Dynamic capabilities in complex projects: the case of London Heathrow terminal 5


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DYNAMIC CAPABILITIES IN COMPLEX PROJECTS: 
THE CASE OF LONDON HEATHROW TERMINAL 5

ABSTRACT

Whereas existing approaches and empirical studies of dynamic capabilities focus on the strategic innovation activities of firms (i.e., permanent organizations executing multiple projects and programs), this article identifies how certain types of dynamic capabilities are required to deliver large, complex, and risky projects. Our longitudinal study of the design and construction of Heathrow Airport Terminal 5 by the British Airports Authority (BAA) makes three main contributions to the literature: (1) It contributes to the project management literature by identifying how specific dynamic capabilities (BAA’s “T5 Agreement,” strategic behaviors, and collaborative processes) are developed through a three-phase process (building, codifying, and mobilizing) to support the strategic management of complex projects; (2) While emphasizing their importance for the successful management of complex projects, our findings also underline the continuing fragility of dynamic capabilities; (3) The case study reveals their fluidity and balancing role with respect to demands for stability and change in complex, uncertain, and volatile project environments.
KEYWORDS: dynamic capabilities; complex projects; risk and uncertainty; owner operator

Introduction

Firms rely on dynamic capabilities to survive, grow, and compete in an evolving technological, market, and regulatory environment. Dynamic capabilities refer to the strategic innovation processes used to adapt, integrate, and reconfigure a firm’s competences, resources, and routines in response to rapidly changing and volatile conditions (Collis, 1994; Teece, Pisano, & Shuen, 1997; Pisano, 2000; Eisenhardt & Martin, 2000; Helfat, 2000; Winter, 2000; Zollo & Winter, 2002; Helfat & Peteraf, 2003, Teece, 2007, 2012; Schreyögg & Kliesch-Eberl, 2007). Research suggests that dynamic capabilities are required to support organizational ambidexterity by exploring innovation and adapting to rapidly changing environment, while at the same time exploiting current capabilities and routines under stable and predictable conditions (O’Reilly & Tushman, 2008). Despite their centrality in the field, dynamic capabilities remain an amorphous concept for many researchers and managers, which is rarely empirically grounded. Reviews of the literature, including Easterby-Smith, Lyles, and Peteraf (2009) and Winter (2012) call for more in-depth qualitative studies of how dynamic capabilities are created and applied over time in different organizational contexts.

The concept has been applied in the project management literature to identify how firms deploy multiple projects for existing customers and launch innovative projects to develop new technologies and create new markets (Gann & Salter, 2000; Davies & Brady, 2000; Brady & Davies, 2004; Ethiraj, Kale, Krishnan, & Singh, 2005; Söderlund & Tell, 2009; Cattini, Ferriani, Frederiksen, & Täube, 2011). Shamsie, Martin, and Miller identify how firms in project-based industries develop the dynamic capabilities to strike a balance between replication and renewal strategies (Shamsie, et al., 2009). Several authors have studied the role of ambidexterity in project-based organizing (Pellegrinelli, Murray-Webster, & Turner, 2014; Turner, Maylor, & Swart, 2014; Turner, Maylor, Lee-Kelley, Brady, Kutsch, & Carver, 2014), but have not yet framed their research using dynamic capabilities theory.

In this article, we respond to a call for further work to understand how dynamic capabilities emerge, evolve, and are applied in different project-based domains (Winch, 2014). Prior research neglects to consider the possibility that organizations establish dynamic capabilities to manage a large, one-off complex project (e.g., airports, urban railway systems, big science experiments, global sporting events, and other large-scale projects) over a defined, yet often extended period of time. We conducted a longitudinal study of how the British Airports
Authority (BAA), a project owner and operator, developed and applied dynamic capabilities to design and deliver the highly complex and uncertain £4.3 billion ($8.5 billion) Heathrow Terminal 5 (T5).

Although the T5 case is addressed in previous research (Davies, Gann, & Douglas, 2009; Gil, 2009; Gil & Tether, 2011; Gil, Miozzo, & Massini, 2012; Brady & Davies, 2014), none of these studies has examined how dynamic capabilities were developed and deployed to manage the project. When the T5 project started in 2002, the investment was equivalent to approximately two-thirds of BAA’s capital value. The project was crucial for the firm’s survival. It is a compelling case, because the project had to be delivered in a radically new way to avoid the huge delays and cost overruns experienced on other major UK civil engineering and international airport projects in the years preceding it. In response to this challenge, the BAA created a separate organization and embodied its dynamic capability in the “T5 Agreement,” a set of flexible, adaptive, and collaborative structures and processes for dealing with uncertain and changing conditions. By balancing innovation and routine action over a fixed period of time, BAA’s dynamic capabilities contributed to the successful construction of the project, but were unable to prevent the chaotic handover to an operating terminal building.

Our study contributes to the project management literature by identifying the three phases in a process—building, codifying, and mobilizing—showing how firms create dynamic capabilities to manage a large complex project. By highlighting the contested role of dynamic capabilities and their vulnerability to breakdown, we emphasize their continuing fragility. We also contribute to the dynamic capabilities literature by providing an in-depth case study emphasizing the fluidity of dynamic capabilities and their balancing role with respect to demands for stability and change in complex, uncertain, and volatile environments.
Dynamic Capabilities and Project Organizing

This section introduces the main theoretical perspectives underpinning the concept of dynamic capabilities and its application to project management research.

Theoretical Perspectives on Dynamic Capabilities

Dynamic capability is an important and influential concept in management research. Yet research on the topic is often criticized for the lack of consensus on basic theoretical elements, conceptual ambiguity, and scarce empirical evidence (Easterby-Smith, Lyles, & Peteraf, 2009; Peteraf, Di Stefano, & Verona, 2013). The majority of the published research on dynamic capabilities is grounded in the resource-based view of the firm (Penrose, 1959; Wernerfelt, 1984; Barney, 1991) and inspired by two main papers (Teece et al, 1997; Eisenhardt & Martin, 2000). Another important stream of research is influenced by evolutionary theory and research on organizational routines (Nelson & Winter, 1982; Zollo & Winter, 2002; Helfat & Peteraf, 2003). Both theoretical perspectives emphasize that dynamic capabilities are learned, patterned, and repetitive activities embodied in strategic processes and routines.

Dynamic capabilities research informed by the resource-based view perspective falls into two main clusters of literature (Peteraf et al., 2013). The first is associated with Teece et al. (1997) and focuses on technology, firm performance, and strategy. Originally developed by Teece and Pisano (1994) and Teece et al. (1997), the concept of dynamic capabilities was introduced to extend resource-based view research by showing how firms adapt, integrate, and reconfigure their resources to deal with rapidly changing environments. More recently, Teece (2007 and 2010) maintains that dynamic capabilities depend on efforts to sense, seize, and reconfigure assets and competencies to keep pace with the rate of change in the environment.

The second cluster builds on Eisenhardt and Martin (2000) and their interest in organizational design and contingency theory. These authors maintain that there are two distinct types of dynamic capabilities, depending on the degree of change and uncertainty in the market environment. In stable and moderately dynamic markets, change in the environment is frequent but largely predictable. Dynamic capabilities based on tacit knowledge, experience, and internally consistent routines built up over years are relied upon to address recurring and predictable conditions. In high-velocity markets, change in the environment is rapid, continuously evolving, and unforeseeable. Dynamic capabilities in this context depend on simple routines, structural principles, real-time learning, and improvisation to master rapidly shifting, unpredictable, and emergent situations (Eisenhardt & Martin, 2000; Eisenhardt & Sull, 2001; Danneels, 2008, 2010).
Eisenhardt and Martin (2000) emphasize the fragility of dynamic capabilities, which are “continuously unstable.”

Evolutionary scholars distinguish between dynamic capabilities and operational capabilities (Helfat & Peteraf, 2003). In what is known as the dual-routines framework, dynamic capabilities are the “higher-order” strategic processes used to modify or create new “lower-order” operational capabilities in a changing environment (Coriat, 2000; Knott, 2001; Zollo & Winter, 2002; Helfat & Peteraf, 2003; Winter, 2003; Helfat & Winter, 2011). Operational capabilities refer to the stable and predictable tasks that a firm performs by producing and selling existing products or services. Firms engage in a search process of experiential and cognitive learning when current operational capabilities are no longer appropriate in a changing environment and there is a perceived need to adjust or replace them (Gavetti & Levinthal, 2000; Tripsas & Gavetti, 2000). Experiential learning is conducted “online” by creating, implementing, and assessing the performance of alternative practices, experiences, and adjustments to existing processes. Cognitive learning involves generating and assessing “offline” analysis, consultations, and experiments without actually implementing new practices or changing the process. Online learning from a series of trials or previous experiences is interspersed with moments of offline deliberation and evaluation.

In an extension of resource-based view and evolutionary research, O’Reilly and Tushman (2008) claim that prior studies have neglected to examine how dynamic capabilities facilitate exploration and exploitation (March, 1991). Dynamic capabilities are not simply about generating change and novelty, but also about performing and maintaining existing operating capabilities. O’Reilly and Tushman (2008) argue that organizational ambidexterity—the strategic processes, behaviors, and specific actions taken by senior managers to mobilize for exploration and exploitation—is a form of dynamic capability. As illustrated in Figure 1, the “simultaneous balancing” of exploration and exploitation involves knowing when to maintain current routines under predictable conditions and when to change them to keep pace with an evolving and uncertain technology and market environment.

The complexity and rate of change facing many firms depends on their ability to exploit and explore at the same time, with distinct sub-units, business models, and alignments for each (Tushman & O’Reilly, 1996, 1997; O’Reilly & Tushman, 2004). Firms’ separate organizational units for exploration and exploitation, each has its own competences, processes, incentives, and cultures. Adler, Goldoftas, and Levine’s (1999) study of the Toyota production system identified how metaroutines (associated with dynamic capabilities) are required to balance efficiency and
flexibility (Adler, Goldoftas, & Levine, 1999). Eisenhardt and Tabrizi (1995) distinguish between two different types of product development projects: a compression model of new product development based on rational, predictable, and sequential process with predictable outcomes and an experiential model that relies on improvisation, flexibility, and the real-time learning required to deal with uncertainty. Within an ambidextrous organizational architecture, these units are held together by a ‘common strategic intent, an overarching set of values, and target structural linking mechanisms to leverage shared assets’ (O’Reilly & Tushman, 2008, p. 193).

Dynamic Capabilities and Project-Based Organizing

A stream of research has begun to consider how dynamic capabilities can be applied to various domains of project-based organizing (Winch, 2014). Projects are a form of temporary organization, ranging from standalone projects involving multiple participants and independent organizations, to multiple projects that are fully embedded within a firm (Schwab & Miner, 2008; Jones & Lichtenstein, 2008; Bakker, 2010). Much of the prior literature has focused on how project-based firms rely on dynamic capabilities to manage a portfolio of embedded projects (Gann & Salter, 2000; Davies & Brady, 2000; Brady & Davies, 2004; Ethiraj, Kale, Krishnan, & Singh, 2005; Söderlund & Tell, 2009; Shamsie, Martin, & Miller, 2009; Cattini, Ferriani, Frederiksen, & Täube, 2011). A project-based firm conducts the majority of its routine and innovative activities in projects for internal clients and/or external customers (Gann & Salter, 2000; Keegan & Turner, 2002; Davies & Hobday, 2005; Whitley, 2006). There is an emerging stream of project management research on ambidexterity, (Pellegrinelli, Murray-Webster, & Turner, 2014; Turner, Maylor, & Swart, 2014; Turner, Maylor, Lee-Kelley, Brady, Kutsch, & Carver, 2014), but it has not yet engaged with the concept of dynamics capabilities.

Several studies recognize that contrasting types of project structures, capabilities, and processes are required for exploitation and exploration (Eisenhardt & Martin, 1995; Pich, Loch, & De Meyer, 2002; Lenfle, 2008). Exploitation projects are organized to achieve predefined goals with a given set of resource constraints. They depend on traditional forms of project management based on compressed sequencing tasks and pre-specified specified instructions. Exploration projects are organized to achieve goals that cannot be easily defined or foreseen at the outset. They require a break with prior routines and capabilities and depend on experiential search processes, real-time learning, and the pursuit of multiple solutions until the best one can be selected (Lenfle, 2008).

While this research helps us understand how dynamic capabilities are deployed by firms to manage multiple embedded projects (e.g., new product development and routine capital
projects), it does not consider the possibility that such dedicated capabilities are required for complex, one-off, and lumpy project investments such as an weapons systems, oil and gas platforms, energy networks, rail transportation links, nuclear power plants, airports, manufacturing plants, and research facilities (Miller & Lessard, 2000; Morris, 2013; Flyvbjerg, Bruzelius, & Rothengatter, 2003). Projects are complex when they are composed of a large number of interdependent components, subsystems, and systems, and when it is difficult to predict how the component parts will interact when joined together as a system. The most complex type of project is large in scale and comprised of a collection of interrelated systems designed to achieve a common purpose, such as a mass transit urban railway system and major sporting event (Shenhar & Dvir, 2007; Davies & Mackenzie, 2014; Brady & Davies, 2014). What is common to them is the high degree of uncertainty at the outset about a project’s goal and the means to achieve it; how much it will cost and how long it will take; and what forms of contract and process are required for dealing with changing conditions and converting uncertainty into certainty as the project progresses toward completion (Hirschman, 1967; Shenhar, 2001; Pich, Loch, & De Meyer, 2002; Sommer & Loch, 2004; Loch, De Meyer, & Pich, 2006; Shenhar & Dvir, 2007).

The challenge of balancing stability and change is clearly important in prior studies of complex projects involving a variety of predictable and highly uncertain conditions (Baccarini, 1996; Williams, 1999; Geraldi, Maylor, & Williams, 2011 Brady, Davies, & Nightingale, 2012; Brady & Davies, 2014). As studies of complex projects show, a variety of standardized routines have to be established for dealing with stable, predictable, and known risks, while having the flexibility to adjust plans and modify routines when conditions change (Sayles & Chandler, 1971; Sapolsky, 1972; Davies et al., 2009; Lenfle & Loch, 2010; Davies & MacKenzie, 2014; Brady & Davies, 2014). Sapolsky (1972, p. 250) introduced the concept of “disciplined flexibility” to identify the how certain processes had to be firmly fixed at the outset, while others had to be kept open to address unexpected situations.

Winch (2014) calls for more research on how dynamic capabilities are assembled by owners and operators to manage large, one-off complex projects. Two contrasting types of project owners and operators are responsible for complex projects (Brady & Davies, 2014). The first is a permanent client organization, such as the BAA, Network Rail, and the London Underground, responsible for executing many routine capital projects and a few less frequent complex projects. These organizations have an opportunity and incentive to develop and apply dynamic capabilities and capture the learning to improve the performance of large, complex projects over many years. The second is a temporary client organization established to execute a single large complex
project, such as the Channel Tunnel Rail Link (High-Speed 1), London 2012 Olympics, and Crossrail suburban railway system (Davies, MacAulay, Debarro, & Thurston, 2014). In these projects, a separate operating company (e.g., Crossrail Limited) has to be created for the project to have an owner, and dynamic capabilities are developed from scratch, in a limited period of time, and are dissolved on completion of the project (Dodgson, Gann, MacAulay, & Davies, 2015). In each case, there are pressurized deadlines for project completion, and dynamic capabilities have to be built, codified, and mobilized to deliver a project that may take several years.

**Methods and Data**

Our research design meets several of Yin’s (2003) rationales for undertaking a single-case study and generalizing the findings to theory. Following Alvesson and Sandberg (2013), our study was a critical case for problematizing the theoretical assumptions that dynamic capabilities are restricted to the conditions found in firms responsible for multiple embedded projects and considering whether some alternative or additional explanation is required to explain their use in large-scale and infrequent complex projects. Several papers have studied the T5 project (Gil, 2009; Gil & Tether, 2011; Gil, Miozzo, & Massini, 2012) but none of them has focused on dynamic capabilities. Our case study is revelatory because we had an opportunity to observe and analyze how dynamic capabilities are created and applied in a rich empirical context (Pettigrew, 1990). Our longitudinal study of a single case enabled us to identify how dynamic capabilities for complex projects evolve over a defined period of time.

Our study was conducted between 1998 and 2009. Undertaking a single case extending over such a length of time is difficult, and in our study of BAA we were fortunate in being able to examine key stages in the T5 project’s evolution. Between 1998 and 1999, one of the authors was involved in a research study of small capital projects undertaken by BAA during the planning of the T5 project. While not envisaged as part of a longer-term project, involvement in this prior research was fortuitous because it provided access to real-time data of projects executed while the BAA was preparing the approach it used to deliver T5. This initial study stimulated our interest in how firms develop the capabilities to manage large, complex projects, and our subsequent research was deliberately designed to examine and capture real-time and retrospective data on T5.

Data collection for the fieldwork was undertaken during two periods. In the first period of real-time research during the construction phase (2005–2006), we interviewed 30 people at multiple levels, including the project client’s and contractor’s senior managers and past and present CEOs, project directors, and project managers, and prepared a case study report as a
narrative chronology for subsequent analysis and to serve as a validation tool (Langley, 1999). In the second period of retrospective research after project completion (2009–2011), we conducted 10 interviews to capture insights and reflections over a year after the project opening in 2008, including a final interview in 2011, to assist our interpretation of the problems during the operational opening of the terminal. Interviews were conducted primarily with senior managers engaged in creating, installing, and enacting a set of dynamic capabilities. Interviews were conducted with BAA, contractors, and British Airways (BA), the occupier of T5. Interview questions focused on how and why the T5 Agreement was created and applied.

Our methodology involved data triangulation using in-depth semi-structured interviews, documentary material, and participatory observation (Pettigrew, 1990). In the latter case, for example, we attended public presentations on T5, and frequently visited its site. Documents, including the project contract and guide book, company PowerPoint presentations, government reports, project audits, newspaper articles, and the trade press were analyzed. In total, we carried out 57 interviews (including a systematic analysis of 39 recorded transcripts of approximately 60 to 180 minutes each). Interviews (see Appendix) were based on semi-structured exploratory questions and our initial interpretation of the BAA’s creation and application of the novel approach for executing the T5 project. Real-time interviews conducted during 2005 and 2006 were manually coded by the author involved throughout the research, which resulted in a 68-page case study report that brought together our findings prior to the project’s completion. A shorter version of the report was shown to several managers involved to verify the accuracy of our findings. A second phase of data analysis included the retrospective interviews conducted in 2009 and a final one in 2011. Our analysis of real-time and retrospective transcriptions was supported by the computer-aided program, NVivo, and coded by an independent researcher who did not take part in the field research. Interviewees are anonymous to preserve confidentiality but identify each individual’s affiliation when he or she was involved in the project.

In an attempt to theorize from our data, we were inspired by Langley’s (1999) call to design process research combining deductive (theory-driven) and inductive (data-driven) methods: “that selectively takes concepts from different theoretical traditions and adapts them to the data at hand, or takes ideas from the data and attaches them to theoretical perspectives, enriching those theories as it goes along” (Langley, 1999, p. 708). We started out deductively by identifying core dynamic capability constructs, including resource-based view and evolutionary perspectives, to formulate our research question; gather “rich” longitudinal data on these perspectives in the setting of a firm responsible for a large, complex project; and make sense of the interpretations used by informants.
We then proceeded inductively by interplaying between data collection and analysis, based on how well the data fitted our emerging understanding and its relevance to the observed phenomenon. Inductive research provides a data-driven way of surfacing new concepts and generating new theories (Gioia, Corley, & Hamilton, 2012). Our informants repeatedly emphasized the importance of the T5 Agreement—a set of collaborative processes, behaviors, and actions to promote flexibility and adaptation. Upon consulting the literature, we realized that our informants were describing how a dynamic capability had been created and applied to balance appropriate responses to stable and changing conditions. Our access to longitudinal data enabled us to identify how firms create dynamic capabilities in a three-phase process that may be applicable to other large and complex projects.

**The Case Study**

The global airport industry is being transformed by rapid growth in passenger numbers and increasing number of budget airlines, the application of new digital technologies, and concerns for environmental impact and terrorist threats. Airport operators have responded to these and other changes by developing the flexibility to “adjust their plans and designs dynamically over time to accommodate the variety of futures that may occur” (De Neufville & Odoni, 2003, p. 81).

The BAA was established as a state-owned organization in 1965, privatized by the Thatcher government in 1986, taken over by an international consortium led by Grupo Ferrovial in 2006, and renamed Heathrow Airport Holdings in 2012. At the start of the T5 project in 2002, the BAA owned and operated seven large airports in the United Kingdom. Most of its revenues were generated by charging landing fees to airlines and ancillary operations such as retailing. In addition to operating airports, the BAA’s large in-house capital projects organization and external framework suppliers were responsible for managing a large program of small-scale routine projects to design, construct, and maintain its airport terminals and facilities. When constructing new airports (e.g., Stansted Airport) or major expansions of existing airports (e.g., T5), the BAA established large standalone and relatively autonomous projects organizations in attempt to manage and contain the high risks involved in such undertakings.

The T5 project was established as a separate organization with a direct line of reporting to BAA’s corporate management. The new terminal was built to be the home of all of BA’s domestic and international passengers at Heathrow Airport with an annual capacity of 30 million passengers. The T5 complex is on a 260-hectares site between the northern and southern runways at the western end of Heathrow. It is comprised of a large four-storey terminal building...
(Concourse A), a satellite building (Concourse B) connected to the main building by an underground people mover transit system, and 62 aircraft stands. A second satellite building was completed in 2011. Additional airfield infrastructure, including a 4,000 space multi-storey car park, a large hotel, and an 87-meter (95 yards) high air traffic control tower has been constructed on the site. T5 is connected by road links to the neighboring M25 motorway. An underground railway station with branches of both the Heathrow Express and the London Underground’s Piccadilly Line provides transportation to and from London.

T5 was a significant risk for the BAA. As BAA’s former CEO put it: “in facing up to this project we knew that any major overrun in cost or time could very easily bankrupt the company. So it was a very high risk project” (BAA interview, 2009). The project faced a variety of uncertainties and challenges as it progressed through four main stages of its life cycle between 1986 and 2008 (see Table 1).

The planning phase started in 1988 and ended in 2001 when the project was granted consent to proceed. This phase included the longest public inquiry in UK planning history. As a result of the inquiry, the project was subject to 700 restrictions, including the diversion of two rivers to meet tough environmental conditions. The original project opening date of 30 March 2008 was set in 2001.

The design phase started in the late 1980s with the development of the overall design concept. In 1989, Richard Rogers Partnership won a national competition to design a new high-profile, iconic building with a 156-meter (171 yards) single-span “wavy roof” and a glass façade. The BAA and BA worked together with architects and designers in a large integrated project team to present a coherent conceptual design to the planning inquiry.

The construction phase of the project involved two main activities: the construction of the infrastructure and buildings from July 2001 to March 2008, and the integration of systems and retail fit-out from January 2006 to March 2008. A large network of suppliers, including 60 first-tier, 500 second-tier, 5,000 fourth-tier, and 15,000 fifth-tier suppliers participated in the project, which was divided into four groups of activities: Buildings, Rails and Tunnels, Infrastructure, and Systems. These groups were responsible for 16 major projects and 147 sub-projects, ranging from the smallest valued at £1 million to larger projects, such as the £300million extension of the Heathrow Express underground rail station. The project faced a huge logistical challenge of having only one entrance and exit for rapid flows and high volumes of materials, components, and people to a site, adjacent to Europe’s busiest motorway, with limited space for storage. At its peak, the project had to manage the logistical problems of dealing with 8,000 workers onsite each
day and nearly 250 deliveries of materials per hour. Work had to be undertaken within confines bounded by the daily operations of Europe’s busiest airport, operating at over capacity.

During the operational readiness phase, a joint BAA and BA team worked for over three years to prepare systems, people, and processes for the opening. The “start–finish” team worked intensively during six months of systems testing and operational trials prior to opening, including 66 trial openings, each involving 2,500 people, to prepare workers, processes, systems, and facilities for the public opening at 4:00 a.m. on 27 March 2008, three days earlier than planned. Despite these preparations for the opening, in the five days after opening, BA misplaced 20,000 bags and cancelled 501 flights, incurring costs of around £16 million. The terminal achieved the first full schedule of operations 12 days after opening. Although the project experienced significant problems when it opened for service, causing considerable reputational damage, it is perceived to have achieved its goals of designing and building high-quality infrastructure exactly on schedule, within budget, and with a satisfactory safety record.

Findings

This section describes how BAA developed and used dynamic capabilities to create a flexible, fluid and responsive approach to deal with the conditions encountered during the execution of the T5 project. Written as a novel form of contract and supporting guidebook, the T5 Agreement included the systematic, relatively predictable procedures and structured principles that BAA intended to use on T5 and subsequent major airport infrastructure projects. The T5 Agreement was designed to help managers decide what to do under stable conditions and sense when project tasks had to be modified or replaced.

Based on our coding of the data, the case study narrative is organized into three phases to describe the processes involved in the creation and application of the T5 Agreement: (1) a building phase when BAA recognized the need to change its current practices and engaged in a search to discover and assess alternative ways required to cope with uncertainty associated with the T5 project; (2) a codifying phase when the results of the prior learning were incorporated in the T5 Agreement, creating the principles, structures and procedures designed to help managers in the integrated project teams address a variety of conditions; and (3) a mobilizing phase when dynamic capabilities were used in practice. The locations of these phases in the literature and analysis of our data are summarized in Tables 2 and 3. Table 3 includes a range of quotations from respondents illustrating the value of the T5 Agreement, but also the tensions within it and resistance to it.

[Insert Tables 2 & 3 here]
Building Phase

The first phase in the evolution of the T5 Agreement began when BAA recognized that its existing practices and traditional project management approaches couldn’t cope with the uncertainties involved in delivering the project. BAA engaged in a deliberate learning process to create a new set of dynamic capabilities, which involved scanning the environment for alternative ways of doing things, learning offline from previous experiences, and conducting online trials to assess the benefits of implementing the new approaches.

When BAA first began to prepare for the delivery of T5, Sir John Egan (BAA’s CEO from 1991 to 1999) found that its suppliers had limited experience in managing a project of this scale, complexity, and uncertainty. As the author of an influential government report identifying major reasons why UK construction projects continually failed to achieve time, cost, and quality objectives, Egan believed that contractors could not be relied upon because they had poor track records in constructing major projects (Egan, 1998). The future operational conditions and uncertainties facing T5 is revealed in the reflection of a former project director:

At outset you didn’t know what the security regime would be, you didn’t know what kind of immigration legislation would be in place, you didn’t know what kind of electronic tagging may or may not be involved in ticketing or baggage or a whole bunch of other customer processes. (BAA interview, 2009).

Previously the CEO of Jaguar Cars, the automobile manufacturer, Egan wanted the BAA to achieve improvements in performance made possible by the lean production techniques used in the Japanese automobile industry, but found that BAA had no orderly, predictable, and replicable operational routines for delivering projects. The organization treated each project as a one-off, unique activity. Each started as a “blank sheet of paper,” and the newly assembled project team tended “to think it through from first principles over and over again” (BAA interview, 2005). BAA’s capital projects were used as online trials to gain feedback and insight into practices and ideas subsequently incorporated in the T5 Agreement. In 1993, BAA introduced partnerships called “Framework Agreements” to work with first-tier suppliers on a long-term basis and BAA’s existing projects proved to be a useful testing ground to experiment with elements of the T5 Agreement on a small-scale. This trial-and-error process of experiential learning ensured that any obstacles to effective performance could be detected, diagnosed, and solved. In 1995, BAA created a standardized project management process written as a guidebook, incorporating concurrent design, project planning, and modularity to establish the operating routines required for small capital projects. Although these and other operating processes and procedures (e.g.,
digital design tools found in aerospace nuclear power, offsite prefabrication in oil and gas, just-in-time logistics in automobiles, and modular store builds in retailing) were adapted for use on T5, the BAA was unable to identify an existing approach that could be imported wholesale to manage such a large and risky project.

A search was initiated to create a new way of successfully delivering the T5 project. BAA brought together a core team of managers and consultants with in-depth experience gained on other complex, high-risk projects, such as the Hong Kong International Airport and North Sea oil and gas projects. Successive T5 project directors were headhunted by BAA because “they had a track record for completing projects and thrive on the cross-sharing of capability from best practices found in other industries” (BAA interview, 2006). Members of the team embarked on field trips to other firms, industries, and projects throughout the world to discover how successful practices, technologies, and ideas worked and might be transferred to create a way to deliver T5.

Lessons about bearing risks and working collaboratively in integrated project teams were learned from one particularly large and complex project. While preparing for T5, BAA was involved in the Heathrow Express project connecting the airport with London’s Paddington Station. The project was brought to a halt in October 1994 when one of the main tunnels collapsed after a period of heavy rain. At one point, the project was 24 months behind schedule. Under a traditional fixed-price contract, the prime contractor was accountable for this risk and solving any emergent problems. A typical response to a crisis of this kind would be to sue the contractor for breach of contract. However, BAA recognized that it was ultimately responsible for carrying the risk, because it would incur the loss of revenues and tarnished reputation associated with a heavily delayed service. As a result of BAA’s decision to work collaboratively and incur the costs, the project met its tight target date and opened for service in June 1998. In the opinion of another manager: “Heathrow Express was proof of concept that the T5 Agreement could work” (BAA interview, 2006). First-hand experience of an early version of the T5 Agreement would later prove to be valuable during the project execution “when implementing the T5 Agreement got tough” (Doherty, 2008, p. 237).

In addition to learning from internal trials and prior project experiences, BAA’s T5 management team conducted an offline search to understand, calibrate, and identify how to cope with the uncertainties involved in delivering a project of this scale and complexity. Between 2000 and 2002, BAA managers conducted case studies of every major UK construction project over £1 billion built over the previous decade and every international airport opened during the previous 15 years. Informed by these studies, BAA recognized that “the fascinating thing about a megaproject like this is not to try and get certainty where certainty doesn't exist” (BAA interview,
2009). They discovered that poor project performance was associated with fixed-price contracts to transfer risk and responsibility to a prime contractor. Clients assumed that contractors could identify future conditions and prepare fixed-price bids to deal with all eventualities. These projects, such as the notoriously over-budget Channel Tunnel joining the United Kingdom and France, culminated in major cost, time, and quality overruns because of disputes and legal battles between clients and contractors over responsibility for scope changes. Poor systems delivery and integration (e.g., in baggage handling), and inadequate operational trials were identified as the main reasons why international airports failed to open on time. BAA predicted that without a radically different delivery strategy, T5 would be £1 billion over budget, one year late, and result in six fatalities.

**Codifying Phase**

In next phase, efforts were made to articulate and codify the knowledge and experience gained from the learning phase with a fundamental reassessment of how the delivery of the project should be managed and recognition that it needed to “change the rules of the game” (BAA interview, 2005). The T5 Agreement was produced to provide a set of simple processes—rules, procedures, and structural principles—to help managers to know when and how to modify or replace its practices and procedures when faced with changing and unexpected conditions. It comprised two written documents: a short and accessible contract and a project delivery handbook.

The T5 Agreement identified the behaviors, processes, and procedures required to create a disciplined but also flexible, responsive, and collaborative organization. The T5 Agreement identified the processes required to deal with change and uncertainty, but also recognized that a project involving a large proportion of planned, recurring, and predictable activities would depend on the ability of managers to know precisely if, when, and how project tasks needed to be performed as originally intended.

The T5 Agreement was based on two structural principles: the client always bears the risk and works with partners in integrated project teams. The 60 first-tier suppliers, which accounted for approximately 75% of the project’s total cost, were all engaged under the T5 Agreement. The project was conceived as a series of customer products delivered by integrated projects teams, including the client and various contractors assembled for each of the 147 sub-projects. The aim was to create a supply chain composed of teams often working in co-located offices.

The T5 Agreement reflected BAA’s decision that the project’s risk should not be transferred to a contractor organization because it was impossible to predict or control all
eventualities from design through construction to operational handover. Suppliers were repaid their costs on a transparent open-book basis and incentivized to improve their performance and innovate by bonuses for exceeding previously agreed target costs and completion dates. This flexible contract created “an environment within which our suppliers can actually find solutions” (BAA interview, 2005).

The T5 Agreement specified that work on the project would be conducted in collaborative integrated project teams involving BAA and first-tier suppliers. The contract did not specify in detail the work to be undertaken, but rather was a commitment from suppliers to provide high-caliber people with the skills and capabilities required to perform specific project tasks at the right time, irrespective of their parent company’s needs. Working in tandem with the T5 contractual approach, the collaborative team structure was set up to undermine attempts to transfer risks or apportion blame by holding an individual supplier responsible for failure to achieve an objective. The Agreement specified how the teams were expected to work constructively toward achieving project goals by solving problems, responding to opportunities, and acting on any learning gained, rather than “allocating blame or exploiting the failure or difficulties of others for commercial advantage” (Wolstenholme, Fugeman, & Hammond, 2008, p. 12). The success of each team depended on efforts to improve performance and create solutions when unforeseen problems were encountered, rather than seek additional payments or enter into legal disputes.

BAA strived to ensure that contractual and collaborative principles were clear and unambiguous, so that that they could be communicated and understood by members of the project. The T5 Agreement delivery handbook illustrated how project teams were expected to behave:

Conventional project logic seeks to predefine all requirements and banish change once the project has started. Yet flexibility and adaptability are key objectives for T5. Conventional processes and solutions are therefore not tenable. It will require flexibility of approach: flexibility of solutions; latest responsible decision making, etc. For this reason processes, practices and deliverables will be firmed up in stages. (BAA, 1999)

Essentially, the document was drafted as simple rules and procedures to promote desired practices and behaviors, rather than fixed procedures and detailed instructions that had to be adhered to. It was designed to provide safeguards to correct dysfunctional behaviors and incentives to encourage individual project teams to find innovative solutions to unexpected problems or opportunities.

Mobilizing Phase
In the final phase, the T5 Agreement was mobilized so that managers knew when and how planned project tasks and schedules had to be enforced, modified and changed depending on the conditions encountered. As soon as the project began, the “theory of the T5 Agreement was tested” (Egan 2008); as one project director clarified: “for a number of years we’ve been rehearsing the big game. This is the big game.” (BAA interview, 2005) The T5 Agreement had to be actively applied and maintained by a large standalone project organization established by BAA to run the project that, at its peak, included 300 managers, engineers, and consultants. This level of cohesion and adherence was necessary, because the multiple participants involved were expected to adopt the new behaviors, and the application of the T5 Agreement often challenged the established operating routines that each participant organization brought to the project.

Informants in our study emphasized the continuing role of the T5 Agreement as an “umbrella” framework and set of principles presiding over and guiding behavior and performance over the course of the project. Our interviews identified a variety of project processes and procedures, ranging from standardized and repetitive construction tasks to deal with known and predictable risks (e.g., project management, production, just-in-time logistics, and operational trials) to more complex design tasks used to help project teams respond in a structure and consistent way to emergent events, such as “progressive design fixity”; a procedure used to avoid freezing designs too early and incurring costly revisions at a later stage (Gil & Tether, 2010). The T5 Agreement created the context within which operational capabilities was performed. For example, digital technologies and practices were adopted to anticipate many problems in advance and coordinate the design, integration, and testing of components during the design and construction phases. The enactment of design practices was overseen by the T5 Agreement: “Ultimately the single model environment flows from our decision on how we’d manage risk and the T5 Agreement attempted to take the normal risk of contracting off the table” (BAA interview, 2009).

Our research revealed that it took time for many participants to understand the new principles and behaviors espoused by the T5 Agreement, and the continual need to reassert its principles reveals its fragility. When first introduced, the T5 Agreement was open to interpretation because many individuals and organizations had little or no experience with the alternative ways of working. As one manager explained: “So our role in BAA is to almost continually reinvigorate, tease out and reinforce that learning, the culture, the way we work together.” (BAA interview 2006) Collaboration, integrated project teams, and risk sharing; challenged current routines, authority structures, and inter-organizational relationships. Senior BAA managers intervened on many occasions to encourage project teams to abide to the T5
principles and put them into practice when tackling specific operational situations. BAA invested a great deal of time and resources in communicating how the principles embodied in the T5 Agreement could help project teams to achieve or exceed their targets for performance. As the project progressed, BAA put in place an “organizational effectiveness” program to promote consistent and regular patterns of collaborative behavior across the first-tier supply chain. Providing training and building trust among members of the project were critical contextual factors (Adler et al., 1999) underpinning the implementation of the T5 Agreement.

Interviewees in BAA and suppliers emphasized the importance of “working within the spirit of the T5 Agreement.” While many individuals and firms willingly adopted the behavioral principles enshrined in the T5 Agreement, some actively resisted it. It was designed to provide a stable reference point ensuring that project team practices adhered to uniformly agreed on norms of behavior. Teams that deviated from desired standards of conduct had to be “brought back into line.” As the Project Director at the time observed, BAA was attempting a “change program on an industry-wide scale, against institutionalized learning, and behavior for decades” (BAA interview, 2005). He estimated that one-third of the people on the project understood the behavioral changes required by the T5 Agreement, another third claimed they understood but in practice “they are still on a journey of transition,” and the final third continued according to the “old rules of commercial contracting” (BAA interview, 2005).

BAA tried, not always successfully, to prevent contractors on T5 from resorting to traditional commercial contracting methods by continuously using the T5 Agreement to promote flexibility and reinvigorate collaborative behavior (BAA interview, 2005). For example, in a team led by the main contractor Laing O’Rourke (LOR), Mott MacDonald (an engineering consultancy) had fallen behind schedule in delivering design drawings. When LOR turned to the client for advice, BAA instructed the team to find a resolution “within the spirit of the T5 Agreement” (LOR interview, 2005). After some initial resistance, LOR and Mott MacDonald learned how to work collaboratively and succeeded in finding an improvised solution using 3D modeling to produce digital prototype designs.

The T5 Agreement served as a template and normative goal, providing an opportunity for managers in the integrated project teams to assess whether existing operational capabilities were appropriate, consider alternatives, set new priorities, and decide what managerial action was required to enforce, modify, or replace them. Two vignettes illustrate how the T5 Agreement was used to generate innovative solutions to unexpected problems or opportunities. First, the “roof team,” including designers, suppliers, and fabricators, was responsible for one of the most complex and uncertain sub-projects on T5. Guided by the Agreement, the team was encouraged
to identify and expose the risks and safety concerns associated with the challenge of erecting roof abutment structures with spans of over 150 meters (164 yards) on site. Their solution was to test the erection of the pre-erected roof structure in advance in an offsite location in the North of England. The pilot trial identified 140 lessons, each with a preemptive risk mitigation plan to enable rapid construction onsite. As one manager put it: “A key success factor on T5—enabled by early involvement with the suppliers and integrated working—is the first run studies and prototyping because getting people early allows you to plan your approach and one big success on that would be the roof” (BAA interview, 2006). Although the prototype cost £3.5 million to build, the project was delivered three months earlier than originally planned and saved an estimated £5.5 million (National Audit Office, 2005, p. 5).

Second, the team responsible for erecting the 84-meter high air traffic control tower had to create a novel approach to overcome the challenge of its construction and erection in the short period of time during the night when the airport was not in use. As a National Audit Office (2005, p. 6) report found: “The clear confirmation from the project director was that ‘this is BAA’s problem, not the suppliers,’ which allowed the entire integrated project team to concentrate solely on problem-solving.” The T5 Agreement played its role by encouraging the team to collaborate and engage its own localized search by adopting offsite pre-assembly techniques from the oil and gas industry (Matthews, 2008). Delays to the project were minimized and a solution was found without resorting to adversarial practices. “The control tower has got to be an example of where the integrated team and T5 Agreement, having hit a fundamental technical challenge halfway through the project, actually enabled us to meet our commitments to deliver the tower” (BAA interview, 2006).

Despite these successes, we found that when faced with conditions that should have prompted reflection and reconsideration of their operational capabilities, interviewees noted that some organizational members consciously ignored the T5 Agreement, preferring to respond by executing past ways of operating, even when things were not working well. Again reflecting its fragility, on many occasions BAA had to intervene forcefully to correct behavior outside of the T5 Agreement.

The application of the T5 Agreement in the supply chain varied during the life of the project. During its first half, the supply chain was composed of 10 to 15 suppliers with a long history of working with BAA. They were considered “match fit for T5” and ready and willing to work collaboratively when the project got underway (BAA interview, 2005). During the second half, “the landscape started to look quite different, with more suppliers on site, many of them wanting to work in a much more traditional, short-term, transactional way” (Doherty, 2008, p.
These problems compounded the difficulties experienced during the final operational handover phase of the project, when the Agreement was not used effectively to reflect on the adequacy of existing operational capabilities and their compliance with the principles of collaboration and risk sharing, and act to prevent the chaotic opening of the terminal.

Interviews conducted at mid-point in the project revealed that BAA was fully aware that the opening could be disrupted by the failure to follow pre-specified operational routines for systems testing, staff training, and familiarization. BAA recognized that the opening could be delayed by a “passive operator [British Airways] who will just stand back,” rather than one who “gets in early, operates early, steals this off you, takes all the learning, does final commission, and witnesses all the testing” (BAA interview, 2006). Although the T5 Agreement was confined to BAA’s first-tier suppliers, BA was expected to understand the importance of working collaboratively and flexibly to achieve a successful outcome.

The T5 Agreement provided BAA’s “operational readiness” team with an opportunity to review the adequacy of the operational routines established to prepare for the opening and consider whether more effort was needed to enforce or revise them before serious damage was done. Reflecting on the outcome of the project, one of BAA’s senior managers believed that the early success of the T5 Agreement during construction may have contributed to a growing managerial hubris and expectation that the project could not fail. A government review concluded that the tumultuous opening could have been avoided through “better preparation and more effective joint working” between BAA and BA (House of Commons Transport Committee, 2008). A major cause of the problem was BA’s decision to press ahead with the opening in the knowledge that its staff had insufficient training and familiarity with the terminal’s facilities and baggage handling system (Done, 2008; Williams & Done, 2008; Brady & Davies, 2010). In retrospect, one of BAA’s project directors recognizes that more effort should have been made to build collaborative relationships with BA: “It would seem so simple looking back that that was probably the most important relationship of all. It was avoidable.” (BAA interview, 2009)

The T5 Agreement’s twin-principles, which worked well during construction, broke down during the handover, with partners blaming each other and no attempt to share responsibility. BAA was confident that the T5 Agreement was easily understandable and transferable, but BA was unwilling to formally adopt it and had not invested in the learning, experience and tacit knowledge required to make use of it. The problem was eventually resolved when BAA and BA adopted the T5 principles of integrated team working and flexibility that contributed to a successful second batch of moves from Terminal 4 to T5 on 5 June 2008.
BAA’s investment in the creation of the T5 Agreement was considered worthwhile, because the original intention was to develop and apply this dynamic capability on its next major project, to renovate and rebuild existing terminals at Heathrow. BAA aimed to “maintain the wisdom of the organization” (BAA interview, 2006) by reflecting on the learning gained during the mobilization of the T5 Agreement and retaining successful insights, improvements, and tacit knowledge. Despite the efforts invested in creating and maintaining its dynamic capability, BAA jettisoned the approach typified by the T5 Agreement, a decision that surprised many in the UK construction industry. The company had been taken over in June 2006 by Ferrovial, the Spanish-owned transport infrastructure company, and in a complete reversal of strategy decided to revert back to the traditional role of client as procurer rather than project manager, relying on “risk-shifting contracts,” detailed up-front specifications, and inflexible routines (Oliver, 2009).

**Discussion and Conclusions**

**Contributions to the Literature**

This article makes three main theoretical contributions to the literature: (1) it contributes to project management research by identifying how new dynamic capabilities (associated with BAA’s T5 Agreement) are developed through a three-phase process to support the strategic management of large complex projects; (2) it draws attention to the contested role of dynamic capabilities and their vulnerability to breakdown, revealing their continuing fragility; and (3) it contributes to the mainstream management literature by emphasizing the fluidity of dynamic capabilities and their balancing role in dealing with the stable and predictable, as well as rapidly changing, volatile, and uncertain conditions.

We offer new insights for project management research by identifying the three-phased process through which dynamic capabilities are developed by firms to manage a large and complex standalone project. The BAA’s dynamic capabilities were specifically developed to deliver the T5 project and subsequent projects at Heathrow. During the building phase, BAA used the lessons gained from other projects and industries, as well as its own experience and internal trials to identify the reliable processes, technologies, and practices that could be used to manage the T5 project. During the codifying phase, efforts were made to articulate a set of flexible, adaptable, and collaborative processes embodied in the T5 Agreement to support the delivery of the project. During the mobilizing phase, BAA had to apply and maintain the T5 Agreement, support specific integrated project teams, and help them balance routine and innovative action in a changing and uncertain project environment.
We suggest that dynamic capabilities is a useful concept for understanding how organizations develop the strategic organizational processes required to manage varying degrees of uncertainty found in many large and complex projects. In their study of North Sea oil and gas projects, Stinchcombe and Heimer (1985) argue that firms have to depend on standardized project routines to address predictable conditions and known risks, but they must also be able to innovate when faced with unexpected problems, emerging opportunities, and rapidly changing conditions (Stinchcombe & Heimer, 1985, p. 248). In other words, the extent to which such complex projects rely on routine action or innovation is contingent on the degree of uncertainty present (Shenhar, 2001; Shenhar & Dvir, 2007). In-depth case studies in the past suggest that organizations responsible for complex projects develop the disciplined flexibility—a form of dynamic capability—to maintain consistency, while responding flexibly to coping with changes in technologies, user requirements, and the operating environment (Sapolsky, 1972).

Despite the importance of dynamic capabilities to the successful delivery of a project, their fragility of dynamic capabilities is revealed in the extensive efforts required to mobilize them. Although the T5 Agreement was embraced by most participants and organizations involved in the project, some traditional suppliers were less willing to comply with the core principles of innovation and collaborative team working. When innovation was required to address unexpected problems or opportunities, these firms often fell back on their existing non-collaborative routines and risk-averse, adversarial behaviors. BAA’s senior managers often had to intervene to ensure that the collaborative intent of the T5 Agreement was continuously reiterated. The poorly executed handover from the project to operating airport terminal underlines the vulnerability of dynamic capabilities. Insufficient effort was made to enforce the operational processes for testing the systems and handover trials that were carefully developed in advance to prepare for the opening. In retrospect, managers agree that the T5 Agreement should have been used to review those routines and consider the possibility of revising them when things started going wrong. In the opinion of one manager, the very success of the early stages of the project may have contributed to the hubris and degree of comfort that led to the lack of subsequent lack of attention at later stages. Such misplaced assurance has been noted in the “Icarus paradox” of Miller (1993) and the movement from core competences to core rigidities by Leonard-Barton (1992).

The fragility of dynamic capabilities is further revealed in the way the extensive efforts to build, codify, and mobilize them with a view to their use in subsequent projects were negated by the company being subject to an overseas acquisition, and the new owner’s decision to resort to traditional approaches—a similar consequence of acquisition for dynamic capabilities was found in the study of Narayanan, Colwell, and Douglas (2009).
By citing our research in a project context we emphasize the role of dynamic capabilities in supporting organizational fluidity. Concerned with identifying contrasting ideal types (Eisenhardt & Martin, 2000), resource-based view research does not fully capture the more nuanced ways in which dynamic capabilities work in fluid situations when stable conditions become volatile or when rapidly changing and uncertain situations become more stable and predictable. Evolutionary research recognizes that the line between dynamic capabilities and operational capabilities is unavoidably blurry (Helfat & Winter, 2011), but the rigid and rather static assumption that dynamic capabilities are confined to generating change neglects need for contingent and balanced responses including knowing when to enforce existing operating routines when conditions remain stable and predictable: that is, when not to change.

Our research contributes to debates about fluidity versus efficiency, innovation versus routine action (Farjoun, 2010; Schreyögg & Sydow, 2010; Eisenhardt, Furr, & Bingham, 2010), confirming their argument that these are not mutually exclusive activities and showing that dynamic capabilities are specific identifiable processes for achieving organizational ambidexterity (O’Reilly & Tushman, 2008). Our study responds to recent calls for research that studies the “pursuit of consistency and change in contexts where variability and change appear to dominate” (Turner & Rindova, 2012). Our understanding of dynamic capabilities meets Nelson and Winter’s (1982, p. 106) requirements for “flexible performance in which an organization does different things at different times” and responds “with a wide variety of performances to variation in the environment.” As our case study reveals, dynamic capabilities are required to achieve organizational fluidity and flexibility by balancing routine and innovative action as conditions change rapidly, slowly evolve, or stabilize, variously and simultaneously in different parts of the firm. In complex projects, they offer the disciplined flexibility to ensure that original objectives are met within a changing and uncertain environment.

Limitations and Future Research Opportunities

It would be helpful if future research could engage in careful testing of our conceptualization of dynamic capabilities, and explore their actual manifestations and dynamics in other complex projects and enduring organizations that do not have a fixed beginning and end. We recognize that firms deploy dynamic capabilities to balance routine and innovative action not only within one complex project but also across other projects. Research might consider how firms learn how to hone and improve dynamic capabilities to enhance performance from one large, one-off project to the next.
Whereas our research focused on a firm—a repeat client—responsible for a continuing stream of large infrastructure and small capital projects over many years, it would be interesting to explore how dynamic capabilities are assembled by temporary client organizations to deliver one-off projects, such as the delivery partner organizations established to execute many of the United Kingdom’s largest public infrastructure projects.

Given their significance as identifiable, strategic activities, there clearly remains a need for more theoretical and empirical research to advance our understanding of dynamic capabilities in complex projects and how to simultaneously organize for stability and change. There still remains a tendency among researchers and managers to distinguish dichotomously between the routine action in a stable environment and innovative action in changing one (Farjoun, 2010; Schreyögg & Sydow, 2010), but the challenge in most organizations is one of “proportion and simultaneity rather than choice” (Weick, 1998, p. 551), and we show how dynamic capabilities mediate that balance. We hope that our study encourages future research that offers a deeper understanding of the complementary, interdependent, and mutually reinforcing relationship between routine and innovative responses to changing conditions in complex projects. Our research shows how future theorizing about dynamic capabilities could valuably explore their role in providing organizational ambidexterity in project organizations, and should incorporate understanding about their continuing fluidity and fragility.

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Williams, J., & Done, K. (2008). BA optimistic after that was the week that was. *Financial Times* 5 April 2008.


Figure 1: Dynamic capabilities: Balancing stability and change.

Table 1: Heathrow Terminal 5 project life cycle.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Approximate Time</th>
<th>Description</th>
<th>Key Challenges</th>
</tr>
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<tbody>
<tr>
<td>1. Planning</td>
<td>Around 1986 to 20 November 2001</td>
<td>Gaining approval for planning approval. Consent to proceed granted on 20 November 2001.</td>
<td>Managing external stakeholders (e.g., airlines, environmental campaigners, and local communities) and responding to planning conditions.</td>
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<tr>
<td>2. Design</td>
<td>1989 to 2001 (concept design)</td>
<td>2.1 Concept Design Developing architectural solution for client to create passenger experience and win planning approval.</td>
<td>The Partnership developed four different designs before finally developing the “loose-fit” design submitted to the Planning Inquiry. At its peak, over 2,000 designers worked on T5.</td>
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<td></td>
<td>2001 to 2007 (detailed design)</td>
<td>2.2 Detail design Proceeded concurrently with construction.</td>
<td></td>
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<tr>
<td>3. Construction</td>
<td>July 2002 to 27 March 2008</td>
<td>3.1 Build Construction started in July 2002 for a planned opening date of 30 March 2008 (later brought forward to 27 March 2008).</td>
<td>Construction of T5 through one entrance on a constrained site, presented huge challenges for logistics, assembly of major constructs (e.g., the roof and air traffic control tower) and safety and efficiency. At its peak, 8,000 people worked onsite.</td>
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<td>3.2 Integration and Retail Fit-out IT and systems integration. Fit-out team began work on internal facilities in early 2006 and large-scale fit out started in February 2007. Final commissioning of building in September 2007.</td>
<td>IT integration was a major multidisciplinary challenge bringing together civil, mechanical, electrical, and systems (IT and rail).</td>
</tr>
<tr>
<td>4. Operational</td>
<td>October 2007 to 27 March 2008</td>
<td>Testing of systems and 66 proving trials—“soft openings”—to prepare people, systems and facilities ready for opening. Accountability for delivering T5 passed from construction manager to managing director of Heathrow airport on 17 September 2007.</td>
<td>Delayed opening costing BA $31m in first five days.</td>
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<td>Readiness</td>
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Table 2: Three phases of dynamic capabilities in a complex project.

<table>
<thead>
<tr>
<th>Key Activities</th>
<th>Building Phase</th>
<th>Codifying Phase</th>
<th>Mobilizing Phase</th>
</tr>
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<tbody>
<tr>
<td>Assess the organization’s capabilities and current routines for dealing with future conditions (degree of uncertainty, threat to survival, etc.).</td>
<td>Capture learning gained by deliberate efforts to articulate what works and doesn’t work.</td>
<td>Support and promote reflection and managerial actions required to deal with conditions ranging from stable and predictable to rapidly changing and uncertain.</td>
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<tr>
<td>Consider alternatives and learn from other contexts and own experience, consider alternatives, and conduct trials.</td>
<td>Design dynamic capability written as simple rules, structural principles, and formal mechanism for promoting possible action under varying conditions.</td>
<td>Maintenance of dynamic capability requires learning, tacit knowledge and ongoing training and capability development.</td>
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<tr>
<th>Core conceptual contributions</th>
<th>Search, internally and externally, to test, evaluate, and select components of innovative combination (Nelson &amp; Winter, 1982; Teece et al., 1997).</th>
<th>Codify understandings of prior learning and performance implications in written guidelines, processes or tools (Zollo &amp; Winter, 2002).</th>
<th>Consciously learn, evaluate, and periodically change operating routines to deal with changing conditions (Zollo &amp; Winter, 2002)</th>
</tr>
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<tbody>
<tr>
<td>Clear need to change routines to resolve a threat to the survival of the organization (Winter, 2000).</td>
<td>Design a systematic procedure, simple rules, and guidelines to reduce task autonomy and variety compared with unfettered innovation (Adler et al., 1999).</td>
<td>Appropriate action depends on environmental conditions, stable and moderately dynamic versus high-velocity (Eisenhardt &amp; Martin, 2000; Eisenhardt &amp; Sull, 2001).</td>
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<tr>
<td>Develop informed judgments “working hypotheses” about future conditions using data, facts and anecdotes learning offline and from online trials, which are updated as new evidence emerges (Teece, 2007; Gavetti &amp; Levinthal, 2000).</td>
<td>Cognitive representation (e.g., lean production) does not fully specify particular actions to be performed, although it offers guiding principles, or outline, for possible action (Gavetti &amp; Levinthal, 2000)</td>
<td>Strategic routines govern how managers intervene and search for solutions (Coriat, 2000; Teece et al., 1997).</td>
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<td></td>
<td></td>
<td>Managerial intervention to enforce, modify or change routines (Zollo &amp; Winter, 2002; Helfat &amp; Peteraf, 2003) striking a balance between efficiency and flexibility (Adler et al., 1999; Schreyögg &amp; Sydow, 2010; Eisenhardt et al., 2010).</td>
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Table 3: Evolution of the T5 Agreement: Illustrative quotes.
Building Phase

“I was involved in 1994. I went to BAA and my job was to run the development and construction program and develop the way they did their project, to put in place arrangements for developing projects and implementing projects that would enable them to show continuous improvements in performance. What we were doing was preparing for T5” (BAA interview, 2005).

“A very clear objective was to make BAA the best client in the country and to have a fabulous team at the centre of all that. We realized we had a big change program on our hands. We did this survey upfront to benchmark where our starting point was and we asked our business partners and our customers in the airport what did they think of BAA as a client. We had it done professionally and it came back with a horror story: the client from hell, incompetent, no process. We knew where our base was” (BAA interview, 2005).

“John’s [Egan] view was go out there into the world and find out what’s best in construction and bring it back here. So I had like £2 million budget for development. We used to spend a lot of time with the Lean Construction Institute in Stanford, California and we went out and really found out what was going on” (BAA interview, 2005).

“T5 was about bringing together lessons from many places and [its] success is more because of the breadth of capability we brought together and this willingness to bring in the already known stuff [that] were already being tried in a number of other industries…It was the leap of faith that said we’ll put this lot together”. (BAA interview, 2009).

“What the frameworks brought about was a group of delivery partners that got used to working with one another, working in a completely different methodology, being far more open and transparent, and as a consequence enabled getting better process. These kinds of things are common practice or common place in parts of the automotive industry and aircraft industries and many others. But in the construction industry, it wasn’t the normal route.” (BAA interview, 2009).

“Don’t forget, prior to T5 we’d had a very successful experience of this [collaboration and sharing risk] with our Heathrow Express rail project and on a number of smaller projects along the way. We regarded many of them as sort of training exercises, getting the teams ready to collaborate well, to work out things of sharing pain and reward, ways of sharing risk. So it wasn’t as though it was a clean sheet of paper. We’d tried all these processes before T5 started.” (BAA interview, 2009).

Codifying Phase

“What we wanted to do was to create a form of contract, the T5 Agreement, that actually converted risk into being a positive, where people applied their most capable individuals to understand the dimensions of risk and then how you would mitigate it, how you would manage that risk away… What we tried to do is say right, risk is something that we need to make transparent.” (BAA interview, 2009).

“The T5 Agreement was a very good mechanism to be able to bring in lessons, to be able to share those lessons for to people to be accountable on our behalf, managing it on our behalf, without the traditional behaviors around worrying about the commercial consequence.” (BAA interview, 2009).

“It was really a document, which defined the way we wanted to work. It was based on very positive things about rewarding success, not penalizing failure and this in turn was based on BAA really carrying all the risk, all the time… At the same time you have to have mechanisms whereby the members of the supply chain that do not perform come under scrutiny and if necessary eliminated.” (BAA interview, 2006).

“It was about behaviors. It was about managing change. We needed to something substantially different and we designed the T5 Agreement, for which for a lawyer was a nightmare because it was full of diagrams as opposed to line items as to what to do when things went wrong. This was a contract to tell you what to do to make sure things don’t go wrong and how you need to behave in integrated teams. It was based on people’s ability to work as a team and people’s ability to trust each other.” (BAA interview, 2009).

“Our design director got the people who had a commitment to delivering T5 to write the processes in the spirit of the T5 Agreement. So it’s thinking very consciously about making a process that would work for all the different parts of work that we had… The tricky bit is keeping the processes “live” and having people who are committed to making them work” (BAA interview, 2006).

“The T5 Agreement is unique because it’s never been tried and tested in court. The checks and balances that are needed come through years and years of refinement of a normal contract. So to some extent we have to make it up as we go along, the detail of the processes to support the principles within the T5 Agreement. If you don’t display the principles, you don’t consistently apply them, then you can’t expect people to believe in them. So it’s the whole thing about being a disciple of belief and carrying
“We were very processes-focused [before T5] and not terribly behavior-focused. There was a lot of effort that went into defining the process, writing it down. I just see it as a total change in the way we approach things now... So it was progressive, a realization. We took the step to organize it. So there was this process side which said this was how you were going to live with your project, but we also looked at the way we organized BAA and the supply chain. The behavioral side very much just evolved. I think the difference now is we're putting a change program. You say “what behaviors can underpin this.”” (BAA interview, 2006)

<table>
<thead>
<tr>
<th>Mobilizing Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>“When Tony [project director] first came in, I asked: what are the three things you want me to handle?[He said] “the T5 Agreement, the T5 Agreement, the T5 Agreement,” because that is the differentiator between us and other projects. Take the commercial risk off people’s shoulders and you have an opportunity to get the right people round the table and different behaviors.” (BAA interview, 2006)</td>
</tr>
<tr>
<td>“BAA created an environment to do things differently. They insisted people integrate, co-locate and had a cost model that was fair and equitable and transparent. If you read the T5 Agreement it talks a lot about best practice and world-class performance. We [LOR] invested heavily and worked with our supply chain to support these approaches. Nobody’s really done it and made it successful, so people and suppliers were quite resistant.” (LOR interview, 2005)</td>
</tr>
<tr>
<td>“We were building up a framework as to how we were going to tackle various bit and pieces of the project. So you’re really trying to learn individual techniques. We knew the overall approach we were going to take and actually how do you do various parts of it.” (BAA interview, 2009)</td>
</tr>
<tr>
<td>“If you know the hierarchy of the T5 Agreement, the suppliers sign a T5 Agreement and they all signed up in 1998. Each supplier gets a supplemental agreement…Everybody else at T5 employs suppliers to design or construct their element of the work through the T5 Agreement. Huge chunks of work are delivered for me and I’m accountable for cost by suppliers with whom I contract.” (BAA interview, 2006)</td>
</tr>
<tr>
<td>“Because the client says the ultimate risk lies with me, you’re prepared to be bolder and more honest than you would in the traditional instance. By getting those people [contractors] in early you build a trust relationship with them.” (Rogers Partnership interview, 2009).</td>
</tr>
<tr>
<td>“The intervention in this particular case [the air traffic control tower] was to bring all of the parties involved together and to remind themselves of the T5 Agreement, which made quite clear ultimately I held all the risk all the time and what we needed now was a smart solution. That allowed, I think, sanity to prevail and everybody then to concentrate their efforts on finding a way forward that mitigated the problem in hand.” (BAA interview, 2009)</td>
</tr>
<tr>
<td>“We’re going to have to compromise here, we’ve got something that’s not working, and make sure that we actually just got the balance right…You get a new tension. There’s a danger that you revert to a traditional approach with the supplier.” (BAA interview, 2006)</td>
</tr>
<tr>
<td>“It’s very flexible. We can shuffle things around a lot, which allows us to change things, move things on, much more than you would on a very standard contract form.” (BAA interview, 2006)</td>
</tr>
<tr>
<td>“It helps a lot if you have a flexible contractual arrangement. And that is all about knowing when to go from being flexible to actually firming it up.” (BAA interview 2006).</td>
</tr>
<tr>
<td>“When things go wrong, that’s when the quality and robustness of the team is tested and that’s when you either come together to solve a problem or break apart.” (BAA interview, 2006)</td>
</tr>
<tr>
<td>“The designers are Mott McDonald’s. They work to their program. They are flexible in some ways, but in others they got a program pattern and they need to be sure to be doing that....Working together, we are the design team and we prioritize and re-prioritize work. Basically, I re-prioritize Mott McDonald’s program if there’s a need for it....So in a sense it’s a reality check on the program.” (BAA interview, 2006)</td>
</tr>
<tr>
<td>“So coming from an environment from where we had to expose everything we did commercially and production wise, working in a collaborative environment was to say the least a huge culture shock. About 9 months into the program I recommended that we actually got out of the framework [when LOR signed up to the T5 Agreement].” (LOR interview, 2005)</td>
</tr>
<tr>
<td>“I could not get across, I did in the end, but it took me a long time, the fact that risk transfer is complete avoidance, it’s not...”</td>
</tr>
</tbody>
</table>

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management of risk. [BAA] were two or three years ahead of us [BA] in managing this project and in understanding how the joint work and the T5 Agreement actually works and functions. They know the pitfalls and they know the advantages. We would be extremely foolish to go in and pretend that we can do it as well as they can.” (BA interview, 2006)

“What I need is, when it goes wrong, because it will, is actually everybody comes together to find a solution, rather than everybody comes together to write a sophisticated book of excuses.” (BAA interview, 2005).
### Period 1

#### BAA Terminal 1 International Arrivals Concourse Refurbishment Project

<table>
<thead>
<tr>
<th>Date</th>
<th>Interviewee</th>
<th>Affiliation</th>
<th>Job Title/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/02/98</td>
<td>Stuart Henderson</td>
<td>BAA</td>
<td>Project Manager</td>
</tr>
<tr>
<td>05/03/98</td>
<td>Chris Ctori</td>
<td>BAA</td>
<td>Project Manager</td>
</tr>
<tr>
<td>27/04/98</td>
<td>Joanna Nice</td>
<td>BAA</td>
<td>BAA Development Manager</td>
</tr>
<tr>
<td>01/05/98</td>
<td>Leon Chasteauneuf</td>
<td>BAA</td>
<td>General Manager</td>
</tr>
<tr>
<td>01/05/98</td>
<td>Michele Soper</td>
<td>MACE</td>
<td>BAA Project coordinator</td>
</tr>
<tr>
<td>28/05/98</td>
<td>Mark Reynolds</td>
<td>MACE</td>
<td>Project Manager</td>
</tr>
<tr>
<td>28/05/98</td>
<td>Amanda Smith</td>
<td>BAA Heathrow</td>
<td>HAL Retail Manager</td>
</tr>
<tr>
<td>04/02/98</td>
<td>Karon Taylor</td>
<td>BAA HAL</td>
<td>HAL Property Manager</td>
</tr>
<tr>
<td>29/05/98</td>
<td>Glen Tripper</td>
<td>BAA HAL</td>
<td>Line Manager</td>
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#### BAA Terminal 4 Baggage Handling ABF2 Project

<table>
<thead>
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<th>Date</th>
<th>Interviewee</th>
<th>Affiliation</th>
<th>Job Title/Function</th>
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</thead>
<tbody>
<tr>
<td>19/02/98</td>
<td>Mike Nolan</td>
<td>British Airways</td>
<td>Principal Infrastructure Development Manager</td>
</tr>
<tr>
<td>05/03/98</td>
<td>David Frazzell</td>
<td>BAA</td>
<td>Development Officer T4</td>
</tr>
<tr>
<td>16/04/98</td>
<td>Kevin Petisa</td>
<td>Turner and Townsend</td>
<td>Quantity Surveyors</td>
</tr>
<tr>
<td>10/04/98</td>
<td>Morris Felps</td>
<td>Flour Daniels</td>
<td>Project Controls Manager for the ABF2</td>
</tr>
<tr>
<td>13/05/98</td>
<td>Ernie Bardircks</td>
<td>Project Manager</td>
<td>Siemens</td>
</tr>
<tr>
<td>26/05/98</td>
<td>Mike Read</td>
<td>Support Services</td>
<td>BAA</td>
</tr>
<tr>
<td>04/02/98</td>
<td>Kevin Beaumont</td>
<td>BAA Project Manager</td>
<td>Fluor Daniel</td>
</tr>
<tr>
<td>16/04/98</td>
<td>Tony Street</td>
<td>Design Manager</td>
<td>MACE</td>
</tr>
</tbody>
</table>

### Period 2

#### Heathrow Terminal 5 Project: Within Project Interviews

<table>
<thead>
<tr>
<th>Date</th>
<th>Interviewee</th>
<th>Affiliation</th>
<th>Job Title/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/10/05</td>
<td>Simon Murray</td>
<td>Formerly BAA</td>
<td>Formerly BAA Group Technical Services</td>
</tr>
<tr>
<td>22/10/05</td>
<td>Tony Douglas</td>
<td>BAA</td>
<td>Managing Director T5</td>
</tr>
<tr>
<td>29/11/05</td>
<td>Nigel Harper</td>
<td>LOR</td>
<td>Director Performance Improvement</td>
</tr>
<tr>
<td>10/01/06</td>
<td>Andrew Wolstenholme</td>
<td>BAA</td>
<td>T5 Project Manager and Project Director</td>
</tr>
<tr>
<td>18/01/06</td>
<td>Mike Robins</td>
<td>LOR</td>
<td>Group Business Leader</td>
</tr>
<tr>
<td>10/02/06</td>
<td>Ian Fugeman</td>
<td>BAA</td>
<td>Head Rail and Tunnels T5</td>
</tr>
<tr>
<td>13/02/06</td>
<td>Bill Frankland</td>
<td>LOR</td>
<td>Head of Roof Project T5</td>
</tr>
<tr>
<td>15/02/06</td>
<td>Timm Wellens</td>
<td>LOR</td>
<td>Phase 2 Production Leader</td>
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<tr>
<td>15/02/06</td>
<td>Nigel Harris</td>
<td>LOR</td>
<td>Digital Prototyping</td>
</tr>
<tr>
<td>15/02/06</td>
<td>Tony Blackler</td>
<td>LOR</td>
<td>Senior Construction Manager</td>
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<tr>
<td>15/02/06</td>
<td>Gavin Milligan</td>
<td>LOR</td>
<td>3D Modeler</td>
</tr>
<tr>
<td>15/02/06</td>
<td>Matthew Prentice</td>
<td>LOR</td>
<td>Production Manager</td>
</tr>
<tr>
<td>15/02/06</td>
<td>Damian Leydon</td>
<td>LOR</td>
<td>Construction Manager</td>
</tr>
<tr>
<td>27/02/06</td>
<td>Steve Nuttall</td>
<td>LOR</td>
<td>CTRL Project Leader</td>
</tr>
<tr>
<td>27/02/06</td>
<td>Spiros Tsakonas</td>
<td>LOR</td>
<td>Production Leader, CTRL</td>
</tr>
<tr>
<td>27/02/06</td>
<td>Andrew Williams</td>
<td>LOR</td>
<td>CTRL</td>
</tr>
<tr>
<td>03/03/06</td>
<td>Phil Wilbraham</td>
<td>BAA</td>
<td>Head Design, Building Projects</td>
</tr>
<tr>
<td>10/03/06</td>
<td>Rob Stewart</td>
<td>BAA</td>
<td>Head Infrastructure projects T5</td>
</tr>
<tr>
<td>21/03/06</td>
<td>Colin Clarkson</td>
<td>British Airways</td>
<td>Formerly BA T5 Project Director</td>
</tr>
<tr>
<td>29/03/06</td>
<td>John Milford</td>
<td>BAA</td>
<td>Head Buildings Projects T5</td>
</tr>
<tr>
<td>04/04/06</td>
<td>Nick Gaines</td>
<td>BAA</td>
<td>Head Systems Integration Projects T5</td>
</tr>
<tr>
<td>10/04/06</td>
<td>Liz Daily</td>
<td>LOR</td>
<td>Head of Business Improvement Team</td>
</tr>
<tr>
<td>10/04/06</td>
<td>Robert Hicks</td>
<td>LOR</td>
<td>3D/4D/5D and nD modeling</td>
</tr>
<tr>
<td>10/04/06</td>
<td>Matt Blackwell</td>
<td>LOR</td>
<td>3D/4D/5D and nD modeling</td>
</tr>
<tr>
<td>Date</td>
<td>Interviewee</td>
<td>Affiliation</td>
<td>Job Title/Function</td>
</tr>
<tr>
<td>---------</td>
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<td>------------------------------</td>
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<tr>
<td>10/04/06</td>
<td>Ray O’Rourke</td>
<td>LOR</td>
<td>Chairman</td>
</tr>
<tr>
<td>05/05/06</td>
<td>Roy Adams</td>
<td>LOR</td>
<td>Head of R@DD (Radical at Design &amp; Delivery)</td>
</tr>
<tr>
<td>05/05/06</td>
<td>Jim Dennis</td>
<td>LOR</td>
<td>Brighton Marina Project</td>
</tr>
<tr>
<td>05/05/06</td>
<td>Jacqui Radford</td>
<td>LOR</td>
<td></td>
</tr>
<tr>
<td>22/05/06</td>
<td>John Harris</td>
<td>BAA</td>
<td>3D modeling</td>
</tr>
<tr>
<td>14/06/06</td>
<td>Norman Haste</td>
<td>Formerly BAA, now LOR</td>
<td>Formerly T5 Project Director</td>
</tr>
</tbody>
</table>

**Period 3**

**Heathrow Terminal 5 Project: Retrospective Interviews**

<table>
<thead>
<tr>
<th>Date</th>
<th>Interviewee</th>
<th>Affiliation</th>
<th>Job Title/Function</th>
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</thead>
<tbody>
<tr>
<td>31/07/09</td>
<td>Denise Kingsmill</td>
<td>British Airways</td>
<td>Non-Executive Director</td>
</tr>
<tr>
<td>04/08/09</td>
<td>Norman Haste</td>
<td>LOR</td>
<td>COO (formerly T5 Construction Director, BAA)</td>
</tr>
<tr>
<td>11/08/09</td>
<td>Simon Murray</td>
<td>Geoffrey Osborne Ltd</td>
<td>Chairman (formerly Director BAA Group Technical Services)</td>
</tr>
<tr>
<td>17/08/09</td>
<td>Tony Douglas</td>
<td>LOR</td>
<td>COO – Europe (formerly T5 Project Director; Managing Director Heathrow Airport, BAA)</td>
</tr>
<tr>
<td>14/09/09</td>
<td>Nick Gaines</td>
<td>Volkswagen</td>
<td>UK CIO Volkswagen (formerly T5 Head of Systems, BAA)</td>
</tr>
<tr>
<td>05/10/09</td>
<td>Ray O’Rourke</td>
<td>LOR</td>
<td>Chairman</td>
</tr>
<tr>
<td>16/09/09</td>
<td>John Egan</td>
<td>Severn Trust</td>
<td>Chairman and Chief Executive (formerly BAA CEO)</td>
</tr>
<tr>
<td>21/09/09</td>
<td>Mike Davies</td>
<td>Rogers Stirk Harbour &amp; Partners</td>
<td>Principal T5 Architect</td>
</tr>
<tr>
<td>29/10/09</td>
<td>Andrew Wolstenholme</td>
<td>Balfour Beatty</td>
<td>Managing Director (formerly T5 Projects Director, BAA; now CEO Crossrail)</td>
</tr>
<tr>
<td>03/03/11</td>
<td>Mike Forster</td>
<td>Forster Associates</td>
<td>Director (formerly BAA Strategy Director; T5 Design Director)</td>
</tr>
</tbody>
</table>