REPORT BY THE COMPTROLLER AND AUDITOR GENERAL,HC 252 Session 2006-2007, 2 February 2007*



	Candidate File estimates – 2004 prices in US $	Candidate File estimates – 2004 prices in £ sterling[2]	Outturn estimates at bid submission
	US $ million	£ million	£ million
Venues	1,132[3]	708	971
Venues legacy conversion	n/a	n/a	89
Olympic infrastructure	800[4]	500	640
Transport infrastructure	600[5]	375	466
Transport operating costs	n/a	n/a	234
Support for elite and community sport	n/a	n/a	300
Paralympics	72[6]	45	54
Other	n/a	n/a	238[7]
Total	–	–	**2,992**
Less Expected private sector funding (see Figure 6)	–	–	(738)
Total to be met from the public sector funding package	–	–	**2,254**

Sources: London 2012 Candidate File; outturn estimates taken from paper prepared by the Department for Culture, Media and Sport in September 2004

NOTES

1 n/a – not applicable as International Olympic Committee instructions on completion of Candidate City File did not request this information.

2 The costs were estimated in pounds sterling and converted into US dollars for the Candidate File, using an exchange rate of £1=$1.6.

3 This Figure includes the cost of sports venues (**$917 million**) and the International Broadcast Centre/Main Press Centre (**$215 million**) shown in the Candidate File. It does not include the cost of the Olympic Village (shown in the Candidate File as **$1,040 million**) which was expected to make use of a planned $1 billion public-private partnership.

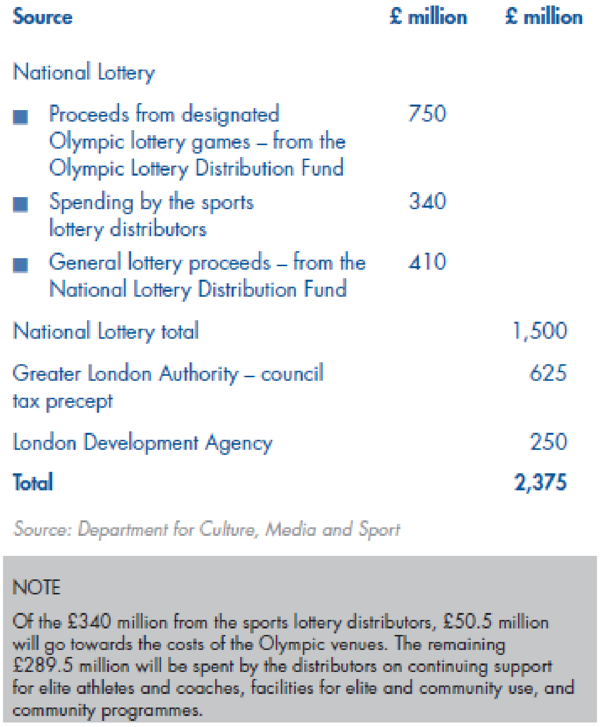
4 The cost of Olympic infrastructure is included within the **$2,100 million** shown in the Candidate File for Olympic Park infrastructure. The total of $2,100 million also includes $1,300 million of investment in 'non-Olympic' infrastructure, which was to be covered by Exchequer funding (see paragraph 51).

5 $600 million represents the amount the Olympic Delivery Authority was expected to spend on transport infrastructure and was included within the **$11.5 billion** shown in the Candidate File for capital investment in roads and railways.

6 The $72 million shown for the Paralympic Games represents half of the total marginal cost of the Paralympics (shown as $144 million in the Candidate File). Under the Host City Contract, the state is required to fund 50 per cent of Paralympic costs, with the other 50 per cent to be funded by LOCOG.

7 Other costs include £190 million of security costs (see Figure 6).

8 This Figure does not include the costs incurred by LOCOG in staging the Games. LOCOG's estimated costs are set out in Appendix 6.



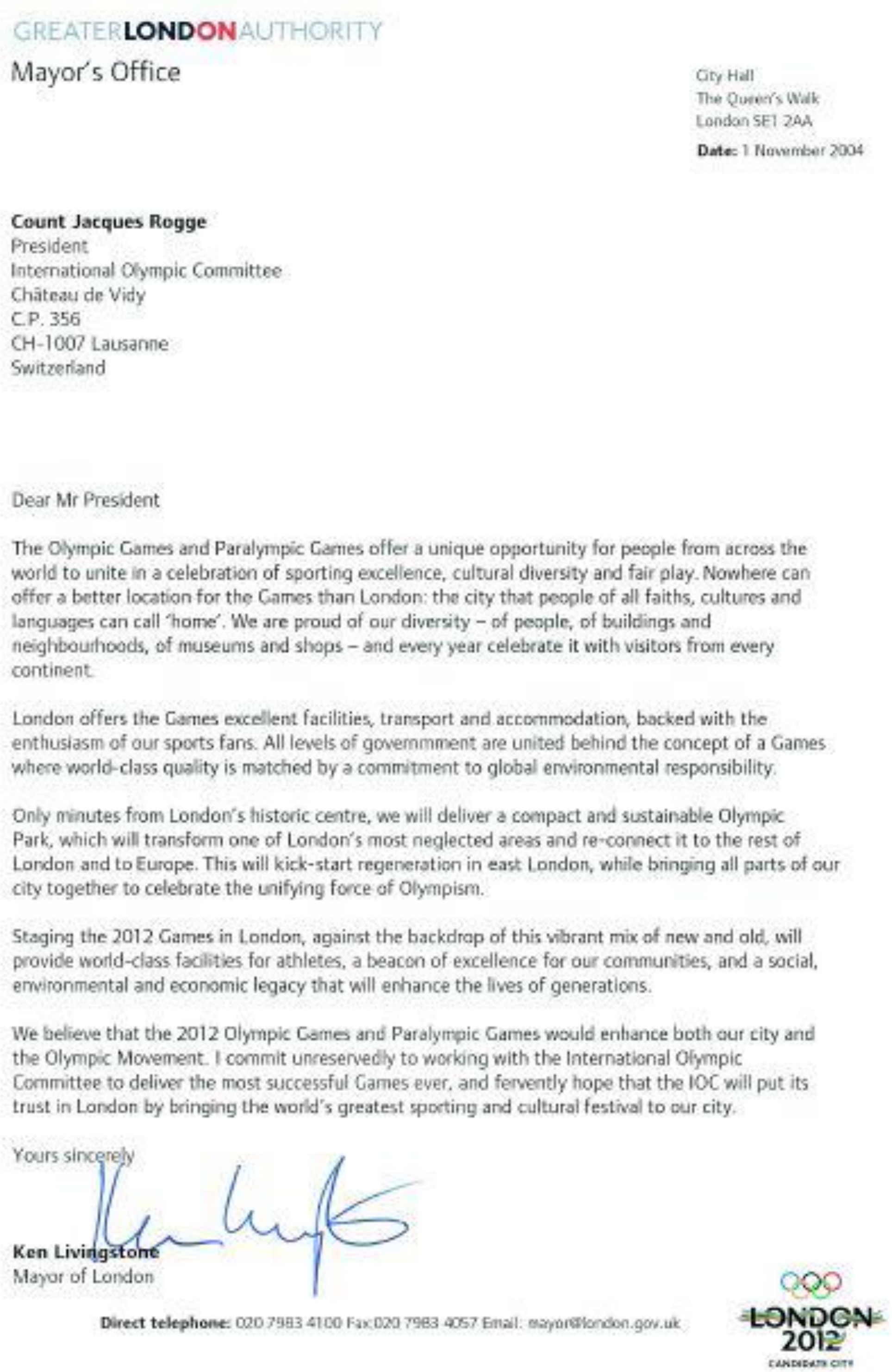
Source	**£ million**	**£ million**
National Lottery		
■ Proceeds from designated Olympic lottery games – from the Olympic Lottery Distribution Fund	750	
■ Spending by the sports lottery distributors	340	
■ General lottery proceeds – from the National Lottery Distribution Fund	410	
National Lottery total		1,500
Greater London Authority – council tax precept		625
London Development Agency		250
Total		**2,375**

Source: Department for Culture, Media and Sport

NOTE

Of the £340 million from the sports lottery distributors, £50.5 million will go towards the costs of the Olympic venues. The remaining £289.5 million will be spent by the distributors on continuing support for elite athletes and coaches, facilities for elite and community use, and community programmes.

Exhibit 11- Bid book Mayor of London's letter of endorsement



GREATER**LONDON**AUTHORITY
Mayor's Office

City Hall
The Queen's Walk
London SE1 2AA

Date: 1 November 2004

Count Jacques Rogge
President
International Olympic Committee
Château de Vidy
C.P. 356
CH-1007 Lausanne
Switzerland

Dear Mr President

The Olympic Games and Paralympic Games offer a unique opportunity for people from across the world to unite in a celebration of sporting excellence, cultural diversity and fair play. Nowhere can offer a better location for the Games than London: the city that people of all faiths, cultures and languages can call 'home'. We are proud of our diversity – of people, of buildings and neighbourhoods, of museums and shops – and every year celebrate it with visitors from every continent.

London offers the Games excellent facilities, transport and accommodation, backed with the enthusiasm of our sports fans. All levels of governmment are united behind the concept of a Games where world-class quality is matched by a commitment to global environmental responsibility.

Only minutes from London's historic centre, we will deliver a compact and sustainable Olympic Park, which will transform one of London's most neglected areas and re-connect it to the rest of London and to Europe. This will kick-start regeneration in east London, while bringing all parts of our city together to celebrate the unifying force of Olympism.

Staging the 2012 Games in London, against the backdrop of this vibrant mix of new and old, will provide world-class facilities for athletes, a beacon of excellence for our communities, and a social, environmental and economic legacy that will enhance the lives of generations.

We believe that the 2012 Olympic Games and Paralympic Games would enhance both our city and the Olympic Movement. I commit unreservedly to working with the International Olympic Committee to deliver the most successful Games ever, and fervently hope that the IOC will put its trust in London by bringing the world's greatest sporting and cultural festival to our city.

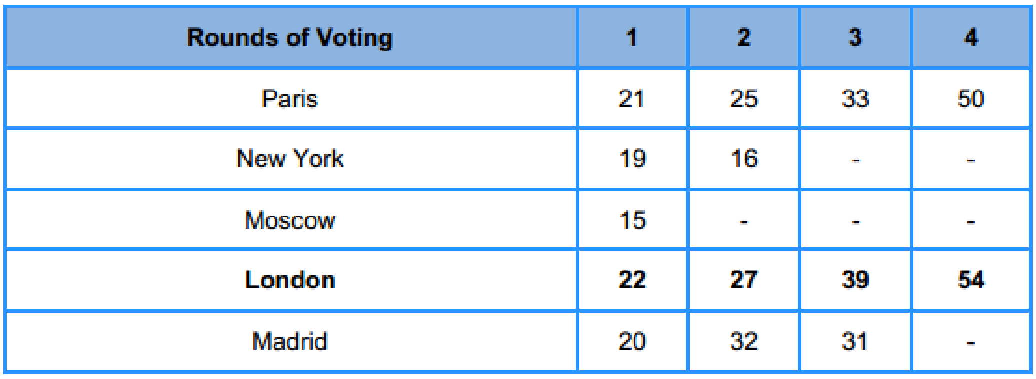
Yours sincerely

Ken Livingstone
Mayor of London

Direct telephone: 020 7983 4100 Fax:020 7983 4057 Email: mayor@london.gov.uk

LONDON 2012
CANDIDATE CITY

Exhibit 12 –IOC's Rounds of voting



Rounds of Voting	**1**	**2**	**3**	**4**
Paris	21	25	33	50
New York	19	16	-	-
Moscow	15	-	-	-
London	**22**	**27**	**39**	**54**
Madrid	20	32	31	-

Exhibit 13 – Overall transitional system of relationships and the chain of accountability [9 August 2005 Letter from the Mayor of London to the Chief Executive of the London development Agency on the "Direction and Delegation to the London Development Agency"]

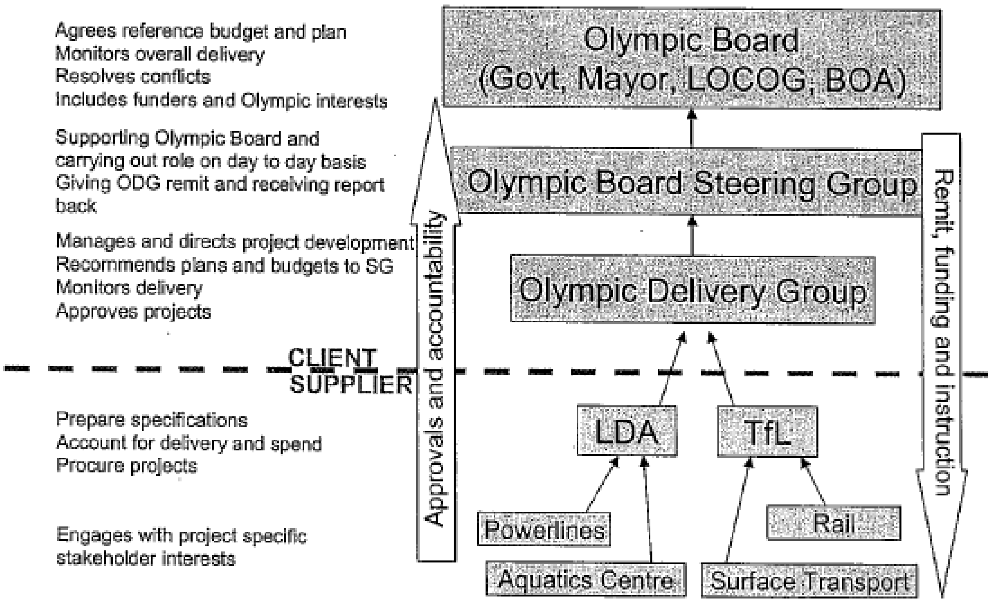

Agrees reference budget and plan
Monitors overall delivery
Resolves conflicts
Includes funders and Olympic interests
Supporting Olympic Board and carrying out role on day to day basis
Giving ODG remit and receiving report back
Manages and directs project development
Recommends plans and budgets to SG
Monitors delivery
Approves projects
CLIENT
SUPPLIER
Prepare specifications
Account for delivery and spend
Procure projects
Engages with project specific stakeholder interests
Approvals and accountability
Olympic Board (Govt, Mayor, LOCOG, BOA)
Olympic Board Steering Group
Olympic Delivery Group
LDA
TfL
Powerlines
Aquatics Centre
Rail
Surface Transport
Remit, funding and instruction

Exhibit 14 - iODA Proposed structure [LDA report No. 6 to Olympic Delivery Committee, August 2005]

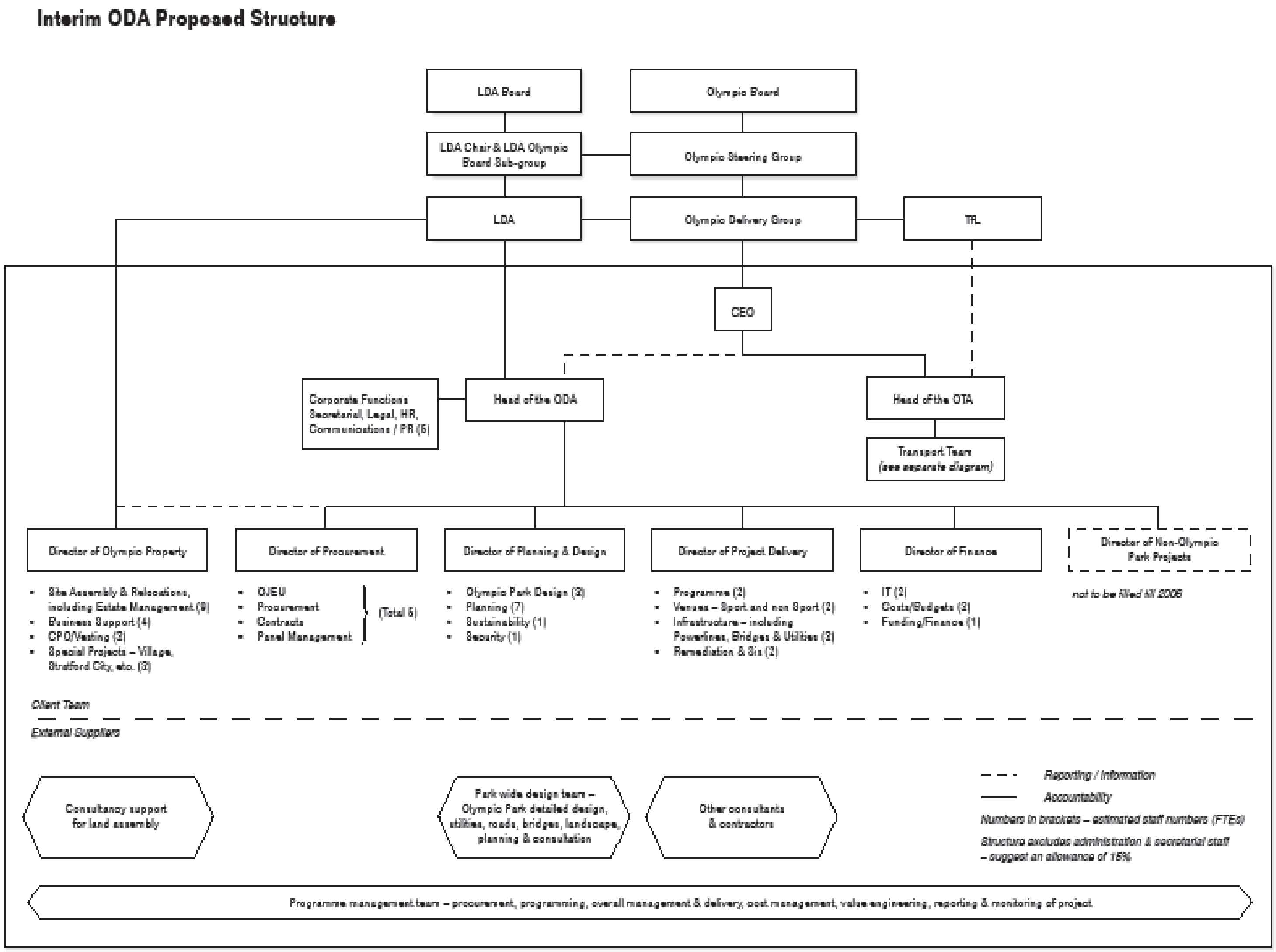
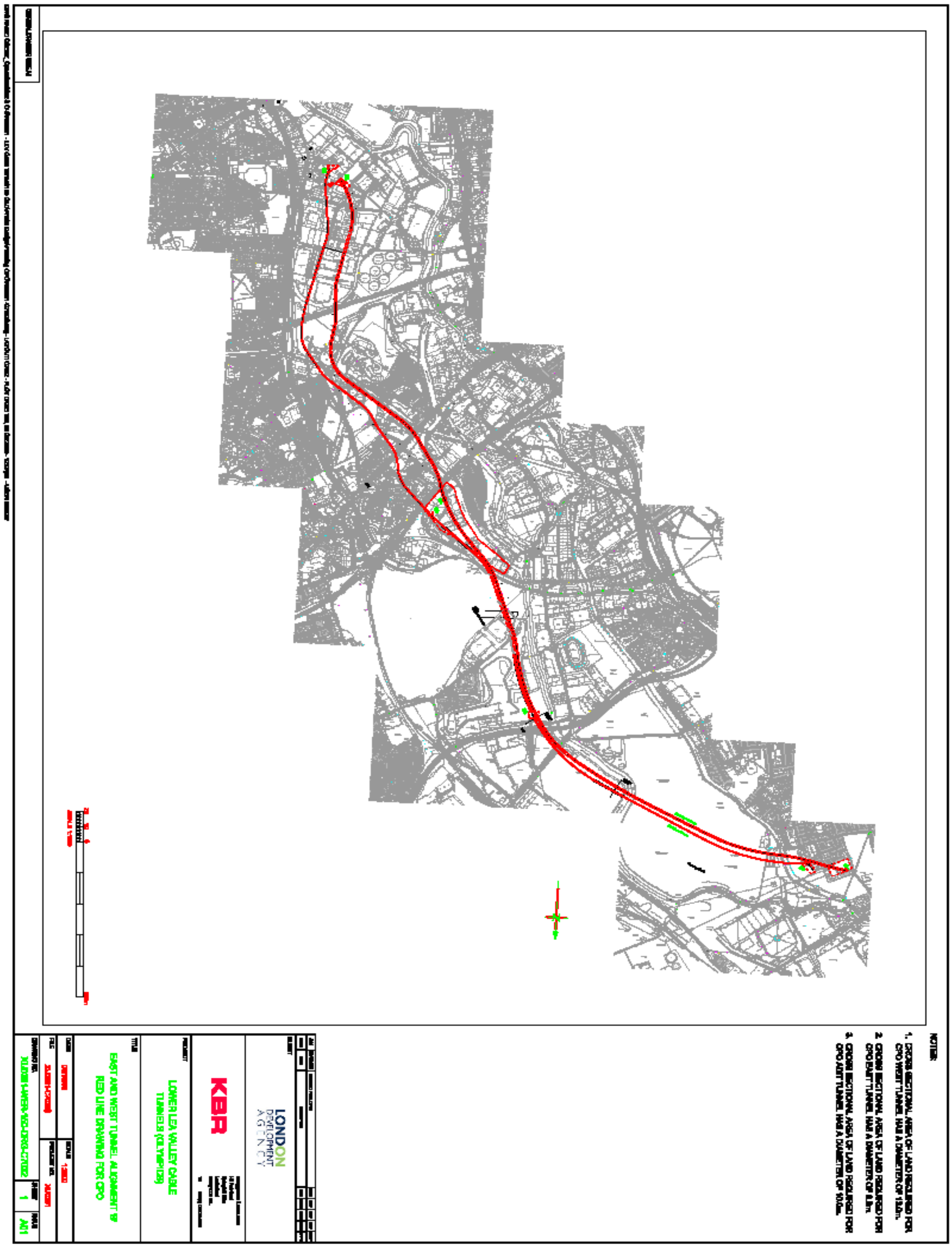

Interim ODA Proposed Structure
LDA Board
Olympic Board
LDA Chair & LDA Olympic Board Sub-group
Olympic Steering Group
LDA
Olympic Delivery Group
TfL
CEO
Corporate Functions Secretarial, Legal, HR, Communications / PR (5)
Head of the ODA
Head of the OTA
Transport Team (see separate diagram)
Director of Olympic Property
Director of Procurement
Director of Planning & Design
Director of Project Delivery
Director of Finance
Director of Non-Olympic Park Projects
Site Assembly & Relocations, including Estate Management (9)
Business Support (4)
CPO/Vesting (2)
Special Projects – Village, Stratford City, etc. (3)
OJEU
Procurement
Contracts
Panel Management
(Total 5)
Olympic Park Design (3)
Planning (7)
Sustainability (1)
Security (1)
Programme (2)
Venues – Sport and non Sport (2)
Infrastructure – including Powerlines, Bridges & Utilities (2)
Remediation & Sis (2)
IT (2)
Costs/Budgets (2)
Funding/Finance (1)
not to be filled till 2006
Client Team
External Suppliers
Consultancy support for land assembly
Park wide design team – Olympic Park detailed design, utilities, roads, bridges, landscape, planning & consultation
Other consultants & contractors
Reporting / Information
Accountability
Numbers in brackets – estimated staff numbers (FTEs)
Structure excludes administration & secretarial staff – suggest an allowance of 15%
Programme management team – procurement, programming, overall management & delivery, cost management, value engineering, reporting & monitoring of project.

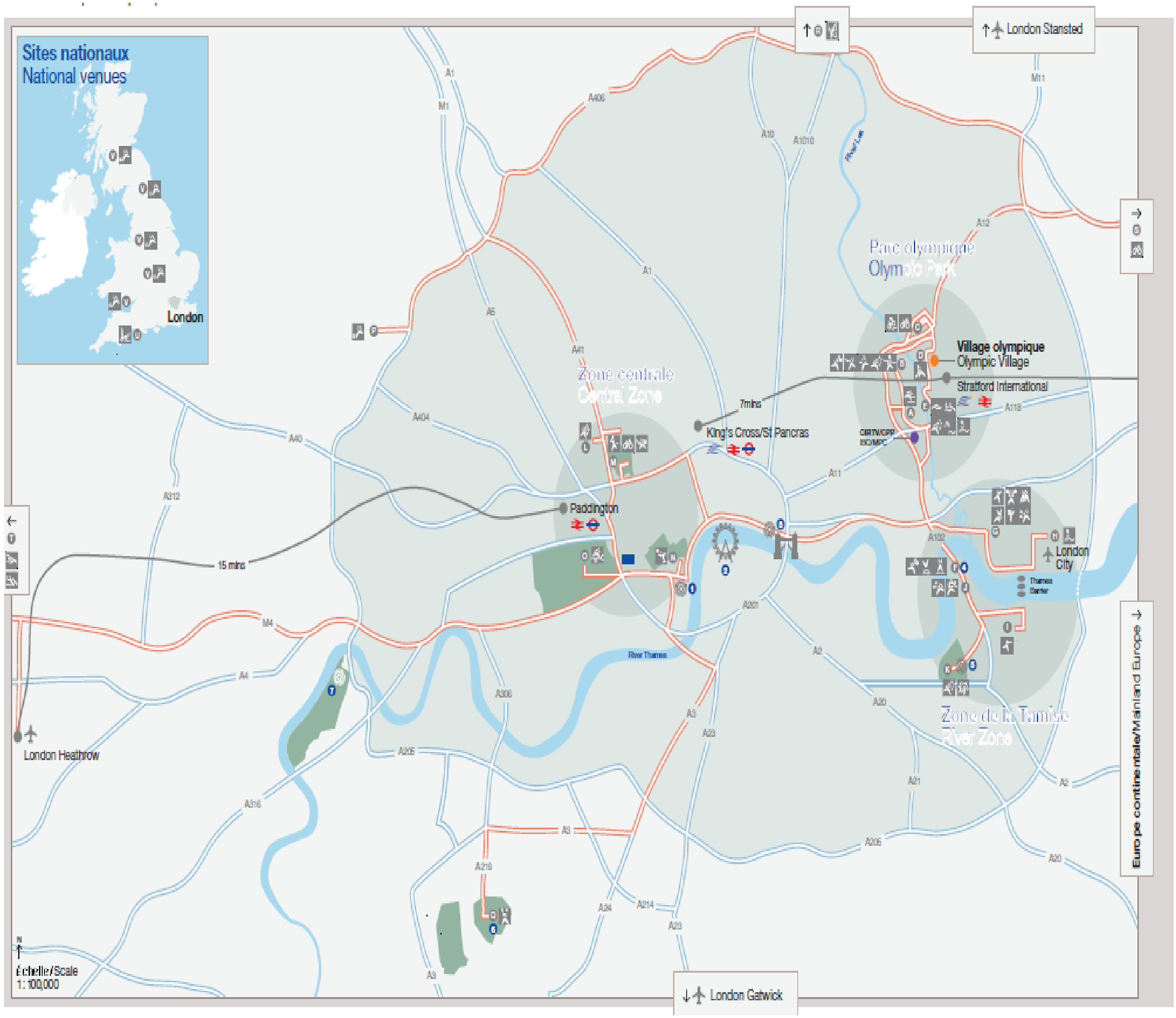
Exhibit 15 - CPO boundaries for project to underground two sets of overhead power lines


LONDON DEVELOPMENT AGENCY
KBR
PROJECT
LOWER LEA VALLEY CABLE TUNNELS (OLYMPICS)
TITLE
EAST AND WEST TUNNEL ALIGNMENT &
RED LINE DRAWING FOR CPO
SCALE
SHEET
1
REV
A01

NOTES:

1. CROSS SECTIONAL AREA OF LAND REQUIRED FOR CPO WEST TUNNEL HAS A DIAMETER OF 13.0m.
2. CROSS SECTIONAL AREA OF LAND REQUIRED FOR CPO EAST TUNNEL HAS A DIAMETER OF 8.8m.
3. CROSS SECTIONAL AREA OF LAND REQUIRED FOR CPO ADIT TUNNEL HAS A DIAMETER OF 10.0m.

Exhibit 16 – Conceptual Map and Olympic park (London 2012 bid book)


Sites nationaux
National venues
London
Parc olympique
Olympic Park
Village olympique
Olympic Village
Stratford International
Zone centrale
Central Zone
King's Cross/St Pancras
7mins
Paddington
15 mins
London Heathrow
River Thames
River Lea
CIBTV/CPP
IBC/MPC
London City
Thames Barrier
Zone de la Tamise
River Zone
London Stansted
London Gatwick
Europe continentale/Mainland Europe
Échelle/Scale
1:100,000
N
A1
M1
A406
A10
A1010
A12
M11
A5
A41
A404
A40
A312
M4
A4
A306
A205
A316
A3
A219
A24
A214
A23
A201
A2
A20
A21
A102
A11
A118
A13

Parc olympique
Olympic Park

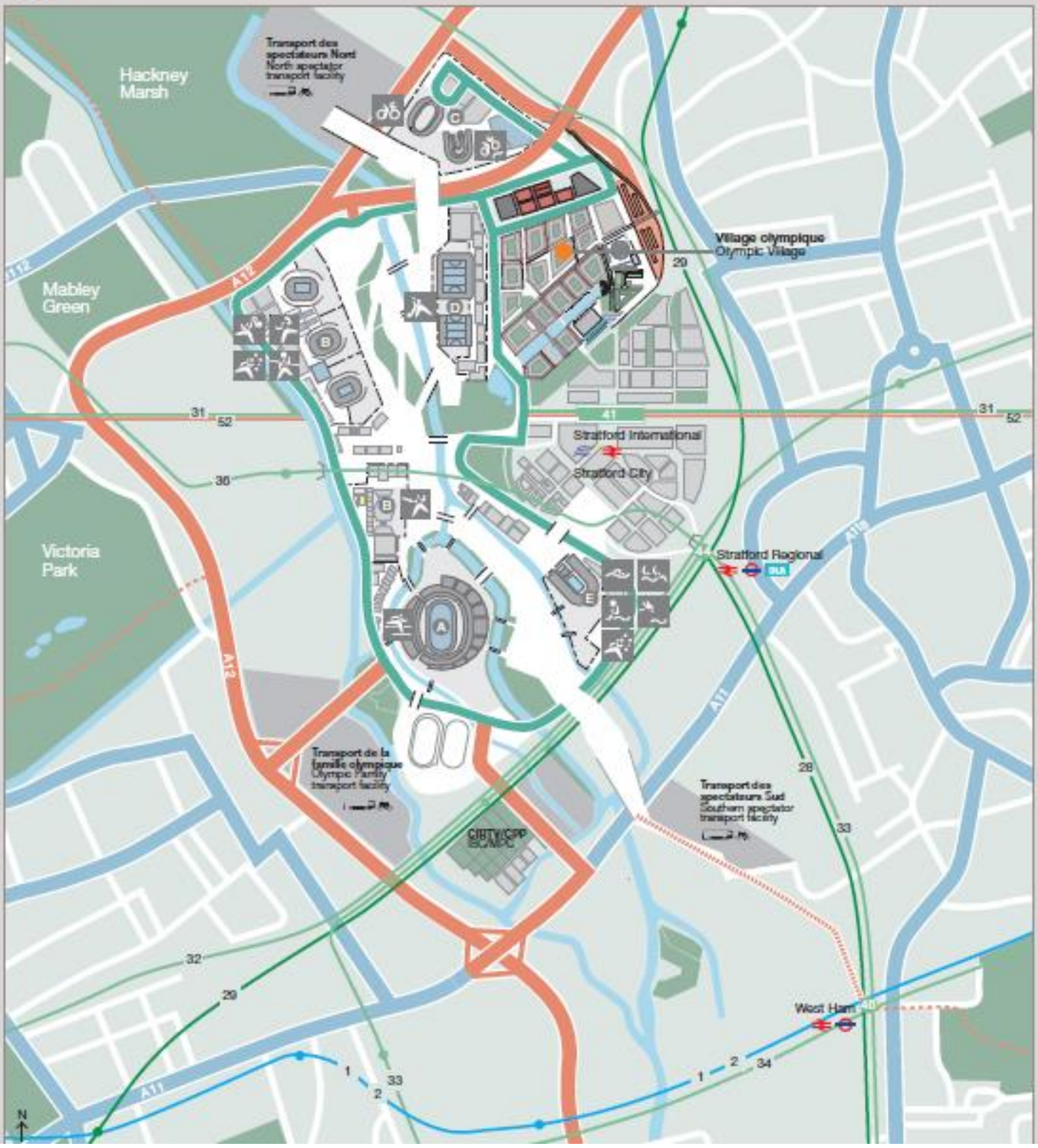

Transport des spectateurs Nord
North spectator transport facility
Hackney Marsh
C
Village olympique
Olympic Village
29
A112
Mabley Green
A12
D
B
31
52
41
Stratford International
Stratford City
36
B
Stratford Regional
DLR
Victoria Park
E
A
A12
A11
A11b
Transport de la famille olympique
Olympic Family transport facility
Transport des spectateurs Sud
Southern spectator transport facility
28
33
CIRTV/CPP
IBC/MPC
32
29
West Ham
1
2
33
1
2
34
A11
N

Exhibit 17 –Olympic stadium and park (London 2012 bid book)

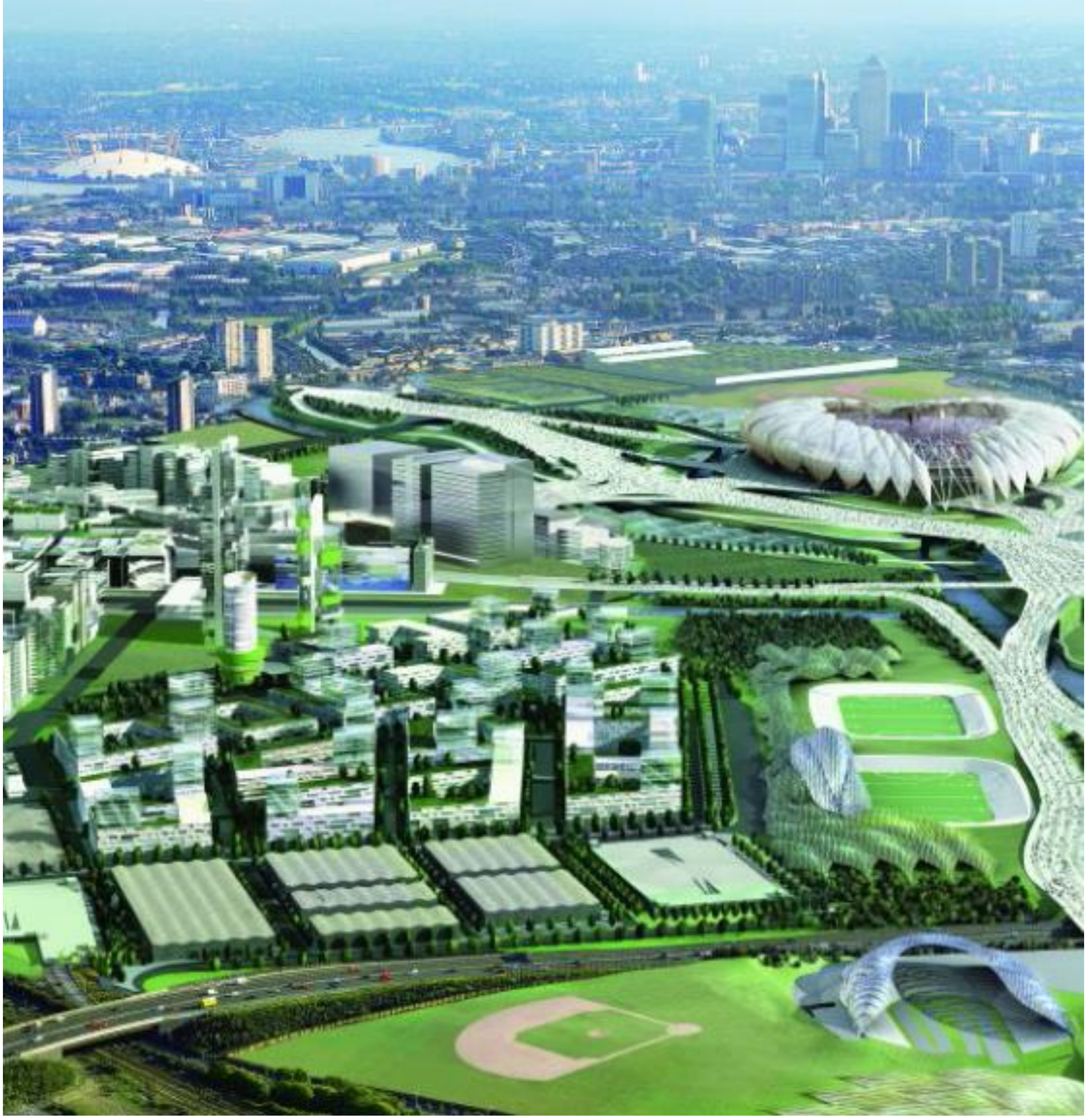
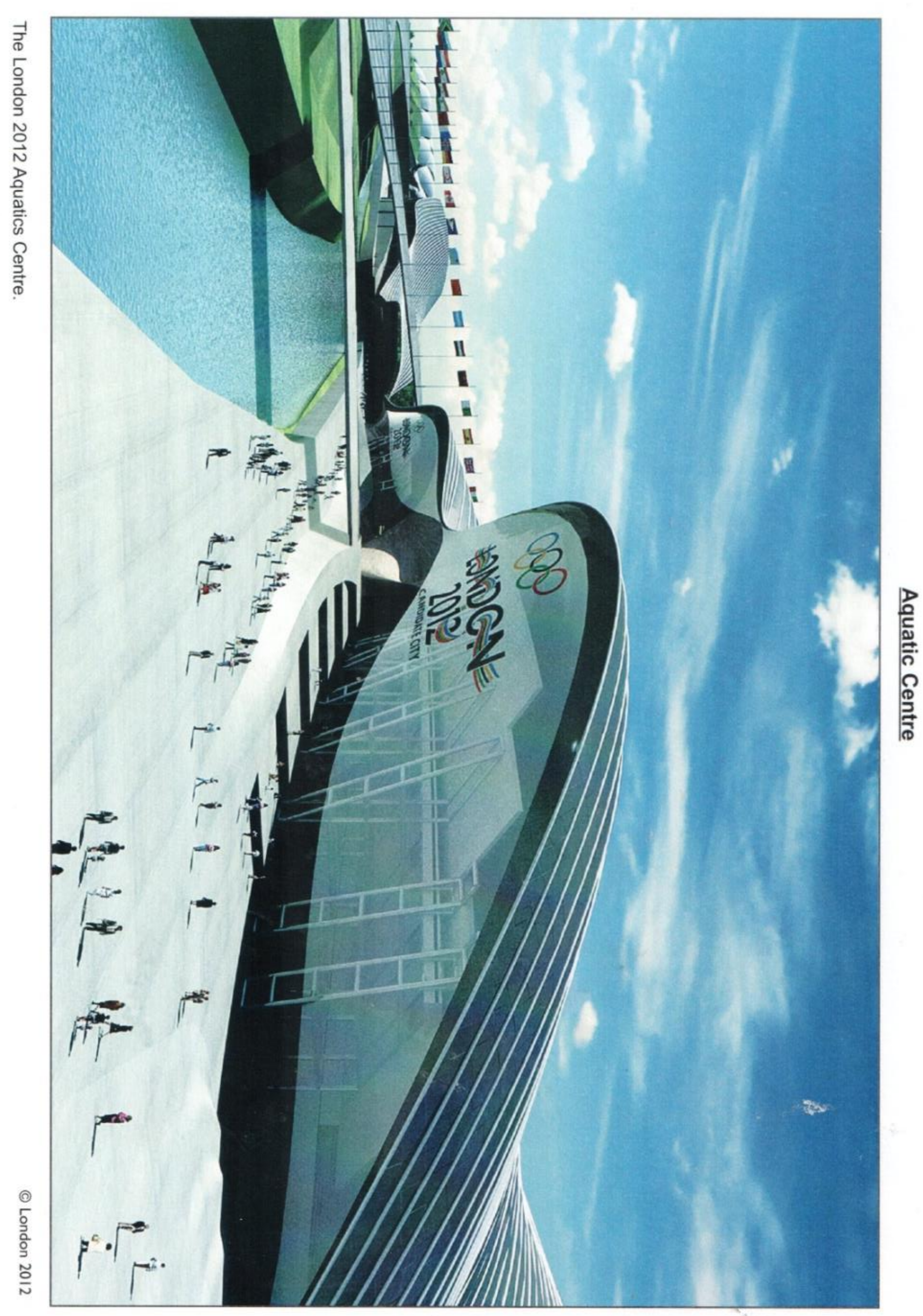


Exhibit 18 – The Aquatics centre (renderings produced for London 2012 bid book)


Aquatic Centre

The London 2012 Aquatics Centre.

© London 2012
LONDON 2012
CANDIDATE CITY

Exhibit 19 - Olympic Village (London 2012 bid book)

Plan du village paralympique/Paralympic Village plan
Blocs inoccupés
Unused blocks
Hébergement
Officiels techniques
Technical officials
accommodation
LONDON 2012